FINAL PLAN REPORT
CONSULTANT ACTIVITY 175

Hysham Rest Area
IM G 94-2(36)65
UPN 8200000

Prepared for:

MONTANA MDT DEPARTMENT OF TRANSPORTATION

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July, 2016

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1.0 INTRODUCTION

The purpose of this final report is to compile the reported material developed through the review process of Phase I for the proposed improvements to the Hysham Rest Area. These reports are intended for use in developing Phase II design for the Hysham Rest Area. The reports provide a framework for design improvements to increase the capacity of the rest area to serve the traveling public. Included in the report are designs and Montana Department of Environmental Quality (MDEQ) permit approval for the water system and non-degradation wastewater approval for the rest area. Also included is the environmental compliance documentation in accordance with the National and Montana Environmental Policy Acts (NEPA/MEPA). The attached permits and environmental compliance documentation allow for the development of a design-build or a design-bid-build project to reconstruct the rest area.

2.0 PROJECT BACKGROUND

The Hysham Rest Area is a dual rest area site located adjacent to Interstate 94 and includes entry and exit ramps, paved parking areas, restroom buildings (one each at the westbound and the eastbound sites), and covered picnic shelters. The dual rest areas were originally constructed in 1967, and were rehabilitated in 1981 to address Americans with Disabilities Act (ADA) requirements. The rest area facilities are generally in fair condition.

The project site is located at the Hysham Rest Area adjacent to Interstate 94 (I-94), 5 miles southwest of Hysham, in Treasure County, MT, Township 5 North, Range 36 East, Section 5. The rest area serving the eastbound (EB) direction of travel is located at reference post (RP) 64.7. The rest area serving the westbound (WB) direction of travel is located at RP 64.8. Interstate 94 is functionally classified as a *Principal Arterial — Interstate* within the MDT functional classification system. The project limits will include the eastbound and westbound rest area sites including the entrance and exit ramps, and a portion of the I-94 right-of-way adjacent to the rest area facilities. Precise project limits will be determined during the design phase of the project but are expected to remain within the current MDT right-of-way.

Box Elder Creek parallels the westbound rest area site and its anticipated floodplain is located adjacent to the site's northern right-of-way.

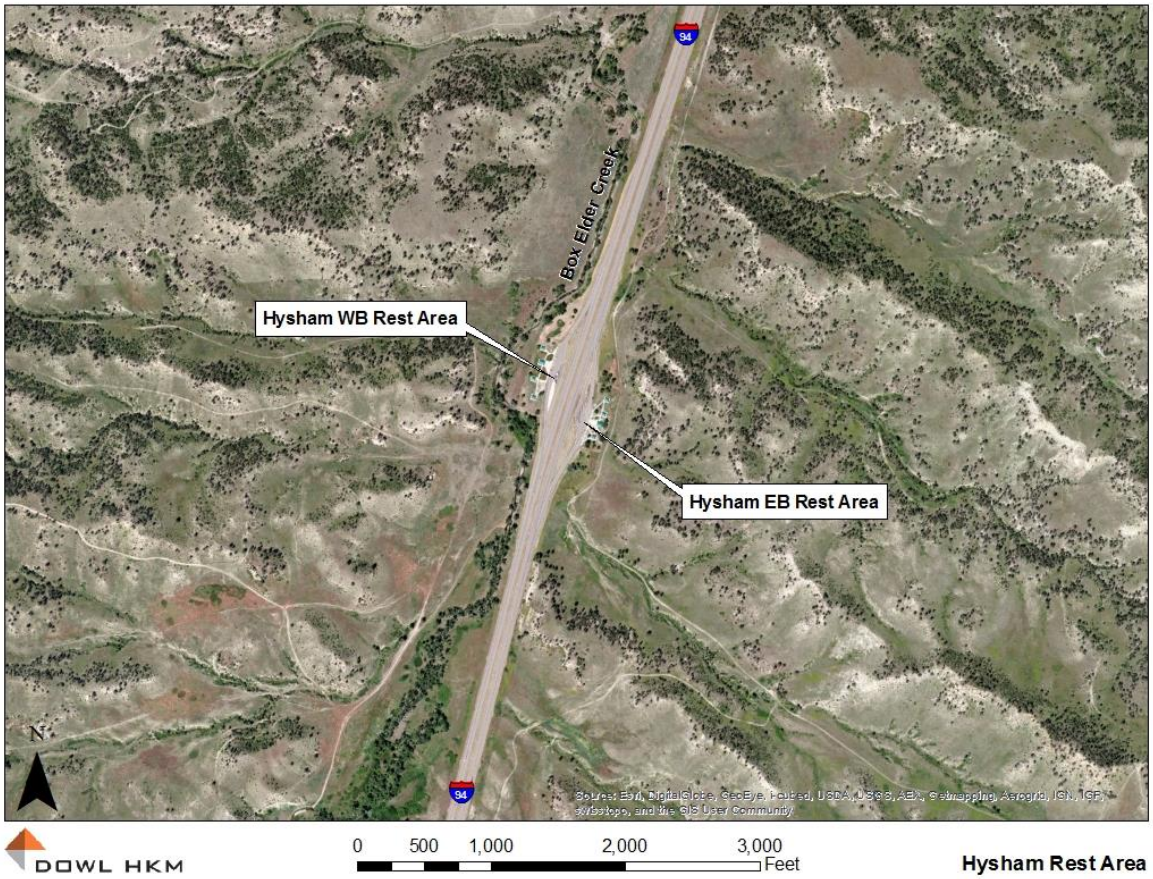
The purpose of the overall project will be to reconstruct the existing Hysham Rest Area to meet current and future demand based on the projected usage through the design horizon. Wastewater systems with increased capacity and improved treatment capabilities, expanded car and truck parking spaces, and expanded restroom facilities are needed to accommodate future demand.

Anticipated usage through the 22-year planning horizon was used as the basis for the Phase I design, as it reflects the typical design life of a water and wastewater system and is the typical timeframe for estimating future traffic volumes.

To accommodate both future and current demands for the rest stop facility, updated car and truck parking areas, and expanded restroom facilities are required. Additionally, new water and wastewater systems will be needed; the new wastewater system will have both increased capacity and improved treatment capabilities. Phase I of the project developed a design and obtained approval for anticipated improvements to the proposed water and wastewater systems; these designs will be used during subsequent design and construction phases to reconstruct the rest area. Phase I also includes preparation of environmental compliance documentation for the full reconstruction of the rest area (Phase II). Phase II improvements are expected to be developed through a design-build project, and are not included in this project.

The project location is shown on the project Vicinity Map, Figure 1.

Figure 1 Vicinity Map



3.0 PRELIMINARY GEOTECHNICAL REPORT

The preliminary geotechnical report was developed in support of Phase I for the Hysham Rest Area project. This report evaluated the site for the purpose of designing the water/wastewater systems for the Hysham Rest Area, and for supporting the permitting of the systems through the Montana Department of Environmental Quality (MDEQ). Future improvements to the rest area site are anticipated to include a water and wastewater system, new building facilities, and updated parking facilities. The full preliminary geotechnical report developed for the water and wastewater system is contained in Appendix A of this document.

Soil Conditions

Subgrade soils beneath the proposed wastewater system site consist of soils classifying sandy silt loams and sandy loams (USDA)/ (lean clays (USCS). Most of these soils were observed to depths ranging from 0.5 to 10 feet. The deeper soils were generally, medium stiff in consistency, grey to brown, low plasticity and contained varying amounts of sands, clays, silts, and gravels.

From the field evaluation and laboratory testing, it was determined that the receiving soils beneath the drainfield system can provide adequate disposal of the treated effluent.

Groundwater

Groundwater or groundwater indicators were not observed at depths ranging from 1 to 10 feet in the six test pits that were excavated on the site. DOWL found the eastbound aquifer to be located in the Bearpaw shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. These logs indicate that the existing public wells located water at an interval depth of 6 to 200 feet below ground surface. Sandy clays, Sandy silts, gravels dominate the upper 10 feet of the wells. Shale and sandstone layers are found from 25 feet to 200 feet. Based on the information presented in the well logs, it appears that the aquifer is found in a confined/semi confined aquifer formation. .

4.0 CONTROL AND TOPOGRAPHICAL SURVEY

A control and topographical survey of the site was conducted for Phase I. Control survey data (including the establishment of the horizontal and vertical control of the project corridor), control diagram, coordinate listings of benchmarks, control traverse stations, peg test notes and calibration baseline reports for survey instruments are provided in Appendix B of this document.

Topography of the site was developed in Micro-Station, and is available from MDT for use in developing Phase II.

5.0 PRELIMINARY OWNERSHIP REPORT

An ownership report detailing adjacent property owners was not conducted in Phase I of the project. Right-of-way or adjacent parcel boundaries were not retraced for Phase I. All improvements to the rest area are expected to occur within the current rest area boundary.

6.0 PRELIMINARY TRAFFIC REPORT

A preliminary traffic report was developed in support of Phase I for the Hysham Rest Area. Recommendations were considered in the development of a conceptual layout of the site suitable for guidance during the development of a design for Phase II. It is anticipated that the conceptual layout developed during Phase I will be used to assist in determining the ultimate number of parking spaces and restroom stalls that will eventually fit within the physical constraints of the site (existing right-of-way boundaries, topography, sensitive natural resources, and state-required setbacks from groundwater wells and wastewater systems).

Based on a 22-year planning horizon and MDT provided traffic data, the minimum number of parking stalls necessary to accommodate expected future use was calculated using the Western Transportation Institute (WTI) methodology detailed in the *"WTI Rest Area Use: Data Acquisition and Usage Estimation Report"* (2011). The calculation resulted in fewer car parking stalls than is currently provided and recommends an expanded number of commercial vehicle parking spaces at the Hysham Rest Area. While the actual number of parking stalls to be included at the site will be determined during Phase II design, it is anticipated that parking will be maximized to the extents practical while still meeting other site requirements and aesthetics. It should be noted, however, that the available land for development at the site is finite, as no new right-of-way is anticipated. As such, the site will need to accommodate several features (building, drainfield, well locations, etc.), as well as parking and circulation isles.

The most recent traffic volume data from the MDT Traffic Data Collection & Analysis Section reported the following traffic characteristics for Interstate 90 near the Hysham Rest Area:

2014 (Current Year)

AADT= 4,940 vpd

2036 (Design Year)

AADT=	7,650 vpd
DHV=	880 vpd
V=	70 mph
T=	27.3 %
AGR=	2.0 %

AADT: Annual Average Daily Traffic (both directions of travel)
DHV: Design Hourly Volume (both directions of travel)
V: Design Speed
T: Percent Trucks
AGR: Annual Growth Rate
vpd: vehicles per day
mph: miles per hour

The preliminary traffic memorandum developed under Phase I is provided in the Appendix D of this document.

7.0 PRELIMINARY HYDRAULIC REPORT:

The rest area sites are located toward the bottom of a hill within the Box Elder Creek drainage area. The existing public drinking water wells and proposed wastewater areas are located such that existing drainage patterns for storm water and snowmelt runoff should not pose a flooding risk. The final grading and drainage plan developed under Phase II can be designed to divert any stormwater and snowmelt runoff away from the proposed water and wastewater systems. The final rest area design should take into account the calculated runoff from the final site layout and incorporate storm water runoff quantity and quality control measures in accordance with MDT Hydraulics Design criteria. Stormwater control measures will similarly need to be designed for the entirety of the rest area reconstruction.

The preliminary hydraulics memo developed for Phase I of this project is attached in Appendix E.

8.0 BIOLOGICAL RESOURCE REPORT

A preliminary Biological Resource Report (BRR) was developed under Phase I to provide a review of resources within the project area. Based on the conclusions of this document, it is recommended that all project work, maintenance practices, and the placement of staging areas should be conducted so as to avoid impacts to the adjacent property.

8.0.1 GENERAL VEGETATION (Recommended Conservation Measures)

Best Management Practices (BMPs) should be used to limit ground disturbance and minimize vegetation removal, control erosion, and re-vegetate disturbed areas within the project limits as soon as construction is complete.

- Mature trees and shrubs should be preserved where feasible.
- Topsoil should be segregated and utilized during restoration efforts.
- Areas will receive topsoil and seeding according to MDT standard specifications and recommendations of the MDT Reclamation Specialist.

8.0.2 NOXIOUS WEEDS/INVASIVE SPECIES (*Recommended Conservation Measures)*

All disturbed soils not landscaped or otherwise permanently stabilized by construction should be seeded using a seed mix approved by MDT appropriate to the project vicinity to discourage rapid colonization by noxious and invasive species. Machinery and equipment should be cleaned prior to entering the project site.

8.0.3 GENERAL WILDLIFE SPECIES (*Recommended Conservation Measures)*

MDT Standard Specifications for Road and Bridge Construction (2014) effectively address the protection of environmental resources.

The following recommended measures are in addition to the Standard Specifications.

- In order to comply with the Migratory Bird Treaty Act, all trees and shrubs existing within the construction limits and affected by construction, will be removed outside of the nesting season between the dates of August 16 to April 15. Special Provision 107-25C (Migratory Bird Treaty Act Compliance – Vegetation) will be added to the contract plans for this project (see Appendix D). Any active nests discovered during construction must not be removed or otherwise impacted.
- Minimize vegetation removal.
- Preserve mature trees and shrubs where feasible.
- Restore with a combination of desirable and native vegetation and landscape components where possible.

8.0.4 AQUATIC RESOURCES (*Recommended Conservation Measures)*

No conservation measures are recommended as no wetlands or other aquatic resources were identified in the project area.

8.0.5 SENSITIVE SPECIES OF SPECIAL CONCERN *(Recommended Conservation Measures)*

No conservation measures are recommended for state Species of Concern, as none have been documented or are anticipated in the project area.

8.0.6 THREATENED AND ENDANGERED SPECIES *(Recommended Conservation Measures)*

No conservation measures are recommended for federally listed endangered, threatened, proposed, and candidate species, as none have been documented nor are likely to occur in the project area.

8.0.7 WETLANDS *(Recommended Conservation Measures)*

No specific conservation measures for wetlands are recommended as no wetlands were identified within the project area.

The Biological Resource Memo developed for Phase I of this project is attached in Appendix F to the document.

9.0 MDEQ WASTEWATER REPORT

At final construction, the rest area will include public facilities. All facilities will be serviced by the public wastewater system.

The wastewater at the Hysham Rest Area will enter a septic tank located at each rest area structure. Once in the septic tanks, the solids are settled out, the effluent will pass into a dosing station/tank and pumped to a treatment tank that doses the advanced wastewater treatment system. Upon being processed through the advanced treatment system, the wastewater will enter the drainfield dose tank, where it will be dosed through a force main to separate zones within the drainfield.

The wastewater treatment system is designed to serve a maximum daily flow of 2,890 gpd. The rest area site will utilize two 4,000-gallon septic tanks, new recirculating trickling filter, new 2,500-gallon dose chamber and a new drainfield sized with an application rate of 0.5 gpd/sf (a 50% reduction for trickling filtered treated waste).

The approval is based on the locations dimensions and orientations of the primary and

replacement subsurface wastewater treatment systems as submitted to Montana Department of Environmental Quality on September 11, 2015 and the additional information provided on January 11, 2016 in accordance with Department Design Standard DEQ-4. The MDEQ Wastewater System Improvement Determination of Significance approval is based on the information submitted as a result of Phase I activities, and is not valid if any substantive changes from the proposal are made in the project.

MDEQ concluded that this project, as proposed, will not degrade state waters.

Final site plans and specifications for the proposed wastewater treatment system must be submitted to, and approved by, MDEQ and Treasure County prior to installation.

Failure to abide by the above-stated conditions is considered a significant violation of the Montana Public Water Supply Laws (PWSL), and the administrative rules promulgated there under. The applicant is responsible for compliance with all other applicable federal, state, local and tribal law regulations and ordinances, including but not limited to, the Montana Water Use Act, Mont. Code Ann. Title 85, Chapter 2.

The Wastewater Design Report and approval is provided in Appendix G of this document.

10.0 MDEQ WATER REPORT

The public water supply system for the Hysham Rest Area will consist of

The Hysham Rest Area is classified as a *Transient / Non-Community* facility. Approval of the water system improvements are based on the design report, plans and specifications received September 11, 2015 and the additional information provided on January 11, 2016 in accordance with Department design standards DEQ-3. The project consists of a new rest area building, new 35 gpm well (east bound), two new pressure tanks (each site), four parallel cartridge filters (each site) to remove particulate matter, and new water distribution lines for each rest area.

Water System Improvement Conditions:

1. The final grading and drainage plan developed under Phase II should be designed to divert any storm water and snowmelt runoff away from the public wells.

2. The rest area's public water system will need to undergo a complete disinfection of

the new pump room apparatus, the new piping network and existing wells. Once the reconstruction of rest areas begin, all well apparatus will be removed and cleaned. After cleaning is performed, water tests from the source water is required.

3. The existing abandoned well on the east bound side will need to be abandoned per MDEQ requirements.

MDEQ Required Conditions:

1. No portion of the project may be placed into operation until the project engineer certifies by letter to MDEQ that the activated portion of the project was inspected and found to be constructed in accordance with the approved plans and specifications.

2. Any deviations from the approved plans and specifications must be submitted to the MDEQ prior to modification.

3. Within 90 days after construction completion, the project engineer must submit a complete set of certified as-built drawings for the project.

4. Construction of this project must be completed within three years of the date of the approval letter. If more than three years elapse before completing construction, plans and specifications must be resubmitted and approved before construction may begin. This three-year expiration period does not extend any compliance schedule requirements pursuant to enforcement action against a public water/sewage system.

Failure to abide by the above conditions specified by MDEQ is considered a significant violation of the Montana Public Water Supply Laws (PWSL), and the administrative rules promulgated there under. The applicant is responsible for compliance with all other applicable federal, state, local and tribal law regulations and ordinances, including but not limited to, the Montana Water Use Act, Mont. Code Ann. Title 85, Chapter 2.

The Water Design report and approval is provided in Appendix H of this document.

11.0 HAZARDOUS MATERIALS/SUBSTANCES

An ISA form was prepared in support of the Categorical Exclusion developed for Phase I of this project, and is included in Appendix J of this document.

An asbestos and lead-based inspection was completed by Northern Industrial Hygiene on April 15, 2015 for the Hysham Rest Area. Northern Industrial Hygiene found no asbestos-containing materials in any of the building materials in either the west or east bound rest area buildings or shelters. Lead-based paint (LBP) was identified in 1 component in both the east and west bound rest areas. No other building components tested positive for lead-based paint. The confirmed building component included the yellow parking curbs. All LBP painted components observed were peeling at the time of the survey.

12.0 PRELIMINARY ENVIRONMENTAL DOCUMENT

A group (c) Categorical Exclusion was approved on November 12, 2014 for this project. A more detailed environmental review is not considered necessary because rest area improvements are anticipated to remain within the existing MDT right-of-way. A copy of the Group (c) action letter detailing the above information is contained in Appendix K of this document.

No wetlands were observed within the project area.

A cultural resources survey was not conducted for this project because improvements are anticipated to remain within previously-disturbed areas and the rest area buildings are less than 50 years old.

13.0 ROADWAY ALIGNMENT PLAN

A preliminary conceptual site layout was developed only to the point of being able to define the site for a future design-build phase of the project without defining specific parameters or design elements that could hinder the design and innovation of a design-build process. The conceptual site layout includes a planning-level estimate of parking needs, and identifies existing constraints such as well locations relative to drainfield improvements and the drainfield locations. Detailed herein is a list of criteria that was used to generate the conceptual site layouts.

EASTBOUND SITE DESIGN ASSUMPTIONS

Design	Remarks
Proposed Parking	Only cars can generally meet calculated parking demands as identified in the preliminary traffic report dated June 4, 2014. Truck parking is lower due to site restrictions.

	*CARS	TRUCKS
EXISTING PARKING	15	4
CALCULATED PARKING DEMAND	9	31
PROPOSED PARKING	16	19

*(CAR PARKING INCLUDES HANDICAP STALLS)

Off-ramp The existing off-ramp is 650-ft and meets the minimum deceleration distance of 590-ft for passenger cars, assuming Vi=70 mph and Vf=15 mph. The off-ramp meets the minimum deceleration distance of 640-ft for trucks, assuming Vi=55 mph and Vf=15 mph.

On-ramp The existing on-ramp is 540-ft. The ramp length requirements are 1,560-ft (passenger cars) and 2,795-ft (trucks), assuming Vi= 15 mph, Vf=70 mph. The existing ramp lengths meets the minimum deceleration distance of 490-ft assuming Vi=70 mph, Vf=15 mph (passenger cars). The existing ramp length does not meet the lowest minimum requirements of 625-ft for trucks, assuming Vi=15 mph, Vf=55 mph.

Clearzone A 38-ft clearzone is required at 5:1 slopes, 70 mph minimum, from the edge of interstate traveled lane. Existing guardrail separates eastbound travel lanes from the rest area.

Grading Site appears to meet ADA requirements (all grades less than 5%) without special grading needs.

Environmental Improvements are expected to be located outside wetlands. Wells are currently located outside parking areas and meet setback requirements.

Drainage On-site and off-site drainage will be perpetuated utilizing existing culverts and inlets.

Rest Room Stalls The existing number of rest room units is 4 women's toilets stalls and 2 men's urinals + 2 men's toilet stalls. Proposed number of rest rooms units is 4 women's bathrooms and 3 men's bathrooms (men's bathroom includes urinal and toilet).

Rest Area Building Conceptual rest area building footprint size will be determined by MDT.

WESTBOUND SITE DESIGN ASSUMPTIONS

Design	Remarks
Proposed Parking	Only cars can generally meet calculated parking demands as identified in the preliminary traffic report dated June 4, 2014. Truck parking is lower due to site restrictions.

	*CARS	TRUCKS
EXISTING PARKING	16	4
CALCULATED PARKING DEMAND	9	27
PROPOSED PARKING	17	20

*(CAR PARKING INCLUDES HANDICAP STALLS)

Off-ramp The existing off-ramp is 640-ft and meets the minimum deceleration distance of 590-ft for passenger cars, assuming Vi=70 mph and Vf=15 mph. The off-ramp meets the minimum deceleration distance of 640-ft for trucks, assuming Vi=55 mph and Vf=15 mph.

On-ramp The existing on-ramp is 310-ft. The ramp length requirements are 1,560-ft (passenger cars) and 2,795-ft (trucks), assuming Vi= 15 mph, Vf=70 mph. The existing ramp lengths meets the minimum deceleration distance of 300-ft for passenger cars, assuming Vi=15 mph, Vf=40 mph (passenger cars). The existing ramp length does not meet the lowest minimum requirements of 625-ft for trucks, assuming Vi=15mph, Vf=55mph.

Clearzone A 38-ft clearzone is required at 5:1 slopes, 70 mph minimum, from the edge of interstate traveled lane.

Grading Site appears to meet ADA requirements (all grades less than 5%) without special grading needs.

Environmental Improvements are expected to be located outside wetlands. Wells are currently located outside parking areas and meet setback requirements.

Drainage On-site and off-site drainage will be perpetuated utilizing existing culverts and inlets.

Rest Room Stalls The existing number of rest room units is 4 women's toilets stalls and 2 men's urinals + 2 men's toilet stall. Proposed number of rest rooms units is 4 women's bathrooms and 3 men's bathrooms (men's bathroom includes urinal and toilet).

Rest Area Building Conceptual rest area building footprint size will be determined by MDT

The conceptual site layout developed for Phase I is provided in Appendix L of this document.

MONTANA MDT DEPARTMENT OF TRANSPORTATION

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DOWL

APPENDIX A:

Preliminary Geotechnical Report

Hysham Rest Area
IM 94-2(36)65
UPN 8200000

PRELIMINARY GEOTECHNICAL AND MATERIALS REPORT

MDT Activity 106

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1.0 INTRODUCTION

This Preliminary Geotechnical report as developed in support of Phase I of the Hysham Rest Area project in order to evaluate and design new water/wastewater systems and to obtain permitting of the systems through the Montana Department of Environmental Quality (MDEQ) for the future full reconstruction of the rest area. Future improvements are anticipated to include new water and wastewater systems, new building facilities, and updated parking facilities.

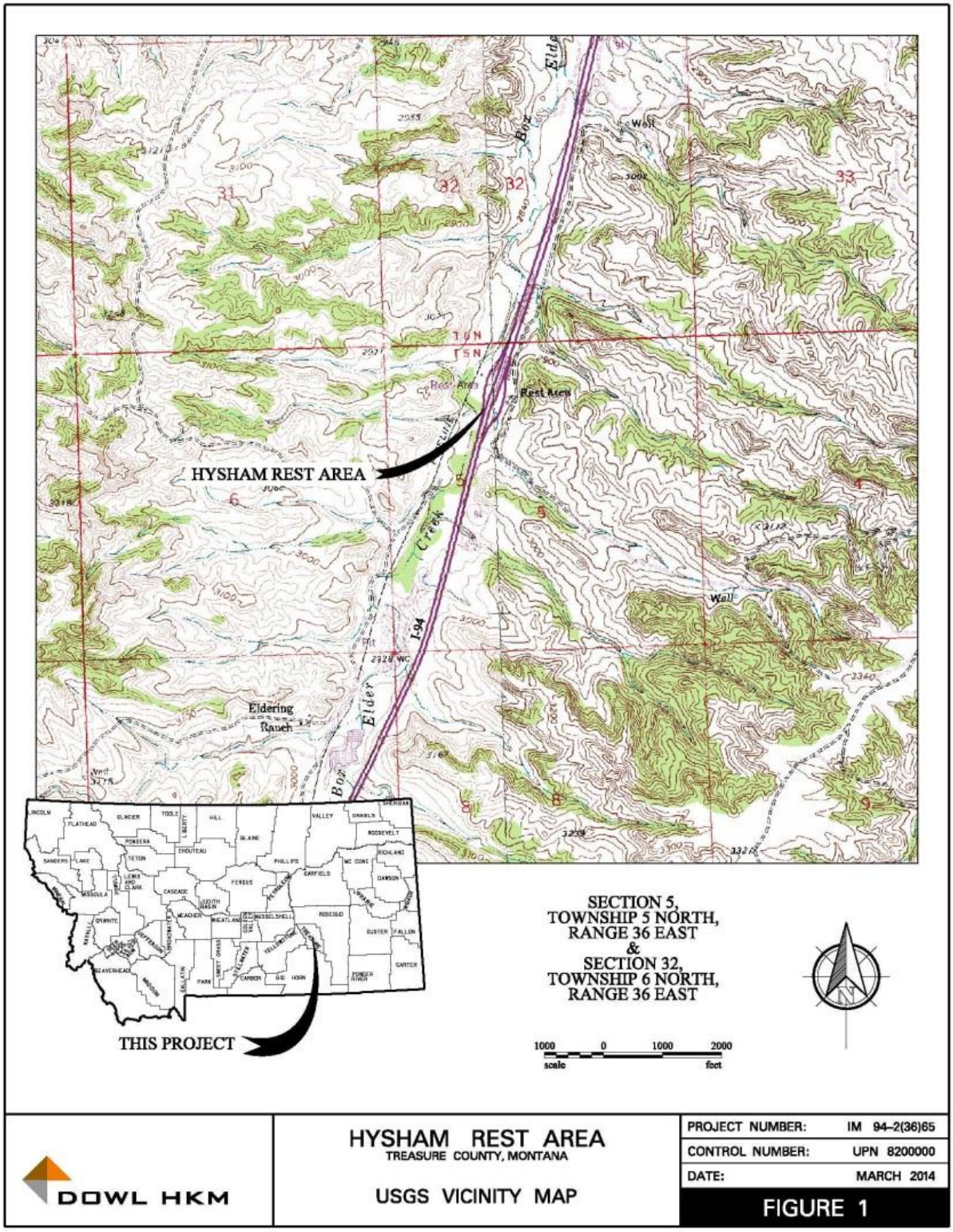
This report is intended to satisfy Montana Department of Transportation (MDT) Consultant Activity 106. The results of the evaluation are presented in this Preliminary Geotechnical and Materials Report. The purpose of this report is to present preliminary information regarding soil and groundwater conditions and to provide preliminary recommendations for design of the new wastewater disposal drainfields for the Hysham Rest Area project. The preliminary recommendations include design and construction of the proposed wastewater disposal systems.

1.1 Project Background

The Hysham Rest Area consists of two separate rest area sites located on each side of Interstate 94 (I-94), approximately 5 miles south/southwest of Hysham in Treasure County, Montana. The rest area serving the eastbound (EB) direction of travel and the rest area serving the westbound (WB) direction of travel are both located at approximate reference post (RP) 65. Interstate 94. A site vicinity map showing the project location is presented in Figure 1.

In an effort to develop rest area guidelines that more accurately reflect conditions specific to Montana, MDT initiated a research project with WTI that culminated in the completion of the *Rest Area Use: Data Acquisition and Usage Estimation Report* (2011). As part of this study, water flow/usage data and door counts were collected at nearly all MDT-maintained rest areas on Montana highways, with recommendations for estimating water usage and facility demand usage factors based on a cross-section of representative rest areas. The WTI method is used in this report to determine rest area usage needs at the Hysham Rest Area

Figure 1 Vicinity Map



2.0 SITE INVESTIGATION

The site investigation conducted for this project site included the review of existing information and field explorations. The field exploration consisted of a reconnaissance of the project site, pavement borings and subsurface excavation of test pits at potential drainfield sites. The visual reconnaissance included observation of surface conditions such as apparent geologic hazards, drainage conditions, and performance of existing water and wastewater systems.

2.1 Document Review

The geotechnical document review included a cursory review of pertinent documents provided for the project. The documents reviewed included:

- *Geologic Map of the Hysham 30' x 60' Quadrangle*,
- *Natural Resources Conservation Service (NRCS) Web Soils Survey, Treasure County Area*
- *Well Logs for Existing Wells, Montana's Groundwater Information Center (GWIC)*
- *Door Counts & Water Usage,* 2013, *(Montana Department of Transportation)*

2.2 Drainage Inspection

A visual inspection of the current storm water facilities was performed on March 2014 and June, 2014. The visual inspection evaluated storm water influences in regard to plants and soils near current and potential water /wastewater facilities. The site had no indications of standing water in close proximity to the public well and wastewater drainfield. The rest area has drainages that runs along the northwest and southeast side of the rest area locations. It is recommended that these areas will have to be addressed further in the storm water design and grading plan for Phase II of this project.

2.3 Subsurface Exploration

The field exploration consisted of excavating six test pits (TP1 through TP-6) and three percolation tests. The six (6) test pits were excavated utilizing a Caterpillar rubber tire backhoe. The test pits were excavated at accessible locations to depths ranging from 8 to 10 feet. The excavation termination was based on estimation of proposed drainfield trench depth and possible indicators/or lack of indicators of limiting layers such as groundwater, dense clay, or bedrock. The test pits were excavated at locations which would provide an optimal wastewater disposal area for the sites (see Table 1).

Table 1 Exploration Plan Summary Hysham Rest Area			
Test Pit	**Station**	**Depth**	**Intent of Exploration**
TP-1	See Site Plan	8'	Verify existing soil condition
TP-2	See Site Plan	9'	Verify existing soil condition
TP-3	See Site Plan	10’	Verify existing soil condition
TP-4	See Site Plan	10’	Proposed Drainfield Replacement Area
TP-5	See Site Plan	8.5'	Proposed Drainfield Replacement Area
TP-6	See Site Plan	9.0’	Proposed Drainfield Replacement Area

The test pit locations were selected by DOWL HKM’s engineers based on elevations and prominent site features. A DOWL HKM engineer directed excavation operations, and recorded lithology and other soil conditions. At select intervals, soil samples were collected, by removing soil from selected soil horizon. Test pit locations are shown on the Preliminary Site Plan in Appendix A.

During the excavation of the test pits, specific attention was placed on limiting layer indicators such as mottling, root depth, residual calcium carbonate, dense clays, moisture content and bedrock. The test pits were backfilled and the surface was restored to its previous state.

3.0 LABORATORY TESTING

The lithology and soil conditions are presented in the test pit logs. The stratification contacts shown on the test pit logs represent approximate boundaries between soil types. Logs of the Test Pits are presented in Appendix B.

Soil samples collected during the field investigation were returned to DOWL HKM’s materials laboratory. Representative soil samples were selected for laboratory testing after careful visual examination and consideration of the design criteria. Soil samples were classified in accordance with AASHTO and the Unified Soil Classification System (USCS).

The following tests were performed as part of this project:

Table 2 Laboratory Testing Hysham Rest Area	
Test	**Purpose of Test**
Atterberg Limits	To determine soil characteristics for classification and determine behavior conditions of silts and clays corresponding to varying moisture content.
Particle-Size Distribution	To determine the grain sizes of the soils for classification and identification of physical characteristics.

Laboratory test results are presented on the test pit logs which are located in Appendix B and on individual laboratory test reports in Appendix G.

DOWL HKM acknowledges that laboratory soil classes are not provided for each soil profile or subgrade. The soils were visually classified in the field in accordance with ASTM D 2488 (Visual- Manual Procedure). The field exploration and testing program was developed and supervised by a DOWL HKM professional engineer. Decisions regarding sampling and specific tests performed on individual samples were based on experience, requirements of the project, project site design features, geologic variability, field conditions encountered while excavation and other factors. The tests completed on the samples selected are considered representative of the conditions encountered in the field.

Table 3
Soil Classification

HYSHAM REST AREA
PHASE 1

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

GEOTECHNICAL INVESTIGATION

DOWL HKM

LAB NUMBER	LOCATION	DEPTH RANGE	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND NO. 200(0.075 mm) TO NO. 4(4.76 mm)	GRAVEL NO. 4(4.76 mm) TO 3 IN.(76.2 mm)	COBBLES 3 IN.(76.2 mm) TO 5 IN.(127 mm)	OVERSIZE LARGER THAN 5 IN.(127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	MAXIMUM DRY UNIT WEIGHT(D698)-pcf	OPTIMUM MOISTURE CONTENT - %	OVERSIZE SPEC. GRAV.(BULK)	ABSORPTION	MINUS #4 SPECIFIC GRAVITY	LA Abrasion-Grading A, % Loss	CALIFORNIA BEARING RATIO	NATURAL MOISTURE - %	Resistivity (Ohm-Cm) Natural Moisture	Resistivity (Ohm-Cm) Saturated	pH	WATER SOLUBLE SO4 - %
29633	TP-5	1.5-2.0'	SM		30.3	69.1	0.6			30	5								7.7				

4.0 SITE RECONNAISSANCE

A geotechnical reconnaissance of the site was performed by Jennifer Pinkerton, a geotechnical engineer with DOWL HKM, on June 26, 2014. The following sections present the findings of the document review and notable site conditions observed within the project site area.

4.1 Geologic Setting

The site is located on Cretaceous Age deposits. The area is generally mapped as sandstone and shales as depicted on the geologic map in appendix D. The alluvium in this area generally consists of:

1. **Kl Lance Formation (Upper Cretaceous)**
   Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

2. **Kfh Fox Hills Formation (Upper Cretaceous)**
   Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

3. **Kb Bearpaw Shale (Upper Cretaceous)**
   Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500.

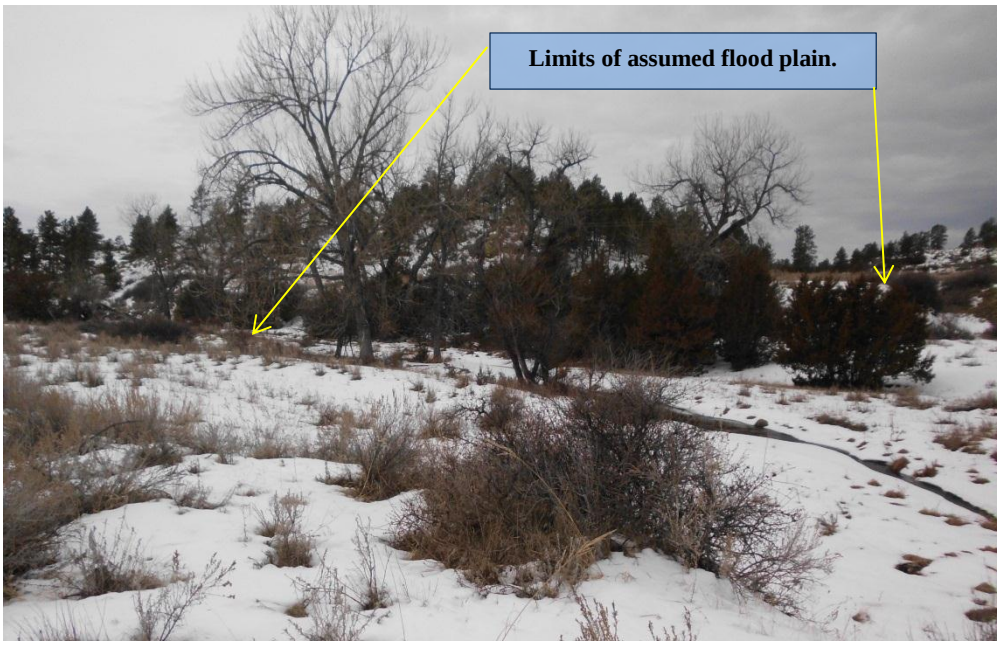
The prominent geologic features at the sites are a drainage area located southeast portion of the eastbound rest area, a large sandstone out cropping located due east of the eastbound rest area and Box Elder Creek located west of the westbound rest area. The sandstone outcropping and Box Elder Creek contributed to the sand and gravel deposits throughout the sites. No other prominent geologic features were observed in the immediate vicinity of the project site corridor. Based on visual examination, the surficial soils consist of silt, clay, sand, and gravel associated with the formations within the rest area sites.

4.2 Topography/Floodplain

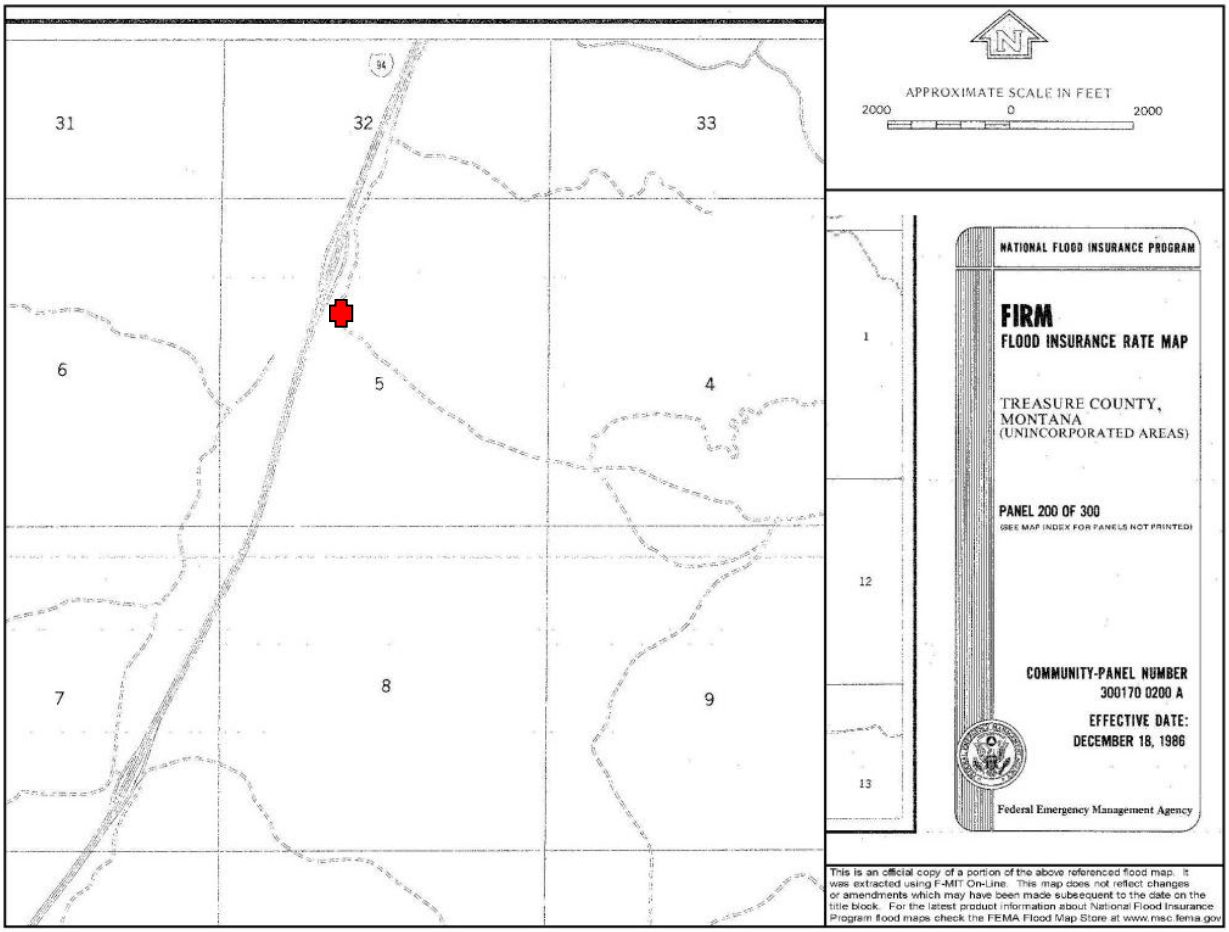
The proposed wastewater system sites are located on gently sloping Cretaceous Age deposits. The wastewater system will be located in an area with approximately 2% to 4% slope (see Site Plan).

Flooding risk from Box Elder Creek was assessed from published FEMA maps and visual verifications of channel characteristics, vegetation growth and bank elevation. As seen in Figures 2, the project site is located outside of the FEMA-designated 100-year flood plain. The proposed wastewater system site is located approximately 520 feet southwest of the potential floodplain boundary of Box Elder Creek. The proposed wastewater system is located in areas above any potential flooding inundation.

Photo 1. View of Box Elder Creek bordering westbound rest area, looking southwest.



The proposed drainfield areas are located such that stormwater and spring melt runoff should not pose any flooding risk to the drainfield. As a precaution, a Phase II drainage plan should be designed to divert any stormwater and spring melt runoff away from the proposed drainfield.



4.3 Site Condition

The majority of the proposed wastewater site alignment occurs over Upper Cretaceous deposits of sandstone, sandy shales and silty shales. Based on the NRCS soil survey, the majority of subgrade soils beneath the project site consist of soils classifying as McRae and Havre Loam (1 to 4 percent slope), McRae and Bainville Loam (8-20 percent slope) and McRae and Havre Loam (4 to 8 percent slope).

The topography generally increases in elevation from the north to the south end of the project. The project site area is surrounded by pasture and native grassland.

An area of the investigation focus is located in the northeastern portion of the project site where the proposed drainfield is located. In this area, soils were found to range from lean clays with sand/gravels (sandy silt loam). These types of soils are fine enough to filter and treat wastewater but not too fine to constrict or limit permeability. Percolation rates in this area ranged from 6 minutes per inch to 15 minutes per inch. Based on the site's subsurface conditions, the new wastewater system will be more than capable of handling the anticipated effluent flows.

4.4 Wetlands

A wetland delineation was not completed for this project. However, a drainage swale was identified adjacent to the project area but outside of the area proposed for disturbance. The drainage swale is located southeast of the eastbound rest area site and drains about half of the eastbound rest area. Continuous flow in the swale was absent during the investigation.

All construction activities will remain outside the boundary of the potential drainage/riparian area. The drainage area will not be impacted by proposed construction activities.

4.5 Hazardous Materials

All project work, maintenance practices, and the placement of staging areas should be conducted so as to avoid impacts to the drainage areas located within or adjacent to the project site. All chemicals and wastes associated with this project's construction, such as fuels, oils, coolants, hydraulic fluids, solvents, paints, etc., are to be carefully contained and stored 50 feet (15 meters) away from the top of drainage areas. Specific sampling or testing for hazardous materials was not conducted as part of this investigation. No visibly obvious hazardous materials were observed at the areas of investigation.

5.0 SUBSURFACE CONDITIONS

5.1 Existing

Currently the existing rest area has two individual wastewater treatment systems. The rest area's drainfields are located on the northeastern and northwestern portions of the sites. The drainfields did not show signs of problems and/or failure.

5.2 Soil Conditions

Subgrade soils beneath the proposed wastewater system site consist of soils classifying sandy silt loams and sandy loams (USDA)/ (lean clays (USCS). Most of these soils were observed to depths ranging from 0.5 to 10 feet. The deeper soils were generally, medium stiff in consistency, grey to brown, low plasticity and contained varying amounts of sands, clays, silts, and gravels.

5.3 Groundwater

Groundwater or groundwater indicators were not observed at depths ranging from 1 to 10 feet in the six test pits. DOWL HKM found the eastbound aquifer to be located in the Bearpaw shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. These logs indicate that the existing public wells located water at an interval depth of 6 to 200 feet below

ground surface. Sandy clays, Sandy silts, gravels dominate the upper 10 feet of the wells. Shale and sandstone layers are found from 25 feet to 200 feet. Based on the information presented in the well logs, it appears that the aquifer is found in a confined/semi confined aquifer formation. .

5.4 Borrow Source and Topsoil Survey

Borrow source investigation and topsoil surveys are not included in the project scope and were not performed. However a total of eight (8) exploration e borings were performed within the rest area pavements for informational purposes. The soil descriptions shown on the boring logs are based on field classification in accordance with ASTM Standards D 2488 (Visual Manual– Procedure). Laboratory testing was not conducted on any of the exploration boring samples. The stratigraphic contacts shown on the individual borehole logs represent the approximate boundaries between soil types. The actual transitions may be more gradual or abrupt. The soil and groundwater conditions depicted are only for the specific dates and locations reported, and therefore, are not necessarily representative of other locations and times. The logs of the borings are included in Appendix B. The boring locations are shown on the attached Site Plan.

6.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

The engineering analysis consisted of a review of existing geologic and geotechnical information, investigation of subsurface conditions, and applying the results to project design considerations. The following sections present recommendations for the wastewater system design. The recommendations presented herein are based on available project site information to date and are intended to assist in final planning and design.

6.1 Drainfield Sizing and Design

Based on percolation rates of 15 min/inch and the existence of silt loam to sandy loam soils in the test pits, MDEQ specifies an application rate of 0.5 gallons per day (gpd) per square feet (ft^2).

The future wastewater flow rates are estimated using the growth rate equation noted below.

(Current Wastewater Flows)*(1 + [Growth Rate]) Number of Years = Design Year Wastewater Flows.
(1,470 peak visits*1.5gals/visits) *(1+ [2%])^22 years=
A 2.0 percent growth rate over a 22-year period has been agreed upon by DOWL HKM and MDT and has been used to estimate the 22 year flow rate. The proposed flow rate was calculated from on-site meters and door counters data projected over a 22-year design period.

Assumptions:

1. Flow rate of 3,408 gpd of effluent, and
2. An application rate of 0.5 gpd/ft2, and
3. An infiltration area discount factor of 50% for secondary treatment.

Use: 3,408 gpd/0.5 gpd/ft^2 = 6,817.77 sf $\Rightarrow$ 6818 sf * 0.5 = 3,409 sf

The proposed site plan (See Appendix A) shows the primary drainfield sizes with the 50% reductions (secondary treatment) and a replacement drainfield area without the 50% reduction. MDEQ will make the final determination on drainfield size reduction. This will be based on treated effluent strength, soil conditions and non-degradation to groundwater.

Table 4
Drainfield Design

Description	Lateral length (ft)	Trench Width (ft)	Trench Length (ft)	Number of Laterals	Distance Between Laterals (ft)	Primary Drainfield Area (ft^2)	Replacement Drainfield Area (ft^2)	System Type
Public Drainfield	100’	3’	100’	12	7’	100’x77’	100’x154’	Secondary Treatment Pressure Dosed, Leaching Chambers

The primary drainfield has been located and designed so that all minimum separation distance requirements are met. The replacement drainfield location and design also meet these criteria.

The installer must construct the drainfield per manufacturer’s instructions and all regulatory standards according to Gravelless Absorption Trenches of Circular DEQ-4. The construction and placement of the pressure distribution drainfield will be according to the attached plans and the dimensions shown in Table 5.

All laterals (Infiltrator Chambers) are to be installed perpendicular to ground slope with clean-out risers on the ends. A total of 1,200 lineal feet of Infiltrator Chambers (or approved equal) is required to be installed in standard 3-foot wide trenches at a minimum of 7 feet on center. Each lateral is 100 feet long.

Cleanouts are to be provided at the end of each lateral. The cleanouts are to be at the finished grade and a metal location marker or plastic valve cover must be provided for each cleanout. Cleanouts are constructed from either a long-sweep elbow or two 45-degree bends.

Use a minimum of 12 inches of soil to cap the entire drainfield. The minimum drainfield cap is a 3:1 or flatter slope away from the drainfield area. Only grass (native or turf) is to be used over the entire area of the drainfield.

6.2 Slope Stability

Slopes observed along the alignment generally appeared stable and no significant slope instability or failure was observed. A slope stability analysis was not performed.

6.3 Photographs

Photographs taken during the investigation are presented in Appendix H.

6.4 Special Provisions

This project will include elements that are not adequately specified in the MDT Standard Specifications. The final project specifications should include additional special provisions for the following items:

1. Septic Tank Installation
2. Drainfield Installation

7.0 LIMITATIONS

The conclusions and recommendations presented in this report assume that site conditions are not substantially different than those exposed by the explorations. If during construction, subsurface conditions different from those encountered in the explorations are observed or appear to be present, DOWL HKM should be advised at once to review those conditions and reconsider recommendations where necessary.

If there is a substantial lapse of time between submission of this report and the start of work at the site, and if conditions have changed due to natural causes or construction operations at or near the site, this report should be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions.

This report was prepared for the use of the Montana Department of Transportation and its consultants for this project. It should be made available to prospective contractors for information on factual data only and not as a warranty of subsurface conditions.

Any conclusions by a construction contractor or bidder relating to construction means, methods, techniques, sequences or costs based upon the information provided in this report are not the responsibility of the Montana Department of Transportation or DOWL HKM

8.0 REFERENCES

Lopez, D.A., Berg, R.B., & Lonn, J.D., (2000) *Geologic Map of Hysham 30' x 60' Quadrangle, Montana.*

Montana Bureau of Mines and Geology, Groundwater Information Center, Well Logs, accessed June 2014.

Montana Department of Environmental Quality (2013) Circular DEQ-4 –*Montana Standards for Subsurface Wastewater Treatment Systems*

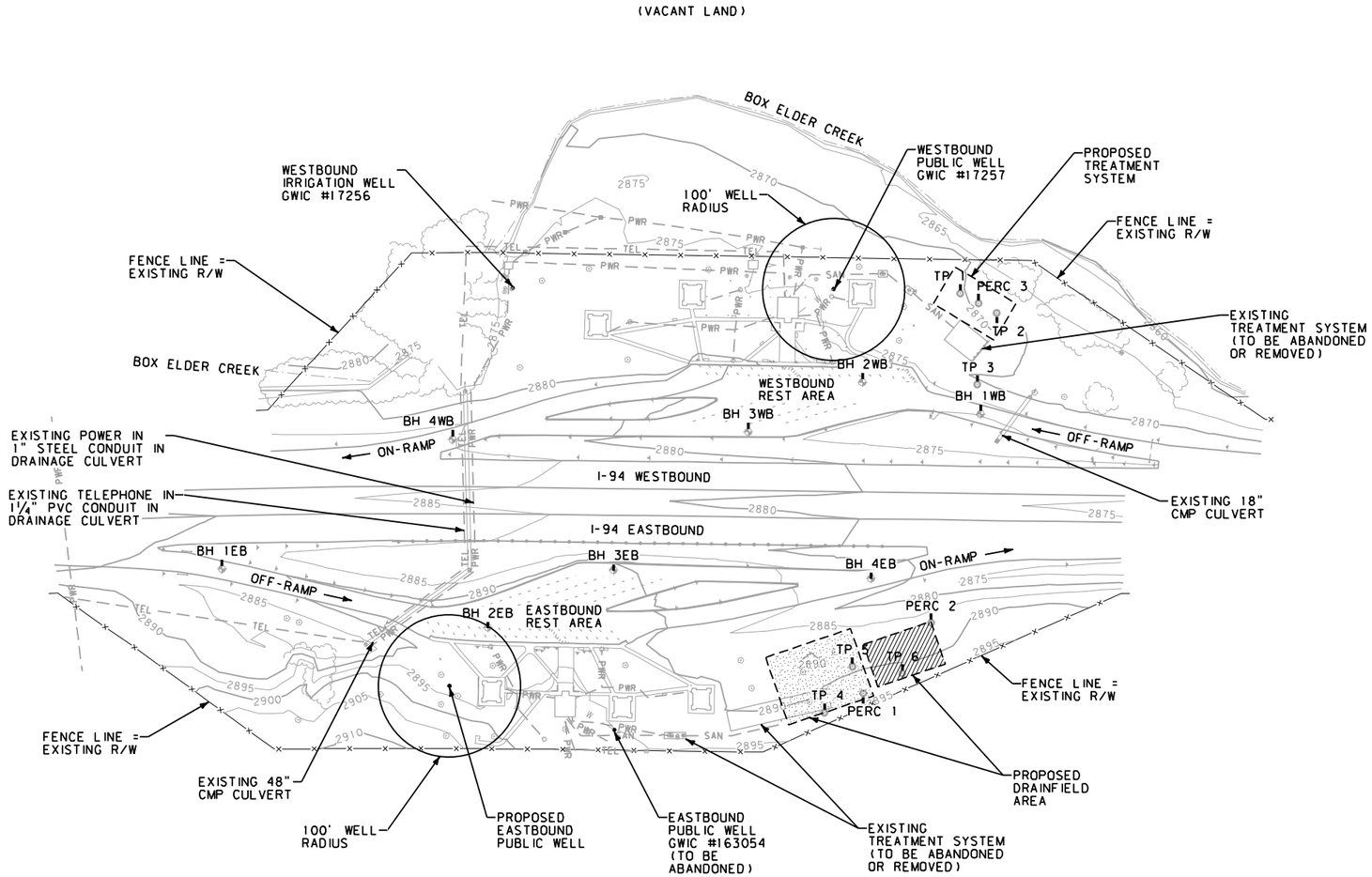
Natural Resources Conservation Service, *Web Soil Survey National Cooperative Soil Survey, Treasure County, accessed June 2014.*

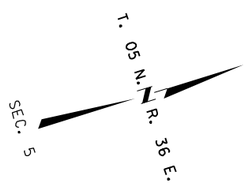
Western Transportation Institute, (February 2011), *Rest Area Use: Data Acquisition and Usage Estimation.*

APPENDIX A

SITE PLAN

DOWL HKM





LEGEND

- PROPOSED 100% REPLACEMENT AREA
- PROPOSED PRIMARY DRAINFIELD
- PERC TEST — PERC #
- TEST PIT — TP #
- BORE HOLE — BH #

NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.
3. PROPOSED FACILITIES ARE APPROXIMATE.

SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\RD\Misc Drawings\SITE PLAN.DGN	DESIGNED BY	T BECKEN-GADDO	9/16/2014	SITE PLAN	HYSHAM REST AREA - MONTANA / IM 94-2(36)65
1		9/17/2014	REVIEWED BY	B DREYER	9/16/2014		
		3:46:19 PM ABeckengadd	CHECKED BY	B DREYER	9/16/2014	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 1 OF 1

APPENDIX B

LOG OF TEST PITS/PERCOLATION TEST & LOGS OF EXPOLORATION BORINGS

Project No.: IM 94-2(36)65

LOG OF TEST PIT TP-1

Sheet 1 of 1

CLIENT: Montana Department of Transportation

PROJECT: Hysham Rest Area - Phase I

TEST PIT LOCATION: Northing: 726387.6 Easting:2537398.6

SITE: Treasure County, Montana

Surface Elevation: 2870.7 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	ELEVATION (FT.)	ADDITIONAL DATA/ REMARKS
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black		Many Organics
0.8	2869.9		
	Lean Clay (CL), stiff, slightly moist, gray to brown	2869.5	USDA Classification Fine Sandy Loam Common Organics
1.5			
2.5	2868.2		
	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded	2868	USDA Classification Coarse Sands
3			
		2866.5	47" - End of Organics
4.5			
		2865	
6			
		2863.5	
7.5			
8.0	2862.7		
	Test Pit Terminated at 8.0 feet		No groundwater or limiting layer observed in test pit
9			
10.5			

SAMPLES: BULK/GRAB; POCKET PENE-TROMETER, TSF; M.C. (PL 10 20 30 40 LL)

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-2	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726428.2 Easting: 2537440.2	Treasure County, Montana

Surface Elevation: 2868.1 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	12" +/- Topsoil, Lean Clay (CL), stiff, moist, black					Many Organics
1.0	2867.1					
	Lean Clay (CL), stiff, moist, gray to brown	2866.5				USDA Classification Fine Sandy Loam Common Organics
1.5						
2.0	2866.1					
	Poorly Graded Gravel with Sand (GP), loose to dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded	2865				USDA Classification Coarse Sands
3						
						49" - End of Organics
4.5		2863.5				
6		2862				
6.5	2861.6					
	Lean Clay (CL), soft, moist to very moist, gray to brown	2860.5				USDA Classification Sandy Clay Loam
7.5						
9	9.0 2859.1					No groundwater or limiting layer observed in test pit
	Test Pit Terminated at 9.0 feet					
10.5						

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CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-3	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726372.1 Easting: 2537527.9	Treasure County, Montana

Surface Elevation: 2871.2 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	12" +/- Topsoil, Lean Clay (CL), stiff, moist, black	2871				Many Organics
1.0	2870.2					
1.5	Lean Clay (CL), stiff, slightly moist, gray to brown	2869.5				USDA Classification Fine Sandy Loam Common Organics
3	3.0 2868.2	2868				
3	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded					USDA Classification Coarse Sand
4.5		2866.5				54" - End of Organics
5.0	2866.2					
5	Lean Clay (CL), stiff, moist, gray to brown					USDA Classification Fine Sandy Loam
5.8	2865.4					
6	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded	2865				USDA Classification Coarse Sand
7.5		2863.5				
9		2862				
10.0	2861.2					
10	Test Pit Terminated at 10.0 feet					No groundwater or limiting layer observed in test pit
10.5						

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-4	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726029.3 Easting: 2537904.5	Treasure County, Montana

Surface Elevation: 2892.5 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black	2892				Many Organics
0.8		2891.7				
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform					USDA Classification Sandy Silt Loam Common Organics
1.5		2890.5				
3		2889				
						48" - End of Organics
4.5		2887.5				
6		2886				
7.5		2884.5				
9		2883				
10.0		2882.5				
	Test Pit Terminated at 10.0 feet					No groundwater or limiting layer observed in test pit
10.5						

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-5	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726086.1 Easting: 2537854.4	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	Surface Elevation: 2888.9 Datum: NAD83						
	6" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.5	2888.4						
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform						USDA Classification Sandy Silt Loam Common Organics
			2887.5				
1.5							
			2886				
3							
			2884.5				50" - End of Organics
4.5							
			2883				
6							
			2881.5				
7.5							
8.5	2880.4						
	Test Pit Terminated at 8.5 feet						No groundwater or limiting layer observed in test pit
9							
10.5							

DOWL HKM

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-6	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726150.1 Easting: 2537884.6	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	Surface Elevation: 2891.8 Datum: NAD83						
	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.8			2891				
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform		2890.5				USDA Classification Sandy Silt Loam Common Organics
1.5							
			2889				
3							
							47" - End of Organics
			2887.5				
4.5							
			2886				
6							
			2884.5				
7.5							
			2883				
9							
9.0			2882.8				
	Test Pit Terminated at 9.0 feet						No groundwater or limiting layer observed in test pit
10.5							

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near Fence East Bound Test Number PT# 1

Diameter of Test Hole: 6” Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 10:15

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5”

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)
10:18 am	10:33 am	15min	23”	24”	1”	15
10:33 am	10:48 am	15min	23”	23.3/4”	3/4”	20
10:48 am	11:03 am	15min	23”	24”	1”	15
11:03 am	11:18 am	15min	23”	24”	1”	15

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.

William Dreyer		7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near on Ramp East Bound Test Number PT# 2

Diameter of Test Hole: 6” Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 10:18

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5 ft

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)
10:20 am	10:35 am	15min	21 3/4”	24 1/2”	2 3/4”	5.45
10:35 am	10:50 am	15min	21 3/4”	24.1/4”	2 1/2”	6
10:50 am	11:05 am	15min	21 3/4”	24 1/4”	2 1/2”	6
11:05 am	11:20 am	15min	21 3/4”	24 1/4”	2 1/2”	6

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.

William Dreyer		7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near Off Ramp West Bound Existing Drainfield Test Number PT# 3

Diameter of Test Hole: 6” Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 11:45

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5 ft

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)
11:50 am	11:52 am	2 min	21 1/4”	26”	4 3/4”	0.42

20 gallons of water in 10 minutes was use. Based on DEQ 4 the soils are considered Sandy Graves and the test can be stopped.

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.

William Dreyer		7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

DOWL HKM

LOG OF BORING

Boring 8200000-B-1 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725280.9 ft **Coordinates** E: 2537458.8 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2888.6 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BD	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.7 *2887.9*						
2 *2886.6*			53		16 - 14 - 8		BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.	2.2 *2886.4*						
4 *2884.6*			80		3 - 5 - 5		Lean CLAY with sand (CL), medium stiff to stiff, moist to wet, yellow to brown. possible organic zones.							
6 *2882.6*			87		2 - 3 - 5									
8 *2880.6*														
10 *2878.6*			73		9 - 11 - 10		Poorly-Graded GRAVEL with sand (GP), medium dense, dry, yellow to gray, fine to coarse grained, rounded to subrounded.	9.0 *2879.6*						
							Boring Depth: 10.5 ft, *Elevation: 2878.1 ft*	10.5 *2878.1*						

Water Level Observations		Remarks:
After Drilling: *()*	During Drilling: **Not Encountered** After Drilling: *()*	

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LOG OF BORING

Boring 8200000-B-2 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725613.3 ft **Coordinates** E: 2537649 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2892.7 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.	0.5 *2892.2*						
2 *2890.7*														
							Lean CLAY with sand (CL), stiff to soft, moist, gray to brown. occasional pebbles observed.	2.5 *2890.2*						
			100		5 - 6 - 8									
4 *2888.7*														
			100		2 - 3 - 2									
6 *2886.7*														
8 *2884.7*														
			100		2 - 2 - 2									
10 *2882.7*														
							Boring Depth: 10.5 ft, *Elevation: 2882.2 ft*	10.5 *2882.2*						

Water Level Observations

During Drilling: **Not Encountered**	Remarks:
After Drilling: *()*	After Drilling: *()*

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LOG OF BORING

Boring 8200000-B-3 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725806.1 ft **Coordinates** E: 2537624.6 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2890.4 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6 *2889.8*						
2 *2888.4*			53		11 - 16 - 27		BASE COURSE, Well-Graded GRAVEL with sand (GW), dense, moist, gray, fine to coarse grained, angular to subangular.	2.6 *2887.8*						
4 *2886.4*			80		2 - 3 - 3		Lean CLAY (CL), medium stiff, moist, yellow to brown.	5.0 *2885.4*						
6 *2884.4*			100		1 - 3 - 2		Lean CLAY with sand (CL), medium stiff, moist, yellow to brown. scattered pebbles and 2" silty sand layers.							
8 *2882.4*														
10 *2880.4*			100		2 - 3 - 2									
							Boring Depth: 10.5 ft, *Elevation: 2879.9 ft*	10.5 *2879.9*						

Water Level Observations

During Drilling: **Not Encountered**

After Drilling: *()*

After Drilling: *()*

Remarks:

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LOG OF BORING

Boring 8200000-B-4 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726148.1 ft **Coordinates** E: 2537743.9 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2881.8 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.7 *2881.1*						
2 *2879.8*			67		10 - 12 - 8		BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), medium dense, moist, gray, fine to coarse grained, angular to subangular.							
4 *2877.8*			80		5 - 6 - 7		Lean CLAY (CL), stiff, moist, dark brown.	2.6 *2879.2*						
6 *2875.8*			100		3 - 3 - 2		Lean CLAY with sand (CL), medium stiff, moist, dark brown.	5.0 *2876.8*						
8 *2873.8*														
10 *2871.8*			100		3 - 3 - 3		Lean CLAY with sand (CL), medium stiff, moist, dark brown. silty sand seams.	9.5 *2872.3*						
12 *2869.8*														
14 *2867.8*							Lean CLAY with gravel (CL), medium dense, moist, dark brwon, coarse grained, rounded to subrounded.	12.5 *2869.3*						
			27		15 - 16 - 16		Poorly-Graded GRAVEL with sand (GP), dense, dry to moist, yellow to brown, fine to coarse grained, rounded to subrounded.	14.0 *2867.8*						
							Boring Depth: 15.5 ft, *Elevation: 2866.3 ft*	15.5 *2866.3*						

Water Level Observations

During Drilling: **Not Encountered**

After Drilling: *()*

After Drilling: *()*

Remarks:

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LOG OF BORING

Boring 8200000-B-1 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726364.2 ft **Coordinates** E: 2537569 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2875.2 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6						
2			67		9 - 5 - 9		BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), medium dense, moist, gray, fine to coarse grained, angular to subangular.	*2874.6*						
2873.2								2.3						
							Lean CLAY (CL), stiff to very stiff, moist, gray to brown.	*2872.9*						
4			100		6 - 6 - 7									
2871.2														
6			100		7 - 7 - 9									
2869.2														
								6.8						
							Poorly-Graded GRAVEL with sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded. Water table observed at 14.0 feet.	*2868.4*						
8														
2867.2														
10			80		8 - 9 - 10									
2865.2														
12														
2863.2														
14														
2861.2								14.2						
			100		1 - 4 - 8		Lean CLAY (CL), soft, wet, gray to brown.	*2861.0*						
							Poorly-Graded GRAVEL with clay (GP-GC), medium dense, wet, yellow to brown, coarse grained, rounded to subrounded.	15.0 *2860.2*						
								15.5 *2859.7*						

Boring Depth: 15.5 ft, *Elevation: 2859.7 ft*

Water Level Observations		Remarks:
After Drilling: *()*	During Drilling: **14.0 ft** ***(2861.2 ft)***	
	After Drilling: *()*	

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LOG OF BORING

Boring 8200000-B-2 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726219 ft **Coordinates** E: 2537476.9 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2877.4 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6 *2876.8*						
2 *2875.4*			80		14 - 16 - 13		BASE COURSE, Well-Graded GRAVEL with sand (GW), medium dense, moist, gray, fine to coarse grained, angular to subangular.	2.2 *2875.2*						
4 *2873.4*			67		4 - 3 - 3		Lean CLAY with sand (CL), medium stiff to stiff, moist, gray to brown.							
6 *2871.4*			100		2 - 5 - 5									
8 *2869.4*							Poorly-Graded GRAVEL with sand (GP), loose to very dense, dry, yellow to brown, fine to coarse grained, rounded to subrounded.	8.0 *2869.4*						
10 *2867.4*			0		11 - 19 - 31									
							Boring Depth: 10.5 ft, *Elevation: 2866.9 ft*	10.5 *2866.9*						

Water Level Observations		Remarks:
▽ During Drilling: **Not Encountered**	▽ After Drilling: *()*	
▼ After Drilling: *()*		

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LOG OF BORING

Boring 8200000-B-3 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726044.8 ft **Coordinates** E: 2537495.7 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2877.6 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6						
2 2875.6							BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.	2877.0						
							Sandy Lean CLAY (CL), soft, moist, yellow to brown.	2.2 2875.4						
4 2873.6			100		4 - 2 - 2									
							Poorly-Graded GRAVEL (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded.	5.0 2872.6						
6 2871.6			100		9 - 17 - 13									
8 2869.6							Poorly-Graded GRAVEL (GP), Cobbles, medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded.	8.0 2869.6						
10 2867.6			67		8 - 12 - 9									
							Boring Depth: 10.5 ft, *Elevation: 2867.1 ft*	10.5 2867.1						

Water Level Observations		Remarks:
After Drilling: ()	During Drilling: Not Encountered After Drilling: ()	

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LOG OF BORING

Boring 8200000-B-4 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725644.8 ft **Coordinates** E: 2537381.6 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2885.3 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6 *2884.7*						
2 *2883.3*			80		10 - 17 - 14		BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), dense, moist, gray, fine to coarse grained, angular to subangular.	2.3 *2883.0*						
4 *2881.3*			0		6 - 4 - 6		Lean CLAY (CL), stiff, moist, gray to brown.							
6 *2879.3*			100		3 - 4 - 5									
							Lean CLAY with gravel (CL), stiff to medium stiff, moist, gray to brown, coarse grained, rounded to subrounded.	7.0 *2878.3*						
8 *2877.3*							Lean CLAY with sand (CL), medium stiff, moist, gray to brown.	8.0 *2877.3*						
10 *2875.3*			100		3 - 3 - 3									
							Boring Depth: 10.5 ft, *Elevation: 2874.8 ft*	10.5 *2874.8*						

Water Level Observations		Remarks:
▽ After Drilling: *()*	▽ During Drilling: **Not Encountered** ▼ After Drilling: *()*	

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APPENDIX C

NRCS SOILS INFORMATION

United States Department of Agriculture

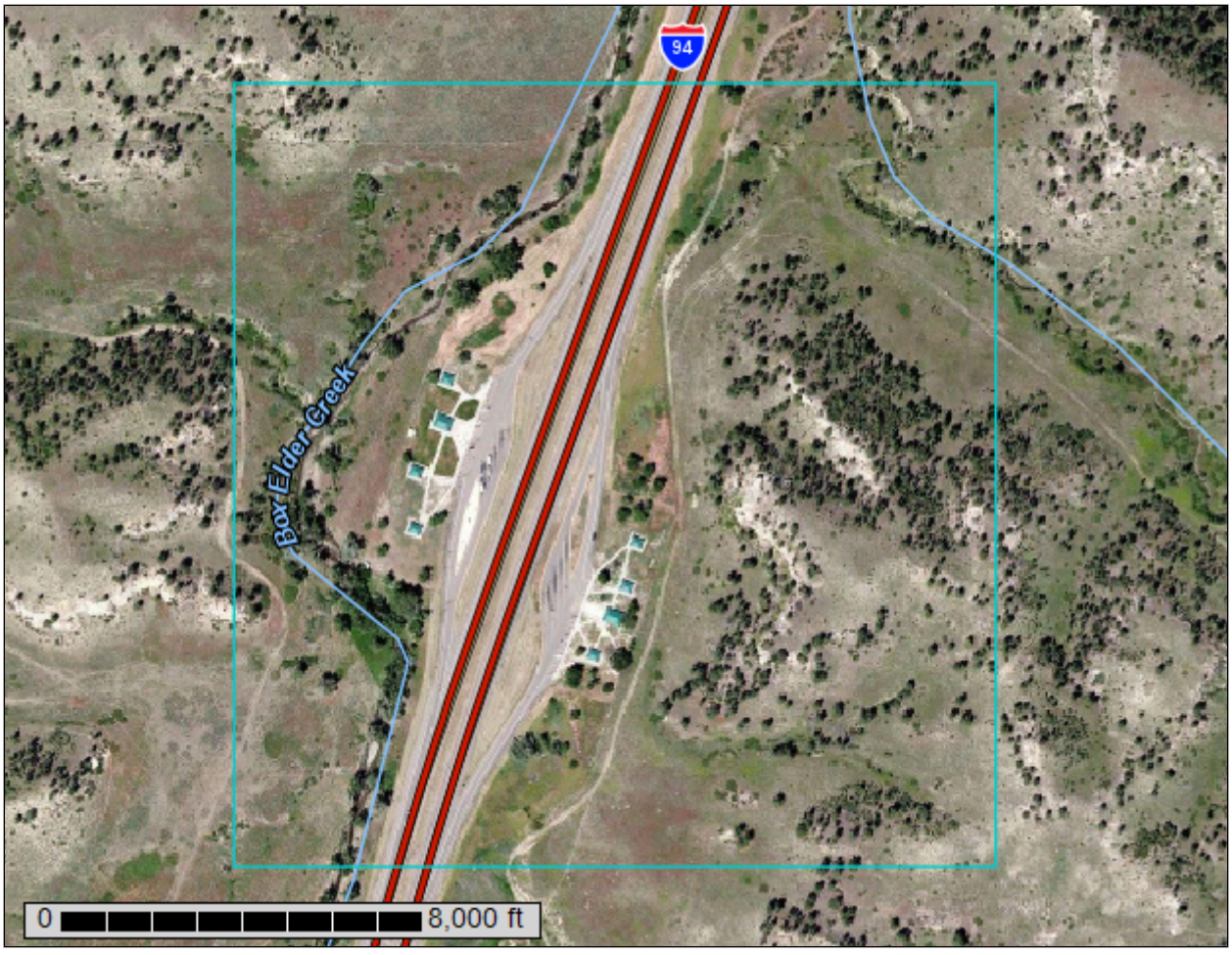
NRCS

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 Treasure County, Montana

Hysham Rest Area



September 17, 2014

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 (http://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.

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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.

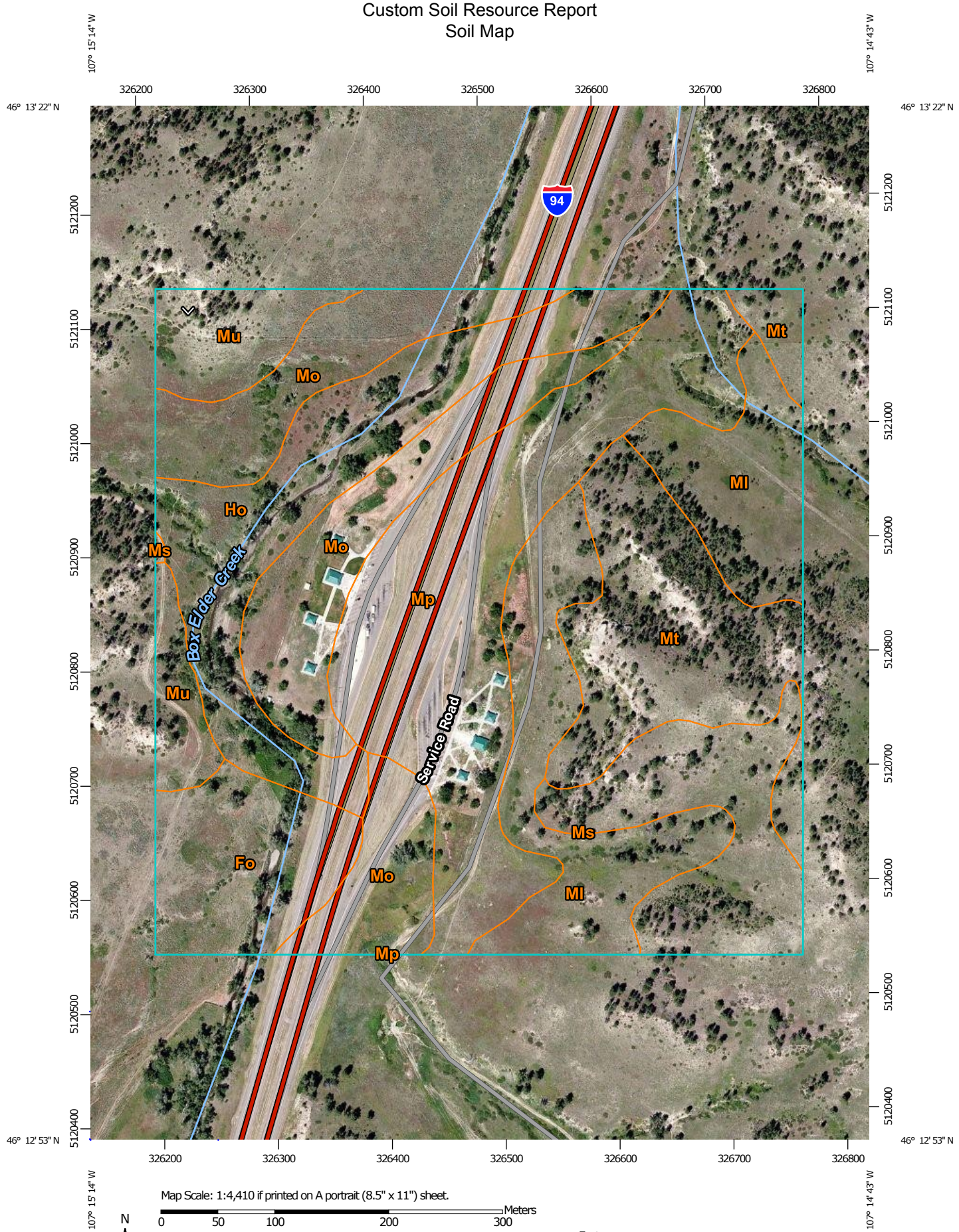
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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 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 Scale: 1:4,410 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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

Treasure County, Montana (MT103)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Fo	Fort Collins loam, 1 to 4 percent slopes	5.8	7.0%
Ho	Havre and Lohmiller soils	10.8	13.1%
Ml	McRae-Bainville loams, 8 to 20 percent slopes	12.5	15.2%
Mo	McRae and Havre loams, 1 to 4 percent slopes	14.7	17.9%
Mp	McRae and Havre loams, 4 to 8 percent slopes	16.6	20.1%
Ms	Midway clay loam, 15 to 35 percent slopes	6.9	8.4%
Mt	Midway-Bainville complex	10.3	12.6%
Mu	Midway-Nihill gravelly loam	4.6	5.6%
Totals for Area of Interest		**82.3**	**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.

Treasure County, Montana

Fo—Fort Collins loam, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: clfp
Mean annual precipitation: 10 to 13 inches
Frost-free period: 110 to 135 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Fort Collins

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 4 inches: loam
Bt - 4 to 12 inches: clay loam
Bk - 12 to 60 inches: loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Arvada

Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Beckton

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear

Ho—Havre and Lohmiller soils

Map Unit Setting

National map unit symbol: clgg
Elevation: 1,800 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Havre and similar soils: 30 percent
Havre and similar soils: 30 percent
Harlem and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harlem

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

A - 0 to 8 inches: clay loam
C1 - 8 to 40 inches: stratified clay to silty clay loam
C2 - 40 to 60 inches: stratified silty clay loam to fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (4.0 to 8.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Description of Havre

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 8 inches: loam
C - 8 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 8 inches: clay
C - 8 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional

Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Minor Components

Bowdoin

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Havre

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Overflow (ov) rru 58a-e 10-14" p.z. (R058AE007MT)

Glendive

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

MI—McRae-Bainville loams, 8 to 20 percent slopes

Map Unit Setting

National map unit symbol: clhj
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 50 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Mcrae and similar soils: 65 percent
Bainville and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Bainville

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and siltstone

Typical profile

A - 0 to 4 inches: loam
C - 4 to 26 inches: silt loam
Cr - 26 to 60 inches: weathered bedrock

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Cherry

Percent of map unit: 4 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Havre

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Mo—McRae and Havre loams, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: clhm
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcrae and similar soils: 50 percent
Havre and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 7 inches: loam
C1 - 7 to 39 inches: stratified fine sandy loam to clay loam
C2 - 39 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)

Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Lohmiller

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Mp—McRae and Havre loams, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: clhn
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcrae and similar soils: 50 percent
Havre and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 7 inches: loam
C1 - 7 to 39 inches: stratified fine sandy loam to clay loam
C2 - 39 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Cherry

Percent of map unit: 3 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 2 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Ms—Midway clay loam, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: clhq
Elevation: 1,900 to 4,500 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 39 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Minor Components

Bainville

Percent of map unit: 8 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Mcrae

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Cherry

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Nunn

Percent of map unit: 4 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 3 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Rock outcrop

Percent of map unit: 3 percent

Mt—Midway-Bainville complex

Map Unit Setting

National map unit symbol: clhr
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 50 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 50 percent
Bainville and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 30 to 65 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Description of Bainville

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and siltstone

Typical profile

A - 0 to 3 inches: loam
C - 3 to 22 inches: silt loam
Cr - 22 to 60 inches: weathered bedrock

Properties and qualities

Slope: 35 to 65 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Minor Components

Cherry

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Mcrae

Percent of map unit: 3 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Travessilla

Percent of map unit: 3 percent
Landform: Hills
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear

Tullock

Percent of map unit: 2 percent
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-steep (systp) rru 58a-e 10-14" p.z. (R058AE006MT)

Havre

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Mu—Midway-Nihill gravelly loam

Map Unit Setting

National map unit symbol: clhs
Elevation: 1,900 to 4,700 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 60 percent
Nihill and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Description of Nihill

Setting
Landform: Hillslopes
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Typical profile
A - 0 to 8 inches: gravelly loam
C - 8 to 40 inches: very gravelly loam
2C - 40 to 60 inches: stratified extremely gravelly sandy loam to very gravelly loam

Properties and qualities
Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Minor Components

Bainville
Percent of map unit: 10 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Shallow (sw) rru 58a-e 10-14" p.z. (R058AE019MT)

Rock outcrop
Percent of map unit: 5 percent

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Building Site Development

Building site development interpretations are designed to be used as tools for evaluating soil suitability and identifying soil limitations for various construction purposes. As part of the interpretation process, the rating applies to each soil in its described condition and does not consider present land use. Example interpretations can include corrosion of concrete and steel, shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping.

Shallow Excavations (Hysham Rest Area)

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

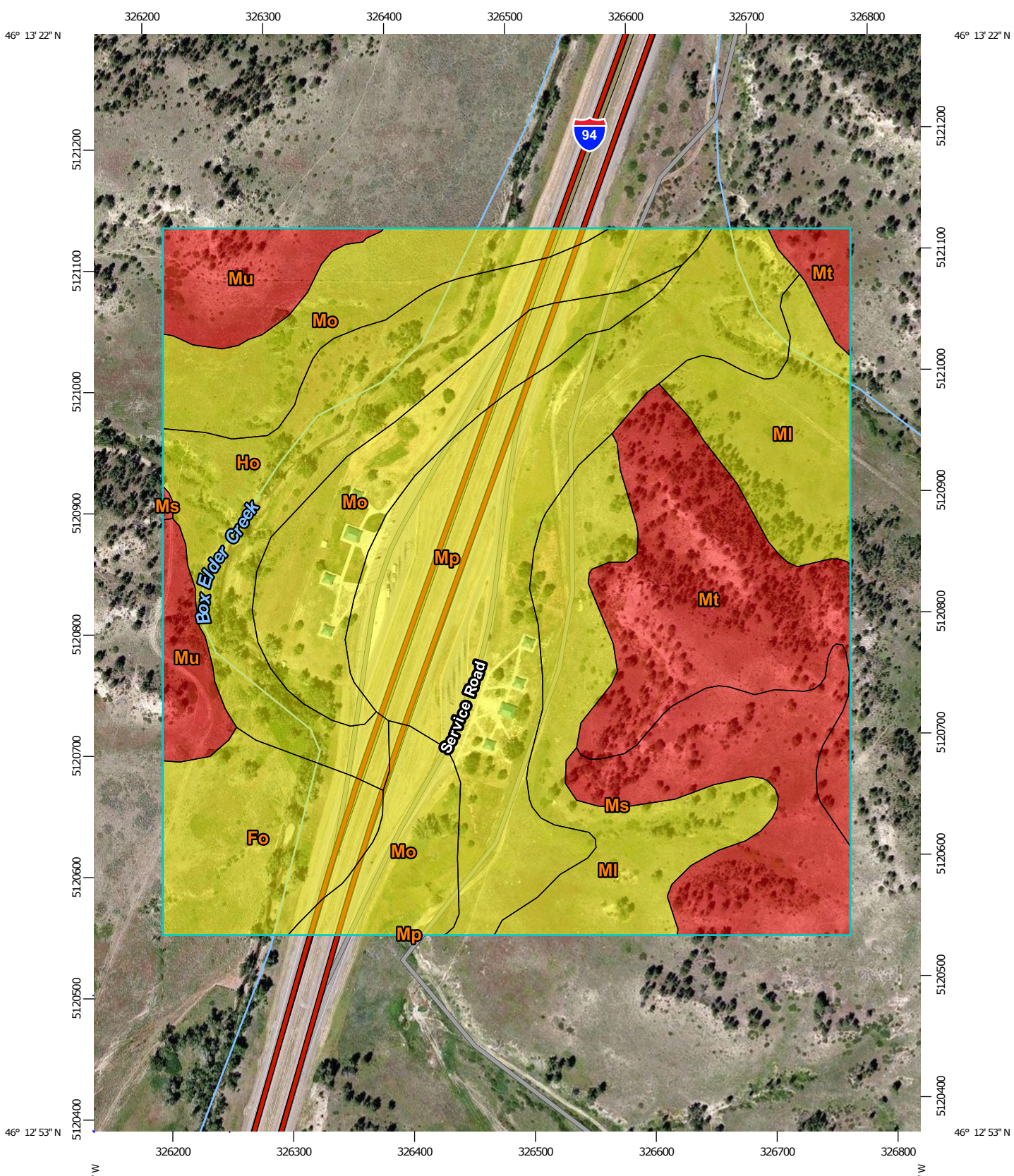
"Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Shallow Excavations (Hysham Rest Area)



Map Scale: 1:4,410 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines

- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points

- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Shallow Excavations (Hysham Rest Area)

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Dusty (0.33)	5.8	7.0%
				Unstable excavation walls (0.01)		
			Arvada (5%)	Unstable excavation walls (0.51)		
				Dusty (0.40)		
			Beckton (5%)	Unstable excavation walls (0.51)		
				Dusty (0.42)		
				Too clayey (0.13)		
Ho	Havre and Lohmiller soils	Somewhat limited	Harlem (30%)	Flooding (0.60)	10.8	13.1%
				Dusty (0.31)		
				Too clayey (0.13)		
				Unstable excavation walls (0.01)		
			Havre (30%)	Flooding (0.60)		
				Dusty (0.16)		
				Unstable excavation walls (0.01)		
			Havre (30%)	Flooding (0.60)		
				Dusty (0.21)		
				Unstable excavation walls (0.01)		
			Havre (3%)	Flooding (0.80)		
				Dusty (0.14)		
				Unstable excavation walls (0.01)		
Ml	McRae-Bainville loams, 8 to 20 percent slopes	Somewhat limited	McRae (65%)	Slope (0.96)	12.5	15.2%
				Dusty (0.34)		
				Unstable excavation walls (0.01)		
			Bainville (25%)	Slope (0.96)		
				Depth to soft bedrock (0.79)		

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
				Dusty (0.50)		
				Unstable excavation walls (0.01)		
			Cherry (4%)	Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (4%)	Slope (0.63)		
				Dusty (0.25)		
				Unstable excavation walls (0.01)		
			Havre (2%)	Dusty (0.15)		
				Unstable excavation walls (0.01)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Dusty (0.34)	14.7	17.9%
				Unstable excavation walls (0.01)		
			Havre (45%)	Dusty (0.17)		
				Unstable excavation walls (0.01)		
			Lohmiller (5%)	Dusty (0.19)		
				Unstable excavation walls (0.01)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Dusty (0.34)	16.6	20.1%
				Unstable excavation walls (0.01)		
			Havre (45%)	Dusty (0.32)		
				Unstable excavation walls (0.01)		
			Cherry (3%)	Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (2%)	Dusty (0.19)		
				Unstable excavation walls (0.01)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Depth to soft bedrock (1.00)	6.9	8.4%

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Bainville (8%)	Depth to soft bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (3%)	Slope (1.00)		
				Dusty (0.25)		
				Unstable excavation walls (0.01)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Depth to soft bedrock (1.00)	10.3	12.6%
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Bainville (35%)	Slope (1.00)		
				Depth to soft bedrock (0.97)		
				Dusty (0.50)		
				Unstable excavation walls (0.01)		
			Travessilla (3%)	Depth to hard bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.05)		
				Unstable excavation walls (0.01)		
			Tullock (2%)	Slope (1.00)		
				Depth to soft bedrock (0.64)		
				Unstable excavation walls (0.01)		
				Dusty (0.00)		

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Depth to soft bedrock (1.00)	4.6	5.6%
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Nihill (25%)	Slope (1.00)		
				Dusty (0.22)		
				Unstable excavation walls (0.01)		
			Bainville (10%)	Depth to soft bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.24)		
				Unstable excavation walls (0.01)		
Totals for Area of Interest					**82.3**	**100.0%**

Shallow Excavations— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Somewhat limited	60.4	73.4%
Very limited	21.9	26.6%
Totals for Area of Interest	**82.3**	**100.0%**

Rating Options—Shallow Excavations (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component

typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Construction Materials

Construction materials interpretations are tools designed to provide guidance to users in selecting a site for potential source of various materials. Individual soils or groups of soils may be selected as a potential source because they are close at hand, are the only source available, or they meets some or all of the physical or chemical properties required for the intended application. Example interpretations include roadfill, sand and gravel, topsoil and reclamation material.

Gravel Source (Hysham Rest Area)

Gravel consists of natural aggregates (2 to 75 millimeters in diameter) suitable for commercial use with a minimum of processing. It is used in many kinds of construction. Specifications for each use vary widely. Only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

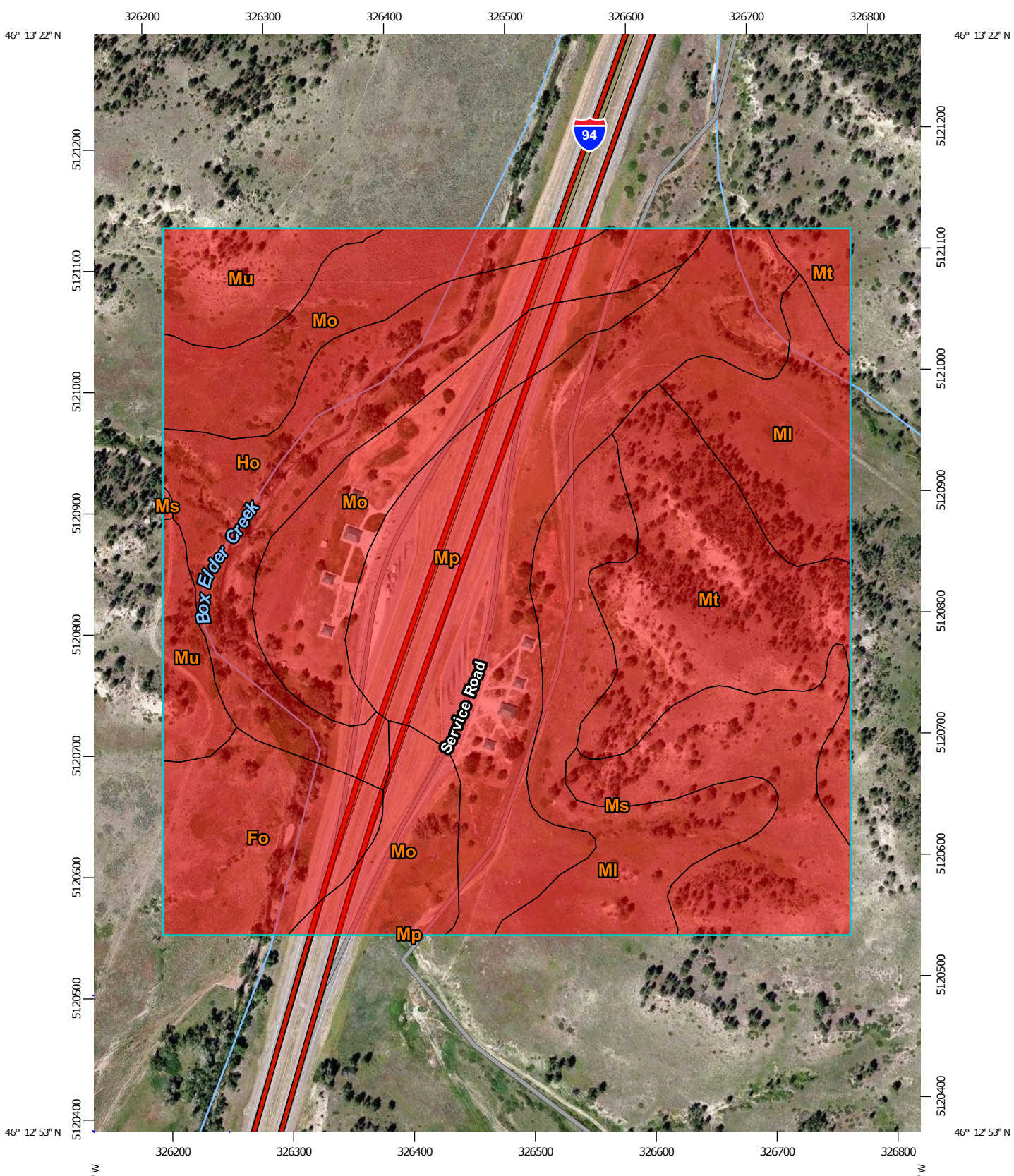
The properties used to evaluate the soil as a source of gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains gravel, the soil is considered a likely source regardless of thickness. The assumption is that the gravel layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be gravel.

The soils are rated "good," "fair," or "poor" as potential sources of gravel. A rating of "good" or "fair" means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Gravel Source (Hysham Rest Area)



Map Scale: 1:4,410 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Poor

Fair

Good

Not rated or not available

Soil Rating Lines

Poor

Fair

Good

Not rated or not available

Soil Rating Points

Poor

Fair

Good

Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Gravel Source (Hysham Rest Area)

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
Fo	Fort Collins loam, 1 to 4 percent slopes	Poor	Fort Collins (90%)	Bottom layer (0.00)	5.8	7.0%
				Thickest layer (0.00)		
			Arvada (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Beckton (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Ho	Havre and Lohmiller soils	Poor	Harlem (30%)	Bottom layer (0.00)	10.8	13.1%
				Thickest layer (0.00)		
			Havre (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Bowdoin (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Ml	McRae-Bainville loams, 8 to 20 percent slopes	Poor	McRae (65%)	Bottom layer (0.00)	12.5	15.2%
				Thickest layer (0.00)		
			Bainville (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Lohmiller (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Poor	McRae (50%)	Bottom layer (0.00)	14.7	17.9%
				Thickest layer (0.00)		
			Havre (45%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Poor	McRae (50%)	Bottom layer (0.00)	16.6	20.1%
				Thickest layer (0.00)		
			Havre (45%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Ms	Midway clay loam, 15 to 35 percent slopes	Poor	Midway (70%)	Bottom layer (0.00)	6.9	8.4%
				Thickest layer (0.00)		
			Bainville (8%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			McRae (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Nunn (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mt	Midway-Bainville complex	Poor	Midway (50%)	Bottom layer (0.00)	10.3	12.6%
				Thickest layer (0.00)		
			Bainville (35%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Travessilla (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			McRae (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Tullock (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (1%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mu	Midway-Nihill gravelly loam	Poor	Midway (60%)	Bottom layer (0.00)	4.6	5.6%
				Thickest layer (0.00)		
			Nihill (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Bainville (10%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Totals for Area of Interest					**82.3**	**100.0%**

Gravel Source— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Poor	82.3	100.0%
Totals for Area of Interest	**82.3**	**100.0%**

Rating Options—Gravel Source (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Sanitary Facilities

Sanitary Facilities interpretations are tools designed to guide the user in site selection for the safe disposal of sewage and solid waste. Example interpretations include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Septic Tank Absorption Fields (Hysham Rest Area)

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown

for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map Scale: 1:4,410 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Lines

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Points

Very limited

Somewhat limited

Not limited

Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Septic Tank Absorption Fields (Hysham Rest Area)

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Slow water movement (0.50)	5.8	7.0%
Ho	Havre and Lohmiller soils	Very limited	Harlem (30%)	Flooding (1.00)	10.8	13.1%
				Slow water movement (1.00)		
			Havre (30%)	Flooding (1.00)		
				Slow water movement (0.50)		
			Havre (30%)	Flooding (1.00)		
				Slow water movement (0.50)		
			Bowdoin (4%)	Slow water movement (1.00)		
				Flooding (0.40)		
			Glendive (3%)	Filtering capacity (1.00)		
				Flooding (0.40)		
			Havre (3%)	Flooding (1.00)		
				Slow water movement (0.50)		
Ml	McRae-Bainville loams, 8 to 20 percent slopes	Somewhat limited	McRae (65%)	Slope (0.96)	12.5	15.2%
				Slow water movement (0.50)		
			Cherry (4%)	Slow water movement (0.50)		
			Lohmiller (4%)	Slope (0.63)		
				Slow water movement (0.50)		
			Havre (2%)	Slow water movement (0.50)		
				Flooding (0.40)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Slow water movement (0.50)	14.7	17.9%

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Havre (45%)	Slow water movement (0.50)		
			Lohmiller (5%)	Slow water movement (0.50)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Slow water movement (0.50)	16.6	20.1%
			Havre (45%)	Slow water movement (0.50)		
			Cherry (3%)	Slow water movement (0.50)		
			Lohmiller (2%)	Slow water movement (0.50)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Depth to bedrock (1.00)	6.9	8.4%
				Slope (1.00)		
			Bainville (8%)	Depth to bedrock (1.00)		
				Slope (1.00)		
			Nunn (4%)	Slow water movement (1.00)		
			Lohmiller (3%)	Slope (1.00)		
				Slow water movement (0.50)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Depth to bedrock (1.00)	10.3	12.6%
				Slope (1.00)		
			Bainville (35%)	Slope (1.00)		
				Depth to bedrock (1.00)		
			Travessilla (3%)	Depth to bedrock (1.00)		
				Slope (1.00)		
			Tullock (2%)	Slope (1.00)		
				Depth to bedrock (1.00)		
				Filtering capacity (1.00)		
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Depth to bedrock (1.00)	4.6	5.6%
				Slope (1.00)		

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Nihill (25%)	Slope (1.00)		
				Seepage, bottom layer (1.00)		
				Slow water movement (0.50)		
			Bainville (10%)	Depth to bedrock (1.00)		
				Slope (1.00)		
Totals for Area of Interest					**82.3**	**100.0%**

Septic Tank Absorption Fields— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Somewhat limited	49.6	60.3%
Very limited	32.7	39.7%
Totals for Area of Interest	**82.3**	**100.0%**

Rating Options—Septic Tank Absorption Fields (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a

percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Water Management

Water Management interpretations are tools for evaluating the potential of the soil in the application of various water management practices. Example interpretations include pond reservoir area, embankments, dikes, levees, and excavated ponds.

Subsurface Water Management, Outflow Quality (Hysham Rest Area)

The ratings for Subsurface Water Management, Outflow Quality are based on the soil properties that affect the capacity of the soil to convey surface and subsurface water and on the properties that affect water quality. The properties that affect the conveyance and water quality include salinity, sodicity, soil reaction, soil taxonomic great group placement, gypsum content, shrink-swell potential, soil saturation, and surface erosion.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor water quality can be expected.

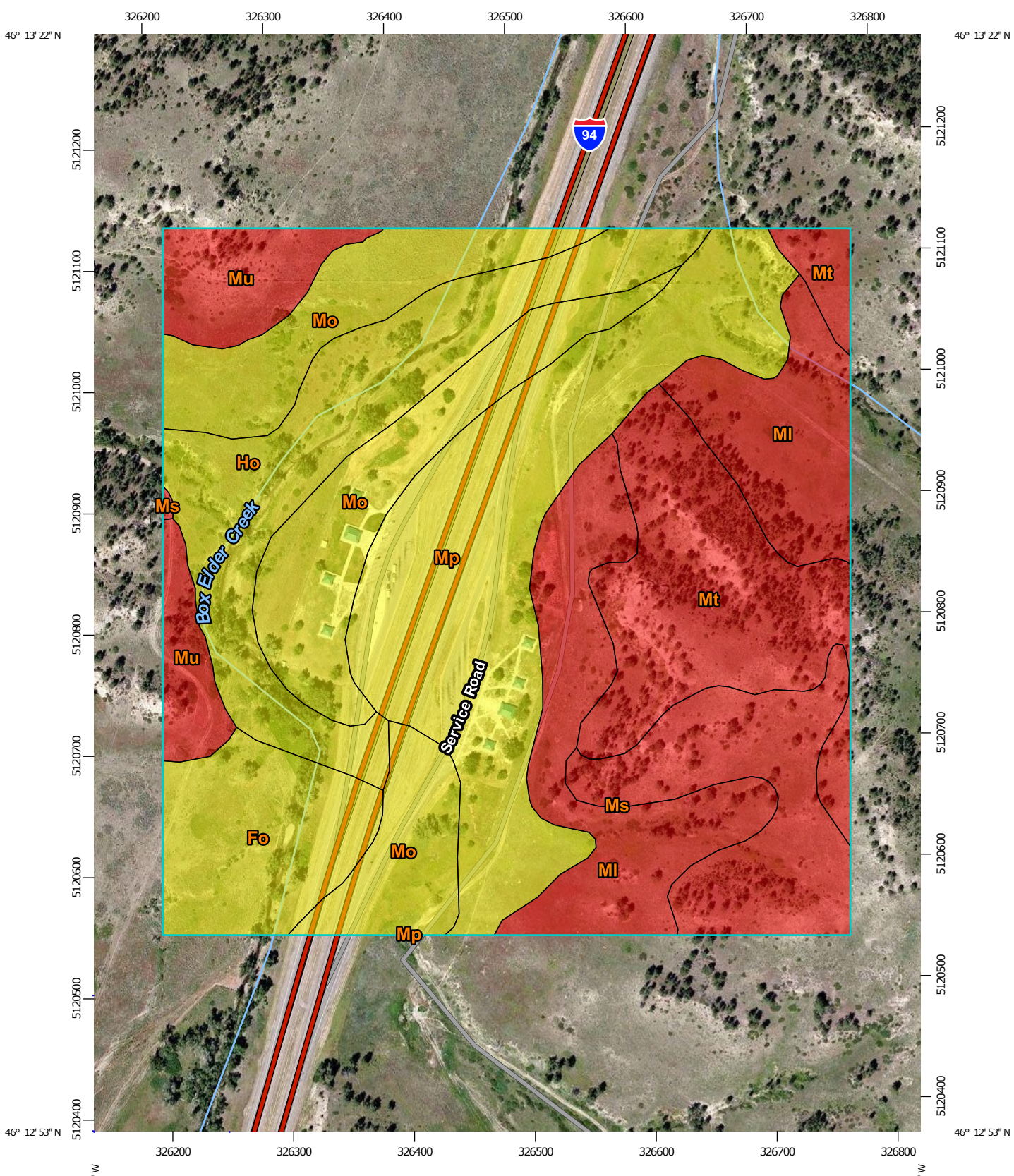
Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are

determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as that listed for the map unit. The percent composition of each component in a particular map unit is given so that the user will realize the percentage of each map unit that has the specified rating.

A map unit may have other components with different ratings. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Subsurface Water Management, Outflow Quality (Hysham Rest Area)



Map Scale: 1:4,410 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Lines

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Points

Very limited

Somewhat limited

Not limited

Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Subsurface Water Management, Outflow Quality (Hysham Rest Area)

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Pesticide and nutrient movement (0.22)	5.8	7.0%
Ho	Havre and Lohmiller soils	Somewhat limited	Harlem (30%)	Excess Salt (0.06)	10.8	13.1%
			Havre (30%)	Pesticide and nutrient movement (0.22)		
			Glendive (3%)	Pesticide and nutrient movement (0.22)		
			Havre (3%)	Pesticide and nutrient movement (0.22)		
Ml	McRae-Bainville loams, 8 to 20 percent slopes	Very limited	McRae (65%)	Water Erosion (1.00)	12.5	15.2%
				Pesticide and nutrient movement (0.22)		
			Bainville (25%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Pesticide and nutrient movement (0.22)	14.7	17.9%
			Havre (45%)	Pesticide and nutrient movement (0.22)		
			Lohmiller (5%)	Pesticide and nutrient movement (0.00)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Pesticide and nutrient movement (0.22)	16.6	20.1%
				Water Erosion (0.10)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Havre (45%)	Water Erosion (0.23)		
				Pesticide and nutrient movement (0.22)		
			Cherry (3%)	Pesticide and nutrient movement (0.22)		
			Lohmiller (2%)	Pesticide and nutrient movement (0.00)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Water Erosion (1.00)	6.9	8.4%
				Pesticide and nutrient movement (0.29)		
			Bainville (8%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
				Excess Salt (0.01)		
			McRae (6%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Lohmiller (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Water Erosion (1.00)	10.3	12.6%
				Pesticide and nutrient movement (0.29)		
			Bainville (35%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
			Travessilla (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			McRae (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Tullock (2%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Water Erosion (1.00)	4.6	5.6%
				Pesticide and nutrient movement (0.29)		
			Nihill (25%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Bainville (10%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
				Excess Salt (0.01)		
Totals for Area of Interest					**82.3**	**100.0%**

Subsurface Water Management, Outflow Quality— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Somewhat limited	47.9	58.2%
Very limited	34.4	41.8%
Totals for Area of Interest	**82.3**	**100.0%**

Rating Options—Subsurface Water Management, Outflow Quality (Hysham Rest Area)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Sanitary Facilities

This folder contains a collection of tabular reports that present soil interpretations related to sanitary facilities. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Sanitary facilities interpretations are tools designed to guide the user in site selection for the safe disposal of sewage and solid waste. Example interpretations include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Sewage Disposal (Hysham Rest Area)

This table shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Saturated hydraulic conductivity (Ksat) is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a Ksat rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Sewage Disposal (Hysham Rest Area)

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Fo—Fort Collins loam, 1 to 4 percent slopes					
Fort collins	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Arvada	5	Very limited		Not limited	
		Slow water movement	1.00		
Beckton	5	Very limited		Not limited	
		Slow water movement	1.00		
Ho—Havre and Lohmiller soils					
Harlem	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	1.00		
Havre	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
Havre	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
Bowdoin	4	Very limited		Somewhat limited	
		Slow water movement	1.00	Flooding	0.40
		Flooding	0.40		
Glendive	3	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.40	Flooding	0.40
Havre	3	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Ml—McRae-Bainville loams, 8 to 20 percent slopes					
Mcrae	65	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Bainville	25	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Cherry	4	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Lohmiller	4	Somewhat limited		Very limited	
		Slope	0.63	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Havre	2	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
		Flooding	0.40	Flooding	0.40
Mo—McRae and Havre loams, 1 to 4 percent slopes					
Mcrae	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Havre	45	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Lohmiller	5	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Mp—McRae and Havre loams, 4 to 8 percent slopes					
Mcrae	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Havre	45	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Cherry	3	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Lohmiller	2	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Ms—Midway clay loam, 15 to 35 percent slopes					
Midway	70	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Bainville	8	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	0.50
Cherry	6	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Mcrae	6	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Nunn	4	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.92
Lohmiller	3	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Rock outcrop	3	Not rated		Not rated	

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Mt—Midway-Bainville complex					
Midway	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Bainville	35	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
				Seepage	0.50
Cherry	6	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Mcrae	3	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Travessilla	3	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
Tullock	2	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Filtering capacity	1.00	Seepage	1.00
Havre	1	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
		Flooding	0.40	Flooding	0.40
Mu—Midway-Nihill gravelly loam					
Midway	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Nihill	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	0.50		
Bainville	10	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	0.50
Rock outcrop	5	Not rated		Not rated	

Soil Chemical Properties

This folder contains a collection of tabular reports that present soil chemical properties. The reports (tables) include all selected map units and components for each map unit. Soil chemical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

Chemical Soil Properties (Hysham Rest Area)

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg

concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Fo—Fort Collins loam, 1 to 4 percent slopes								
Fort collins	0-4	15-20	—	6.6-7.8	0	0	0	0
	4-12	20-25	—	7.4-8.4	0	0	0	0
	12-60	15-20	—	7.9-9.0	5-15	0	0.0-2.0	0
Arvada	0-6	15-20	—	6.6-7.8	0	0	0.0-2.0	0
	6-17	25-35	—	7.4-9.0	0	0	1.0-8.0	10-20
	17-60	20-25	—	7.9-9.0	5-15	0	8.0-16.0	13-30
Beckton	0-6	20-25	—	6.6-7.8	0	0	0.0-2.0	0
	6-22	25-35	—	7.4-9.0	0	0	1.0-8.0	10-20
	22-60	20-25	—	7.9-9.0	5-15	0	8.0-16.0	13-30

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Ho—Havre and Lohmiller soils								
Harlem	0-8	20-25	—	7.4-8.4	1-5	0	2.0-4.0	0
	8-40	25-30	—	7.4-8.4	5-10	0	2.0-4.0	0
	40-60	15-20	—	7.9-9.0	5-10	0	4.0-8.0	0
Havre	0-8	15-20	—	7.4-8.4	1-5	0	0.0-2.0	0
	8-60	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
Havre	0-8	25-30	—	7.4-8.4	1-5	0	0.0-2.0	0
	8-60	15-20	—	7.4-8.4	1-5	0	0.0-4.0	0
Bowdoin	0-7	30-50	—	7.4-9.0	1-5	0	8.0-16.0	5-13
	7-42	35-55	—	7.4-9.0	1-5	0	8.0-16.0	13-30
	42-62	30-45	—	7.9-9.0	1-5	0	8.0-16.0	13-30
Glendive	0-8	10-15	—	7.4-8.4	0	0	0.0-2.0	0
	8-18	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	18-60	1.0-5.0	—	7.4-8.4	5-10	0	0.0-4.0	0
Havre	0-5	15-20	—	7.4-8.4	1-5	0	0.0-2.0	0
	5-60	15-25	—	7.4-8.4	1-10	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
MI—McRae-Bainville loams, 8 to 20 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Bainville	0-4	15-20	—	6.6-7.8	1-5	0	0	0
	4-26	10-15	—	7.4-8.4	5-10	0	0.0-4.0	0
	26-60	—	—	—	—	—	—	—
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Lohmiller	0-7	15-20	—	6.6-8.4	0	0	0	0
	7-60	10-15	—	6.6-8.4	0-5	0	0	0
Havre	0-9	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	9-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mo—McRae and Havre loams, 1 to 4 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Havre	0-7	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	7-39	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	39-60	15-25	—	7.4-9.0	1-5	0	2.0-8.0	0
Lohmiller	0-20	20-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	20-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mp—McRae and Havre loams, 4 to 8 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Havre	0-7	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	7-39	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	39-60	15-25	—	7.4-9.0	1-5	0	2.0-8.0	0
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Lohmiller	0-20	20-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	20-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Ms—Midway clay loam, 15 to 35 percent slopes								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Bainville	0-3	10-15	—	7.4-9.0	5-10	0	0.0-4.0	0
	3-15	5.0-10	—	7.4-9.0	10-15	0	0.0-4.0	1-5
	15-60	—	5.0-10	—	15-25	—	2.0-8.0	1-5
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	5-10	0	0.0-2.0	0
	10-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Nunn	0-6	20-25	—	6.1-7.8	0	0	0	0
	6-14	25-30	—	6.6-8.4	0	0	0	0
	14-60	20-25	—	7.4-9.0	5-15	0	0	1-5
Lohmiller	0-7	15-20	—	6.6-8.4	0	0	0	0
	7-60	10-15	—	6.6-8.4	0-5	0	0	0
Rock outcrop	—	—	—	—	—	—	—	—

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mt—Midway-Bainville complex								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Bainville	0-3	15-20	—	6.6-7.8	1-5	0	0	0
	3-22	10-15	—	7.4-8.4	5-10	0	0.0-4.0	0
	22-60	—	—	—	—	—	—	—
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	5-10	0	0.0-2.0	0
	10-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Travessilla	0-2	10-15	—	6.6-8.4	0	0	0	0
	2-12	5.0-10	—	7.4-9.0	5-10	0	0.0-2.0	0
	12-60	—	—	—	—	—	—	—
Tullock	0-8	10-15	—	7.9-8.4	1-5	0	0	0
	8-28	5.7-13	—	7.9-8.4	5-10	0	0	0
	28-60	—	—	—	—	—	—	—
Havre	0-9	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	9-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mu—Midway-Nihill gravelly loam								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Nihill	0-8	15-20	—	6.6-8.4	0	0	0.0-2.0	0
	8-40	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-8.4	5-15	0	0.0-2.0	0
Bainville	0-4	10-15	—	7.4-9.0	5-10	0	0.0-4.0	0
	4-19	5.0-10	—	7.4-9.0	15-25	1-5	2.0-8.0	1-5
	19-60	—	—	—	—	—	—	—
Rock outcrop	—	—	—	—	—	—	—	—

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Hysham Rest Area)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the

surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

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.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba).

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Fo—Fort Collins loam, 1 to 4 percent slopes														
Fort collins	90	B	0-4	Loam	CL-ML	A-4	0	0	100	100	85-95	60-75	25-30	5-10
			4-12	Clay loam, loam	CL	A-6	0	0	100	100	85-95	65-80	25-35	10-15
			12-60	Loam, clay loam	CL-ML	A-4	0	0	100	100	85-95	60-75	25-30	5-10
Arvada	5	D	0-6	Loam	CL-ML	A-4	0	0	80-100	75-100	60-90	50-80	25-30	5-10
			6-17	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	90-100	90-100	85-100	75-95	40-60	20-40
			17-60	Clay loam, sandy clay loam, clay	CH, CL, SC	A-6, A-7	0	0	90-100	90-100	80-95	45-75	35-55	15-35
Beckton	5	D	0-6	Clay loam	CL	A-6	0	0	80-100	75-100	65-95	60-90	25-40	10-20
			6-22	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	90-100	90-100	85-100	75-95	40-60	20-40
			22-60	Clay loam, sandy clay loam, clay	CH, CL, SC	A-6, A-7	0	0	90-100	90-100	80-95	45-75	35-55	15-35

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Ho—Havre and Lohmiller soils														
Harlem	30	C	0-8	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	70-90	35-45	15-20
			8-40	Stratified clay to silty clay loam	CH, CL	A-7	0	0	100	100	95-100	85-95	40-65	20-40
			40-60	Stratified silty clay loam to fine sandy loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	60-75	20-40	5-15
Havre	30	B	0-8	Loam	CL-ML, ML	A-4	0	0	100	100	80-95	60-75	20-30	NP-10
			8-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15
Havre	30	C	0-8	Clay	CH, CL	A-6, A-7	0	0	100	100	85-100	75-95	35-55	15-30
			8-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15
Bowdoin	4	D	0-7	Clay	CH	A-7	0	0	100	100	90-100	80-95	60-85	30-55
			7-42	Clay	CH	A-7	0	0	100	100	90-100	80-95	60-85	30-55
			42-62	Clay	CH	A-7	0	0	100	100	90-100	80-95	55-80	30-50
Glendive	3	B	0-8	Fine sandy loam	ML, SM	A-4	0	0	100	100	70-85	40-55	—	NP
			8-18	Stratified very fine sandy loam to silt loam	ML	A-4	0	0	100	95-100	85-95	60-85	25-35	NP-5

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			18-60	Extremely gravelly loamy sand, very gravelly sand, extremely gravelly sand	GP, GP-GM	A-1	0	0-5	30-45	20-35	10-25	0-10	—	NP
Havre	3	B	0-5	Loam	CL-ML, ML	A-4	0	0	100	100	80-95	60-75	20-30	NP-10
			5-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Ml—McRae-Bainville loams, 8 to 20 percent slopes														
Mcrae	65	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Bainville	25	C	0-4	Loam	CL-ML, ML	A-4	0	0	100	100	95-100	75-90	20-30	NP-10
			4-26	Silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-90	20-35	5-15
			26-60	Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	4	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Silt loam, clay loam, loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Lohmiller	4	B	0-7	Clay loam	CL	A-6	0	0-5	85-100	80-100	65-90	60-80	30-35	10-15
			7-60	Loam, clay loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	85-100	80-100	65-90	60-80	25-35	5-15
Havre	2	B	0-9	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			9-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mo—McRae and Havre loams, 1 to 4 percent slopes														
Mcrae	50	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Havre	45	B	0-7	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			7-39	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
			39-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Lohmiller	5	C	0-20	Clay loam	CL	A-6	0	0	100	100	85-100	75-95	30-40	10-20
			20-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mp—McRae and Havre loams, 4 to 8 percent slopes														
Mcrae	50	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Havre	45	B	0-7	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			7-39	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
			39-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Cherry	3	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Lohmiller	2	C	0-20	Clay loam	CL	A-6	0	0	100	100	85-100	75-95	30-40	10-20
			20-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-6, A-4	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Ms—Midway clay loam, 15 to 35 percent slopes														
Midway	70	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Bainville	8	D	0-3	Loam	CL-ML	A-4	0	0	90-100	85-100	65-85	55-75	25-30	5-10
			3-15	Loam, clay loam, silty clay loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-100	60-90	55-85	25-35	5-15
			15-60	Unweathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	6	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Mcrae	6	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Nunn	4	C	0-6	Clay loam	CL	A-6	0	0	100	95-100	85-100	70-80	25-40	10-20
			6-14	Silty clay, silty clay loam, clay	CL	A-7	0	0	100	95-100	95-100	90-95	40-50	20-30

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			14-60	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	95-100	95-100	85-95	30-50	10-25
Lohmiller	3	B	0-7	Clay loam	CL	A-6	0	0-5	85-100	80-100	65-90	60-80	30-35	10-15
			7-60	Loam, clay loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	85-100	80-100	65-90	60-80	25-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mt—Midway-Bainville complex														
Midway	50	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Bainville	35	C	0-3	Loam	CL-ML, ML	A-4	0	0	100	100	95-100	75-90	20-30	NP-10
			3-22	Silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-90	20-35	5-15
			22-60	Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	6	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Mcrae	3	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Travessilla	3	D	0-2	Loam	CL-ML, ML	A-4	0	0-10	90-100	85-100	65-85	55-75	20-30	NP-10
			2-12	Sandy loam, fine sandy loam, loam	ML, SM	A-4	0	0-10	90-100	85-100	55-80	40-70	20-30	NP-5

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			12-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Tullock	2	A	0-8	Fine sandy loam	ML, SM	A-4	0	0	100	100	75-95	35-55	20-25	NP-5
			8-28	Fine sandy loam	ML, SM	A-4	0	0	100	100	75-95	35-55	20-25	NP-5
			28-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Havre	1	B	0-9	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			9-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Mu—Midway-Nihill gravelly loam														
Midway	60	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Nihill	25	B	0-8	Gravelly loam	CL-ML, GM, ML, SM	A-4	0	0-10	70-85	60-75	50-65	40-60	20-30	NP-10
			8-40	Gravelly loam, channery loam, very gravelly loam	GC-GM, GM, SC-SM, SM	A-1, A-2, A-4	0	0-15	40-80	30-70	25-60	20-50	20-30	NP-10
			40-60	Stratified extremely gravelly sandy loam to very gravelly loam	GC-GM, GM	A-1, A-2	0	0-25	45-60	40-55	30-45	20-35	15-30	NP-10
Bainville	10	D	0-4	Loam	CL-ML	A-4	0	0	90-100	85-100	65-85	55-75	25-30	5-10
			4-19	Loam, clay loam, silty clay loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-100	60-90	55-85	25-35	5-15
			19-60	Unweathered bedrock	—	—	—	—	—	—	—	—	—	—

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

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

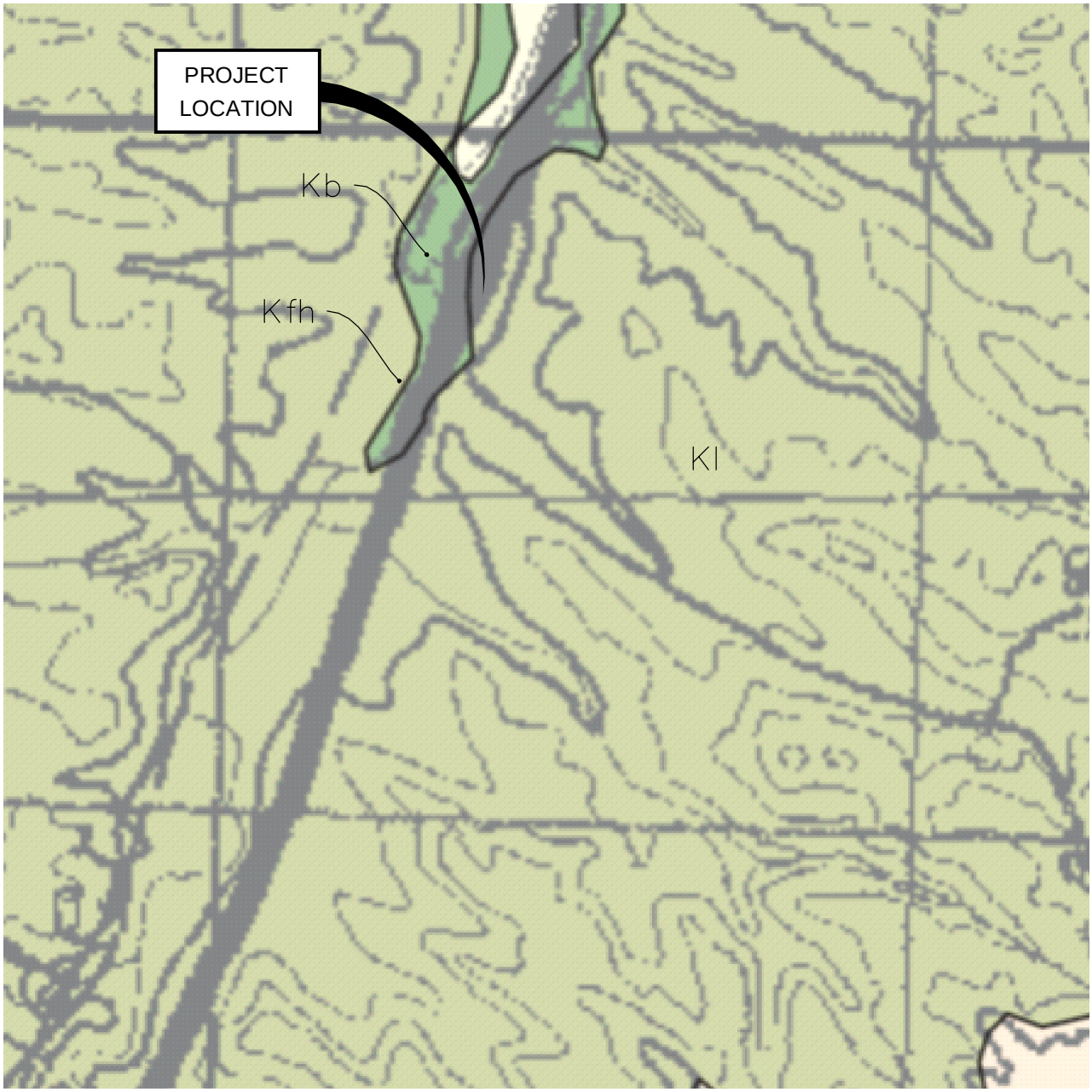
United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

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

APPENDIX D

GEOLOGIC MAP OF HYSHAM

30’ x 60’ quadrangle



MAP UNITS

Kl - Lance Formation (Upper Cretaceous)

Kfh - Fox Hills Formation (Upper Cretaceous)

Kb - Bearpay Shale (Upper Cretaceous)

DOWL HKM
2090 Stadium Drive
406-586-8834
Bozeman, Montana 59715
www.dowlhkm.com

HYSHAM REST AREA
GEOLOGIC SURVEY MAP

PROJECT	24.11355.01
DATE	09/18/2014

FIGURE #1

Q:\24\11355\01\ACT 106\GEOLOGIC FIGURE.dwg PLOT DATE 2014-9-18 13:42 SAVED DATE 2014-09-18 13:24 USER: bduffey

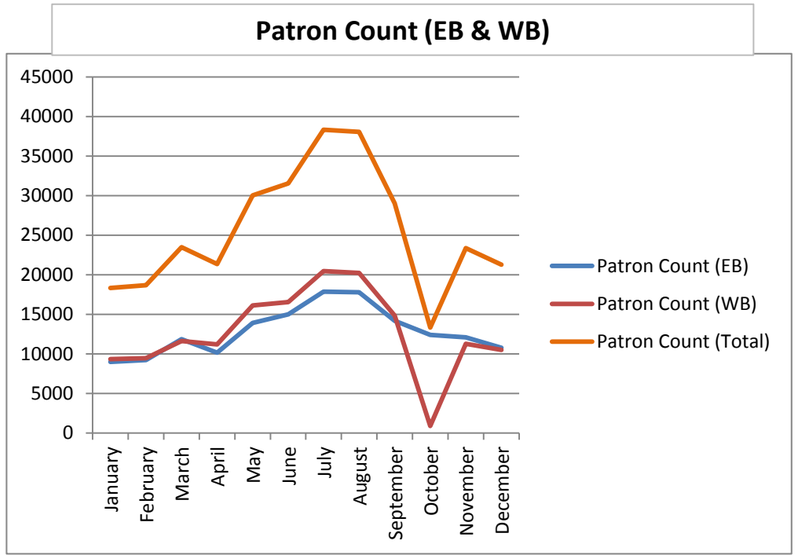
APPENDIX E

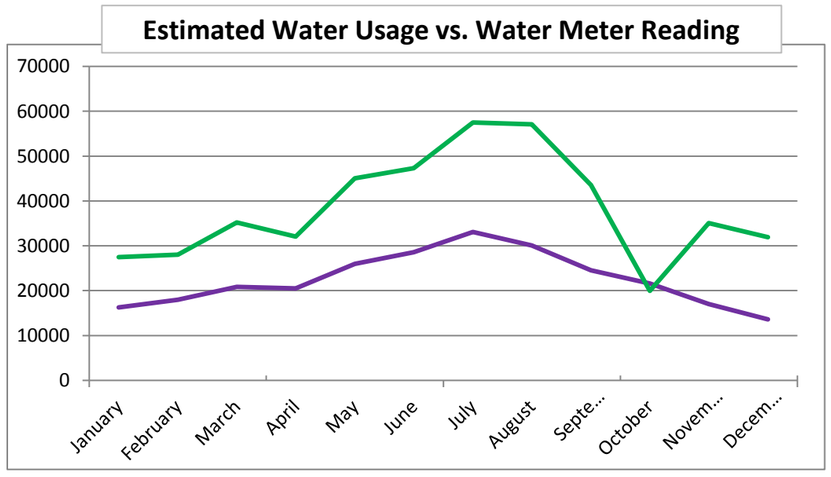
HYSHAM REST AREA FLOW DATA

Hysham Rest Area Patron and Water Usage

Rest Area:	**Hysham**
Month:	**Year Total**
Year:	**2013**

Date	Combined Door Count	Patron Count (EB)	Patron Count (WB)	Patron Count (Total)	Combined Water Meter Reading (gpd)	Estimated Water Usage (Patron Count x 1.5 gal/Patron Count)
January	36642	9000	9321	18321	16300	27482
February	37362	9208	9473	18681	17960	28022
March	46978	11852	11637	23489	20850	35234
April	42700	10166	11184	21350	20480	32025
May	60068	13924	16110	30034	25970	45051
June	63074	14987	16550	31537	28580	47306
July	76671	17853	20483	38336	33070	57503
August	76110	17806	20250	38055	30100	57083
September	58077	14191	14848	29039	24530	43558
October	26648	12422	902	13324	21610	19986
November	46758	12109	11270	23379	17040	35069
December	42545	10766	10507	21273	13620	31909
	Annual Average	**425**	**420**			
	Summer Average	**550**	**623**			
	Peak	**822**	**843**			





APPENDIX F

EXISTING WELL LOGS

MONTANA WELL LOG REPORT

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

Other Options

Go to GWIC website
Plot this site on a topographic map
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:13 PM)

Site Name: HYSHAM REST AREA WESTBOUND
GWIC Id: 17257
DNRC Water Right: W163867-00

Section 1: Well Owner(s)

1) MT DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT N/A [06/25/1999]
2) MONTANA HIGHWAY COMMISSION (MAIL)
C/O WALT RAFFELSON
CUSTER MT 59024 [01/31/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	SW¼ NW¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2197	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2865			

Measuring Point Altitude	Method	Datum	Date Applies
2866.6			9/23/1997 12:16:00 PM

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

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, January 28, 1966

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	65	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	63	6				20 LB STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
63	65	0			OPEN HOLE

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 65
Static Water Level: 14
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
28 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 43 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 NE OF RESTROOMS NEAR PICNIC TABLE SAMPLING PT -FAUCET ON FRONT OF RESTROOM BLDG OR UNDERGROUND SPRINKLER SYSTEM OUTLETS WESTBOUND REST AREA ACCESSED UTILITY ROOM WITH CARETAKER HYSHAM RESTAREA I94 WEST

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	5	GRAYISH TAN SANDY SILT
5	15	CHANGES TO GRAY SANDY CLAY
15	20	TRACES OF GRAVEL
20	25	GRAY SANDY CLAY SOME SURFACE WATER
25	35	GRAY SHALE
35	55	BLUISH GRAY CLAY
55	63	SOME TRACES GRAVEL. INCREASING AMOUNTS OF SAND TO COARSE ROCK AT 63 FT.
63	65	BOTTOMED HOLE IN GRAVEL AND DARK GRAY SAND

Driller Certification

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

Name:

Company: FOX
License No: -
Date Completed: 1/28/1966

MONTANA WELL LOG REPORT

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

Other Options

Go to GWIC website
Plot this site on a topographic map
View hydrograph for this site
View field visits for this site
View scanned well log (6/7/2010 1:21:07 PM)

Site Name: HYSHAM REST AREA EASTBOUND
GWIC Id: 163054

Section 1: Well Owner(s)

1) HYSHAM REST STOP EAST BOUND (MAIL)
N/A
N/A MT N/A [03/14/2003]
2) MONTANA DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT 59105 [09/23/1997]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SE¼ NE¼ NW¼

County
TREASURE

Geocode

Latitude	Longitude	Geomethod	Datum
46.2184	107.2493	NAV-GPS	NAD27

Ground Surface Altitude	Method	Datum	Date
2900			

Measuring Point Altitude	Method	Datum	Date Applies
2901.4			9/23/1997 11:25:00 AM

Addition **Block** **Lot**

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, August 18, 1988

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	35.5	10
25	200	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	35.5	7				23LB STEEL
25	200	4		165.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
28	200	4		1/8	SLOTS

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 200
Static Water Level: 46.89
Water Temperature:

Air Test *

50 gpm with drill stem set at _ feet for 2 hours.
Time of recovery 1 hours.
Recovery water level 40 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 EAST OF BUILDING RESTROOMS AT PICNIC TABLES USED UTILITY SINK FAUCET FOR CHEM NEED TO CONTACT CARETAKER FOR ACCESS NEWEST WELL AT REST AREAS 2 OLDER SHALLOW WELLS ON WEST SIDE IRRIGATION PIPES ACROSS TO THIS SIDE

Section 9: Well Log

Geologic Source

211LHUD - LANCE-HELL CREEK UNDIFFERENTIATED

From	To	Description
0	28	SILT CLAY
28	35	BROWN SANDSTONE
35	50	LIGHT SHALE
50	81	LIGHT SANDSTONE
81	121	SHALE
121	160	GREY SANDSTONE
160	173	GREY SHALE
170	200	GREY SANDSTONE

Driller Certification

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

Name: WILLIAM KUPFNER
Company: ROCK CREEK DRILLING INC
License No: WWC-300
8/18/1988

Date Completed:	

MONTANA WELL LOG REPORT

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

Other Options

Go to GWIC website
Plot this site on a topographic map
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:42 PM)

Site Name: MONTANA HIGHWAY COMMISSION - HYSHAM WESTBOUND IRRIGATION
GWIC Id: 17256

Section 1: Well Owner(s)

1) MONTANA HIGHWAY COMMISSION (MAIL)
HELENA
N/A N/A N/A [02/03/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SW¼ NE¼ NW¼

County
TREASURE

Geocode

Latitude	Longitude	Geomethod	Datum
46.2186	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2870			

Measuring Point Altitude	Method	Datum	Date Applies
2871.7			9/23/1997 9:30:00 AM

Addition **Block** **Lot**

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, February 03, 1966

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	61.5	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 75
Static Water Level: 24
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
16 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 40 feet.

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

Section 8: Remarks

IRRIGATION ONLY WELL BOTH REST AREAS PUMP RUNNING ALL NIGHT

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	10	TAN TO GRAY SANDY SILT WITH SOME CLAY
10	34	GRAY SANDY REWORKED SHALE WITH SOME GRAVEL
34	60	GRAY CLAY
60	61.5	GRAY SANDY SHALE
61.5	70	BOTTOM OF CASING SHOE. SOFT GRAY SANDSTONE
70	75	GRAY SANDY GRAVEL

Driller Certification

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

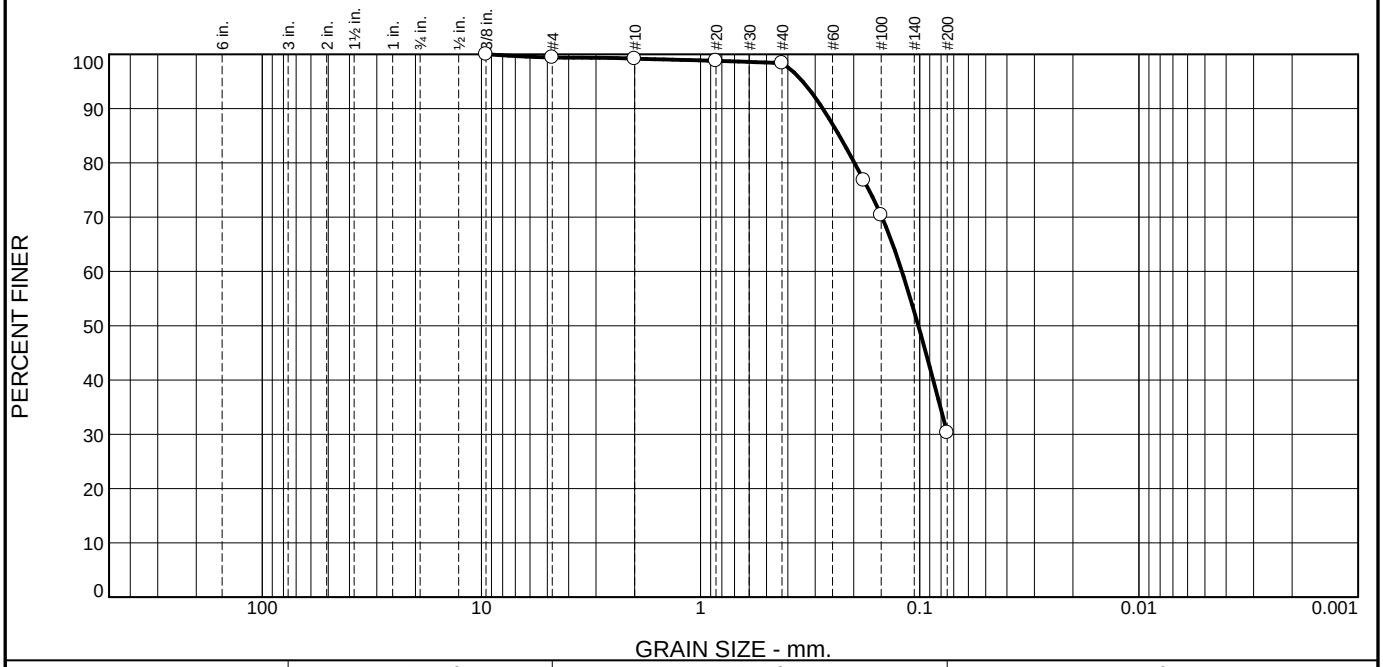
Name:
Company: FOX
License No: -

Date Completed: 2/3/1966

APPENDIX G

LABORATORY TEST RESULTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	0.2	0.8	68.1	30.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.375	100.0		
#4	99.4		
#10	99.2		
#20	98.8		
#40	98.4		
#80	76.8		
#100	70.4		
#200	30.3		

* (no specification provided)

Material Description

silty sand

Atterberg Limits (ASTM D 4318)

PL= 25 **LL=** 30 **PI=** 5

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 0.2770 D_{85}= 0.2328 D_{60}= 0.1206
D_{50}= 0.1015 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled By:DOWL HKM

Date Received: **Date Tested:** 9/17/14

Tested By: MC

Checked By: MC

Title: Lab Manager

Location: TP-5
Sample Number: 29633 **Depth:** 1.5-2.0' **Date Sampled:**

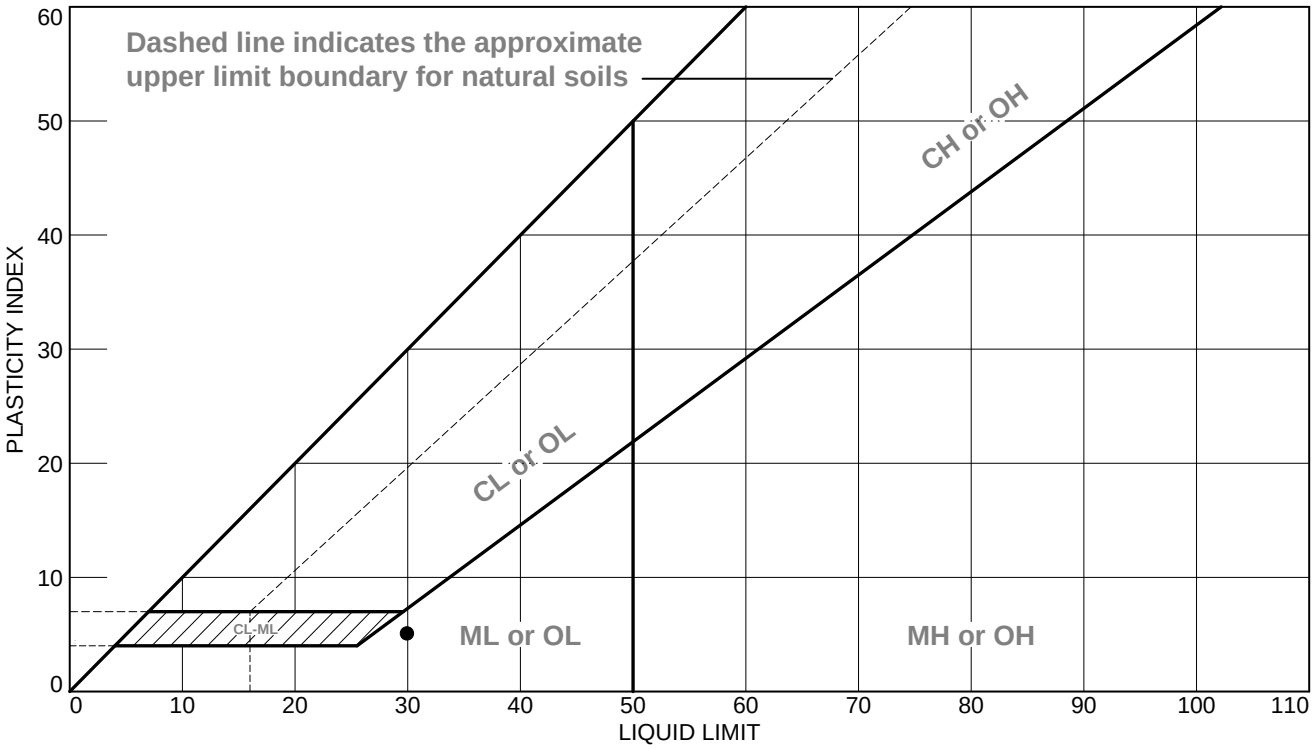
BILLINGS, MONTANA
DOWL HKM

Client: MDOT
Project: Hysham Rest Area Phase 1

Project No: 4524.11355.01 **Figure** 01

Tested By: _____ **Checked By:** _____

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●		29633	1.5-2.0'		25	30	5		SM

BILLINGS, MONTANA

DOWL HKM

Client: MDOT

Project: Hysham Rest Area Phase 1

Project No.: 4524.11355.01 **Figure** 01

Tested By: _____ **Checked By:** _____

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

DOWL HKM

LAB NUMBER	LOCATION	DEPTH RANGE	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND NO. 200(0.075 mm) TO NO. 4(4.76 mm)	GRAVEL NO. 4(4.76 mm) TO 3 IN.(76.2 mm)	COBBLES 3 IN.(76.2 mm) TO 5 IN.(127 mm)	OVERSIZE LARGER THAN 5 IN.(127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	MAXIMUM DRY UNIT WEIGHT(D698)-pcf	OPTIMUM MOISTURE CONTENT - %	OVERSIZE SPEC. GRAV.(BULK)	ABSORPTION	MINUS #4 SPECIFIC GRAVITY	LA Abrasion-Grading A, % Loss	CALIFORNIA BEARING RATIO	NATURAL MOISTURE - %	Resistivity (Ohm-Cm) Natural Moisture	Resistivity (Ohm-Cm) Saturated	pH	WATER SOLUBLE SO4 - %
29633	TP-5	1.5-2.0'	SM		30.3	69.1	0.6			30	5								7.7				

APPENDIX H

PHOTOGRAPHS

Hysham Rest Area

Test Pit #1

July 2, 2014

Hysham Rest Area

Test Pit #2

July 2, 2014

Hysham Rest Area

Test Pit #3

July 2, 2014

Hysham Rest Area

Test Pit #4

July 2, 2014

Hysham Rest Area

Test Pit #5

July 2, 2014

Hysham Rest Area

Test Pit #6

July 2, 2014

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX B:

Control Survey

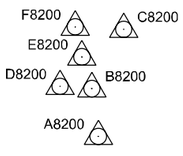
DOWL

CONTROL DIAGRAM

SCALE - 1" = 100'

CONTROL ABSTRACT

POINT NAME/NUMBER	N OR Y COORDINATE	E OR X COORDINATE	POINT ELEVATION	LOCATION AND DESCRIPTION
A8200	725,426.577	2,537,663.876	2,901.29	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "A8200 2014", for the east bound I-94 rest area, on a small bench south of the maintained grass area, 90 ft. E-SE of the east edge of pavement, 76 ft.
				se of a metal sign post(no camping) . Set a metal witness post and MDT sticker 3 ft. north of the cap.
B8200	725,804.962	2,537,612.307	2,890.47	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "B8200 2014", for the east bound I-94 rest area, near the center (N-S) of the rest area, 1 ft. west of the top back of curb for the tractor trailer
				parking area, in the grass area, on top of a small hill between the east bound I-94 gaurd rail and the tr/tr parking area, 45 ft. north of an angle point in along the west edge of the tr/tr parking lot. Set a metal witness post and MDT
				sticker 3 ft. north of the cap.
C8200	726,275.214	2,537,865.555	2,893.44	A #5 X 30 In. rebar with A 2 In. MDT alumInum cap, set flush with the ground, marked "C8200 2014", for the east bound I-94 rest area, 380 ft. north of the north most picnic table, on a small hill above where the exit ramp for the
				rest area meets the east bound lane of I-94, 28 ft. west of the N-S r/w fence. Set a metal witness post and MDT sticker 3 ft. north of the cap.
D8200	725,822.290	2,537,361.381	2,881.88	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "D8200 2014", for the west bound I-94 rest area, near the south most end of the rest area, 7 ft. west of the edge of pavement, 35 ft. northwest of
				the south most nose of the curbing between the car and truck lanes leaving the rest area, west bound onto I-94. Set a metal witness post and MDT sticker 3 ft north of the cap.
E8200	726,056.134	2,537,534.645	2,879.48	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "E8200 2014", for the west bound I-94 rest area, near the center (N-S) of the tractor/trailer parking area, on the grass slope between the west bound
				edge of pavement and the tr/tr parking lot, 10 ft. west of the I-94 edge of pavement, 26 ft. east of the eop for the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
F8200	726,293.950	2,537,481.604	2,876.44	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "F8200 2014", for the west bound I-94 rest area, near the north end of the rest area, 1 ft. north of the edge of pavement, 33 ft. north of the north
				most end of the concrete sidewalk next to the handicap parking stall. Set a metal witness post and MDT sticker 3 ft. east of the cap.
A555	723,475.593	2,537,037.718	2,929.16	A ngs stainless steel rod in a monument box with a lid marked "A555 1981", on the east bound side of I-94, near milepost 64.4, 100 ft. southeast of the centerline of the east bound lane, 1.2 ft. west-northwest of an ngs witness
				post, 1.6 ft. west-northwest of the r/w fence.
B555	728,660.461	2,538,613.291	2,869.74	A ngs stainless steel rod in a monument box with a lid marked "B555 1981", on the east bound side of I-94, near milepost 65.35, 113 ft. E-SE of the centerline of the east bound lane, 1.6 ft. west-northwest of the r/w fence
C555	733,871.091	2,539,864.383	2,814.30	A ngs stainless steel rod in a monument box with a lid marked "C555 1981", on the east bound side of I-94, near milepost 66.4, 93 ft. E-SE of the centerline of the east bound lane, 1.75 ft. west-northwest of the r/w fence.



NOTES:
State Plane Coordinates
Horizontal units are International feet (NAD83-2011).
Vertical units are US survey feet (NAVD88-GEOID12A).
Final project horizontal values are GPS derived holding NGS marks S555, A555(OPUS) and C555(OPUS).
Final project vertical values are from a digital level loop run from A555, through the new control and closed on B555.

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	Q:\24\11355\8200000SUCONZ01.dgn	DESIGNED BY	N PERIUS	7/17/2014	ROAD PLANS	HYSHAM REST AREA	IM 94-2(36)65
2		7/17/2014	REVIEWED BY	R RUX	7/17/2014			
1		12:31:15 PM nperius	CHECKED BY	T CORMIER	7/17/2014	TREASURE COUNTY	CSF = 0.999350895 / UPN 8200000	SHEET 1

ACTIVITY 320 Review Consultant Control Survey

CN: 8200000
HYSHAM REST AREA CONTROL SURVEY
P.N. IM 94-2(36)65

DEFINITION:

Review consultant control survey.

TASKS:

	Task Checklist Description	Yes	No	N/A	Initial	
1	Review vertical control survey data conforming to MDT survey standards including: original field notes, electronic field notes, reduction and adjustment sheets if not part of the original field notes, vertical datum, and vertical datum source.	✓			RR	
2	Review horizontal control survey data conforming to MDT survey standards including: original field notes, electronic field notes, GPS files, computation sheets or electronic files with computations in MDT specified format.	✓			RR	
3	ASCII file containing recovery descriptions for benchmarks and control network points.	✓			RR	.DES
4	ASCII coordinate listings for benchmarks and control network points.	✓			RR	.IFT .PTS
5	Control diagram conforming to MDT standards.					.PDF, .DGN
6	Calibration baseline reports for survey instruments used in control survey.			✓	RR	
7	Peg test notes for survey instruments used in the vertical control survey.	✓			RR	ORIG NOTES & SCANNED NOTES

Materials received and uploaded or filed.

	Task Checklist Description	Yes	No	N/A	Initial
1	Vertical control survey data.				
2	Horizontal control survey data.				
3	Secondary traverse and side tie data.				
4	Instrument calibration reports.				
5	Other control survey data.				

START DEPENDENCIES:

Activity 108.

ACTIVITY 320 Review Consultant Control Survey

CN: 8200000
HYSHAM REST AREA CONTROL SURVEY
P.N. IM 94-2(36)65

DEFINITION:

Review consultant control survey.

TASKS:

	Task Checklist Description	Yes	No	N/A	Initial	
1	Review vertical control survey data conforming to MDT survey standards including: original field notes, electronic field notes, reduction and adjustment sheets if not part of the original field notes, vertical datum, and vertical datum source.	✓			RR	
2	Review horizontal control survey data conforming to MDT survey standards including: original field notes, electronic field notes, GPS files, computation sheets or electronic files with computations in MDT specified format.	✓			RR	
3	ASCII file containing recovery descriptions for benchmarks and control network points.	✓			RR	.DES
4	ASCII coordinate listings for benchmarks and control network points.	✓			RR	.IFT .PTS
5	Control diagram conforming to MDT standards.					.PDF, .DGN
6	Calibration baseline reports for survey instruments used in control survey.			✓	RR	
7	Peg test notes for survey instruments used in the vertical control survey.	✓			RR	ORIG NOTES & SCANNED NOTES

Materials received and uploaded or filed.

	Task Checklist Description	Yes	No	N/A	Initial
1	Vertical control survey data.				
2	Horizontal control survey data.				
3	Secondary traverse and side tie data.				
4	Instrument calibration reports.				
5	Other control survey data.				

START DEPENDENCIES:

Activity 108.

DOWL HKM

www.dowlhkm.com

COMPUTATIONS	Project #: 4524.11355.01
Client Name: MDT	Sheet 1 of 1
Project Name: HYSHAM REST AREA OPUS RESULTS/MEAN	Prepared by: RER Date 7-14-14 / Checked by: Date

UPN 8200000

A555-1	A555-2	A555 MEAN	NGS DATA SHEET
LAT 46-12-43.14374	46-12-43.14411	46-12-43.14393	HT-2880.27
LONG 107-15-10.46046	107-15-10.46030	107-15-10.46038	
N 723475.574	723475.610	723475.592	ELEV-2929.16
E 2537037.713	2537037.723	2537037.718	

C555-1	C555-2	C-555 MEAN	
LAT 46-14-24.97076	46-14-24.97107	46-14-24.97092	HT 2765.32
LONG 107-14-25.99695	107-14-25.99698	107-14-25.99696	
N 733871.076	733871.106	733871.091	ELEV-2814.30
E 2539864.383	2539864.380	2539864.382	

DOWL HKM

www.dowlhkm.com

COMPUTATIONS	Project #: 4524.11355.01
Client Name: MDT	Sheet 1 of 1
Project Name: HYSHAM REST AREA OPUS RESULTS/MEAN	Prepared by: RER Date 7-14-14 / Checked by: Date

UPN 8200000

A555-1	A555-2	A555 MEAN	NGS DATA SHEET
LAT 46-12-43.14374	46-12-43.14411	46-12-43.14393	HT-2880.27
LONG 107-15-10.46046	107-15-10.46030	107-15-10.46038	
N 723475.574	723475.610	723475.592	ELEV-2929.16
E 2537037.713	2537037.723	2537037.718	

C555-1	C555-2	C-555 MEAN	
LAT 46-14-24.97076	46-14-24.97107	46-14-24.97092	HT 2765.32
LONG 107-14-25.99695	107-14-25.99698	107-14-25.99696	
N 733871.076	733871.106	733871.091	ELEV-2814.30
E 2539864.383	2539864.380	2539864.382	

TRIMBLE DINI LEVEL
PEG TEST
7/10/14
RER
DRS
SLI

7/10/14

KUKKAMAKI METHOD

A ← 100' → B ← 100' → C

A1 SR: 0.000 Ft
R: 4.775
HD: 51.94

B1 SR: 0.000 Ft
R: 5.836
HD: 47.90

B2 SR: 0.000 Ft
R: 4.673
HD: 45.01

A2 SR: 0.000 Ft
R: 3.605
HD: 45.77

Adj. measurement result
ΔC -6.5"

Line of sight correction

	old	new
C:	-6.8"	-13.3"

HYSHAM REST AREA
VERTICAL CONTROL
7-10-14

TRIMBLE DINI DIGITAL LEVEL
SN: 711304

STA	BS	HI	FS	NAVD88 ELEV
BM				2929.16
NGS A555				
	6.560	2935.720		
TP			9.445	2926.275
	1.736	2928.011		
TP			9.276	2918.736
	0.208	2918.944		
TP			10.054	2908.890
	0.512	2909.402		
TP			9.999	2899.403
	0.727	2900.131		
TP			8.859	2891.272
	2.885	2894.157		
TP			4.060	2890.097
	7.356	2897.453		
TP			2.524	2894.929
	9.253	2904.182		
A 8200			2.896	2901.286
	2.673	2904.050		
TP			9.085	2894.965
	2.910	2897.875		
B 8200			7.405	2890.470
	3.440	2893.910		

7-10-14

NGS ROD IN MON. BOX W/ CAP — RER, DRS, SLE

A555
2869.74

R/B @ MDT A.C.

R/B @ MDT A.C.

STA	BS	HI	FS	NAVD88 ELEV
		2893.910		
TP			3.753	2890.157
	8.244	2898.402		
C8200			4.967	2893.434
	4.859	2898.294		
TP			8.137	2890.156
	3.035	2893.191		
TP			8.707	2884.484
	1.761	2886.246		
E8200			6.768	2879.478
	7.210	2886.688		
D8200			4.808	2881.880
	2.560	2884.440		
F8200			8.000	2876.439
	4.421	2880.861		
TP			6.393	2874.467
	4.128	2878.595		
TP			7.086	2871.510
	4.563	2876.073		

(A)

7-10-14

REF, DRS, SLT

R/B & MDT A.C.

R/B & MDT A.C.

R/B & MDT A.C.

R/B & MDT A.C.

7-10-14

RER, DRS, SLZ

STA	BS	HI	FS	NAVD88 ELEV
		2876.073		
TP			6.864	2869.208
	6.863	2876.071		
TP			6.864	2869.206
	4.824	2874.031		
TP			6.966	2867.065
	4.864	2871.929		
TP			7.018	2864.911
	5.068	2869.979		
TP			5.959	2864.020
	11.436	2875.456		
BM			5.675	2869.781
NGS B555				EOC = -0.041

ELEV. = 2869.74 NGS S.S. ROD IN A MONUMENT BOX

HYSHAM REST AREA
IM 94-2(36)65
UPN 8200000

4525.11355.01
STATIC GPS CONTROL

SESSION #: 1 DATE: 6-13-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A 555

POINT DESCRIPTION: NGS BENCHMARK, A STAINLESS STEEL ROD IN A MONUMENT BOX MARKED A555, 1981. ROD HAS A PUNCH MARK IN THE CENTER

*DATA IS FOR OPUS SUBMITAL

ANTENNA TYPE: R6 INTERNAL

HI START: 1.876 M START: 6.156 FT.
END: 1.876 M END: 6.155 FT.

HI MEASURED TO: CENTER OF THE BUMPER

TIME BEGIN: 7:40 AM
END: ~~11:40~~ AM
12:15

ARP = 1.819 M

SESSION #: 1 DATE: 6-13-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C 555

POINT DESCRIPTION: NGS BENCH MARK A STAINLESS STEEL ROD W/ PUNCH MARK IN A MONUMENT BOX MARKED C 555 1981

*DATA FOR OPUS

ANTENNA TYPE: R6 INTERNAL

HI START: 1.6705 M START: 5.480 FT.
END: 1.670 M END: 5.480 FT.

HI MEASURED TO: CENTER OF THE BUMPER

TIME BEGIN: 8:11 AM
END: 12:26 PM

ARP = 1.613m

SESSION #: 2				DATE:	6-13-14
OBSERVER: RER					
RECEIVER SN:	7974				
POINT NAME:	A555				
POINT DESCRIPTION: NGS BENCH MARK STAINLESS STEEL ROD W/ CENTER PUNCH IN A MONUMENT BOX MARKED A555, 1981					
*DATA FOR OPUS					
ANTENNA TYPE:	RG INTERNAL				
HI	START:	1.867	M	START:	6.125 FT.
	END:	1.867	M	END:	6.125 FT.
HI MEASURED TO: CENTER OF BUMPER					
TIME	BEGIN:	1220			
	END:	430			

ARP= 1.810M

BATTERY QUIT

SESSION #: 2 DATE: 6-13-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C 555

POINT DESCRIPTION: NGS BENCH MARK STAINLESS STEEL ROD W/ A CENTER PUNCH, IN A MONUMENT BOX MARKED C 555 1981

*DATA FOR OPUS

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.653	M	START: 5.424	FT.
	END:		M	END:	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME - BEGIN: 12 31 PM

END: 442

90 'EOP

(4)

ARP = 1.595m

1100 - 1200

SESSION #: 3 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: A NGS STAINLESS STEEL ROD WITH A CENTER PUNCH MARK SET IN AN ALUMINUM MONUMENT BOX W/ LID, MARKED "A555 1981", AT MILE POST 64.4 ON THE EAST BOUND LANE SIDE OF I-94, 100' SOUTHEAST OF THE ℄ OF THE EAST BOUND LANE, 1.2 FT W-NW OF AN NGS W.P., 1.6FT W-NW OF THE R/W FENCE

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.842	M	START: 6.044	FT.
	END:	1.842	M	END: 6.044	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:35
	END:	12:00

MP 64.4

1.2 WP, 1.6 FENCE

1100-1200

SESSION #: 3 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: A8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" NDT ALUMINUM CAP SET FLUSH WITH THE GROUND, MARKED "A8200 2014", FOR THE EAST BOUND I-94 REST AREA, ON A SMALL BENCH SOUTH OF THE MAINTAINED GRASS AREA, 90 FT E-S.E. OF THE EAST EDGE OF PAVEMENT, 76 FT S.E. OF A METAL SIGN POST (NO CAMPING SIGN).

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.5125	M	START: 4.961	FT.
	END:	1.5125	M	END: 4.961	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:49	AM
	END:	12:07	PM

90' EOP
76' SIGNM

(6)

SET A METAL WITNESS POST WITH A NDT STICKER 3 FT NORTH OF CAP.

1215-1:15

SESSION #: 4 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: NGS SS. ROD IN A MONUMENT BOX W/ LID MARKED "A555 1981".

ANTENNA TYPE: R6 INTERNAL

HI START: 1.819 M START: 5.968 FT.
END: 1.819 M END: 5.968 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 12:03 PM
END: ~~12:15~~ 1:15 PM

12815-f015

SESSION #: 4 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: A8200

POINT DESCRIPTION: #5 X 30" REBAR & 2" NDT ALUMINUM CONTROL CAP W/CENTER PUNCH, SET FLUSH WITH THE GROUND MARKED "A8200 2014"

ANTENNA TYPE:

HI START: 1.4975 M START: 4.913 FT.
END: 1.4975 M END: 4.912 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 12:12 PM
END: 1:23 PM

1:35 - 2:35

SESSION #: 5 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: NGS S.S. ROD IN A ALUMINUM MONUMENT BOX W/ LID MARKED "A 555 1981"

ANTENNA TYPE: R6 INTERAL

HI START: 1.833 M START: 6.014 FT.
END: 1.833 M END: 6.014 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 1:19 PM
END: 2:35 PM

1:35-2:35

SESSION #: 5 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: F8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT ALUMINUM CONTROL CAP SET FLUSH WITH THE GROUND MARKED "F8200 2014" FOR THE WEST BOUND REST AREA, NEAR THE NORTH END OF THE RESTAREA, 1FT N. OF THE E.O.P. AT THE HANDICAP PARKING SPACE, 33FT NORTH OF THE NORTH MOST END OF THE

ANTENNA TYPE: RG INTERNAL

HI START: 1.530 M START: 5.022 FT.
END: 1.530 M END: 5.020 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 1:34 PM
END: 2:44 PM

CONCRETE SIDEWALK FROM THE HANDICAP SPACE TO THE REST ROOMS. SET A METAL WITNESS POST WITH A MDT STICKER 3FT EAST OF THE CAP.

2:50-3:50

SESSION #: 6 DATE: 7-9-2014

OBSERVER: REP

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: ~~A #5 x 30" REBAR & MDT ALUMINUM CONTROL CAP SET FLUSH WITH THE GROUND MARKED~~ " A NGS STAINLESS STEEL ROD W/ A CENTER PUNCH IN A ALUMINUM MONUMENT BOX WITH A LID

ANTENNA TYPE: R6 INTERNAL

HI START: 1.8495 M START: 6.068 FT.
END: 1.8495 M END: 6.068 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 2:39 PM
END: 3:50 PM

2:50-3:50

SESSION #: 6 DATE: 7-9-2014

OBSERVER: REL

RECEIVER SN: 7945

POINT NAME: FS200

POINT DESCRIPTION: A #5 X 30" REBAR W/ 2" MDT ALUMINUM CONTROL CAP, SET FLUSH MARKED "FS200 2014"

ANTENNA TYPE: R6 INTERNAL

HI START: 1.540 M START: 5.054 FT.
END: 1.540 M END: 5.055 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 2:49 PM
END: 4:01 PM

940-955

SESSION #: 7 DATE: 7-10-14

OBSERVER: BER

RECEIVER SN: 7974

POINT NAME: A 8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT ALUMINUM CAP, SET FLUSH W/ GROUND MARKED "AB200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.742	M	START: 5.716	FT.
	END:	1.742	M	END: 5.716	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	9:38	AM
	END:	955	AM

SESSION #: 8 10-1020 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: A #5X30" REBAR & 2" MDT ALUMINUM CONTROL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.727	M	START: 5.668	FT.
	END:	1.727	M	END: 5.667	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 9:58 AM

END: 10:20 AM

10:35-10:50

SESSION #: 9 DATE: 7-30-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: A #5 x 30" REBAR & 2" MDT CNTL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.711	M	START: 5.614	FT.
	END:	1.711	M	END: 5.614	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:31 AM
	END:	10:50 AM

10:35-10:50

SESSION #: 9 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT CONTROL CAP SET FLUSH W/ GROUND MARKED "C8200 2014", FOR THE EAST BOUND REST AREA, 380 FT NORTH OF THE NORTH MOST PICNIC TABLE, ON A SMALL HILL ABOVE WHERE THE EXIT RAMP FOR THE REST AREA MEETS THE EAST BOUND LANE OF I-94, 28 FT WEST OF THE N-S R/W FENCE. SET A METAL WITNESS POST & MDT STICKER 3 FT NORTH OF THE CAP.

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.541 M	START:	5.057 FT.
	END:	1.541 M	END:	5.057 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:35 AM
	END:	10:55 AM

11:00-11:16

SESSION #: 10 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: #5 x 30" REBAR & 2" MDT ALUMINUM CONTROL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.6975	M	START: 5.571	FT.
	END:	1.698	M	END: 5.569	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 10:53 AM

END: 11:16 AM

SESSION #: 10 1100-1116 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C8200

POINT DESCRIPTION: A #5 X 30" REBAR & MDT ALUMINUM CAP MARKED "C8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.523	M	START: 4.998	FT.
	END:	1.523	M	END: 4.998	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:00	AM
	END:	11:22	AM

11:38-11:53

SESSION #: 11				DATE:	7-10-14
OBSERVER: RER					
RECEIVER SN: 7974					
POINT NAME: A8200					
POINT DESCRIPTION: #5x30" REBAR & 2" MDT ALUMINUM CONTROL CAP MARKED "A8200 2014"					
ANTENNA TYPE: R6 INTERNAL					
HI	START:	1.680	M	START: 5.513	FT.
	END:	1.680	M	END: 5.513	FT.
HI MEASURED TO: CENTER OF BUMPER					
TIME	BEGIN:	11:36 AM			
	END:	11:55 AM			

1138-1155

SESSION #: 11 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: B8200

POINT DESCRIPTION: A #5X30" REBAR & 2" MDT ALUMINUM CONTROL CAP SET FLUSH WITH THE GROUND MARKED "B8200 2014", FOR THE EAST BOUND REST AREA, NEAR THE CENTER (N-S), 1FT. WEST OF THE TOP BACK OF CURB FOR THE TRACTOR/TRAILER PARKING AREA,

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.484	M	START: 4.869	FT.
	END:	1.484	M	END: 4.869	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:33 AM
	END:	12:06 PM

(20)

IN THE GRASS AREA, ON TOP OF A SMALL HILL BETWEEN THE TRACTOR/TRAILER PARKING AREA & THE EDGE OF PAVEMENT FOR THE EAST BOUND LANE OF I-94,

1208-1225

SESSION #: 12 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: A #5 X 20" REBAR &
MDT CONTROL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	~~1.668~~ 1.669	M	START: 5.476	FT.
	END:	1.6685	M	END: 5.476	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 12:08 PM

END: 12:25 PM

1208-1225

SESSION #: 12 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: B8200

POINT DESCRIPTION: #5x30" REBAR & 2" MDT CONTROL CAP MARKED "B8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.498	M	START: 4.918	FT.
	END:	1.4975	M	END: 4.913	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	12:05 PM
	END:	12:29 PM

SESSION #: 18 ~~1246-1102~~ 1:07-122 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: B8200

POINT DESCRIPTION: ANT 5x20" REBAR 4-2"
MDT CONTROL CAP MARKED "B8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.5085	M START: 4.949	FT.
	END:	1.5085	M END: 4.948	FT.

HI MEASURED TO: CENTER OF BUMPER

		1:06 PM	
TIME	BEGIN:	~~1244~~ PM	1:06PM
	END:	~~1102~~ PM	1:22 PM

*BATTERY FAILURE ON F8200 BEFORE THE END OF SESSION 13. RE-OBSERVED

~~1246-1:02~~

SESSION #: 13 1:07-1:22 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: C8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT CONTROL CAP MARKED "C8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.814	M	START: 5.951	FT.
	END:	1.8135	M	END: 5.950	FT.

HI MEASURED TO: CENTER OF BUMPER

1:03

TIME	BEGIN:	~~12:39~~ PM	1:03 PM	
	END:	1:32 PM		

BATTERY FAILURE @ C8200 BEFORE THE END OF SESSION 13. RE OBSERVED

SESSION #:			DATE:		
OBSERVER:					
RECEIVER SN:					
POINT NAME:					
POINT DESCRIPTION:					
ANTENNA TYPE:					
HI	START:		M	START:	FT.
	END:		M	END:	FT.
HI MEASURED TO:					
TIME	BEGIN:				
	END:				

HYSHAM REST AREA

DEAN'S NOTES

SESSION #: 3 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD W/O SLEEVE INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH ACCESS COVER, THE RING SURROUNDING THE COVER IS STAMPED "C555 1981", MONUMENT IS 1.75' W/NO OF ROW FENCE, 93° EAST/SE OF

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.680	M	START: 5.514	FT.
	END:	1.680	M	END: 5.514	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:00 AM
	END:	12:00

CENTERLINE OF EASTBOUND LANE OF I94, LOCATED AT MILEPOST 66.4

SESSION #: 4 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.719	M	START: 5.640	FT.
	END:	1.719	M	END: 5.640	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	12:05	PM
	END:	1:15	PM

SESSION #: 5 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.669	M	START: 5,473	FT.
	END:	1.669	M	END: 5,475	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	1:20	PM
	END:	2:35	PM

SESSION #: 6 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER

ANTENNA TYPE: RG INTERNAL

HI	START:	1.737 M	START:	5700	FT.
	END:	M	END:		FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	2:40
	END:	3:50

Receiver Files
1900 - 1903

SESSION #: 7 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: B555

POINT DESCRIPTION: STAINLESS STEEL ROD W/O SLEEVE INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER, THE RING SURROUNDING THE ACCESS COVER IS STAMPED "B555 1981", MONUMENT IS 1.60' WEST/NORTHWEST OF A →

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.659	M	START: 5.445	FT.
	END:	1.659	M	END: 5.445	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	9:29 AM
	END:	9:55 AM

NE-SW ROW FENCE MONUMENT IS 113.2' EAST/SOUTHEAST OF THE EASTBOUND LANE OF I94 AT MILEPOST 65.35

SESSION #: 8 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: B555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER.

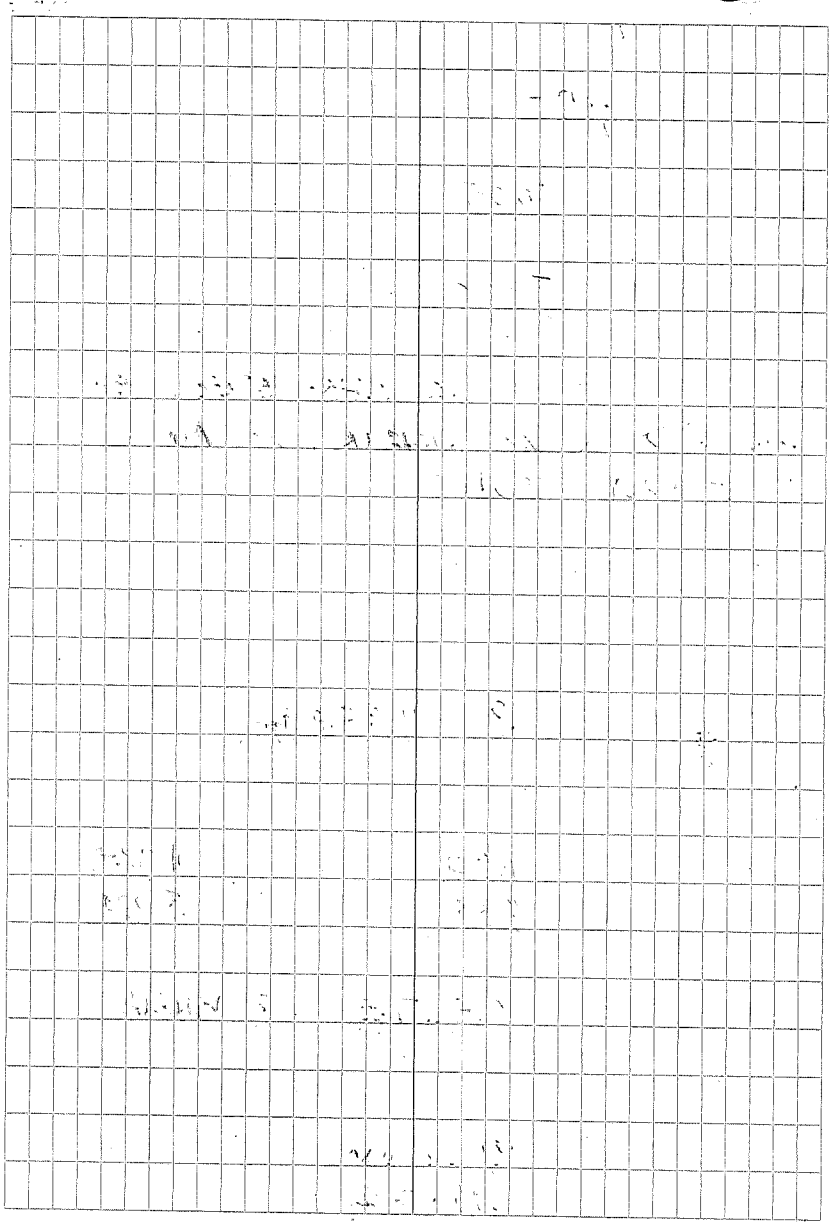
ANTENNA TYPE: R8 INTERNAL

HI	START:	1.706	M	START: 1.706	FT.
	END:	5.597	M	END: 5.597	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 9:59 AM

END: 10:20 AM



SESSION #: 9 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: F8200

POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 X 30" REBAR, STAMPED "F8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.531	M	START: 5.024	FT.
	END:	1.531	M	END: 5.024	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:32 AM
	END:	10:50 AM

SESSION #: 10 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: F8200

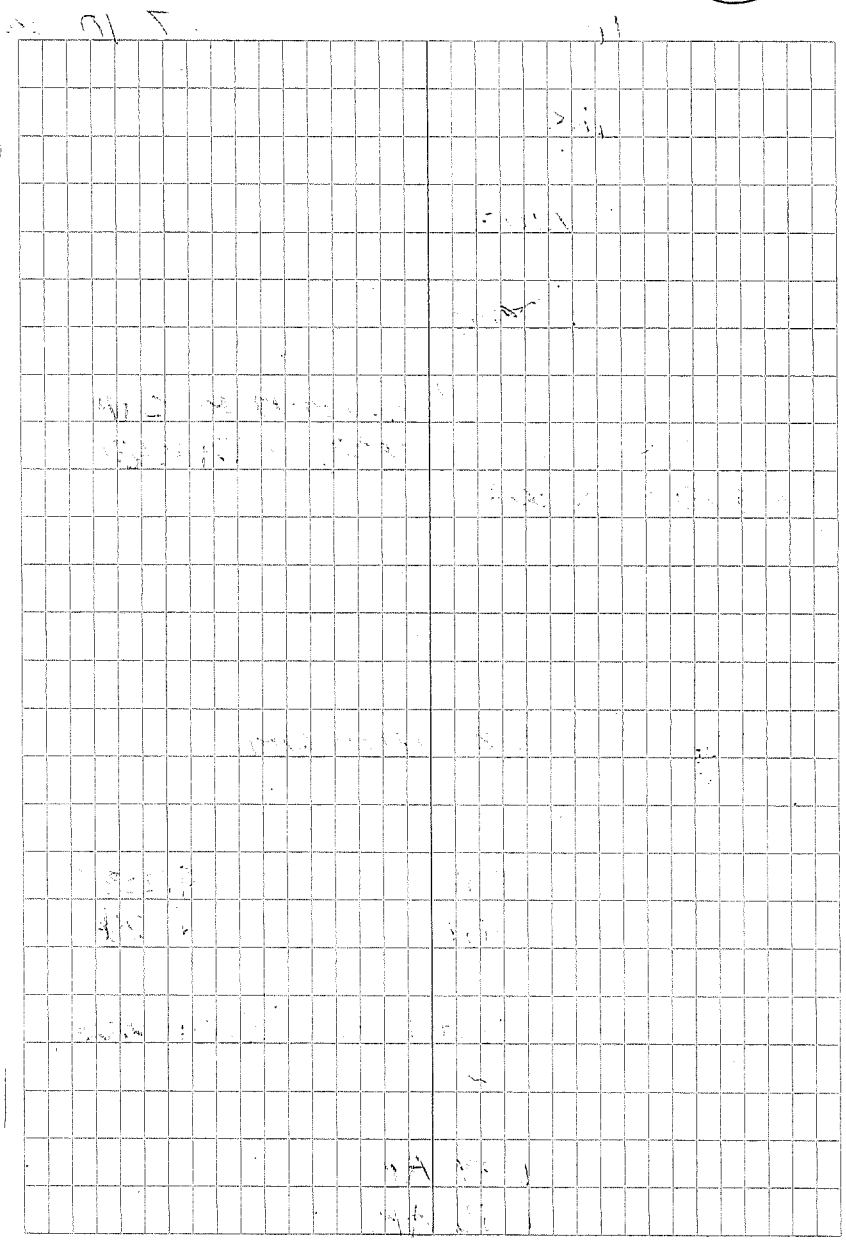
POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 x 30" REBAR, STAMPED "F 8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.511	M	START: 4.958	FT.
	END:	1.511	M	END: 4.958	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:58 AM
	END:	11:16 AM



SESSION #: 11 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: F8200

POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 x 30" REBAR, STAMPED "F8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.562	M	START: 5.125	FT.
	END:	1.562	M	END: 5.124	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:37 AM
	END:	11:55 AM

SESSION #: 12 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: E 8200

POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 x 30" REBAR, STAMPED "E 8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.551 M	START: 5.088	FT.
	END:	1.551 M	END: 5.087	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	12:08 PM
	END:	12:25 PM

A #5 X 30" REBAR & 2" MDT ALUMINUM CONTROL CAP, SET FLUSH WITH THE GROUND, MARKED "E 8200 2014", FOR THE WEST BOUND REST AREA, NEAR THE CENTER (N-S) OF THE TRACTOR/TRAILER PARKING AREA, ON THE GRASS SLOPE BETWEEN THE I-94 WEST BOUND EDGE OF PAVEMENT AND THE TRACTOR/TRAILER PARKING AREA, 10FT WEST OF THE I-94 E.O.P., 26FT EAST OF THE EOP FOR THE TR/TR PARKING LOT. SET A METAL WITNESS POST & MDT STICKER 3FT NORTH OF THE CAP.

SESSION #: 13 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: E 8200

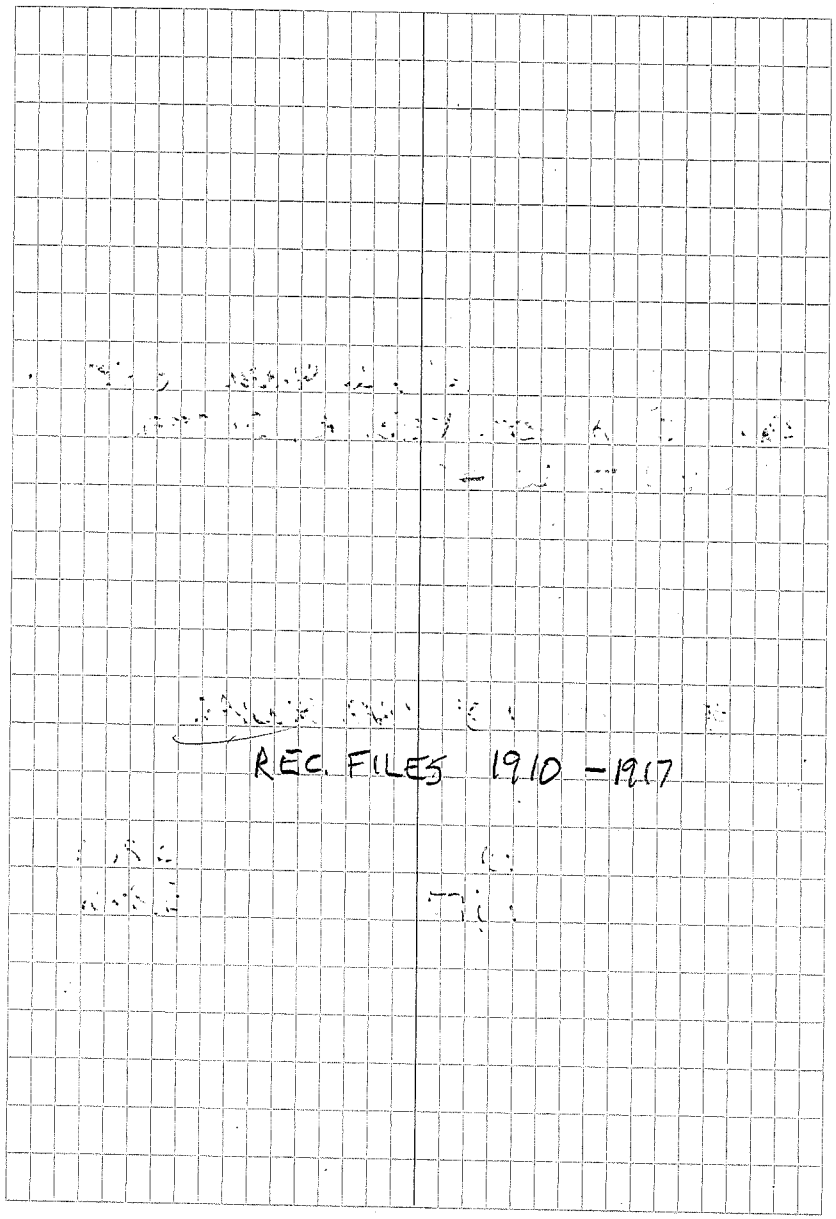
POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 X 30" REBAR, STAMPED "E 8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.587	M	START: 5.206	FT.
	END:	1.587	M	END: 5.206	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN: ~~12:43 PM~~	1:06 PM
	END: ~~1:02 PM~~	1:22 PM



SESSION #:				DATE:	
OBSERVER:					
RECEIVER SN:					
POINT NAME:					
POINT DESCRIPTION:					
ANTENNA TYPE:					
HI	START:		M	START:	FT.
	END:		M	END:	FT.
HI MEASURED TO:					
TIME	BEGIN:				
	END:				

HYSHAM REST AREA

SHELLINA'S NOTES

SESSION #: 3 DATE: 7/9/14

OBSERVER: SHELLINA IRWIN

RECEIVER SN: 8475

POINT NAME: S555

POINT DESCRIPTION:

- NGS Rod 3/4" in CASED by A metal container which is Flush with ground AND SET in concrete. THE monument is located South of the FENCE 1.7ft AND North of Q Frontage RD 683ft

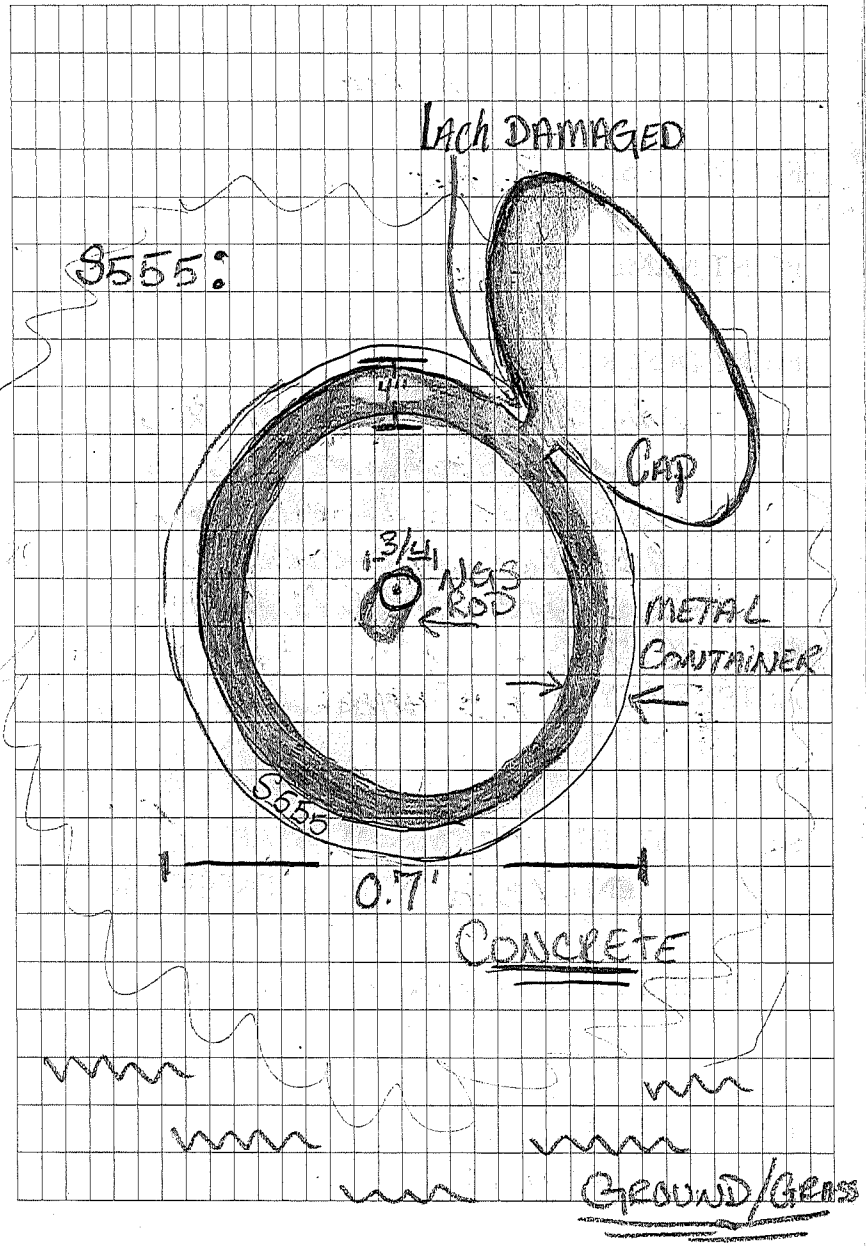
ANTENNA TYPE: RB INTERNAL

HI	START:	1.665	M START:	5.463	FT.
	END:	1.665	M END:	5.463	FT.

HI MEASURED TO: CENTER of BUMPER

TIME BEGIN: 11:00

END: 12:01



SESSION #: 4 DATE: 7/9

OBSERVER: Shelling Lewin

RECEIVER SN: 8475

POINT NAME: S565

POINT DESCRIPTION:

NGS Rod in cased by a mental container. Container is flush with the ground and set in concrete. Diameter of container is 0.7ft

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.723	M	START: 5.654	FT.
	END:	1.723	M	END: 5.654	FT.

HI MEASURED TO: Center of bumper

TIME	BEGIN:	12:06
	END:	11:15

SESSION #: 5 DATE: 7/9

OBSERVER: Shellina Irwin

RECEIVER SN:

POINT NAME: S555

POINT DESCRIPTION:

NGS Rod in cased in a metal container. Container is flush with ground and set in concrete. Diameter on container 0.7 ft

ANTENNA TYPE: RB INTERNAL

HI	START:	1.645	M	START:	5.399	FT.
	END:	1.645	M	END:	5.399	FT.

HI MEASURED TO:

TIME BEGIN: 1:20

END: 2:35

SESSION #: 6 DATE: 7/6

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: 3556

POINT DESCRIPTION:

NGS Rod in cased in a metal container with a Diameter of .7ft. Container is flush with ground and set in concrete

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.708	M START:	5.605	FT.
	END:	1.708	M END:	5.605	FT.

HI MEASURED TO: Center Bumper

TIME	BEGIN:	2:40
	END:	3:53

SESSION #: 7 DATE: 7/10

OBSERVER: Shellina Irwin

RECEIVER SN: 8475

POINT NAME: F8200

POINT DESCRIPTION:

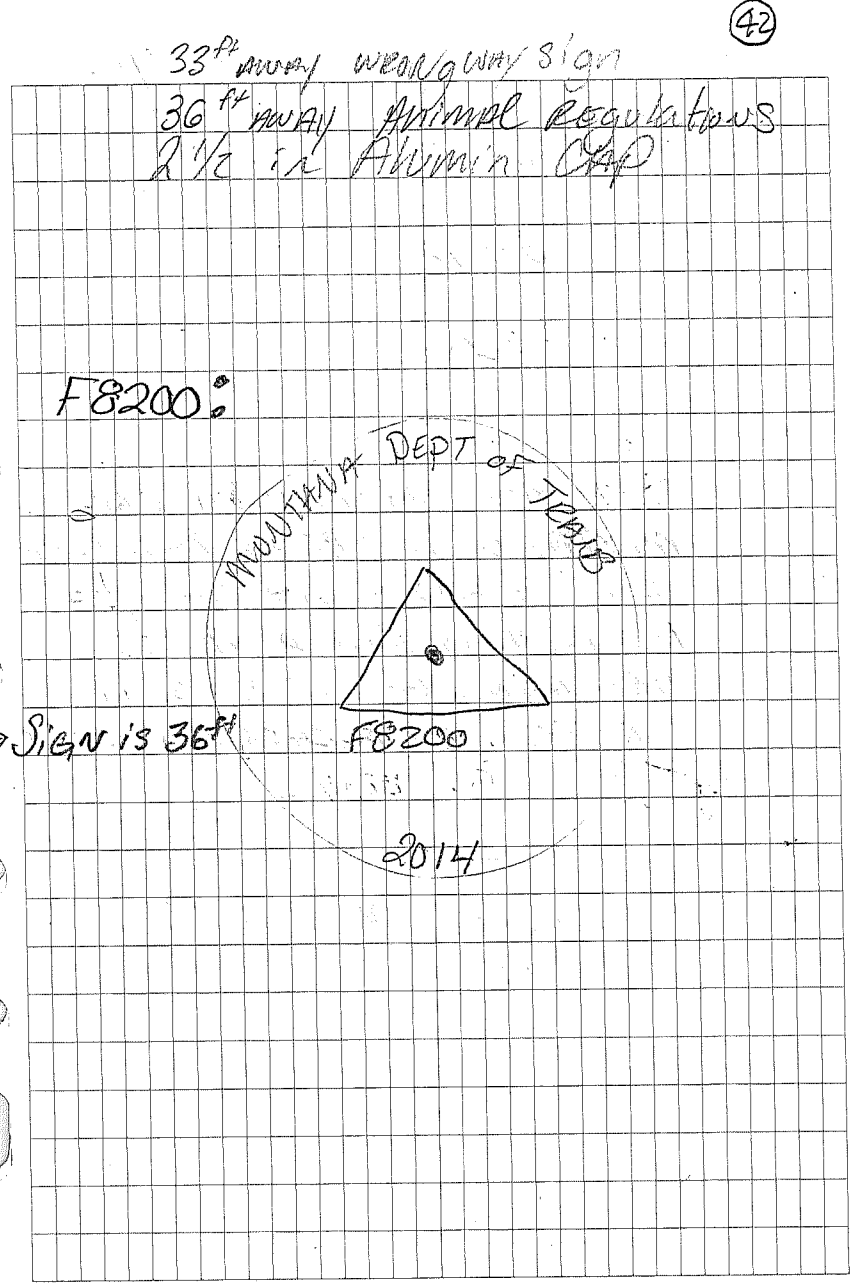
2 1/2 inch Aluminum marked as shown. Set at the beginning of grass by the parking lot of the Hysham rest area. The wrongway sign is 33 ft away and the rest area animal reg → sign is 36 ft

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.5565	M START:	5.107	FT.
	END:	1.556	M END:	5.106	FT.

HI MEASURED TO: Center Bumper

TIME	BEGIN:	9:37
	END:	9:55



SESSION #: 8 DATE: 7/10

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: F8200

POINT DESCRIPTION:

2 1/2 inch Aluminum Cap marked with F8200, Montana Dept. TRANS, 2014, AND ▲ this point is located at the Beginning of the Grass From the Rest Area Parking Lot

ANTENNA TYPE: RB INTERNAL

HI	START: 1.6035	M	START: 5.261	FT.
	END: 1.6035	M	END: 5.261	FT.

HI MEASURED TO: CENTER BUMPER

TIME	BEGIN: 10:02	
	END: 10:20	

A #5 X 30" REBAR AND 2" MDT ALUMINUM CONTROL CAP, SET FLUSH WITH THE GROUND, MARKED "F8200 2014", FOR THE WEST BOUND REST AREA, NEAR THE NORTH END OF THE REST AREA, 1 FT NORTH OF THE EDGE OF PAVEMENT, 3 FT. NORTH OF THE NORTH MOST END OF THE CONCRETE SIDEWALK NEXT TO THE HANDICAP PARKING STALL. SET A METAL WITNESS POST & MDT STICKER 3 FT EAST OF THE CAP.

SESSION #: 9 DATE: 7/10

OBSERVER: Shellina Irwin

RECEIVER SN: 8475

POINT NAME: D8200

POINT DESCRIPTION:

2½ inch Aluminum Cap marked as shown. Set 2ft from the edge of the road of the rest area. Across the road in to the median of the exit road. is an reflector, monument is 52' away. Before the monument is another

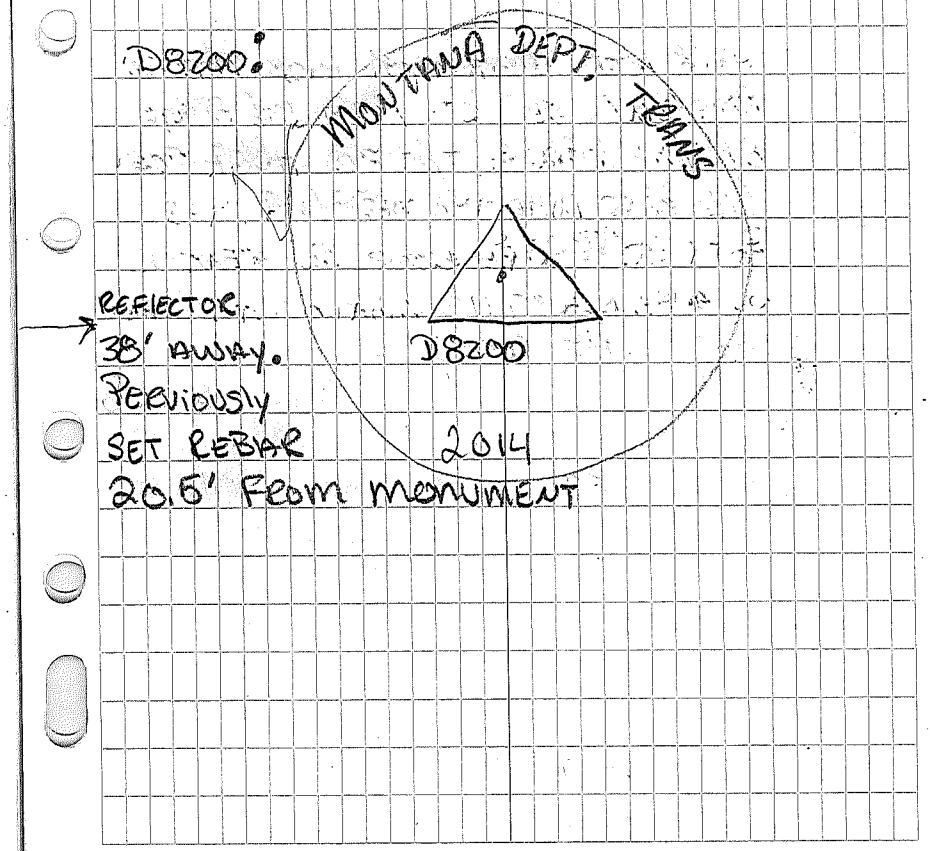
ANTENNA TYPE: RB INTERNAL

HI	START:	1.468	M	START: 4.818	FT.
	END:	1.468	M	END: 4.818	FT.

HI MEASURED TO: CENTER BUMPER

TIME	BEGIN:	10:34
	END:	10:50

20.5' from set rebar
52' from across exit rd median reflector
38' from reflector before same side rd



SESSION #: 10 DATE: 7/10

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: D8200

POINT DESCRIPTION:
2 1/2 Aluminum CAP. Directly Right OF THE EXIT ROAD OF THE REST STOP. MARKED AS D8200, △, 2014 AND MONTANA DEPT. TRANS.

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.529	M	START:	5.016 FT.
	END:	1.529	M	END:	5.016 FT.

HI MEASURED TO:

TIME BEGIN: 11:00
END: 11:16

A #5 X 30" REBAR & 2" MDT ALUMINUM CONTROL CAP, SET FLUSH WITH THE GROUND MARKED "D8200 2014", FOR THE WEST BOUND REST AREA, NEAR THE SOUTH MOST END OF THE REST AREA, 7FT WEST OF THE EDGE OF PAVEMENT 35FT NORTHWEST OF THE SOUTH MOST NOSE OF THE CURBING BETWEEN THE CAR & TRUCK LANES LEAVING THE REST AREA, WEST BOUND, ONTO I-94. SET A METAL WITNESS POST & MDT STICKER 3FT NORTH OF THE CAP.

SESSION #: 11 DATE: 7/10

OBSERVER: Shellina Irwin

RECEIVER SN: 8475

POINT NAME: DB200

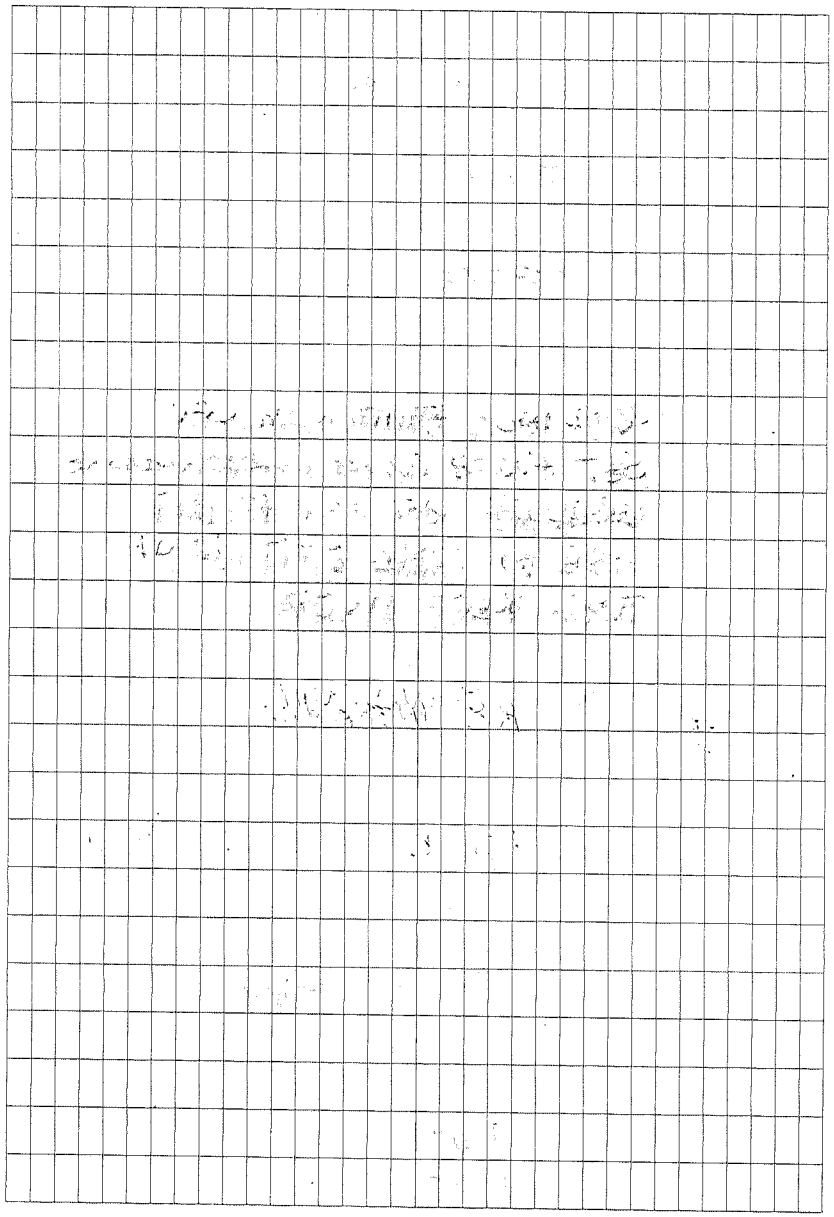
POINT DESCRIPTION:
2½ inch Aluminum Cap
set flush with surrounding
ground on the right
side of the exit rd of
the rest area

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.5776	M	START: 5.174	FT.
	END:	1.5775	M	END: 5.174	FT.

HI MEASURED TO: Center Bumper

TIME	BEGIN:	11:36
	END:	11:55



SESSION #: 12 DATE: 7/10

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: D8200

POINT DESCRIPTION:

2 1/2 inch Aluminum Cap
Set to the Right of the
Exit Road of the Rest Area
about 3' in the Grass
off Road. Marked with
△, 2014, D8200, Montana Dept. Trans

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.529	M	START: 5.015	FT.
	END:	1.529	M	END: 5.015	FT.

HI MEASURED TO: Center Bumper

TIME BEGIN: 12:07

END: 12:25

SESSION #: 13 DATE: 7/10

OBSERVER: Shellissa Irwin

RECEIVER SN: 8475

POINT NAME: F8200

POINT DESCRIPTION:

2 1/2 inch Aluminum Cap

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.554	M	START: 5.1		FT.
	END:	1.554	M	END: 5.98		FT.

HI MEASURED TO: CENTER BUMPER

TIME	BEGIN:	1:06
	END:	1:22

HYSHAM REST AREA
IM 94-2(36)65
UPN 8200000

4525.11355.01
STATIC GPS CONTROL

SESSION #: 1 DATE: 6-13-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A 555

POINT DESCRIPTION: NGS BENCHMARK, A STAINLESS STEEL ROD IN A MONUMENT BOX MARKED A555, 1981. ROD HAS A PUNCH MARK IN THE CENTER

*DATA IS FOR OPUS SUBMITAL

ANTENNA TYPE: R6 INTERNAL

HI START: 1.876 M START: 6.156 FT.
END: 1.876 M END: 6.155 FT.

HI MEASURED TO: CENTER OF THE BUMPER

TIME BEGIN: 7:40 AM
END: ~~11:40~~ AM
12:15

ARP = 1.819 M

SESSION #: 1 DATE: 6-13-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C 555

POINT DESCRIPTION: NGS BENCH MARK A STAINLESS STEEL ROD W/ PUNCH MARK IN A MONUMENT BOX MARKED C 555 1981

*DATA FOR OPUS

ANTENNA TYPE: R6 INTERNAL

HI START: 1.6705 M START: 5.480 FT.
END: 1.670 M END: 5.480 FT.

HI MEASURED TO: CENTER OF THE BUMPER

TIME BEGIN: 8:11 AM
END: 12:26 PM

ARP = 1.613m

SESSION #: 2				DATE:	6-13-14
OBSERVER: RER					
RECEIVER SN:	7974				
POINT NAME:	A555				
POINT DESCRIPTION: NGS BENCH MARK STAINLESS STEEL ROD W/ CENTER PUNCH IN A MONUMENT BOX MARKED A555, 1981					
*DATA FOR OPUS					
ANTENNA TYPE:	RG INTERNAL				
HI	START:	1.867	M	START:	6.125 FT.
	END:	1.867	M	END:	6.125 FT.
HI MEASURED TO: CENTER OF BUMPER					
TIME	BEGIN:	1220			
	END:	430			

ARP= 1.810M

BATTERY QUIT

SESSION #: 2 DATE: 6-13-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C 555

POINT DESCRIPTION: NGS BENCH MARK STAINLESS STEEL ROD W/ A CENTER PUNCH, IN A MONUMENT BOX MARKED C 555 1981

*DATA FOR OPUS

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.653	M	START: 5.424	FT.
	END:		M	END:	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME - BEGIN: 12 31 PM

END: 442

90 'EOP

(4)

ARP = 1.595m

1100 - 1200

SESSION #: 3 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: A NGS STAINLESS STEEL ROD WITH A CENTER PUNCH MARK SET IN AN ALUMINUM MONUMENT BOX W/ LID, MARKED "A555 1981", AT MILE POST 64.4 ON THE EAST BOUND LANE SIDE OF I-94, 100' SOUTHEAST OF THE ℄ OF THE EAST BOUND LANE, 1.2 FT W-NW OF AN NGS W.P., 1.6FT W-NW OF THE R/W FENCE

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.842	M	START: 6.044	FT.
	END:	1.842	M	END: 6.044	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:35
	END:	12:00

MP 64.4

1.2 WP, 1.6 FENCE

1100-1200

SESSION #: 3 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: A8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" NDT ALUMINUM CAP SET FLUSH WITH THE GROUND, MARKED "A8200 2014", FOR THE EAST BOUND I-94 REST AREA, ON A SMALL BENCH SOUTH OF THE MAINTAINED GRASS AREA, 90 FT E-S.E. OF THE EAST EDGE OF PAVEMENT, 76 FT S.E. OF A METAL SIGN POST (NO CAMPING SIGN).

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.5125	M	START: 4.961	FT.
	END:	1.5125	M	END: 4.961	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:49	AM
	END:	12:07	PM

90' EOP
76' SIGNM

(6)

SET A METAL WITNESS POST WITH A NDT STICKER 3 FT NORTH OF CAP.

1215-1:15

SESSION #: 4 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: NGS SS. ROD IN A MONUMENT BOX W/ LID MARKED "A555 1981".

ANTENNA TYPE: R6 INTERNAL

HI START: 1.819 M START: 5.968 FT.
END: 1.819 M END: 5.968 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 12:03 PM
END: ~~12:15~~ 1:15 PM

12815-f015

SESSION #: 4 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: A8200

POINT DESCRIPTION: #5 X 30" REBAR & 2" NDT ALUMINUM CONTROL CAP W/CENTER PUNCH, SET FLUSH WITH THE GROUND MARKED "A8200 2014"

ANTENNA TYPE:

HI START: 1.4975 M START: 4.913 FT.
END: 1.4975 M END: 4.912 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 12:12 PM
END: 1:23 PM

1:35 - 2:35

SESSION #: 5 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: NGS S.S. ROD IN A ALUMINUM MONUMENT BOX W/ LID MARKED "A 555 1981"

ANTENNA TYPE: R6 INTERAL

HI START: 1.833 M START: 6.014 FT.
END: 1.833 M END: 6.014 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 1:19 PM
END: 2:35 PM

1:35-2:35

SESSION #: 5 DATE: 7-9-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: F8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT ALUMINUM CONTROL CAP SET FLUSH WITH THE GROUND MARKED "F8200 2014" FOR THE WEST BOUND REST AREA, NEAR THE NORTH END OF THE RESTAREA, 1FT N. OF THE E.O.P. AT THE HANDICAP PARKING SPACE, 33FT NORTH OF THE NORTH MOST END OF THE

ANTENNA TYPE: RG INTERNAL

HI START: 1.530 M START: 5.022 FT.
END: 1.530 M END: 5.020 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 1:34 PM
END: 2:44 PM

CONCRETE SIDEWALK FROM THE HANDICAP SPACE TO THE REST ROOMS. SET A METAL WITNESS POST WITH A MDT STICKER 3FT EAST OF THE CAP.

2:50-3:50

SESSION #: 6 DATE: 7-9-2014

OBSERVER: REP

RECEIVER SN: 7974

POINT NAME: A555

POINT DESCRIPTION: ~~A #5 x 30" REBAR & MDT ALUMINUM CONTROL CAP SET FLUSH WITH THE GROUND MARKED~~ " A NGS STAINLESS STEEL ROD W/ A CENTER PUNCH IN A ALUMINUM MONUMENT BOX WITH A LID

ANTENNA TYPE: R6 INTERNAL

HI START: 1.8495 M START: 6.068 FT.
END: 1.8495 M END: 6.068 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 2:39 PM
END: 3:50 PM

2:50-3:50

SESSION #: 6 DATE: 7-9-2014

OBSERVER: REL

RECEIVER SN: 7945

POINT NAME: FS200

POINT DESCRIPTION: A #5 X 30" REBAR W/ 2" MDT ALUMINUM CONTROL CAP, SET FLUSH MARKED "FS200 2014"

ANTENNA TYPE: R6 INTERNAL

HI START: 1.540 M START: 5.054 FT.
END: 1.540 M END: 5.055 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 2:49 PM
END: 4:01 PM

940-955

SESSION #: 7 DATE: 7-10-14

OBSERVER: BER

RECEIVER SN: 7974

POINT NAME: A 8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT ALUMINUM CAP, SET FLUSH W/ GROUND MARKED "AB200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.742	M	START: 5.716	FT.
	END:	1.742	M	END: 5.716	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	9:38	AM
	END:	955	AM

SESSION #: 8 10-1020 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: A #5X30" REBAR & 2" MDT ALUMINUM CONTROL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.727	M	START: 5.668	FT.
	END:	1.727	M	END: 5.667	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 9:58 AM

END: 10:20 AM

10:35-10:50

SESSION #: 9 DATE: 7-30-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: A #5 x 30" REBAR & 2" MDT CNTL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.711	M	START: 5.614	FT.
	END:	1.711	M	END: 5.614	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:31 AM
	END:	10:50 AM

10:35-10:50

SESSION #: 9 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT CONTROL CAP SET FLUSH W/ GROUND MARKED "C8200 2014", FOR THE EAST BOUND REST AREA, 380 FT NORTH OF THE NORTH MOST PICNIC TABLE, ON A SMALL HILL ABOVE WHERE THE EXIT RAMP FOR THE REST AREA MEETS THE EAST BOUND LANE OF I-94, 28 FT WEST OF THE N-S R/W FENCE. SET A METAL WITNESS POST & MDT STICKER 3 FT NORTH OF THE CAP.

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.541 M	START:	5.057 FT.
	END:	1.541 M	END:	5.057 FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:35 AM
	END:	10:55 AM

11:00-11:16

SESSION #: 10 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: #5 x 30" REBAR & 2" MDT ALUMINUM CONTROL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.6975	M	START: 5.571	FT.
	END:	1.698	M	END: 5.569	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 10:53 AM

END: 11:16 AM

SESSION #: 10 1100-1116 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: C8200

POINT DESCRIPTION: A #5 X 30" REBAR & MDT ALUMINUM CAP MARKED "C8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.523	M	START: 4.998	FT.
	END:	1.523	M	END: 4.998	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:00	AM
	END:	11:22	AM

11:38-11:53

SESSION #: 11				DATE:	7-10-14
OBSERVER: RER					
RECEIVER SN: 7974					
POINT NAME: A8200					
POINT DESCRIPTION: #5x30" REBAR & 2" MDT ALUMINUM CONTROL CAP MARKED "A8200 2014"					
ANTENNA TYPE: R6 INTERNAL					
HI	START:	1.680	M	START: 5.513	FT.
	END:	1.680	M	END: 5.513	FT.
HI MEASURED TO: CENTER OF BUMPER					
TIME	BEGIN:	11:36 AM			
	END:	11:55 AM			

1138-1155

SESSION #: 11 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: B8200

POINT DESCRIPTION: A #5X30" REBAR & 2" MDT ALUMINUM CONTROL CAP SET FLUSH WITH THE GROUND MARKED "B8200 2014", FOR THE EAST BOUND REST AREA, NEAR THE CENTER (N-S), 1FT. WEST OF THE TOP BACK OF CURB FOR THE TRACTOR/TRAILER PARKING AREA,

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.484	M	START: 4.869	FT.
	END:	1.484	M	END: 4.869	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:33 AM
	END:	12:06 PM

(20)

IN THE GRASS AREA, ON TOP OF A SMALL HILL BETWEEN THE TRACTOR/TRAILER PARKING AREA & THE EDGE OF PAVEMENT FOR THE EAST BOUND LANE OF I-94,

1208-1225

SESSION #: 12 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: A8200

POINT DESCRIPTION: A #5 X 20" REBAR &
MDT CONTROL CAP MARKED "A8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	~~1.668~~ 1.669	M	START: 5.476	FT.
	END:	1.6685	M	END: 5.476	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 12:08 PM

END: 12:25 PM

1208-1225

SESSION #: 12 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: B8200

POINT DESCRIPTION: #5x30" REBAR & 2" MDT CONTROL CAP MARKED "B8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.498	M	START: 4.918	FT.
	END:	1.4975	M	END: 4.913	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	12:05 PM
	END:	12:29 PM

SESSION #: 18 ~~1246-1102~~ 1:07-122 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7945

POINT NAME: B8200

POINT DESCRIPTION: ANT 5x20" REBAR 4-2"
MDT CONTROL CAP MARKED "B8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.5085	M START: 4.949	FT.
	END:	1.5085	M END: 4.948	FT.

HI MEASURED TO: CENTER OF BUMPER

		1:06 PM	
TIME	BEGIN:	~~1244~~ PM	1:06PM
	END:	~~1102~~ PM	1:22 PM

*BATTERY FAILURE ON F8200 BEFORE THE END OF SESSION 13. RE-OBSERVED

~~1246-1:02~~

SESSION #: 13 1:07-1:22 DATE: 7-10-14

OBSERVER: RER

RECEIVER SN: 7974

POINT NAME: C8200

POINT DESCRIPTION: A #5 X 30" REBAR & 2" MDT CONTROL CAP MARKED "C8200 2014"

ANTENNA TYPE: R6 INTERNAL

HI	START:	1.814	M	START: 5.951	FT.
	END:	1.8135	M	END: 5.950	FT.

HI MEASURED TO: CENTER OF BUMPER

1:03

TIME	BEGIN:	~~12:39~~ PM	1:03 PM	
	END:	1:32 PM		

BATTERY FAILURE @ C8200 BEFORE THE END OF SESSION 13. RE OBSERVED

SESSION #:			DATE:		
OBSERVER:					
RECEIVER SN:					
POINT NAME:					
POINT DESCRIPTION:					
ANTENNA TYPE:					
HI	START:		M	START:	FT.
	END:		M	END:	FT.
HI MEASURED TO:					
TIME	BEGIN:				
	END:				

HYSHAM REST AREA

DEAN'S NOTES

SESSION #: 3 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD W/O SLEEVE INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH ACCESS COVER, THE RING SURROUNDING THE COVER IS STAMPED "C555 1981", MONUMENT IS 1.75' W/NO OF ROW FENCE, 93° EAST/SE OF

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.680	M	START: 5.514	FT.
	END:	1.680	M	END: 5.514	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:00 AM
	END:	12:00

CENTERLINE OF EASTBOUND LANE OF I94, LOCATED AT MILEPOST 66.4

SESSION #: 4 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.719	M	START: 5.640	FT.
	END:	1.719	M	END: 5.640	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	12:05	PM
	END:	1:15	PM

SESSION #: 5 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.669	M	START: 5,473	FT.
	END:	1.669	M	END: 5,475	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	1:20	PM
	END:	2:35	PM

SESSION #: 6 DATE: 7-09-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: C555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER

ANTENNA TYPE: RG INTERNAL

HI	START:	1.737 M	START:	5700	FT.
	END:	M	END:		FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	2:40
	END:	3:50

Receiver Files
1900 - 1903

SESSION #: 7 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: B555

POINT DESCRIPTION: STAINLESS STEEL ROD W/O SLEEVE INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER, THE RING SURROUNDING THE ACCESS COVER IS STAMPED "B555 1981", MONUMENT IS 1.60' WEST/NORTHWEST OF A →

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.659	M	START: 5.445	FT.
	END:	1.659	M	END: 5.445	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	9:29 AM
	END:	9:55 AM

NE-SW ROW FENCE MONUMENT IS 113.2' EAST/SOUTHEAST OF THE EASTBOUND LANE OF I94 AT MILEPOST 65.35

SESSION #: 8 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: B555

POINT DESCRIPTION: STAINLESS STEEL ROD INSIDE A COVERED MONUMENT BOX ACCESSED BY A HINGED 5 INCH COVER.

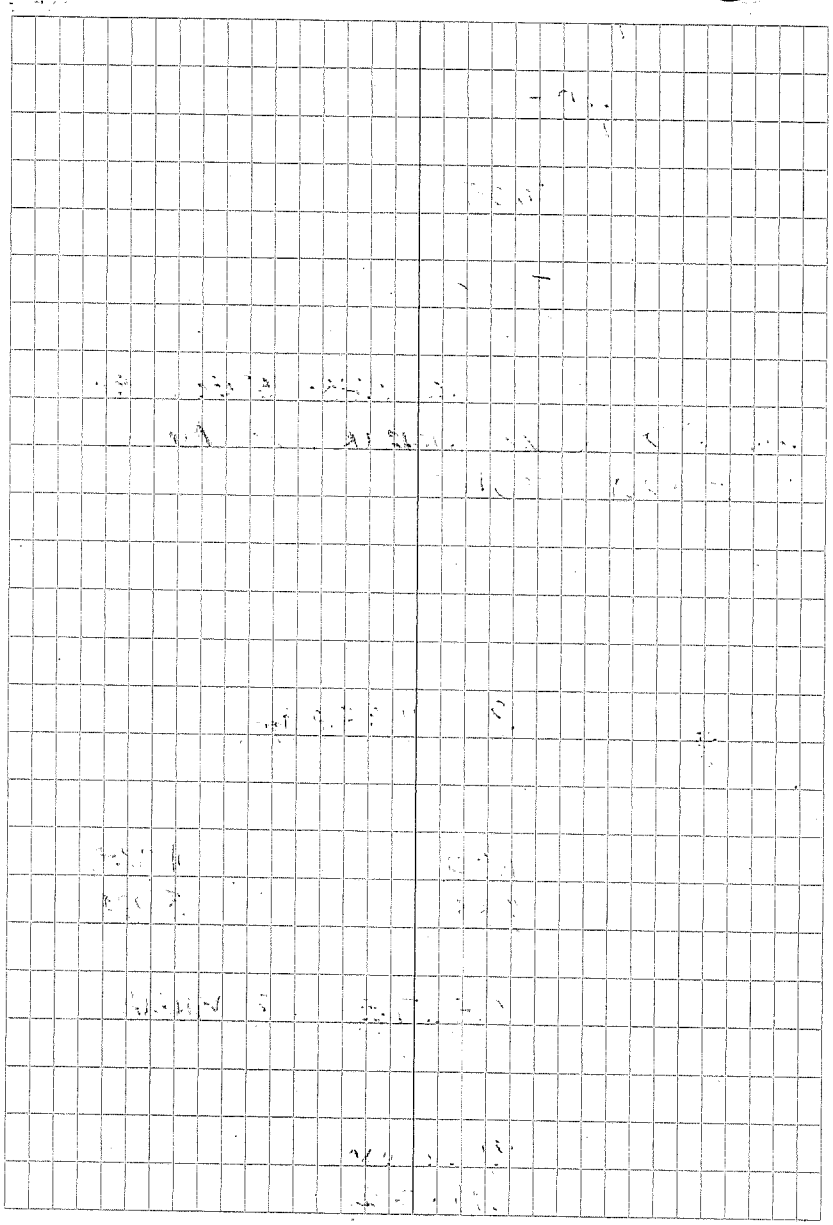
ANTENNA TYPE: R8 INTERNAL

HI	START:	1.706	M	START: 1.706	FT.
	END:	5.597	M	END: 5.597	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME BEGIN: 9:59 AM

END: 10:20 AM



SESSION #: 9 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: F8200

POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 X 30" REBAR, STAMPED "F8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.531	M	START: 5.024	FT.
	END:	1.531	M	END: 5.024	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:32 AM
	END:	10:50 AM

SESSION #: 10 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: F8200

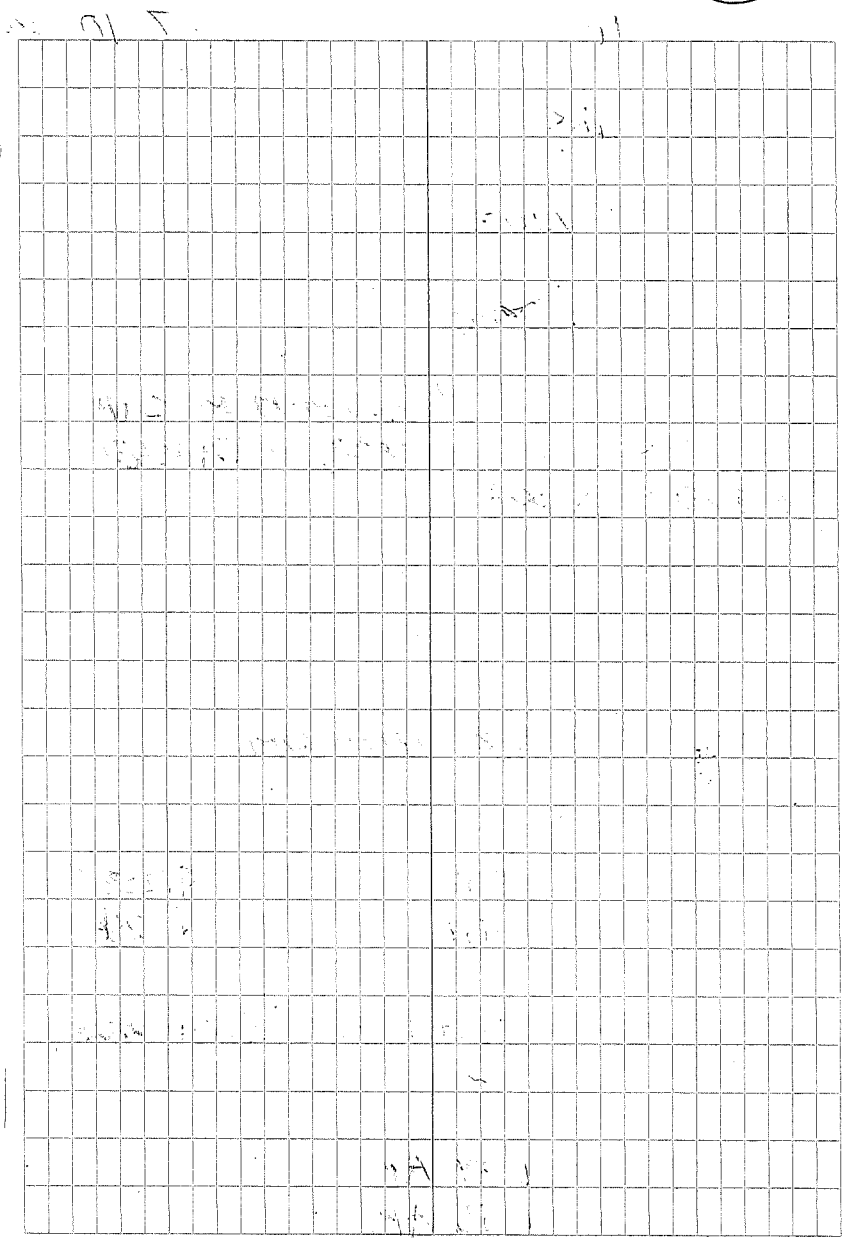
POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 x 30" REBAR, STAMPED "F 8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.511	M	START: 4.958	FT.
	END:	1.511	M	END: 4.958	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	10:58 AM
	END:	11:16 AM



SESSION #: 11 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: F8200

POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 x 30" REBAR, STAMPED "F8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.562	M	START: 5.125	FT.
	END:	1.562	M	END: 5.124	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	11:37 AM
	END:	11:55 AM

SESSION #: 12 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: E 8200

POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 x 30" REBAR, STAMPED "E 8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.551 M	START: 5.088	FT.
	END:	1.551 M	END: 5.087	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN:	12:08 PM
	END:	12:25 PM

A #5 X 30" REBAR & 2" MDT ALUMINUM CONTROL CAP, SET FLUSH WITH THE GROUND, MARKED "E 8200 2014", FOR THE WEST BOUND REST AREA, NEAR THE CENTER (N-S) OF THE TRACTOR/TRAILER PARKING AREA, ON THE GRASS SLOPE BETWEEN THE I-94 WEST BOUND EDGE OF PAVEMENT AND THE TRACTOR/TRAILER PARKING AREA, 10FT WEST OF THE I-94 E.O.P., 26FT EAST OF THE EOP FOR THE TR/TR PARKING LOT. SET A METAL WITNESS POST & MDT STICKER 3FT NORTH OF THE CAP.

SESSION #: 13 DATE: 7-10-14

OBSERVER: DRS

RECEIVER SN: 7005

POINT NAME: E 8200

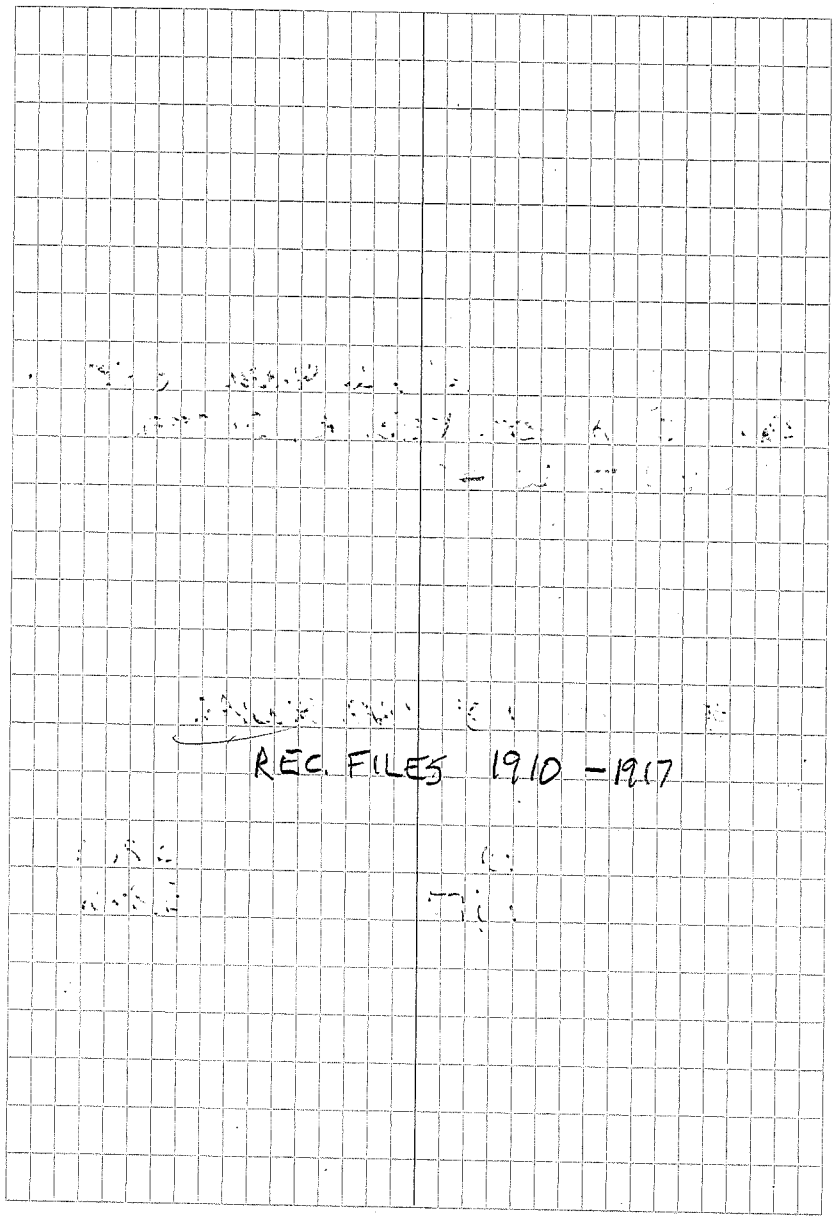
POINT DESCRIPTION: 2" ALUMINUM CAP ON #5 X 30" REBAR, STAMPED "E 8200 2014"

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.587	M	START: 5.206	FT.
	END:	1.587	M	END: 5.206	FT.

HI MEASURED TO: CENTER OF BUMPER

TIME	BEGIN: ~~12:43 PM~~	1:06 PM
	END: ~~1:02 PM~~	1:22 PM



SESSION #:				DATE:	
OBSERVER:					
RECEIVER SN:					
POINT NAME:					
POINT DESCRIPTION:					
ANTENNA TYPE:					
HI	START:		M	START:	FT.
	END:		M	END:	FT.
HI MEASURED TO:					
TIME	BEGIN:				
	END:				

HYSHAM REST AREA

SHELLINA'S NOTES

SESSION #: 3 DATE: 7/9/14

OBSERVER: SHELLINA IRWIN

RECEIVER SN: 8475

POINT NAME: S555

POINT DESCRIPTION:

- NGS Rod 3/4" in CASED by A metal container which is Flush with ground AND SET in concrete. THE monument is located South of the FENCE 1.7ft AND North of Q Frontage RD 683ft

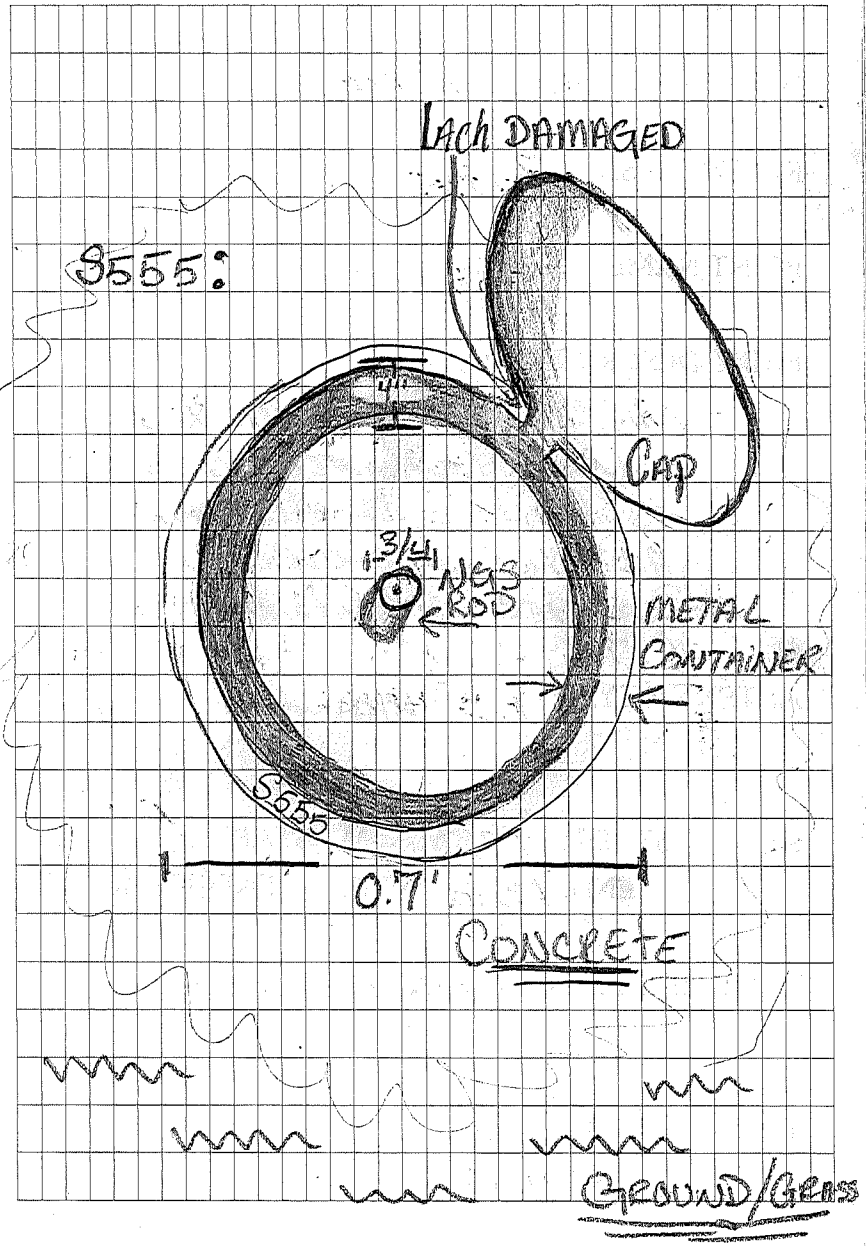
ANTENNA TYPE: RB INTERNAL

HI	START:	1.665	M START:	5.463	FT.
	END:	1.665	M END:	5.463	FT.

HI MEASURED TO: CENTER of BUMPER

TIME BEGIN: 11:00

END: 12:01



SESSION #: 4 DATE: 7/9

OBSERVER: Shelling Lewin

RECEIVER SN: 8475

POINT NAME: S565

POINT DESCRIPTION:

NGS Rod in cased by a mental container. Container is flush with the ground and set in concrete. Diameter of container is 0.7ft

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.723	M	START: 5.654	FT.
	END:	1.723	M	END: 5.654	FT.

HI MEASURED TO: Center of bumper

TIME	BEGIN:	12:06
	END:	11:15

SESSION #: 5 DATE: 7/9

OBSERVER: Shellina Irwin

RECEIVER SN:

POINT NAME: S555

POINT DESCRIPTION:

NGS Rod in cased in a metal container. Container is flush with ground and set in concrete. Diameter on container 0.7 ft

ANTENNA TYPE: RB INTERNAL

HI	START:	1.645	M	START:	5.399	FT.
	END:	1.645	M	END:	5.399	FT.

HI MEASURED TO:

TIME BEGIN: 1:20

END: 2:35

SESSION #: 6 DATE: 7/6

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: 3556

POINT DESCRIPTION:

NGS Rod in cased in a metal container with a Diameter of .7ft. Container is flush with ground and set in concrete

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.708	M START:	5.605	FT.
	END:	1.708	M END:	5.605	FT.

HI MEASURED TO: Center Bumper

TIME	BEGIN:	2:40
	END:	3:53

SESSION #: 7 DATE: 7/10

OBSERVER: Shellina Irwin

RECEIVER SN: 8475

POINT NAME: F8200

POINT DESCRIPTION:

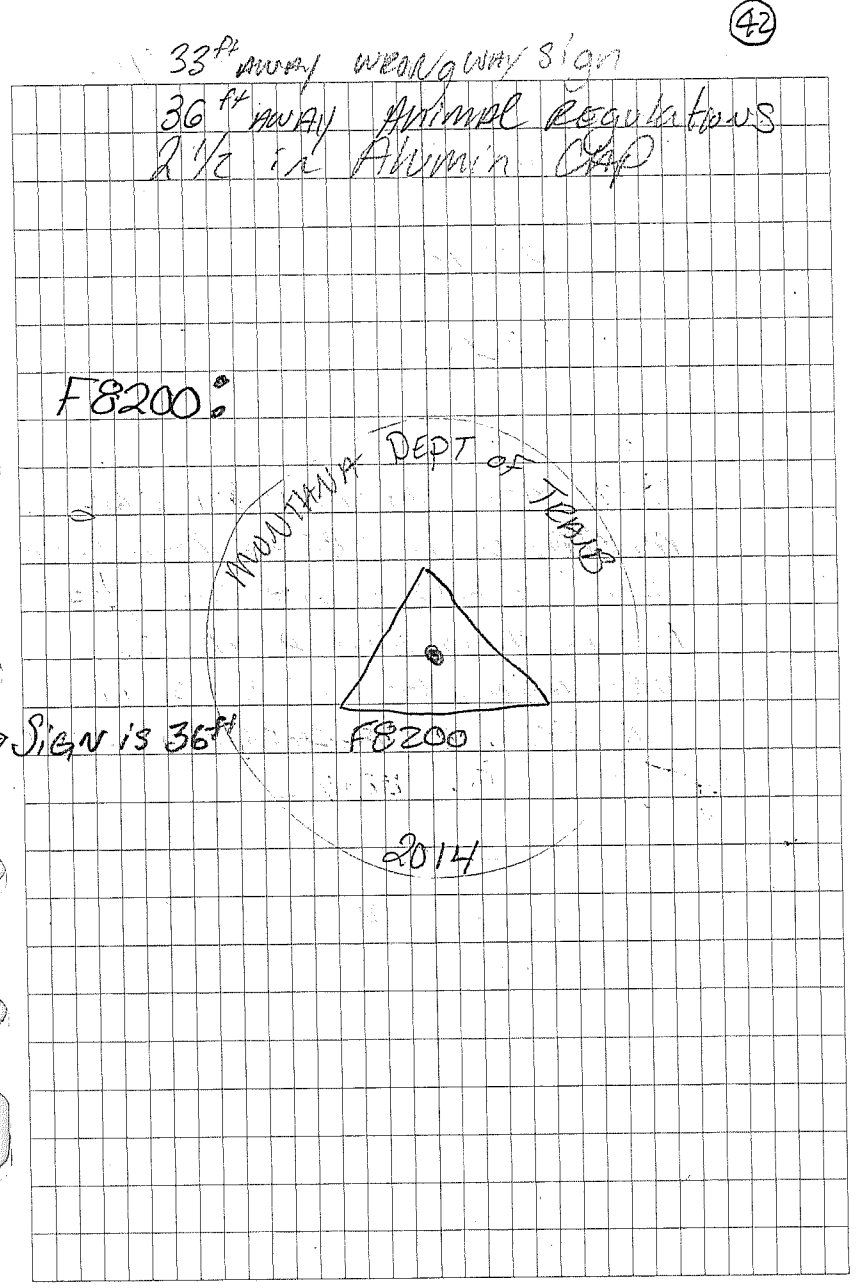
2 1/2 inch Aluminum marked as shown. Set at the beginning of grass by the parking lot of the Hysham rest area. The wrongway sign is 33 ft away and the rest area animal reg → sign is 36 ft

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.5565	M START:	5.107	FT.
	END:	1.556	M END:	5.106	FT.

HI MEASURED TO: Center Bumper

TIME	BEGIN:	9:37
	END:	9:55



SESSION #: 8 DATE: 7/10

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: F8200

POINT DESCRIPTION:

2 1/2 inch Aluminum Cap marked with F8200, Montana Dept. TRANS, 2014, AND ▲ this point is located at the Beginning of the Grass From the Rest Area Parking Lot

ANTENNA TYPE: RB INTERNAL

HI	START: 1.6035	M	START: 5.261	FT.
	END: 1.6035	M	END: 5.261	FT.

HI MEASURED TO: CENTER BUMPER

TIME	BEGIN: 10:02	
	END: 10:20	

A #5 X 30" REBAR AND 2" MDT ALUMINUM CONTROL CAP, SET FLUSH WITH THE GROUND, MARKED "F8200 2014", FOR THE WEST BOUND REST AREA, NEAR THE NORTH END OF THE REST AREA, 1 FT NORTH OF THE EDGE OF PAVEMENT, 3 FT. NORTH OF THE NORTH MOST END OF THE CONCRETE SIDEWALK NEXT TO THE HANDICAP PARKING STALL. SET A METAL WITNESS POST & MDT STICKER 3 FT EAST OF THE CAP.

SESSION #: 9 DATE: 7/10

OBSERVER: Shellina Irwin

RECEIVER SN: 8475

POINT NAME: D8200

POINT DESCRIPTION:

2½ inch Aluminum Cap marked as shown. Set 2ft from the edge of the road of the rest area. Across the road in to the median of the exit road. is an reflector, monument is 52' away. Before the monument is another

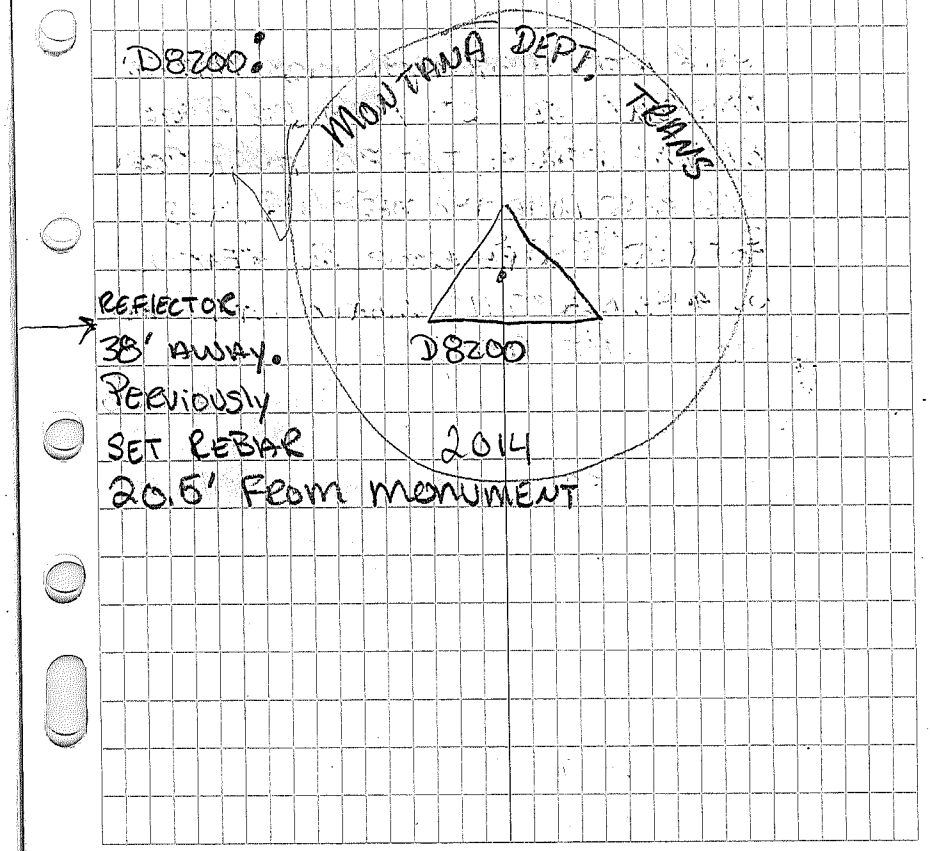
ANTENNA TYPE: RB INTERNAL

HI	START:	1.468	M	START: 4.818	FT.
	END:	1.468	M	END: 4.818	FT.

HI MEASURED TO: CENTER BUMPER

TIME	BEGIN:	10:34
	END:	10:50

20.5' from set rebar
52' from across exit rd median reflector
38' from reflector before same side rd



SESSION #: 10 DATE: 7/10

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: D8200

POINT DESCRIPTION:
2 1/2 Aluminum CAP. Directly Right OF THE EXIT ROAD OF THE REST STOP. MARKED AS D8200, △, 2014 AND MONTANA DEPT. TRANS.

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.529	M	START:	5.016 FT.
	END:	1.529	M	END:	5.016 FT.

HI MEASURED TO:

TIME BEGIN: 11:00
END: 11:16

A #5 X 30" REBAR & 2" MDT ALUMINUM CONTROL CAP, SET FLUSH WITH THE GROUND MARKED "D8200 2014", FOR THE WEST BOUND REST AREA, NEAR THE SOUTH MOST END OF THE REST AREA, 7FT WEST OF THE EDGE OF PAVEMENT 35FT NORTHWEST OF THE SOUTH MOST NOSE OF THE CURBING BETWEEN THE CAR & TRUCK LANES LEAVING THE REST AREA, WEST BOUND, ONTO I-94. SET A METAL WITNESS POST & MDT STICKER 3FT NORTH OF THE CAP.

SESSION #: 11 DATE: 7/10

OBSERVER: Shellina Irwin

RECEIVER SN: 8475

POINT NAME: DB200

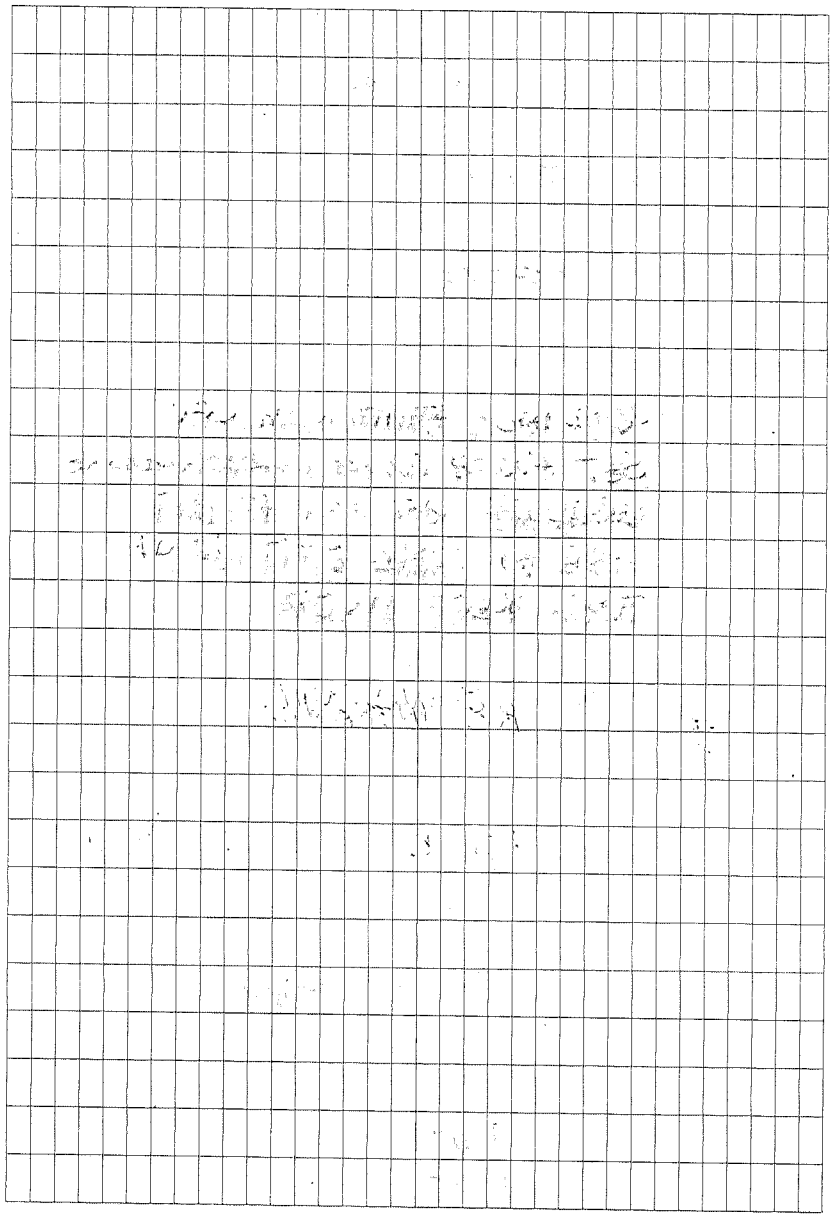
POINT DESCRIPTION:
2½ inch Aluminum Cap
set flush with surrounding
ground on the right
side of the exit rd of
the rest area

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.5776	M	START: 5.174	FT.
	END:	1.5775	M	END: 5.174	FT.

HI MEASURED TO: Center Bumper

TIME	BEGIN:	11:36
	END:	11:55



SESSION #: 12 DATE: 7/10

OBSERVER: Shelina Irwin

RECEIVER SN: 8475

POINT NAME: D8200

POINT DESCRIPTION:

2 1/2 inch Aluminum Cap
Set to the Right of the
Exit Road of the Rest Area
about 3' in the Grass
off Road. Marked with
△, 2014, D8200, Montana Dept. Trans

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.529	M	START: 5.015	FT.
	END:	1.529	M	END: 5.015	FT.

HI MEASURED TO: Center Bumper

TIME BEGIN: 12:07

END: 12:25

SESSION #: 13 DATE: 7/10

OBSERVER: Shellissa Irwin

RECEIVER SN: 8475

POINT NAME: F8200

POINT DESCRIPTION:

2 1/2 inch Aluminum Cap

ANTENNA TYPE: R8 INTERNAL

HI	START:	1.554	M	START: 5.1		FT.
	END:	1.554	M	END: 5.98		FT.

HI MEASURED TO: CENTER BUMPER

TIME	BEGIN:	1:06
	END:	1:22

TRIMBLE DINI LEVEL
PEG TEST
7/10/14
RER
DRS
SLI

7/10/14

KUKKAMAKI METHOD

A ← 100' → B ← 100' → C

A1 SR: 0.000 Ft
R: 4.775
HD: 51.94

B1 SR: 0.000 Ft
R: 5.836
HD: 47.90

B2 SR: 0.000 Ft
R: 4.673
HD: 45.01

A2 SR: 0.000 Ft
R: 3.605
HD: 45.77

Adj. measurement result
ΔC -6.5"

Line of sight correction

	old	new
C:	-6.8"	-13.3"

HYSHAM REST AREA
VERTICAL CONTROL
7-10-14

TRIMBLE DINI DIGITAL LEVEL
SN: 711304

STA	BS	HI	FS	NAVD88 ELEV
BM				2929.16
NGS A555				
	6.560	2935.720		
TP			9.445	2926.275
	1.736	2928.011		
TP			9.276	2918.736
	0.208	2918.944		
TP			10.054	2908.890
	0.512	2909.402		
TP			9.999	2899.403
	0.727	2900.131		
TP			8.859	2891.272
	2.885	2894.157		
TP			4.060	2890.097
	7.356	2897.453		
TP			2.524	2894.929
	9.253	2904.182		
A 8200			2.896	2901.286
	2.673	2904.050		
TP			9.085	2894.965
	2.910	2897.875		
B 8200			7.405	2890.470
	3.440	2893.910		

7-10-14

NGS ROD IN MON. BOX W/ CAP — RER, DRS, SLE

A555
2869.74

R/B @ MDT A.C.

R/B @ MDT A.C.

STA	BS	HI	FS	NAVD88 ELEV
		2893.910		
TP			3.753	2890.157
	8.244	2898.402		
C8200			4.967	2893.434
	4.859	2898.294		
TP			8.137	2890.156
	3.035	2893.191		
TP			8.707	2884.484
	1.761	2886.246		
E8200			6.768	2879.478
	7.210	2886.688		
D8200			4.808	2881.880
	2.560	2884.440		
F8200			8.000	2876.439
	4.421	2880.861		
TP			6.393	2874.467
	4.128	2878.595		
TP			7.086	2871.510
	4.563	2876.073		

(A)

7-10-14

REF, DRS, SLT

R/B & MDT A.C.

R/B & MDT A.C.

R/B & MDT A.C.

R/B & MDT A.C.

7-10-14

RER, DRS, SLZ

STA	BS	HI	FS	NAVD88 ELEV
		2876.073		
TP			6.864	2869.208
	6.863	2876.071		
TP			6.864	2869.206
	4.824	2874.031		
TP			6.966	2867.065
	4.864	2871.929		
TP			7.018	2864.911
	5.068	2869.979		
TP			5.959	2864.020
	11.436	2875.456		
BM			5.675	2869.781
NGS B555				EOC = -0.041

ELEV. = 2869.74 NGS S.S. ROD IN A MONUMENT BOX

APPENDIX C:

Asbestos Inspection Memo

ASBESTOS AND LEAD-BASED PAINT INSPECTION REPORT

HYSHAM REST AREA

HYSHAM, MONTANA

REPORT

ASBESTOS-CONTAINING MATERIALS
AND
LEAD-BASED PAINT

HYSHAM REST AREA

HYSHAM, MONTANA

Prepared For:

Montana Department of Transportation
2701 Prospect Avenue
Helena, Montana

Prepared by:

Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, Montana 59101

Project No. 149-081

April 15, 2015

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EXECUTIVE SUMMARY

Comprehensive asbestos and lead-based paint surveys of the Hysham Rest Area, located five miles southwest of Hysham on I-90 East in rural Montana were performed by Northern Industrial Hygiene, Inc. (Northern) on March 17, 2015.

The rest areas (both east and west bound) construction date was unknown on the day of Northern's inspection. Each main building is approximately 621 square feet in size. There is two storage sheds located at the west bound rest area.

The two main rest area buildings are slab on grade, single story, concrete framed structures. The roofs are finished with metal.

The shelters are slab on grade structures with no exterior walls and have a metal roof finish.

The storage sheds are slab on grade, wood framed, single story structures with either a metal or rolled asphalt roofing.

Typical interior building materials finishes include concrete or quarry tile finished floors, concrete or wood finished walls, and gypsum board or wood finished ceilings.

Typical interior painted building components for each main building include wood and gypsum board ceilings, concrete walls, metal doors and related components and other miscellaneous building components. Painted exterior building components include the exterior side of the door, trim, soffit, metal roofs, wood column, wood beams, electric boxes, metal brackets for shelters, parking stripes, garbage cans, sign posts and other miscellaneous components.

Typical exterior painted building components for the storage shed include wood door, soffit, fascia, and wood walls.

Heat for the buildings is provided by a natural gas forced air furnace. Pipes are insulated with fiberglass straight run insulation. The shelters and storage shed are not heated or insulated.

Asbestos Findings

Asbestos finding are presented below on a building by building basis.

East Bound Hysham Rest Area Building & Shelters

A total of fourteen (14) building materials were identified at this rest area. Of the identified

materials, two of the materials were considered non-suspect for asbestos. These materials included the plastic elbows and the fiberglass straight run pipe insulation.

The remaining 12 materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

For additional information refer to Table 1A and 2A and the attached laboratory report.

West Bound Hysham Rest Area Building & Shelters

A total of fourteen (14) building materials were identified at this rest area. Of the identified materials, two of the materials were considered non-suspect for asbestos. These materials included the plastic elbows and the fiberglass straight run pipe insulation.

The remaining 12 materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

For additional information refer to Table 1B and 2B and the attached laboratory report.

Tan Storage Shed at West Bound Rest Area

A total of 3 building materials were identified in this structure.

The three materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

For additional information refer to Table 1C and 2C and the attached laboratory report.

Green Storage Shed at West Bound Rest Area

A total of 4 building materials were identified in this structure.

The four materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

For additional information refer to Table 1D and 2D and the attached laboratory report.

Lead-Based Paint Findings

This inspection focused on identifying general painted building components on the interior and exterior of the buildings and performing testing of these components in various locations throughout each rest area.

East Bound Rest Area Building & Shelters

Twenty-four (24) painted building components were identified on the interior and exterior of the building and shelters. Lead paint was detected on one of the painted building components tested. This component is the yellow parking curbs.

The painted component was peeling at the time of the inspection.

West Bound Rest Area Building & Shelters

Twenty-five (25) painted building components were identified on the interior and exterior of the building and shelters. Lead paint was detected on one of the painted building components tested. This component is the yellow parking curbs.

The painted component was peeling at the time of the inspection.

Tan Storage Shed at West Bound Rest Area

Five (5) painted building components were identified on the interior and exterior of the building. Lead paint was not detected on any of the painted building components tested.

Green Storage Shed at West Bound Rest Area

Five (5) painted building components were identified on the interior and exterior of the building. Lead paint was not detected on any of the painted building components tested.

1.0 INTRODUCTION

Comprehensive asbestos and lead-based paint surveys of the Hysham Rest Area, located five miles southwest of Hysham on I-90 East in rural Montana were performed by Northern Industrial Hygiene, Inc. (Northern) on March 17, 2015.

The purpose of the asbestos survey was to identify friable and nonfriable suspect asbestos-containing building materials (ACBM).

The scope of the asbestos inspection included the following activities:

- Surveying, identifying, assessing the material's condition and sampling suspect friable and nonfriable ACBM; and
- Documenting locations of identified asbestos materials on drawings.

The intent of the lead-based paint survey was to assess the total lead content of paint in place at the facility and to provide recommendations for management of identified lead-based paint. The lead survey included the assessment of accessible, suspect painted building components on the interior and exterior of the facility. The purpose of this survey was not to identify all potentially lead-containing articles at the site but to focus on lead-based paint.

The scope of the lead-based paint inspection included the following activities:

- Performing a lead-based paint survey of all painted building components at the facility utilizing an X-ray fluorescence (XRF) meter;
- Assessing the condition of each painted building component.

At the completion of the inspections, prepare this comprehensive report documenting the sampling procedures and results of the asbestos and lead-based paint surveys and provide recommendations for management of the identified asbestos and lead painted materials.

Asbestos Overview

Asbestos is a trade name for a group of fibrous naturally occurring minerals that were used widely in building materials because of its ability to bind, resist chemicals, insulate, and fireproof. Exposure to elevated levels of asbestos fibers has been documented to cause a variety of diseases including asbestosis and cancer. Consequently, the application, removal, and disposal of asbestos-containing materials are regulated by several agencies.

Asbestos in most building materials poses little threat to human health as long as the asbestos fibers are securely bound within the building material. However, as the materials deteriorate because of time or exposure, or are disturbed because of human or other activities, the potential increases for the fibers to become airborne. When this occurs, the risk to human health increases significantly when the fibers are inhaled.

One definition for asbestos-containing building materials (ACBM), found in Environmental Protection Agency (EPA) regulations, (40 CFR, Part 763 - Asbestos Model Accreditation Plan and Section 202, Toxic Substance Control Act) is as follows:

- Friable asbestos-containing material containing more than one percent asbestos, which has been applied on ceilings, walls, structural members, piping, duct work, or any other part of a building, which when dry, may be crumbled, pulverized, or reduced to powder by hand pressure. The term includes non-friable asbestos-containing materials after it becomes damaged, by any means, such that when dry, it may be crumbled, pulverized, or reduced to powder by hand-pressure. This definition also includes flooring materials.

Another definition, found in Occupational Safety and Health Administration (OSHA) regulations, (29 CFR Parts 1910 and 1926) is slightly different as follows:

- Asbestos-containing materials are defined as being any material that contains more than one percent asbestos and also defines certain high-risk materials, which are presumed to contain asbestos, as Presumed Asbestos-containing Materials (PACM). The PACM designation applies to thermal system insulation, sprayed on or troweled on surfacing material and debris where such material is present. The PACM terminology was added to ensure compliance with the hazard communication provisions of the laws and specifically for buildings constructed prior to 1980.

Lead-Based Paint Overview

Lead is found in the paint on the inside and outside of many buildings. Most buildings constructed prior to World War II had lead-based paint applied to the interior or exterior surfaces. Some paints introduced up until 1977 contained some level of lead. Regulations enforced by the Consumer Product Safety Commission banned the use of all but small amounts of lead in paints in 1978. However, manufacturers are still allowed to produce paints containing up to 600 parts per million lead.

Lead-based paint is a concern as a source of direct exposure to lead through ingestion of paint chips and as a contributor to lead in interior dust and exterior soil. Regulatory agencies that have addressed lead-based paint include: the Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), Department of Health and Urban Development (HUD), and the Consumer Product Safety Commission (CPSC). A review of these regulations is presented in Appendix C.

If the paint which contains lead is in poor or damaged condition, persons working or living in the area can be exposed to small paint chips or lead-containing dust. Exposure can also result from construction, demolition, repair and refinish (sanding) operations or from the torch cutting or burning of painted materials.

Exposure to the lead can also occur as a result of hobbies or sports. Individuals who work with lead while making stained glass or while melting lead to make sinkers or bullets, or individuals who reload ammunition are all exposed to varying levels of lead.

2.0 INSPECTION PROCEDURES

Asbestos

The asbestos survey was performed using the applicable portions of the currently recognized standard protocol developed for schools under AHERA, as promulgated in Title 40, Code of Federal Regulations (40 CFR), Part 763 and as amended in the Federal Register and State of Montana Regulations. Since the primary concern for this investigation was to identify potential asbestos hazards in the entire building, Northern representatives visually inspected existing conditions considering each construction, addition, or renovation dates as separate, unique buildings.

Asbestos Inspection and Sampling

The inspection was conducted by our accredited inspectors, and consisted of a detailed visual survey of surfacing materials, thermal system insulation, and miscellaneous materials throughout the buildings. Suspect ACBM was then grouped into homogeneous materials and sampling plans were developed. Components of the inspection included:

- Identification of homogeneous suspect materials on a room-by-room basis. Areas from which samples were to be obtained were also identified during this task.

- Collection and analysis of bulk samples to confirm whether or not the suspect materials contain asbestos.

- An assessment of known or assumed ACBMs, generally classifying the materials using categories defined in the National Emission Standards of Hazardous Air Pollutants (NESHAP) regulations.

- Homogeneous suspect ACBMs were, for the purposes of this study and as outlined in the AHERA sampling protocol, placed into the following material type categories: thermal system insulation (TSI), surfacing materials and miscellaneous. AHERA sampling protocol specifies sampling procedures for each material type.

Sample locations for this survey were chosen in a non-random fashion, with emphasis placed on obtaining samples of each type of accessible, suspect material and minimizing damage to the material being sampled. Samples were collected by carefully removing small portions of the suspect material in a non-abrasive manner. When possible, samples from existing damaged areas or loose pieces of material were collected. Immediately after collection, samples were placed in pre-labeled plastic containers. Containers with samples were then placed in a large resealable plastic bag for

transportation to the laboratory. Samples were obtained by using techniques such as wet slicing, wet boring or similar methods designed to limit contamination of the area during sampling. The sampled area was sealed using patching compounds, duct tape, or spray encapsulants as appropriate to the material being sampled.

Laboratory Analysis of Bulk Asbestos Samples

Bulk samples obtained during the inspection were assigned bulk sample numbers and entered on sample summary/chain-of-custody forms. The samples were transported to the laboratory by overnight courier under standard chain-of-custody procedures. The analysis was performed in accordance with EPA Method 600/R-93/116, which employs polarized light microscopic techniques with dispersion staining for identification of mineral forms of asbestos. The quantification of asbestos in the sample is intended to be an estimate only and the limit of detection for this method is approximately 1% by volume. Sample laboratory analysis results are presented in Table 1.

Lead-Based Paint

Testing of the painted surfaces was substantially performed by the primary recommended method for measuring the lead level in paint that is with a portable X-ray fluorescence instrument manufactured for paint analysis. Portable XRF instruments expose the painted surface to X-rays that causes lead to fluoresce with a characteristic frequency. The intensity of this fluorescence is measured by the instrument's detector and is then converted into a number that represents the amount of lead in the paint per unit area (milligrams per square centimeter). The XRF instrument has the capability to analyze the lead content of multiple layers of paint at the same time. Laboratory analysis of paint-chip samples is recommended for components that cannot be tested using XRF instruments or to confirm inconclusive XRF results. Northern uses the XRF instrument manufactured by NITON Corporation. The machine is calibrated prior to, following and periodically during each day's field-testing. All field data is stored electronically by the instrument for direct transfer to computer and is also recorded on field forms.

For labeling and definition purposes in this report, the term lead-based paint means paint or other surface coatings that contain lead equal to or greater than 1.0 mg/cm^2 as measured using an XRF. This definition is utilized by the Department of Housing and Urban Development (HUD) and does not specifically apply to exposure concerns under the Occupational Safety and Health Administration (OSHA). Because OSHA does not recognize a threshold of lead content in paint for personnel exposure concerns, the definition of lead-based paint in this report should be used only to discriminate paint with relatively high lead content from paint with relatively low lead content.

Quality Assurance and Quality Control

Quality Assurance and quality control (QA/QC) measures adopted by Northern involved field and office components. Key parameters are summarized below:

Field QA/QC

- Review inspection forms for completeness;
- Check Homogeneous Materials Listing for sufficient number of collected samples;
- Verify locations of major mechanical components; and
- Perform field calibration of XRF prior to and following each usage.

Office QA/QC

- Review lab results for completeness;
- Ensure appropriate cross-referencing of results from forms for each given ACBM;
- Ensure drawings are updated as necessary following field QC;
- Verify approximate quantities of ACBM based on drawing review; and
- Review recorded field comments for meaning, incorporate as necessary into report.

3.0 FINDINGS

Survey results are presented in the following paragraphs. Additional information is in the Report Tables, the Figures Section, and the Appendices, located at the end of this report.

The Report Tables are outlined below. The Figures section presents the asbestos-containing material location diagrams and the lead-based paint location diagrams. Laboratory analysis reports are presented in Appendix A. Appendix B provides a summary of asbestos sample collection requirements and material category descriptions. Appendix C provides a summary of current lead-based paint regulations and Appendix D contains inspector certificates.

Table Set 1 presents a Summary of Materials Suspected to Contain Asbestos for each building, Table Set 2 presents a Summary of Confirmed or Assumed Asbestos-Containing Materials for each building (if applicable), Table Set 3 presents a Summary of Identified Lead-Based Paint Homogeneous Areas and Screening Results for each building, and Table Set 4 presents a Summary of XRF Instrument Readings for each building.

Building Summary

The rest areas (both east and west bound) construction date was unknown on the day of Northern's inspection. Each main building is approximately 621 square feet in size. There is two storage sheds located at the west bound rest area.

The two main rest area buildings are slab on grade, single story, concrete framed structures. The roofs are finished with metal.

The shelters are slab on grade structures with no exterior walls and have a metal roof finish.

The storage sheds are slab on grade, wood framed, single story structures with either a metal or rolled asphalt roofing.

Typical interior building materials finishes include concrete or quarry tile finished floors, concrete or wood finished walls, and gypsum board or wood finished ceilings.

Typical interior painted building components for each main building include wood and gypsum board ceilings, concrete walls, metal doors and related components and other miscellaneous building components. Painted exterior building components include the exterior side of the door, trim, soffit, metal roofs, wood column, wood beams, electric boxes, metal brackets for shelters, parking stripes, garbage cans, sign posts and other miscellaneous components.

Typical exterior painted building components for the storage shed include wood door, soffit, fascia, and wood walls.

Heat for the buildings is provided by a natural gas forced air furnace. Pipes are insulated with fiberglass straight run insulation. The shelters and storage shed are not heated or insulated.

Asbestos Findings

East Bound Hysham Rest Area Building & Shelters

A total of fourteen (14) building materials were identified at this rest area. Of the identified materials, two of the materials were considered non-suspect for asbestos. These materials included the plastic elbows and the fiberglass straight run pipe insulation.

The remaining 12 materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

West Bound Hysham Rest Area Building & Shelters

A total of fourteen (14) building materials were identified at this rest area. Of the identified materials, two of the materials were considered non-suspect for asbestos. These materials included the plastic elbows and the fiberglass straight run pipe insulation.

The remaining 12 materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

For additional information refer to Table 1B and 2B and the attached laboratory report.

Tan Storage Shed at West Bound Rest Area

A total of 3 building materials were identified in this structure.

The three materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

For additional information refer to Table 1C and 2C and the attached laboratory report.

Green Storage Shed at West Bound Rest Area

A total of 4 building materials were identified in this structure.

The four materials were sampled following sample collection requirements required by the state of Montana. None of the materials sampled contained asbestos.

For additional information refer to Table 1D and 2D and the attached laboratory report.

Lead-Based Paint Findings

This inspection focused on identifying general painted building components on the interior and exterior of the buildings that were constructed prior to 1978 and performing testing of these components in various locations throughout the facility.

East Bound Rest Area Building & Shelters

Twenty-four (24) painted building components were identified on the interior and exterior of the building and shelters. Lead paint was detected on one of the painted building components tested. This component is:

- L16 Yellow Parking Curbs

The painted component was in good condition at the time of the inspection.

West Bound Rest Area Building & Shelters

Twenty-five (25) painted building components were identified on the interior and exterior of the building and shelters. Lead paint was detected on one of the painted building components tested. This component is:

- L16 Yellow Parking Curbs

Tan Storage Shed at West Bound Rest Area

Five (5) painted building components were identified on the interior and exterior of the building. Lead paint was not detected on any of the painted building components tested.

Green Storage Shed at West Bound Rest Area

Five (5) painted building components were identified on the interior and exterior of the building. Lead paint was not detected on any of the painted building components tested.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Asbestos

No asbestos-containing materials were identified in any of the building materials in either the west or east bound rest area buildings or shelters.

Lead-Based Paint

Lead-based paint (LBP) was identified in 1 component in both the east and west bound rest areas. No other building components tested positive for lead-based paint. The confirmed building component included the yellow parking curbs.

All lead-based paint painted components observed was peeling at the time of this survey.

Recommendations

Asbestos

Northern offers no recommendations for additional work.

Lead-Based Paint

Exposure to lead dust or fumes can result from construction, demolition, repair and refinish (sanding) operations or from the torch cutting or burning of painted materials. The two lead-based paint painted components identified at the facility are in intact condition. While no immediate concerns are noted for these components, renovation work can cause an impact on their condition and therefore their hazard potential. If demolition of the parking curbs occur, Northern recommends that the curbs and paint be disposed of as general construction waste.

5.0 LIMITATIONS

This asbestos and lead-based paint assessment report was prepared based on information obtained during the survey, interpretation of the laboratory results of bulk samples of building materials collected during the survey and interpretation of XRF instrument readings obtained in the field. The conclusions of this report are professional opinions based solely upon visual site observations and interpretations of laboratory analyses and field data as described in our report.

This report has been prepared to provide information concerning the various types and estimated quantities of asbestos-containing materials and lead-based paint which may be present at this site. It includes only those materials that were visible and accessible at the time of our inspection. We did not remove any permanent building enclosures or disassemble any equipment to determine if any asbestos-containing materials were present. No samples were collected if the mechanical integrity of the material would be compromised. As a result, additional asbestos-containing materials may be present in inaccessible areas (e.g., between walls, beneath floors, etc.) of the buildings. Permanent building enclosures were not opened or disassembled for inspection and additional asbestos-containing materials may also be present in these areas.

In addition, the common practice of routinely repainting both the interiors and exteriors of buildings may conceal older, potentially lead-based paint, under the newer coatings.

This inspection and report is intended to identify and assess asbestos-containing materials and lead-based paint. It is not intended to be used for purposes of obtaining bids for removal from abatement contractors.

Our opinions are intended exclusively for use by Montana Department of Transportation. The scope of services performed by Northern may not be appropriate to satisfy the needs of other users, and any use or re-use of this document, or the findings presented herein, is at the sole risk of the user.

The opinions presented herein apply to the site conditions existing at the time of our investigation. Therefore, our opinions and recommendations may not apply to future conditions that may exist at the site that we have not had the opportunity to evaluate.

6.0 REFERENCES

Environmental Protection Agency (EPA)
National Emission Standard for Hazardous Air Pollutants, 40 CFR 61 Subpart M.

Environmental Protection Agency (EPA)
Asbestos Hazard Emergency Response Act (AHERA), 40 CFR 763.

Occupational Safety and Health Administration (OSHA)
Construction Industry Standard (1994), 29 CFR 1926.1101.

State of Montana Asbestos Regulations
Administrative Rules of Montana, Title 17, Chapter 74, Subchapter 3.
Montana Asbestos Work Practiced and Procedures Manual

U.S. Department of Housing and Urban Development (HUD),
Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995

Occupational Safety & Health Administration (OSHA),
Lead Exposure in Construction; Interim Final Rule, 29 CFR Part 1926.62 (May 4, 1993).

TABLES

Table Set 1 - Summary of Materials Suspected to Contain Asbestos

Table Set 2 - Summary of Confirmed or Assumed Asbestos-Containing Materials

Table Set 3 - Identified Lead-Based Paint Homogeneous Areas and Screening Results

Table Set 4 - Summary of XRF Instrument Readings

TABLE 1A
SUMMARY OF MATERIALS SUSPECTED TO CONTAIN ASBESTOS AND LABORATORY RESULTS
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Material Description	Material Locations	Laboratory Results
F6.1	4" x 4" brown quarry tile and grout	Men & women's restrooms	All layers - ND
M1.1	Black roofing felt under metal	Restroom building, shelter 1, shelter 2 & shelter 3	All layers - ND
M3.1	Gypsum board ceiling system	Janitor's room, men's restroom & women's restroom	All layers - ND
M8.1	Caulking on vertical seams on exterior of main restroom building	Exterior restroom building	ND
M8.2	Gray caulking on base of building and shelter walls	Restroom building, shelter 1, shelter 2 & shelter 3	ND
M8.3	White interior caulk around seams of wall and around sinks	Men & women's restrooms	ND
M16.1	Concrete slab	Janitor's room, men's restroom & women's restroom	ND
M16.2	Concrete walls	Restroom building, shelter 1, shelter 2 & shelter 3	ND
M16.3	Concrete sidewalk	Exterior sidewalks	ND
M16.4	Styrofoam insulation	Behind caulking on exterior walls of restroom building	ND
M16.5	Black undersink coating	Men & women's restrooms	ND
S1.1	Exterior "pebble looking" surfacing	Exterior of restroom building	ND

NS = Material Not Sampled

ND = No Asbestos Detected

Confirmed Asbestos-Containing Materials Shown in Bold Type

TABLE 1A
SUMMARY OF MATERIALS SUSPECTED TO CONTAIN ASBESTOS AND LABORATORY RESULTS
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Material Description	Material Locations	Laboratory Results
T2.1	Plastic elbows (not suspect)	Janitor's room	NS
T3.1	Fiberglass straight run pipe insulation (not suspect)	Janitor's room	NS

NS = Material Not Sampled

ND = No Asbestos Detected

Confirmed Asbestos-Containing Materials Shown in Bold Type

TABLE 1B
SUMMARY OF MATERIALS SUSPECTED TO CONTAIN ASBESTOS AND LABORATORY RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Material Description	Material Locations	Laboratory Results
F6.1	4" x 4" brown quarry tile and grout	Men & women's restrooms	All layers - ND
M1.1	Black roofing felt under metal	Restroom building, shelter 1, shelter 2 & shelter 3	All layers - ND
M3.1	Gypsum board ceiling system	Janitor's room, men's restroom & women's restroom	All layers - ND
M8.1	Caulk on vertical seams on exterior wall of building	Exterior restroom building	ND
M8.2	Gray caulk on base of building and shelter walls	Restroom building, shelter 1, shelter 2 & shelter 3	ND
M8.3	White interior caulk on seams of walls and around sinks	Men & women's restrooms	ND
M16.1	Concrete slab	Janitor's room, men's restroom & women's restroom	ND
M16.2	Concrete walls	Restroom building, shelter 1, shelter 2 & shelter 3	ND
M16.3	Concrete sidewalk	Exterior sidewalks	ND
M16.4	Styrofoam insulation	Behind caulking on exterior walls of restroom building	ND
M16.5	Black undersink coating	Men & women's restrooms	ND
S1.1	Exterior "pebble looking" surfacing on main building	Exterior of restroom building	ND

NS = Material Not Sampled

ND = No Asbestos Detected

Confirmed Asbestos-Containing Materials Shown in Bold Type

TABLE 1B
SUMMARY OF MATERIALS SUSPECTED TO CONTAIN ASBESTOS AND LABORATORY RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Material Description	Material Locations	Laboratory Results
T2.1	Plastic elbows (not suspect)	Janitor's room	NS
T3.1	Fiberglass straight run pipe insulation (not suspect)	Janitor's room	NS

NS = Material Not Sampled

ND = No Asbestos Detected

Confirmed Asbestos-Containing Materials Shown in Bold Type

TABLE 1C
SUMMARY OF MATERIALS SUSPECTED TO CONTAIN ASBESTOS AND LABORATORY RESULTS
West Bound Hysham Rest Area Tan Storage Shed
Hysham, Montana

Material Number	Material Description	Material Locations	Laboratory Results
M1.1	White asphalt rolled roofing	Exterior roof	All layers - ND
M1.2	Black roofing felt under M1.1	Exterior roof	All layers - ND
M16.1	Concrete slab	Floor of shed	All layers - ND

NS = Material Not Sampled

ND = No Asbestos Detected

Confirmed Asbestos-Containing Materials Shown in Bold Type

TABLE 1D
SUMMARY OF MATERIALS SUSPECTED TO CONTAIN ASBESTOS AND LABORATORY RESULTS
West Bound Hysham Rest Area Green Storage Shed
Hysham, Montana

Material Number	Material Description	Material Locations	Laboratory Results
M1.1	Black roofing felt under metal	Exterior roof	All layers - ND
M2.1	Black siding felt under metal siding	Exterior siding	All layers - ND
M8.1	Gray foam with yellow adhesive at end of metal roofing	Exterior roof west side	All layers - ND
M16.1	Concrete slab	Floor of shed	All layers - ND

NS = Material Not Sampled

ND = No Asbestos Detected

Confirmed Asbestos-Containing Materials Shown in Bold Type

TABLE 2A
SUMMARY OF CONFIRMED OR ASSUMED ASBESTOS-CONTAINING MATERIALS AND RECOMMENDED RESPONSE ACTION
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Material Description	NESHAP Category	Recommended Response Action
No Asbestos Detected			

Category I	Nonfriable ACM such as packings, gaskets, resilient floor covering, and asphalt roofing products.
Category II	All nonfriable ACM, excluding Category I materials.
RACM	Friable ACM; Category I material that has become friable; Category I material that will be subjected to sanding, grinding, cutting, or abrading; or Category II, material that has a high probability of becoming friable.

TABLE 2B
SUMMARY OF CONFIRMED OR ASSUMED ASBESTOS-CONTAINING MATERIALS AND RECOMMENDED RESPONSE ACTION
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Material Description	NESHAP Category	Recommended Response Action
No Asbestos Detected			

Category I	Nonfriable ACM such as packings, gaskets, resilient floor covering, and asphalt roofing products.
Category II	All nonfriable ACM, excluding Category I materials.
RACM	Friable ACM; Category I material that has become friable; Category I material that will be subjected to sanding, grinding, cutting, or abrading; or Category II, material that has a high probability of becoming friable.

TABLE 2C
SUMMARY OF CONFIRMED OR ASSUMED ASBESTOS-CONTAINING MATERIALS AND RECOMMENDED RESPONSE ACTION
West Bound Hysham Rest Area Tan Storage Shed
Hysham, Montana

Material Number	Material Description	NESHAP Category	Recommended Response Action
No Asbestos Detected			

Category I	Nonfriable ACM such as packings, gaskets, resilient floor covering, and asphalt roofing products.
Category II	All nonfriable ACM, excluding Category I materials.
RACM	Friable ACM; Category I material that has become friable; Category I material that will be subjected to sanding, grinding, cutting, or abrading; or Category II, material that has a high probability of becoming friable.

TABLE 2D
SUMMARY OF CONFIRMED OR ASSUMED ASBESTOS-CONTAINING MATERIALS AND RECOMMENDED RESPONSE ACTION
West Bound Hysham Rest Area Green Storage Shed
Hysham, Montana

Material Number	Material Description	NESHAP Category	Recommended Response Action
No Asbestos Detected			

Category I	Nonfriable ACM such as packings, gaskets, resilient floor covering, and asphalt roofing products.
Category II	All nonfriable ACM, excluding Category I materials.
RACM	Friable ACM; Category I material that has become friable; Category I material that will be subjected to sanding, grinding, cutting, or abrading; or Category II, material that has a high probability of becoming friable.

TABLE 3A
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L1	Wall	Concrete	Tan, White	Intact	Negative
L2	Stall wall	Concrete	Tan, White	Intact	Negative
L3	Stall door	Metal	Brown	Intact	Negative
L4	Metal column	Metal	Tan, Black/Gray	Intact	Negative
L5	Ceiling	Gypsum	Tan, White	Intact	Negative
L6	Trim	Wood	Tan, White	Intact	Negative
L7	Air diffuser	Metal	Tan	Intact	Negative
L8	Fascia	Wood	White, Black	Intact	Negative
L9	Parking lines	Asphalt	Yellow, White	Intact	Negative
L10	Door	Metal	Tan	Intact	Negative
L11	Door frame	Metal	Tan	Intact	Negative
L12	Beam	Gypsum	White	Intact	Negative
L13	Pipe	Metal	White	Intact	Negative
L14	Bench/table	Concrete	White	Intact	Negative
L15	Beam	Wood	Brown	Intact	Negative
L16	Curbs	Concrete	Yellow	Peeling	Positive
L17	Roof joist	Wood	White	Intact	Negative
L18	Roof deck	Wood	White	Intact	Negative
L19	Map frame	Wood	Green	Intact	Negative
L20	Signs	Wood	Red	Fair	Negative
L21	Downspout	Metal	Green	Intact	Negative
L22	Gutter	Metal	Green	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3A
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L23	Garbage can	Metal	Gray	Fair	Negative
L24	Garbage can holder	Wood	Gray	Fair	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

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IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
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Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L1	Wall	Concrete	Tan, White	Intact	Negative
L2	Stall wall	Concrete	Tan, White	Intact	Negative
L3	Stall door	Metal	Brown	Intact	Negative
L4	Metal column	Metal	Tan, Black/Gray	Intact	Negative
L5	Ceiling	Gypsum	Tan, White	Intact	Negative
L6	Trim	Wood	Tan, White	Intact	Negative
L7	Air diffuser	Metal	Tan	Intact	Negative
L8	Fascia	Wood	White, Black	Intact	Negative
L9	Parking lines	Asphalt	Yellow, White	Intact	Negative
L10	Door	Metal	Tan	Intact	Negative
L11	Door frame	Metal	Tan	Intact	Negative
L12	Beam	Gypsum	White	Intact	Negative
L13	Pipe	Metal	White	Intact	Negative
L14	Bench/table	Concrete	White	Intact	Negative
L15	Beam	Wood	Brown	Intact	Negative
L16	Curbs	Concrete	Yellow	Peeling	Positive
L17	Roof joist	Wood	White	Intact	Negative
L18	Roof deck	Wood	White	Intact	Negative
L19	Map frame	Wood	Green	Intact	Negative
L20	Signs	Wood	Red	Fair	Negative
L21	Downspout	Metal	Green	Intact	Negative
L22	Gutter	Metal	Green	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

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TABLE 3A
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L23	Garbage can	Metal	Gray	Fair	Negative
L24	Garbage can holder	Wood	Gray	Fair	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

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TABLE 3A
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L1	Wall	Concrete	Tan, White	Intact	Negative
L2	Stall wall	Concrete	Tan, White	Intact	Negative
L3	Stall door	Metal	Brown	Intact	Negative
L4	Metal column	Metal	Tan, Black/Gray	Intact	Negative
L5	Ceiling	Gypsum	Tan, White	Intact	Negative
L6	Trim	Wood	Tan, White	Intact	Negative
L7	Air diffuser	Metal	Tan	Intact	Negative
L8	Fascia	Wood	White, Black	Intact	Negative
L9	Parking lines	Asphalt	Yellow, White	Intact	Negative
L10	Door	Metal	Tan	Intact	Negative
L11	Door frame	Metal	Tan	Intact	Negative
L12	Beam	Gypsum	White	Intact	Negative
L13	Pipe	Metal	White	Intact	Negative
L14	Bench/table	Concrete	White	Intact	Negative
L15	Beam	Wood	Brown	Intact	Negative
L16	Curbs	Concrete	Yellow	Peeling	Positive
L17	Roof joist	Wood	White	Intact	Negative
L18	Roof deck	Wood	White	Intact	Negative
L19	Map frame	Wood	Green	Intact	Negative
L20	Signs	Wood	Red	Fair	Negative
L21	Downspout	Metal	Green	Intact	Negative
L22	Gutter	Metal	Green	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

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** Reference Table 4 for locations of confirmed materials.

TABLE 3A
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L23	Garbage can	Metal	Gray	Fair	Negative
L24	Garbage can holder	Wood	Gray	Fair	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3B
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L1	Wall	Concrete	Tan, White	Intact/Peeling	Negative
L2	Stall wall	Concrete	Tan, White	Intact	Negative
L3	Stall door	Metal	Brown	Intact	Negative
L4	Metal column	Metal	Tan, Black/Gray	Intact	Negative
L5	Ceiling	Gypsum	Tan, White	Intact	Negative
L6	Trim	Wood	Tan, White	Intact	Negative
L7	Air diffuser	Metal	Tan	Intact	Negative
L8	Fascia	Wood	White, Black	Intact	Negative
L9	Parking lines	Asphalt	Yellow, White	Poor	Negative
L10	Door	Metal	Tan	Intact	Negative
L11	Door frame	Metal	Tan	Intact	Negative
L12	Beam	Gypsum	White	Intact	Negative
L13	Pipe	Metal	White	Intact	Negative
L14	Bench/table	Concrete	White	Intact	Negative
L15	Beam	Wood	Brown	Intact	Negative
L16	Curbs	Concrete	Yellow	Peeling	Positive/Negative
L17	Roof joist	Wood	White	Intact	Negative
L18	Roof deck	Wood	White	Intact	Negative
L19	Map frame	Wood	Green	Intact	Negative
L20	Signs	Wood	Red	Intact	Negative
L21	Downspout	Metal	Green	Intact	Negative
L22	Gutter	Metal	Green	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

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** Reference Table 4 for locations of confirmed materials.

TABLE 3B
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L23	Garbage can	Metal	Gray	Intact	Negative
L24	Electrical box	Metal	Gray	Intact	Negative
L25	Shelf	Wood	White	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

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IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L1	Wall	Concrete	Tan, White	Intact/Peeling	Negative
L2	Stall wall	Concrete	Tan, White	Intact	Negative
L3	Stall door	Metal	Brown	Intact	Negative
L4	Metal column	Metal	Tan, Black/Gray	Intact	Negative
L5	Ceiling	Gypsum	Tan, White	Intact	Negative
L6	Trim	Wood	Tan, White	Intact	Negative
L7	Air diffuser	Metal	Tan	Intact	Negative
L8	Fascia	Wood	White, Black	Intact	Negative
L9	Parking lines	Asphalt	Yellow, White	Poor	Negative
L10	Door	Metal	Tan	Intact	Negative
L11	Door frame	Metal	Tan	Intact	Negative
L12	Beam	Gypsum	White	Intact	Negative
L13	Pipe	Metal	White	Intact	Negative
L14	Bench/table	Concrete	White	Intact	Negative
L15	Beam	Wood	Brown	Intact	Negative
L16	Curbs	Concrete	Yellow	Peeling	Positive/Negative
L17	Roof joist	Wood	White	Intact	Negative
L18	Roof deck	Wood	White	Intact	Negative
L19	Map frame	Wood	Green	Intact	Negative
L20	Signs	Wood	Red	Intact	Negative
L21	Downspout	Metal	Green	Intact	Negative
L22	Gutter	Metal	Green	Intact	Negative

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TABLE 3B
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L23	Garbage can	Metal	Gray	Intact	Negative
L24	Electrical box	Metal	Gray	Intact	Negative
L25	Shelf	Wood	White	Intact	Negative

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TABLE 3B
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L1	Wall	Concrete	Tan, White	Intact/Peeling	Negative
L2	Stall wall	Concrete	Tan, White	Intact	Negative
L3	Stall door	Metal	Brown	Intact	Negative
L4	Metal column	Metal	Tan, Black/Gray	Intact	Negative
L5	Ceiling	Gypsum	Tan, White	Intact	Negative
L6	Trim	Wood	Tan, White	Intact	Negative
L7	Air diffuser	Metal	Tan	Intact	Negative
L8	Fascia	Wood	White, Black	Intact	Negative
L9	Parking lines	Asphalt	Yellow, White	Poor	Negative
L10	Door	Metal	Tan	Intact	Negative
L11	Door frame	Metal	Tan	Intact	Negative
L12	Beam	Gypsum	White	Intact	Negative
L13	Pipe	Metal	White	Intact	Negative
L14	Bench/table	Concrete	White	Intact	Negative
L15	Beam	Wood	Brown	Intact	Negative
L16	Curbs	Concrete	Yellow	Peeling	Positive/Negative
L17	Roof joist	Wood	White	Intact	Negative
L18	Roof deck	Wood	White	Intact	Negative
L19	Map frame	Wood	Green	Intact	Negative
L20	Signs	Wood	Red	Intact	Negative
L21	Downspout	Metal	Green	Intact	Negative
L22	Gutter	Metal	Green	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3B
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L23	Garbage can	Metal	Gray	Intact	Negative
L24	Electrical box	Metal	Gray	Intact	Negative
L25	Shelf	Wood	White	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3C
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Tan Storage Shed
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L18	Roof deck	Wood	Tan	Intact	Negative
L26	Walls	Metal	Green	Intact	Negative
L27	Fascia	Metal	Tan	Intact	Negative
L28	Garage Door	Metal	White	Intact	Negative
L29	Roof	Metal	Tan	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3C
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Tan Storage Shed
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L18	Roof deck	Wood	Tan	Intact	Negative
L26	Walls	Metal	Green	Intact	Negative
L27	Fascia	Metal	Tan	Intact	Negative
L28	Garage Door	Metal	White	Intact	Negative
L29	Roof	Metal	Tan	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3C
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Tan Storage Shed
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L18	Roof deck	Wood	Tan	Intact	Negative
L26	Walls	Metal	Green	Intact	Negative
L27	Fascia	Metal	Tan	Intact	Negative
L28	Garage Door	Metal	White	Intact	Negative
L29	Roof	Metal	Tan	Intact	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3D
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Green Storage Shed
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L30	Siding	Wood	Tan	Intact/Peeling	Negative
L31	Door	Wood	Tan, Red	Intact	Negative
L32	Soffit	Wood	Tan	Intact/Peeling	Negative
L33	Fascia	Wood	Black	Peeling	Negative
L34	Well cover	Metal	Green, Red	Poor	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3D
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Green Storage Shed
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L30	Siding	Wood	Tan	Intact/Peeling	Negative
L31	Door	Wood	Tan, Red	Intact	Negative
L32	Soffit	Wood	Tan	Intact/Peeling	Negative
L33	Fascia	Wood	Black	Peeling	Negative
L34	Well cover	Metal	Green, Red	Poor	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 3D
IDENTIFIED PAINTED BUILDING COMPONENTS and XRF SCREENING RESULTS
West Bound Hysham Rest Area Green Storage Shed
Hysham, Montana

Material Number	Building Component	Substrate	Color (at time of survey)	Material Condition	Screening Result*
L30	Siding	Wood	Tan	Intact/Peeling	Negative
L31	Door	Wood	Tan, Red	Intact	Negative
L32	Soffit	Wood	Tan	Intact/Peeling	Negative
L33	Fascia	Wood	Black	Peeling	Negative
L34	Well cover	Metal	Green, Red	Poor	Negative

* Pos = Lead-based paint - equal to or greater than 1.0 mg/cm2 measured using XRF screening.

* Neg = Nonlead-based paint - less than 1.0 mg/cm2 measured using XRF screening.

** Reference Table 4 for locations of confirmed materials.

TABLE 4A
Results of XRF Instrument Paint Testing
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
0	0	0	0	0	1	0	0	0	0	0	0	1.63	0
0	0	0	0	0	2	0	0	0	0	0	0	1.6	0
HYSHAM EAST	MAO	0	0	0	3	0	CALIBRATE	0	0	0	1.12	0.3	Negative
HYSHAM EAST	MAO	0	0	0	4	0	CALIBRATE	0	0	0	1.01	0.27	Negative
HYSHAM EAST	MAO	0	0	0	5	0	CALIBRATE	0	0	0	1.48	0.4	Negative
HYSHAM EAST	MAO	0	0	0	6	0	CALIBRATE	0	0	0	1.15	1.1	Positive
HYSHAM EAST	MAO	0	0	0	7	0	CALIBRATE	0	0	0	1.12	1.1	Null
HYSHAM EAST	MAO	0	0	0	8	0	CALIBRATE	0	0	0	1.09	1.1	Positive
HYSHAM EAST	MAO	0	0	0	9	0	CALIBRATE	0	0	0	1.19	3.4	Positive
HYSHAM EAST	MAO	0	0	0	10	0	CALIBRATE	0	0	0	1.33	3.9	Positive
HYSHAM EAST	MAO	0	0	0	11	0	CALIBRATE	0	0	0	1.19	3.4	Positive
HYSHAM EAST	MAO	1ST	MEN	D	12	L1	WALL	CONCRETE	TAN	INTACT	1.67	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	A	13	L1	WALL	CONCRETE	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	B	14	L1	WALL	CONCRETE	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	D	15	L1	WALL	CONCRETE	TAN	INTACT	2.83	< LOD	Null
HYSHAM EAST	MAO	1ST	MEN	A	16	L2	STALL WALL	CONCRETE	TAN	INTACT	4.85	< LOD	Null
HYSHAM EAST	MAO	1ST	MEN	D	17	L2	STALL WALL	CONCRETE	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	D	18	L3	STALL DOOR	CONCRETE	BROWN	INTACT	3.18	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	D	19	L3	STALL DOOR	CONCRETE	BROWN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	D	20	L4	COLUMN	METAL	TAN	INTACT	1.7	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	D	21	L4	COLUMN	METAL	TAN	INTACT	4.03	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	0	22	L5	CEILING	DRYWALL	TAN	INTACT	2.94	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	B	23	L56	TRIM	WOOD	TAN	INTACT	10	< LOD	Null
HYSHAM EAST	MAO	1ST	MEN	B	24	L56	TRIM	WOOD	TAN	INTACT	1	< LOD	Null
HYSHAM EAST	MAO	1ST	MEN	B	25	L56	TRIM	WOOD	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	A	26	L7	DIFFUSER	METAL	TAN	INTACT	1	< LOD	Null
HYSHAM EAST	MAO	1ST	MEN	A	27	L7	DIFFUSER	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	A	28	L10	DOOR	METAL	TAN	INTACT	1.46	< LOD	Negative
HYSHAM EAST	MAO	1ST	MEN	A	29	L11	DOOR FAME	METAL	TAN	INTACT	1	< LOD	Negative

TABLE 4A
Results of XRF Instrument Paint Testing
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
HYSHAM EAST	MAO	1ST	WOMEN	A	30	L11	DOOR FAME	METAL	TAN	INTACT	1.38	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	A	31	L10	DOOR	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	A	32	L7	DIFFUSER	METAL	TAN	INTACT	3.7	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	D	33	L7	COLUMN	METAL	TAN	INTACT	2.23	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	D	34	L7s3	STALL DOOR	METAL	BROWN	INTACT	1	< LOD	Null
HYSHAM EAST	MAO	1ST	WOMEN	D	35	L7s3	STALL DOOR	METAL	BROWN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	A	36	L2	STALL WALL	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	A	37	L1	WALL	METAL	TAN	INTACT	1.19	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	C	38	L1	WALL	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	0	39	L5	CEILING	DRYWALL	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	WOMEN	B	40	L6	TRIM	WOOD	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MECH	D	41	L10	DOOR	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MECH	D	42	L11	DOOR FRAME	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MECH	B	43	L1	WALL	CONCRETE	WHITE	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MECH	B	44	L1	WALL	CONCRETE	RED	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MECH	D	45	L1	WALL	CONCRETE	RED	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	MECH	A	46	L12	BEAM	DRYWALL	WHITE	INTACT	1.2	< LOD	Negative
HYSHAM EAST	MAO	1ST	MECH	A	47	L13	PIPE	METAL	WHITE	INTACT	1.16	< LOD	Null
HYSHAM EAST	MAO	1ST	MECH	0	48	L4	CEILING	DRYWALL	WHITE	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	49	L15	BEAM	WOOD	BROWN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	D	50	L15	BEAM	WOOD	BROWN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	51	L17	ROOF JOIST	WOOD	WHITE	INTACT	2.75	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	52	L18	ROOF DECK	WOOD	WHITE	INTACT	1.52	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	53	L4	COLUMN	METAL	BLACK	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	54	L21	DWN SPOUT	METAL	GREEN	INTACT	1.33	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	55	L22	GUTTER	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	56	L8	FASCIA	WOOD	BROWN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	57	L6	TRIM	WOOD	BROWN	INTACT	1	< LOD	Null
HYSHAM EAST	MAO	1ST	EXT	A	58	L6	TRIM	WOOD	BROWN	INTACT	1	< LOD	Negative

TABLE 4A
Results of XRF Instrument Paint Testing
East Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
HYSHAM EAST	MAO	1ST	EXT	A	59	L19	MAP FRAME	WOOD	GREEN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	60	L20	SIGN	WOOD	RED	FAIR	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	A	61	L23	GARBAGE CAN	METAL	GRAY	FAIR	2.91	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	D	62	L24	CAN BOX	WOOD	GRAY	FAIR	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	PICNIC	0	63	L14	BENCH	CONCRETE	WHITE	INTACT	1.21	< LOD	Null
HYSHAM EAST	MAO	1ST	PICNIC	0	64	L14	BENCH	CONCRETE	WHITE	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	PICNIC	C	65	L1	WALL	CONCRETE	TAN	INTACT	1.66	< LOD	Null
HYSHAM EAST	MAO	1ST	PICNIC	D	66	L5	BEAM	WOOD	BROWN	PEELING	1	< LOD	Null
HYSHAM EAST	MAO	1ST	PICNIC	D	67	L5	BEAM	WOOD	BROWN	PEELING	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	PICNIC	0	68	L17	ROOF JOIST	WOOD	WHITE	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	PICNIC	0	69	L18	ROOF DECK	WOOD	WHITE	INTACT	1	< LOD	Null
HYSHAM EAST	MAO	1ST	PICNIC	0	70	L18	ROOF DECK	WOOD	WHITE	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	PICNIC	D	71	L8	FASCIA	WOOD	BROWN	INTACT	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	PICNIC	A	72	L4	COLUMN	METAL	BLACK	FAIR	1.43	< LOD	Negative
HYSHAM EAST	MAO	1ST	PICNIC	A	73	L4	COLUMN	METAL	GRAY	FAIR	1	< LOD	Null
HYSHAM EAST	MAO	1ST	PICNIC	A	74	L4	COLUMN	METAL	GRAY	FAIR	1.52	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	0	75	L16	CURB	CONCRETE	YELLOW	PEELING	10	< LOD	Positive
HYSHAM EAST	MAO	1ST	EXT	0	76	L9	PARK STRIPE	CONCRETE	YELLOW	PEELING	1	< LOD	Null
HYSHAM EAST	MAO	1ST	EXT	0	77	L9	PARK STRIPE	CONCRETE	YELLOW	PEELING	1	< LOD	Negative
HYSHAM EAST	MAO	1ST	EXT	0	78	L9	PARK STRIPE	ASPHALT	WHITE	PEELING	2.54	< LOD	Negative

TABLE 4B
Results of XRF Instrument Paint Testing
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
HYSHAM WEST	MAO	1ST	MEN	A	79	L1	WALL	CONCRETE	TAN	INTACT	1.55	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	A	80	L2	STALL WALL	CONCRETE	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	D	81	L3	STALL DOOR	METAL	BLACK	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	B	82	L4	COLUMN	METAL	TAN	INTACT	4.72	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	0	83	L4c5	CEILING	DRYWALL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	D	84	L6	TRIM	WOOD	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	A	85	L7	DIFFUSER	METAL	TAN	INTACT	4.29	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	A	86	L10	DOOR	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MEN	A	87	L11	DOOR FRAME	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	A	88	L11	DOOR FRAME	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	A	89	L10	DOOR	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	A	90	L7	DIFFUSER	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	B	91	L4	COLUMN	METAL	TAN	INTACT	1.91	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	B	92	L3	STALL DOOR	METAL	BLACK	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	C	93	L2	STALL WALL	METAL	TAN	INTACT	1.3	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	C	94	L1	WALL	METAL	TAN	INTACT	1	< LOD	Null
HYSHAM WEST	MAO	1ST	WOMEN	B	95	L1	WALL	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	0	96	L5	CEILING	DRYWALL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	WOMEN	B	97	L6	TRIM	WOOD	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MECH	0	98	L5	CEILING	DRYWALL	TAN	INTACT	1	< LOD	Null
HYSHAM WEST	MAO	1ST	MECH	0	99	L5	CEILING	DRYWALL	TAN	INTACT	10	< LOD	Null
HYSHAM WEST	MAO	1ST	MECH	0	100	L5	CEILING	DRYWALL	WHITE	INTACT	1	< LOD	Null
HYSHAM WEST	MAO	1ST	MECH	0	101	L5	CEILING	DRYWALL	WHITE	INTACT	2.81	< LOD	Negative
HYSHAM WEST	MAO	1ST	MECH	B	102	L12	BEAM	DRYWALL	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MECH	A	103	L13	PIPE	DRYWALL	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MECH	A	104	L1	WALL	CONCRETE	WHITE	INTACT	3.99	< LOD	Negative
HYSHAM WEST	MAO	1ST	MECH	D	105	L1	WALL	CONCRETE	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MECH	B	106	L25	SHELF	WOOD	WHITE	INTACT	1	< LOD	Negative

TABLE 4B
Results of XRF Instrument Paint Testing
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
HYSHAM WEST	MAO	1ST	MECH	D	107	L10	DOOR	METAL	TAN	INTACT	1	< LOD	Null
HYSHAM WEST	MAO	1ST	MECH	D	108	L10	DOOR	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	MECH	D	109	L11	DOOR FRAME	METAL	TAN	INTACT	1.18	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	A	110	L6	TRIM	METAL	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	111	L17	ROOF JOIST	METAL	WHITE	INTACT	4.75	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	112	L18	ROOF DECK	METAL	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	D	113	L15	BEAM	METAL	BLACK	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	D	114	L8	FASCIA	METAL	BLACK	INTACT	1.62	< LOD	Null
HYSHAM WEST	MAO	1ST	EXT	D	115	L8	FASCIA	METAL	BLACK	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	D	116	L22	GUTTER	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	A	117	L21	DWN SPOUT	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	A	118	L4	COLUMN	METAL	BLACK	INTACT	1.51	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	A	119	L19	MAP FRAME	WOOD	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	A	120	L20	SIGN	WOOD	RED	INTACT	3.71	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	A	121	L23	GARBAGE CAN	METAL	GRAY	INTACT	2.71	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	A	122	L24	GARBAGE BOX	WOOD	GRAY	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	123	L9	PARK STRIPE	ASPHALT	YELLOW	POOR	1.62	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	124	L16	CURB	CONCRETE	YELLOW	PEELING	1	< LOD	Positive
HYSHAM WEST	MAO	1ST	EXT	0	125	L16	CURB	CONCRETE	YELLOW	PEELING	1	< LOD	Null
HYSHAM WEST	MAO	1ST	EXT	0	126	L16	CURB	CONCRETE	YELLOW	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	127	L16	CURB	CONCRETE	YELLOW	PEELING	10	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	128	L16	CURB	CONCRETE	YELLOW	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	129	L16	CURB	CONCRETE	YELLOW	PEELING	6.92	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	130	L16	CURB	CONCRETE	YELLOW	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	EXT	0	131	L16	CURB	CONCRETE	YELLOW	PEELING	9.03	< LOD	Null
HYSHAM WEST	MAO	1ST	EXT	0	132	L16	CURB	CONCRETE	YELLOW	PEELING	1.47	< LOD	Null
HYSHAM WEST	MAO	1ST	EXT	0	133	L16	CURB	CONCRETE	YELLOW	PEELING	1.06	2.1	Positive
HYSHAM WEST	MAO	1ST	SHELTER	0	134	L14	BENCH	CONCRETE	WHITE	INTACT	1	< LOD	Null

TABLE 4B
Results of XRF Instrument Paint Testing
West Bound Hysham Rest Area Building and Shelters
Hysham, Montana

Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
HYSHAM WEST	MAO	1ST	SHELTER,	0	135	L14	BENCH	CONCRETE	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	0	136	L14	BENCH	CONCRETE	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	A	137	L1	WALL	CONCRETE	TAN	INTACT	1.62	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	A	138	L4	COLUMN	METAL	BLACK	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	D	139	L1	WALL	CONCRETE	TAN	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	D	140	L15	BEAM	WOOD	BLACK	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	D	141	L8	FASCIA	WOOD	BLACK	INTACT	3.25	< LOD	Null
HYSHAM WEST	MAO	1ST	SHELTER,	D	142	L8	FASCIA	WOOD	BLACK	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	0	143	L17	ROOF JOIST	WOOD	WHITE	INTACT	1.04	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	0	144	L18	ROOF DECK	WOOD	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	A	145	L26	WINDOW	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	A	146	L26	WINDOW	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	B	147	L26	WALL	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	SHELTER,	C	148	L26	WALL	METAL	GREEN	INTACT	1	< LOD	Negative

TABLE 4C
Results of XRF Instrument Paint Testing
West Bound Hysham Rest Area Green Storage Shed
Hysham, Montana

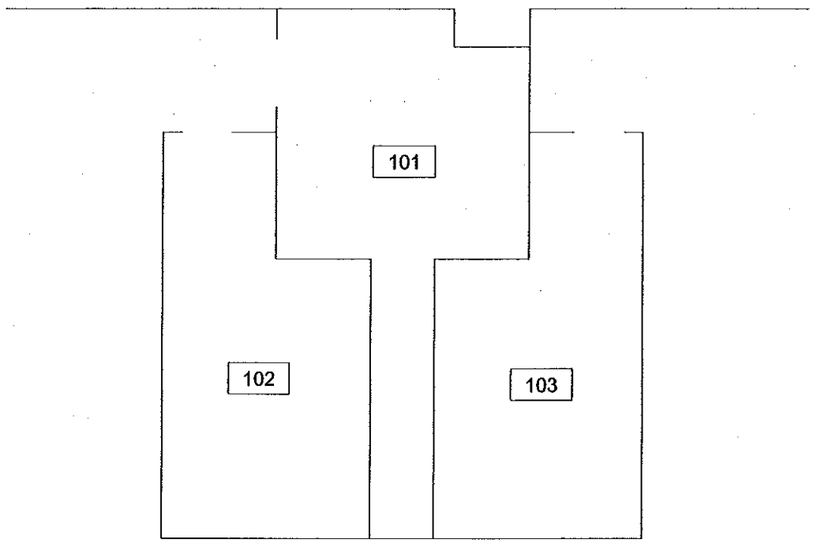
Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
HYSHAM WEST	MAO	1ST	GRN STR BLDG	D	149	L26	WALL	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	GRN STR BLDG	A	150	L27	FASCIA	METAL	TAN	INTACT	1	< LOD	Null
HYSHAM WEST	MAO	1ST	GRN STR BLDG	A	151	L27	FASCIA	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	GRN STR BLDG	B	152	L27	FASCIA	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	GRN STR BLDG	0	153	L18	ROOF DECK	WOOD	TAN	INTACT	7.22	< LOD	Negative
HYSHAM WEST	MAO	1ST	GRN STR BLDG	A	154	L28	GARG DOOR	METAL	WHITE	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	GRN STR BLDG	0	155	L29	ROOF	METAL	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	GRN STR BLDG	0	156	L29	ROOF	METAL	TAN	INTACT	1	< LOD	Null

TABLE 4D
Results of XRF Instrument Paint Testing
West Bound Hysham Rest Area Tan Storage Shed
Hysham, Montana

Site	Insp.	Floor	Room	Side	Read. No	Mat. No.	Component	Substrate	Color	Cond.	Depth Index	PbC	Result
HYSHAM WEST	MAO	1ST	TAN STR BLDG	A	157	L30	SIDING	WOOD	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	B	158	L30	SIDING	WOOD	TAN	INTACT	3.5	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	C	159	L30	SIDING	WOOD	TAN	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	D	160	L30	SIDING	WOOD	TAN	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	A	161	L31	DOOR	WOOD	TAN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	A	162	L31	DOOR	WOOD	RED	INTACT	1.63	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	B	163	L32	SOFFIT	WOOD	TAN	INTACT	5.01	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	D	164	L32	SOFFIT	WOOD	TAN	PEELING	1.66	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	C	165	L33	FASCIA	WOOD	BLACK	PEELING	1	< LOD	Null
HYSHAM WEST	MAO	1ST	TAN STR BLDG	C	166	L33	FASCIA	WOOD	BLACK	PEELING	1.56	< LOD	Null
HYSHAM WEST	MAO	1ST	TAN STR BLDG	C	167	L33	FASCIA	WOOD	BLACK	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	A	168	L33	FASCIA	WOOD	BLACK	PEELING	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	A	169	L33	FASCIA	WOOD	BLACK	PEELING	1.41	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	B	170	L34	WELL COVER	METAL	RED	POOR	1.02	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	B	171	L34	WELL COVER	METAL	GREEN	POOR	1	0.3	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	0	172	L29	ROOF	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	1ST	TAN STR BLDG	0	173	L29	ROOF	METAL	GREEN	INTACT	1	< LOD	Negative
HYSHAM WEST	MAO	0	0	0	174	0	CALIBRATE	0	0	0	1	0.28	Negative
HYSHAM WEST	MAO	0	0	0	175	0	CALIBRATE	0	0	0	1	0.27	Negative
HYSHAM WEST	MAO	0	0	0	176	0	CALIBRATE	0	0	0	1.14	1.1	Null
HYSHAM WEST	MAO	0	0	0	177	0	CALIBRATE	0	0	0	1.2	1.2	Positive
HYSHAM WEST	MAO	0	0	0	178	0	CALIBRATE	0	0	0	1.19	3.5	Positive
HYSHAM WEST	MAO	0	0	0	179	0	CALIBRATE	0	0	0	1.37	4.1	Positive
HYSHAM WEST	MAO	0	0	0	180	0	CALIBRATE	0	0	0	1.22	3.5	Positive

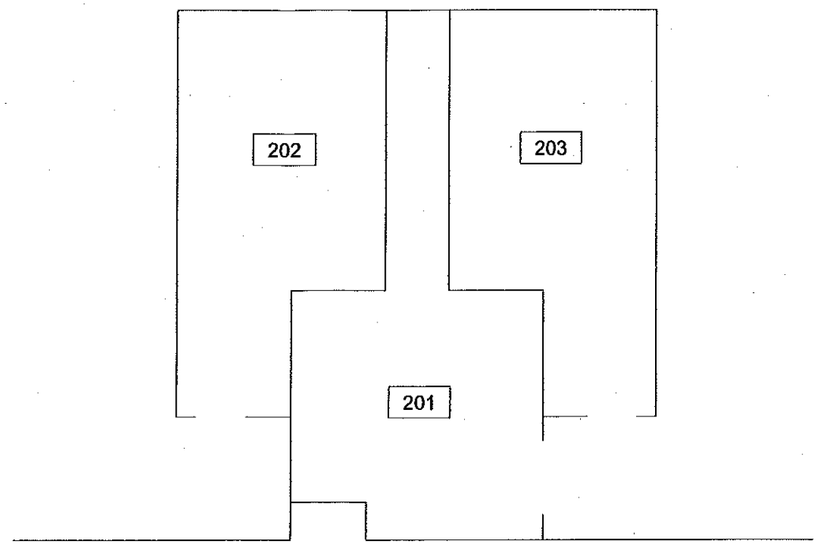
FIGURES

Figure Set 1 - Asbestos and Lead-Based Paint Material Location Diagram



EASTBOUND ASBESTOS
LOCATION PLAN

SCALE: 1/8" = 1'-0"



WESTBOUND ASBESTOS
LOCATION PLAN

SCALE: 1/8" = 1'-0"

KEY NOTES

1. NO ASBESTOS WAS DETECTED AT EITHER REST AREAS IN THE BUILDINGS INSPECTED.
2. LEAD BASED PAINT WAS IDENTIFIED ON THE CONCRETE PARKING CURBS PAINTED YELLOW.

NORTHERN INDUSTRIAL HYGIENE, INC.

DATE:	04/15/15	PROJECT NAME:	EAST AND WESTBOUND HYSHAM REST AREAS
DRAWN BY:	PB	LOCATION:	HYSHAM, MT
CHK BY:	KBO		
CAD FILE:	149-081-Hysham	NIH PROJECT NUMBER:	149-081

FIG. 1.1: ASBESTOS AND LEAD-BASED PAINT MATERIAL LOCATION PLAN

APPENDIX A

ASBESTOS LABORATORY ANALYSIS REPORTS

EMSL Analytical, Inc.
3356 West Catalina Drive, Phoenix, AZ 85017
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http://www.EMSL.com phoenixlab@emsl.com

EMSL Order:	121501151
CustomerID:	NIHI62
CustomerPO:	
ProjectID:	

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Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101

Phone:	(406) 245-7766
Fax:	(406) 254-1428
Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
F6.1A-Tile *121501151-0001*	4"x4" Brown Quarry Tile & Grout	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1A-Grout *121501151-0001A*	4"x4" Brown Quarry Tile & Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1B-Tile *121501151-0002*	4"x4" Brown Quarry Tile & Grout	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1B-Grout *121501151-0002A*	4"x4" Brown Quarry Tile & Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1C-Tile *121501151-0003*	4"x4" Brown Quarry Tile & Grout	Brown Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1C-Grout *121501151-0003A*	4"x4" Brown Quarry Tile & Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M1.1A *121501151-0004*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80% Cellulose	20% Non-fibrous (other)	None Detected
M1.1B *121501151-0005*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80% Cellulose	20% Non-fibrous (other)	None Detected

Analyst(s)
Cheryl Replogle (33)
Jillian Chesson (16)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:05:05

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http://www.EMSL.com phoenixlab@emsl.com

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Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	Description	Appearance	% Fibrous		% Non-Fibrous	% Type
M1.1C *121501151-0006*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M3.1A-Texture *121501151-0007*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected
M3.1A-Tape *121501151-0007A*	Gypsum Board Ceiling System	Beige Fibrous Homogeneous	99%	Cellulose	1% Non-fibrous (other)	None Detected
M3.1A-Joint Compound *121501151-0007B*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected
M3.1A-Drywall *121501151-0007C*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% 2%	Cellulose Glass	85% Gypsum 3% Non-fibrous (other)	None Detected
M3.1A-Composite *121501151-0007D*	Gypsum Board Ceiling System	Various Fibrous Heterogeneous	20% 2%	Cellulose Glass	65% Gypsum 13% Non-fibrous (other)	None Detected
		This is a composite result of wallboard, jt. compound, and tape.				
M3.1B-Joint Compound *121501151-0008*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected
M3.1B-Drywall *121501151-0008A*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% 2%	Cellulose Glass	85% Gypsum 3% Non-fibrous (other)	None Detected

Analyst(s)
Cheryl Replogle (33)
Jillian Chesson (16)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Initial report from 03/26/2015 08:05:05

EMSL Analytical, Inc.
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http://www.EMSL.com phoenixlab@emsl.com

EMSL Order:	121501151
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ProjectID:	

Attn: **Kari Taylor**
Northern Industrial Hygiene, Inc.
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Billings, MT 59101

Phone:	(406) 245-7766
Fax:	(406) 254-1428
Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	Description	Appearance	% Fibrous		% Non-Fibrous	% Type
M3.1B-Composite *121501151-0008B*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% Cellulose 2% Glass		75% Gypsum 13% Non-fibrous (other)	None Detected
		This is a composite result of wallboard and jt. compound.				
M3.1C-Texture *121501151-0009*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected
M3.1C-Tape *121501151-0009A*	Gypsum Board Ceiling System	Beige Fibrous Homogeneous	99% Cellulose		1% Non-fibrous (other)	None Detected
M3.1C-Joint Compound *121501151-0009B*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected
M3.1C-Drywall *121501151-0009C*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% Cellulose 2% Glass		85% Gypsum 3% Non-fibrous (other)	None Detected
M3.1C-Composite *121501151-0009D*	Gypsum Board Ceiling System	Various Fibrous Heterogeneous	20% Cellulose 2% Glass		65% Gypsum 13% Non-fibrous (other)	None Detected
		This is a composite result of wallboard, jt. compound, and tape.				
M8.1A *121501151-0010*	Caulk On Vertical Seams On Ext Walls On Building	Gray Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected
M8.1B *121501151-0011*	Caulk On Vertical Seams On Ext Walls On Building	Gray Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected

Analyst(s)
Cheryl Replogle (33)
Jillian Chesson (16)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M8.1C *121501151-0012*	Caulk On Vertical Seams On Ext Walls On Building	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.2A *121501151-0013*	Gray Caulk On Base Of Building & Shelter Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.2B *121501151-0014*	Gray Caulk On Base Of Building & Shelter Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.2C *121501151-0015*	Gray Caulk On Base Of Building & Shelter Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.3A *121501151-0016*	White Interior Caulk On Seams Of Walls & Around	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.3B *121501151-0017*	White Interior Caulk On Seams Of Walls & Around	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.3C *121501151-0018*	White Interior Caulk On Seams Of Walls & Around	Beige Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.1A *121501151-0019*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)
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Jillian Chesson (16)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Initial report from 03/26/2015 08:05:05

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Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M16.1B *121501151-0020*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.1C *121501151-0021*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.2A *121501151-0022*	Concrete Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.2B *121501151-0023*	Concrete Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.2C *121501151-0024*	Concrete Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.3A *121501151-0025*	Concrete Sidewalk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.3B *121501151-0026*	Concrete Sidewalk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.3C *121501151-0027*	Concrete Sidewalk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)
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Michelle Wilson, Laboratory Manager
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Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M16.4A *121501151-0028*	Styrofoam Insulation	Peach Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
M16.4B *121501151-0029*	Styrofoam Insulation	Peach Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
M16.4C *121501151-0030*	Styrofoam Insulation	Peach Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
M16.5A *121501151-0031*	Black Undersink Coating	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
M16.5B *121501151-0032*	Black Undersink Coating	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
M16.5C *121501151-0033*	Black Undersink Coating	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
S1.1A *121501151-0034*	Exterior "Pebble Looking" Surfacing On Main	Various Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**
S1.1B *121501151-0035*	Exterior "Pebble Looking" Surfacing On Main	Various Non-Fibrous Homogeneous		100% Non-fibrous (other)	**None Detected**

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Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
S1.1C *121501151-0036*	Exterior "Pebble Looking" Surfacing On Main	Various Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)
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Initial report from 03/26/2015 08:05:05

OrderID: 121501151

West Hysham Rest Area

121501151

Chain of Custody

NVLAP Lab Code 200511-0

Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101
Office Phone: (406) 245-7766
Cell Phone: (406) 647-5275
Email: ktaylor@bridgeband.com
Inspector/Contact: Kari Taylor

NIH Lab Batch ID:	
Project Name:	MDOT Various Rest Areas
Project Number:	149-081
Date Samples Taken:	3/17/2015
Type of Analysis:	PLM

Turnaround Time Requested	
2 Hour:	
Same Day:	
24 Hour:	
48 Hour:	
5 Day:	X
10 Day:	

For Lab Use Only
Sample(s) Size: ___Accepted ___Rejected
Non-Conformance Memo: ___Yes ___No
Package Condition: ___Good ___Damaged ___Severe Damage

NIH LAB ID	SAMPLE #	SAMPLE DESCRIPTION	SAMPLE LOCATION
	F6.1A	4" x 4" brown glossy tile +	101-Women's west wall
	B	grout	101 Women's south wall
	C	↓ ↓ ↓ ↓	102- men's North wall
	M1.1A	Black roofing felt under	North Shelter #1
	B	metal	South Shelter #3
	C	↓ ↓ ↓ ↓	Restroom building
	M3.1A	Gypsum board ceiling	103-Janitor
	B	System	
	C	↓ ↓ ↓ ↓	↓ ↓ ↓
	M8.1A	Caulk on vertical seams	Ext SE Corner
	B	on ext walls on building	NE Corner
	C	& shelters ↓ ↓	NW Corner
	M8.2A	Gray caulk on base of	Base of wall North #1
	B	building & shelter walls	" " South #3
	C	↓ ↓ ↓ ↓	Base of main bldg
	M8.3A	White interior caulk on	103-Janitor (north wall)
	B	seams of walls & ground	101-Women's (North wall)
	C	sinks ↓ ↓	101-Women's ground sink
	M16.1A	Concrete slab	103-Janitor
	B	↓ ↓ ↓ ↓	North Shelter #1
	C		South Shelter #3

Special Instructions: Analyze Group Method - Stop at First Positive — Yes X — No

Number of samples shipped this page: 32

Total number of samples shipped: 32

Relinquished By:		Date: 3/18/15	Time: 5:30	Firm: NIH
Received By:		Date: 3/19/15	Time: 9:30	Firm: Fed Exp
Analyzed By:		Date:	Time:	Firm:

Revised 01/20/15 RIM

(8001 0683 2760)

OrderID: 121501151

West Hysham Rest Area

121501151

Chain of Custody

NVLAP Lab Code 200511-0

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Cell Phone: (406) 647-5275
Email: ktaylor@bridgeband.com
Inspector/Contact: Kari Taylor

NIH Lab Batch ID:	
Project Name:	MDOT Various Rest Areas
Project Number:	149-081
Date Samples Taken:	3/17/2015
Type of Analysis:	PLM

For Lab Use Only	
Sample(s) Size:	___Accepted ___Rejected
Non-Conformance Memo:	___Yes ___No
Package Condition:	___Good ___Damaged ___Severe Damage

Turnaround Time Requested	
2 Hour:	
Same Day:	
24 Hour:	
48 Hour:	
5 Day:	X
10 Day:	

NIH LAB ID	SAMPLE #	SAMPLE DESCRIPTION	SAMPLE LOCATION
	M16.2A	Concrete walls	101- Women's South wall
	B		103- Janitor's north wall
	C		South Shelter #2
	M16.3A	Concrete sidewalk	towards shelter #1
	B		towards main bldg
	C		towards shelter #3
	M16.4A	Styrofoam insulation	103- Janitor north wall
	B		Ext. SE Corner
	C		Ext. NW Corner
	M16.5A	Black undercoat coating	101- Women's
	B		102- men's
	C		102- men's
	S1.1A	Exterior "pebble looking"	South side
	B	surfacing on main building	west side
	C		North side

Special Instructions: Analyze Group Method - Stop at First Positive	X	Yes	No	
Number of samples shipped this page:	15			
Total number of samples shipped:	15			
Relinquished By: Kari Taylor	Date: 3/18/15	Time: 5pm	Firm: NIH	
Received By:	Date:	Time:	Firm:	
Analyzed By:	Date:	Time:	Firm:	

Revised 01/20/15 RIM

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3356 West Catalina Drive, Phoenix, AZ 85017
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EMSL Order:	121501154
CustomerID:	NIHI62
CustomerPO:	
ProjectID:	

Attn: **Kari Taylor**
Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101

Phone:	(406) 245-7766
Fax:	(406) 254-1428
Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
F6.1A-Tile *121501154-0001*	4"x4" Brown Quarry Tile & Grout	Red Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1A-Grout *121501154-0001A*	4"x4" Brown Quarry Tile & Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1B-Tile *121501154-0002*	4"x4" Brown Quarry Tile & Grout	Red Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1B-Grout *121501154-0002A*	4"x4" Brown Quarry Tile & Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1C-Tile *121501154-0003*	4"x4" Brown Quarry Tile & Grout	Red Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
F6.1C-Grout *121501154-0003A*	4"x4" Brown Quarry Tile & Grout	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M1.1A *121501154-0004*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80% Cellulose	20% Non-fibrous (other)	None Detected
M1.1B *121501154-0005*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80% Cellulose	20% Non-fibrous (other)	None Detected

Analyst(s)
Bradley Orlowski (32)
Jillian Chesson (15)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:17:27

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EMSL Order:	121501154
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Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M1-1C *121501154-0006*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80% Cellulose	20% Non-fibrous (other)	None Detected
M3.1A-Joint Compound *121501154-0007*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M3.1A-Drywall *121501154-0007A*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% Cellulose 2% Glass	85% Gypsum 3% Non-fibrous (other)	None Detected
M3.1A-Composite *121501154-0007B*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% Cellulose 2% Glass	75% Gypsum 13% Non-fibrous (other)	None Detected
		This is a composite result of wallboard and jt. compound.			
M3.1B-Texture *121501154-0008*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M3.1B-Tape *121501154-0008A*	Gypsum Board Ceiling System	Beige Fibrous Homogeneous	99% Cellulose	1% Non-fibrous (other)	None Detected
M3.1B-Joint Compound *121501154-0008B*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M3.1B-Drywall *121501154-0008C*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% Cellulose 2% Glass	85% Gypsum 3% Non-fibrous (other)	None Detected

Analyst(s)
Bradley Orlowski (32)
Jillian Chesson (15)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:17:27

EMSL Analytical, Inc.
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EMSL Order:	121501154
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ProjectID:	

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Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M3.1B-Composite *121501154-0008D*	Gypsum Board Ceiling System	Various Fibrous Heterogeneous	20% Cellulose 2% Glass	65% Gypsum 13% Non-fibrous (other)	None Detected
		This is a composite result of wallboard, jt. compound, and tape.			
M3.1C-Joint Compound *121501154-0009*	Gypsum Board Ceiling System	White Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M3.1C-Drywall *121501154-0009A*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% Cellulose 2% Glass	85% Gypsum 3% Non-fibrous (other)	None Detected
M3.1C-Composite *121501154-0009B*	Gypsum Board Ceiling System	Brown/White Fibrous Heterogeneous	10% Cellulose 2% Glass	75% Gypsum 13% Non-fibrous (other)	None Detected
		This is a composite result of wallboard and jt. compound.			
M8.1A *121501154-0010*	Caulking On Vertical Seams On Ext. Of Main	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.1B *121501154-0011*	Caulking On Vertical Seams On Ext. Of Main	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.1C *121501154-0012*	Caulking On Vertical Seams On Ext. Of Main	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.2A *121501154-0013*	Gray Caulking On Base Of Building & Shelter Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)
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Jillian Chesson (15)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:17:27

EMSL Analytical, Inc.
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EMSL Order:	121501154
CustomerID:	NIHI62
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ProjectID:	

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Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M16.2A *121501154-0022*	Concrete Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.2B *121501154-0023*	Concrete Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.2C *121501154-0024*	Concrete Walls	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.3A *121501154-0025*	Concrete Sidewalk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.3B *121501154-0026*	Concrete Sidewalk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.3C *121501154-0027*	Concrete Sidewalk	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.4A *121501154-0028*	Styrofoam Insulation	Beige Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.4B *121501154-0029*	Styrofoam Insulation	Beige Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)
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Jillian Chesson (15)

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or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

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ProjectID:	

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Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M16.4C *121501154-0030*	Styrofoam Insulation	Peach Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.5A *121501154-0031*	Black Undersink Coating	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.5B *121501154-0032*	Black Undersink Coating	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.5C *121501154-0033*	Black Undersink Coating	Black Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
S1.1A *121501154-0034*	Exterior "Pebble Looking" Surfacing	Gray Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
S1.1B *121501154-0035*	Exterior "Pebble Looking" Surfacing	Gray Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected
S1.1C *121501154-0036*	Exterior "Pebble Looking" Surfacing	Gray Non-Fibrous Heterogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)
Bradley Orlowski (32)
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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:17:27

OrderID: 121501154

East Hysham Rest Area

121501154

Chain of Custody

NVLAP Lab Code 200511-0

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201 South 30th Street
Billings, MT 59101
Office Phone: (406) 245-7766
Cell Phone: (406) 647-5275
Email: ktaylor@bridgeband.com
Inspector/Contact: Kari Taylor

NIH Lab Batch ID:	
Project Name:	MDOT Various Rest Areas
Project Number:	149-081
Date Samples Taken:	3/17/2015
Type of Analysis:	PLM

For Lab Use Only
Sample(s) Size:___Accepted___Rejected
Non-Conformance Memo:___Yes___No
Package Condition:___Good___Damaged___Severe Damage

Turnaround Time Requested	
2 Hour:	
Same Day:	
24 Hour:	
48 Hour:	
5 Day:	X
10 Day:	

NIH LAB ID	SAMPLE #	SAMPLE DESCRIPTION	SAMPLE LOCATION
	FE.1A	4"x4" brown quarry tile	101-Women's (east wall)
	B	& grout	101-Women's (North wall)
	C	↓ ↓ ↓ ↓	102-men's (South wall)
	M.1A	Black roofing felt under	Rest area building
	B	metal	North shelter #1
	C	↓ ↓ ↓ ↓	South shelter #3
	MB.1A	Gypsum board Ceiling	103-Janitor/pipe Chase
	B	system	
	C	↓ ↓ ↓ ↓	↓ ↓ ↓
	MB.1A	Caulking on vertical seams	Ext Northwest Corner
	B	on ext of min restroom	Ext east wall
	C	building ↓ ↓ ↓	Ext Southwest Corner
	MB.2A	Gray Caulking on base of	North shelter #1
	B	building & shelter walls	Restroom building
	C	↓ ↓ ↓ ↓	South shelter #3
	MB.3A	White interior caulk around	101-Women's (south wall)
	B	seams of wall & around	102-men's (around sink)
	C	sinks ↓ ↓ ↓	103-Janitor (North wall)
	M/6.1A	Concrete slab	North shelter #2
	B		103-Janitor
	C	↓ ↓ ↓ ↓	South shelter #3

Special Instructions: Analyze Group Method - Stop at First Positive				X Yes	No
Number of samples shipped this page:	21				
Total number of samples shipped:	36				
Relinquished By: Kari Taylor	Date: 3/18/15	Time: 5pm	Firm: NIH		
Received By: Deborah Kozy	Date: 3/19/15	Time: 9:30	Firm: Fed Ex		
Analyzed By:	Date:	Time:	Firm:		

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(8001 0683 2720)

OrderID: 121501154

East Hysham Rest Area

121501154

Chain of Custody

NVLAP Lab Code 200511-0

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Email: ktaylor@bridgeband.com
Inspector/Contact: Karl Taylor

NIH Lab Batch ID:	
Project Name:	MDOT Various Rest Areas
Project Number:	149-00
Date Samples Taken:	3/17/2015
Type of Analysis:	P/M

Turnaround Time Requested	
2 Hour:	
Same Day:	
24 Hour:	
48 Hour:	
5 Day:	X
10 Day:	

For Lab Use Only
Sample(s) Size:___Accepted___Rejected
Non-Conformance Memo:___Yes___No
Package Condition:___Good___Damaged___Severe Damage

Page 2 of 2

NIH LAB ID	SAMPLE #	SAMPLE DESCRIPTION	SAMPLE LOCATION
	M16.2A	Concrete walls	103-Janitor (south wall)
	B		North Shelter #2
	C		South Shelter #3
	M16.3A	Concrete Sidewalk	West sidewalk to building
	B		N. sidewalk to #1
	C		S. towards #3
	M16.4A	Styrofoam insulation	Ext SE corner
	B		Ext NW Corner
	C		103-Janitor (south wall)
	M16.5A	Black undercoat coating	102-Men's
	B		101-Women's
	C		101-Women's
	S1.1A	Exterior "pebble looking"	North side
	B	Surfacing	East side
	C		South side

Special Instructions: Analyze Group Method - Stop at First Positive X Yes ___ No
Number of samples shipped this page: 15
Total number of samples shipped: 30

Relinquished By: Karl Taylor	Date: 3/18/15	Time: 5pm	Firm: NIH
Received By:	Date:	Time:	Firm:
Analyzed By:	Date:	Time:	Firm:

Revised 01/20/15 RIM

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EMSL Order:	121501096
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Received:	03/19/15 9:30 AM
Analysis Date:	3/24/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	Description	Appearance	% Fibrous		% Non-Fibrous	% Type
M1.1A-Shingle *121501096-0001*	White Rolled Roofing	White/Black Fibrous Heterogeneous	10%	Glass	90% Non-fibrous (other)	None Detected
M1.1A-Mastic *121501096-0001A*	White Rolled Roofing	Black Fibrous Homogeneous	10%	Cellulose	90% Non-fibrous (other)	None Detected
M1.1B-Shingle *121501096-0002*	White Rolled Roofing	White/Black Fibrous Heterogeneous	10%	Glass	90% Non-fibrous (other)	None Detected
M1.1C-Shingle *121501096-0003*	White Rolled Roofing	White/Black Fibrous Heterogeneous	10%	Glass	90% Non-fibrous (other)	None Detected
M1.1C-Mastic *121501096-0003A*	White Rolled Roofing	Black Fibrous Homogeneous	10%	Cellulose	90% Non-fibrous (other)	None Detected
M1.2A *121501096-0004*	Black Roofing Felt	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M1.2B *121501096-0005*	Black Roofing Felt	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M1.2C *121501096-0006*	Black Roofing Felt	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected

Analyst(s)
Bradley Orlowski (7)
Carlos Rivadeneyra (4)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Initial report from 03/26/2015 08:18:34

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Received:	03/19/15 9:30 AM
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Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M16.1A *121501096-0007*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.1B *121501096-0008*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.1C *121501096-0009*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

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Carlos Rivadeneyra (4)

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or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:18:34

OrderID: 121501096

Tan Storage Shed Hysham 121501096

Chain of Custody

NVLAP Lab Code 200511-0

Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101
Office Phone: (406) 245-7766
Cell Phone: (406) 647-5275
Email: ktaylor@bridgeband.com
Inspector/Contact: Karl Taylor

NIH Lab Batch ID:	
Project Name:	MDOT Various Rest Areas
Project Number:	149-081
Date Samples Taken:	3/17/2015
Type of Analysis:	PLM

Turnaround Time Requested	
2 Hour:	
Same Day:	
24 Hour:	
48 Hour:	
5 Day:	X
10 Day:	

For Lab Use Only
Sample(s) Size: ___Accepted ___Rejected
Non-Conformance Memo: ___Yes ___No
Package Condition: ___Good ___Damaged ___Severe Damage

Page 1 of 1

NIH LAB ID	SAMPLE #	SAMPLE DESCRIPTION	SAMPLE LOCATION
	ML1A	White rolled roofing	Roof
	B	↓	↓
	C	↓	↓
	ML2A	Black roofing felt	Under ML1
	B	↓	↓
	C	↓	↓
	ML6A	Concrete Slab	Shed floor
	B	↓	↓
	C	↓	↓

Special Instructions: Analyze Group Method - Stop at First Positive	X	Yes		No
Number of samples shipped this page:	9			
Total number of samples shipped:	9			
Relinquished By: Kay Taylor	Date: 3/19/15	Time: 5pm	Firm: NIH	
Received By: [illegible]	Date: 3/19/15	Time: 0930	Firm: Fed up	
Analyzed By:	Date:	Time:	Firm:	

Revised 01/20/15 RIM

(800) 6683 2760

Tan Storage Shed Hysham

Chain of Custody

NVLAP Lab Code 200511-0

Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101
Office Phone: (406) 245-7766
Cell Phone: (406) 647-5275
Email: ktaylor@bridgeband.com
Inspector/Contact: Kari Taylor

NIH Lab Batch ID:	
Project Name:	MDOT Various Rest Areas
Project Number:	149-081
Date Samples Taken:	3/17/2015
Type of Analysis:	PLM

For Lab Use Only
Sample(s) Size: ___Accepted ___Rejected
Non-Conformance Memo: ___Yes ___No
Package Condition: ___Good ___Damaged ___Severe Damage

Turnaround Time Requested	
2 Hour:	
Same Day:	
24 Hour:	
48 Hour:	
5 Day:	X
10 Day:	

Page 1 of 1

NIH LAB ID	SAMPLE #	SAMPLE DESCRIPTION	SAMPLE LOCATION
	ML1A	White rolled roofing	Roof
	B	↓	↓
	C	↓	↓
	ML2A	Black roofing felt	Under ML1
	B	↓	↓
	C	↓	↓
	ML3A	Concrete Slab	Shed floor
	B	↓	↓
	C	↓	↓

Special Instructions: Analyze Group Method - Stop at First Positive	X Yes	No	
Number of samples shipped this page:	9		
Total number of samples shipped:	9		
Relinquished By: Kari Taylor	Date: 3/19/15	Time: 5pm	Firm: NIH
Received By:	Date:	Time:	Firm:
Analyzed By:	Date:	Time:	Firm:

Revised 01/20/15 RIM

EMSL Analytical, Inc.
3356 West Catalina Drive, Phoenix, AZ 85017
Phone/Fax: (602) 276-4344 / (602) 276-4053
http://www.EMSL.com phoenixlab@emsl.com

EMSL Order:	121501095
CustomerID:	NIHI62
CustomerPO:	
ProjectID:	

Attn: **Kari Taylor**
Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101

Phone:	(406) 245-7766
Fax:	(406) 254-1428
Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	Description	Appearance	%	Fibrous	% Non-Fibrous	% Type
M1.1A *121501095-0001*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M1.1B *121501095-0002*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M1.1C *121501095-0003*	Black Roofing Felt Under Metal	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M2.1A *121501095-0004*	Black Siding Felt Under Metal Siding	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M2.1B *121501095-0005*	Black Siding Felt Under Metal Siding	Black Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M2.1C *121501095-0006*	Black Siding Felt Under Metal Siding	Black/Yellow Fibrous Homogeneous	80%	Cellulose	20% Non-fibrous (other)	None Detected
M8.1A-Foam *121501095-0007*	Gray Foam With Yellow Adhesive At End Of Metal	Gray Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected
M8.1A-Adhesive *121501095-0007A*	Gray Foam With Yellow Adhesive At End Of Metal	Yellow Non-Fibrous Homogeneous			100% Non-fibrous (other)	None Detected

Analyst(s)
Bradley Orlowski (10)
Cheryl Replogle (5)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:19:36

EMSL Analytical, Inc.
3356 West Catalina Drive, Phoenix, AZ 85017
Phone/Fax: (602) 276-4344 / (602) 276-4053
http://www.EMSL.com phoenixlab@emsl.com

EMSL Order:	121501095
CustomerID:	NIHI62
CustomerPO:	
ProjectID:	

Attn: **Kari Taylor**
Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101

Phone:	(406) 245-7766
Fax:	(406) 254-1428
Received:	03/19/15 9:30 AM
Analysis Date:	3/25/2015
Collected:	3/17/2015

Project: **149-081 / MDOT Various Rest Areas**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	Description	Appearance	% Fibrous	% Non-Fibrous	% Type
M8.1B-Foam *121501095-0008*	Gray Foam With Yellow Adhesive At End Of Metal	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.1B-Adhesive *121501095-0008A*	Gray Foam With Yellow Adhesive At End Of Metal	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.1C-Foam *121501095-0009*	Gray Foam With Yellow Adhesive At End Of Metal	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M8.1C-Adhesive *121501095-0009A*	Gray Foam With Yellow Adhesive At End Of Metal	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.1A *121501095-0010*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.1B *121501095-0011*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected
M16.1C *121501095-0012*	Concrete Slab	Gray Non-Fibrous Homogeneous		100% Non-fibrous (other)	None Detected

Analyst(s)
Bradley Orlowski (10)
Cheryl Replogle (5)

Michelle Wilson
Michelle Wilson, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc. Phoenix, AZ NVLAP Lab Code 200811-0, AZ0937

Initial report from 03/26/2015 08:19:36

OrderID: 121501095

Green Storage Shed Hysham 121501095

Chain of Custody

NVLAP Lab Code 200511-0

Northern Industrial Hygiene, Inc.
201 South 30th Street
Billings, MT 59101
Office Phone: (406) 245-7766
Cell Phone: (406) 647-5275
Email: ktaylor@bridgeband.com
Inspector/Contact: Karl Taylor

NIH Lab Batch ID:	
Project Name:	MDOT Various Rest Areas
Project Number:	149-081
Date Samples Taken:	3/17/2015
Type of Analysis:	PLM

For Lab Use Only
Sample(s) Size:___Accepted___Rejected
Non-Conformance Memo:___Yes___No
Package Condition:___Good___Damaged___Severe Damage

Turnaround Time Requested	
2 Hour:	
Same Day:	
24 Hour:	
48 Hour:	
5 Day:	X
10 Day:	

Page 1 of ____

NIH LAB ID	SAMPLE #	SAMPLE DESCRIPTION	SAMPLE LOCATION
	M1.1A	Black roofing felt	Exterior roof
	B	under metal	↓
	C	↓	↓
	M2.1A	Black siding felt under	Exterior siding
	B	metal siding	↓
	C	↓	↓
	M3.1A	Gray foam with yellow	Exterior roof
	B	adhesive at end of	↓
	C	metal roofing	↓
	M16.1A	Concrete slab	Shed floor
	B	↓	↓
	C	↓	↓

Special Instructions: Analyze Group Method - Stop at First Positive X Yes ___ No
Number of samples shipped this page: 12
Total number of samples shipped: 12

Relinquished By: Karl Taylor	Date: 3/18/2015	Time: 5pm	Firm: NIH
Received By: [signature]	Date: 3/19/15	Time: 930	Firm: Fed ex
Analyzed By:	Date:	Time:	Firm:

Revised 01/20/15 RIM

(800) 6683 2760)

APPENDIX B

ASBESTOS SAMPLE COLLECTION REQUIREMENTS AND MATERIAL CATEGORY DESCRIPTIONS

SAMPLE COLLECTION REQUIREMENTS

Friable Surfacing Material

1) At least three bulk samples from each homogeneous material that is 1,000 square feet or less.
2) At least five bulk samples from each homogeneous material that is greater than 1,000 square feet but less than or equal to 5,000 square feet.
3) At least seven bulk samples from each homogeneous material that is greater than 5,000 square feet.

Thermal System Insulation

1) In a randomly distributed manner, at least three bulk samples from each homogeneous material of thermal system insulation that is not assumed to contain asbestos.
2) At least one bulk sample from each homogeneous material of patched thermal system insulation that was not assumed to be asbestos-containing material (ACBM).
3) In a manner sufficient to determine whether the material was ACBM or not ACBM, (generally three samples), bulk samples from each insulated mechanical system that was not assumed to be ACBM where cement or plaster was used on fittings such as tees, elbows, or valves.
4) Bulk samples were not collected from any homogeneous material where the inspector determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-asbestos-containing building material.

Miscellaneous Materials

1) Three bulk samples were collected from each area of homogeneous friable miscellaneous material that was not assumed to be ACBM.

Non-friable suspected ACBM

1) I Three bulk samples were collected from each area of homogeneous friable miscellaneous material that was not assumed to be ACBM.

AHERA AND NESHAP CATEGORIES

Following receipt of the laboratory analysis, homogeneous ACBM were identified and the quantities determined. The materials were then categorized using NESHAP criteria and a general recommended response action was determined for each ACBM.

AHERA Categories

Category 1: Damaged or significantly damaged thermal system insulation ACM.
Category 2: Damaged friable surfacing ACM.
Category 3: Significantly damaged friable surfacing ACM.
Category 4: Damaged or significantly damaged friable miscellaneous ACM.
Category 5: ACBM with potential for damage.
Category 6: ACBM with potential for significant damage.
Category 7: Remaining friable ACBM or friable suspected ACBM.

NESHAP Categories

Category I is non-friable asbestos-containing materials including packings, gaskets, resilient floor covering and asphalt roofing products containing more than 1 percent asbestos. This category also includes pliable asbestos-containing sealants and mastics.

Category II is non-friable ACBM, excluding Category I non-friable ACBM, containing more than one percent asbestos. This category includes Transite ® (cement asbestos) products.

Regulated Asbestos-Containing Materials (RACM) are friable materials, Category I non-friable materials that will or may be subjected to sanding, grinding, cutting, or abrading and Category II non-friable materials that have a high probability of becoming or have become crumbled, pulverized, or reduced to powder by forces expected to act on the material in the course of demolition or renovation operations.

General Recommended Response Actions

Removal:	remove noted damaged ACBM;
Repair:	repair noted damaged ACBM;
Encapsulate:	encapsulate ACBM with a penetrating or bridging encapsulate;
Enclosure:	enclose ACBM by construction an air tight barrier;
O&M:	include material in a formal operations and maintenance program and maintain ACBM in a non-friable condition.

APPENDIX C

SUMMARY OF LEAD-BASED PAINT REGULATIONS

LEAD-BASED PAINT REGULATORY OVERVIEW

Regulatory agencies which have addressed lead-based paint include the Consumer Product Safety Commission (CPSC), the Occupational Safety and Health Administration (OSHA), the Department of Housing and Urban Development (HUD), and the Environmental Protection Agency (EPA).

Consumer Product Safety Commission

The content of lead in paint is regulated by the Consumer Product Safety Commission. Under CPSC regulations, paints manufactured after 1978 cannot contain more than 0.06 % lead by weight, calculated as lead metal, in the nonvolatile content of the liquid paint. Paints containing more than this amount in the liquid paint are classified by the CPSC as lead-based paint. The Department of Housing and Urban Development established separate standards defining lead-based paint for dried in-place paint. Dried, in-place paint is defined by HUD as being lead-based if bulk sample tests indicate lead at greater than 0.5% by weight or if XRF tests indicate lead at greater than 1 milligram per square centimeter (mg/cm^2).

Occupational Safety and Health Administration

OSHA has established a standard regulating workers exposure to lead in both general industry and in construction. The lead in construction standard (29 CFR 1926.62) applies to all construction work where an employee may be exposed to lead. The standard does not recognize any minimum concentration of lead and does not define lead-based paint. Consequently, all painted surfaces in which any detectable level of lead is present must be considered as having the potential to present an occupational exposure to lead.

OSHA regulated construction work is defined as work for construction, alteration and/or repair, including painting and decorating. Typical activities which fall into these categories include: demolition or salvage of structures where lead or materials containing lead are present; removal or encapsulation of materials containing lead; lead contamination/emergency cleanup; transportation, disposal, storage or containment of lead or materials containing lead on the site or location at which construction activities are performed and maintenance operations associated with the construction activities described above including construction cleanup.

Housing and Urban Development

HUD has established the only comprehensive guidelines for inspecting, sampling, assessing exposure risk and performing lead abatement including provisions for clearance testing following lead removal projects. These guidelines were promulgated under section 402 of the Toxic Substances Control Act (TSCA). As mentioned above, HUD defines lead-based paint as containing greater than 0.5% by weight or greater than 1 milligram per square centimeter (mg/cm^2).

Environmental Protection Agency

The EPA has promulgated regulations addressing the disposal of toxic or hazardous waste materials. Materials painted with lead-based paint are considered potentially hazardous and therefore fall under the requirements of the Resource Conservation and Recovery Act (RCRA) that requires testing to determine the proper disposal method. The EPA regulations require the testing of representative wastes using the Toxicity Characteristic Leaching Procedure (TCLP). This test determines to what extent the lead in the waste can be leached out of the waste under conditions representing those found in landfills. If the quantity of leachable lead exceeds the established standard, the waste is classified as hazardous and must be disposed in a hazardous waste landfill. If the quantity of leachable lead is less than the standard, the waste may be disposed at a municipal landfill that accepts construction or demolition debris.

APPENDIX D

INSPECTOR ASBESTOS TRAINING CERTIFICATES

KARI TAYLOR

has met the requirements of Montana Administrative Rule 17.74.362 and/or 17.74.363 for accreditation in the following asbestos-type occupation(s) as indicated by an expiration date(s).

MTA-4281

CS	MP	PD	IN
05/29/2015			05/30/2015
WK			

MT DEQ Asbestos Control Program

APPENDIX D:

Preliminary Traffic Report

Hysham Rest Area
IM 94-2(36)65
UPN 8200000

Preliminary Traffic Technical Memorandum

MDT Activity 112

Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION
2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Prepared by:

DOWL HKM
1300 Cedar Street
Helena, MT 59601

June 9, 2014

1.0 Introduction

This Preliminary Traffic Technical Memorandum was developed in support of Phase I of the Hysham Rest Area project to evaluate and design water/wastewater systems for the rest area sites, to obtain permitting of the system through the Montana Department of Environmental Quality (MDEQ), and to develop environmental compliance documentation (specifically a categorical exclusion [CE]) in accordance with the National and Montana Environmental Policy Acts (NEPA/MEPA) for the future full reconstruction of the rest area sites. Future improvements are anticipated to include new water and wastewater systems, new building facilities, and updated parking facilities. Once approved, the permit and CE will allow the development of a design-build or a design-bid-build project to reconstruct the rest area sites.

The Hysham Rest Area consists of two separate rest area sites located on each side of Interstate 94 (I-94) in Treasure County, MT. The rest area serving the eastbound (EB) direction of travel is located at reference post (RP) 64.7. The rest area serving the westbound (WB) direction of travel is located at RP 64.8.

This memorandum is intended to calculate future parking demand and building facility needs based on an evaluation of available traffic volumes and door count data.

2.0 Rest Area Usage

The *Montana Rest Area Plan* (Amend. May 2004), developed by MDT in cooperation with the Western Transportation Institute (WTI), provides guidance regarding estimating rest area usage based on American Association of State Highway and Transportation Officials (AASHTO) formulas. The number of vehicles stopping at a rest area site per hour is calculated as a percentage of the directional traffic volume, with factors for the type of vehicle as well as the type of mainline route to account for mainline traffic composition. While the AASHTO methodology for estimating rest area usage is used throughout the United States, it is considered highly conservative.

In an effort to develop guidelines that more accurately reflect conditions specific to Montana, MDT initiated a research project with WTI that culminated in the completion of the *Rest Area Use: Data Acquisition and Usage Estimation Report* (2011). As part of this study, traffic data was collected at nearly all MDT-maintained rest areas on Montana highways, with recommendations for estimating parking and facility demand usage factors based on a cross-section of representative rest areas. Four control stations were chosen to represent high-volume Interstate rest area sites. Short-term data was collected at all other locations (defined as coverage stations). The WTI method is used in this memorandum to determine rest area parking and usage needs at the Hysham rest areas. The AASHTO method will not be referenced further in this memorandum.

As part of MDT's ongoing effort to update the Montana Rest Area Plan, DOWL HKM modified the methodology outlined in Chapter 5 of the WTI report by substituting site-specific door count data (where available) in place of WTI-recommended default values to identify peak-hour visitation at state-maintained rest areas.

Equation 1 identifies the variables used to estimate the recommended number of passenger vehicle (car) and commercial vehicle (truck) parking spaces. Equation 1 differs from WTI methodology by replacing the default P value (representing the statewide 85th percentile of mainline traffic stopping at rest areas) with site-specific door count data as a percentage of mainline traffic ([PDD/2]/[UV/AADT]). Equation 1 also eliminates the peak factor (ratio of average-day usage during the five peak summer months compared with the average over the entire year) because peak door count data is considered.

Equation 1

$$\mathbf{Nc\ or\ Nt} = \frac{\mathbf{PHV} * \frac{\left(\frac{\mathbf{PDD}}{\mathbf{2}}\right)}{\frac{\mathbf{UV}}{\mathbf{AADT}}} * \mathbf{Dc\%\ or\ Dt\%} * \mathbf{VHSc\ or\ VHSt}}{\mathbf{UCF}}$$

N_c = Number of parking spaces for cars (passenger vehicles)

N_t = Number of parking spaces for trucks (commercial vehicles)

PHV = Peak hour volume (mainline)

PDD = Peak daily door count

UV = Restroom users per vehicle

AADT = Average annual daily traffic (mainline)

$D_{c\%}$ = Percentage of cars (passenger vehicles) in the mainline traffic stream during daytime/nighttime periods

$D_{t\%}$ = Percentage of trucks (commercial vehicles) in the mainline traffic stream during daytime/nighttime periods

VHS_c = Average dwell time for cars (passenger vehicles) in minutes

VHS_t = Average dwell time for trucks (commercial vehicles) in minutes

UCF = Unit conversion factor = 60 (60 minutes/hour)

Equation 2 identifies the variables used for estimating the recommended number of restroom stalls.

Equation 1

$$\mathbf{T} = \frac{\mathbf{UV} * \mathbf{D2}}{\mathbf{UHS}}$$

T = Number of restroom stalls

UV = Restroom users per vehicle

D_2 = Total vehicles stopping at rest area during peak hour

UHS = Users per hour per restroom stall, based on a two-minute cycle = 30

The following sections discuss the methods and data used to identify the above variables.

2.1 Existing Traffic Volumes

MDT provided 2014 average annual daily traffic (AADT) volumes at short-term count stations near the Hysham rest areas on I-94. Hourly full detail traffic volume data from a count station located near the Hysham rest areas was used to identify the highest hourly mainline volume or peak hour volume (PHV) within the WTI-defined daytime and nighttime periods. The daytime is defined as the period from 9:00 a.m. to 4:00 p.m. and the nighttime is defined as the period from 12:00 a.m. to 6:00 a.m. The WTI report uses daytime PHV and nighttime PHV to calculate rest area usage. PHV represents data collected on a single day of the year. Traffic volumes recorded on a single day may or may not be representative of typical volumes for similar time periods. Table 1 lists the AADT, daytime PHV, and nighttime PHV for existing 2014 conditions for rest areas serving the EB and WB directions of travel.

Table 1 AADT, Daytime PHV, and Nighttime PHV (2014)

Rest Area (Direction)	AADT [1]	PHV Daytime Period (9 a.m. – 4 p.m.)	PHV Nighttime Period (12 a.m. – 6 a.m.)
Eastbound	2,468	250	67
Westbound	2,468	229	53

Source: MDT, 2014; DOWL HKM, 2014.
PHV = Peak Hour Volume
AADT = Average Annual Daily Traffic
[1] AADT volumes assumes a 50%:50% directional split.

2.2 Growth Rates and Future Traffic Volumes

MDT supplied a design year (2036) AADT volume for the section of I-94 encompassing the Hysham rest areas, with an average annual growth rate of 2.0 percent per year. Daytime and nighttime PHV percentages identified for existing 2014 conditions were applied to 2036 AADT volumes provided by MDT. Table 2 lists the AADT, daytime PHV, and nighttime PHV for future 2036 conditions for rest areas serving the EB and WB directions of travel.

Table 2 AADT, Daytime PHV, and Nighttime PHV (2036)

Rest Area (Direction)	AADT [1]	PHV Daytime Period (9 a.m. – 4 p.m.)	PHV Nighttime Period (12 a.m. – 6 a.m.)
Eastbound	3,816	386	103
Westbound	3,816	354	81

Source: MDT, 2014; DOWL HKM, 2014.
PHV = Peak Hour Volume
AADT = Average Annual Daily Traffic
[1] AADT volumes assumes a 50%:50% directional split.

2.3 Proportion of Mainline Traffic Stopping at Rest Area (P)

MDT has installed door counters at most state-maintained rest areas that record each time a rest area door opens. This information can be converted to estimate rest area usage as a percentage of mainline traffic. For this technical memorandum, site-specific P values were calculated using door count data provided by MDT. Door count data provides a reasonable estimation of patrons using a rest area building during the course of a day, but may not account for drivers or passengers that do not enter the building, or patrons holding the door for other parties. Daily door counts do not provide information about hourly usage patterns throughout a 24-hour period, the types of vehicles occupying a parking lot, or the length of patron stay. In the absence of site-specific data, mainline volumes are still required to identify hourly breakouts and truck/car percentages. Equation 3 identifies the variables used to calculate site-specific P values for rest areas using door count data.

Equation 3

$$\mathbf{P = \frac{(PDD / 2)}{(UV / AADT)}}$$

P = Proportion of mainline traffic stopping at rest area
PDD = Peak daily door count
2 = Conversion from door count to people
UV = Users per vehicle (1.5)
AADT = Average annual daily traffic

Site-specific P values are based on the relationship between peak-day door count data and average annual mainline traffic volumes. This provides a static estimate, and may not be representative of usage characteristics as traffic volumes change over time.

2.4 Proportion of Commercial Vehicles and Buses and Proportion of Passenger Vehicles Using Facility (D_d/D_t)

MDT supplied daily percentages of buses and commercial vehicles within the mainline traffic stream. Within the WTI report, Guideline #3 notes it is reasonable to assume the percentage of commercial vehicles during the daytime and nighttime periods is equivalent to 70 percent and 200 percent, respectively, of the daily commercial vehicle percentage for the mainline served by the rest area. This guideline corresponds roughly to the Emigrant daytime/nighttime ratios, which were the highest ratios of the control stations WTI studied. Daytime ratios for Divide SB and Greycliff EB were closer to 60 percent, while nighttime ratios for these two sites were closer to 160 percent. It is unknown if truck percentage data for the three control stations is representative of all state-maintained rest areas. The percent of passenger vehicles using the Hysham rest areas was calculated by subtracting the percent of commercial vehicles and buses from 100 percent.

2.5 Average Dwell Time (VHS)

The WTI report investigated parking dwell times at three Montana rest areas to better understand rest area parking needs. Of the three rest areas studied, the Divide SB rest area is most similar to

the Hysham rest areas as both are located adjacent to a lower volume (>5,000 AADT) interstate highway segment. Table 3 lists the average dwell time by vehicle type during the day and night at the Divide SB rest area.

Table 3 Average Dwell Time at the Divide SB Rest Area

Location	Vehicle Type	Average Dwell Time (Hr: Min: Sec)	
		Day	Night
Divide SB	Cars	00:10:47	00:50:14
	Trucks	00:37:50	03:21:42
	RVs	00:14:44	01:07:04

Source: WTI, 2011.

2.6 Restroom Users per Vehicle (UV)

WTI Guideline #9 concludes for rest area planning and design purposes, a rate of 1.5 restroom users per vehicle may be used in estimating the number of patrons using the rest area building.

2.7 Summary of Estimated Usage

Table 4 summarizes data elements used for the Hysham rest area sites, based on WTI methodology for rest area usage estimation.

Table 4 Data Elements Employed in Usage Calculations for Hysham Rest Areas

Variable	Rest Area (Direction)	Existing 2014	Future 2036	Notes
Average Annual Daily Traffic (AADT)	Eastbound	2,468	3,816	Based on 2013 short-term count stations 52-2-2, seasonally adjusted with growth rate applied.
	Westbound			
Average Annual Daily Traffic (Trucks) ($AADT_t$)	Eastbound	674	1,042	Based on 2013 short-term count stations 52-2-2, seasonally adjusted with growth rate applied.
	Westbound			
Peak Hour Volume (PHV)	Eastbound	250 (day) 67 (night)	386 (day) 103 (night)	Based on 2013 short-term count stations 52-2-2, seasonally adjusted with growth rate applied.
	Westbound	229 (day) 53 (night)	354 (day) 81 (night)	
Peak Daily Door Count (PDD)	Eastbound	1,677	2,592	Based on 2013 door count data provided by MDT.
	Westbound	1,719	2,657	
Proportion of Mainline Traffic Stopping at Rest Area (P)	Eastbound	0.23		P = [(PDD / 2) / UV] / AADT
	Westbound	0.23		
Percentage of Cars in the Mainline Traffic Stream During Daytime/Nighttime Periods ($D_{c\%}$)	Eastbound	72.70%		Dc% = (AADT - $AADT_t$) / AADT
	Westbound			
Percentage of Trucks in the Mainline Traffic Stream During Daytime/Nighttime Periods ($D_{t\%}$)	Eastbound	19.11% (day) 54.60% (night)		Guideline #3 Day = ($AADT_t$ / AADT) * 0.7 Night = ($AADT_t$ / AADT) * 2.0
	Westbound			
Average Dwell Time (VHS)	Eastbound	11 minutes (cars) 38 minutes (trucks - day) 202 minutes (trucks - night)		Based on research from SB Divide rest area.
	Westbound			
Restroom Users per Vehicle (UV)	Eastbound	1.5		Based on WTI Guideline #9.
	Westbound			

Source: WTI, 2011; MDT, 2014; DOWL HKM, 2014.

Table 5 presents the recommended number of parking and restroom stalls according to the WTI methodology. Calculation formulas are presented on page 2 of this memorandum. Detailed calculations are provided in Appendix B.

Table 5 Recommended Parking and Restroom Stalls at Hysham Rest Areas

Variable	Rest Area (Direction)	Existing 2014	Existing 2014	Future 2036
		Current Conditions (No Improvements)	WTI Methodology (Reconstruction)	WTI Methodology (Reconstruction)
Passenger vehicle stalls	Eastbound	15	6	9
	Westbound	16	6	9
Commercial vehicle stalls	Eastbound	4	21 [1]	31 [1]
	Westbound	4	18 [1]	27 [1]
Restroom stalls	Eastbound	4 (women) 4 (men)	1 (women) 1 (men)	2 (women) 1 (men)
	Westbound	4 (women) 4 (men)	1 (women) 1 (men)	2 (women) 1 (men)

Source: WTI, 2011; MDT, 2014; DOWL HKM, 2014.
[1] Night usage controls.

Based on the results listed above, there is a surplus of passenger vehicle and restroom stalls and a shortage of commercial vehicle stalls at the Hysham rest area sites. When assessing parking and restroom demand and supply, MDT could consider preserving the current number of parking and restroom stalls (if greater than the number of stalls indicated in demand calculations). MDT could also consider re-striping some passenger vehicle stalls as commercial vehicle parking stalls.

3.0 Summary of Crash Analysis

MDT provided crash data for I-94 from RP 64.0 to RP 65.5 for the ten-year period from January 1, 2004, to December 31, 2013. During this period, twenty-one crashes occurred within this 1.5-mile segment. Only one of the twenty-one reported crashes was related to the interchange. This single vehicle crash involved a passenger car hitting a fixed object off the right roadway shoulder. This crash occurred during the day with snowy or slushy roadway conditions. Contributing circumstances included traveling too fast for conditions and other road/environment conditions. As only one crash was related to the interchange, no correctable trends could be identified for the ten-year analysis period.

4.0 Left-and Right-turn Lanes

The needs for left- and right-turn lanes were not considered at the Hysham rest areas because the rest areas are accessed by exit ramps from I-94.

5.0 Conclusion

This preliminary traffic technical memorandum recommends an expanded number of commercial vehicle parking spaces at the Hysham rest areas compared to current conditions based on estimated future traffic volumes over a 22-year design period. Recommendations will be considered during upcoming tasks to develop a conceptual layout of the sites. The conceptual

layout will be used to assess the recommended number of parking spaces and restroom stalls to fit within the physical constraints of each site, including consideration of existing right-of-way boundaries, topography, sensitive natural resources, and state-required setbacks from groundwater wells and wastewater systems.

Appendix A

Traffic Data

Montana Department of Transportation
Helena, Montana 59620

Memorandum

To: Kevin Malone, P.E.
Helena Consultant Design Engineer

From: Becky Duke, Supervisor
Traffic Data Collection & Analysis Section

Date: May 19, 2014

Subject: IM 94-2(36)65
Hysham Rest Area
Control No. 8200

Attached is the traffic information requested in a memo dated May 6, 2014. There are no major traffic breaks within the project. Please note that the equivalency factors used to calculate ESAL values are determined using information from our weigh-in-motion sites and reflect a five-year average.

If you have any questions or need further assistance, please contact me at 6122.

CC: Pavement Analysis and Research - Helena
Project File

RAIL TRANSIT AND PLANNING DIVISION
TRAFFIC DATA COLLECTION SECTION
Worksheet for Engineering and Planning Purposes

Project Description: Interstate Flexible
IM 94-2(36)65
Hysham Rest Area
UPN: 8200
I-94: RP 064+0.000 to 065+0.500

DATE: 19-May-14

				*Truck Distribution**	
			5	**3.0 %**	**0.8 %**
2014	AADT= **4,940**	PRESENT	6	**2.5 %**	**0.7 %**
			7	**0.1 %**	**0.0 %**
2016	AADT= **5,140**	LETTING YEAR	8	**20.0 %**	**5.4 %**
2036	AADT= **7,650**	DESIGN YEAR	9	**55.4 %**	**15.1 %**
	DHV= **880**		10	**7.2 %**	**2.0 %**
	D=		11	**0.8 %**	**0.2 %**
	T= **27.3%**		12	**1.8 %**	**0.5 %**
	EAL= **827**		13	**9.1 %**	**2.5 %**
	AGR= **2.0%**				
				100.0 %	27.2 %

2013

AADT*= 4,840

BUS= 0.2% 10

COM= 27.3% 1319
FUT= 2.0%
DHV= 11.50%

Distribution: 2013 Continuous VC
* Count (Site ID: A-31: only January distribution)

* AADTs and Growth Rate: 2013 TYC

Montana Department of Transportation

MDT

Short Term Profile -Volume Only

Hysham

For Year: 2013
Treasure County
Station 2-002
Tech: GEORGE

Location ID: 52-2-2
Functional Class: Principal Arterial - Int - Rur
Traffic Factor Group: RI
I-94, RP 54, 1 mi NE of Big Horn Int

(STPV)

Year	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994
AADT	4,840	4,770	4,670	4,230	4,400	3,990	4,530	3,620	3,650	3,650		3,370	3,720	2,810	2,455	3,000	3,090	3,230	3,490	
Source	A	A	A	A	A	A	A	L	L	L		L	L	L	L	L	L	L	L	

HOURLY FULL DETAIL

Date	Bin	Road	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL
07/24	Volume	E	44	36	26	33	43	84	131	202	235	305	314	251	264	277	313	297	262	260	241	211	169	123	104	84	4,309
07/24	Volume	W	49	46	40	39	34	66	107	140	225	267	268	263	272	263	288	281	283	277	237	193	143	134	103	64	4,082
07/24	Volume	T	93	82	66	72	77	150	238	342	460	572	582	514	536	540	601	578	545	537	478	404	312	257	207	148	8,391

RAW BIN DETAIL

Date	Bin	Road	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL
07/23	Volume	E	N	N	N	N	N	N	N	N	N	N	N	289	249	284	284	290	278	235	241	199	162	129	101	95	2836
07/23	Volume	W	N	N	N	N	N	N	N	N	N	N	N	228	251	238	274	269	271	239	237	194	146	137	99	65	2648
07/24	Volume	E	49	23	26	35	58	97	148	196	252	305	314	251	279	269	341	303	245	285	240	223	175	117	107	72	4410
07/24	Volume	W	45	51	34	51	22	76	110	149	236	267	268	263	293	288	302	292	295	314	236	192	139	130	107	62	4222
07/25	Volume	E	38	49	26	31	28	71	114	208	217	286	N	N	N	N	N	N	N	N	N	N	N	N	N	N	1068
07/25	Volume	W	52	41	45	26	45	55	103	131	214	280	N	N	N	N	N	N	N	N	N	N	N	N	N	N	992

FACTOR USED: 0.577 ACF: 0.736 RI, SDOWF: 0.784 RI

** NOTES-- None*

Source Legend: A (Actual) , E (Estimate) , M (Manually Entered), L (Legacy), C (Unknown)

Printed 5/20/2014 3:27:29 PM

Appendix B

Usage Calculation Spreadsheet

Hysham (East) Rest Area - Peak Daily Door Count

	Description	Variable	Existing (2014) DAY	Existing (2014) NIGHT	Future (2036) DAY	Future (2036) NIGHT	Notes
DATA	Average Annual Daily Traffic	AADT	2,468	2,468	3,816	3,816	Traffic Count Site 52-2-2 Eastbound Volume
	Average Annual Daily Traffic (Trucks)	$AADT_t$	674	674	1,042	1,042	Traffic Count Site 52-2-2 Eastbound Volume
	Average Daily Traffic	ADT	3,428	3,428	5,300	5,300	Traffic Count Site 52-2-2 Hourly Full Detail Eastbound Volume
	Peak Daily Door Count	PDD	1,677	1,677	2,592	2,592	Door Count Data Provided by MDT
	Peak Daily People	PDP	838	838	1,296	1,296	PDP = PDD / 2 (Section 4.5.1 Patron/Door Count Correlation)
	Peak Hour Volume	PHV	250	67	386	103	Traffic Count Site 52-2-2, Seasonally Adjusted Eastbound Volume
	Peak Day Peak Hour People	PHP	61	16	94	25	PHP = PDP * (PHV / ADT)
	Peak Day Peak Hour Vehicles Stopping at Rest Area	PHV_p	41	11	63	17	$PHV_p = PHP_p / UV$
	Percentage of Cars in the Mainline Traffic Stream During Daytime/Nighttime Periods	$D_{c\%}$	72.70%	72.70%	72.70%	72.70%	$D_{c\%} = (AADT - AADT_t) / AADT$
	Percentage of Trucks in the Mainline Traffic Stream During Daytime/Nighttime Periods	$D_{t\%}$	19.11%	54.60%	19.11%	54.60%	Guideline #3 Day = $(AADT_t / AADT) * 0.7$ Night = $(AADT_t / AADT) * 2.0$
	Number of Cars Stopping at Rest Area	D_c	30	8	46	13	$D_c = D_{c\%} * PHV_p$
	Number of Trucks Stopping at Rest Area	D_t	8	6	13	10	$D_t = D_{t\%} * PHV_p$
	Total Vehicles Stopping at Rest Area During Peak Hour (Factored)	D_2	38	14	59	23	$D_2 = D_c + D_t$
	Average Dwell Time for Cars (Minutes)	VHS_c	11	NA	11	NA	Research from Divide (Southbound) Rest Area
	Average Dwell Time for Trucks (Minutes)	VHS_t	38	202	38	202	
	Restroom Users Per Vehicle	UV	1.5	1.5	1.5	1.5	Guideline #9
RECOMMENDED PARKING SPACES	Parking Spaces for Cars (Day Controls)	N_c	6	NA	9	NA	$N_c = (PHV_p * D_{c\%} * VHS_c) / 60$
	Parking Spaces for Trucks (Night Controls)	N_t	NA	21	NA	31	$N_t = (PHV_p * D_{t\%} * VHS_t) / 60$
RECOMMENDED RESTROOM STALLS	Total Restroom Stalls	T	2	NA	3	NA	$T = (UV * D_2) / 30$
	Total Restroom Stalls - Women	T_w	1	NA	2	NA	$T_w = T * 0.6$
	Total Restroom Stalls - Men	T_m	1	NA	1	NA	$T_m = T * 0.4$

[1] Compound Annual Growth Rate = 2.00%

Hysham (West) Rest Area - Peak Daily Door Count							
	Description	Variable	Existing (2014) DAY	Existing (2014) NIGHT	Future (2036) DAY	Future (2036) NIGHT	Notes
DATA	Average Annual Daily Traffic	AADT	2,468	2,468	3,816	3,816	Traffic Count Site 52-2-2 Westbound Volume
	Average Annual Daily Traffic (Trucks)	$AADT_t$	674	674	1,042	1,042	Traffic Count Site 52-2-2 Westbound Volume
	Average Daily Traffic	ADT	3,248	3,248	5,021	5,021	Traffic Count Site 52-2-2 Hourly Full Detail Eastbound Volume
	Peak Daily Door Count	PDD	1,719	1,719	2,657	2,657	Door Count Data Provided by MDT
	Peak Daily People	PDP	859	859	1,329	1,329	PDP = PDD / 2 (Section 4.5.1 Patron/Door Count Correlation)
	Peak Hour Volume	PHV	229	53	354	81	Traffic Count Site 52-2-2, Seasonally Adjusted Eastbound Volume
	Peak Day Peak Hour People	PHP	61	14	94	21	PHP = PDP * (PHV / ADT)
	Peak Day Peak Hour Vehicles Stopping at Rest Area	PHV_p	40	9	62	14	$PHV_p = PHP_p / UV$
	Percentage of Cars in the Mainline Traffic Stream During Daytime/Nighttime Periods	$D_{c\%}$	72.70%	72.70%	72.70%	72.70%	$D_{c\%} = (AADT - AADT_t) / AADT$
	Percentage of Trucks in the Mainline Traffic Stream During Daytime/Nighttime Periods	$D_{t\%}$	19.11%	54.60%	19.11%	54.60%	Guideline #3 Day = $(AADT_t / AADT) * 0.7$ Night = $(AADT_t / AADT) * 2.0$
	Number of Cars Stopping at Rest Area	D_c	30	7	46	11	$D_c = D_{c\%} * PHV_p$
	Number of Trucks Stopping at Rest Area	D_t	8	6	12	8	$D_t = D_{t\%} * PHV_p$
	Total Vehicles Stopping at Rest Area During Peak Hour (Factored)	D_2	38	13	58	19	$D_2 = D_c + D_t$
	Average Dwell Time for Cars (Minutes)	VHS_c	11	NA	11	NA	Research from Divide (Southbound) Rest Area
	Average Dwell Time for Trucks (Minutes)	VHS_t	38	202	38	202	
	Restroom Users Per Vehicle	UV	1.5	1.5	1.5	1.5	Guideline #9
RECOMMENDED PARKING SPACES	Parking Spaces for Cars (Day Controls)	N_c	6	NA	9	NA	$N_c = (PHV_p * D_{c\%} * VHS_c) / 60$
	Parking Spaces for Trucks (Night Controls)	N_t	NA	18	NA	27	$N_t = (PHV_p * D_{t\%} * VHS_t) / 60$
RECOMMENDED RESTROOM STALLS	Total Restroom Stalls	T	2	NA	3	NA	$T = (UV * D_2) / 30$
	Total Restroom Stalls - Women	T_w	1	NA	2	NA	$T_w = T * 0.6$
	Total Restroom Stalls - Men	T_m	1	NA	1	NA	$T_m = T * 0.4$

[1] Compound Annual Growth Rate = 2.00%

APPENDIX E:

Preliminary Hydraulic Memo

DOWL HKM

Address:
2090 Stadium Drive
Bozeman, Montana 59715

Phone: (406) 586-8834 Fax: (406) 586-1730

MEMORANDUM

To: Kevin Malone, PE
MDT Project Manager

From: William Dreyer, PE
DOWL HKM - Project Manager

Date: September 15, 2014

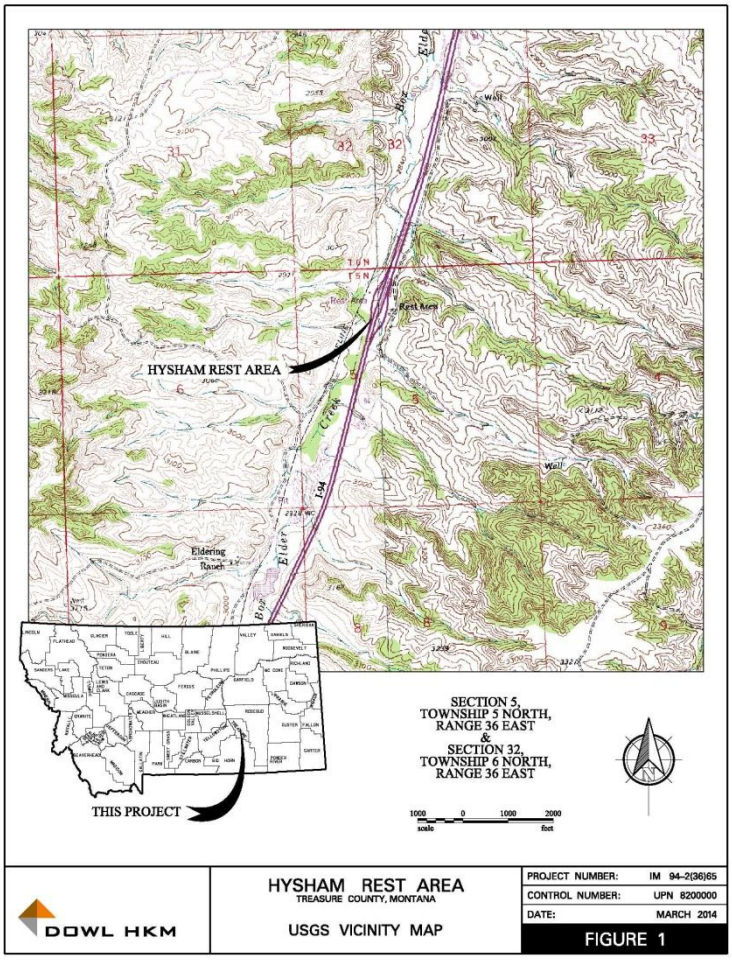
Subject: Hysham Rest Area (IM 94-2(36)65; UPN 8200000)
Preliminary Hydraulics Memo (MDT Activity 170)

INTRODUCTION

This preliminary hydraulics memo was developed in support of Phase I of the Hysham Rest Area project. The Montana Department of Transportation (MDT) is planning to reconstruct the existing Hysham Rest Area on Interstate 94 (I-94), approximately 5 miles south/southwest of Hysham in Treasure County, Montana. As part of the Preliminary Hydraulics evaluation, the memorandum is intended to identify existing hydraulics, and provide initial recommendations for the design of the water and wastewater systems for Hysham's EB and WB rest areas. A detailed hydraulics report will need to be prepared under the Phase II portion of this project. Proposed improvements for Phase I encompass permitting of water and wastewater systems. Phase II improvements are expected to include a full reconstruction of the rest areas, and will be developed by others.

The Hysham Rest Area consists of two separate rest area sites located on each side of Interstate 94 (I-94) in Treasure County, MT. The rest area serving the eastbound (EB) direction of travel and the rest area serving the westbound (WB) direction of travel are both located at reference post (RP) 418.8.

Figure 1. Hysham Vicinity Map



STORM WATER INSPECTION

A visual inspection of the current storm water facilities was performed March, 2014 as well as June 2014. The visual inspection was intended to identify storm water influences in regard to current and future potable water facilities and wastewater facilities. History of standing water was not identified in close proximity to the existing wells and/or the currently proposed wastewater system locations at either site. The eastbound and westbound areas are located toward the bottom of a hill within the Box Elder Creek drainage area. Storm water is currently diverted via culverts to drainage swales located on both sides of the westbound site. One ephemeral drainage was identified adjacent to the project area and outside of the area proposed for disturbance. Both drainages were sparsely wooded.

A drainage swale (Photo 1) located off of the off ramp on the eastbound rest area drains a portion of the eastbound rest area. Intermittent pools of standing water and wetland vegetation were observed within the bottom of the swale, but continuous flow was absent during the investigation.

A portion of the eastbound drainage area (Photo 2) drains the southwest portion of the rest area. A defined drainage swale was observed, but flow was absent during the time of the investigation.

Photo 1. Looking southwest of the eastbound rest area (drainage swale)

Photo 2. Looking northeast of the eastbound rest area (drainage swale)

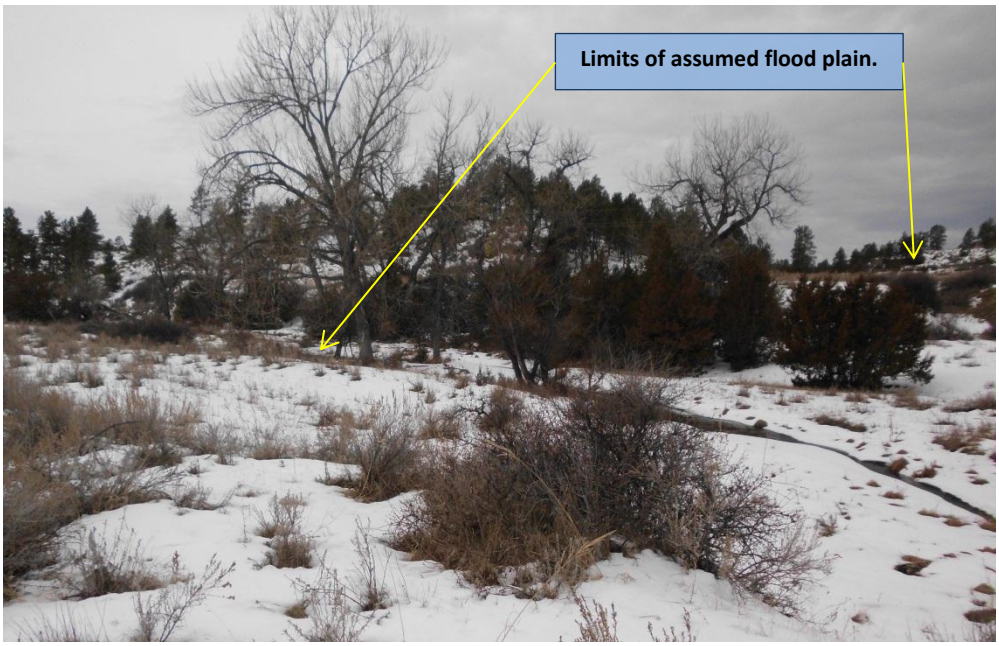
Photo 3. Drainage Culvert looking north on eastbound rest area

The Phase II site design will need to identify changes, if any, to the site drainage, and provide adequate drainage around the water and wastewater facilities.

The proposed wastewater system sites will be located on gently sloping Cretaceous Age deposits and will be in an area with approximately 2% to 3% slope (see Drainage Plan).

Flooding risk from Box Elder Creek was assessed from published FEMA maps and visual verifications of channel characteristics, vegetation growth and bank elevation. As seen in Figures 2 and 3, the project site is located outside of the FEMA-designated 100-year flood plain. The proposed wastewater system site is located approximately 520 feet southwest of the potential floodplain boundary of Box Elder Creek. The proposed wastewater system is located in areas above any potential flooding inundation.

Photo 4. View of Box Elder Creek bordering westbound rest area, looking southwest.



The proposed drainfield areas are located such that storm water and spring melt runoff should not pose any flooding risk to the drainfield. As a precaution, a Phase II drainage plan should be designed to divert any storm water and spring melt runoff away from the proposed drainfield.

Figure 2: FEMA Flood Map Index

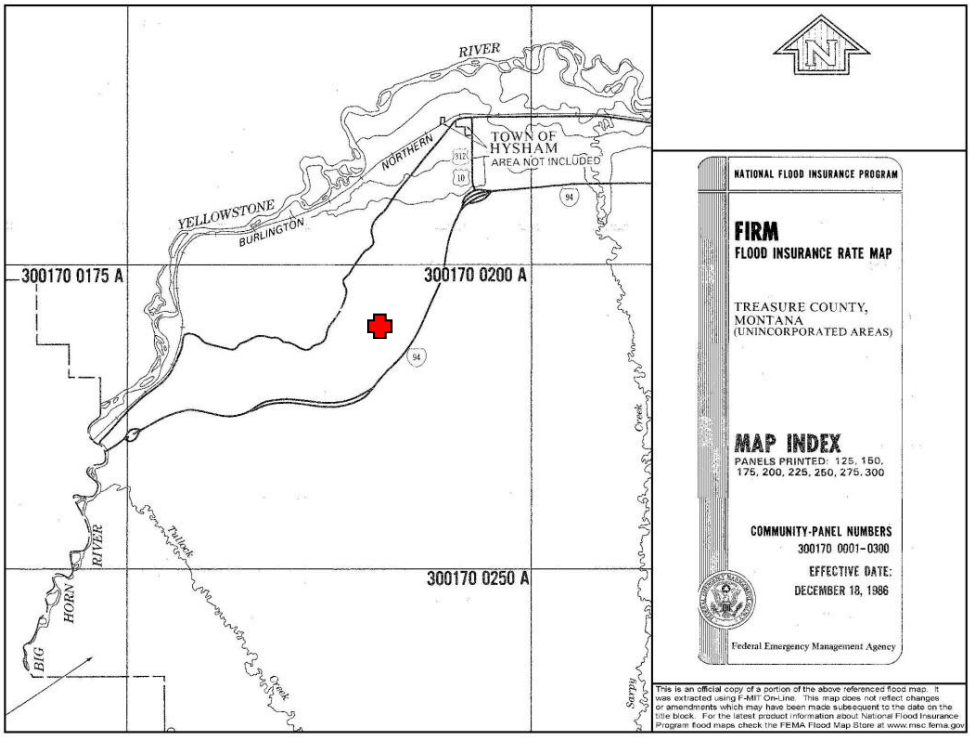
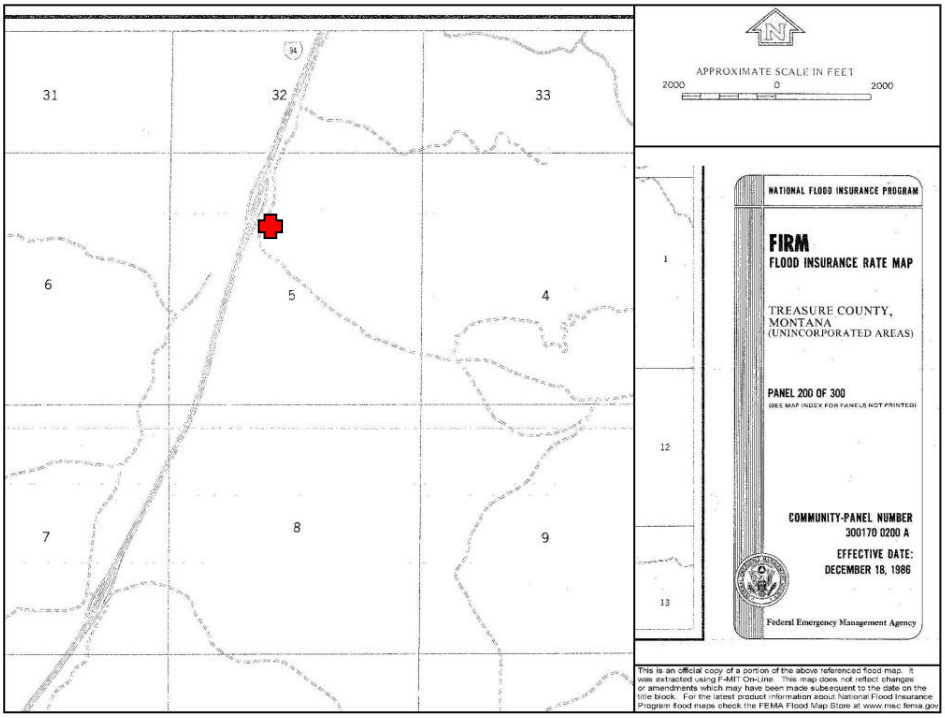


Figure 3: FEMA Flood Map



STORM WATER MANAGEMENT

Storm water run-off from the area around the drainfield can be diverted via sheet flow, or can be channelized to low areas that will be developed through the Phase II site grading design. The Phase II design of the rest area may incorporate retention/detention ponds to control the quantity of site runoff as well as providing water quality treatment, should proper separation from the water and wastewater systems be maintained. Consideration should also be given to the need of an oil-water separator in final design for collection and treatment of accidental spills from the parking areas, prior to discharge into the retention area. Final design of these storm water controls can be developed under Phase II design efforts.

CONCLUSION:

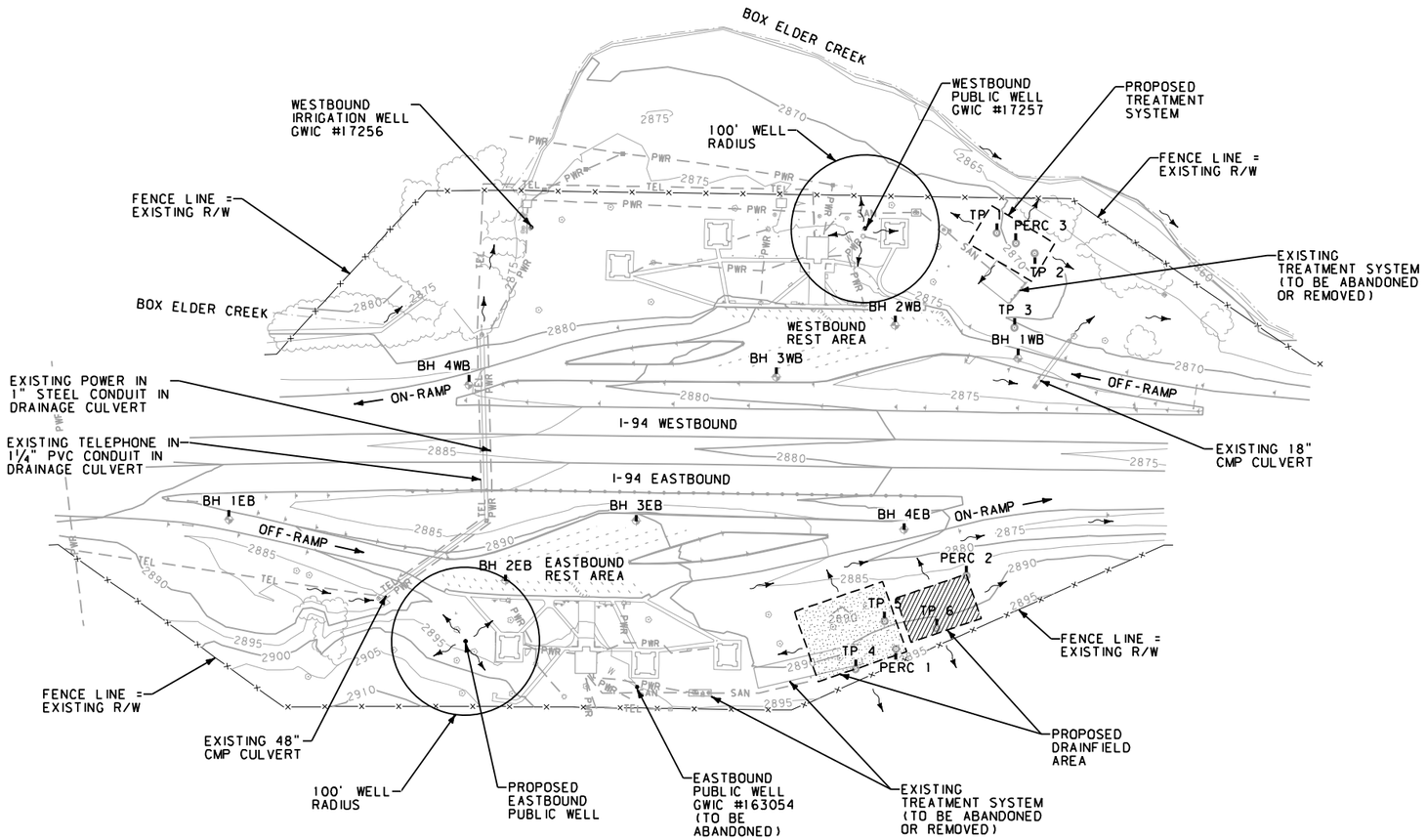
The Hysham Rest Area sites are located beyond the estimated floodplain of Box Elder Creek. The existing drinking water wells and proposed wastewater areas are located such that existing drainage patterns for storm water and snowmelt runoff should not pose a flooding risk. The final grading and drainage plan developed under Phase II can be designed to divert any storm water and snowmelt runoff away from the proposed water and wastewater systems. The final rest area design should take into account the calculated runoff from the final site layout and incorporate storm water runoff quantity and quality control measures in accordance with MDT Hydraulics Design criteria. Storm water control measures will similarly need to be designed for the entirety of the rest area reconstruction.

APPENDIX A

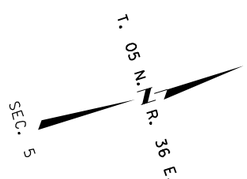
STORM WATER MANAGEMENT PLAN

DOWL HKM

(VACANT LAND)



(VACANT LAND)



LEGEND

- PROPOSED 100% REPLACEMENT AREA
- PROPOSED PRIMARY DRAINFIELD
- FLOW ARROW
- PERC TEST (PERC #)
- TEST PIT (TP #)
- BORE HOLE (BH #)

NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.
3. PROPOSED FACILITIES ARE APPROXIMATE.

STORM WATER PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\STORM WATER PLAN.DGN	DESIGNED BY	T BECKEN-GADDO	9/16/2014	STORM WATER PLAN	HYSHAM REST AREA - MONTANA / IM 94-2(36)65
		9/17/2014	REVIEWED BY	B DREYER	9/16/2014		
1		3:47:27 PM ABeckengadd	CHECKED BY	B DREYER	9/16/2014	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 1 OF 1

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX F:

Biological Resource Report

DOWL

DRAFT
Biological Resources Report

MDT Activity 182

Hysham Rest Area
IM 94-2(36)65
UPN 8200000

Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION
2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Prepared by:

DOWL HKM
1300 Cedar Street
Helena, Montana 59601

October 2, 2014

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EXECUTIVE SUMMARY

The Montana Department of Transportation (MDT) is planning to reconstruct the existing Hysham Rest Area on Interstate 94 (I-94), approximately 5 miles south/southwest of Hysham in Treasure County, Montana. As part of the environmental review process, this Biological Resources Report evaluates the project's potential impacts on terrestrial and aquatic plant and animal species, wetlands and non-wetland waterways (aquatic resources), state species of concern, and threatened or endangered species.

This project would have no effect on federally-listed species, state species of concern, or state special status species. No wetlands or other aquatic resources were identified within the project area.

1.0 INTRODUCTION

This Biological Resources Report (BRR) has been prepared as part of the environmental review process for the I-94 Hysham rest area reconstruction project in Treasure County, Montana. This report identifies biological resources, state species of concern, threatened and endangered species, wetlands, and other aquatic resources found within the project area, and includes a preliminary assessment of potential impacts to these resources as a result of the proposed project. Potential issues were identified through a field survey of the project area, a review of available literature, and professional opinion.

PROJECT DESCRIPTION

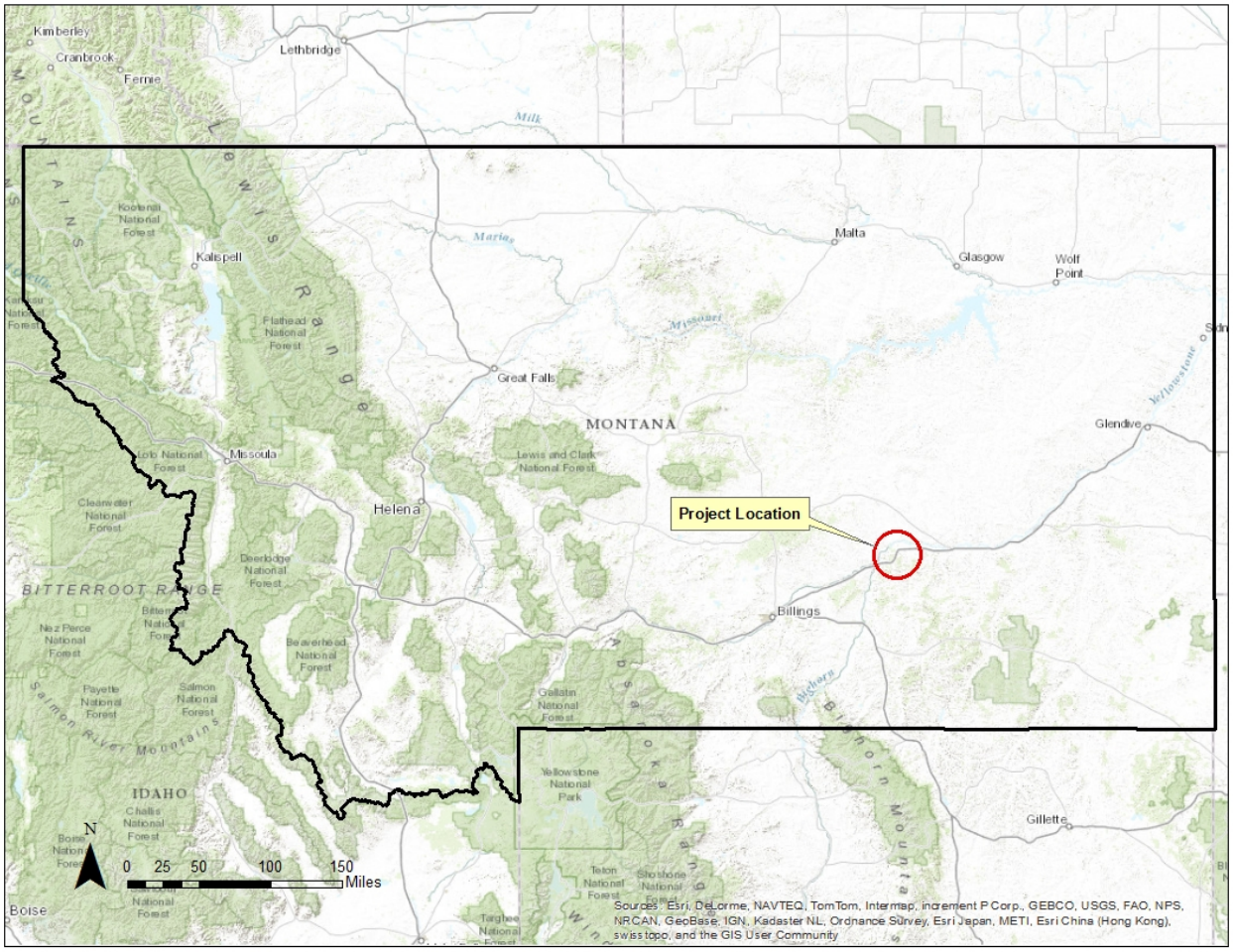
MDT intends to reconstruct the eastbound and westbound Hysham rest areas on I-94 at approximate reference post (RP) 65 (Figure 1). The project area is located approximately 5 miles south/southwest of Hysham in Treasure County within Section 5, Township 5 North, Range 36 East. The project limits will include the eastbound and the westbound rest areas, entrance and exit ramps, and a portion of I-94 approaching and departing the rest areas. Precise project limits will be determined during the design phase of the project, but are expected to remain within the existing MDT right-of-way.

The purpose of the project is to reconstruct the existing rest areas to meet current and future demand based on anticipated usage. Wastewater systems with increased capacity and improved treatment capabilities, expanded car and truck parking spaces, and expanded restroom facilities may be needed to accommodate future demand.

Phase I of the project will include preliminary design and conditional permitting for anticipated improvements to the water and wastewater systems to be used during subsequent design and construction phases (Phase II). Phase I will also include preparation of environmental compliance documentation. At this time, Phase II improvements are expected to be developed through a design-build project.

The majority of the project area was previously disturbed for construction of the existing Hysham rest areas. Reconstruction of the eastbound and westbound rest areas is anticipated to remain within previously-disturbed areas within the existing rights-of-way.

Figure 1. Project location

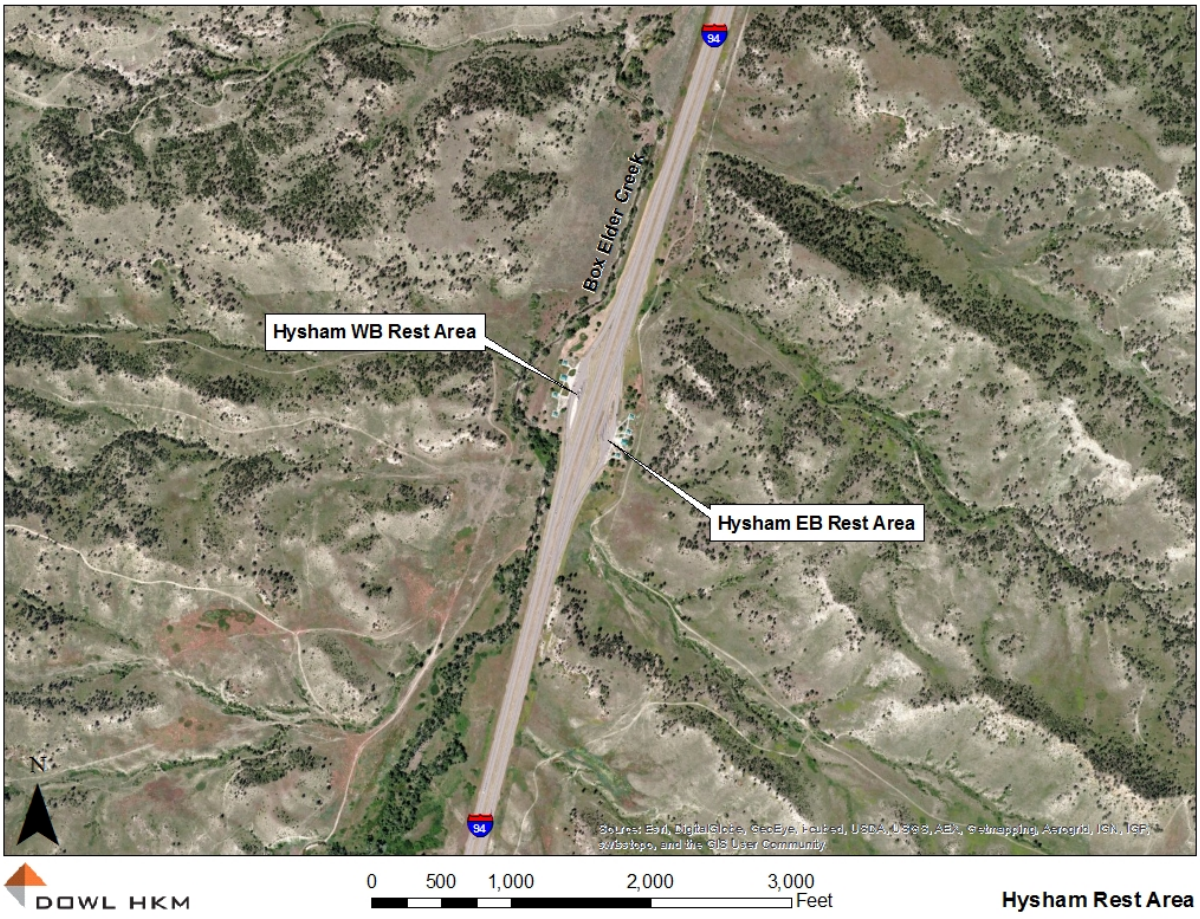


GENERAL AREA DESCRIPTION

The Yellowstone River generally parallels I-94 at this location and its floodplain is approximately 2.6 miles north of the existing westbound rest area (Figure 2). The eastbound and westbound rest areas are located in the foothills above the Yellowstone River valley.

The project's elevation is approximately 2,880 feet above mean sea level. Land adjacent to the project area consists of privately-owned undeveloped grasslands and shrub lands. Box Elder Creek generally parallels the westbound rest area right-of-way. The town of Hysham is located approximately 2.7 miles north/northeast of the site within the greater Yellowstone River valley.

Figure 2. Project vicinity



2.0 GENERAL STUDY METHODS

AGENCY COORDINATION

It was determined by MDT that agency coordination would not be required based on the scope and nature of the project.

LITERATURE/DATABASE SEARCHES

A review of the most current United States Fish and Wildlife Service (USFWS) species list for Treasure County, Montana (USFWS, 2014), the Montana Natural Heritage Program (MTNHP) online database (MTNHP, 2014), the Montana Fish, Wildlife and Parks (MFWP) 2012 Bald Eagle data, and the Montana Natural Resources Information System (NRIS, 2014) was conducted to determine which species, or suitable habitat, might be present in the project area. Appendices A, B, and C provide complete lists of findings. In addition, aerial maps, United States Geological

Survey (USGS) topographical maps, Natural Resource Conservation Service (NRCS) soils maps, USFWS National Wetland Inventory (NWI) maps, and the State of Montana Cadastral Map were also reviewed for information on the project area.

FIELD SURVEYS

An on-site survey of the project area was conducted on June 2, 2014, by Will Trimbath, DOWL HKM. The survey included both eastbound and westbound rest areas and entrance and exit ramps (Photos 1 and 2). The survey was primarily conducted to identify potential wetlands and other aquatic resources within the project area. Aquatic features found just outside of the survey area were noted during the field visit. A formal wetland and stream delineation was not performed as no such features were present in the project area. During the effort, a general survey for wildlife and plant communities was also conducted.

Photo 1. View of eastbound I-94 Hysham rest area, looking south

Photo 2. View of westbound Hysham I-94 rest area, looking southeast.

3.0 TERRESTRIAL RESOURCES

METHODS

In addition to the field survey conducted in June 2014, the MTNHP and NRIS online databases were researched for information on the natural setting of the area (MTNHP, 2014 and NRIS, 2014). Aerial maps, USGS topographic maps, and published resource maps were also reviewed.

RESULTS

Ecological Setting and General Description

The project area is within the Northwestern Great Plains (Level III) and Pine Scoria Hills (Level IV) Ecoregions. The Pine Scoria Hills ecoregion is classified as unglaciated, rugged, broken land with stony, rough hills, where precipitation ranges from 12 to 19 inches per year (EPA, 2012).

Land cover within the project area primarily consists of Human Land Use – Developed, Interstate. This land cover includes the National Highway System (NHS), limited access highways, and their shoulders and rights-of-way (NRIS, 2014).

The majority of the project area has been disturbed for construction of the Hysham rest areas (Photos 1 and 2). Reconstruction of the eastbound and westbound rest areas is anticipated to occur within previously-disturbed areas, and not require any additional earth disturbance.

General Vegetation

Baseline Conditions

The majority of the upland area surrounding the project area has been disturbed by agricultural/grazing practices and sporadic residential development. The project area predominantly consists of maintained lawn areas and grasslands which are occasionally mowed. Dominant vegetation observed during the June 2, 2014, survey is provided in Table 1.

Table 1. Vegetation observed within the project area

Common Name	Scientific Name
Big sagebrush	*Artemisia tridentata*
Cheatgrass**	*Bromus tectorum*
Common dandelion*	*Taraxacum officinale*
Crested wheatgrass*	*Agropyron cristatum*
Plains cottonwood	*Populus deltoides*
Goldenrod sp.	*Solidago sp.*
Rocky Mountain juniper	*Juniperus scopulorum*
Russian olive**	*Elaeagnus angustifolia*
Showy milkweed	*Asclepias speciosa*
Smooth brome*	*Bromus inermis*
Timothy*	*Phleum pratense*
Woods' rose	*Rosa woodsii*

Source: DOWL HKM Field Visit, 2014. **regulated plant *introduced

Potential Impacts

Project construction limits have not been finalized for this project; however, vegetation impacts should be limited as the majority of work is anticipated to be performed within previously-disturbed areas within the existing rights-of-way. Some vegetation may be disturbed from construction access and staging.

Avoidance and Minimization

Only previously-disturbed areas will be permanently affected by this project, therefore, avoidance and minimization measures are not necessary.

Recommended Conservation Measures

Best Management Practices (BMPs) should be used to limit ground disturbance and minimize vegetation removal, control erosion, and re-vegetate disturbed areas within the project limits as soon as construction is complete.

- Mature trees and shrubs should be preserved where feasible.
- Topsoil should be segregated and utilized during restoration efforts.
- Areas will receive topsoil and seeding according to MDT standard specifications and recommendations of the MDT Reclamation Specialist.

Noxious Weeds/Invasive Species

Species Present and Distribution

Several noxious weeds/invasive species occur in Treasure County including but not limited to spotted knapweed, Canada thistle, St. John's-wort, as well as two regulated species: cheatgrass and Russian olive.

General Description and Degree of Infestation

Based on observations during the DOWL HKM June 2014 field review and observations from the Treasure County Weed District, the predominant occurrence of noxious and invasive species occurs in areas outside of those routinely mowed and maintained for the rest area facilities, entrance and exit ramps, and I-94.

Recommended Conservation Measures

All disturbed soils not landscaped or otherwise permanently stabilized by construction should be seeded using a seed mix approved by MDT appropriate to the project vicinity to discourage rapid colonization by noxious and invasive species. Machinery and equipment should be cleaned prior to entering the project site.

General Wildlife Species

Species Description and Distribution

Wildlife habitats in and adjacent to the project area consist of roadside ditches, shrubland, grazing pastures, landscaping, and a riparian corridor along Box Elder Creek. A search of the MTNHP database was conducted to identify species occurrences in the project vicinity and can be found in Appendix A. Most of the species on the list can be found in grass, shrub, or tree habitats and have the potential to occur in the project area. Those species with specific aquatic habitat elements are unlikely to be present. Field survey during the site resulted in observation of two bird species: American Robin (*Turdus migratorius*) and Western Meadowlark (*Sturnella neglecta*).

Potential Impacts

Due to the scope of the project, impacts to wildlife from reconstruction of the Hysham eastbound and westbound rest areas resulting from loss of some habitat within the construction zone due to clearing for construction activities will likely be minor. Although construction will largely be limited to the existing rest area footprint, minor temporary impacts may occur from construction staging and access activities. Temporary impacts to individuals may also result from activities associated with construction such as noise, vibration, human activity, and construction equipment movement.

Avoidance and Minimization

Disturbance of wildlife habitat will be avoided and minimized by limiting construction activities to areas within the existing rest areas. Disturbed areas will be re-vegetated as soon as practicable following construction using a seeding mixture approved by MDT.

Recommended Conservation Measures

MDT Standard Specifications for Road and Bridge Construction (2014) effectively address the protection of environmental resources.

The following recommended measures are in addition to the Standard Specifications.

- In order to comply with the Migratory Bird Treaty Act, all trees and shrubs existing within the construction limits and affected by construction, will be removed outside of the nesting season between the dates of August 16 to April 15. Special Provision 107-25C (Migratory Bird Treaty Act Compliance – Vegetation) will be added to the contract plans for this project (see Appendix D). Any active nests discovered during construction must not be removed or otherwise impacted.
- Minimize vegetation removal.
- Preserve mature trees and shrubs where feasible.
- Restore with a combination of desirable and native vegetation and landscape components where possible.

4.0 AQUATIC RESOURCES

METHODS

Prior to the field visit, the project area was researched for the potential presence of aquatic sites. Various mapping resources were used, including the USFWS NWI maps, USGS topographic quad maps, aerial photographs, and NRCS soils maps. The MFISH database was not reviewed due to the absence of waterways within the project area.

During the site visit conducted June 2, 2014, the project area was investigated for wetlands and other aquatic resources according to the United States Army Corps of Engineers (USACE) wetland delineation manual (USACE, 1987), the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0) (USACE, 2010), and USACE Regulatory Guidance Letter No. 05-05: Ordinary High Water Mark Identification (USACE, 2005).

RESULTS

No wetlands or other aquatic resources were identified within the project area where ground-disturbing project improvements will likely take place.

Aquatic Sites

Site Description

A review of the USFWS NWI database did not identify any wetlands or other aquatic resources within the project area; this was supported during the June 2014 field review. No wetlands or other aquatic resources were identified within the project area where ground-disturbing project activities will likely take place.

One stream, Box Elder Creek (Photo 3), generally parallels the westbound rest area site and its floodplain is located adjacent to the site's current right-of-way. Box Elder Creek is a small perennial stream that drains into the Yellowstone River. No impacts are anticipated to this stream as it is located outside of the right-of-way limits, and will not be impacted from ground-disturbing project activities.

A review of the USFWS NWI database did not identify any wetlands or other aquatic resources within the project area. One small wetland was located on the NWI map along Box Elder Creek, bordering the westbound rest area. However Box Elder Creek and any associated riparian wetlands are not within the westbound Hysham rest area, and will be avoided during the reconstruction project. Additionally, there were no wetlands or other aquatic resources identified within the project area during the June 2014 field review.

Photo 3. View of Box Elder Creek bordering westbound rest area, looking west.

Potential Impacts

There are no potential impacts to wetlands or other aquatic resources from this project.

Avoidance and Minimization

Wetlands, streams, or any other aquatic resources identified outside of the project area will be avoided during the design process and will not be disturbed.

Recommended Conservation Measures

No conservation measures are recommended as no wetlands or other aquatic resources were identified in the project area.

Permitting Required

No permits will be required for impacts to wetlands, streams, or any other aquatic resource, as none are present within the project area. Depending on the project design, construction storm water permits may be required.

General Aquatic Species

Species Description and Distribution

No waterways exist within the project area, so no aquatic species are present.

Habitat Requirements

Habitat requirements were not assessed due to the absence of aquatic habitat.

Potential to Occur in Project Area

There is no potential for aquatic species to occur within the project area due to a lack of habitat.

Potential Impacts

No direct impacts to aquatic species are anticipated due to a lack of habitat.

Avoidance and Minimization

BMPs will be installed to limit ground disturbance and minimize vegetation removal, control erosion, and re-vegetate disturbed areas within the project limits as soon as construction is complete, as timing will allow. Measures will also be taken to prevent construction materials, sediment, and spills from entering receiving waterways during construction of project improvements.

Recommended Conservation Measures

MDT Standard Specifications for Road and Bridge Construction (2014) effectively address resources including air, water, and noise pollution concerns as defined by state, local, and federal laws and regulations. In order to minimize impacts to waters downstream of the project area, conservation measures outlined in these specifications should be strictly followed.

5.0 SPECIES OF CONCERN AND SPECIAL STATUS SPECIES

METHODS

A data request was submitted to MTNHP to determine if any Species of Concern may be present in or near the project area.

RESULTS

One bird species, the Great Blue Heron, was identified in the Species of Concern report provided by MTNHP (Appendix B, MTNHP, 2014). This species, its conservation status, habitat requirements, habitat requirements, and potential to occur in the project area are outlined below in Table 2.

Table 2. State Species of Concern within the project vicinity

Common Name *Scientific Name*	Status*	Last Observed in Project Vicinity	Habitat Requirements	Potential to Occur in Project Area
Great Blue Heron, *Ardea herodias*	S3, G5	2008	Requires aquatic sites and can be found from urban wetlands to wilderness settings. Most Montana nesting colonies are in cottonwoods along major rivers and lakes, with a smaller number occurring in riparian ponderosa pines and on islands in prairie wetlands.	Unlikely to occur within project area due to a lack of suitable habitat.

Source: MTNHP, 2014 and Montana Field Guide (fieldguide.mt.gov)
*Key to rankings: G=Global rank based on range-wide status, S=State rank based on status in Montana, B=Breeding, and M=Migratory; S3 or G3: Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas; S5 or G5: Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.

Bald and Golden Eagles are protected under the Bald and Golden Eagle Act of 1940 and receive special state status. As indicated by MDT, no Bald or Golden Eagle nests have been documented within a four-mile radius of the project area (MNHP, 2012). During the June 2014 field visit, no Bald or Golden Eagle nests or individual birds were observed within or adjacent to the project area.

Potential Impacts

Due to the lack of suitable habitat, the proposed project will have no direct or indirect impact on Species of Concern.

As previously noted, the extent of impacts to wildlife habitat will be minimal due to the scope of the reconstruction project. Wildlife habitats, state Species of Concern, and state special status species are highly unlikely to be permanently impacted by the project.

Avoidance and Minimization

No avoidance or minimization of activities is proposed as no state Species of Concern have been documented or are anticipated in the project area.

Recommended Conservation Measures

No conservation measures are recommended for state Species of Concern as none have been documented or are anticipated in the project area.

6.0 THREATENED AND ENDANGERED SPECIES

INTRODUCTION

The federal list of threatened and endangered species is maintained by the USFWS. Species on this list receive protection under the Endangered Species Act (ESA). An Endangered species is in danger of extinction throughout all or a significant portion of its range. A Threatened species is likely to become endangered in the foreseeable future. The USFWS also maintains a list of species that are candidates or proposed for possible addition to the federal list.

METHODS

To determine which federally-listed species may occur in the project vicinity, the USFWS list of species for Treasure County and the MTNHP database for threatened or endangered species were reviewed for occurrences using a three-mile buffer around the project area (MTNHP 2014).

RESULTS

Table 3 presents federally-listed endangered, threatened, proposed, and candidate species in Treasure County (Appendix C, USFWS, 2014), along with their preferred habitat and the potential for each species to be found in the project area.

Table 3. Federally Listed Endangered, Threatened, Proposed, and Candidate Species Potentially Occurring in Treasure County, Montana

Common Name, *Scientific Name*	USFWS Status	Habitat Requirements	Potential to Occur in Project Area
Black-footed Ferret, *Mustela nigripes*	Endangered	Critical habitat requirement is prairie dog colonies.	Highly unlikely due to lack of suitable habitat. No prairie dog colonies exist within the rest area.
Greater Sage-G rouse, *Centrocercus urophasianus*	Candidate	Sagebrush is the preferred habitat. Uses 6- to 18-inch high sagebrush covered benches in June to July; moves to alfalfa fields or greasewood bottoms when forbs on the benches dry out; and moves back to sagebrush in late August to early September.	Unlikely due to lack of suitable habitat. The project area is disturbed, and lacks abundant native high-density sagebrush vegetation.

Common Name, *Scientific Name*	USFWS Status	Habitat Requirements	Potential to Occur in Project Area
Sprague's Pipit, *Anthus spragueii*	Candidate	A ground nester that prefers native, medium- to intermediate-height prairie, and in a short-grass prairie landscape, can often be found in areas with taller grasses. The Sprague's pipit is significantly more abundant in native prairie than in exotic vegetation and has been shown to be area sensitive, requiring relatively large areas of appropriate habitat. Also known to utilize and breed in alkaline meadows and around the edges of alkaline lakes.	Unlikely due to lack of suitable habitat. The project area is highly disturbed.

Source: USFWS, 2014

Potential Impacts

This project, as proposed on this date, is expected to have ***No Effect*** on federally-listed Endangered or Threatened species and ***Is Not Likely to Jeopardize the Continued Existence*** of federal Proposed or Candidate species as these species are not documented in the project area, are not likely to occur in the project area, and the project area does not contain critical or suitable habitat.

Avoidance and Minimization

No impacts are anticipated as a result of the proposed project.

Recommended Conservation Measures

No conservation measures are recommended for federally-listed endangered, threatened, proposed, and candidate species as none have been documented nor are likely to occur in the project area.

7.0 WETLANDS

INTRODUCTION

The USACE administers Section 404 of the Clean Water Act, which regulates the discharge of fill into waters of the United States and associated wetlands subject to USACE jurisdiction. The USACE defines wetlands as those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The USACE and EPA determine which wetlands are jurisdictional; all impacts to jurisdictional waters of the United States are regulated.

METHODS

Aerial photos, USGS topographical maps, NRCS soils maps, and the USFWS National Wetland Inventory maps were reviewed to determine potential locations for wetlands within the project area.

During the June 2, 2014, site visit, wetland determinations were conducted following the Routine Method described in the USACE wetland delineation manual (USACE, 1987), and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region (Version 2.0) (USACE, 2010).

RESULTS

Description of Delineated Wetlands

No wetlands were identified within the project area.

Wetland Delineation and Functional Assessment Classification

No wetlands were identified within the project area, therefore, no wetland delineation and functional assessment classifications were conducted.

Potential Wetland Impacts

No wetlands were identified within the project area; therefore, no impacts to wetlands are anticipated.

Avoidance and Minimization

No avoidance and minimization measures are anticipated.

Proposed Wetland and Stream Mitigation

No wetland or stream mitigation is anticipated for this project.

Recommended Conservation Measures

No conservation measures for wetlands are recommended as no wetlands were identified within the project area.

8.0 REFERENCES

EPA. 2012. Environmental Protection Agency Ecoregions of the Continental United States. Accessed July 30, 2014. ftp://ftp.epa.gov/wed/ecoregions/mt/mt_back_2.pdf

MDT. 2014. Montana Department of Transportation Standard Specifications for Road and Bridge Construction. 2014 Edition.

MFWP. 2012. Fish Wildlife and Park 2012 Bald Eagle Nesting Data provided to MDT.

MTNHP. 2014. Montana Natural Heritage Program Map Viewer. Observations Report. Accessed on July 30, 2014. http://mtnhp.org/MapViewer/.

MTNHP. 2014. Montana Natural Heritage Program Map Viewer. Land Cover Type. Accessed July 28, 2014. http://mtnhp.org/MapViewer/.

MTNHP. 2014. Montana Natural Heritage Program. Montana Field Guide. Accessed August 1, 2014. http://fieldguide.mt.gov/

MT Cadastral. 2014. Montana Cadastral Map. Accessed August 1, 2014. http://svc.mt.gov/msl/mtcadastral/

NRIS. 2014. Montana Natural Resource Information System. Accessed July 28, 2014. http://nris.mt.gov/

USACE. 1987. *Corps of Engineers Wetland Delineation Manual.* Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

USACE. 2005. RGL 05-05: Regulatory Guidance Letter on Ordinary High Water mark Identification. Issued December 7, 2005.

USACE. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Great Plains Region*. Engineer Research and Development Center.

USFWS. 2014. US Fish and Wildlife Service Ecological Services Montana Field Office. Endangered, Threatened, Proposed, and Candidate Species for Montana Counties. Accessed July 16, 2014.

USFWS. 2014. National Wetland Inventory Maps. http://www.fws.gov/wetlands/Data/Mapper.html. Accessed July 31, 2014.

APPENDIX A

WILDLIFE SPECIES DOCUMENTED IN PROJECT VICINITY

Common Name	Scientific Name	Observed During Site Visit
Mammals		
Coyote	*Canis latrans*	-
Striped skunk	*Mephitis mephitis*	-
Bobcat	*Lynx rufus*	-
Birds		
Western grebe	*Aechmophorus occidentalis*	-
Great blue heron	*Ardea herodias*	-
Canada goose	*Branta canadensis*	-
Green-winged teal	*Anas crecca*	-
Mallard	*Anas platyrhynchos*	-
Northern pintail	*Anas acuta*	-
Northern shoveler	*Anas clypeata*	-
Gadwall	*Anas strepera*	-
Common merganser	*Mergus merganser*	-
Turkey vulture	*Cathartes aura*	-
Osprey	*Pandion haliaetus*	-
Swainson's hawk	*Buteo swainsoni*	-
Red-tailed hawk	*Buteo jamaicensis*	-
Killdeer	*Charadrius vociferus*	-
Solitary sandpiper	*Tringa solitaria*	-
Wilson's phalarope	*Phalaropus tricolor*	-
Rock pigeon	*Columba livia*	-
Eurasian collared-dove	*Streptopelia decaocto*	-
Mourning dove	*Zenaida macroura*	-
Eastern screech-owl	*Megascops asio*	-
Common nighthawk	*Chordeiles minor*	-
White-throated swift	*Aeronautes saxatalis*	-
Belted kingfisher	*Megaceryle alcyon*	-
Downy woodpecker	*Picoides pubescens*	-
Northern flicker	*Colaptes auratus*	-
Western wood-pewee	*Contopus sordidulus*	-
Western kingbird	*Tyrannus verticalis*	-
Eastern kingbird	*Tyrannus tyrannus*	-
Horned lark	*Eremophila alpestris*	-
Violet-green swallow	*Tachycineta thalassina*	-
Western meadowlark	*Sturnella neglecta*	Yes - heard
Cliff swallow	*Petrochelidon pyrrhonota*	-
Barn swallow	*Hirundo rustica*	-
American crow	*Corvus brachyrhynchos*	-

Common raven	*Corvus corax*	-
Black-capped chickadee	*Poecile atricapillus*	-
Rock wren	*Salpinctes obsoletus*	-
House wren	*Troglodytes aedon*	-
American robin	*Turdus migratorius*	Yes - observed
Warbling vireo	*Vireo gilvus*	-
Yellow warbler	*Setophaga petechia*	-
Lazuli bunting	*Passerina amoena*	-
Spotted towhee	*Pipilo maculatus*	-
Lark sparrow	*Chondestes grammacus*	-
Lark bunting	*Calamospiza melanocorys*	-
Song sparrow	*Melospiza melodia*	-
Red-winged blackbird	*Agelaius phoeniceus*	-
Bullock's oriole	*Icterus bullockii*	-
American goldfinch	*Spinus tristis*	-
Reptiles		
Gophersnake	*Pituophis catenifer*	-

Source: MNHP, 2014, and DOWL HKM Field Visit, 2014.

APPENDIX B

MONTANA SPECIES OF CONCERN IN PROJECT VICINITY

Natural Resource Information System
Montana State Library
PO Box 201800
Helena, MT 59620-1800
(406)444-3009 mtnhp@mt.gov

Species of Concern Data Report

Visit http://mtnhp.org for additional information.

Report Date:
Wednesday, May 7, 2014

Ardea herodias

View Species in MT Field Guide

Common Name: Great Blue Heron

General Habitat: Riparian forest

Description: Birds

Mapping Delineation:

Confirmed nesting area buffered by a minimum distance of 6,500 meters in order to be conservative about encompassing the areas commonly used for foraging near the breeding colony and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters.

Species Status

Click Status for Explanations

Natural Heritage Ranks:

State: S3
Global: G5

FWP CFWCS Tier: 3

MT PIF Code:

Federal Agency Status:

U.S. Fish & Wildlife Service:
U.S. Forest Service:
U.S. Bureau of Land Management:

Species Occurrences

Species Occurence Map Label: 10017762

First Observation Date:	1975-02-16	**SO Number:**	587
Last Observation Date:	1976-05-03	**Acreage:**	32,633

Species Occurence Map Label: 10017745

First Observation Date:	1976-05-03	**SO Number:**	120
Last Observation Date:	1976-05-03	**Acreage:**	32,633

Species Occurence Map Label: 10017755

First Observation Date:	1988-04-28	**SO Number:**	201
Last Observation Date:	1988-07-28	**Acreage:**	32,633

Species Occurence Map Label: 10017765

First Observation Date:	1988-04-28	**SO Number:**	202
Last Observation Date:	1988-07-28	**Acreage:**	32,633

Species Occurence Map Label: 10017751

First Observation Date:	2008-04-08	**SO Number:**	411
Last Observation Date:	2008-04-08	**Acreage:**	32,633

Species Occurence Map Label: 10017756

First Observation Date:	2008-04-08	**SO Number:**	412
Last Observation Date:	2008-04-08	**Acreage:**	32,633

Natural Resource Information System
Montana State Library
PO Box 201800
Helena, MT 59620-1800
(406)444-3009 mtnhp@mt.gov

Species of Concern Data Report

Visit http://mtnhp.org for additional information.

Report Date:
Wednesday, May 7, 2014

Species Occurrences

Species Occurence Map Label: 10017764

First Observation Date:	2008-04-08	**SO Number:**	413
Last Observation Date:	2008-04-08	**Acreage:**	32,633

Species Occurence Map Label: 10017761

First Observation Date:	2008-04-08	**SO Number:**	414
Last Observation Date:	2008-04-08	**Acreage:**	32,633

APPENDIX C

US FISH AND WILDLIFE SPECIES LIST FOR TREASURE COUNTY, MONTANA

U.S. Fish and Wildlife Service

Trust Resources List

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

Montana Ecological Services Field Office
585 SHEPARD WAY, SUITE 1
HELENA, MT 59601
(406) 449-5225

Project Name:

Hysham Rest Areas

Project Counties:

Treasure, MT

Project Type:

Transportation

Endangered Species Act Species List (USFWS Endangered Species Program).

There are a total of **3** threatened, endangered, or candidate species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fishes may appear on the species list because a project could cause downstream effects on the species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section below for critical habitat that lies within your project area. Please contact the designated FWS office if you have questions.

Species that should be considered in an effects analysis for your project:

Birds	Status		Has Critical Habitat	Contact

Trust Resources List

Greater sage-grouse (*Centrocercus urophasianus*) Population: entire	Candidate	species info		Montana Ecological Services Field Office
Sprague's Pipit (*Anthus spragueii*)	Candidate	species info		Montana Ecological Services Field Office
Mammals				
Black-Footed ferret (*Mustela nigripes*) Population: entire population, except where EXPN	Endangered	species info		Montana Ecological Services Field Office

Critical habitats within your project area:

There are no critical habitats within your project area.

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There is **1** refuge in your refuge list

Charles M. Russell Wetland Management District (406) 538-8706 C/O CHARLES M. RUSSELL NWR P.O. BOX 110 LEWISTOWN, MT59457	refuge profile

FWS Migratory Birds (USFWS Migratory Bird Program).

The protection of birds is regulated by the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. For more information regarding these Acts see http://www.fws.gov/migratorybirds/RegulationsandPolicies.html.

All project proponents are responsible for complying with the appropriate regulations protecting birds when planning and developing a project. To meet these conservation obligations, proponents should identify potential or existing project-related impacts to migratory birds and their habitat and develop and implement conservation

measures that avoid, minimize, or compensate for these impacts. The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

For information about Birds of Conservation Concern, go to http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html.

Migratory birds of concern that may be affected by your project:

There are **9** birds on your Migratory birds of concern list. The Division of Migratory Bird Management is in the process of populating migratory bird data with an estimated completion date of August 1, 2014; therefore, the list below may not include all the migratory birds of concern in your project area at this time. While this information is being populated, please contact the Field Office for information about migratory birds in your project area.

Species Name	Bird of Conservation Concern (BCC)	Species Profile	Seasonal Occurrence in Project Area
American bittern (*Botaurus lentiginosus*)	Yes	species info	Breeding
Bald eagle (*Haliaeetus leucocephalus*)	Yes	species info	Year-round
Brewer's Sparrow (*Spizella breweri*)	Yes	species info	Breeding
Cassin's Finch (*Carpodacus cassinii*)	Yes	species info	Breeding
Greater sage-grouse (*Centrocercus urophasianus*)	Yes	species info	Year-round
Marbled Godwit (*Limosa fedoa*)	Yes	species info	Breeding
Mountain plover (*Charadrius montanus*)	Yes	species info	Breeding
Pinyon Jay (*Gymnorhinus cyanocephalus*)	Yes	species info	Year-round
Prairie Falcon (*Falco mexicanus*)	Yes	species info	Year-round

Trust Resources List

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Data Limitations, Exclusions and Precautions
The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the

advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The following wetland types intersect your project area in one or more locations:

Wetland Types	NWI Classification Code	Total Acres
Freshwater Emergent Wetland	PEMA	614.0256
Freshwater Emergent Wetland	PEMFx	0.1888
Freshwater Emergent Wetland	PEMC	99.8774
Freshwater Emergent Wetland	PEMCh	2.0274
Freshwater Emergent Wetland	PEMAh	11.1521
Freshwater Emergent Wetland	PEMAf	0.3448
Freshwater Emergent Wetland	PEMAx	8.9024
Freshwater Emergent Wetland	PEMCx	11.1154
Freshwater Emergent Wetland	PEMFh	0.4189
Freshwater Forested/Shrub Wetland	PSSA	124.0491
Freshwater Pond	PUBFx	0.0138
Freshwater Pond	PABFh	53.6211
Freshwater Pond	PUSC	17.4254
Freshwater Pond	PUSA	19.3213
Freshwater Pond	PUSAh	3.7161
Freshwater Pond	PUSCx	0.8888
Freshwater Pond	PUSCh	3.0481
Freshwater Pond	PUBF	0.1715
Freshwater Pond	PABF	16.6969
Freshwater Pond	PUBFh	1.4285
Freshwater Pond	PABFx	6.4996
Riverine	R4SBC	50.8267

Trust Resources List

Riverine	R2UBF	24.4126
Riverine	R2UBG	34.132
Riverine	R4SBA	28.3625
Riverine	R2USC	121.3503
Riverine	R4SBCx	102.5043
Riverine	R2USA	44.163

APPENDIX D

MIGRATORY BIRD TREATY ACT COMPLIANCE

MIRGRATORY BIRD ACT COMPLIANCE

1. MIGRATORY BIRD TREATY ACT COMPLIANCE -VEGETATION REMOVAL [107] (ADDED 9-26-13)

A. Description. Suitable nesting habitat (trees and shrubs) exists for migratory birds within the construction limits.

B. Construction Requirements: Perform any required cutting of trees or shrubs between August 16th and April 15th. Remove only those trees and shrubs in direct conflict with the permanent construction limits. Where possible, do not remove, but trim trees and shrubs as necessary for equipment access and construction activities.

C. Method of Measurement and Basis of Payment. Work described in this provision is not measured for payment. Consider all costs associated with this provision incidental to performance of the work. Include the cost in the cost of other items.

APPENDIX G:

MDEQ Wastewater Report

DEQ
Montana Department
of Environmental Quality

Steve Bullock, Governor

Airport Business Park • 1371 Rimtop Dr. • Billings, MT 59105-9702 • Website: www.deq.mt.gov

Bill Dreyer, PE
DOWL
2090 Stadium Drive
Bozeman, Montana 59715

January 27, 2016

Re: Hysham Rest Area Wastewater Design Basis and Non-Degradation **EQ# 16-1509**

Dear Mr. Dreyer:

The Department has reviewed the preliminary plans and specifications for the subject project, submitted on September 11, 2015 and the additional information provided on January 11, 2016, in accordance with Department Design Standard DEQ-4. The preliminary design concept and non-degradation analysis for the new public wastewater treatment system to serve the Hysham Eastbound and Westbound Rest Areas is hereby approved.

The project generally consists of a new 10,000 gallon septic tank, a new recirculating trickling filter or approved equivalent, a new 4,000 gallon dose chamber and new drainfield sized with an application rate of 0.4 gpd/sf and a 50% reduction for trickling filter treated wastewater effluent. The wastewater treatment system is designed to serve a maximum daily flow of 3,386 gpd.

The preliminary approval of the non-degradation analyses is based on the following parameters: design daily flow of 3,386 gallons per day, aquifer hydraulic conductivity of 34 ft/day, hydraulic gradient of 0.007 ft/ft, a 500 foot long nitrate mixing zone, a background groundwater nitrate concentration of approximately 0.2 mg/L, and a treated effluent total nitrogen concentration of no more than 26 mg/L; a depth from the bottom of the drainfield to a limiting layer of approximately 47 feet, and a distance of approximately 750 feet from the drainfield to the nearest surface water. If any of these parameters is found to differ significantly during final design or construction, reevaluation of the non-degradation analyses may be required.

Final plans and specifications for the proposed wastewater treatment system must be submitted to the Department for review and approval prior to commencing construction

Failure to abide by the above conditions is considered a significant violation of the Montana Public Water Supply Laws (PWSL), and the administrative rules promulgated there under. The applicant is responsible for compliance with all other applicable federal, state, local, and tribal law, regulations, and ordinances, including but not limited to, the Montana Water Use Act, Mont. Code Ann. Title 85, Chapter 2.

The applicant is responsible for compliance with all applicable federal, state, local, and tribal law, regulations, and ordinances. Approval in this document is limited solely to the matters therein specifically contained and does not constitute approval, implied or otherwise, for the purposes of any other law, regulation, or ordinance.

If I can offer any further information or assistance, please feel free to contact me at (406) 247-4455 or mwaite@mt.gov.

Sincerely,

Matthew Waite, PE
Permitting and Compliance Division
Billings Regional Office

cc: Douglas Lieb, MDT
Treasure County Sanitarian
File

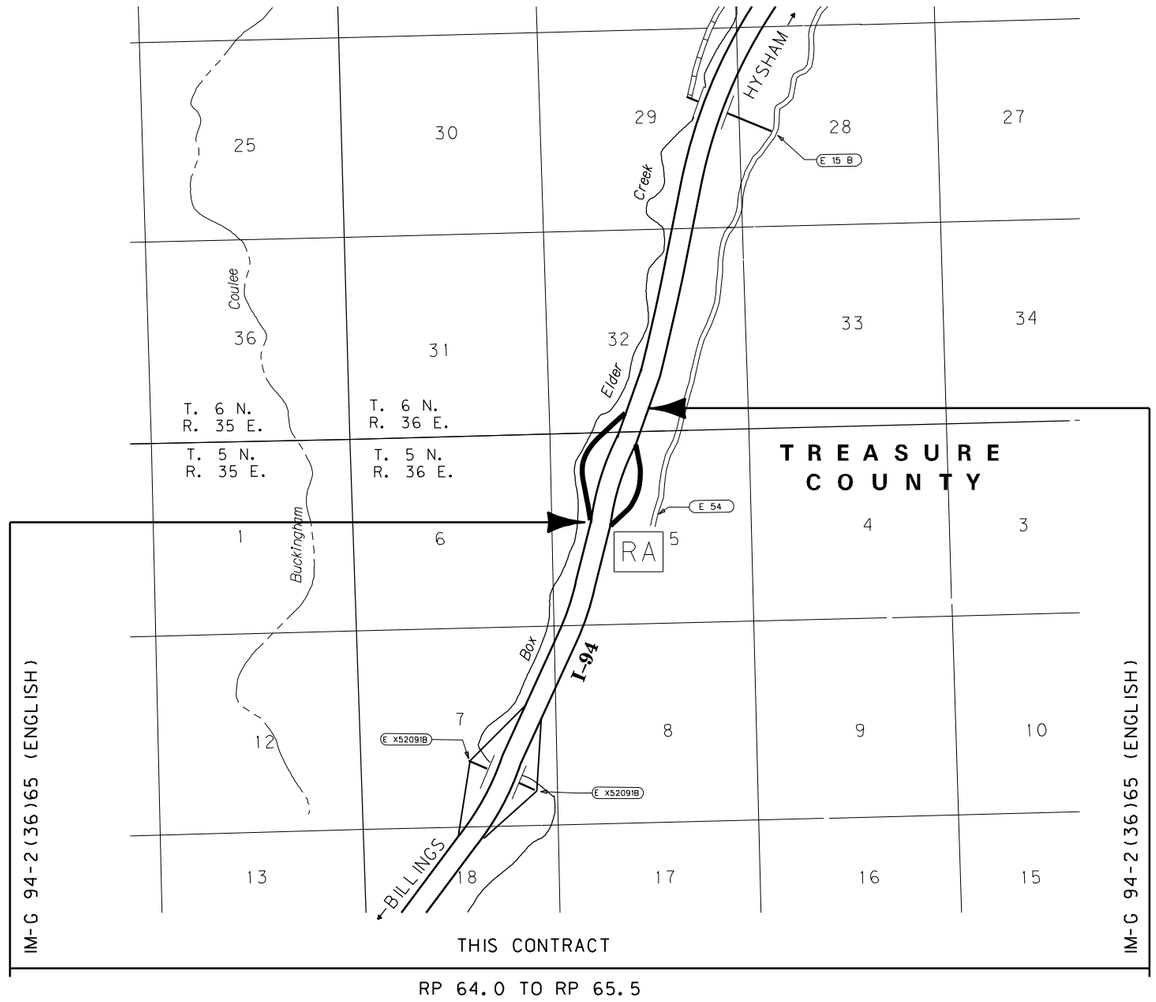
MONTANA DEPARTMENT OF TRANSPORTATION

PRESENT	2014	A.D.T. = 4,940
LETTING	2016	A.D.T. = 5,140
DESIGN	2036	A.D.T. = 7,650
		D.H.V. = 880
		TRUCKS = 27.3%
		V. = 70 MPH
		18 KIP ESAL'S = 827
		GROWTH RATE = 2.0%

FEDERAL AID PROJECT IM-G 94-2(36)65
WASTEWATER MDEQ PERMITTING
HYSHAM REST AREA - MONTANA
TREASURE COUNTY

CSF=0.9993521809

LENGTH N/A MILES



RP 64.0 TO RP 65.5

MDEQ
NON-DEGRADATION
APPROVED

PLANS PREPARED BY

DOWL

2090 STADIUM DRIVE
BOZEMAN, MONTANA 59715
(406) 586-8834

ASSOCIATED PROJECT AGREEMENT NUMBERS	
R/W & I.C.	
P.E.	IM-G 94-2(36)65

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTTTLZ10.DGN	D FISCHER	7/22/2016	WASTEWATER PLANS
2		7/22/2016	B DREYER	7/22/2016	UPN 8200000
		11:48:58 AM dofischer	T CORMIER	7/22/2016	

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LINEAR AND LEVEL DATA

BEARING SOURCE

GRID -- MONTANA COORDINATE SYSTEM NAD83-2011

LEVEL DATUM SOURCE

NAVD88 (GNSS DERIVED ELEVATIONS USING GEOID 12A AND HOLDING NGS MARK A555)

NOTES

UTILITIES

CALL THE UTILITIES UNDERGROUND LOCATION CENTER (811) OR OTHER NOTIFICATION SYSTEM FOR THE MARKING AND LOCATION OF ALL LINES AND SERVICE BEFORE EXCAVATING. ALL CLEARANCES OR DEPTHS PROVIDED FOR UTILITIES ARE FROM EXISTING GROUND LINE.

WETLANDS

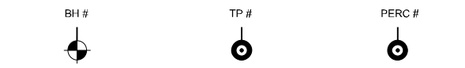
WETLANDS MAY EXIST ADJACENT TO THE ROADWAY AND BEYOND THE PROJECT LIMITS. A WETLAND DELINEATION HAS NOT BEEN COMPLETED FOR THIS PROJECT. IMPACTS TO WETLAND AREAS ARE NOT ANTICIPATED IN ASSOCIATION WITH THE PROPOSED WORK. NO PERMITS HAVE BEEN OBTAINED. ANY ACTION IMPACTING WETLAND AREAS WITHOUT THE APPROPRIATE PERMITTING IS THE RESPONSIBILITY OF THE CONTRACTOR.

SOILS INFORMATION

SOILS INFORMATION ON THE PLAN AND PROFILE SHEETS IS A BRIEF SUMMARY OF THE SOILS CLASSES. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.

GEOTECHNICAL BORING / SOIL SURVEY LEGEND

- MATERIAL IS LABELED AT THE BOTTOM OF THE LAYER
- A MINUS (-) OFFSET INDICATES A DIRECTION LEFT OF PROJECT CENTERLINE
- THE GEOTECHNICAL TEST PITS WERE CONDUCTED FOR WASTEWATER DESIGN PURPOSES



(GEOTECHNICAL BORING) (GEOTECHNICAL TEST PIT) (PERCOLATION TEST)

COMBINATION SCALE FACTOR

ALL COORDINATES ARE STATE PLANE (SEE CONTROL DIAGRAM).
CSF IS 0.9993521809.

R/W SURVEY LEGEND

EXISTING CONCRETE R/W MONUMENT

EXISTING METAL R/W REFERENCE PIN

EXISTING STATION MARKER

CONTROL DIAGRAM

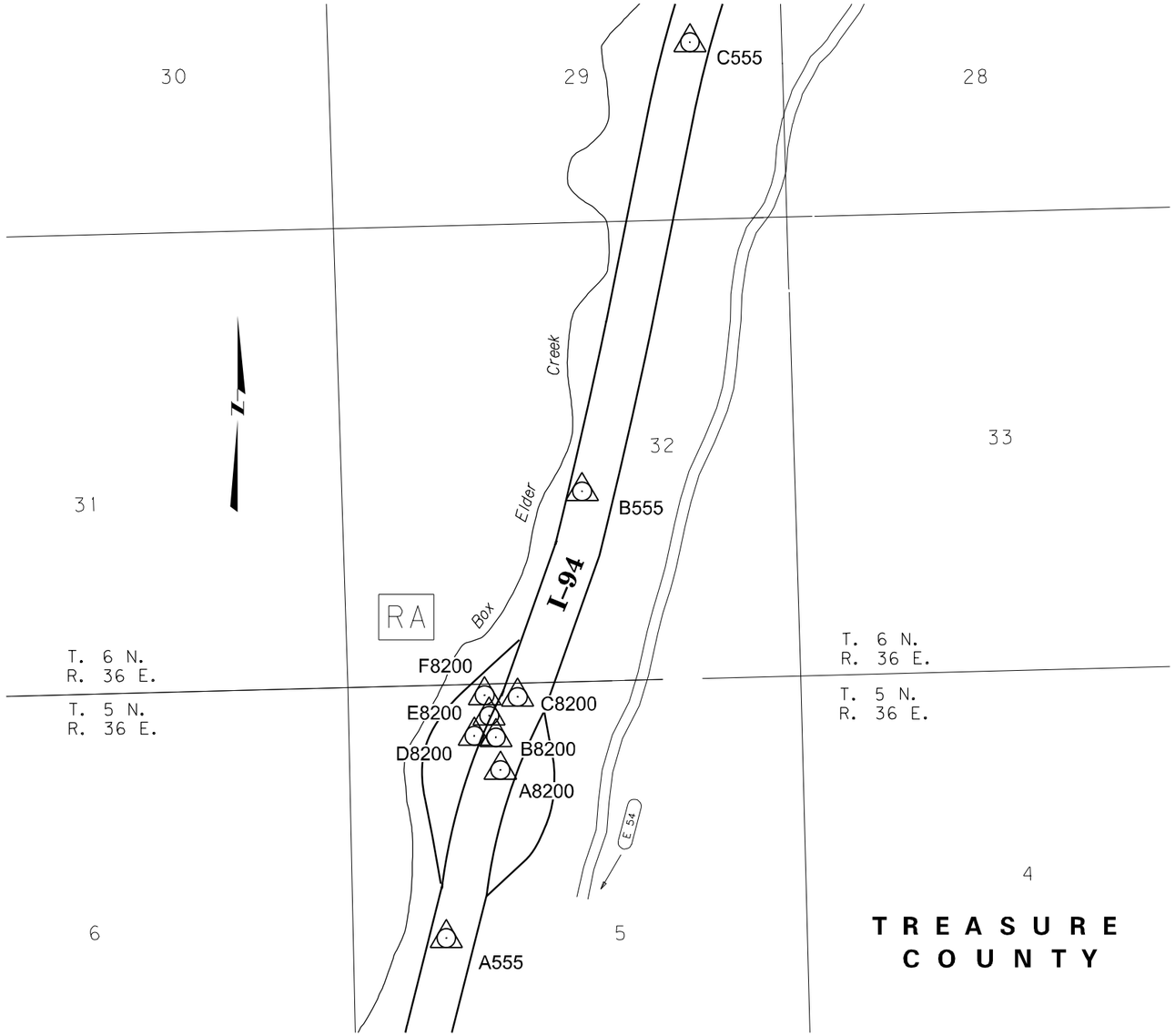
SCALE: N/A

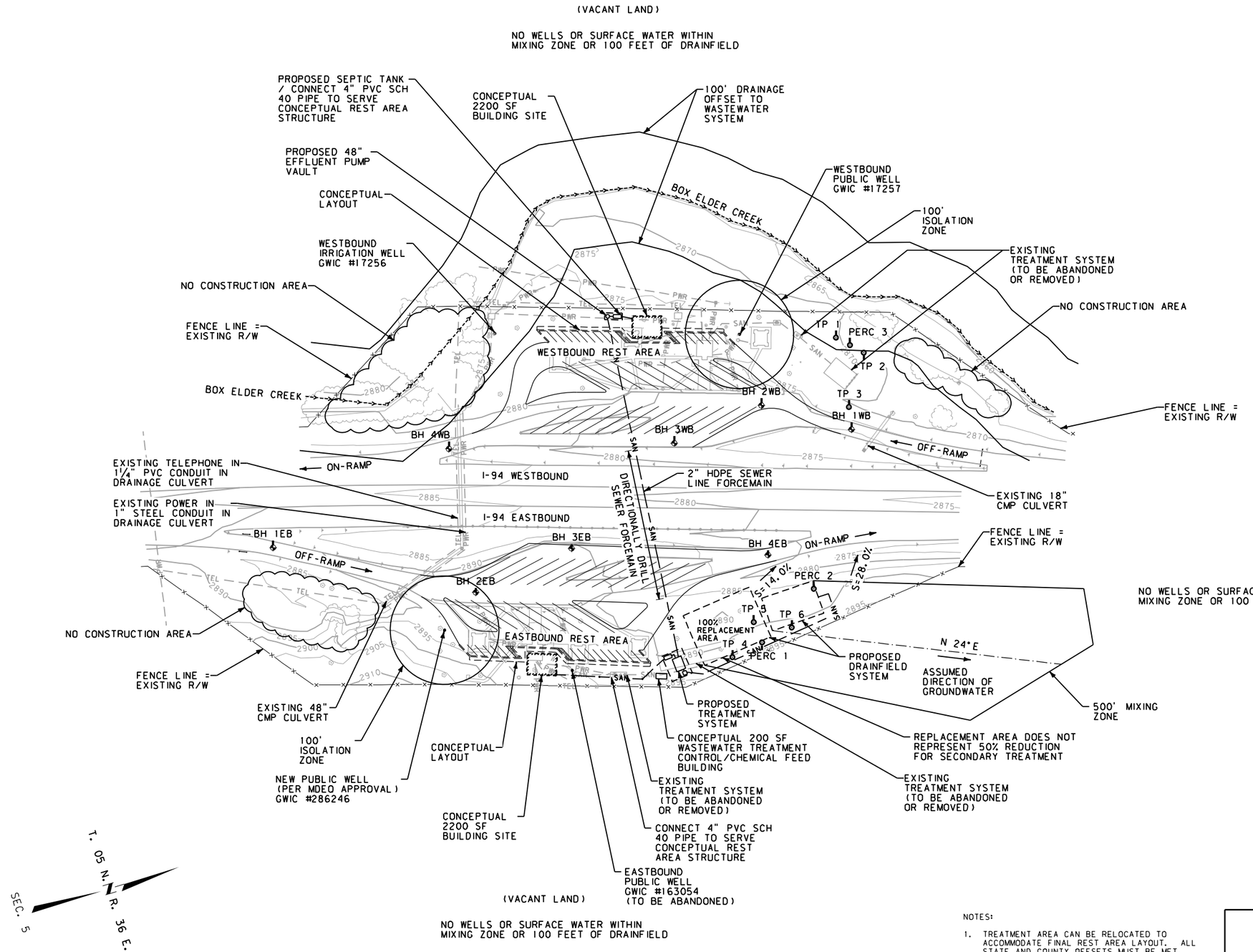
NOTE:
THIS PROJECT IS ON THE MONTANA COORDINATE SYSTEM NAD83-2011.
NORTHING AND EASTING COORDINATES ARE EXPRESSED IN UNITS OF INTERNATIONAL FEET AND ELEVATIONS ARE IN UNITS OF U.S. SURVEY FEET.

DIMENSIONS SHOWN ON THE PLANS ARE GRID. ALL SURVEY AND STAKING REQUIRE THE USE OF A COMBINATION SCALE FACTOR (CSF) TO CONVERT GRID DIMENSIONS TO GROUND DIMENSIONS (GRID DISTANCE % CSF = GROUND DISTANCE).
THE CSF FOR THIS PROJECT IS 0.9993521809.

CONTROL ABSTRACT

POINT NAME/NUMBER	N OR Y COORDINATE	E OR X COORDINATE	POINT ELEVATION	LOCATION AND DESCRIPTION
A8200	725,426.577	2,537,663.876	2,901.27	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "A8200 2014", for the east bound I-94 rest area, on a small bench south of the maintained grass area, 90 ft. E-SE of the east edge of pavement, 76 ft. se of a metal sign post(no camping) . Set a metal witness post and MDT sticker 3 ft. north of the cap.
B8200	725,804.962	2,537,612.307	2,890.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "B8200 2014", for the east bound I-94 rest area, near the center (N-S) of the rest area, 1 ft. west of the top back of curb for the tractor trailer parking area, in the grass area, on top of a small hill between the east bound I-94 guard rail and the tr/tr parking area, 45 ft. north of an angle point in along the west edge of the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
C8200	726,275.214	2,537,865.555	2,893.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "C8200 2014", for the east bound I-94 rest area, 380 ft. north of the north most picnic table, on a small hill above where the exit ramp for the rest area meets the east bound lane of I-94, 28 ft. west of the N-S r/w fence. Set a metal witness post and MDT sticker 3 ft. north of the cap.
D8200	725,822.290	2,537,361.381	2,881.85	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "D8200 2014", for the west bound I-94 rest area, near the south most end of the rest area, 7 ft. west of the edge of pavement, 35 ft. northwest of the south most nose of the curbing between the car and truck lanes leaving the rest area, west bound onto I-94. Set a metal witness post and MDT sticker 3 ft north of the cap.
E8200	726,056.134	2,537,534.645	2,879.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "E8200 2014", for the west bound I-94 rest area, near the center (N-S) of the tractor/trailer parking area, on the grass slope between the west bound edge of pavement and the tr/tr parking lot, 10 ft. west of the I-94 edge of pavement, 26 ft. east of the eop for the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
F8200	726,293.950	2,537,481.604	2,876.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "F8200 2014", for the west bound I-94 rest area, near the north end of the rest area, 1 ft. north of the edge of pavement, 33 ft. north of the north most end of the concrete sidewalk next to the handicap parking stall. Set a metal witness post and MDT sticker 3 ft. east of the cap.
A555	723,475.593	2,537,037.718	2,929.16	A ngs stainless steel rod in a monument box with a lid marked "A555 1981", on the east bound side of I-94, near milepost 64.4, 100 ft. southeast of the centerline of the east bound lane, 1.2 ft. west-northwest of an ngs witness post, 1.6 ft. west-northwest of the r/w fence.
B555	728,660.461	2,538,613.291	2,869.74	A ngs stainless steel rod in a monument box with a lid marked "B555 1981", on the east bound side of I-94, near milepost 65.35, 113 ft. E-SE of the centerline of the east bound lane, 1.6 ft. west-northwest of the r/w fence
C555	733,871.091	2,539,864.383	2,814.30	A ngs stainless steel rod in a monument box with a lid marked "C555 1981", on the east bound side of I-94, near milepost 66.4, 93 ft. E-SE of the centerline of the east bound lane, 1.75 ft. west-northwest of the r/w fence.





NOTES:

1. TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.
2. FINAL LOCATION OF STRUCTURES WILL BE DETERMINED IN PHASE II OF THIS PROJECT.
3. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
4. CONCEPTUAL FACILITIES ARE APPROXIMATE.
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

OVERALL SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ10.dgn	DESIGNED BY	D FISCHER	7/22/2016	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA / IM-C 94-2(36)65
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016		
		11:50:44 AM doflscher	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 4 OF 11

DOWL

MATCH LINE SEE SHEET 6

EXISTING TELEPHONE IN 1¼" PVC CONDUIT IN DRAINAGE CULVERT

EXISTING POWER IN 1" STEEL CONDUIT IN DRAINAGE CULVERT

1-94 EASTBOUND

2" HDPE SEWER LINE FORCEMAIN (SEE SHEET 11)

DIRECTIONALLY DRILL SEWER FORCEMAIN

SAN FLOW

1EB

EXISTING 48" CMP CULVERT

BH 3EB

25' MIN. SET BACK FROM ROAD

BH 4EB

ON-RAMP

OFF-RAMP

FENCE LINE = EXISTING R/W

BH 2EB

EASTBOUND REST AREA CONCEPTUAL LAYOUT

S=14.0%

100'

133'

PERC 2

63'

S=28.0%

TP 5

TP 6

100' PERP. DIST.

4,000 GALLON SEPTIC TANK

TP 4

PERC 1

7'

10 LATERALS @ 7' ON CENTER

2" TRANSPORT LINE

N 24°E

ASSUMED DIRECTION OF GROUNDWATER

NO CONSTRUCTION AREA

FLOW

10' MIN. SET BACK FROM EXISTING R/W (TYP)

500' MIXING ZONE

FENCE LINE = EXISTING R/W

100' ISOLATION ZONE

CONCEPTUAL 2200 SF BUILDING SITE

EASTBOUND PUBLIC WELL GWIC #163054 (TO BE ABANDONED)

ABANDON OR REMOVE EXISTING TANK

2,500 GALLON DOSE TANK

REPLACEMENT AREA DOES NOT REPRESENT 50% REDUCTION FOR SECONDARY TREATMENT

NEW PUBLIC WELL (PER MDEQ APPROVAL) GWIC #286246

4" CLEAN OUT 100' O.C. MAX (TYP)

PROPOSED TREATMENT SYSTEM

ABANDON OR REMOVE EXISTING DRAINFIELD

CONNECT 4" PVC SCH 40 PIPE TO SERVE CONCEPTUAL REST AREA STRUCTURE

CONCEPTUAL 200 SF WASTEWATER TREATMENT CONTROL/CHEMICAL FEED BUILDING

T. 05 N. R. 36 E. SEC. 5

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN MIXING ZONE OR 100 FEET OF DRAINFIELD

LEGEND

PROPOSED 100% REPLACEMENT AREA

PROPOSED PRIMARY DRAINFIELD

NOTES:

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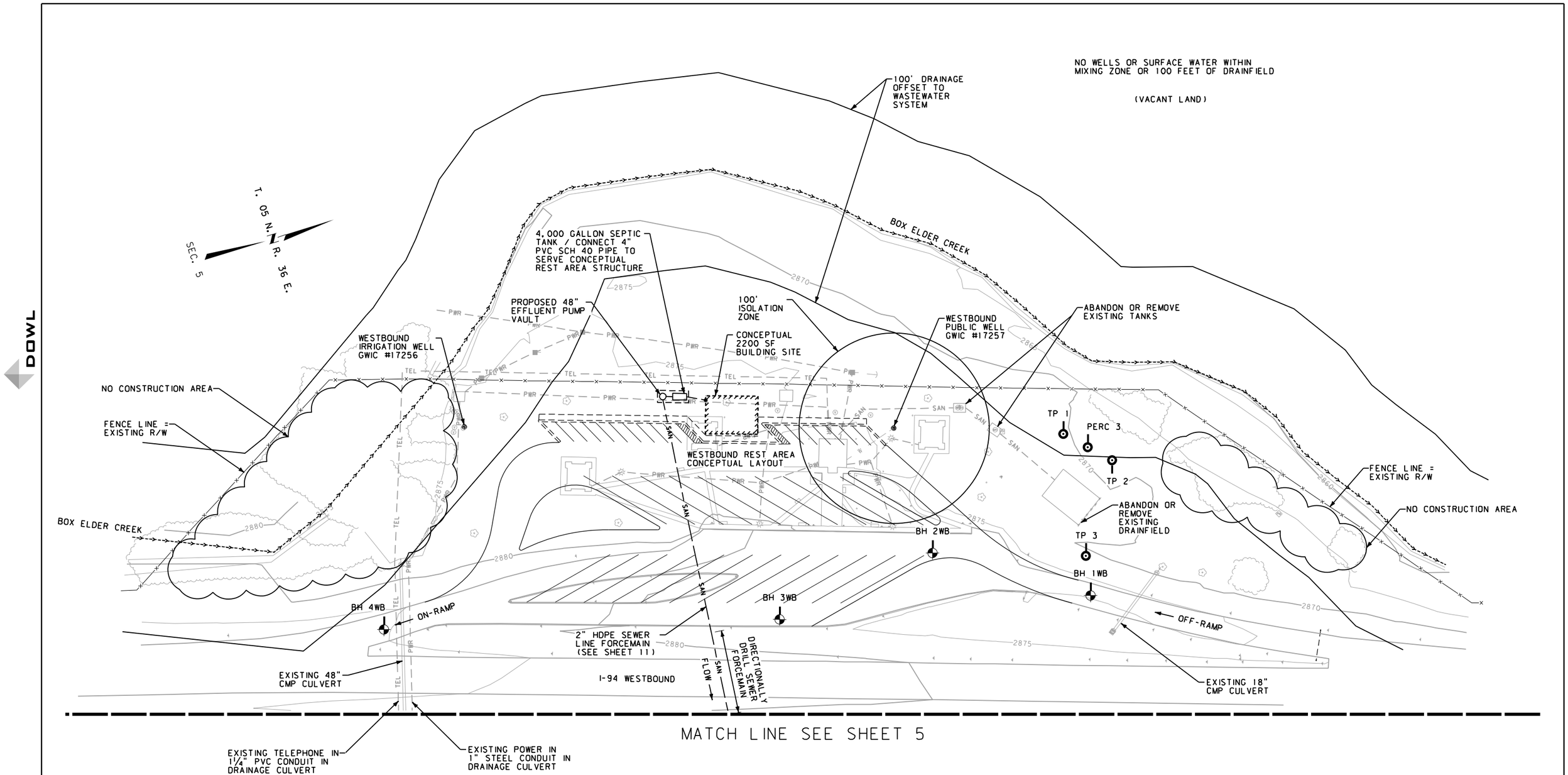
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

SEPTIC DETAIL

EASTBOUND SITE

SCALE 1"=50'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ10.dgn	DESIGNED BY	D FISCHER	7/22/2016	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA	IM-G 94-2(36)65
1		7/22/2016	REVIEWED BY	B DREYER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000	SHEET 5 OF 11
		11:50:46 AM dofischer	CHECKED BY	T CORMIER	7/22/2016			



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SEPTIC DETAIL

WESTBOUND SITE

SCALE 1"=50'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ10.dgn	DESIGNED BY	D FISCHER	7/22/2016	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA / IM-C 94-2(36)65
1		7/22/2016	REVIEWED BY	B DREYER	7/22/2016		
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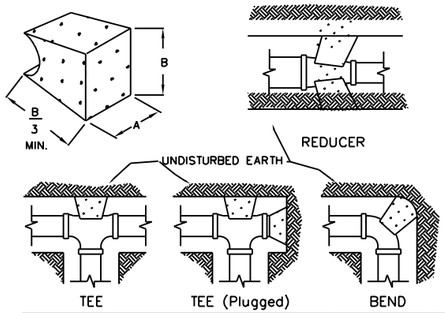


DIMENSIONS FOR THRUST BLOCKING

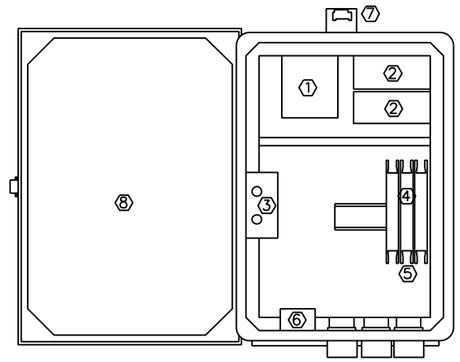
FITTING SIZES	TEES & PLUGS		90° BEND		45° BEND & WYES		REDUCERS & 22 1/2° BEND	
	A	B	A	B	A	B	A	B
2"-4"	1'-10"	1'-5"	1'-10"	1'-6"	1'-8"	1'-0"	1'-7"	0'-6"
6"	2'-3"	1'-11"	2'-8"	2'-4"	2'-0"	1'-8"	1'-9"	1'-0"
8"	3'-0"	2'-6"	3'-6"	3'-2"	2'-8"	2'-3"	2'-0"	1'-6"
10"	3'-8"	3'-3"	4'-4"	4'-0"	3'-3"	2'-10"	2'-5"	2'-0"
12"	4'-3"	4'-0"	5'-1"	4'-10"	3'-10"	3'-6"	2'-9"	2'-6"
14"	5'-8"	4'-1"	6'-9"	5'-0"	5'-0"	3'-8"	3'-7"	2'-7"
16"	6'-3"	4'-10"	7'-8"	5'-9"	5'-9"	4'-2"	4'-5"	2'-9"

NOTE:
THIS TABLE IS BASED ON 150 PSI MAIN PRESSURE
1500 PSF SOIL BEARING PRESSURE

1/7 THRUST BLOCKING FOR PRESSURE MAIN

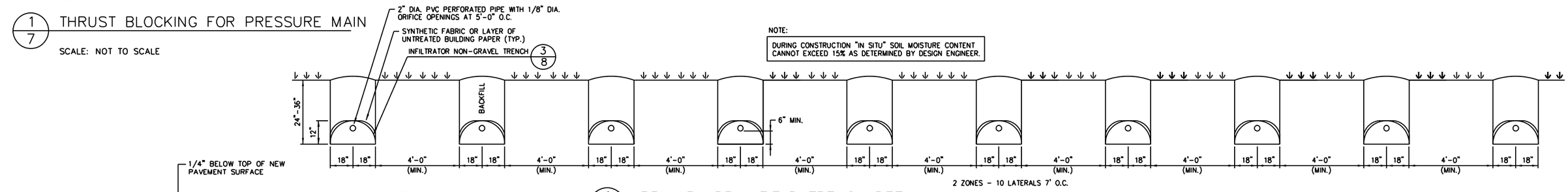
SCALE: NOT TO SCALE

FEATURE	SPECIFICATIONS
① PROGRAMMABLE LOGIC UNIT	120/240 VAC programmable logic unit with built-in LCD screen and programming keys. Provides control functions and timing for panel operation.
② MOTOR-START CONTACTORS	120 VAC: 14 FLA 3/4 hp, 60 hz; 2.5 million cycles at FLA (10 million at 50% FLA 240 VAC: 14 FLA 2 hp, 60 hz; 2.5 million cycles at FLA (10 million at 50% FLA
③ TOGGLE SWITCHES	Single-pole, double throw HOA switch. 20 amps, 1 hp.
④ CONTROLS CIRCUIT BREAKER	10 amps, OFF/ON switch. Single pole 120 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
⑤ PUMP CIRCUIT BREAKERS	20 amps, OFF/ON switch. Single pole 120 VAC. double-pole 240 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
⑥ AUDIO ALARM	80 dB at 24", warble-tone sound.
⑦ VISUAL ALARM	red lens, "Push-to-silence." NEMA 4
⑧ PANEL ENCLOSURE	Measures 11.52" high x 9.31" wide x 5.43" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.
MVP-SI-RO OR APPROVED EQUAL	120 VAC, 3/4 hp, 14 amps, single phase, 60 Hz. 240 VAC, 2 hp, 14 amps, single phase, 60 Hz.



3/7 DOSE CONTROL AND ALARM PANEL

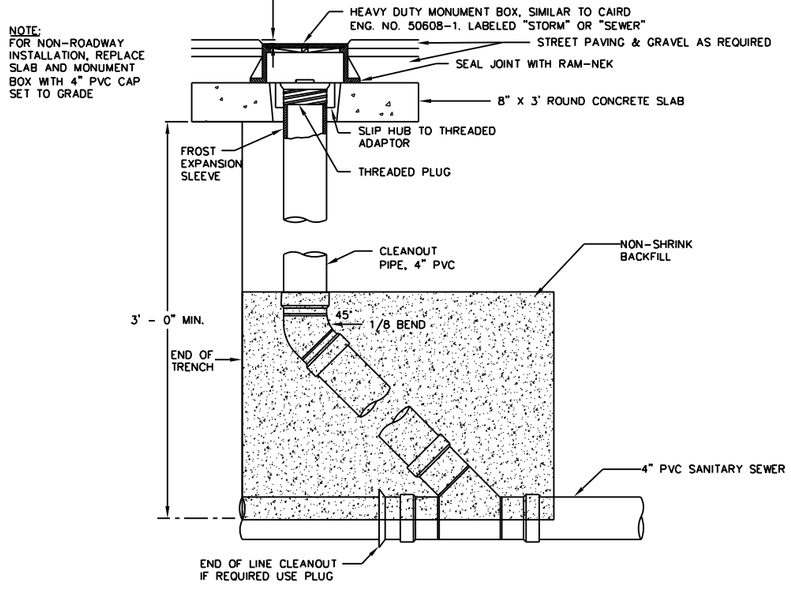
SCALE: NOT TO SCALE



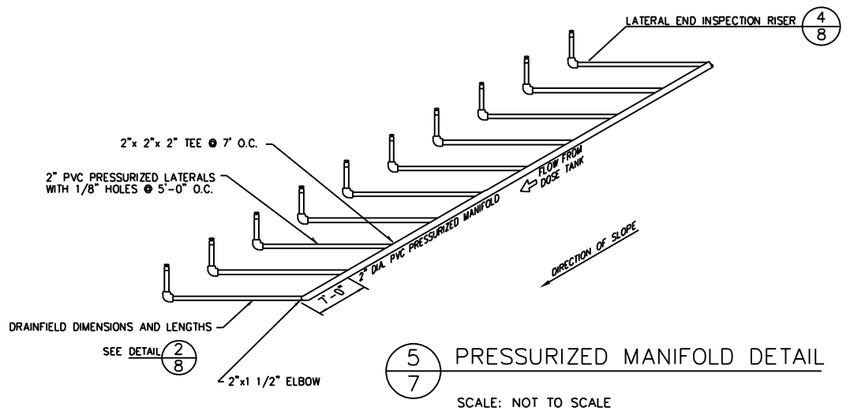
NOTE:
DURING CONSTRUCTION "IN SITU" SOIL MOISTURE CONTENT CANNOT EXCEED 15% AS DETERMINED BY DESIGN ENGINEER.

4/7 PRIMARY DRAINFIELD TRENCH DETAIL

SCALE: NOT TO SCALE



2/7 SEWER CLEANOUT DETAIL



5/7 PRESSURIZED MANIFOLD DETAIL

SCALE: NOT TO SCALE

SANITARY SEWER DETAILS

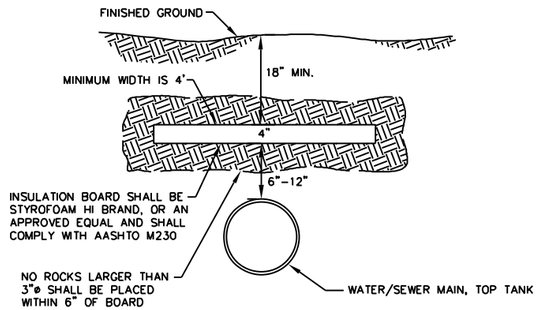
NO SCALE

DOWL

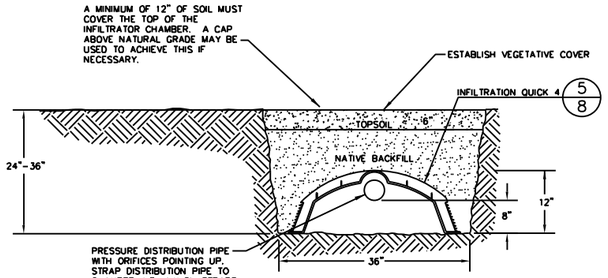
3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ11.dgn	DESIGNED BY	D FISCHER	7/22/2016	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA	IM-C 94-2(36)65
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000	SHEET 7 OF 11
		11:52:04 AM dofischer	CHECKED BY	T CORMIER	7/22/2016			

GENERAL WASTEWATER TREATMENT SYSTEM CONSTRUCTION NOTES:

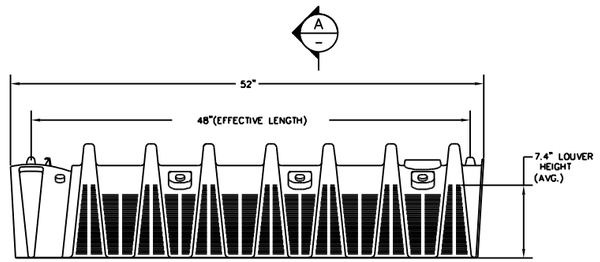
1. ALL CONSTRUCTION SHALL CONFORM TO THE ACCOMPANYING PLANS.
2. NO CHANGE OR MODIFICATION OF THE APPROVED PLANS SHALL BE MADE WITHOUT THE PRIOR WRITTEN APPROVAL OF THE ENGINEER AND/OR MDEQ.
3. INSTALLER MUST BE LICENSED AND QUALIFIED TO INSTALL SUBSURFACE WASTEWATER TREATMENT SYSTEMS IN TREASURE COUNTY, MONTANA.
4. ALL SYSTEM COMPONENTS WILL BE BURIED, COVERED AND INSULATED WHERE REQUIRED TO PREVENT MALFUNCTION. USE INSULATED RISERS AND/OR RIGID INSULATION IF REQUIRED.
5. ALL ELECTRICAL EQUIPMENT SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE, CLASS 1. GROUP D, DIVISION 2.
6. ALL GRAVITY SEWER SERVICE LINES TO BE 4" SCH 40 PVC AND TO BE PLACED AT A MINIMUM DOWNWARD SLOPE OF 1/4" PER FOOT.
7. ALL SYSTEM COMPONENTS WILL MEET OR EXCEED ALL DESIGN CRITERIA AS OUTLINED IN MDEQ-CIRCULAR DEQ-4 "MONTANA STANDARDS FOR SUBSURFACE WASTEWATER TREATMENT SYSTEMS".
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH TREASURE COUNTY REGULATIONS/MDEQ FOR WASTEWATER TREATMENT SYSTEMS.
9. ALL SYSTEM COMPONENTS MUST BE WATERTIGHT.
10. SEE MANUFACTURER'S DETAILS FOR ANY SYSTEM COMPONENT DETAILS NOT SHOWN ON THIS SHEET.
11. ALL FIELD TESTING WILL BE CONDUCTED AS REQUIRED IN DEQ-4.



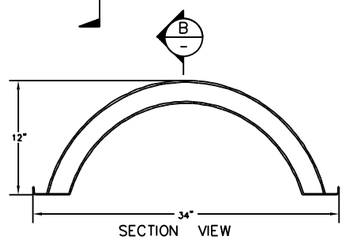
1/8 DETAIL
INSULATION BOARD
SCALE : NOT TO SCALE



3/8 STANDARD INFILTRATION TRENCH
SCALE: NOT TO SCALE

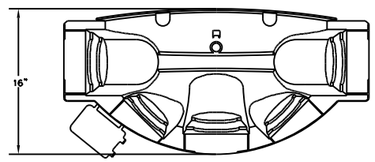


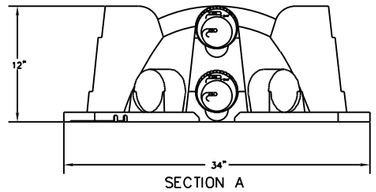
SIDE VIEW



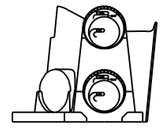
SECTION VIEW

MULTIPORT END CAP





SECTION A



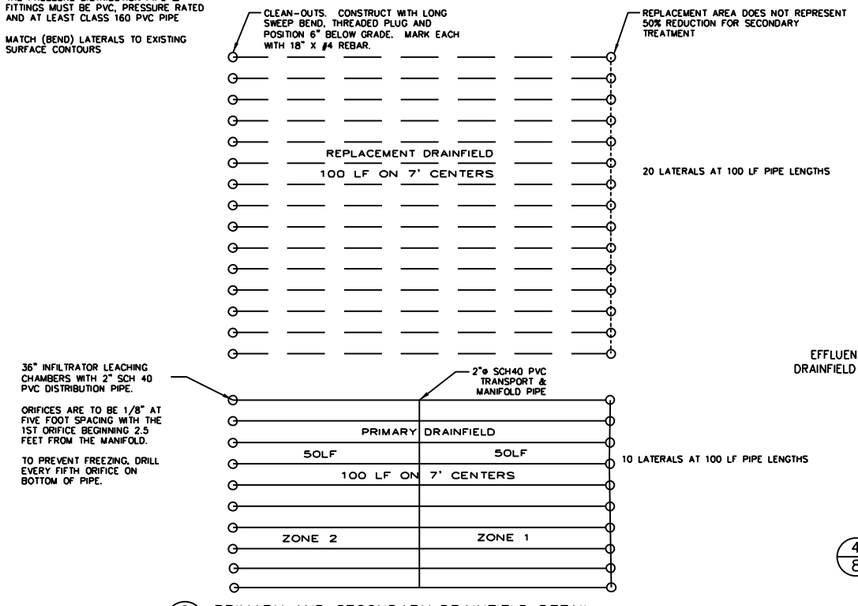
SECTION B

5/8 STANDARD CHAMBER DETAIL
SCALE: NOT TO SCALE

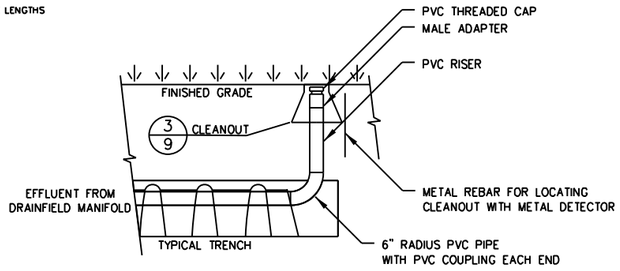
NOTE:

THE PRESSURE DISTRIBUTION PIPE & FITTINGS MUST BE PVC, PRESSURE RATED AND AT LEAST CLASS 160 PVC PIPE

MATCH (BEND) LATERALS TO EXISTING SURFACE CONTOURS



2/8 PRIMARY AND SECONDARY DRAINFIELD DETAIL
SCALE: NOT TO SCALE



4/8 TYPICAL DRAINFIELD LATERAL END INSPECTION RISER
SCALE: NOT TO SCALE

SANITARY SEWER DETAILS

NO SCALE

DOWL

CONSTRUCTION TESTING:

ALL TANKS MUST BE WATER TIGHT. TANKS USED FOR COMMERCIAL FACILITIES, MULTIPLE-USER SYSTEMS OR PUBLIC SYSTEMS MUST BE TESTED IN PLACE FOR WATER TIGHTNESS. WATER TIGHTNESS TESTING FOR CONCRETE TANK MAY BE CONDUCTED USING A WATER TEST OR VACUUM TEST.

1. WATER TESTING MUST BE CONDUCTED BY SEALING THE OUTLETS, FILLING THE SEPTIC TANK TO ITS OPERATIONAL LEVEL, AND ALLOWING THE TANK TO STAND FOR AT LEAST EIGHT (8) HOURS. IF THERE IS A MEASURABLE LOSS (2 INCHES OR MORE), REFILL THE TANK AND LET STAND FOR ANOTHER 8 HOURS. IF THERE IS AGAIN A MEASURABLE LOSS, THE TANK MUST BE REJECTED.

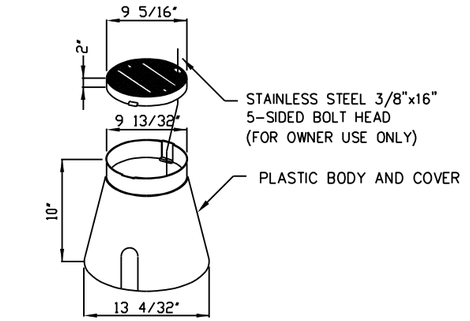
2. VACUUM TESTING MUST BE CONDUCTED BY SEALING ALL INLETS, OUTLETS, AND ACCESSES, THEN INTRODUCING A VACUUM OF 4 INCHES OF MERCURY. IF THE VACUUM DROPS IN THE FIRST 5 MINUTES, IT MUST BE BROUGHT BACK TO 4 INCHES OF MERCURY. IF THE SEPTIC TANK FAILS TO HOLD THE VACUUM AT 4 INCHES OF MERCURY FOR 5 MINUTES, THE TANK MUST BE REJECTED.

4,000 GALLON SEPTIC TANK NOTES:

CONCRETE IS 4000 PSI @ 28 DAYS
CEMENT IS TYPE V, WITH MAX C3A OF 8%, PER MT DEQ-4
REINFORCING = #4 GRADE 60 REBAR
MAXIMUM EARTH COVER IS 6 FEET
THIS TANK MUST BE PLACED ON COMPACTED 3/4" ROAD-BASE OR SIMILAR MATERIAL. MINIMUM RELATIVE COMPACTION IS 95%. DO NOT USE FLOWABLE BACKFILL MATERIALS SUCH AS 3/4" WASHED GRAVELS.
TANK MUST BE BACKFILLED TO TOP BEFORE WATER TESTING.
TANK JOINT SEALED w/1"DIA. CONSEAL

2,500 GALLON DOSE TANK NOTES:

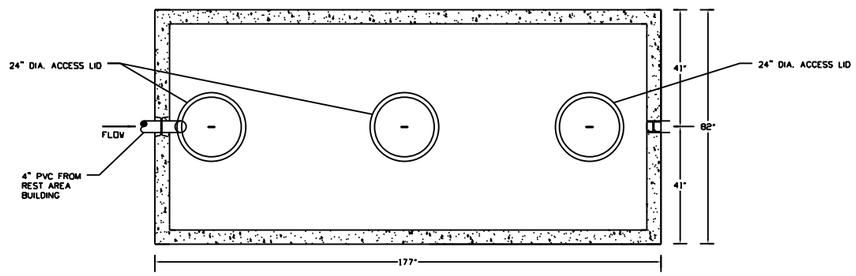
CONCRETE IS 4000 PSI @ 28 DAYS
CEMENT IS TYPE V, WITH MAX C3A OF 8%, PER MT DEQ-4
REINFORCING = #4 GRADE 60 REBAR
MAXIMUM EARTH COVER IS 6 FEET
THIS TANK MUST BE PLACED ON COMPACTED 3/4" ROAD-BASE OR SIMILAR MATERIAL. MINIMUM RELATIVE COMPACTION IS 95%. DO NOT USE FLOWABLE BACKFILL MATERIALS SUCH AS 3/4" WASHED GRAVELS.
TANK MUST BE BACKFILLED TO TOP BEFORE WATER TESTING.
TANK JOINT SEALED w/1"DIA. CONSEAL

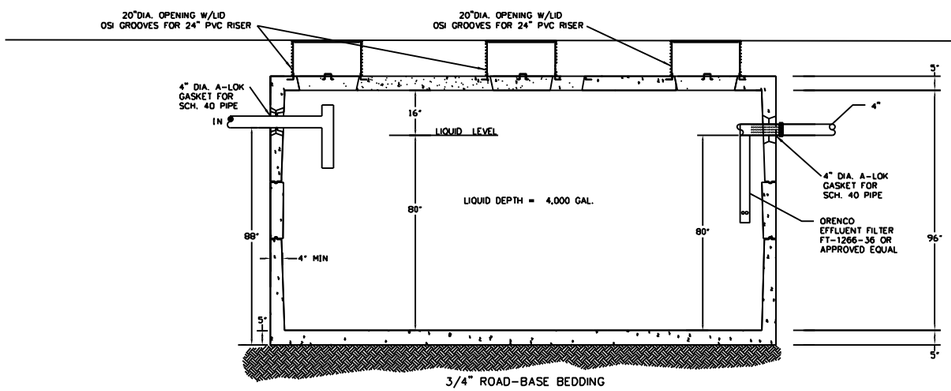


NOTES:
1. CLEANOUT BOX SHALL BE IDENTIFIED BY STAMPING "SEWER" ON THE COVER
2. CLEANOUT BOX SHALL BE APPLIED ENGINEERING PRODUCTS (SERIES 910L WITH STRONGER LOAD STRENGTH "T" COVER), CARSON-BROOKS PLASTICS (MODEL 910 WITH "T" COVER) OR EQUAL

3/9 TYPICAL DRAINFIELD LATERAL CLEANOUT BOX

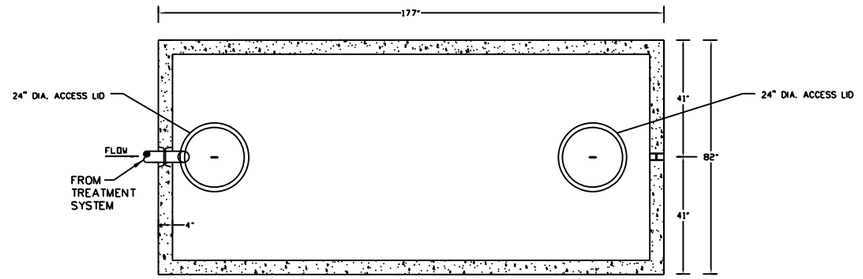
SCALE: NOT TO SCALE

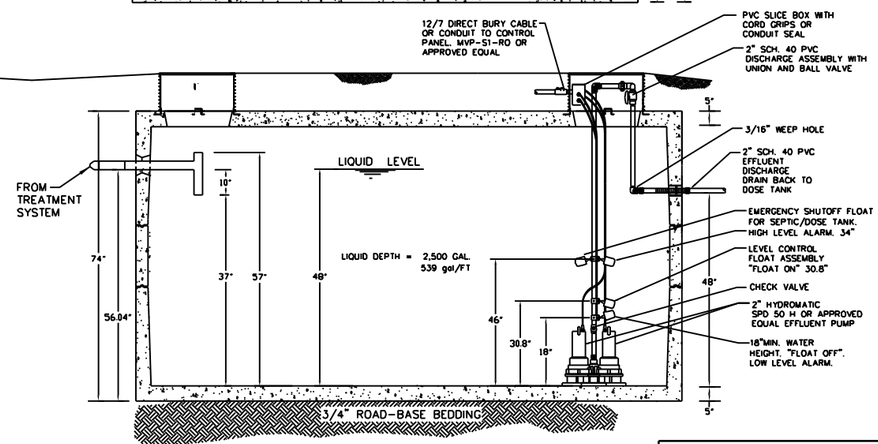




1/9 4,000 GALLON SEPTIC TANK
NON-TRAFFIC - FOR PUBLIC WASTE WATER SYSTEM

SCALE: NOT TO SCALE





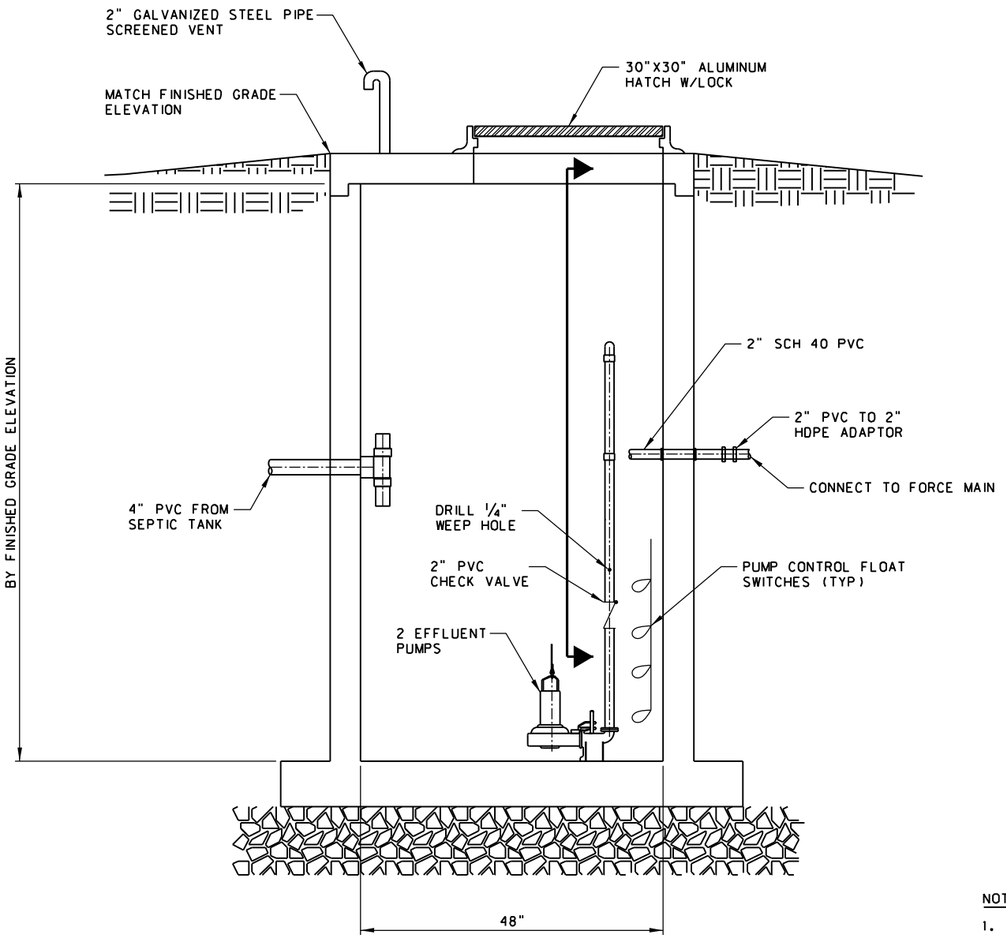
2/9 2500 GALLON DOSE TANK
NON-TRAFFIC - FOR PUBLIC WASTE WATER SYSTEM

SCALE: NOT TO SCALE

SANITARY SEWER DETAILS

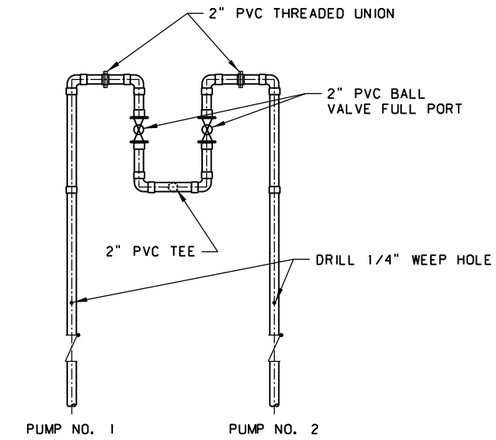
NO SCALE

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ11.dgn	DESIGNED BY	D FISCHER	7/22/2016	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA / IM-C 94-2(36)65
1		7/22/2016	REVIEWED BY	B DREYER	7/22/2016		
		11:52:06 AM doflscher	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 9 OF 11



1/10 EFFLUENT PUMP VAULT

SCALE : NOT TO SCALE



SECTION

SCALE : NOT TO SCALE

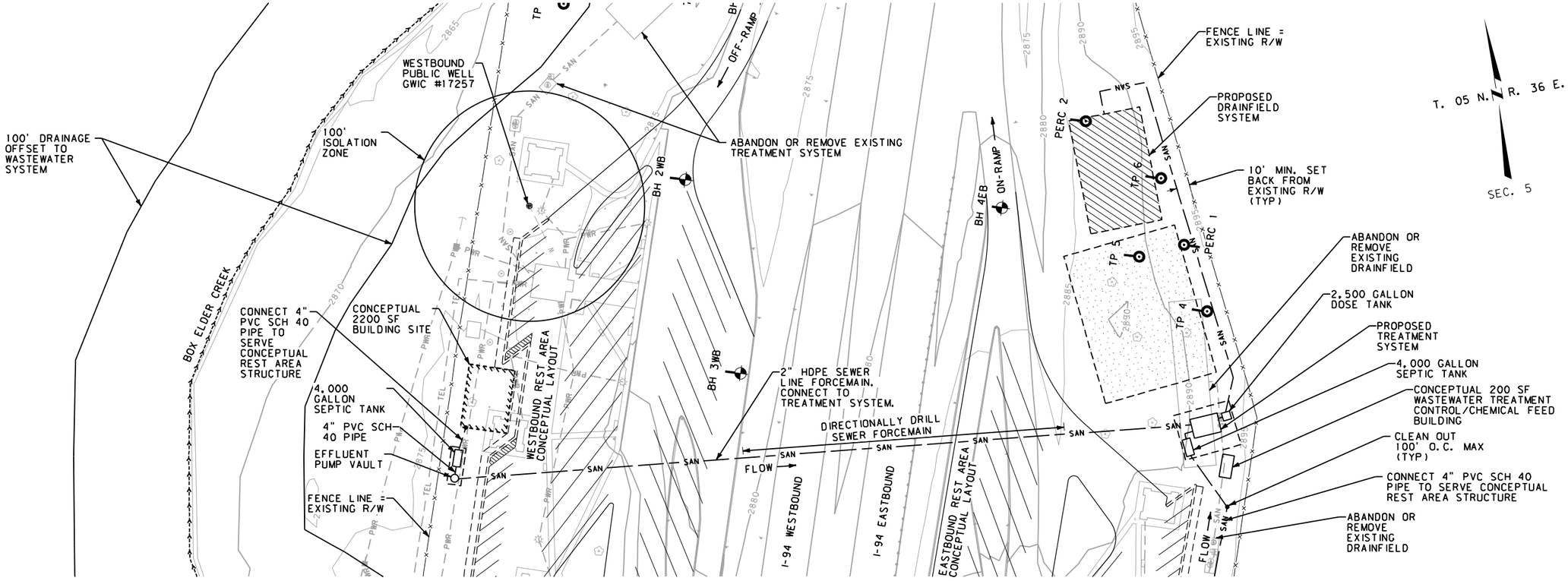
NOTES:

1. 0.5 HP EFFLUENT PUMPS TO BE RATED FOR 20 GPM AT 50 TDH. PUMPS TO BE LIBERTY MODEL FL50, ZOELLER MODEL 161/4161, OR APPROVED EQUAL.
2. PUMPS TO OPERATE IN LEAD/LAG MODE WITH AUTOMATIC ALTERNATION.
3. PUMP CONTROL PANEL TO BE MOUNTED IN BUILDING MECHANICAL OR STORAGE ROOM. PANEL TO BE ZOELLER DUPLEX ELECTRICAL ALTERNATOR CONTROL PANEL OR APPROVED EQUAL.
4. ALUMINUM HATCH ON PUMP VAULT TO BE HALLIDAY SERIES S1R OR APPROVED EQUAL.

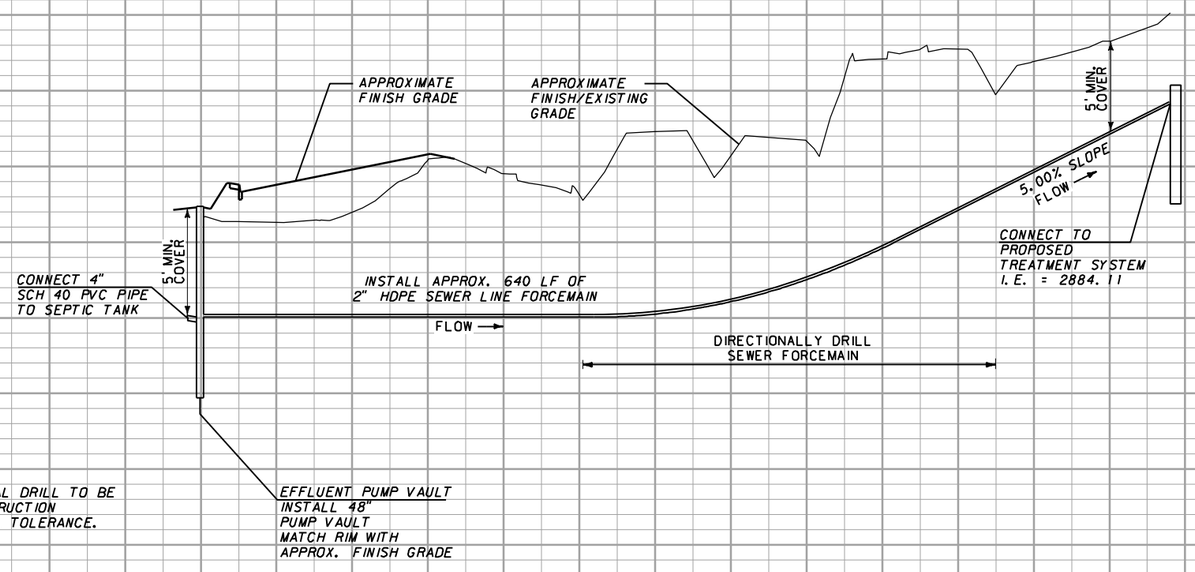
SANITARY SEWER DETAILS

EFFLUENT PUMP VAULT

NO SCALE



DIRECTIONALLY DRILLED 2" SEWER FORCEMAIN



3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTPLPZ10.dgn	DESIGNED BY	D FISCHER	7/22/2016	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA / IM-C 94-2(36)65
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016		
		11:56:46 AM dofischer	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 11 OF 11

Plan Review Fee Record

Date Plans Received	Account Number	EQ Number

Invoice Number	Receipt Number	Check Number	Total Received

PWSID	Public Water Supply Name	Total fee Determined
	Hysham Rest Area	$1,260.00

County	Nearest City	DEQ Review Engineer	Total Fee Due
Treasure	Hysham Rest Area	Clark	$1,260.00

Project Name: Hysham Rest Area Wastewater System

Design Engineer Name / Firm / Address

Name
Address
City

Owner Name / Address

Name MDT
Address
City

Schedule I - DEQ 1

Policies			
	Ultra Violet Disinfection		$700
	Point-of-Use / Point-of-Entry Treatment		$700
Section 1.0	Engineering Report		$280
Section 3.1	Surface Water		
	quality and quantity		$700
	structures		$700
Section 3.2	Groundwater		$840
Section 4.1	Microscreening		$280
Section 4.2	Clarification		
	Standard clarification		$700
	solid contact units		$1,400
Section 4.3	Filtration		
	rapid rate		$1,750
	pressure filtration		$1,400
	diatomaceous earth		$1,400
	slow sand		$1,400
	direct filtration		$1,400
	biologically active filtration		$1,400
	membrane filtration		$1,400
	micro and ultra filtration		$1,400
	bag and cartridge filtration		$420
Section 4.4	Disinfection		$700
Section 4.5	Softening		$700
Section 4.6	Ion Exchange		$700
Section 4.7	Aeration		
	natural draft		$280
	forced draft		$280
	spray / pressure		$280
	packed tower		$700
Section 4.8	Iron and Manganese		$700
Section 4.9	Fluoridation		$700
Section 4.10	Stabilization		$420
Section 4.11	Taste and Odor Control		$560
Section 4.12	Adsorptive Media		$700
Chapter 5	Chemical Application		$980
Chapter 6	Pumping Facilities		$980
Section 7.1	Plant Storage		$980
Section 7.2	Hydropneumatic Tanks		$420
Section 7.3	Distribution Storage		$980
	Number of lots _____	X $70	$0.00
	Non-standard Specifications		$420
	Transmission Distribution (lineal feet) _____	X 0.25	$0.00
	Rural Distribution (lineal feet) _____	X 0.03	$0.00
	Slipining Existing Mains (lineal feet) _____	X 0.15	$0.00
Chapter 9	Waste Disposal		$700
Appendix A			
	New Systems		$280
	Modifications		$140
Deviations			

Schedule II - DEQ 2

Chapter 10	Engineering Reports and Facility Plans		
	Engineering Reports (minor)		$280
	Comprehensive Facility Plan (major)		$1,400
Chapter 30	Design of Sewers		
	Number of Lots _____	X $70	$0.00
	Non-standard Specifications		$420
	Collection System (lineal feet) _____	X $0.25	$0.00
	Slipping (lineal feet) _____	X $0.15	$0.00
Chapter 40			
	Force Mains (lineal feet) _____	X $0.25	$0.00
	Pumping Station	1000 gpm or less	$700
	Pumping Station	greater than 1000 gpm	$1,400
Chapter 60	Screening Grit Removal		
	Screening Devices & Comminutors		$420
	Grit Removal		$420
	Flow Equalization		$700
Chapter 70	Settling		$1,120
Chapter 80	Sludge Handling		$2,240
Chapter 90	Biological Treatment		$3,360
	Nonaerated Treatment Ponds		$1,120
	Aerated Treatment Ponds		$1,960
Chapter 100	Disinfection		$900
Chapter 120	Irrigation & Rapid Infiltration Systems		$980
Appendix A	Septage	(per design)	$980
Appendix C	Alternative (non-standard) Sewer System	(per design)	$980

Schedule III - DEQ 3

Section 3.2	Ground Water	$840
Chapter 6	Pump Facilities	$420
Chapter 7	Finished Storage / Hydropneumatic Tanks	$420
Chapter 8	Distribution Systems	$420

Schedule IV - DEQ 4

Chapter 4	Pressure Dosing	$280
Chapter 5	Septic Tanks	$280
Chapter 6	Soil Absorption Systems	$280
Chapter 6	Subchapter 6.8 ETA and ET Systems	$700
Chapter 7	Subchapter 7.1, 7.2 & 7.3 Filters	$280
Chapter 7	Subchapter 7.4 Aerobic Treatment	$700
Chapter 7	Subchapter 7.5 Chemical Nutrient-Reduction Systems	$700
Chapter 7	Subchapter 7.6 Alternative Advanced Treatment Systems	$700
Chapter 8	Holding Tanks, Pit Privy, Seepage Pits, Waste Segregation, Experimental Systems	$280
Appendix D		$280
Non-Degradation Review		$420

Schedule V

Spring Box and Collection Lateral	$350

Schedule VI

Cisterns	$420

Other Fees

Plans & Specifications Not Covered ---- hours	X $105	$0
Re-review ---- hours	X $105	$0

HYSHAM REST AREA
Table of Contents

PART I: WASTE WATER DESIGN REPORT

TABLE OF SECTIONS

Appendix A LOCATION MAPS Location Maps

Appendix B SITE PLAN (Three sets)

Appendix C TEST HOLE LOGS & PERC TESTS

Appendix D WASTEWATER QUALITY

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MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

PART 1:

WASTEWATER DESIGN REPORT

DOWL

WASTEWATER DESIGN REPORT
CONSULTANT ACTIVITY 134

Hysham Rest Area
IM 94-2(36)65
UPN 8200000

Prepared for:

MONTANA MDT DEPARTMENT OF TRANSPORTATION

Prepared by:

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WASTEWATER TREATMENT FACILITY MANAGEMENT REPORT

INTRODUCTION

Each individual item in the following Design Report has been addressed in the order it appears in Montana Department of Environmental Quality (MDEQ) publications DEQ Circulars 2 and 4, "Montana Standards for Subsurface Wastewater Treatment Systems."

11.2 Facility Plans - General

The Hysham Rest Area is a dual rest area site located adjacent to Interstate 94 and includes entry and exit ramps, paved parking areas, restroom buildings (one each at the westbound and eastbound sites), and covered picnic shelters. The dual rest areas were originally constructed in 1967, and were rehabilitated in 1981 to address Americans with Disabilities Act (ADA) requirements. The rest area facilities are generally in fair condition.

The Hysham westbound rest area site is located near Box Elder Creek below the grade of Interstate 94. The eastbound site is substantially above the grade of Box Elder Creek and above the grade of Interstate 94.

The area adjacent to the Hysham Rest Area is rural and bordered by undeveloped grasslands under private ownership.

Water for consumption and irrigation is provided to the sites through individual wells. Power is available at the rest area location.

The purpose of the overall project is to reconstruct the existing Hysham Rest Area to meet current and future demand. This project was identified by the Rest Area Prioritization Committee for reconstruction due to the age of the facility and the analysis of need and stated objective within the rest area asset management approach.

Anticipated usage through the 22 planning horizon is utilized for the Phase I design as it reflects the typical design life of water and wastewater systems and is the typical timeframe for estimating future traffic volumes.

New water and wastewater systems with increased capacity as well as improved treatment

capabilities, updated car and truck parking spaces, and expanded restroom facilities are needed to accommodate current and future demand. Phase I of the project will entail design and approval for anticipated improvements to the water and wastewater systems to be used during subsequent design and construction phases to reconstruct the rest area. Phase I also includes preparation of environmental compliance documentation for full reconstruction of the rest area (Phase II). At this time, Phase II improvements are expected to be developed through a design-build project, and are not included in this project.

DRAWING OVERALL SEWER PLAN/SEWER SYSTEM/DETAILS, COMPONENTS, ETC.

11.21 Problem Evaluation and Existing Facility Review

The existing system is not sized for current flows, effluent concentrations and future flows. The new/replacement system will be designed in compliance with MDEQ and Treasure County Regulations. The system will be classified as a public wastewater system.

11.22 Planning and Service Area

The system is designed so that all the facilities within the rest area will be able to tie into the proposed wastewater system. The proposed wastewater system for Hysham Rest Area is designed to meet current and future demands—based on anticipated usage through a 22-year planning horizon.

11.23 Population Projection and Planning Period

The population and flow data was based on average summer door counts from the existing facilities. Water usage and door counts have been collected from 01/2013 thru 12/2013. These counts indicated that there is an average summer calculated flow usage of 1,019.4 gallons per day (combined) from an average of 1,246 visitors per day (combined). For design purposes, DOWL used the average summer time people visits per day (623 x 2 =1,246 people per day (combined)). Based on the 22 year planning horizon and provided summer average for people visits, the resulting 22 year projection using the summertime summer average visits is 1,927 people per day. The drainfield size necessary to accommodate this future daily flow was calculated using the WTI methodology detailed in the WTI Rest Area Use: Data Acquisition and Usage Estimation Report (2011).

11.24 Hydraulic Capacity

11.241 Flow Definitions and Identification

a. Design Flow:

Based upon DEQ-4, Assuming $Q_{in} = Q_{out}$; the design flow for the wastewater treatment facility is as follows:

b. **Daily Design Flow:**

(On-site flow data)

1. Summer average number of people per day (Door counts for 06/2013 - 8/2013) = 1,246 people per day (combined).

2. Water usage per person 1.5 gpd/person. (WTI rest area recommendation for water and wastewater usage)

3. The future wastewater flow rates are estimated using the growth rate equation noted below.
(Current Peak Number of People)*(1 + [Growth Rate Decimal Form (2.0%)]) $^{\text{Number of Years}}$ = Design Year Number of People

Design Year number of People * 1.5 Water usage = Design Flow Rate

A 2.0 percent growth rates over a 22-year period has been agreed upon by DOWL and MDT and has been used to estimate the 22 year flow rate.

An individual wastewater flow rate projected 22 years is 2,890 gallons per day.
(The flows reflect average summer flows).

TOTAL= 2,890 gallons (combined)

Population:

People visiting the Rest Areas= 1,927 persons (projected average summer combined).

c. **Daily Design Flow (Domestic Water):**

The future wastewater flow rates are estimated using the growth rate equation noted below.

(Current Wastewater Flows)(1 + [Growth Rate])* $^{\textit{Number of Years}}$ *= Design Year Wastewater Flows*
(The flows reflect existing/future low-flow fixtures).

d. SEE ABOVE

e. Design Peak Hourly Flow - The instantaneous peak demand is estimated to be:

Peak Demand

As shown in the following table, the peak flow demand based on water fixture count is 45.1 gallons per minute combined. Each rest area side is approximately 22.6 gallons per minute (Domestic Demand).

Water Demand Estimate Using Fixture Values

(Based on AWWA M22 Manual, Second Edition)

Facility Name	Hysham Rest Area
Building address or number	
Residential or Non-Residential	Non-Residential
Minimum Pressure (psi)	35

Fixture or Appliance	Fixture Value (at 60 psi)	Number of Fixtures	Subtotal Fixture Value
Toilet (tank)	4	14	56
Toilet (flush valve)	35	0	0
Urinal (wall or stall)	16	6	96
Urinal (flush valve)	35		0
Bidet	2		0
Shower (single head)	2.5	0	0
Sink (lavatory)	1.5	14	21
Kitchen Sink	2.2	0	0
Utility Sink	4	2	8
Dishwasher	2	0	0
Bathtub	8	0	0
Clothes Washer	6	0	0
Hose connections (with 50 ft of hose)			
1/2 in.	5	4	20
5/8 in.	9		0
3/4 in.	12		0
Miscellaneous			
Bedpan washers	10		0
Drinking fountains	2		0
Dental units	2		0
Combined Fixture Value			201
Demand (gpm)			61
Pressure Adjustment Factor			0.74
Total Adjusted demand (gpm)			45.1

11.242 Hydraulic Capacity for WW Facilities to Serve Existing Collection Systems

Since this is a total reconstruction of the rest area and there are no existing facilities connecting, this section is not applicable.

11.243 Hydraulic Capacity for WW Facilities to Serve New Collection Systems

a. The wastewater flow gathered from on-site data is used in the design of this wastewater treatment facility. The design flow for the facilities is based on a "per

day" flow. The design daily summer average flow of 2,890 combined gpd applies specifically to this project.

b. See "Design Peak Hourly Flow" in 11.241e

c. Since the replacement system will include a new collection system, infiltration and additional inflow is not an issue.

11.244 Combined Sewer Interceptors

Not applicable.

11.25 Organic Capacity

A. Design Average BOD_5

The design average BOD_5 for the initial phase of the project is estimated to be:

Combined ((50 mg/l) x (2,890 gpd) x 8.34lb/Mgal*mg/l))/ (1 Mgal) = 1.21 lb/day
"Wastewater Engineering Treatment, Design, and Disposal" By Metcalf and Eddy, Inc., Third Edition.

Design Maximum Day BOD_5

The design maximum day BOD_5 for this project will be approximately the same as the design average day BOD_5. Storm water will not be directed into the wastewater collection system. The proposed system is dedicated for year round use. There is no reason to expect significant variations in the average loading rate during the summer months.

Use a design maximum day BOD_5 of:
Combined ((50 mg/l) x (2,890 gpd) x 8.34lb/Mgal*mg/l))/ (1 Mgal) = 1.21 lb/day
Therefore, the design maximum day BOD_5 is = **1.21 lb/day**.

Design Peak Hourly BOD_5

To determine the design peak hourly BOD_5 loading rate, apply a peaking factor of 3 to the design average loading rate. This is consistent with typical system of this type. Therefore; the design combined peak hourly BOD5 is 1.21 lb/day x 3 = **3.62 lb/day.**

B. See enclosed Non-degradation report.

11.252 Design of Organic Capacity of Wastewater Treatment Facilities to Serve Existing Collection Systems

a.-d. Not applicable since this is a replacement system.

11.253 Organic Capacity of Wastewater Treatment Facilities to Serve New Collection Systems

See response to Section 11.25.

11.26 Wastewater Treatment Facility Design Capacity

The wastewater system proposed for these facilities has been designed to handle higher-strength nitrates-nitrites and phosphorus at summer average flow rates of 2,890 gallons per day at the design summer average BOD_5 of 1.21 lb/day.

11.27 State and Federal Treatment Standards

It is DOWL 's understanding, that since the proposed wastewater systems are considered a replacement systems, the systems are designed so that the minimum standards for wastewater treatment—as defined by U.S. EPA and in accordance with the Federal Water Pollution Control Act—are met. See enclosed non-degradation report.

11.28 Initial Alternative Development

Not applicable.

11.29 Detailed Alternative Evaluation

a. **Existing Sewer System Revisions.**

1. The proposed wastewater system will be permitted through state and county authorities.

b. **Wet Weather Flows**

1. Wet Weather flows will not interact with the proposed wastewater system.

c. **Site Evaluation**

1. The wastewater system is designed so that noise pollution, potential odors, and potential impacts on air quality are insignificant. The performance record for MDT approval advance-treatment systems and pressurized drainfields indicates that, odor and air quality impacts are negligible. The noise generated by the system is also insignificant. The area set aside for sanitation facilities is large enough to provide a buffer area between the proposed wastewater treatment system and any neighboring building, such that no occupied structures would be disturbed by noise or odor.

2. There is no zoning located at this site.

3. Topography in the area of the proposed sanitation facilities is moderate

with slopes of 1-5%. Accessibility to the sanitation facilities and drainfield locations is good at this site.

4. At this time, the design of the wastewater systems are projected out for future demand based on anticipated usage through a 22-year planning horizon. The rest area is being upgraded and brought up to current standards.

5. According to the Western Regional climate center, average monthly high and low temperatures (in degrees Fahrenheit) from 11/1/1945 to 1/20/2015 at Hysham, Montana are:

Month	Low	High		Month	Low	High
January	9.0	33.1		July	56.1	89.1
February	14.1	39.6		August	53.7	87.8
March	21.9	49.5		September	43.4	76.3
April	32.1	61.7		October	33.2	63.8
May	41.9	71.2		November	21.6	46.8
June	50.3	80.0		December	12.8	36.4

6. The proposed wastewater system site is located on gently sloping Cretaceous Age deposits. The wastewater system will be located in an area with approximately 2% to 4% slope (see Site Plan).

   Flooding risk from Box Elder Creek was assessed from visual verifications of channel characteristics, vegetation growth and bank elevation. The proposed wastewater system site is located approximately 600 feet southwest of the potential floodplain boundary of Box Elder Creek. The proposed wastewater system is located in areas above any potential flooding inundation.

   The proposed drainfield areas are located such that stormwater and spring melt runoff should not pose any flooding risk to the drainfield. As a precaution, a Phase II drainage plan should be designed to divert any stormwater and spring melt runoff away from the proposed drainfield.

7. The site is located on Cretaceous Age deposits. The area is generally mapped as sandstone and shales as depicted on the geologic map in Appendix K. The formations in this area generally consists of:

   a. Kl Lance Formation (Upper Cretaceous)

Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

b. **Kfh Fox Hills Formation (Upper Cretaceous)**
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

c. **Kb Bearpaw Shale (Upper Cretaceous)**
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500.

The prominent geologic features at the sites are a drainage area located in the southeast portion of the eastbound rest area, a large sandstone out cropping located due east of the eastbound rest area and Box Elder Creek located west of the westbound rest area. The sandstone outcropping and Box Elder Creek contributed to the sand and gravel deposits throughout the sites. No other prominent geologic features were observed in the immediate vicinity of the project site corridor. Based on visual examination, the surficial soils consist of silt, clay, sand, and gravel associated with the formations within the rest area sites.

8. DOWL found the eastbound aquifer to be located in the Bearpaw shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. These logs indicate that the existing public wells located water at an interval depth of 6 to 200 feet below ground surface. Sandy clays, Sandy silts, gravels dominate the upper 10 feet of the wells. Shale and sandstone layers are found from 25 feet to 200 feet. Based on

the information presented in the well logs, it appears that the aquifer below the drainfield is found in a confined/semi confined aquifer formation. .

9. The area of the investigation focus is located in the northeastern portion of the project site where the proposed drainfield is located. In this area, soils were found to range from lean clays with sand/gravels (sandy silt loam). These types of soils are fine enough to filter and treat wastewater but not too fine to constrict or limit permeability. Percolation rates in this area ranged from 6 minutes per inch to 15 minutes per inch. Based on the site's subsurface conditions, the new wastewater system will be more than capable of handling the anticipated effluent flows.

10. The separation distances required of public subsurface sewage treatment systems by MDEQ Design Circular DEQ-4 are satisfied by the existing wells and proposed pressure-dosed drainfield location. Test holes dug in the vicinity of the proposed drainfield indicate that the required 4 feet of separation distance between the bottom of the drainfield trench and any limiting layer will be maintained.

    Groundwater or groundwater indicators were not observed at depths ranging from 1 to 10 feet in the six test pits.

    The logs of test pits dug in the area for the drainfield consist of soils classifying sandy silt loams and sandy loams (USDA)/ (lean clays (USCS). Most of these soils were observed to depths ranging from 0.5 to 10 feet. The deeper soils were generally, medium stiff in consistency, grey to brown, low plasticity and contained varying amounts of sands, clays, silts, and gravels. No field tiles are proposed for this proposed wastewater system.

11. DOWL anticipates no problems available space for the wastewater treatment facility (see enclosed site plan).

12. Enclosed are recent effluent quality results. The proposed wastewater system includes advanced treatment for the effluent stream. The effluent quality will be dramatically improved. See enclosed existing waste water results.

13. Not Applicable.

14. A cultural resources survey was not conducted for this project because improvements are anticipated to remain within previously-disturbed areas and the rest area buildings are less than 50 years old.

15. No wetlands were observed within the project area

16. Since this a replacement wastewater system, this item is not applicable

17. The Montana Natural Heritage Program (MNHP) is the clearing house for species of concern in Montana. A search of the MNHP database was conducted. No species of concern occur within the project vicinity, therefore there will be "no impact" to state species of concern.

    This proposed project will have "**no effect**" on any endangered, threatened, proposed, and candidate species based on the following factors:

    - The proposed project site is located at an existing rest area within MDT right-of-way and is not considered suitable habitat for any listed species based on a review of habitat requirements.
    - No habitat for listed species is anticipated to be lost as a result of this project and this project is not anticipated to have any negative effects on any population of a listed species.
    - Listed species/vehicle collisions are not anticipated to increase as a result of this project.

18. Spray irrigation is not proposed for this project.

d. Unit Sizing - DEQ 4

Wastewater System Design

The following specifications shall be followed during the installation and construction of the wastewater treatment system.

Sewer Design

As a minimum, each component will be installed according to the applicable State of Montana Codes (DEQ-4) and/or the Treasure County Regulations for wastewater treatment systems, whichever is more stringent. In addition, the following specifications are required:

Septic Tank Sizing –Chapter 7

All the required tank material specifications for the proposed concrete tanks, including strengths, are shown on the enclosed plans. All tanks must be reinforced concrete with effluent filters.

The septic tanks are sized based on the projected summertime average flows from the new structure.

Septic Tank Sizing:

(From Circular DEQ 4, section 5.1.6.3)

The septic tank is sized based on a combined flow from each rest facility's

wastewater flow rate that is projected out 22 years (**2,890** gallons per day).

(2,890 gallons per day) x 2.5 septic tank multiplier = 7,225 gallon tank minimum.

Use minimum **7,500 gallon** liquid volume capacity. For design purpose, a 10,000 gallon septic tank is proposed (Anderson Precast, Belgrade MT). Tank must be reinforced concrete with effluent filter.

Dose Tank Sizing:

The dose tank is sized so that both rest area's wastewater flows can be accommodated. 575 gpd (dose volume) + 722.5 gpd (25% average daily flow) + 835.5 gallons (pump submergence) = 2,133 gallons.

Use minimum **2,500 gallon** liquid volume capacity. The dose tank must be reinforced concrete. See enclosed site plan.

Inlet Baffle:

10,000 Gallon Tank

The inlets to the septic tank are 4" schedule 40 PVC line. The inlet lines are located at 81 inches from the bottom of the tank and the outlet is at 78 inches from the bottom of the tank. (81 inches – 78 inches = 3 inches).
The difference of 3 inches meets DEQ 4 sec. 7.2.5.1 design requirements

2,500 Gallon Tank

The inlet to the dose tank is a 4" Schedule 40 PVC line. The inlet line will be located at 51 inches from the bottom of the tank and the outlet will be located at 48 inches from the bottom of the tank. (51 inches–48 inches = 3 inches). The difference of three inches which meets DEQ 4 sec. 7.2.5.1 design requirements

Baffle 10% Submergence:

10,000 Gallon Tank

The tank's liquid level of the 10,000 gallon tank is:
Height (93.96 in) x Width (91.2 in) x Length (307.2 in) =2,632,443in^3= 11,396 gallons.
Ten percent of the volume is 1,139.6 gallons. There is a total of 1,455 gallons per foot in the 10,000 gallon tank. (1,139.6 gallons / 1,455 gallons/foot = 0.78 feet). The end of the baffle should be a maximum of 70.68 inches off of the bottom of the tank. The baffle shown is located 70 inches off of the bottom of the tank.

2,500 Gallon Tank

The tank's liquid level of the 2,500 tank is:

Height (64 in) x Width (73 in) x Length (168 in) = 3398 gallons.

Ten percent of the volume is 339.8 gallons. There is a total of 539 gallons per foot in the 2,500 gallon tank. (339.8 gallons / 557 gallons/foot = 0.61 feet = 7.3inches. The end of the baffle should be a maximum of 47.7 inches off of the bottom of the tank. The baffle shown is located 47 inches off of the bottom of the tank.

Baffle Above the Liquid Level

10,000 Gallon Tank

The Liquid level of the 10,000 gallon tank is 80.04 inches above the bottom of the tank; therefore the baffle must extend at least to 87 inches above the floor of the tank. As shown on the enclosed plans, the baffle extends 90 inches above the floor.

2,500 Gallon Tank

The liquid level of the 2,500 gallon tank is 48 inches above the bottom of the tank; therefore the baffle must extend at least to 57 inches above the floor of the tank. As shown on the enclosed plans, the baffle extends 57 inches above the floor

Effluent Filter

10,000 Gallon Tank

30 percent of the liquid volume 10,199.1 gallons is 3,059.74 gallons. There is 1,500 gallons per foot in the 10,000 gallon septic tank. Divide 3,060 gallons by 1,500 gallons per foot, this equals 2.04 feet. Therefore, 2.0 feet of filter is required above the inlet to the filter. As shown on the attached data sheets and detail plans, there is 2.0 feet of filter above the inlet holes.

Drainfield Sizing and Design-DEQ-4, Chapter 8

Based on percolation rates of a maximum of 15 min/inch and the existence of sandy lean clay(sandy loam) in the test pits, MDEQ specifies an application rate of 0.5 gallons per day (gpd) per square feet (ft^2).

The proposed flow rate was calculated from on-site meters and door counter data projected over a 22-year design period (combined sites).

Assumptions:

1. Flow rate of 2,890 gpd of effluent, and
2. An application rate of 0.5 gpd/ft^2, and
3. An infiltration area discount factor of 50% for advanced treatment.

Use: 2,890 gpd/0.5 gpd/ft^2 = 5,780 sf
5,780 sf * 0.5 = 2,890 sf

Lateral Requirements:

(2,890 sf) / (3 ft trench "infiltrator") = 964 lnft

TOTAL = 964 lineal feet required

Total Drainfield / 100% Replacement Area:

Use ten, 100 foot, 2.0 inch drainfield laterals in three foot wide "infiltrator" gravelless drainfield septic chambers in a "standard depth trench" at seven feet on center (minimum). Thus the drainfield area required will be 100 feet by6 3 feet. See Site Plan Attached.

TOTAL DRAINFIELD AREA = 100 feet x 63 feet

The conceptual site plan shows the primary drainfield sizes with the 50% reductions, (advanced treatment) and a replacement drainfield area without the 50% reduction. The final determination on drainfield size reductions will be based on treated effluent strength, soil conditions, and non-degradation to groundwater.

The primary drainfield has been located and designed so that all minimum separation distance requirements are met. The replacement drainfield location and design also meet these criteria.

Table 1 Drainfield Design								
Description	Lateral length (ft.)	Trench Width (ft.)	Trench Length (ft.)	Number of Laterals	Distance Between Laterals (ft.)	Primary Drainfield Area (ft^2)	Replacement Drainfield Area (ft^2)	System Type
Public Drainfield	100'	3'	100'	10	7'	100'x 63'	100'x126'	Advanced Treatment Pressure Dosed, Leaching Chambers

The primary and replacement drainfields are located and designed so all the minimum separation distance requirements are met. The replacement drainfield location and design also meet these criteria.

The installer must follow the manufacturer's instructions and all regulatory standards according to gravelless absorption trenches of Circular DEQ-4 when installing the pressure distribution pipelines. The pressure distribution drainfield shall be constructed and placed according to the attached plans and the dimensions shown in Table 1. The dosed drainfield lateral trenches shall be perpendicular to the slope of the ground surface and level, to provide even distribution between laterals.

All pipe and fittings must be PVC, pressure-rated and at least Class 160 PVC pipe. PVC is to be joined with primed solvent/cement welded joints.

All laterals (gravelless chambers) are to be installed perpendicular to ground slope with clean-out risers on the ends. Install a total of 1,000 lineal feet of gravelless chambers in standard 3-foot wide trenches at a minimum of 7 feet on center. Each lateral shall be approximately 100 feet long.

Distribution laterals shall have orifices constructed so that all burrs are removed and the drill holes are not egg shaped. There shall be a single row of 1/8" diameter orifices placed in a straight line. The first orifice shall be placed 2.5 feet downstream from the manifold, and the remaining orifices shall be placed at 5-foot intervals. Pressure distribution piping shall be hung from the ceiling of the leeching chamber according to manufacturer's guidelines.

Cleanouts shall be provided at the end of each lateral. The cleanouts must be at the finished grade, and a metal location marker or plastic valve cover must be provided for each cleanout. Cleanouts shall be constructed from either a long-sweep elbow or two 45-degree bends.

A minimum of 12 inches of soil shall cap the entire drainfield. The cap shall be graded to extend to a 3:1 or flatter slope away from the drainfield area. Only grass (native or planted) shall be present over the entire area of the elevated drainfield.

Mainlines within the system will be PVC schedule 40 pipe, laid sloping back so that effluent in the mainline will drain back to the dose tank after its dosing cycle.

Prior to placing backfill or cover, the Engineer shall inspect all leaching chambers, piping, orifices and construction. The pressure distribution system must be field-tested to verify uniform distribution and proper operation.

Plumbing Requirements

All pumps, pipes, orifice sizing, diameters, etc. are based on the hydraulic analysis enclosed within this report.

Dosing System Chapter -9

One 2,500 gallon dose tank will be used for this system (see attached plans). The tank is designed to handle the daily flow from each rest area site. The dosing tank shall provide over 25% of the daily volume for temporary storage to handle peak flows and electrical failures.

The 2,500 gallon dose tank will be used to dose the proposed drainfield.

The dose tank will collect the processed effluent from the treatment system and dose it to the pressurized drainfield.

Sizing of Tank:
The dose tank is sized so that the both rest area's wastewater flows can be accommodated. 575gpd (dose volume) + 723gpd (25% average daily flow) + 835.5 gallons (pump submergence) = 2,130.5 gallons.

Use minimum **2,500 gallon** liquid volume capacity. The dose tank must be reinforced concrete. See enclosed site plan.

All pipe and fittings must be PVC, pressure rated and at least Class 160 PVC pipe.

The dose system shall be constructed with explosion-proof pumps and an audio and/or visual high-level alarm on the side of the structures or with on an electrical pedestal. All wiring shall be protected from sewer gases and be corrosion proof.

Riser and tank joints exposed to infiltration must be grouted between sections when installed.

Tank risers shall be installed per manufacturer instructions to a height of 2 inches above finished grade before placing lid. Risers that are too tall need to be CUT AT THE BOTTOM END to size. Engineer, upon presentation, may approve an alternate installation design.

Dosing Pump
The pump for the dosing system shall be two effluent pumps that can accommodate a flow of **44 gallons per minute at 21 feet of dynamic head** (Hydromatic SPD 50H or approved equal). The pumps shall provide a minimum pressure of 2.16 psi (5.0 feet of head) at end of each distribution lateral.

Pump Controls
The dose tanks contain a set of float switches, which will control operation of the pumps (dose volumes will equal a total of 575 gallons per dose.). Floats are mounted on a 2" SCH 40 PVC Float Stem, which extends the

depth of the dose tank. See attach detail sheet and design calculations for float height settings. A high-water alarm shall be provided for the dosing chamber. The float switches and timer shall be positioned so that the dose duration does not exceed 15 minutes.

The pumps and controls in the dosing system shall be corrosion resistant and meet the requirements of National Electrical Code Class I, Division 2 locations in accordance with DEQ-4.

e. **Flow Diagram**
Flow diagram of the treatment facilities including all flows are shown in the enclosed drawings.

f. **Emergency Operation**
The wastewater system is designed to accommodate a power failure and other "down times" through the reserve capacity in the dose tank. The dose tank has enough capacity so the day to day operations would not be affected. Both the well (i.e. water supply) and wastewater will be on the same power supply; meaning that during power failures neither water nor sewer systems would operate. See Operation and Maintenance Manual, bound separately and attached.

Operation and maintenance personnel will have a portable pump available for immediate use when individual components of the system are not operating and transfer of wastewater from one component to the other is required. A contract will also be available with a licensed waste hauler to assure that any portion of the system can be pumped out and disposed of safely, if it is ever required.

g. **Technology Not Included in These Standards**
Not applicable.

h. **Sludge**
When necessary, a qualified local sludge handler will be contracted to pump the septic tanks. The handler will need to be licensed to transport human waste.

i. **Treatment During Construction**
The current system will be used until the proposed system is constructed

and is approved by the design engineer and MDEQ.

j. **Operation and Maintenance**

Operation and maintenance of this type of a system is critical to its long-term success. All aspects of the system require proper operational procedures. A complete O & M manual will be provided for the entire system. A copy is enclosed with this submittal.

j **Cost Estimates:**

Task		Range		
ON-SITE WATER	$	15,000.00	$	40,000.00
WASTEWATER TREATMENT	$	15,000.00	$	25,000.00
DRAINFIELD	$	15,000.00	$	25,000.00
TANKS & PUMPS	$	10,000.00	$	15,000.00
CONTROLS	$	5,000.00	$	10,000.00
Subtotal	$	60,000.00	$	115,000.00
Mobilization - 18%	$	10,800.00	$	20,700.00
Subtotal	$	70,800.00	$	135,700.00
Contingency - 10%	$	7,080.00	$	13,570.00
Total	**$**	**77,880.00**	**$**	**149,270.00**

System Budget

Since this is a state-run facility, a wastewater system budget is not needed.

k **Environmental Review:**

Since this is a replacement system, environmental review is not required. However the replacement system has been designed so that environmental concerns have been considered.

11.29 Final Project Selection

It is anticipated that the proposed system can be constructed, operated, and maintained to consistently and reliably deliver a level of treatment at a cost which is economically viable for Montana Department of Transportation.

CHAPTER 20 PLANS AND SPECIFICATIONS

See enclosed plans and specifications.

CHAPTER 30 DESIGN OF SEWERS

The system consists of conventional drain, waste, and vent (DWV) piping within the structures that is connected to one 10,000 gallon septic tank. The effluent is then

transported to a level II treatment system. From the treatment system, the treated effluent is collected in a 2,500 dose tank. From the dose tank, the effluent is transported to a pressurized, dosed drainfield. The drainfield is designed to accommodate 2,890 gallons per day (combined).

Main Lines

PVC pipe is laid with the contour of the terrain as much as possible, and placed within wastewater corridors where available.

Effluent sewers generally receive about 80 percent of the daily water usage and are not required to satisfy fire and peak domestic flows water flows. The storage reserve in the sewer system (septic and dose tanks) is to provide sufficient buffering capacity addressing any concern for rushing the effluent away in large doses or flow rates.

Pumps

The pumps within the proposed wastewater system will demonstrate uniform distribution with no greater than 10 percent variation across the entire absorption system

CHAPTER 50 WASTEWATER TREATMENT WORKS (FACILITY DESIGN)

This section is not applicable since no treatment facility is proposed in this phase of the design.

LIMITATIONS

The conclusions and recommendations presented in this report assume that site conditions are not substantially different than those exposed by the explorations. If during construction, subsurface conditions different from those encountered in the explorations are observed or appear to be present, DOWL should be advised at once to review those conditions and reconsider recommendations where necessary.

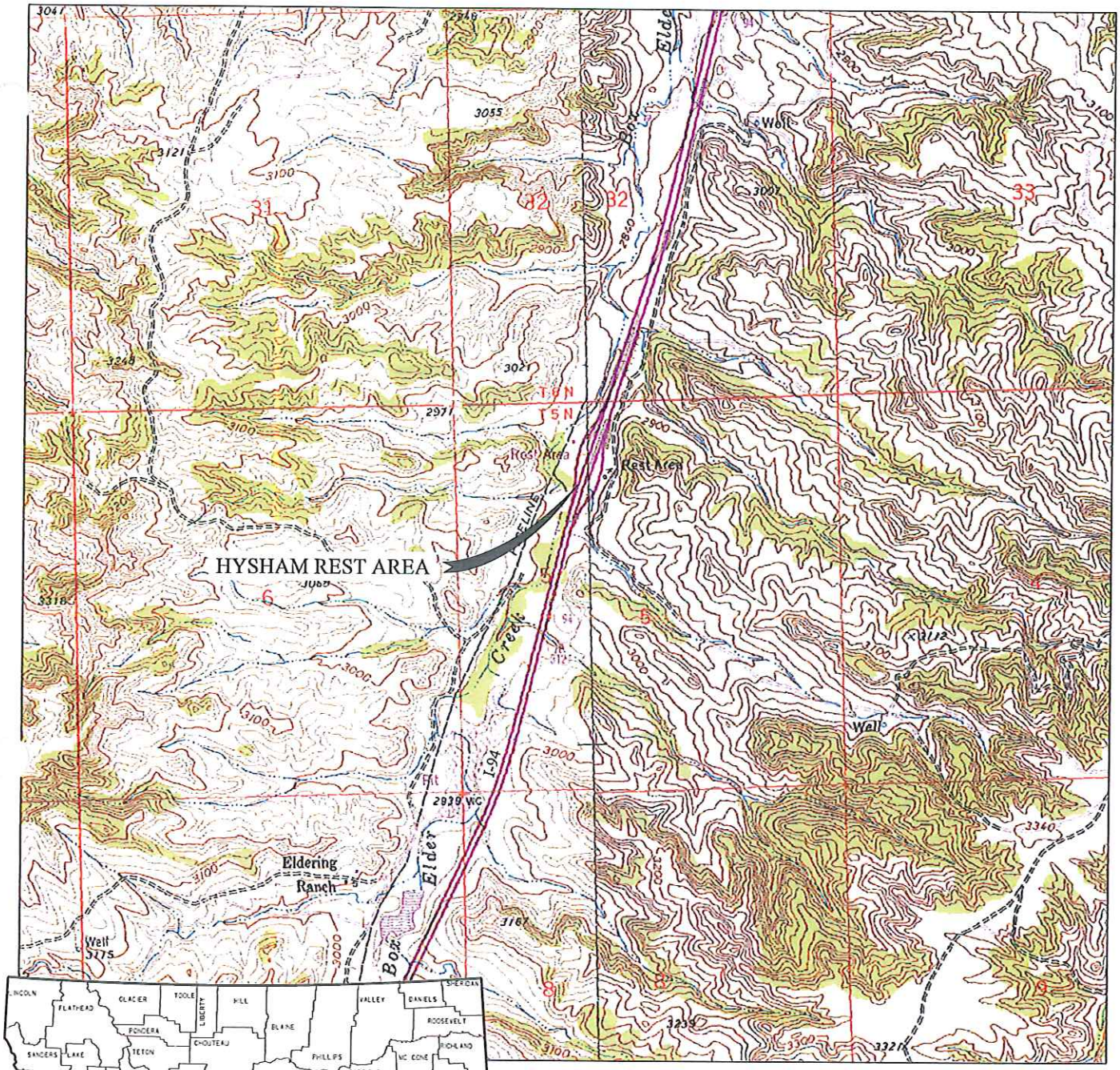
If there is a substantial lapse of time between submission of this report and the start of work at the site, and if conditions have changed due to natural causes or construction operations at or near the site, this report should be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions.

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX A:

LOCATION MAPS

DOWL



DOWL HKM

HYSHAM REST AREA

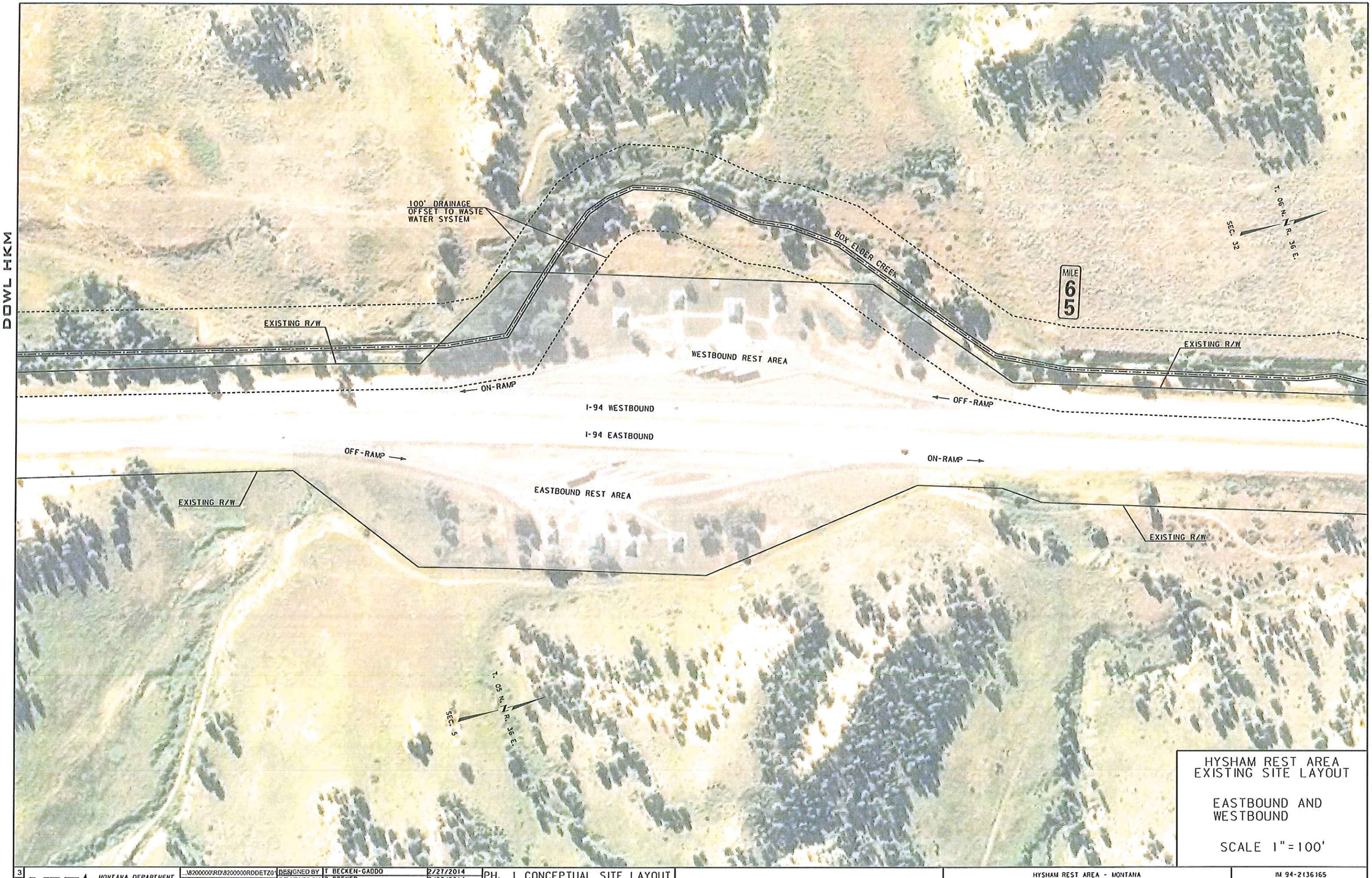
TREASURE COUNTY, MONTANA

USGS VICINITY MAP

PROJECT NUMBER:	IM 94-2(36)65
CONTROL NUMBER:	UPN 8200000
DATE:	MARCH 2014

FIGURE 1

DOWL HKM



HYSHAM REST AREA EXISTING SITE LAYOUT

EASTBOUND AND WESTBOUND

SCALE 1"=100'

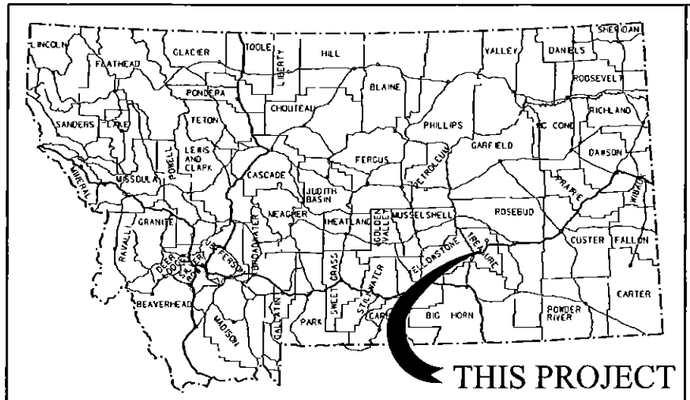
3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDDETZ01	DESIGNED BY	T BECKEN-GADDO	2/27/2014	PH. 1 CONCEPTUAL SITE LAYOUT	HYSHAM REST AREA - MONTANA / UPN 8200000	IM 94-2(36)165
2		2/28/2014	REVIEWED BY	B DREYER	2/27/2014			
1		3:41:54 PM ABeckengadd	CHECKED BY	B DREYER	2/27/2014	TREASURE COUNTY		

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX B:

SITE PLAN

DOWL



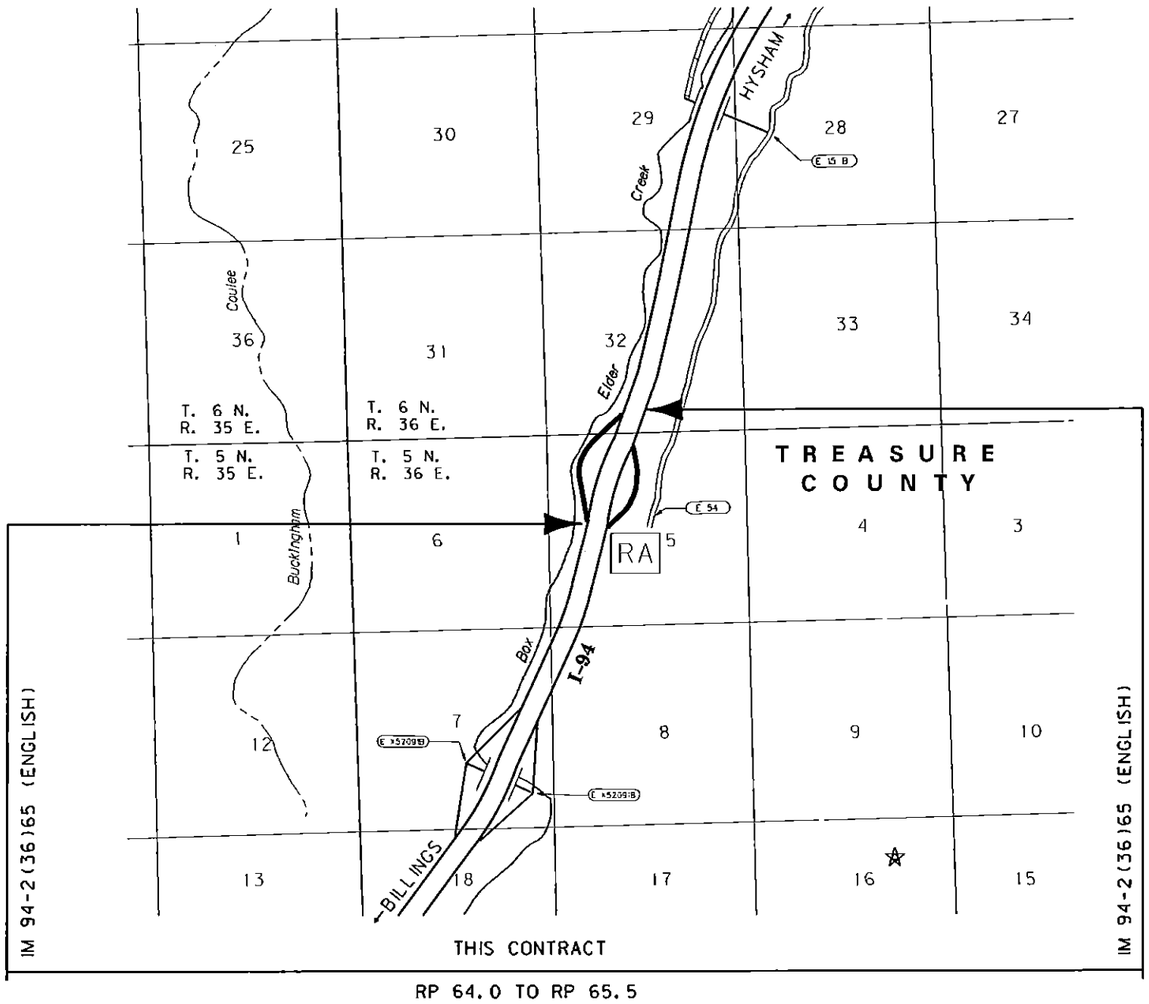
MONTANA DEPARTMENT OF TRANSPORTATION

FEDERAL AID PROJECT IM 94-2(36)65
WASTEWATER MDEQ PERMITTING
HYSHAM REST AREA - MONTANA
TREASURE COUNTY

PRESENT 2014 A.D.T.	= 4,940
LETTING 2016 A.D.T.	= 5,140
DESIGN 2036 A.D.T.	= 7,650
D.H.V.	= 880
TRUCKS	= 27.3%
V.	= 70 MPH
18 KIP ESAL'S	= 827
GROWTH RATE	= 2.0%

CSF=0.9993521809

LENGTH N/A MILES



RP 64.0 TO RP 65.5

PLANS PREPARED BY

DOWL

2090 STADIUM DRIVE
BOZEMAN, MONTANA 59715
(406) 586-8834

ASSOCIATED PROJECT AGREEMENT NUMBERS	
R/W & I.C.	
P.E.	IM 94-2(36)65

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UIT\8200000UTTTLZ10.dgn	DESIGNED BY	T BECKEN-GADDO	8/26/2015
2		8/28/2016	REVIEWED BY	B DREYER	8/26/2015
		11:51:36 AM ABeckengadd	CHECKED BY	T CORNER	8/26/2015

WASTEWATER PLANS

UPN 8200000

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SANITARY SEWER SYSTEM	

LINEAR AND LEVEL DATA

BEARING SOURCE

GRID -- MONTANA COORDINATE SYSTEM NAD83-2011

LEVEL DATUM SOURCE

NAVD88 (GNSS DERIVED ELEVATIONS USING GEOID 12A AND HOLDING NGS MARK A555)

NOTES

UTILITIES

CALL THE UTILITIES UNDERGROUND LOCATION CENTER (811) OR OTHER NOTIFICATION SYSTEM FOR THE MARKING AND LOCATION OF ALL LINES AND SERVICE BEFORE EXCAVATING. ALL CLEARANCES OR DEPTHS PROVIDED FOR UTILITIES ARE FROM EXISTING GROUND LINE.

WETLANDS

WETLANDS MAY EXIST ADJACENT TO THE ROADWAY AND BEYOND THE PROJECT LIMITS. A WETLAND DELINEATION HAS NOT BEEN COMPLETED FOR THIS PROJECT. IMPACTS TO WETLAND AREAS ARE NOT ANTICIPATED IN ASSOCIATION WITH THE PROPOSED WORK. NO PERMITS HAVE BEEN OBTAINED. ANY ACTION IMPACTING WETLAND AREAS WITHOUT THE APPROPRIATE PERMITTING IS THE RESPONSIBILITY OF THE CONTRACTOR.

SOILS INFORMATION

SOILS INFORMATION ON THE PLAN AND PROFILE SHEETS IS A BRIEF SUMMARY OF THE SOILS CLASSES. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.

GEOTECHNICAL BORING / SOIL SURVEY LEGEND

- MATERIAL IS LABELED AT THE BOTTOM OF THE LAYER
- A MINUS (-) OFFSET INDICATES A DIRECTION LEFT OF PROJECT CENTERLINE
- THE GEOTECHNICAL TEST PITS WERE CONDUCTED FOR WASTEWATER DESIGN PURPOSES

BH #	TP #	PERC #
(GEOTECHNICAL BORING)	(GEOTECHNICAL TEST PIT)	(PERCOLATION TEST)

COMBINATION SCALE FACTOR

ALL COORDINATES ARE STATE PLANE (SEE CONTROL DIAGRAM).
CSF IS 0.9993521809

R/W SURVEY LEGEND

R/W	EXISTING CONCRETE R/W MONUMENT
R/W	EXISTING METAL R/W REFERENCE PIN
SM	EXISTING STATION MARKER

CONTROL DIAGRAM

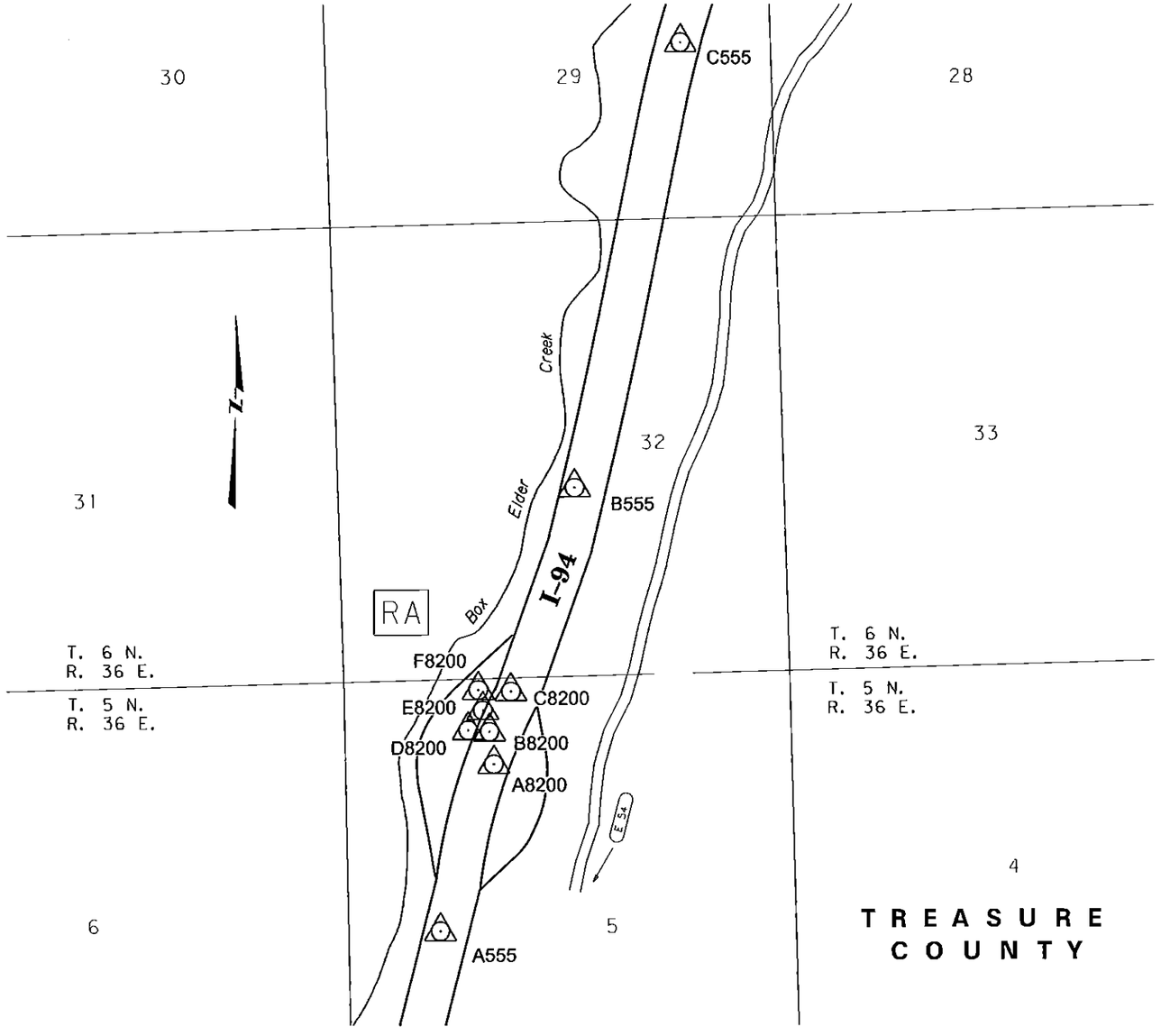
SCALE: N/A

NOTE:
THIS PROJECT IS ON THE MONTANA COORDINATE SYSTEM NAD83-2011.
NORTHING AND EASTING COORDINATES ARE EXPRESSED IN UNITS OF INTERNATIONAL FEET AND ELEVATIONS ARE IN UNITS OF U.S. SURVEY FEET.

DIMENSIONS SHOWN ON THE PLANS ARE GRID. ALL SURVEY AND STAKING REQUIRE THE USE OF A COMBINATION SCALE FACTOR (CSF) TO CONVERT GRID DIMENSIONS TO GROUND DIMENSIONS (GRID DISTANCE % CSF = GROUND DISTANCE).
THE CSF FOR THIS PROJECT IS 0.9993521809.

CONTROL ABSTRACT

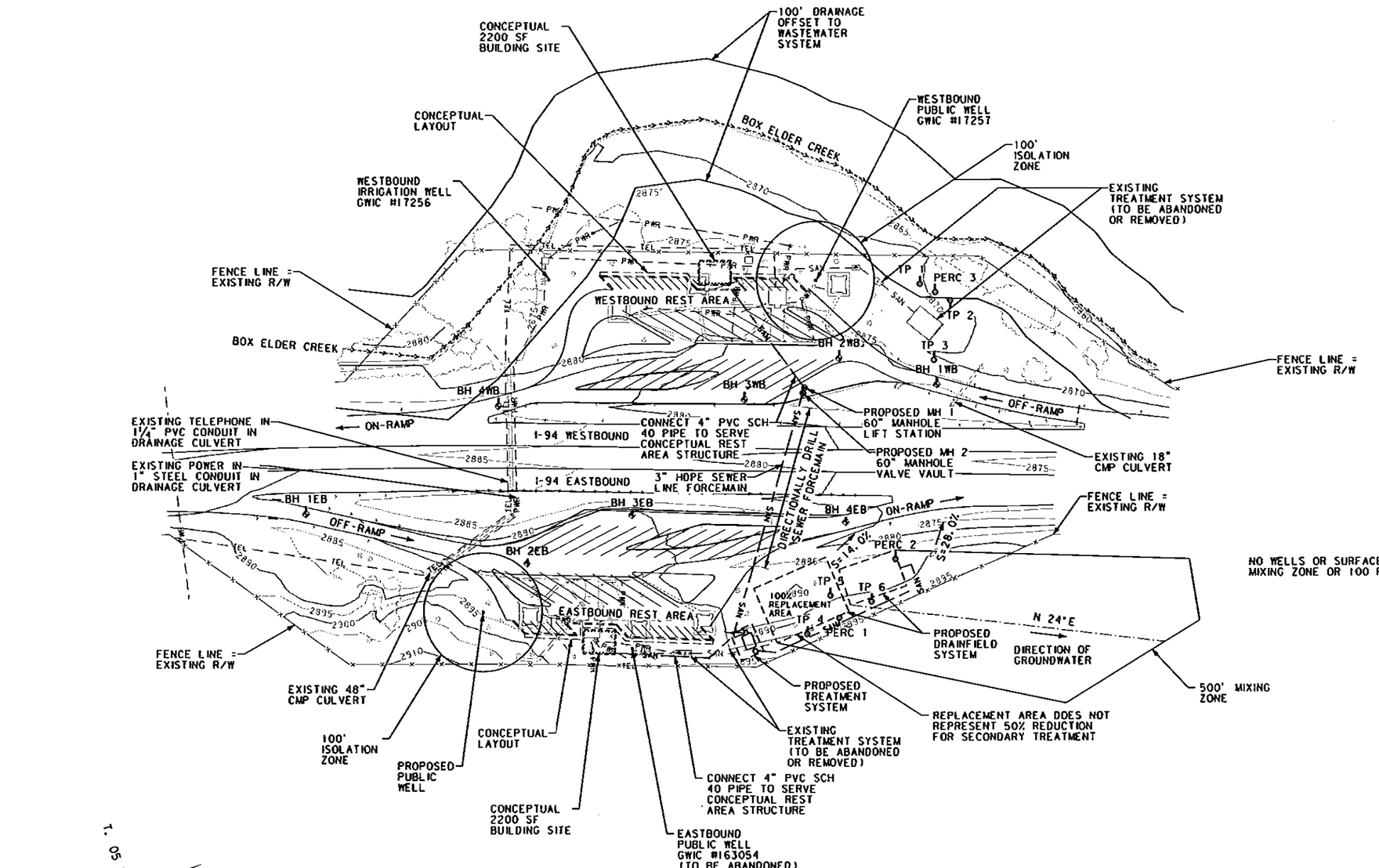
POINT NAME/NUMBER	N OR Y COORDINATE	E OR X COORDINATE	POINT ELEVATION	LOCATION AND DESCRIPTION
A8200	725,426.577	2,537,663.876	2,901.27	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "A8200 2014", for the east bound I-94 rest area, on a small bench south of the maintained grass area, 90 ft. E-SE of the east edge of pavement, 76 ft. se of a metal sign post(no camping) . Set a metal witness post and MDT sticker 3 ft. north of the cap.
B8200	725,804.962	2,537,612.307	2,890.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "B8200 2014", for the east bound I-94 rest area, near the center (N-S) of the rest area, 1 ft. west of the top back of curb for the tractor trailer parking area, in the grass area, on top of a small hill between the east bound I-94 guard rail and the tr/tr parking area, 45 ft. north of an angle point in along the west edge of the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
C8200	726,275.214	2,537,865.555	2,893.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "C8200 2014", for the east bound I-94 rest area, 380 ft. north of the north most picnic table, on a small hill above where the exit ramp for the rest area meets the east bound lane of I-94, 28 ft. west of the N-S r/w fence. Set a metal witness post and MDT sticker 3 ft. north of the cap.
D8200	725,822.290	2,537,361.381	2,881.85	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "D8200 2014", for the west bound I-94 rest area, near the south most end of the rest area, 7 ft. west of the edge of pavement, 35 ft. northwest of the south most nose of the curbing between the car and truck lanes leaving the rest area, west bound onto I-94. Set a metal witness post and MDT sticker 3 ft north of the cap.
E8200	726,056.134	2,537,534.645	2,879.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "E8200 2014", for the west bound I-94 rest area, near the center (N-S) of the tractor/trailer parking area, on the grass slope between the west bound edge of pavement and the tr/tr parking lot, 10 ft. west of the I-94 edge of pavement, 26 ft. east of the eop for the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
F8200	726,293.950	2,537,481.604	2,876.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "F8200 2014", for the west bound I-94 rest area, near the north end of the rest area, 1 ft. north of the edge of pavement, 33 ft. north of the north most end of the concrete sidewalk next to the handicap parking stall. Set a metal witness post and MDT sticker 3 ft. east of the cap.
A555	723,476.593	2,537,037.718	2,929.16	A ngs stainless steel rod in a monument box with a lid marked "A555 1981", on the east bound side of I-94, near milepost 64.4, 100 ft. southeast of the centerline of the east bound lane, 1.2 ft. west-northwest of an ngs witness post, 1.6 ft. west-northwest of the r/w fence.
B555	728,660.461	2,538,613.291	2,869.74	A ngs stainless steel rod in a monument box with a lid marked "B555 1981", on the east bound side of I-94, near milepost 65.35, 113 ft. E-SE of the centerline of the east bound lane, 1.6 ft. west-northwest of the r/w fence
C555	733,871.091	2,539,864.383	2,814.30	A ngs stainless steel rod in a monument box with a lid marked "C555 1981", on the east bound side of I-94, near milepost 66.4, 93 ft. E-SE of the centerline of the east bound lane, 1.75 ft. west-northwest of the r/w fence.



3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTTRVZ10.dgn	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA	IM 94-2(36)165
2		8/28/2015	REVIEWED BY	B DREYER	8/26/2015			
		11:51:56 AM ABeckengadd	CHECKED BY	T CORNER	8/26/2015	TREASURE COUNTY	CSF = 0.9993521809 UPN 8200000	SHEET 3 OF 11

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD



NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD

T. 05 N.
R. 36 E.
SEC. 5

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD

NOTES:

1. TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.
2. FINAL LOCATION OF STRUCTURES WILL BE DETERMINED IN PHASE II OF THIS PROJECT.
3. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
4. CONCEPTUAL FACILITIES ARE APPROXIMATE.
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

OVERALL SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ10.dgn	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA / NH 94-2136(165)
2		8/28/2015	REVIEWED BY	B DRETER	8/26/2015		
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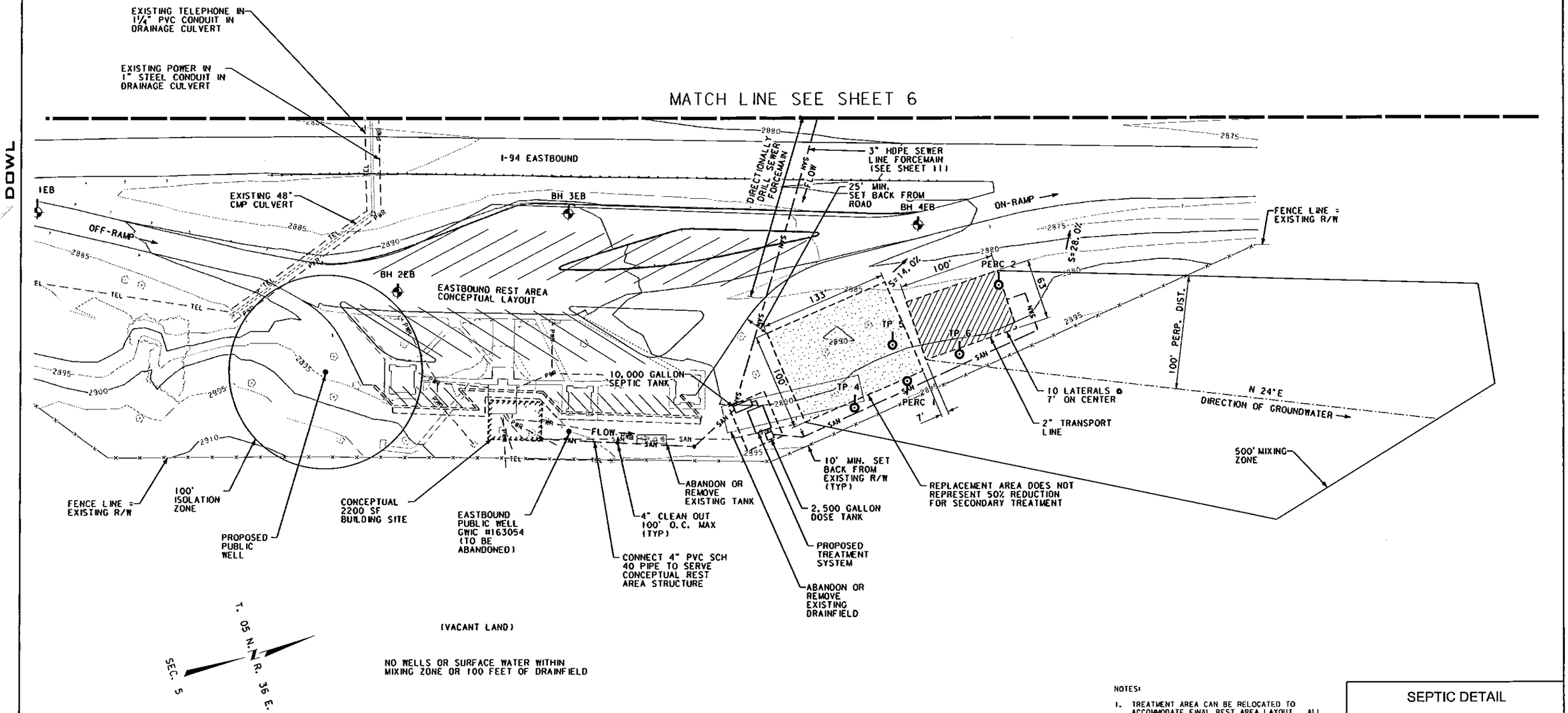

LEGEND

PROPOSED 100% REPLACEMENT AREA

PROPOSED PRIMARY DRAINFIELD

NOTES:

1. TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.
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3. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
4. CONCEPTUAL FACILITIES ARE APPROXIMATE.
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

SEPTIC DETAIL

EASTBOUND SITE

SCALE 1"=50'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ10.dgn	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA	IM 94-2136165
		8/28/2015	REVIEWED BY	B DREYER	8/26/2015			
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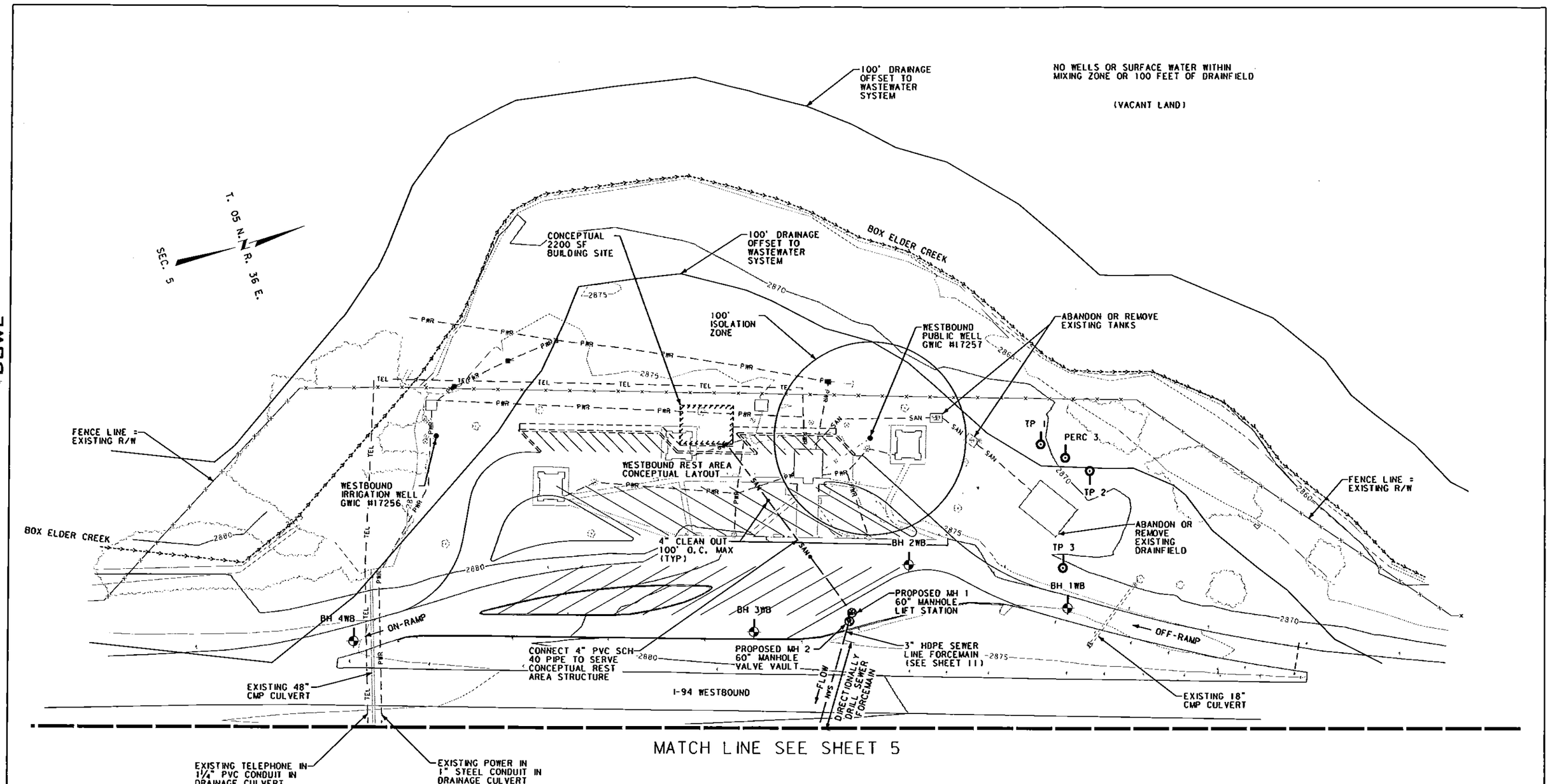


MATCH LINE SEE SHEET 5

NOTES:

1. TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.
2. FINAL LOCATION OF STRUCTURES WILL BE DETERMINED IN PHASE II OF THIS PROJECT.
3. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
4. CONCEPTUAL FACILITIES ARE APPROXIMATE.
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

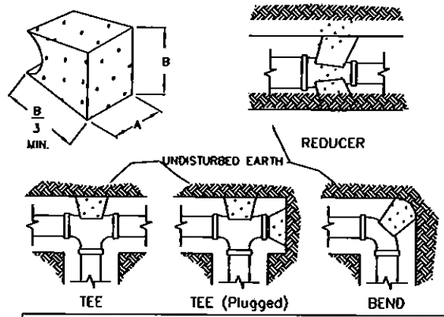
SEPTIC DETAIL

WESTBOUND SITE

SCALE 1"=50'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UTIL\8200000UTDETZ10	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WASTEWATER PLANS	
1		8/28/2015	REVIEWED BY	B DREYER	8/26/2015	TREASURE COUNTY	
		11:52:16 AM ABeckengadd	CHECKED BY	T CORNER	8/26/2015		

HYSHAM REST AREA - MONTANA		IM 94-2136(65
CSF=0.9993521809	UPN 8200000	SHEET 6 OF 11



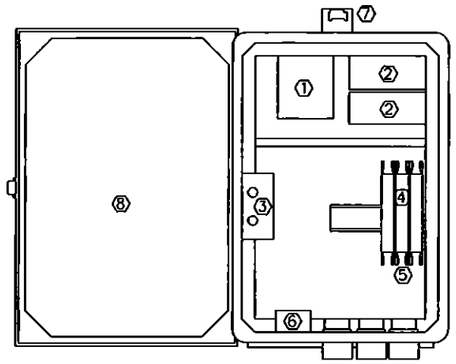
DIMENSIONS FOR THRUST BLOCKING								
FITTING SIZES	TEES & PLUGS		90° BEND		45° BEND & WYES		REDUCERS & 22 1/2° BEND	
	A	B	A	B	A	B	A	B
2"-4"	1'-10"	1'-5"	1'-10"	1'-6"	1'-8"	1'-0"	1'-7"	0'-6"
6"	2'-3"	1'-11"	2'-8"	2'-4"	2'-0"	1'-8"	1'-9"	1'-0"
8"	3'-0"	2'-6"	3'-6"	3'-2"	2'-8"	2'-3"	2'-0"	1'-6"
10"	3'-8"	3'-3"	4'-4"	4'-0"	3'-3"	2'-10"	2'-5"	2'-0"
12"	4'-3"	4'-0"	5'-1"	4'-10"	3'-10"	3'-6"	2'-9"	2'-6"
14"	5'-8"	4'-1"	6'-9"	5'-0"	5'-0"	3'-8"	3'-7"	2'-7"
16"	6'-3"	4'-10"	7'-8"	5'-9"	5'-9"	4'-2"	4'-5"	2'-9"

NOTE:
THIS TABLE IS BASED ON 150 PSI MAIN PRESSURE
1500 PSF SOIL BEARING PRESSURE

1/7 THRUST BLOCKING FOR PRESSURE MAIN

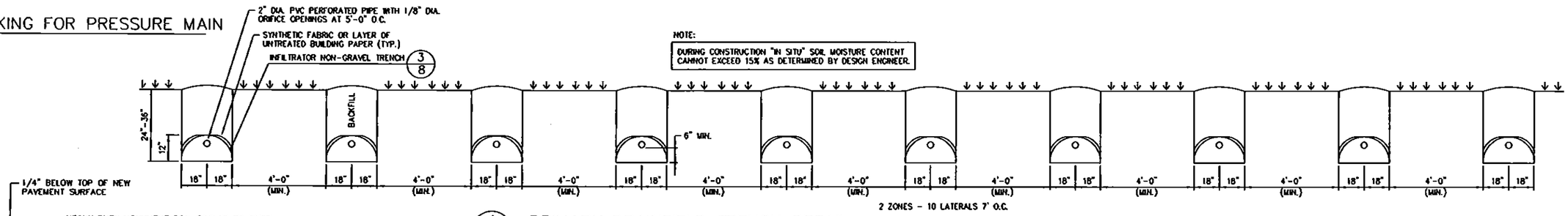
SCALE: NOT TO SCALE

FEATURE	SPECIFICATIONS
① PROGRAMMABLE LOGIC UNIT	120/240 VAC programmable logic unit with built-in LCD screen and programming keys. Provides control functions and timing for panel operation.
② MOTOR-START CONTACTORS	120 VAC: 14 FLA 3/4 hp, 60 hz; 2.5 million cycles at FLA (10 million at 50% FLA 240 VAC: 14 FLA 2 hp, 60 hz; 2.5 million cycles at FLA (10 million at 50% FLA
③ TOGGLE SWITCHES	Single-pole, double throw HOA switch. 20 amps, 1 hp.
④ CONTROLS CIRCUIT BREAKER	10 amps, OFF/ON switch. Single pole 120 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
⑤ PUMP CIRCUIT BREAKERS	20 amps, OFF/ON switch. Single pole 120 VAC. double-pole 240 VAC. DIN rail mounting with thermal magnetic tripping characteristics.
⑥ AUDIO ALARM	80 dB at 24", warble-tone sound.
⑦ VISUAL ALARM	red lens, "Push-to-silence." NEMA 4
⑧ PANEL ENCLOSURE	Measures 11.52" high x 9.31" wide x 5.43" deep. NEMA 4X rated. Constructed of UV-resistant fiberglass; hinges and latch are stainless steel. Conduit couplings provided.
MVP-SI-RO OR APPROVED EQUAL	120 VAC, 3/4 hp, 14 amps, single phase, 60 Hz.
	240 VAC, 2 hp, 14 amps, single phase, 60 Hz.



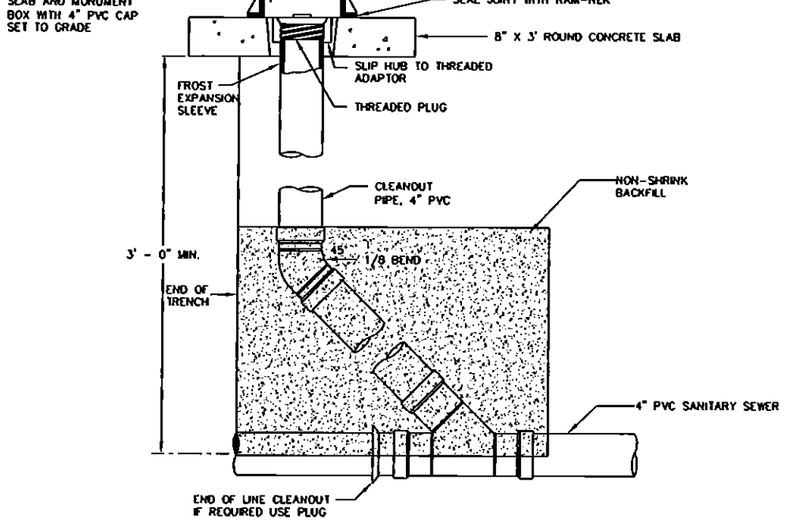
3/7 DOSE CONTROL AND ALARM PANEL

SCALE: NOT TO SCALE

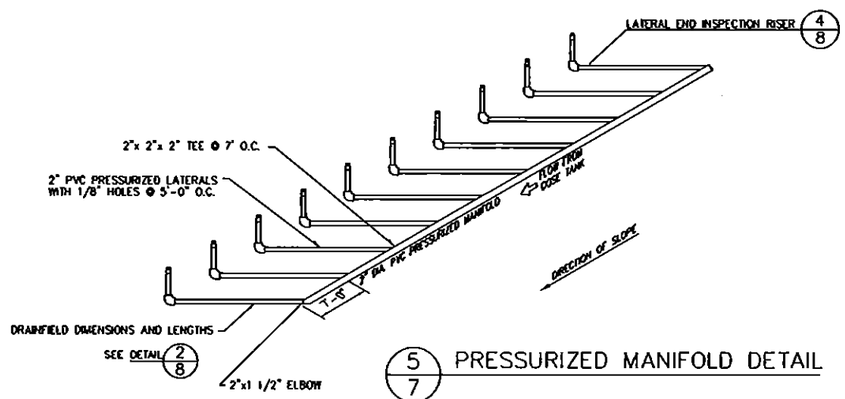


4/7 PRIMARY DRAINFIELD TRENCH DETAIL

SCALE: NOT TO SCALE



2/7 SEWER CLEANOUT DETAIL



5/7 PRESSURIZED MANIFOLD DETAIL

SCALE: NOT TO SCALE

SANITARY SEWER DETAILS

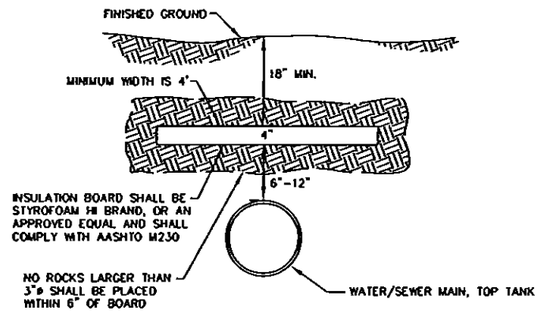
NO SCALE

3 2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ11	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA	M 94-2136165
		8/28/2015	REVIEWED BY	B DREYER	8/26/2015			
		11:52:26 AM ABeckengadd	CHECKED BY	T CORMIER	8/26/2015	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 7 OF 11

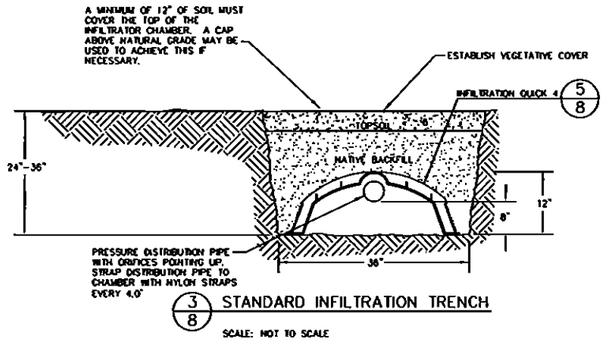
DOWL

GENERAL WASTEWATER TREATMENT SYSTEM CONSTRUCTION NOTES:

1. ALL CONSTRUCTION SHALL CONFORM TO THE ACCOMPANYING PLANS.
2. NO CHANGE OR MODIFICATION OF THE APPROVED PLANS SHALL BE MADE WITHOUT THE PRIOR WRITTEN APPROVAL OF THE ENGINEER AND/OR MDEQ.
3. INSTALLER MUST BE LICENSED AND QUALIFIED TO INSTALL SUBSURFACE WASTEWATER TREATMENT SYSTEMS IN TREASURE COUNTY, MONTANA.
4. ALL SYSTEM COMPONENTS WILL BE BURIED, COVERED AND INSULATED WHERE REQUIRED TO PREVENT MALFUNCTION. USE INSULATED RISERS AND/OR RIGID INSULATION IF REQUIRED.
5. ALL ELECTRICAL EQUIPMENT SHALL COMPLY WITH THE NATIONAL ELECTRIC CODE, CLASS I, GROUP D, DIVISION 2.
6. ALL GRAVITY SEWER SERVICE LINES TO BE 4" SCH 40 PVC AND TO BE PLACED AT A MINIMUM DOWNWARD SLOPE OF 1/4" PER FOOT.
7. ALL SYSTEM COMPONENTS WILL MEET OR EXCEED ALL DESIGN CRITERIA AS OUTLINED IN MDEQ-CIRCULAR DEQ-4 "MONTANA STANDARDS FOR SUBSURFACE WASTEWATER TREATMENT SYSTEMS".
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH TREASURE COUNTY REGULATIONS/MDEQ FOR WASTEWATER TREATMENT SYSTEMS.
9. ALL SYSTEM COMPONENTS MUST BE WATERTIGHT.
10. SEE MANUFACTURER'S DETAILS FOR ANY SYSTEM COMPONENT DETAILS NOT SHOWN ON THIS SHEET.
11. ALL FIELD TESTING WILL BE CONDUCTED AS REQUIRED IN DEQ-4.



1/8 DETAIL
INSULATION BOARD
SCALE : NOT TO SCALE

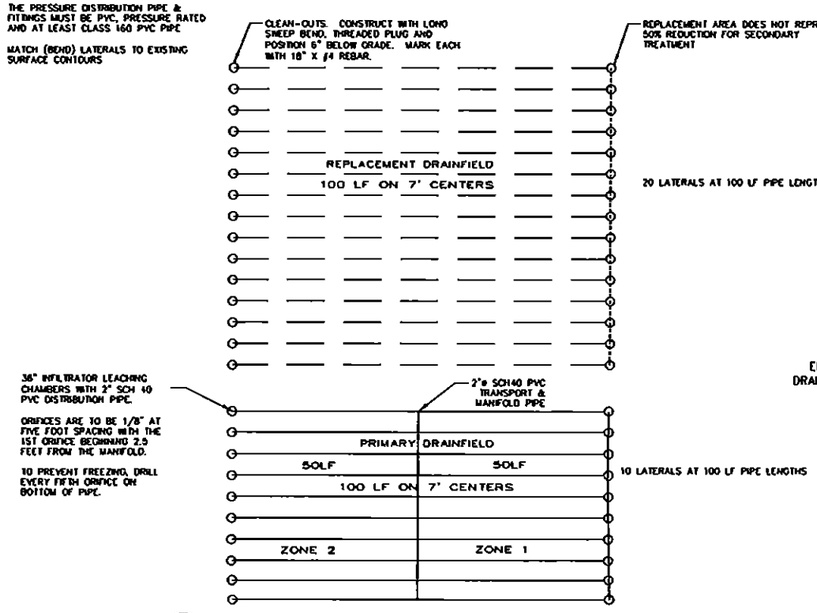


3/8 STANDARD INFILTRATION TRENCH
SCALE: NOT TO SCALE

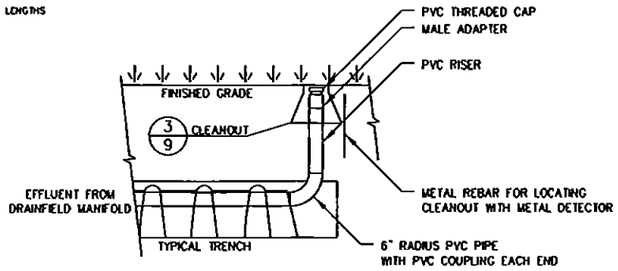
NOTE:

THE PRESSURE DISTRIBUTION PIPE & FITTINGS MUST BE PVC, PRESSURE RATED AND AT LEAST CLASS 160 PVC PIPE

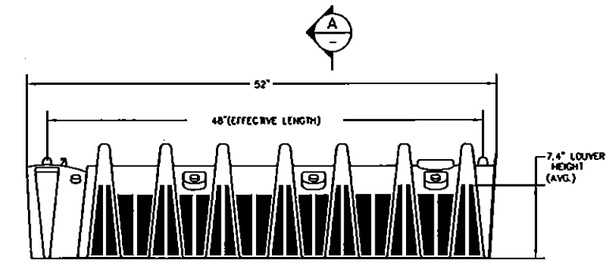
MATCH (BEND) LATERALS TO EXISTING SURFACE CONTOURS



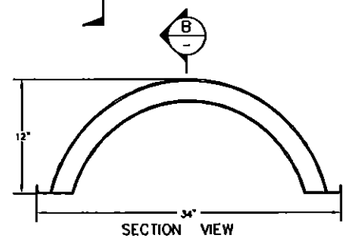
2/8 PRIMARY AND SECONDARY DRAINFIELD DETAIL
SCALE: NOT TO SCALE



4/8 TYPICAL DRAINFIELD LATERAL END INSPECTION RISER
SCALE: NOT TO SCALE

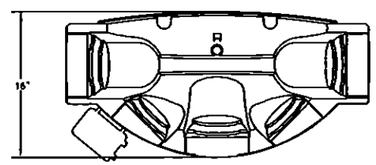


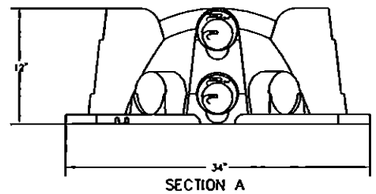
SIDE VIEW



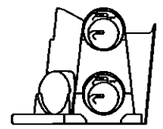
SECTION VIEW

MULTIPORT END CAP





SECTION A



SECTION B

5/8 STANDARD CHAMBER DETAIL
SCALE: NOT TO SCALE

SANITARY SEWER DETAILS

NO SCALE

CONSTRUCTION TESTING:

ALL TANKS MUST BE WATER TIGHT. TANKS USED FOR COMMERCIAL FACILITIES, MULTIPLE-USER SYSTEMS OR PUBLIC SYSTEMS MUST BE TESTED IN PLACE FOR WATER TIGHTNESS. WATER TIGHTNESS TESTING FOR CONCRETE TANK MAY BE CONDUCTED USING A WATER TEST OR VACUUM TEST.

1. WATER TESTING MUST BE CONDUCTED BY SEALING THE OUTLETS, FILLING THE SEPTIC TANK TO ITS OPERATIONAL LEVEL, AND ALLOWING THE TANK TO STAND FOR AT LEAST EIGHT (8) HOURS. IF THERE IS A MEASURABLE LOSS (2 INCHES OR MORE), REFILL THE TANK AND LET STAND FOR ANOTHER 8 HOURS. IF THERE IS AGAIN A MEASURABLE LOSS, THE TANK MUST BE REJECTED.

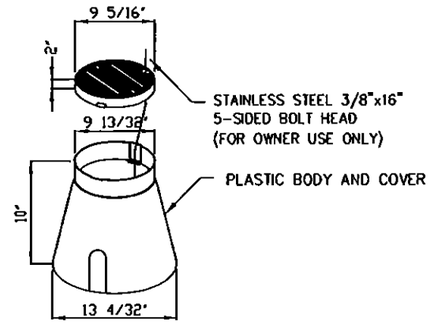
2. VACUUM TESTING MUST BE CONDUCTED BY SEALING ALL INLETS, OUTLETS, AND ACCESSES, THEN INTRODUCING A VACUUM OF 4 INCHES OF MERCURY. IF THE VACUUM DROPS IN THE FIRST 5 MINUTES, IT MUST BE BROUGHT BACK TO 4 INCHES OF MERCURY. IF THE SEPTIC TANK FAILS TO HOLD THE VACUUM AT 4 INCHES OF MERCURY FOR 5 MINUTES, THE TANK MUST BE REJECTED.

10,000 GALLON SEPTIC TANK NOTES:

CONCRETE IS 4000 PSI @ 28 DAYS
CEMENT IS TYPE V, WITH MAX C3A OF 8%, PER MT DEQ-4
REINFORCING = #4 GRADE 60 REBAR
MAXIMUM EARTH COVER IS 6 FEET
THIS TANK MUST BE PLACED ON COMPACTED 3/4" ROAD-BASE OR SIMILAR MATERIAL. MINIMUM RELATIVE COMPACTION IS 95%. DO NOT USE FLOWABLE BACKFILL MATERIALS SUCH AS 3/4" WASHED GRAVELS.
TANK MUST BE BACKFILLED TO TOP BEFORE WATER TESTING.
TANK JOINT SEALED w/1"DIA. CONSEAL

2,500 GALLON DOSE TANK NOTES:

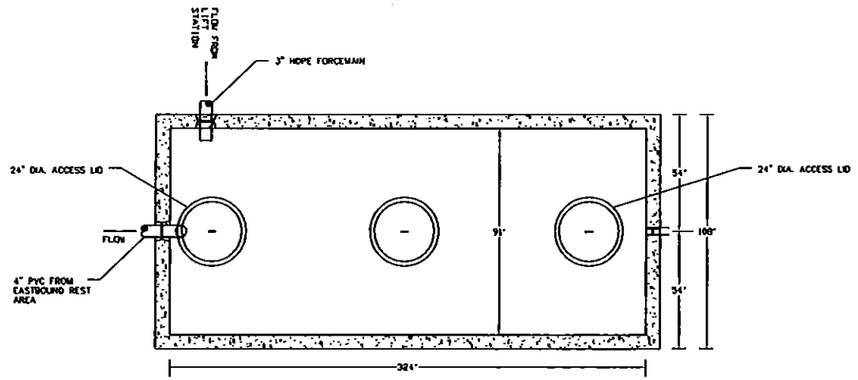
CONCRETE IS 4000 PSI @ 28 DAYS
CEMENT IS TYPE V, WITH MAX C3A OF 8%, PER MT DEQ-4
REINFORCING = #4 GRADE 60 REBAR
MAXIMUM EARTH COVER IS 6 FEET
THIS TANK MUST BE PLACED ON COMPACTED 3/4" ROAD-BASE OR SIMILAR MATERIAL. MINIMUM RELATIVE COMPACTION IS 95%. DO NOT USE FLOWABLE BACKFILL MATERIALS SUCH AS 3/4" WASHED GRAVELS.
TANK MUST BE BACKFILLED TO TOP BEFORE WATER TESTING.
TANK JOINT SEALED w/1"DIA. CONSEAL

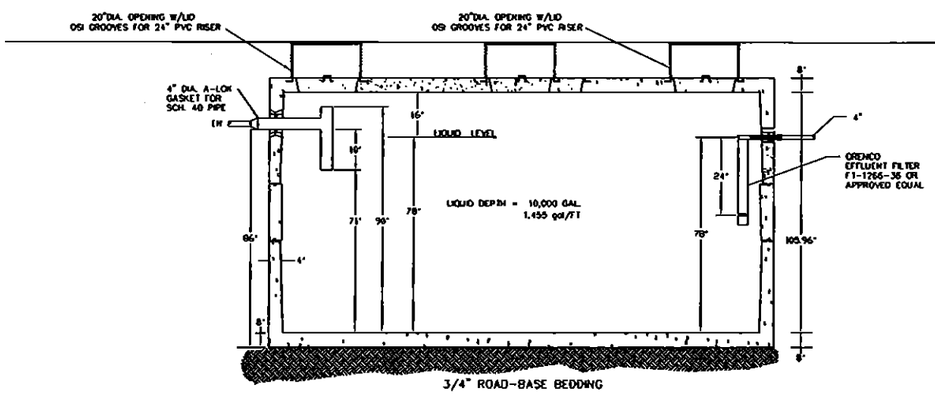


NOTES:
1. CLEANOUT BOX SHALL BE IDENTIFIED BY STAMPING "SEWER" ON THE COVER
2. CLEANOUT BOX SHALL BE APPLIED ENGINEERING PRODUCTS (SERIES 910L WITH STRONGER LOAD STRENGTH "I" COVER), CARSON-BROOKS PLASTICS (MODEL 910 WITH "I" COVER) OR EQUAL

3/9 TYPICAL DRAINFIELD LATERAL CLEANOUT BOX

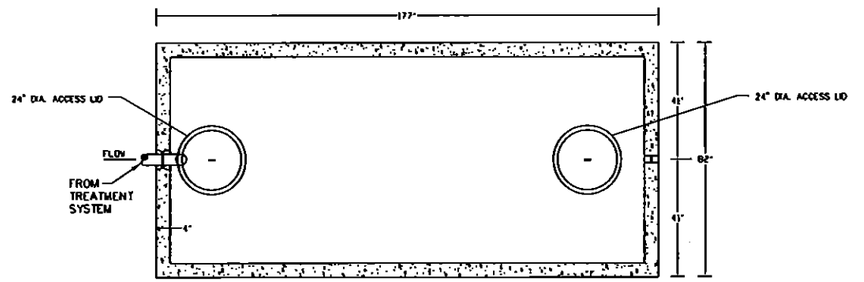
SCALE: NOT TO SCALE

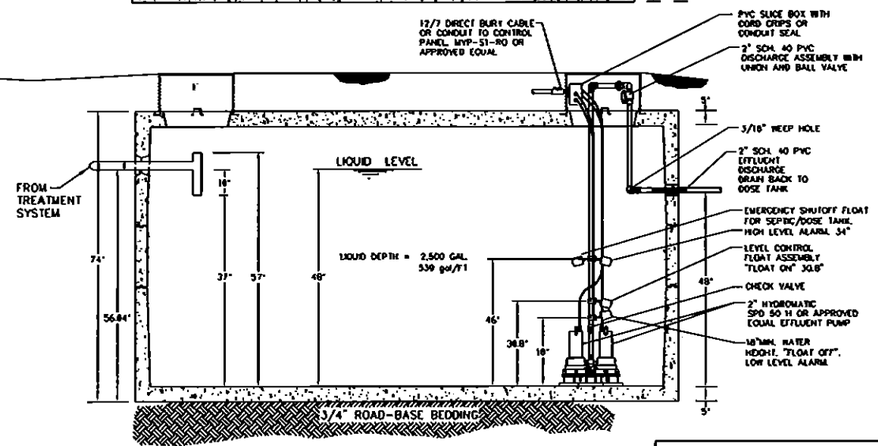




1/9 10,000 GALLON SEPTIC TANK
NON-TRAFFIC - FOR PUBLIC WASTE WATER SYSTEM

SCALE: NOT TO SCALE





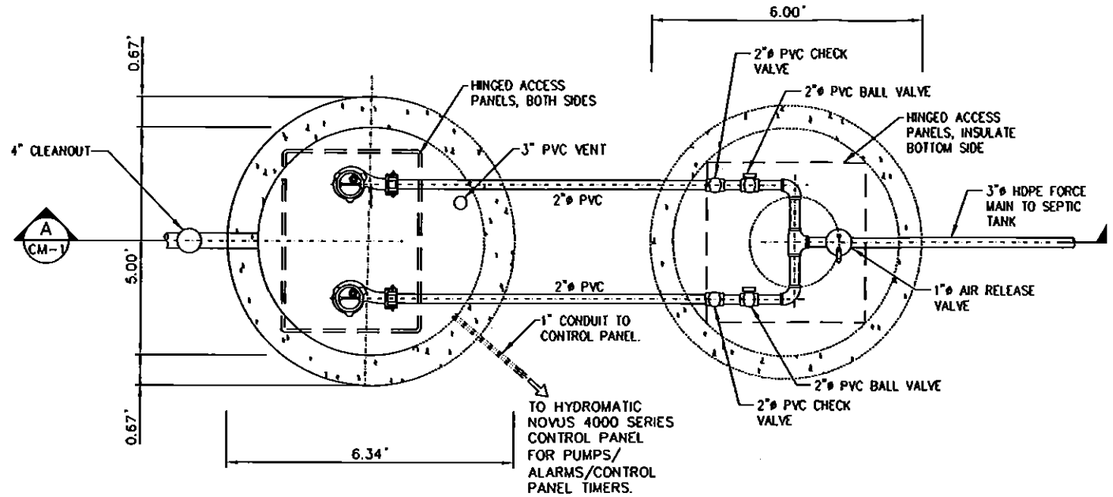
2/9 2500 GALLON DOSE TANK
NON-TRAFFIC - FOR PUBLIC WASTE WATER SYSTEM

SCALE: NOT TO SCALE

SANITARY SEWER DETAILS

NO SCALE

2 1	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000UT\8200000UTDETZ11	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA / IM 94-2(136)65
		8/28/2015	REVIEWED BY	B DREYER	8/26/2015		
		11:52:31 AM ABeckengadd	CHECKED BY	T CORMIER	8/26/2015	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 9 OF 11



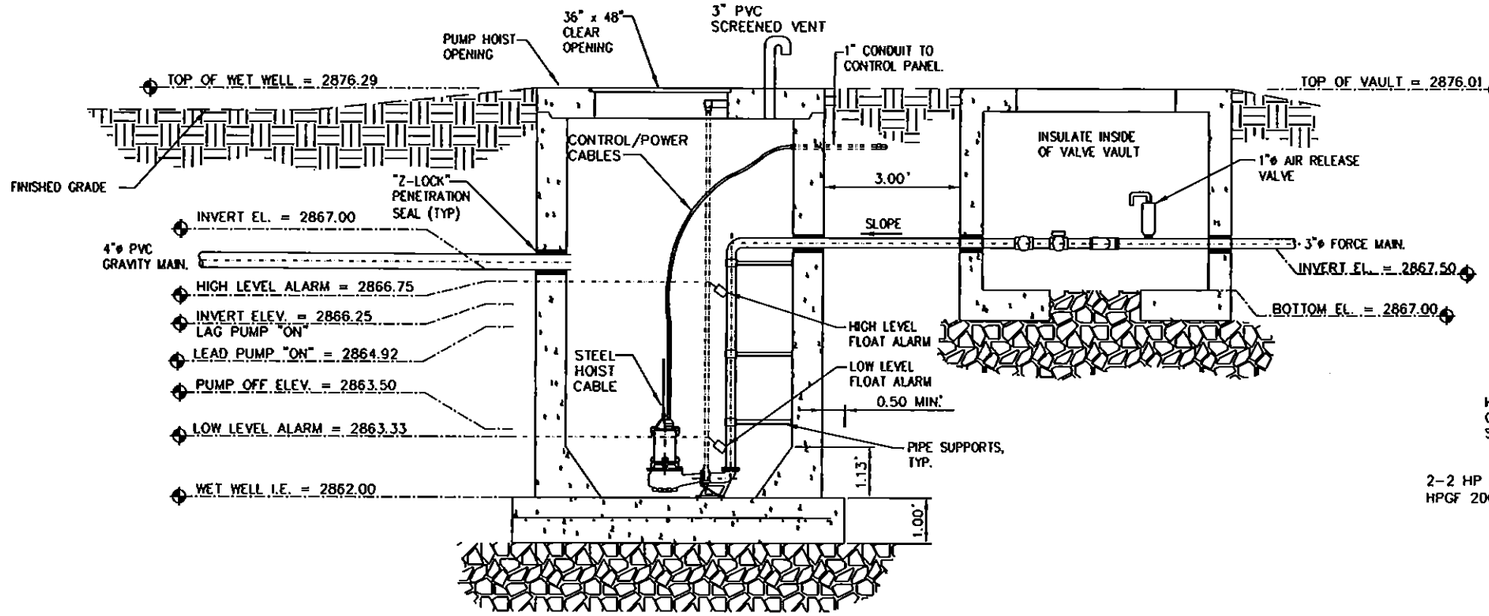
NOTES:

1. ALL MECHANICAL PIPING TO BE FACTORY PRIMEDAND FIELD PAINTED.
2. NOT ALL ITEMS ARE INCLUDED IN MANUFACTURE SUPPLIED LIFT STATION, CONSULT MANUFACTURE.
3. LIFT STATION AND COMPONENTS WILL MEET OR EXCEED ALL DESIGN CRITERIA OUTLINED IN MDEQ CIRCULAR DEQ-2.
4. 60" WET WELL APPROX. 145 GALLONS PER FOOT

DESIGN CRITERIA:

DESIGN PUMP CAPACITY:	62 GPM
NUMBER/TYPE OF PUMPS:	2 SUBMERSIBLE
PUMP HORSEPOWER:	2 HP
PUMP RPM:	3,463 RPM
VOLTAGE/PHASE:	230 V/1P

PUMP SHALL BE A HP&F 200 OR APPROVED EQUAL.



1/10 60" DIA. CONCRETE LIFT STATIONS

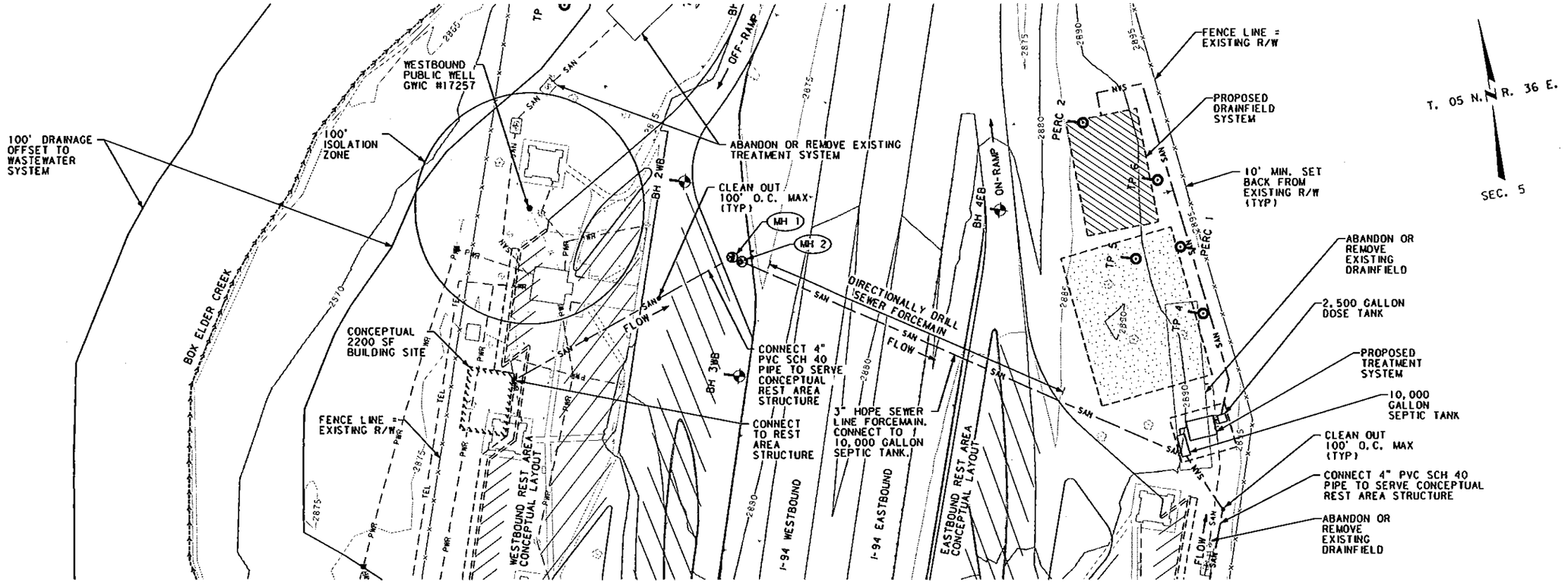
LIFT STATION TO BE MONOLITHIC.
LIFT STATION TO BE REINFORCED CONCRETE.

SCALE : NOT TO SCALE

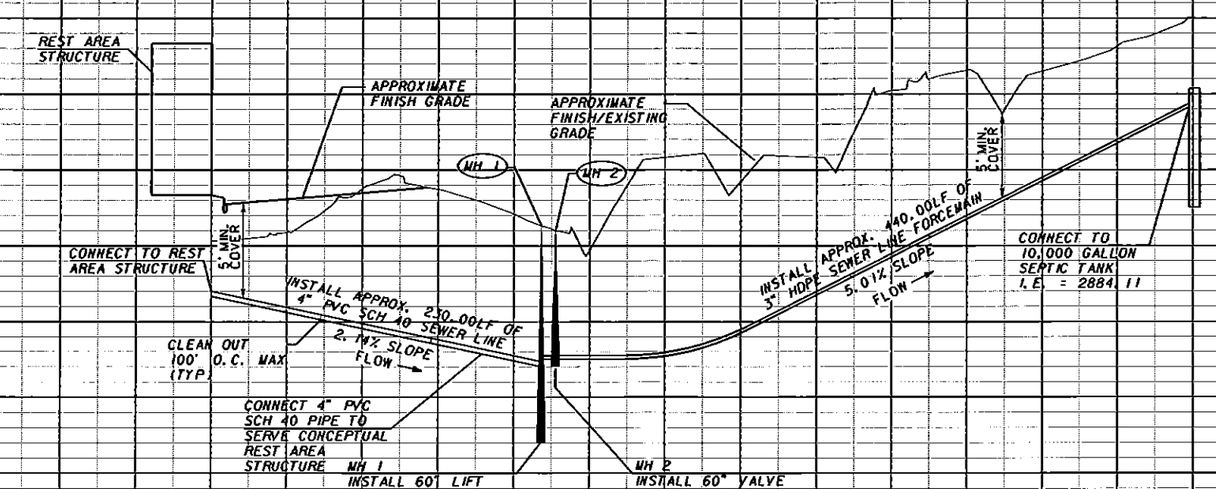
SANITARY SEWER DETAILS

LIFT STATIONS

NO SCALE



DIRECTIONALLY DRILLED 3" SEWER FORCEMAIN



LENGTH OF DIRECTIONAL DRILL TO BE DETERMINED BY CONSTRUCTION TECHNIQUE & MATERIAL TOLERANCE.

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	\8200000\UT\8200000UTPLPZ10	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WASTEWATER PLANS	HYSHAM REST AREA - MONTANA	IM 94-2136(65
2		8/28/2015	REVIEWED BY	B DREYER	8/26/2015			
1		11:53:06 AM ABeckengadd	CHECKED BY	T CORMIER	8/26/2015	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 11 OF 11

MONTANA MDT DEPARTMENT OF TRANSPORTATION

APPENDIX C:

TEST HOLE LOGS & PERC TESTS

DOWL

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-1	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726387.6 Easting:2537398.6	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENE-TROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
	Surface Elevation: 2870.7 Datum: NAD83						
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.8	2869.9						
	Lean Clay (CL), stiff, slightly moist, gray to brown		2869.5				USDA Classification Fine Sandy Loam Common Organics
1.5							
2.5	2868.2						
	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded		2868				USDA Classification Coarse Sands
3							
			2866.5				47" - End of Organics
4.5							
			2865				
6							
			2863.5				
7.5							
8.0	2862.7						
	Test Pit Terminated at 8.0 feet						No groundwater or limiting layer observed in test pit
9							
10.5							

DOWL HKM
2090 Stadium Drive
Bozeman, Montana 59715
Telephone: (406) 586-8834
www.dowlhkm.com

STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-2	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726428.2 Easting: 2537440.2	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENE-TROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
	Surface Elevation: 2868.1 Datum: NAD83						
0	12" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
1.0	2867.1						
	Lean Clay (CL), stiff, moist, gray to brown		2866.5				USDA Classification Fine Sandy Loam Common Organics
1.5							
2.0	2866.1						
	Poorly Graded Gravel with Sand (GP), loose to dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded						USDA Classification Coarse Sands
3			2865				
							49" - End of Organics
4.5			2863.5				
6			2862				
6.5	2861.6						
	Lean Clay (CL), soft, moist to very moist, gray to brown						USDA Classification Sandy Clay Loam
7.5			2860.5				
9	9.0 2859.1						
	Test Pit Terminated at 9.0 feet						No groundwater or limiting layer observed in test pit
10.5							

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-3	Sheet 1 of 1

CLIENT: Montana Department of Transportation

PROJECT: Hysham Rest Area - Phase I

TEST PIT LOCATION: Northing: 726372.1 Easting: 2537527.9

SITE: Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION (Surface Elevation: 2871.2 Datum: NAD83)	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENE-TROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	12" +/- Topsoil, Lean Clay (CL), stiff, moist, black		2871				Many Organics
1.0			2870.2				
	Lean Clay (CL), stiff, slightly moist, gray to brown						USDA Classification Fine Sandy Loam Common Organics
1.5			2869.5				
3							
3.0			2868.2				
	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded		2868				USDA Classification Coarse Sand
4.5			2866.5				54" - End of Organics
5.0			2866.2				
	Lean Clay (CL), stiff, moist, gray to brown						USDA Classification Fine Sandy Loam
5.8			2865.4				
6	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded		2865				USDA Classification Coarse Sand
7.5			2863.5				
9			2862				
10.0			2861.2				
	Test Pit Terminated at 10.0 feet						No groundwater or limiting layer observed in test pit
0.5							

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-4	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726029.3 Easting: 2537904.5	Treasure County, Montana

Surface Elevation: 2892.5 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENE-TROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black	2892				Many Organics
0.8	2891.7					
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform					USDA Classification Sandy Silt Loam Common Organics
1.5		2890.5				
3		2889				
						48" - End of Organics
4.5		2887.5				
6		2886				
7.5		2884.5				
9		2883				
10.0	2882.5					
	Test Pit Terminated at 10.0 feet					No groundwater or limiting layer observed in test pit
10.5						

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Bozeman, Montana 59715
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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-5	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726086.1 Easting: 2537854.4	Treasure County, Montana

Surface Elevation: 2888.9 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	6" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.5	2888.4						
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform						USDA Classification Sandy Silt Loam Common Organics
			2887.5	X			
1.5							
			2886				
3							
			2884.5				50" - End of Organics
4.5							
			2883				
6							
			2881.5				
7.5							
8.5	2880.4						
	Test Pit Terminated at 8.5 feet						No groundwater or limiting layer observed in test pit
9							
10.5							

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Bozeman, Montana 59715
Telephone: (406) 586-8834
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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-6	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726150.1 Easting: 2537884.6	Treasure County, Montana

Surface Elevation: 2891.8 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENE-TROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.8	2891						
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform		2890.5				USDA Classification Sandy Silt Loam Common Organics
1.5							
			2889				
3							
							47" - End of Organics
			2887.5				
4.5							
			2886				
6							
			2884.5				
7.5							
			2883				
9	9.0 2882.8						
	Test Pit Terminated at 9.0 feet						No groundwater or limiting layer observed in test pit
10.5							

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Bozeman, Montana 59715
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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near Fence East Bound Test Number PT# 1

Diameter of Test Hole: 6" Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 10:15

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5"

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)
10:18 am	10:33 am	15min	23"	24"	1"	15
10:33 am	10:48 am	15min	23"	23.3/4"	3/4"	20
10:48 am	11:03 am	15min	23"	24"	1"	15
11:03 am	11:18 am	15min	23"	24"	1"	15

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.

William Dreyer William Dreyer 7/16/14

Name (printed) Signature Date

Company DOWL HKM

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near on Ramp East Bound Test Number PT# 2

Diameter of Test Hole: 6" Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 10:18

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5 ft

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)
10:20 am	10:35 am	15min	21 3/4"	24 1/2"	2 3/4"	5.45
10:35 am	10:50 am	15min	21 3/4"	24.1/4"	2 1/2"	6
10:50 am	11:05 am	15min	21 3/4"	24 1/4"	2 1/2"	6
11:05 am	11:20 am	15min	21 3/4"	24 1/4"	2 1/2"	6

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.

William Dreyer		7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near Off Ramp West Bound Existing Drainfield Test Number PT# 3

Diameter of Test Hole: 6" Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 11:45

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5 ft

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)
11:50 am	11:52 am	2 min	21 1/4"	26"	4 3/4"	0.42

20 gallons of water in 10 minutes was use. Based on DEQ 4 the soils are considered Sandy Graves and the test can be stopped.

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.

William Dreyer		7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

DOWL HKM

LOG OF BORING

Boring 8200000-B-1 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725280.9 ft **Coordinates** E: 2537458.8 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2888.6 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BD	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.7 2887.9						
2 2886.6			53		16 - 14 - 8		BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.							
							Lean CLAY with sand (CL), medium stiff to stiff, moist to wet, yellow to brown. possible organic zones.	2.2 2886.4						
			80		3 - 5 - 5									
4 2884.6														
6 2882.6			87		2 - 3 - 5									
8 2880.6														
							Poorly-Graded GRAVEL with sand (GP), medium dense, dry, yellow to gray, fine to coarse grained, rounded to subrounded.	9.0 2879.6						
10 2878.6			73		9 - 11 - 10									
							Boring Depth: 10.5 ft, *Elevation: 2878.1 ft*	10.5 2878.1						

Water Level Observations		Remarks:
▽ After Drilling: 0	▽ During Drilling: Not Encountered ▽ After Drilling: 0	

(2) MDT LOG OF BORING - MDT_REVISED_2009+(CPT_IMPORT).GDT - 9/17/14 14:14 - H:\24\11355\GEOTECH LOGS\HYSHAM REST STOP GEOTECH LOGS.GPJ

LOG OF BORING

DOWL HKM

Boring 8200000-B-2 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location Coordinates** N: 725613.3 ft E: 2537649 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2892.7 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.5 2892.2						
2 2890.7							BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.							
			100		5 - 6 - 8		Lean CLAY with sand (CL), stiff to soft, moist, gray to brown. occasional pebbles observed.	2.5 2890.2						
4 2888.7														
6 2886.7			100		2 - 3 - 2									
8 2884.7														
10 2882.7			100		2 - 2 - 2									
							Boring Depth: 10.5 ft, *Elevation: 2882.2 ft*	10.5 2882.2						

Water Level Observations		Remarks:
▽ After Drilling: 0	▽ During Drilling: Not Encountered ▽ After Drilling: 0	

(2) MDT LOG OF BORING - MDT_REVISED_2009+(CPT_IMPORT).GDT - 9/17/14 14:14 - H:\24\11355\GEOTECH LOGS\HYSHAM REST STOP GEOTECH LOGS.GPJ

LOG OF BORING

DOWL HKM

Boring 8200000-B-3 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location Coordinates** N: 725806.1 ft E: 2537624.6 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2890.4 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6 *2889.8*						
2 *2888.4*			53		11 - 16 - 27		BASE COURSE, Well-Graded GRAVEL with sand (GW), dense, moist, gray, fine to coarse grained, angular to subangular.	2.6 *2887.8*						
4 *2886.4*			80		2 - 3 - 3		Lean CLAY (CL), medium stiff, moist, yellow to brown.	5.0 *2885.4*						
6 *2884.4*			100		1 - 3 - 2		Lean CLAY with sand (CL), medium stiff, moist, yellow to brown. scattered pebbles and 2" silty sand layers.							
8 *2882.4*														
10 *2880.4*			100		2 - 3 - 2			10.5 *2879.9*						

Boring Depth: 10.5 ft, *Elevation: 2879.9 ft*

Water Level Observations		Remarks:
▽ After Drilling: *0*	▽ During Drilling: Not Encountered ▼ After Drilling: *0*	

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DOWL HKM

LOG OF BORING

Boring 8200000-B-4 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location Coordinates** N: 726148.1 ft E: 2537743.9 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2881.8 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), medium dense, moist, gray, fine to coarse grained, angular to subangular.	0.7 2881.1						
2 2879.8			67		10 - 12 - 8									
							Lean CLAY (CL), stiff, moist, dark brown.	2.6 2879.2						
			80		5 - 6 - 7									
4 2877.8														
							Lean CLAY with sand (CL), medium stiff, moist, dark brown.	5.0 2876.8						
6 2875.8			100		3 - 3 - 2									
8 2873.8														
							Lean CLAY with sand (CL), medium stiff, moist, dark brown. silty sand seams.	9.5 2872.3						
10 2871.8			100		3 - 3 - 3									
12 2869.8														
							Lean CLAY with gravel (CL), medium dense, moist, dark brwon, coarse grained, rounded to subrounded.	12.5 2869.3						
14 2867.8														
							Poorly-Graded GRAVEL with sand (GP), dense, dry to moist, yellow to brown, fine to coarse grained, rounded to subrounded.	14.0 2867.8						
			27		15 - 16 - 16									
							Boring Depth: 15.5 ft, *Elevation: 2866.3 ft*	15.5 2866.3						

Water Level Observations		Remarks:
▽ After Drilling: 0	▽ During Drilling: Not Encountered ▼ After Drilling: 0	

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DOWL HKM

LOG OF BORING

Boring 8200000-B-1 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726364.2 ft **Coordinates** E: 2537569 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2875.2 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), medium dense, moist, gray, fine to coarse grained, angular to subangular.	0.6 *2874.6*						
2 *2873.2*			67		9 - 5 - 9									
							Lean CLAY (CL), stiff to very stiff, moist, gray to brown.	2.3 *2872.9*						
4 *2871.2*			100		6 - 6 - 7									
6 *2869.2*			100		7 - 7 - 9									
							Poorly-Graded GRAVEL with sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded. Water table observed at 14.0 feet.	6.8 *2868.4*						
8 *2867.2*														
10 *2865.2*			80		8 - 9 - 10									
12 *2863.2*														
14 *2861.2*							▽							
			100		1 - 4 - 8		Lean CLAY (CL), soft, wet, gray to brown.	14.2 *2861.0*						
							Poorly-Graded GRAVEL with clay (GP-GC), medium dense, wet, yellow to brown, coarse grained, rounded to subrounded.	15.0 *2860.2*						
								15.5 *2859.7*						

Boring Depth: 15.5 ft, *Elevation: 2859.7 ft*

Water Level Observations		Remarks:
▽ After Drilling: *0*	▽ During Drilling: **14.0 ft** ***(2861.2 ft)***	
	▽ After Drilling: *0*	

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DOWL HKM

LOG OF BORING

Boring 8200000-B-2 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726219 ft **Coordinates** E: 2537476.9 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2877.4 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
2 2875.4			80		14 - 16 - 13		BASE COURSE, Well-Graded GRAVEL with sand (GW), medium dense, moist, gray, fine to coarse grained, angular to subangular.	0.6 2876.8						
4 2873.4			67		4 - 3 - 3		Lean CLAY with sand (CL), medium stiff to stiff, moist, gray to brown.	2.2 2875.2						
6 2871.4			100		2 - 5 - 5									
8 2869.4							Poorly-Graded GRAVEL with sand (GP), loose to very dense, dry, yellow to brown, fine to coarse grained, rounded to subrounded.	8.0 2869.4						
10 2867.4			0		11 - 19 - 31									
							Boring Depth: 10.5 ft, *Elevation: 2866.9 ft*	10.5 2866.9						

Water Level Observations		Remarks:
During Drilling: Not Encountered	After Drilling: 0	
After Drilling: 0		

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DOWL HKM

LOG OF BORING

Boring 8200000-B-3 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726044.8 ft **Coordinates** E: 2537495.7 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2877.6 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.	0.6 2877.0						
2 2875.6							Sandy Lean CLAY (CL), soft, moist, yellow to brown.	2.2 2875.4						
4 2873.6			100		4 - 2 - 2									
							Poorly-Graded GRAVEL (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded.	5.0 2872.6						
6 2871.6			100		9 - 17 - 13									
8 2869.6							Poorly-Graded GRAVEL (GP), Cobbles, medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded.	8.0 2869.6						
10 2867.6			67		8 - 12 - 9									
							Boring Depth: 10.5 ft, *Elevation: 2867.1 ft*	10.5 2867.1						

Water Level Observations		Remarks:
▽ After Drilling: 0	▽ During Drilling: Not Encountered ▽ After Drilling: 0	

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DOWL HKM

LOG OF BORING

Boring 8200000-B-4 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725644.8 ft **Coordinates** E: 2537381.6 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2885.3 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6 *2884.7*						
2 *2883.3*			80		10 - 17 - 14		BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), dense, moist, gray, fine to coarse grained, angular to subangular.	2.3 *2883.0*						
4 *2881.3*			0		6 - 4 - 6		Lean CLAY (CL), stiff, moist, gray to brown.							
6 *2879.3*			100		3 - 4 - 5									
8 *2877.3*							Lean CLAY with gravel (CL), stiff to medium stiff, moist, gray to brown, coarse grained, rounded to subrounded.	7.0 *2878.3*						
10 *2875.3*			100		3 - 3 - 3		Lean CLAY with sand (CL), medium stiff, moist, gray to brown.	8.0 *2877.3*						
							Boring Depth: 10.5 ft, *Elevation: 2874.8 ft*	10.5 *2874.8*						

Water Level Observations		Remarks:
▽ After Drilling: *0*	▽ During Drilling: Not Encountered ▽ After Drilling: *0*	

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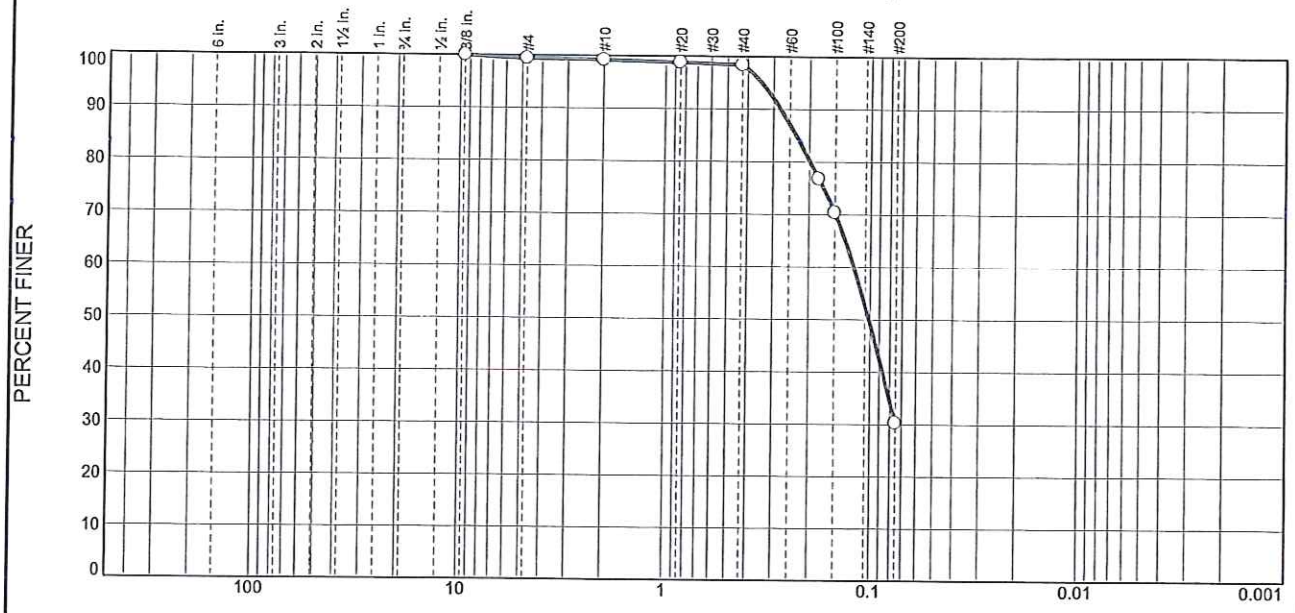
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	0.2	0.8	68.1	30.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.375	100.0		
#4	99.4		
#10	99.2		
#20	98.8		
#40	98.4		
#80	76.8		
#100	70.4		
#200	30.3		

* (no specification provided)

Material Description

silty sand

Atterberg Limits (ASTM D 4318)

PL= 25 LL= 30 PI= 5

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 0.2770 D_{85}= 0.2328 D_{60}= 0.1206
D_{50}= 0.1015 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled By:DOWL HKM

Date Received: Date Tested: 9/17/14

Tested By: MC

Checked By: MC

Title: Lab Manager

Location: TP-5
Sample Number: 29633 Depth: 1.5-2.0' Date Sampled:

BILLINGS, MONTANA

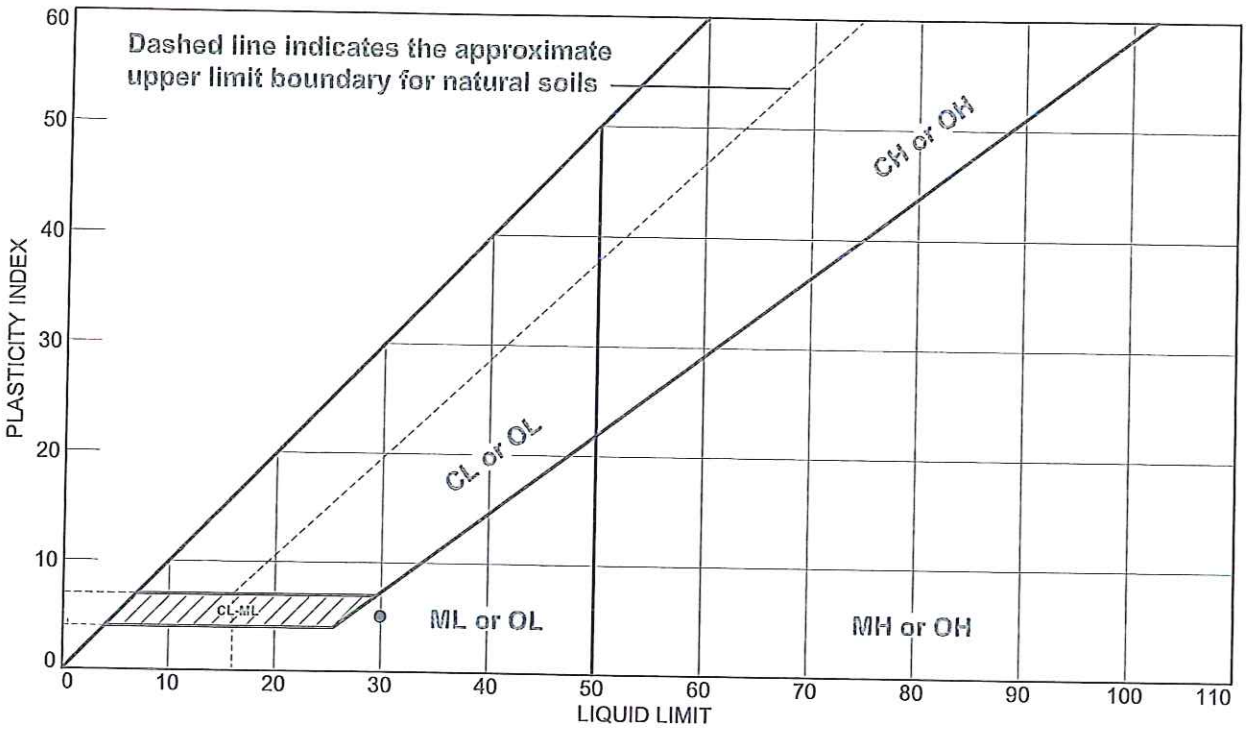
DOWL HKM

Client: MDOT
Project: Hysham Rest Area Phase 1

Project No: 4524.11355.01 Figure 01

Tested By: _____ Checked By: _____

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●		29633	1.5-2.0'		25	30	5		SM

BILLINGS, MONTANA

DOWL HKM

Client: MDOT

Project: Hysham Rest Area Phase 1

Project No.: 4524.11355.01

Figure 01

Tested By: _____ **Checked By:** _____

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

DOWL HKM

LAB NUMBER	LOCATION	DEPTH RANGE	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND NO. 200(0.075 mm) TO NO. 4(4.76 mm)	GRAVEL NO. 4(4.76 mm) TO 3 IN.(76.2 mm)	COBBLES 3 IN.(76.2 mm) TO 5 IN.(127 mm)	OVERSIZE LARGER THAN 5 IN.(127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	MAXIMUM DRY UNIT WEIGHT(D698)-pcf	OPTIMUM MOISTURE CONTENT - %	OVERSIZE SPEC. GRAV.(BULK)	ABSORPTION	MINUS #4 SPECIFIC GRAVITY	LA Abrasion-Grading A, % Loss	CALIFORNIA BEARING RATIO	NATURAL MOISTURE - %	Resistivity (Ohm-Cm) Natural Moisture	Resistivity (Ohm-Cm) Saturated	pH	WATER SOLUBLE SO4 - %
29633	TP-5	1.5-2.0'	SM		30.3	69.1	0.6			30	5								7.7				

Hysham Rest Area

Test Pit #1

July 2, 2014

Hysham Rest Area

Test Pit #2

July 2, 2014

Hysham Rest Area

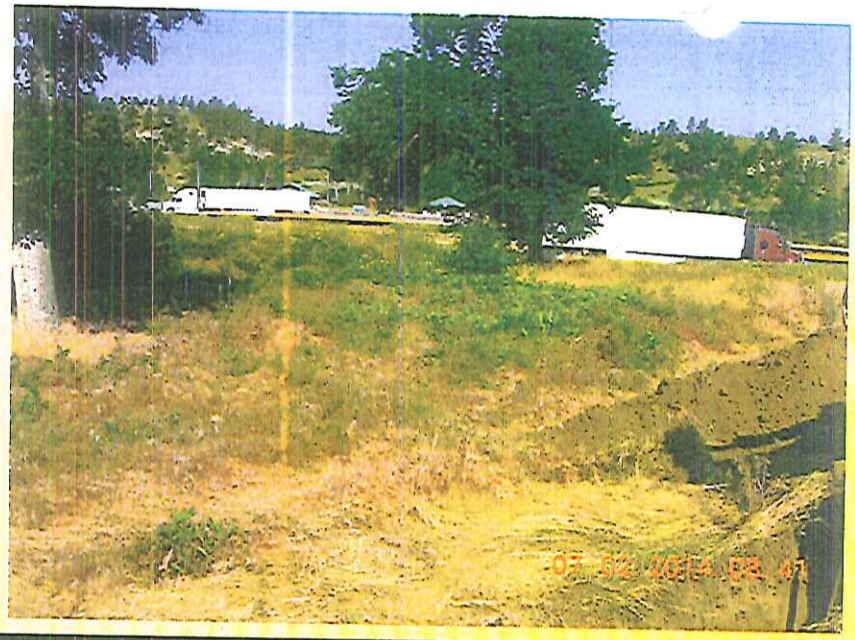
Test Pit #3

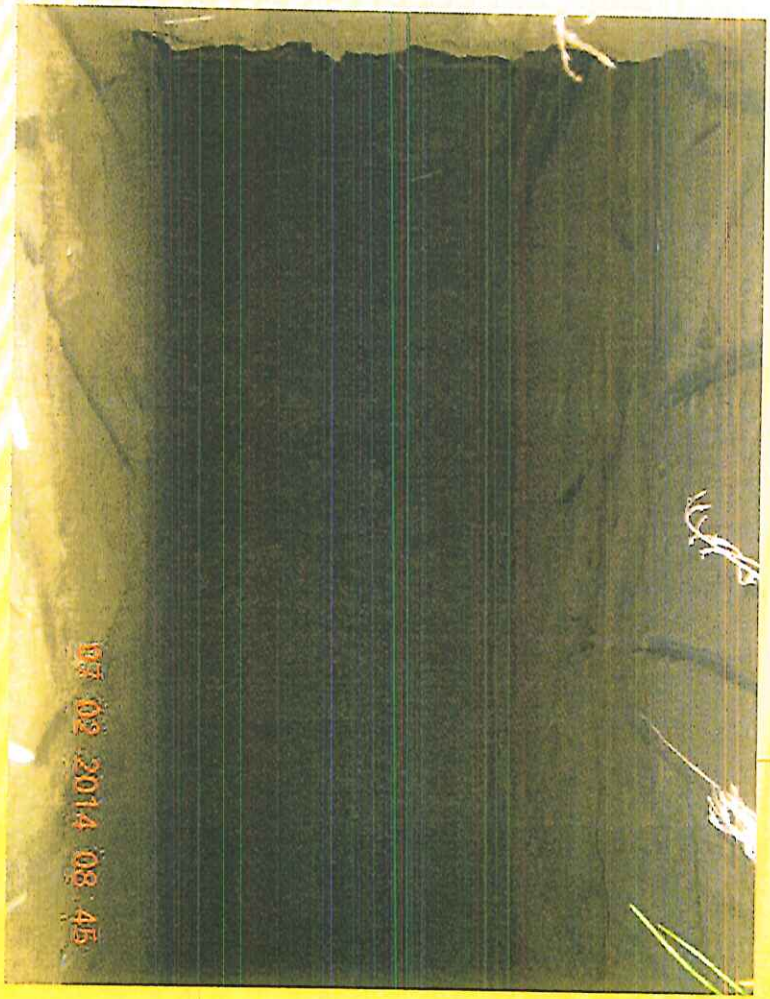
July 2, 2014

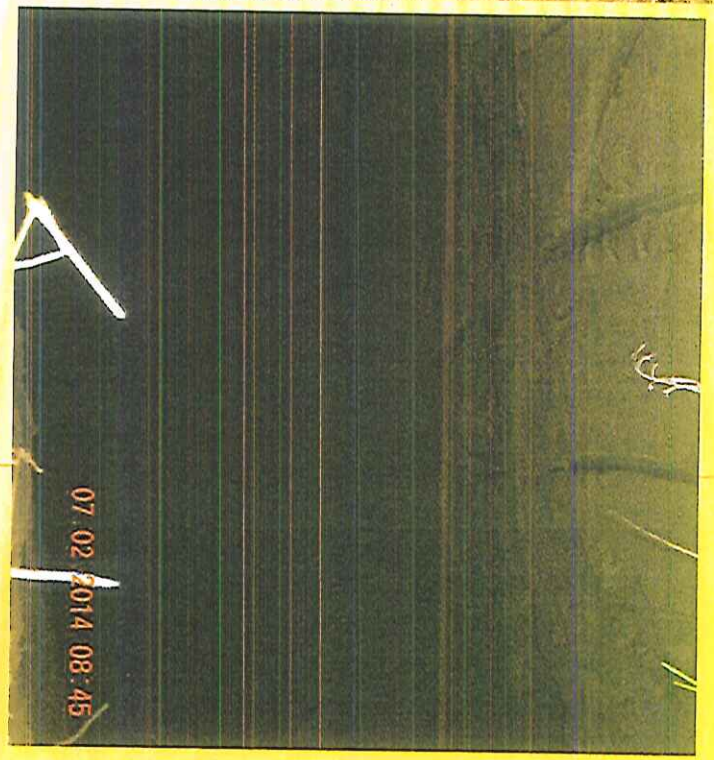
Hysham Rest Area

Test Pit #4

July 2, 2014







Hysham Rest Area

Test Pit #5

July 2, 2014

Hysham Rest Area

Test Pit #6

July 2, 2014

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX D:

WASTEWATER QUALITY

DOWL

ENERGY LABORATORIES
www.energylab.com
Analytical Excellence Since 1952
Helena, MT 877-472-0711 • Billings, MT 800-735-4489 • Casper, WY 888-235-0515
Gillette, WY 866-686-7175 • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

ANALYTICAL SUMMARY REPORT

June 26, 2014

DOWL HKM
2090 Stadium Dr
Bozeman, MT 59715-0616

Work Order: B14061283
Project Name: Hysham Rest Area

Energy Laboratories Inc Billings MT received the following 2 samples for DOWL HKM on 6/13/2014 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B14061283-001	Hysham Rest Area East Bound	06/13/14 9:30	06/13/14	Waste Water	Alkalinity Biochemical Oxygen Demand, 5 Day Chlorine, Residual Chemical Oxygen Demand Conductivity Oil & Grease, Gravimetric Anions by Ion Chromatography Nitrogen, Ammonia Nitrogen, Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen, Total (TKN+NO3+NO2) pH Digestion, Total P TKN preparation Phosphorus, Total Solids, Total Dissolved Solids, Total Suspended
B14061283-002	Hysham Rest Area West Bound	06/13/14 11:30	06/13/14	Waste Water	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Cindy Rohrer
Laboratory Co-Manager

Digitally signed by
Cindy Rohrer
Date: 2014.06.26 15:31:25 -06:00

CLIENT: DOWL HKM
Project: Hysham Rest Area
Work Order: B14061283

Report Date: 06/26/14

CASE NARRATIVE

Tests associated with analyst identified as ELI-G were subcontracted to Energy Laboratories, 400 W Boxelder Rd, Gillette, WY, EPA Number WY00006.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area
Lab ID: B14061283-001
Client Sample ID: Hysham Rest Area East Bound

Report Date: 06/26/14
Collection Date: 06/13/14 09:30
DateReceived: 06/13/14
Matrix: Waste Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.3	s.u.	H	0.1		A4500-H B	06/13/14 16:34 / cnm
Conductivity @ 25 C	4920	umhos/cm		5		A2510 B	06/13/14 16:34 / cnm
Solids, Total Suspended TSS @ 105 C	125	mg/L		50		A2540 D	06/17/14 11:56 / pjw
Solids, Total Dissolved TDS @ 180 C	2030	mg/L		50		A2540 C	06/18/14 09:44 / pjw
INORGANICS							
Alkalinity, Total as CaCO3	1850	mg/L		4		A2320 B	06/13/14 22:22 / bas
Chloride	252	mg/L	D	5		E300.0	06/17/14 10:44 / rbf
Chlorine, Total Residual	0.1	mg/L		0.1		A4500-Cl G	06/13/14 15:30 / kmp
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	930	mg/L		600		A5210 B	06/13/14 17:34 / fap
Oxygen Demand, Chemical (COD)	1360	mg/L	D	100		E410.4	06/16/14 14:00 / klc
NUTRIENTS							
Nitrogen, Ammonia as N	365	mg/L	D	5		E350.1	06/19/14 09:28 / klc
Nitrogen, Nitrate+Nitrite as N	0.02	mg/L		0.01		E353.2	06/19/14 15:47 / jbm
Nitrogen, Kjeldahl, Total as N	398	mg/L	D	3		E351.2	06/19/14 10:54 / jbm
Nitrogen, Total	398	mg/L		3		Calculation	06/20/14 08:30 / meh
Phosphorus, Total as P	48.1	mg/L	D	0.5		E365.1	06/17/14 12:46 / jll
ORGANIC CHARACTERISTICS							
Oil & Grease (HEM)	8	mg/L		1		E1664A	06/24/14 09:34 / eli-g

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area
Lab ID: B14061283-002
Client Sample ID: Hysham Rest Area West Bound

Report Date: 06/26/14
Collection Date: 06/13/14 11:30
DateReceived: 06/13/14
Matrix: Waste Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.0	s.u.	H	0.1		A4500-H B	06/13/14 16:36 / cnm
Conductivity @ 25 C	4740	umhos/cm		5		A2510 B	06/13/14 16:36 / cnm
Solids, Total Suspended TSS @ 105 C	150	mg/L		30		A2540 D	06/17/14 11:56 / pjw
Solids, Total Dissolved TDS @ 180 C	1730	mg/L		50		A2540 C	06/18/14 09:45 / pjw
INORGANICS							
Alkalinity, Total as CaCO3	1740	mg/L		4		A2320 B	06/13/14 22:33 / bas
Chloride	228	mg/L	D	5		E300.0	06/17/14 10:59 / rbf
Chlorine, Total Residual	ND	mg/L		0.1		A4500-Cl G	06/13/14 15:30 / kmp
AGGREGATE ORGANICS							
Oxygen Demand, Biochemical (BOD)	680	mg/L		200		A5210 B	06/13/14 17:37 / fap
Oxygen Demand, Chemical (COD)	1020	mg/L	D	100		E410.4	06/16/14 14:00 / klc
NUTRIENTS							
Nitrogen, Ammonia as N	372	mg/L	D	5		E350.1	06/19/14 09:29 / klc
Nitrogen, Nitrate+Nitrite as N	0.12	mg/L		0.01		E353.2	06/19/14 15:48 / jbm
Nitrogen, Kjeldahl, Total as N	412	mg/L	D	3		E351.2	06/19/14 10:55 / jbm
Nitrogen, Total	412	mg/L		3		Calculation	06/20/14 08:30 / meh
Phosphorus, Total as P	6.1	mg/L	D	0.1		E365.1	06/17/14 12:47 / jll
ORGANIC CHARACTERISTICS							
Oil & Grease (HEM)	12	mg/L		1		E1664A	06/24/14 09:35 / eli-g

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Gillette, WY Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/25/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E1664A									Batch: 140624A
Lab ID: MBLK1406240000	Method Blank				Run: BAL-ACCU-124_140624A				06/24/14 09:26
Oil & Grease (HEM)	ND	mg/L	0.8						
Lab ID: LCS1406240000	Laboratory Control Sample				Run: BAL-ACCU-124_140624A				06/24/14 09:27
Oil & Grease (HEM)	33	mg/L	5.0	83	78	114			
Lab ID: LCSD1406240000	Laboratory Control Sample Duplicate				Run: BAL-ACCU-124_140624A				06/24/14 09:27
Oil & Grease (HEM)	31	mg/L	5.0	78	78	114	5.6	18	
Lab ID: G14060353-001CMS	Sample Matrix Spike				Run: BAL-ACCU-124_140624A				06/24/14 09:29
Oil & Grease (HEM)	19	mg/L	5.0	39	78	114			S

Qualifiers:

RL - Analyte reporting limit.
S - Spike recovery outside of advisory limits.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B									Batch: R225504
Lab ID: MBLK	Method Blank				Run: MAN-TECH_140613A				06/13/14 21:28
Alkalinity, Total as CaCO3	ND	mg/L	4.0						
Lab ID: LCS	Laboratory Control Sample				Run: MAN-TECH_140613A				06/13/14 21:36
Alkalinity, Total as CaCO3	99.5	mg/L	4.0	99	90	110			
Lab ID: B14061277-002ADUP	Sample Duplicate				Run: MAN-TECH_140613A				06/13/14 21:47
Alkalinity, Total as CaCO3	ND	mg/L	4.0						10
Lab ID: B14061281-001AMS	Sample Matrix Spike				Run: MAN-TECH_140613A				06/13/14 22:02
Alkalinity, Total as CaCO3	551	mg/L	4.0	93	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2510 B									Batch: R225437
Lab ID: SC 2nd 1413	Laboratory Control Sample				Run: PHSC _101-B_140613A				06/13/14 09:21
Conductivity @ 25 C	1360	umhos/cm	5.0	96	90	110			
Lab ID: MBLK	Method Blank				Run: PHSC _101-B_140613A				06/13/14 16:05
Conductivity @ 25 C	4.00	umhos/cm	5.0						
Lab ID: B14061281-001ADUP	Sample Duplicate				Run: PHSC _101-B_140613A				06/13/14 16:31
Conductivity @ 25 C	1550	umhos/cm	5.0				0.0	10	

Qualifiers:

'L - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C								Batch: TDS140618A	
Lab ID: MB-1_140618A	Method Blank				Run: BAL #11_140618A			06/18/14 09:41	
Solids, Total Dissolved TDS @ 180 C	ND	mg/L	3						
Lab ID: LCS-2_140618A	Laboratory Control Sample				Run: BAL #11_140618A			06/18/14 09:42	
Solids, Total Dissolved TDS @ 180 C	2010	mg/L	10	101	90	110			
Lab ID: B14061312-001A MS	Sample Matrix Spike				Run: BAL #11_140618A			06/18/14 09:44	
Solids, Total Dissolved TDS @ 180 C	2150	mg/L	10	98	90	110			
Lab ID: B14061312-006A DUP	Sample Duplicate				Run: BAL #11_140618A			06/18/14 09:44	
Solids, Total Dissolved TDS @ 180 C	174	mg/L	10		90	110	6.2	5	R

Qualifiers:

RL - Analyte reporting limit.
- RPD exceeds advisory limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

lient: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 D									Batch: TSS140617A
Lab ID: MB-1_140617A	Method Blank				Run: BAL #11_140617A				06/17/14 09:31
Solids, Total Suspended TSS @ 105 C	ND	mg/L	0.5						
Lab ID: LCS-2_140617A	Laboratory Control Sample				Run: BAL #11_140617A				06/17/14 09:31
Solids, Total Suspended TSS @ 105 C	97.0	mg/L	10	97	80	120			
Lab ID: B14061257-002A DUP	Sample Duplicate				Run: BAL #11_140617A				06/17/14 11:55
Solids, Total Suspended TSS @ 105 C	1.00	mg/L	10					5	

- RPD greater than method limit. Difference < PQL - RPD not applicable.

Qualifiers:

`L - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-Cl G								Analytical Run: AQ-CL-101_140613C	
Lab ID: HACH STD 0.20 mg/L1_1	Initial Calibration Verification Standard							06/13/14 07:45	
Chlorine, Total Residual	0.180	mg/L	0.10	90	90	110			
Method: A4500-Cl G								Batch: 140613A-CL-RES-W	
Lab ID: B14061283-001BDUP	Sample Duplicate				Run: AQ-CL-101_140613C			06/13/14 15:30	
Chlorine, Total Residual	0.110	mg/L	0.10				9.5	10	
Lab ID: B14061283-002BDUP	Sample Duplicate				Run: AQ-CL-101_140613C			06/13/14 15:30	
Chlorine, Total Residual	ND	mg/L	0.10					10	
Lab ID: MBLK1_140613A	Method Blank				Run: AQ-CL-101_140613C			06/13/14 15:30	
Chlorine, Total Residual	ND	mg/L	0.02						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B								Analytical Run: PHSC _101-B_140613A	
Lab ID: pH 8	Initial Calibration Verification Standard							06/13/14 09:10	
pH	7.95	s.u.	0.10	99	98	102			
Method: A4500-H B								Batch: R225437	
Lab ID: B14061281-001ADUP	Sample Duplicate				Run: PHSC _101-B_140613A			06/13/14 16:31	
pH	7.54	s.u.	0.10				0.4	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A5210 B									Batch: 140613_1_BOD5-W
Lab ID: DII-H201_140613	Dilution Water Blank				Run: BOD-SP2000_140613A				06/13/14 14:25
Oxygen Demand, Biochemical (BOD)	0.14	mg/L	0.20		0	0.2			
Lab ID: GGA1_140613	Laboratory Control Sample				Run: BOD-SP2000_140613A				06/13/14 14:32
Oxygen Demand, Biochemical (BOD)	200	mg/L	78	103	85	115			
Lab ID: B14061219-002ADUP	Sample Duplicate				Run: BOD-SP2000_140613A				06/13/14 15:49
Oxygen Demand, Biochemical (BOD)	170	mg/L	86				6.2	15	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte		Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method:	**E300.0**									Analytical Run: IC202-B_140616A
Lab ID:	**ICV**	Initial Calibration Verification Standard								06/16/14 11:02
Chloride		24.8	mg/L	1.0	99	90	110			
Method:	**E300.0**									Batch: R225603
Lab ID:	**ICB**	Method Blank				Run: IC202-B_140616A				06/16/14 11:17
Chloride		ND	mg/L	0.06						
Lab ID:	**LFB**	Laboratory Fortified Blank				Run: IC202-B_140616A				06/16/14 11:32
Chloride		24.3	mg/L	1.0	97	90	110			
Lab ID:	**B14061281-001AMS**	Sample Matrix Spike				Run: IC202-B_140616A				06/17/14 09:58
Chloride		136	mg/L	1.3	98	90	110			
Lab ID:	**B14061281-001AMSD**	Sample Matrix Spike Duplicate				Run: IC202-B_140616A				06/17/14 10:13
Chloride		139	mg/L	1.3	101	90	110	2.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E350.1									Analytical Run: FIA203-B_140619A
Lab ID: ICV	Initial Calibration Verification Standard								06/19/14 09:15
Nitrogen, Ammonia as N	11.3	mg/L	0.30	105	90	110			
Method: E350.1									Batch: R225759
Lab ID: MBLK	Method Blank				Run: FIA203-B_140619A				06/19/14 09:16
Nitrogen, Ammonia as N	ND	mg/L	0.007						
Lab ID: LFB	Laboratory Fortified Blank				Run: FIA203-B_140619A				06/19/14 09:17
Nitrogen, Ammonia as N	0.991	mg/L	0.050	100	90	110			
Lab ID: B14060446-001BMS	Sample Matrix Spike				Run: FIA203-B_140619A				06/19/14 09:23
Nitrogen, Ammonia as N	10.00	mg/L	0.50	100	90	110			
Lab ID: B14060446-001BMSD	Sample Matrix Spike Duplicate				Run: FIA203-B_140619A				06/19/14 09:24
Nitrogen, Ammonia as N	10.1	mg/L	0.50	101	90	110	1.1	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E351.2								Analytical Run: FIA204-B_140619A	
Lab ID: ICV	Initial Calibration Verification Standard							06/19/14 10:47	
Nitrogen, Kjeldahl, Total as N	9.74	mg/L	0.50	97	90	110			
Method: E351.2								Batch: 80666	
Lab ID: MB-80666	Method Blank				Run: FIA204-B_140619A			06/19/14 10:48	
Nitrogen, Kjeldahl, Total as N	ND	mg/L	0.2						
Lab ID: LCS-80666	Laboratory Control Sample				Run: FIA204-B_140619A			06/19/14 10:49	
Nitrogen, Kjeldahl, Total as N	232	mg/L	4.0	93	90	110			
Lab ID: B14061344-003DMS	Sample Matrix Spike				Run: FIA204-B_140619A			06/19/14 11:01	
Nitrogen, Kjeldahl, Total as N	8.85	mg/L	0.50	87	90	110			S
Lab ID: B14061344-003DMSD	Sample Matrix Spike Duplicate				Run: FIA204-B_140619A			06/19/14 11:02	
Nitrogen, Kjeldahl, Total as N	9.48	mg/L	0.50	93	90	110	6.9	10	
Lab ID: B14061375-005AMS	Sample Matrix Spike				Run: FIA204-B_140619A			06/19/14 11:17	
Nitrogen, Kjeldahl, Total as N	11.1	mg/L	0.50	91	90	110			
Lab ID: B14061375-005AMSD	Sample Matrix Spike Duplicate				Run: FIA204-B_140619A			06/19/14 11:18	
Nitrogen, Kjeldahl, Total as N	10.8	mg/L	0.50	88	90	110	2.7	10	S

Qualifiers:

RL - Analyte reporting limit.

S - Spike recovery outside of advisory limits.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

lient: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2									Analytical Run: FIA204-B_140619B
Lab ID: ICV	Initial Calibration Verification Standard								06/19/14 15:27
Nitrogen, Nitrate+Nitrite as N	13.6	mg/L	0.10	94	90	110			
Method: E353.2									Batch: R225810
Lab ID: MBLK	Method Blank				Run: FIA204-B_140619B				06/19/14 15:28
Nitrogen, Nitrate+Nitrite as N	ND	mg/L	0.003						
Lab ID: LFB	Laboratory Fortified Blank				Run: FIA204-B_140619B				06/19/14 15:29
Nitrogen, Nitrate+Nitrite as N	1.02	mg/L	0.010	102	90	110			
Lab ID: B14061288-001CMS	Sample Matrix Spike				Run: FIA204-B_140619B				06/19/14 15:54
Nitrogen, Nitrate+Nitrite as N	0.965	mg/L	0.010	94	90	110			
Lab ID: B14061288-001CMSD	Sample Matrix Spike Duplicate				Run: FIA204-B_140619B				06/19/14 15:55
Nitrogen, Nitrate+Nitrite as N	0.982	mg/L	0.010	96	90	110	1.8	10	

Qualifiers:

'L - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E365.1									Analytical Run: FIA202-B_140617A
Lab ID: ICV	Initial Calibration Verification Standard								06/17/14 10:55
Phosphorus, Total as P	0.244	mg/L	0.0050	98	90	110			
Method: E365.1									Batch: 80582
Lab ID: LCS-80582	Laboratory Control Sample				Run: FIA202-B_140617A				06/17/14 10:57
Phosphorus, Total as P	0.185	mg/L	0.0050	93	90	110			
Lab ID: MB-80582	Method Blank				Run: FIA202-B_140617A				06/17/14 11:17
Phosphorus, Total as P	ND	mg/L	0.10						
Lab ID: B14061212-001BMS	Sample Matrix Spike				Run: FIA202-B_140617A				06/17/14 12:40
Phosphorus, Total as P	13.5	mg/L	0.50	90	90	110			
Lab ID: B14061212-001BMSD	Sample Matrix Spike Duplicate				Run: FIA202-B_140617A				06/17/14 12:41
Phosphorus, Total as P	13.4	mg/L	0.50	85	90	110	0.7	10	S
Lab ID: B14061283-002CMS	Sample Matrix Spike				Run: FIA202-B_140617A				06/17/14 12:48
Phosphorus, Total as P	6.84	mg/L	0.10	370	90	110			S
Lab ID: B14061283-002CMSD	Sample Matrix Spike Duplicate				Run: FIA202-B_140617A				06/17/14 12:50
Phosphorus, Total as P	6.74	mg/L	0.10	320	90	110	1.5	10	S

Qualifiers:

RL - Analyte reporting limit.
S - Spike recovery outside of advisory limits.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Area

Report Date: 06/26/14
Work Order: B14061283

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E410.4									Batch: R225646
Lab ID: MB-R225646	Method Blank				Run: SPEC_140616C				06/16/14 14:00
Oxygen Demand, Chemical (COD)	ND	mg/L	5						
Lab ID: LCS-R225646	Laboratory Fortified Blank				Run: SPEC_140616C				06/16/14 14:00
Oxygen Demand, Chemical (COD)	23.2	mg/L	5.0	95	90	110			
Lab ID: B14060927-001BDUP	Sample Duplicate				Run: SPEC_140616C				06/16/14 14:00
Oxygen Demand, Chemical (COD)	6.00	mg/L	5.0				15	30	
Lab ID: B14061288-001CMS	Sample Matrix Spike				Run: SPEC_140616C				06/16/14 14:00
Oxygen Demand, Chemical (COD)	104	mg/L	5.0	96	90	110			
Lab ID: B14061316-001BDUP	Sample Duplicate				Run: SPEC_140616C				06/16/14 14:00
Oxygen Demand, Chemical (COD)	7800	mg/L	500				3.8	10	
Lab ID: B14061316-001BMS	Sample Matrix Spike				Run: SPEC_140616C				06/16/14 14:00
Oxygen Demand, Chemical (COD)	10500	mg/L	500	98	90	110			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

DOWL HKM

B14061283

Login completed by: Randa Nees
Reviewed by: BL2000\lcadreau
Reviewed Date: 6/16/2014

Date Received: 6/13/2014
Received by: dlf
Carrier name: Hand Del

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

Standard Reporting Procedures:

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

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

Contact and Corrective Action Comments:

Temp Blank temperature for Cooler 1 was 2.0°C and Cooler 2 was 3.2°C.

Samples for Nutrients were received at pH ~ 7. 2 mL of sulfuric acid was added to each sample in the laboratory in an attempt to preserve to pH<2. The result for both samples was a final pH~7.

Chain of Custody and Analytical Request Record

Page ____ of ____

PLEASE PRINT (Provide as much information as possible.)

Company Name: DOWL HKM	Project Name, PWS, Permit, Etc.: Hysham Rest Area	Sample Origin State: MT	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address (Required): 2090 Stadium Drive Bozeman MT 59715	Contact Name: William Dreyer Phone/Fax: (406) 551-1446 Cell: 539-9954		Sampler: (Please Print) William Dreyer
☐ No Hard Copy Email:	Invoice Contact & Phone: William Dreyer	Purchase Order:	Quote/Bottle Order: 80833
Invoice Address (Required): Same ☐ No Hard Copy Email:			

Special Report/Formats:
☐ DW ☐ EDD/EDT (Electronic Data)
☐ POTW/WWTP Format: ____
☐ State: ____ ☐ LEVEL IV
☐ Other: ____ ☐ NELAC

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids Vegetation Bioassay Other DW - Drinking Water

ANALYSIS REQUESTED

Standard Turnaround (TAT) — RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments:

Shipped by: Hand
Cooler ID(s):
Receipt Temp 3.2 °C
On Ice: (Y) N
Custody Seal On Bottle Y (N) On Cooler Y (N)
Intact Y N
Signature Match Y N

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	SEE ATTACHED
1	Hysham Rest Area East Bound	6/13/14	9:30	GW	X
2	Hysham Rest Area West Bound	6/13/14	11:30	GW	X
3					
4					
5					
6					
7					
8					
9					
10					

Waste Water
4 L Bottle only

LABORATORY USE ONLY: L406 1283-001 L 002

Custody Record MUST be Signed

Relinquished by (print): William Dreyer	Date/Time: 6/13/14	Signature: William Dreyer	Received by (print): Date/Time: Signature:
Relinquished by (print):	Date/Time:	Signature:	Received by (print): Date/Time: Signature:
Sample Disposal: Return to Client: ____		Lab Disposal: ____	Received by Laboratory: Debra Osborn Date/Time: 6/13/14 1512 Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.

ENERGY LABORATORIES
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Analytical Excellence Since 1952

Helena, MT 877-472-0711 • Billings, MT 800-735-4489 • Casper, WY 888-235-0515
Gillette, WY 866- • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

BOTTLE ORDER 80833

SHIPPED TO: DOWL HKM

Contact: Bill Dreyer
2090 Stadium Drive
Bozeman MT 59715
Phone: (406) 586-8834
Project:

Order Created by: Gina McCartney
Shipped From: Billings, MT
Ship Date: 6/6/2014
VIA: Ground

Bottle Size/Type	Bottles Per Samp	Method	Tests	Critical Hold Time	Preservative	Notes	Num of Samp
DW (4 Sets)							
1 Liter Plastic	1	A2320 B	Alkalinity			Cl, SO4 & F by E300.0	1
		A2510 B	Conductivity				
		E300.0	Anions by Ion Chromatography				
		E353.2	Nitrogen, Nitrite	48 hrs			
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Dissolved			Will be Filtered and Preserved in lab for Ca, Mg, K & Na	1
		A2340 B	Hardness as CaCO3				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Drinking Water		HNO3	Sb, As, Ba, Be, Cd, Cr, Fe, Mn, Hg, Ni, Se, Tl	1
250 mL Plastic	1	E353.2	Nitrogen, Nitrate + Nitrite		H2SO4		1
		Calculation	Nitrogen, Nitrate				
100 mL Plastic Sterile	1	A9223	Bacteria, Private Water Supply	48 hrs			1
WW (4 Sets)							
1 Liter Plastic	1	A5210 B	Biochemical Oxygen Demand, 5 Day	48 hrs			1

1 Liter Plastic	1	A2320 B	Alkalinity			Cl	1
		E300.0	Anions by Ion Chroma[illegible]ny				
		A2510 B	Conductivity				
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
		A2540 D	Solids, Total Suspended				
500 mL Plastic	1	E350.1	Nitrogen, Ammonia		■ H2SO4		1
		E353.2	Nitrogen, Nitrate + Nitrite				
		E351.2	Nitrogen, Total Kjeldahl				
		Calculation	Nitrogen, Total (TKN+NO3+NO2)				
		E365.1	Phosphorus, Total				
		E410.4	Chemical Oxygen Demand				
40 mL Clear Glass VOA	1	A4500-Cl G	Chlorine, Residual	2.4 hrs		Zero headspace	1
1 Liter Clear Glass Narrow Mouth	2	E1664A	Oil & Grease, Gravimetric		■ H2SO4		1

■ HNO3 - Nitric Acid ☐ H2SO4 - Sulfuric Acid ■ NaOH - Sodium Hydroxide

■ ZnAc - Zinc Acetate ■ HCl - Hydrochloric Acid ☐ H3PO4 - Phosphoric Acid

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

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

Corrosive Chemicals: Nitric, Sulfuric, Phosphoric, Hydrochloric Acids and Sodium Hydroxide. Zinc Acetate is a skin irritant.

Subcontracting of sample analyses to an outside laboratory may be required. If so, Energy Laboratories will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX E:

NRCS SOILS DATA

DOWL

United States Department of Agriculture

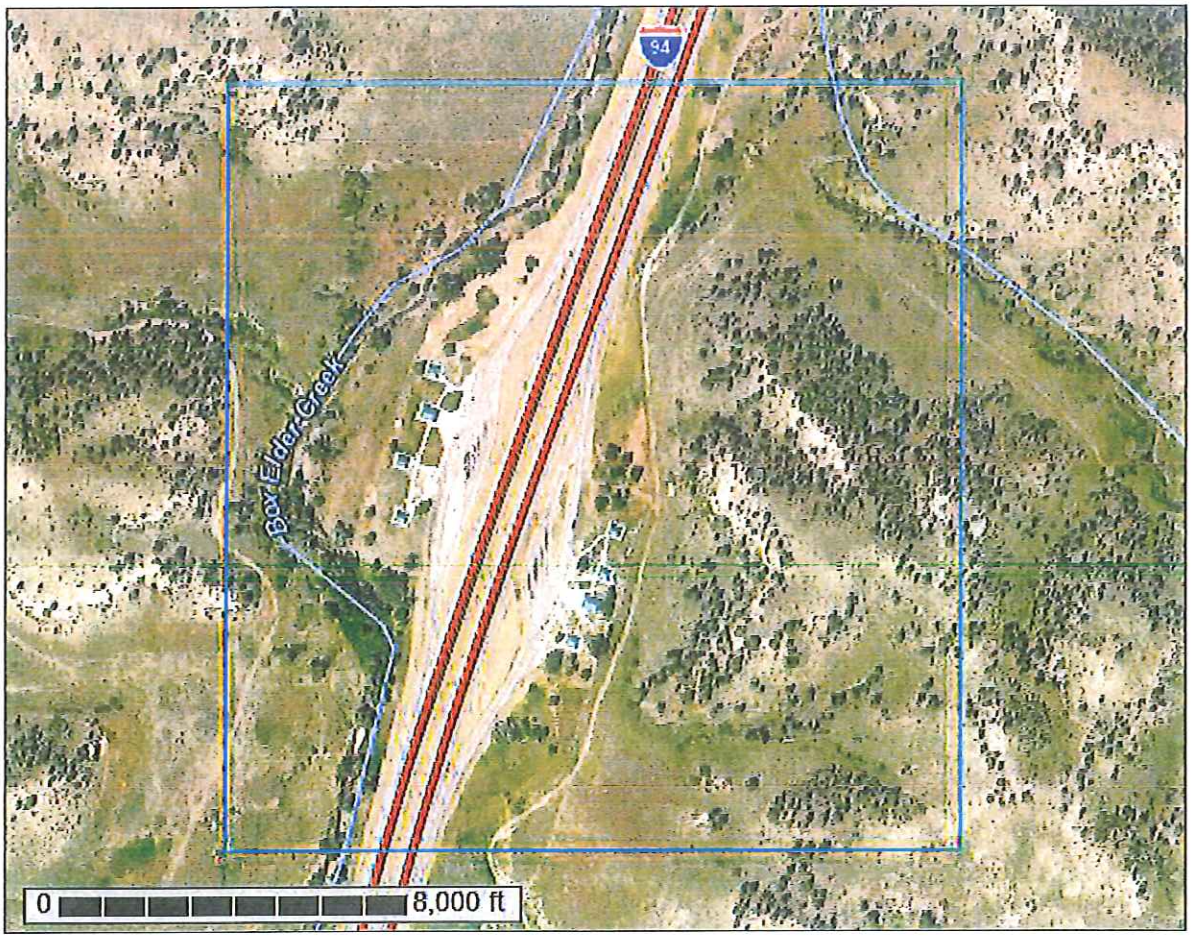
NRCS

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 Treasure County, Montana

Hysham Rest Area



September 17, 2014

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 (http://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.

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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.

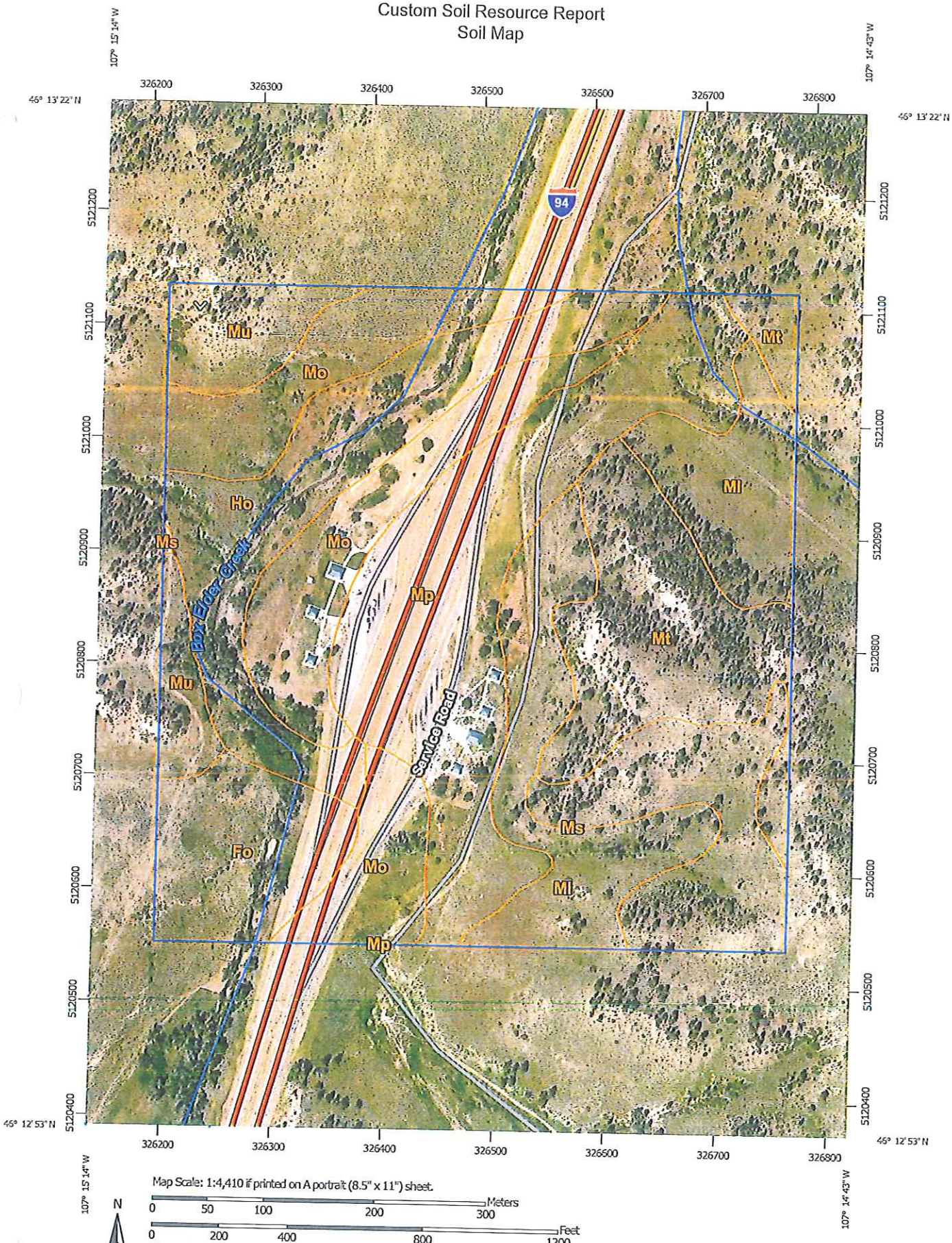
While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the 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 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.


107° 15' 14" W
107° 14' 43" W
46° 13' 22" N
46° 12' 53" N
326200
326300
326400
326500
326600
326700
326800
5121200
5121100
5121000
5120900
5120800
5120700
5120600
5120500
5120400
94
Mu
Mo
Mt
Ml
Ho
Ms
Mp
Fo
Box Elder Creek
Service Road
Map Scale: 1:4,410 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 200 400 800 1200
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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

Treasure County, Montana (MT103)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	5.8	7.0%
Ho	Havre and Lohmiller soils	10.8	13.1%
Ml	McRae-Bainville loams, 8 to 20 percent slopes	12.5	15.2%
Mo	McRae and Havre loams, 1 to 4 percent slopes	14.7	17.9%
Mp	McRae and Havre loams, 4 to 8 percent slopes	16.6	20.1%
Ms	Midway clay loam, 15 to 35 percent slopes	6.9	8.4%
Mt	Midway-Bainville complex	10.3	12.6%
Mu	Midway-Nihill gravelly loam	4.6	5.6%
Totals for Area of Interest		82.3	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.

Treasure County, Montana

Fo—Fort Collins loam, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: clfp
Mean annual precipitation: 10 to 13 inches
Frost-free period: 110 to 135 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Fort Collins

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 4 inches: loam
Bt - 4 to 12 inches: clay loam
Bk - 12 to 60 inches: loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Arvada

Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Beckton

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear

Ho—Havre and Lohmiller soils

Map Unit Setting

National map unit symbol: clgg
Elevation: 1,800 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Havre and similar soils: 30 percent
Havre and similar soils: 30 percent
Harlem and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harlem

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

A - 0 to 8 inches: clay loam
C1 - 8 to 40 inches: stratified clay to silty clay loam
C2 - 40 to 60 inches: stratified silty clay loam to fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (4.0 to 8.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Description of Havre

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 8 inches: loam
C - 8 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 8 inches: clay
C - 8 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional

Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Minor Components

Bowdoin

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Havre

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Overflow (ov) rru 58a-e 10-14" p.z. (R058AE007MT)

Glendive

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

MI—McRae-Bainville loams, 8 to 20 percent slopes

Map Unit Setting

National map unit symbol: clhj
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 50 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Mcrae and similar soils: 65 percent
Bainville and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Bainville

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and siltstone

Typical profile

A - 0 to 4 inches: loam
C - 4 to 26 inches: silt loam
Cr - 26 to 60 inches: weathered bedrock

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Cherry

Percent of map unit: 4 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Havre

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Mo—McRae and Havre loams, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: clhm
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcrae and similar soils: 50 percent
Havre and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 7 inches: loam
C1 - 7 to 39 inches: stratified fine sandy loam to clay loam
C2 - 39 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)

Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Lohmiller

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Mp—McRae and Havre loams, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: clhn
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcrae and similar soils: 50 percent
Havre and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 7 inches: loam
C1 - 7 to 39 inches: stratified fine sandy loam to clay loam
C2 - 39 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Cherry

Percent of map unit: 3 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 2 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Ms—Midway clay loam, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: clhq
Elevation: 1,900 to 4,500 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 39 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Minor Components

Bainville

Percent of map unit: 8 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Mcrae

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Cherry

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Nunn

Percent of map unit: 4 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 3 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Rock outcrop

Percent of map unit: 3 percent

Mt—Midway-Bainville complex

Map Unit Setting

National map unit symbol: clhr
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 50 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 50 percent
Bainville and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 30 to 65 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Description of Bainville

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and siltstone

Typical profile

A - 0 to 3 inches: loam
C - 3 to 22 inches: silt loam
Cr - 22 to 60 inches: weathered bedrock

Properties and qualities

Slope: 35 to 65 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Minor Components

Cherry

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Mcrae

Percent of map unit: 3 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Travessilla

Percent of map unit: 3 percent
Landform: Hills
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear

Tullock

Percent of map unit: 2 percent
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-steep (systp) rru 58a-e 10-14" p.z. (R058AE006MT)

Havre

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Mu—Midway-Nihill gravelly loam

Map Unit Setting

National map unit symbol: clhs
Elevation: 1,900 to 4,700 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 60 percent
Nihill and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Description of Nihill

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Typical profile

A - 0 to 8 inches: gravelly loam
C - 8 to 40 inches: very gravelly loam
2C - 40 to 60 inches: stratified extremely gravelly sandy loam to very gravelly loam

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Minor Components

Bainville

Percent of map unit: 10 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Shallow (sw) rru 58a-e 10-14" p.z. (R058AE019MT)

Rock outcrop

Percent of map unit: 5 percent

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Building Site Development

Building site development interpretations are designed to be used as tools for evaluating soil suitability and identifying soil limitations for various construction purposes. As part of the interpretation process, the rating applies to each soil in its described condition and does not consider present land use. Example interpretations can include corrosion of concrete and steel, shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping.

Shallow Excavations (Hysham Rest Area)

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

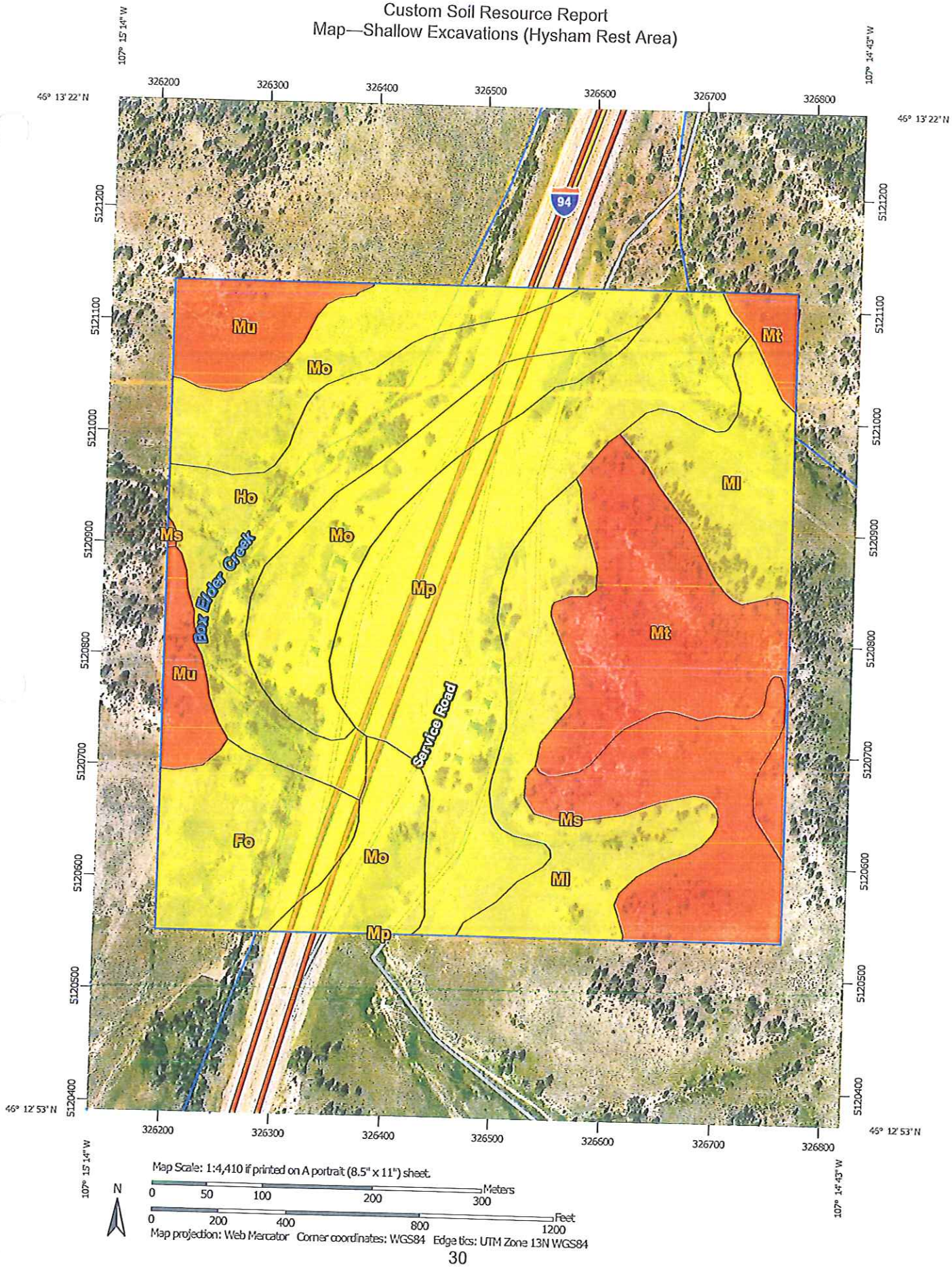
"Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Shallow Excavations (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Shallow Excavations (Hysham Rest Area)

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Dusty (0.33)	5.8	7.0%
				Unstable excavation walls (0.01)		
			Arvada (5%)	Unstable excavation walls (0.51)		
				Dusty (0.40)		
			Beckton (5%)	Unstable excavation walls (0.51)		
				Dusty (0.42)		
				Too clayey (0.13)		
Ho	Havre and Lohmiller soils	Somewhat limited	Harlem (30%)	Flooding (0.60)	10.8	13.1%
				Dusty (0.31)		
				Too clayey (0.13)		
				Unstable excavation walls (0.01)		
			Havre (30%)	Flooding (0.60)		
				Dusty (0.16)		
				Unstable excavation walls (0.01)		
			Havre (30%)	Flooding (0.60)		
				Dusty (0.21)		
				Unstable excavation walls (0.01)		
			Havre (3%)	Flooding (0.80)		
				Dusty (0.14)		
				Unstable excavation walls (0.01)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Somewhat limited	McRae (65%)	Slope (0.96)	12.5	15.2%
				Dusty (0.34)		
				Unstable excavation walls (0.01)		
			Bainville (25%)	Slope (0.96)		
				Depth to soft bedrock (0.79)		

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Dusty (0.50)		
				Unstable excavation walls (0.01)		
			Cherry (4%)	Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (4%)	Slope (0.63)		
				Dusty (0.25)		
				Unstable excavation walls (0.01)		
			Havre (2%)	Dusty (0.15)		
				Unstable excavation walls (0.01)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Dusty (0.34)	14.7	17.9%
				Unstable excavation walls (0.01)		
			Havre (45%)	Dusty (0.17)		
				Unstable excavation walls (0.01)		
			Lohmiller (5%)	Dusty (0.19)		
				Unstable excavation walls (0.01)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Dusty (0.34)	16.6	20.1%
				Unstable excavation walls (0.01)		
			Havre (45%)	Dusty (0.32)		
				Unstable excavation walls (0.01)		
			Cherry (3%)	Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (2%)	Dusty (0.19)		
				Unstable excavation walls (0.01)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Depth to soft bedrock (1.00)	6.9	8.4%

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Bainville (8%)	Depth to soft bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (3%)	Slope (1.00)		
				Dusty (0.25)		
				Unstable excavation walls (0.01)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Depth to soft bedrock (1.00)	10.3	12.6%
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Bainville (35%)	Slope (1.00)		
				Depth to soft bedrock (0.97)		
				Dusty (0.50)		
				Unstable excavation walls (0.01)		
			Travessilla (3%)	Depth to hard bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.05)		
				Unstable excavation walls (0.01)		
			Tullock (2%)	Slope (1.00)		
				Depth to soft bedrock (0.64)		
				Unstable excavation walls (0.01)		
				Dusty (0.00)		

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Depth to soft bedrock (1.00)	4.6	5.6%
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Nihill (25%)	Slope (1.00)		
				Dusty (0.22)		
				Unstable excavation walls (0.01)		
			Bainville (10%)	Depth to soft bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.24)		
				Unstable excavation walls (0.01)		
Totals for Area of Interest					82.3	100.0%

Shallow Excavations— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Somewhat limited	60.4	73.4%
Very limited	21.9	26.6%
Totals for Area of Interest	82.3	100.0%

Rating Options—Shallow Excavations (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component

typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Construction Materials

Construction materials interpretations are tools designed to provide guidance to users in selecting a site for potential source of various materials. Individual soils or groups of soils may be selected as a potential source because they are close at hand, are the only source available, or they meets some or all of the physical or chemical properties required for the intended application. Example interpretations include roadfill, sand and gravel, topsoil and reclamation material.

Gravel Source (Hysham Rest Area)

Gravel consists of natural aggregates (2 to 75 millimeters in diameter) suitable for commercial use with a minimum of processing. It is used in many kinds of construction. Specifications for each use vary widely. Only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

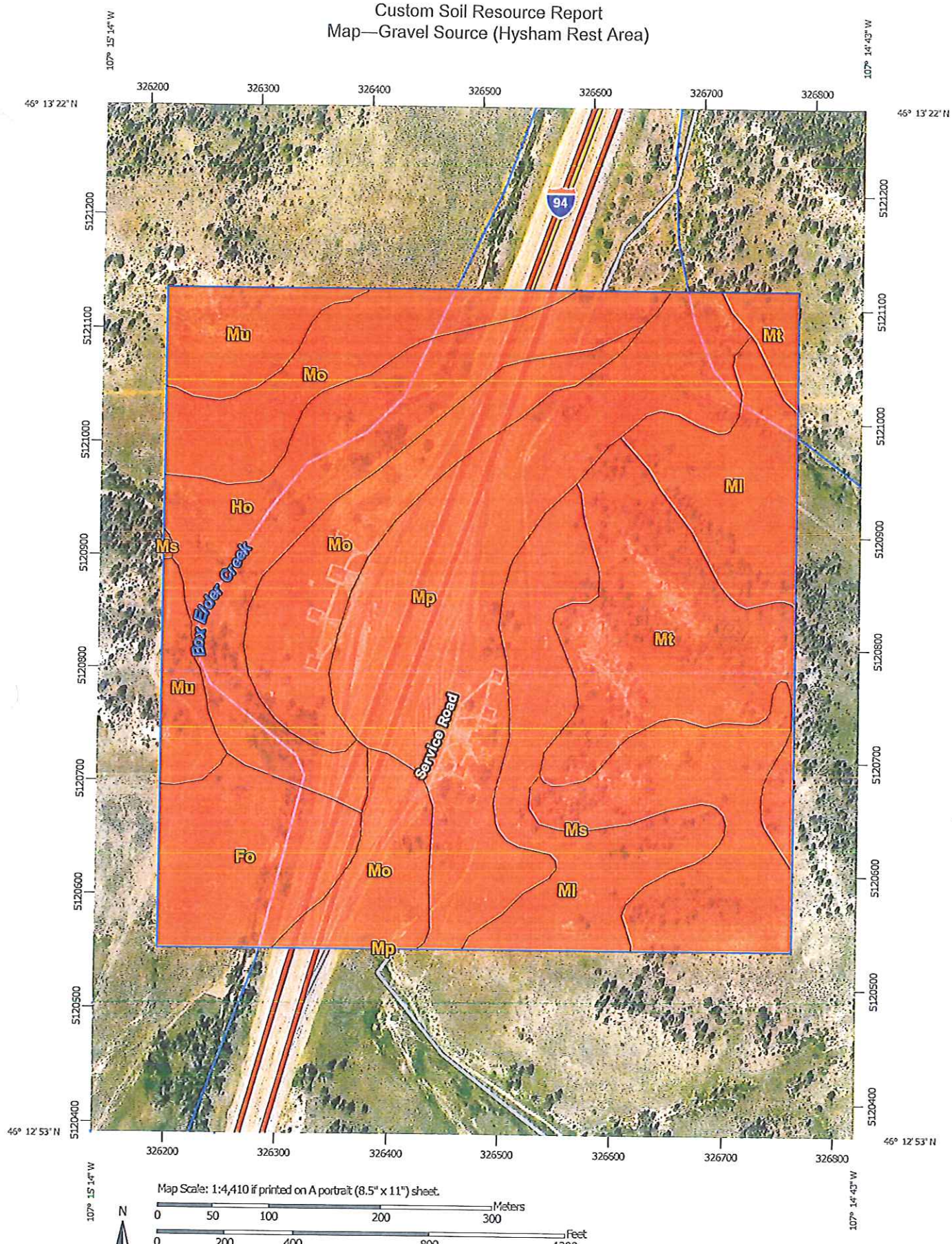
The properties used to evaluate the soil as a source of gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains gravel, the soil is considered a likely source regardless of thickness. The assumption is that the gravel layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be gravel.

The soils are rated "good," "fair," or "poor" as potential sources of gravel. A rating of "good" or "fair" means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Gravel Source (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Poor
- Fair
- Good
- Not rated or not available

Soil Rating Lines
- Poor
- Fair
- Good
- Not rated or not available

Soil Rating Points
- Poor
- Fair
- Good
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Gravel Source (Hysham Rest Area)

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	Poor	Fort Collins (90%)	Bottom layer (0.00)	5.8	7.0%
				Thickest layer (0.00)		
			Arvada (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Beckton (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Ho	Havre and Lohmiller soils	Poor	Harlem (30%)	Bottom layer (0.00)	10.8	13.1%
				Thickest layer (0.00)		
			Havre (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Bowdoin (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Poor	McRae (65%)	Bottom layer (0.00)	12.5	15.2%
				Thickest layer (0.00)		
			Bainville (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Lohmiller (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Poor	McRae (50%)	Bottom layer (0.00)	14.7	17.9%
				Thickest layer (0.00)		
			Havre (45%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Poor	McRae (50%)	Bottom layer (0.00)	16.6	20.1%
				Thickest layer (0.00)		
			Havre (45%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Ms	Midway clay loam, 15 to 35 percent slopes	Poor	Midway (70%)	Bottom layer (0.00)	6.9	8.4%
				Thickest layer (0.00)		
			Bainville (8%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			McRae (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Nunn (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mt	Midway-Bainville complex	Poor	Midway (50%)	Bottom layer (0.00)	10.3	12.6%
				Thickest layer (0.00)		
			Bainville (35%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Travessilla (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			McRae (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Tullock (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (1%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mu	Midway-Nihill gravelly loam	Poor	Midway (60%)	Bottom layer (0.00)	4.6	5.6%
				Thickest layer (0.00)		
			Nihill (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Bainville (10%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Totals for Area of Interest					82.3	100.0%

Gravel Source— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Poor	82.3	100.0%
Totals for Area of Interest	82.3	100.0%

Rating Options—Gravel Source (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Sanitary Facilities

Sanitary Facilities interpretations are tools designed to guide the user in site selection for the safe disposal of sewage and solid waste. Example interpretations include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Septic Tank Absorption Fields (Hysham Rest Area)

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

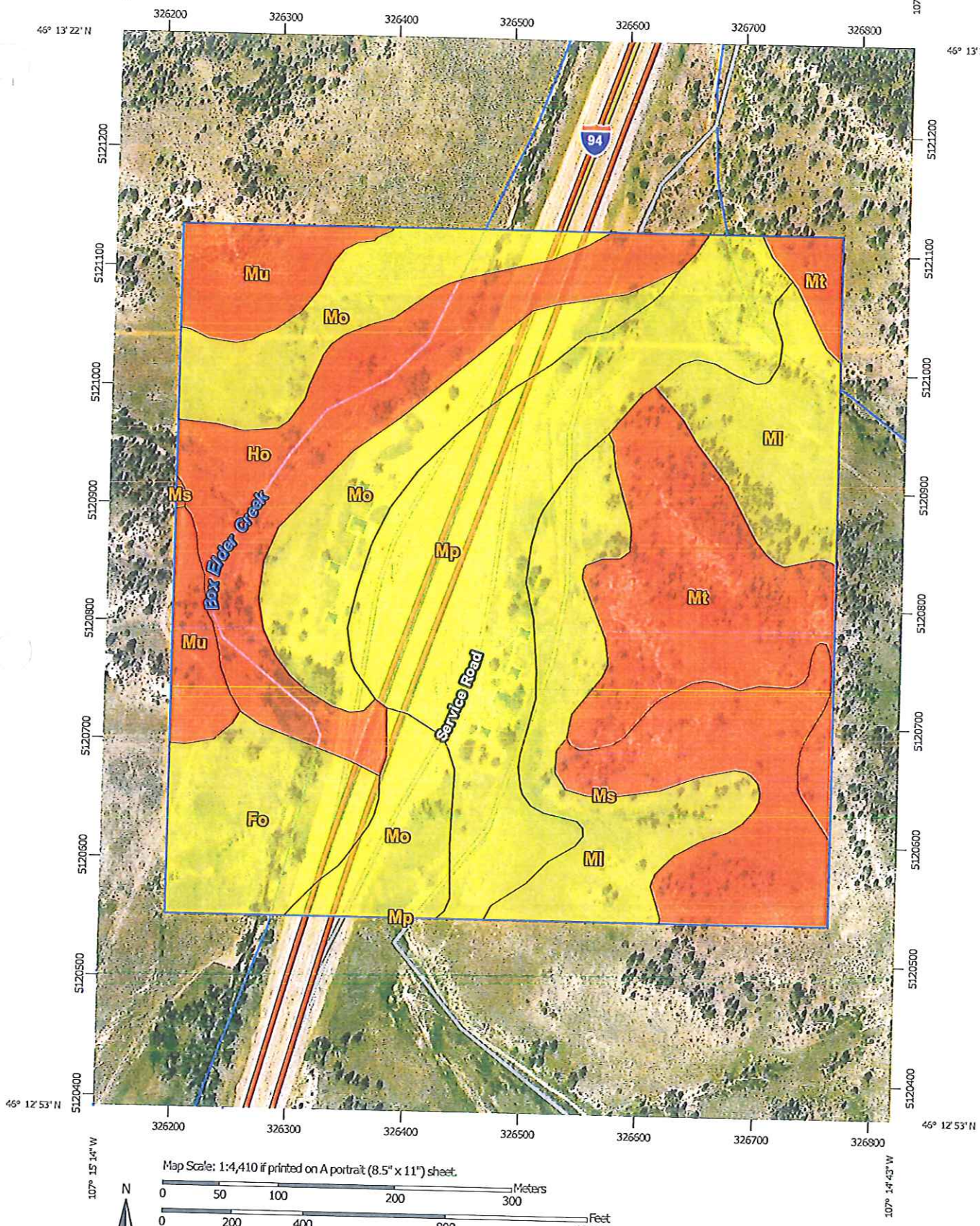
Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown

for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Septic Tank Absorption Fields (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Septic Tank Absorption Fields (Hysham Rest Area)

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Slow water movement (0.50)	5.8	7.0%
Ho	Havre and Lohmiller soils	Very limited	Harlem (30%)	Flooding (1.00)	10.8	13.1%
				Slow water movement (1.00)		
			Havre (30%)	Flooding (1.00)		
				Slow water movement (0.50)		
			Havre (30%)	Flooding (1.00)		
				Slow water movement (0.50)		
			Bowdoin (4%)	Slow water movement (1.00)		
				Flooding (0.40)		
			Glendive (3%)	Filtering capacity (1.00)		
				Flooding (0.40)		
			Havre (3%)	Flooding (1.00)		
				Slow water movement (0.50)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Somewhat limited	McRae (65%)	Slope (0.96)	12.5	15.2%
				Slow water movement (0.50)		
			Cherry (4%)	Slow water movement (0.50)		
			Lohmiller (4%)	Slope (0.63)		
				Slow water movement (0.50)		
			Havre (2%)	Slow water movement (0.50)		
				Flooding (0.40)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Slow water movement (0.50)	14.7	17.9%

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Havre (45%)	Slow water movement (0.50)		
			Lohmiller (5%)	Slow water movement (0.50)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Slow water movement (0.50)	16.6	20.1%
			Havre (45%)	Slow water movement (0.50)		
			Cherry (3%)	Slow water movement (0.50)		
			Lohmiller (2%)	Slow water movement (0.50)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Depth to bedrock (1.00)	6.9	8.4%
				Slope (1.00)		
			Bainville (8%)	Depth to bedrock (1.00)		
				Slope (1.00)		
			Nunn (4%)	Slow water movement (1.00)		
			Lohmiller (3%)	Slope (1.00)		
				Slow water movement (0.50)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Depth to bedrock (1.00)	10.3	12.6%
				Slope (1.00)		
			Bainville (35%)	Slope (1.00)		
				Depth to bedrock (1.00)		
			Travessilla (3%)	Depth to bedrock (1.00)		
				Slope (1.00)		
			Tullock (2%)	Slope (1.00)		
				Depth to bedrock (1.00)		
				Filtering capacity (1.00)		
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Depth to bedrock (1.00)	4.6	5.6%
				Slope (1.00)		

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Nihill (25%)	Slope (1.00)		
				Seepage, bottom layer (1.00)		
				Slow water movement (0.50)		
			Bainville (10%)	Depth to bedrock (1.00)		
				Slope (1.00)		
Totals for Area of Interest					82.3	100.0%

Septic Tank Absorption Fields— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Somewhat limited	49.6	60.3%
Very limited	32.7	39.7%
Totals for Area of Interest	82.3	100.0%

Rating Options—Septic Tank Absorption Fields (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a

percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Water Management

Water Management interpretations are tools for evaluating the potential of the soil in the application of various water management practices. Example interpretations include pond reservoir area, embankments, dikes, levees, and excavated ponds.

Subsurface Water Management, Outflow Quality (Hysham Rest Area)

The ratings for Subsurface Water Management, Outflow Quality are based on the soil properties that affect the capacity of the soil to convey surface and subsurface water and on the properties that affect water quality. The properties that affect the conveyance and water quality include salinity, sodicity, soil reaction, soil taxonomic great group placement, gypsum content, shrink-swell potential, soil saturation, and surface erosion.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor water quality can be expected.

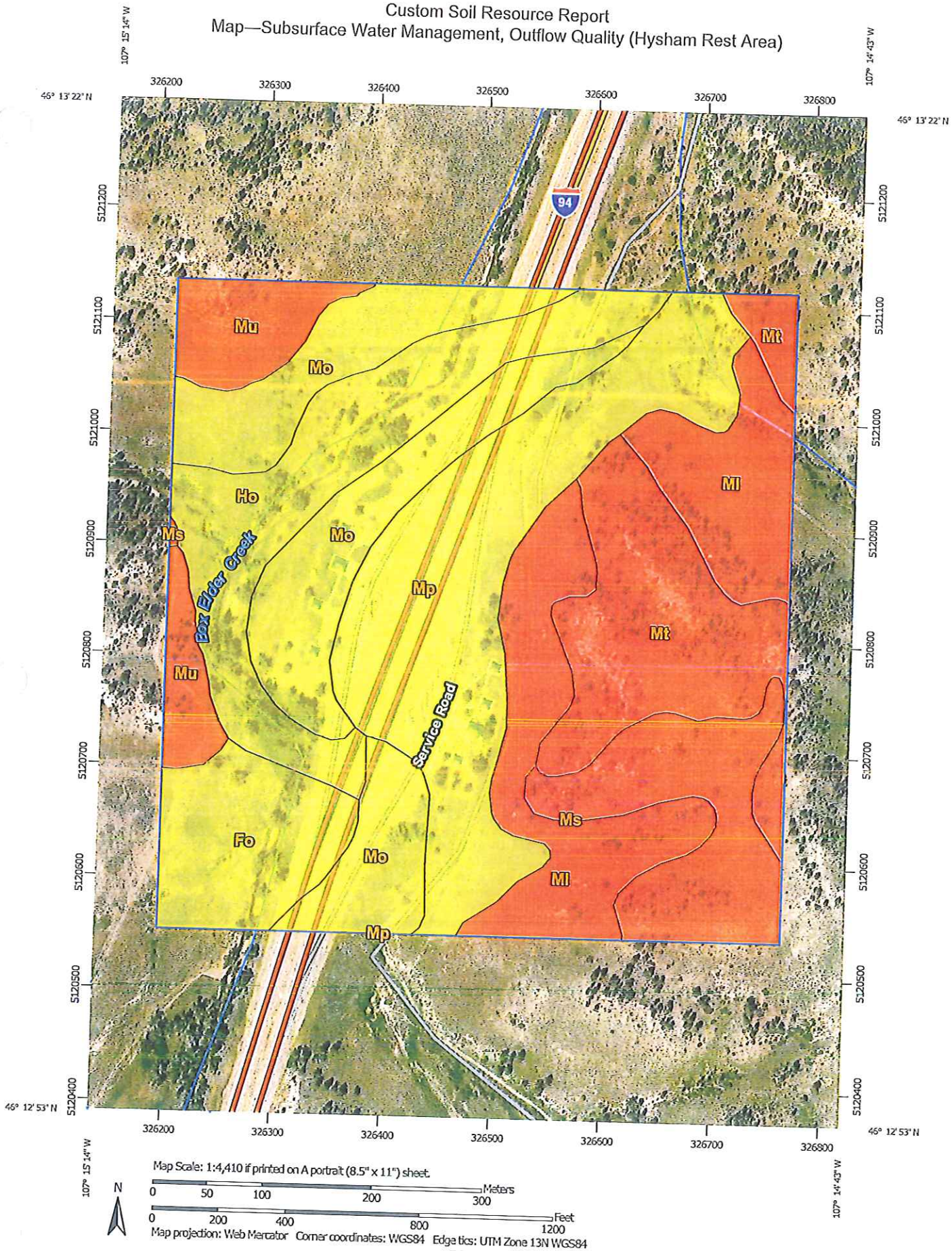
Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are

determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as that listed for the map unit. The percent composition of each component in a particular map unit is given so that the user will realize the percentage of each map unit that has the specified rating.

A map unit may have other components with different ratings. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Subsurface Water Management, Outflow Quality (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Subsurface Water Management, Outflow Quality (Hysham Rest Area)

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Pesticide and nutrient movement (0.22)	5.8	7.0%
Ho	Havre and Lohmiller soils	Somewhat limited	Harlem (30%)	Excess Salt (0.06)	10.8	13.1%
			Havre (30%)	Pesticide and nutrient movement (0.22)		
			Glendive (3%)	Pesticide and nutrient movement (0.22)		
			Havre (3%)	Pesticide and nutrient movement (0.22)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Very limited	McRae (65%)	Water Erosion (1.00)	12.5	15.2%
				Pesticide and nutrient movement (0.22)		
			Bainville (25%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Pesticide and nutrient movement (0.22)	14.7	17.9%
			Havre (45%)	Pesticide and nutrient movement (0.22)		
			Lohmiller (5%)	Pesticide and nutrient movement (0.00)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Pesticide and nutrient movement (0.22)	16.6	20.1%
				Water Erosion (0.10)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Havre (45%)	Water Erosion (0.23)		
				Pesticide and nutrient movement (0.22)		
			Cherry (3%)	Pesticide and nutrient movement (0.22)		
			Lohmiller (2%)	Pesticide and nutrient movement (0.00)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Water Erosion (1.00)	6.9	8.4%
				Pesticide and nutrient movement (0.29)		
			Bainville (8%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
				Excess Salt (0.01)		
			McRae (6%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Lohmiller (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Water Erosion (1.00)	10.3	12.6%
				Pesticide and nutrient movement (0.29)		
			Bainville (35%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Travessilla (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			McRae (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Tullock (2%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Water Erosion (1.00)	4.6	5.6%
				Pesticide and nutrient movement (0.29)		
			Nihill (25%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Bainville (10%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
				Excess Salt (0.01)		
Totals for Area of Interest					82.3	100.0%

Subsurface Water Management, Outflow Quality— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Somewhat limited	47.9	58.2%
Very limited	34.4	41.8%
Totals for Area of Interest	82.3	100.0%

Rating Options—Subsurface Water Management, Outflow Quality (Hysham Rest Area)

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Sanitary Facilities

This folder contains a collection of tabular reports that present soil interpretations related to sanitary facilities. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Sanitary facilities interpretations are tools designed to guide the user in site selection for the safe disposal of sewage and solid waste. Example interpretations include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Sewage Disposal (Hysham Rest Area)

This table shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Saturated hydraulic conductivity (Ksat) is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a Ksat rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Sewage Disposal (Hysham Rest Area)

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Fo—Fort Collins loam, 1 to 4 percent slopes					
Fort collins	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Arvada	5	Very limited		Not limited	
		Slow water movement	1.00		
Beckton	5	Very limited		Not limited	
		Slow water movement	1.00		
Ho—Havre and Lohmiller soils					
Harlem	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	1.00		
Havre	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
Havre	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
Bowdoin	4	Very limited		Somewhat limited	
		Slow water movement	1.00	Flooding	0.40
		Flooding	0.40		
Glendive	3	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.40	Flooding	0.40
Havre	3	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MI—McRae-Bainville loams, 8 to 20 percent slopes					
Mcrae	65	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Bainville	25	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Cherry	4	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Lohmiller	4	Somewhat limited		Very limited	
		Slope	0.63	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Havre	2	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
		Flooding	0.40	Flooding	0.40
Mo—McRae and Havre loams, 1 to 4 percent slopes					
Mcrae	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Havre	45	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Lohmiller	5	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Mp—McRae and Havre loams, 4 to 8 percent slopes					
Mcrae	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Havre	45	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Cherry	3	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Lohmiller	2	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Ms—Midway clay loam, 15 to 35 percent slopes					
Midway	70	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Bainville	8	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	0.50
Cherry	6	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Mcrae	6	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Nunn	4	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.92
Lohmiller	3	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Rock outcrop	3	Not rated		Not rated	

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Mt—Midway-Bainville complex					
Midway	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Bainville	35	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
				Seepage	0.50
Cherry	6	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Mcrae	3	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Travessilla	3	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
Tullock	2	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Filtering capacity	1.00	Seepage	1.00
Havre	1	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
		Flooding	0.40	Flooding	0.40
Mu—Midway-Nihill gravelly loam					
Midway	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Nihill	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	0.50		
Bainville	10	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	0.50
Rock outcrop	5	Not rated		Not rated	

Soil Chemical Properties

This folder contains a collection of tabular reports that present soil chemical properties. The reports (tables) include all selected map units and components for each map unit. Soil chemical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

Chemical Soil Properties (Hysham Rest Area)

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg

concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Fo—Fort Collins loam, 1 to 4 percent slopes								
Fort collins	0-4	15-20	—	6.6-7.8	0	0	0	0
	4-12	20-25	—	7.4-8.4	0	0	0	0
	12-60	15-20	—	7.9-9.0	5-15	0	0.0-2.0	0
Arvada	0-6	15-20	—	6.6-7.8	0	0	0.0-2.0	0
	6-17	25-35	—	7.4-9.0	0	0	1.0-8.0	10-20
	17-60	20-25	—	7.9-9.0	5-15	0	8.0-16.0	13-30
Beckton	0-6	20-25	—	6.6-7.8	0	0	0.0-2.0	0
	6-22	25-35	—	7.4-9.0	0	0	1.0-8.0	10-20
	22-60	20-25	—	7.9-9.0	5-15	0	8.0-16.0	13-30

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Ho—Havre and Lohmiller soils								
Harlem	0-8	20-25	—	7.4-8.4	1-5	0	2.0-4.0	0
	8-40	25-30	—	7.4-8.4	5-10	0	2.0-4.0	0
	40-60	15-20	—	7.9-9.0	5-10	0	4.0-8.0	0
Havre	0-8	15-20	—	7.4-8.4	1-5	0	0.0-2.0	0
	8-60	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
Havre	0-8	25-30	—	7.4-8.4	1-5	0	0.0-2.0	0
	8-60	15-20	—	7.4-8.4	1-5	0	0.0-4.0	0
Bowdoin	0-7	30-50	—	7.4-9.0	1-5	0	8.0-16.0	5-13
	7-42	35-55	—	7.4-9.0	1-5	0	8.0-16.0	13-30
	42-62	30-45	—	7.9-9.0	1-5	0	8.0-16.0	13-30
Glendive	0-8	10-15	—	7.4-8.4	0	0	0.0-2.0	0
	8-18	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	18-60	1.0-5.0	—	7.4-8.4	5-10	0	0.0-4.0	0
Havre	0-5	15-20	—	7.4-8.4	1-5	0	0.0-2.0	0
	5-60	15-25	—	7.4-8.4	1-10	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
MI—McRae-Bainville loams, 8 to 20 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Bainville	0-4	15-20	—	6.6-7.8	1-5	0	0	0
	4-26	10-15	—	7.4-8.4	5-10	0	0.0-4.0	0
	26-60	—	—	—	—	—	—	—
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Lohmiller	0-7	15-20	—	6.6-8.4	0	0	0	0
	7-60	10-15	—	6.6-8.4	0-5	0	0	0
Havre	0-9	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	9-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mo—McRae and Havre loams, 1 to 4 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Havre	0-7	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	7-39	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	39-60	15-25	—	7.4-9.0	1-5	0	2.0-8.0	0
Lohmiller	0-20	20-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	20-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mp—McRae and Havre loams, 4 to 8 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Havre	0-7	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	7-39	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	39-60	15-25	—	7.4-9.0	1-5	0	2.0-8.0	0
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Lohmiller	0-20	20-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	20-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Ms—Midway clay loam, 15 to 35 percent slopes								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Bainville	0-3	10-15	—	7.4-9.0	5-10	0	0.0-4.0	0
	3-15	5.0-10	—	7.4-9.0	10-15	0	0.0-4.0	1-5
	15-60	—	5.0-10	—	15-25	—	2.0-8.0	1-5
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	5-10	0	0.0-2.0	0
	10-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Nunn	0-6	20-25	—	6.1-7.8	0	0	0	0
	6-14	25-30	—	6.6-8.4	0	0	0	0
	14-60	20-25	—	7.4-9.0	5-15	0	0	1-5
Lohmiller	0-7	15-20	—	6.6-8.4	0	0	0	0
	7-60	10-15	—	6.6-8.4	0-5	0	0	0
Rock outcrop	—	—	—	—	—	—	—	—

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mt—Midway-Bainville complex								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Bainville	0-3	15-20	—	6.6-7.8	1-5	0	0	0
	3-22	10-15	—	7.4-8.4	5-10	0	0.0-4.0	0
	22-60	—	—	—	—	—	—	—
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	5-10	0	0.0-2.0	0
	10-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Travessilla	0-2	10-15	—	6.6-8.4	0	0	0	0
	2-12	5.0-10	—	7.4-9.0	5-10	0	0.0-2.0	0
	12-60	—	—	—	—	—	—	—
Tullock	0-8	10-15	—	7.9-8.4	1-5	0	0	0
	8-28	5.7-13	—	7.9-8.4	5-10	0	0	0
	28-60	—	—	—	—	—	—	—
Havre	0-9	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	9-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mu—Midway-Nihill gravelly loam								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Nihill	0-8	15-20	—	6.6-8.4	0	0	0.0-2.0	0
	8-40	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-8.4	5-15	0	0.0-2.0	0
Bainville	0-4	10-15	—	7.4-9.0	5-10	0	0.0-4.0	0
	4-19	5.0-10	—	7.4-9.0	15-25	1-5	2.0-8.0	1-5
	19-60	—	—	—	—	—	—	—
Rock outcrop	—	—	—	—	—	—	—	—

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Hysham Rest Area)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the

surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

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.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba).

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Fo—Fort Collins loam, 1 to 4 percent slopes														
Fort collins	90	B	0-4	Loam	CL-ML	A-4	0	0	100	100	85-95	60-75	25-30	5-10
			4-12	Clay loam, loam	CL	A-6	0	0	100	100	85-95	65-80	25-35	10-15
			12-60	Loam, clay loam	CL-ML	A-4	0	0	100	100	85-95	60-75	25-30	5-10
Arvada	5	D	0-6	Loam	CL-ML	A-4	0	0	80-100	75-100	60-90	50-80	25-30	5-10
			6-17	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	90-100	90-100	85-100	75-95	40-60	20-40
			17-60	Clay loam, sandy clay loam, clay	CH, CL, SC	A-6, A-7	0	0	90-100	90-100	80-95	45-75	35-55	15-35
Beckton	5	D	0-6	Clay loam	CL	A-6	0	0	80-100	75-100	65-95	60-90	25-40	10-20
			6-22	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	90-100	90-100	85-100	75-95	40-60	20-40
			22-60	Clay loam, sandy clay loam, clay	CH, CL, SC	A-6, A-7	0	0	90-100	90-100	80-95	45-75	35-55	15-35

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Ho—Havre and Lohmiller soils														
Harlem	30	C	0-8	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	70-90	35-45	15-20
			8-40	Stratified clay to silty clay loam	CH, CL	A-7	0	0	100	100	95-100	85-95	40-65	20-40
			40-60	Stratified silty clay loam to fine sandy loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	60-75	20-40	5-15
Havre	30	B	0-8	Loam	CL-ML, ML	A-4	0	0	100	100	80-95	60-75	20-30	NP-10
			8-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15
Havre	30	C	0-8	Clay	CH, CL	A-6, A-7	0	0	100	100	85-100	75-95	35-55	15-30
			8-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15
Bowdoin	4	D	0-7	Clay	CH	A-7	0	0	100	100	90-100	80-95	60-85	30-55
			7-42	Clay	CH	A-7	0	0	100	100	90-100	80-95	60-85	30-55
			42-62	Clay	CH	A-7	0	0	100	100	90-100	80-95	55-80	30-50
Glendive	3	B	0-8	Fine sandy loam	ML, SM	A-4	0	0	100	100	70-85	40-55	—	NP
			8-18	Stratified very fine sandy loam to silt loam	ML	A-4	0	0	100	95-100	85-95	60-85	25-35	NP-5

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			18-60	Extremely gravelly loamy sand, very gravelly sand, extremely gravelly sand	GP, GP-GM	A-1	0	0-5	30-45	20-35	10-25	0-10	—	NP
Havre	3	B	0-5	Loam	CL-ML, ML	A-4	0	0	100	100	80-95	60-75	20-30	NP-10
			5-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
MI—McRae-Bainville loams, 8 to 20 percent slopes														
Mcrae	65	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Bainville	25	C	0-4	Loam	CL-ML, ML	A-4	0	0	100	100	95-100	75-90	20-30	NP-10
			4-26	Silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-90	20-35	5-15
			26-60	Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	4	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Silt loam, clay loam, loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Lohmiller	4	B	0-7	Clay loam	CL	A-6	0	0-5	85-100	80-100	65-90	60-80	30-35	10-15
			7-60	Loam, clay loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	85-100	80-100	65-90	60-80	25-35	5-15
Havre	2	B	0-9	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			9-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mo—McRae and Havre loams, 1 to 4 percent slopes														
Mcrae	50	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Havre	45	B	0-7	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			7-39	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
			39-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Lohmiller	5	C	0-20	Clay loam	CL	A-6	0	0	100	100	85-100	75-95	30-40	10-20
			20-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mp—McRae and Havre loams, 4 to 8 percent slopes														
Mcrae	50	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Havre	45	B	0-7	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			7-39	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
			39-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Cherry	3	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Lohmiller	2	C	0-20	Clay loam	CL	A-6	0	0	100	100	85-100	75-95	30-40	10-20
			20-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-6, A-4	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Ms—Midway clay loam, 15 to 35 percent slopes														
Midway	70	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Bainville	8	D	0-3	Loam	CL-ML	A-4	0	0	90-100	85-100	65-85	55-75	25-30	5-10
			3-15	Loam, clay loam, silty clay loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-100	60-90	55-85	25-35	5-15
			15-60	Unweathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	6	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Mcrae	6	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Nunn	4	C	0-6	Clay loam	CL	A-6	0	0	100	95-100	85-100	70-80	25-40	10-20
			6-14	Silty clay, silty clay loam, clay	CL	A-7	0	0	100	95-100	95-100	90-95	40-50	20-30

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			14-60	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	95-100	95-100	85-95	30-50	10-25
Lohmiller	3	B	0-7	Clay loam	CL	A-6	0	0-5	85-100	80-100	65-90	60-80	30-35	10-15
			7-60	Loam, clay loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	85-100	80-100	65-90	60-80	25-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mt—Midway-Bainville complex														
Midway	50	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Bainville	35	C	0-3	Loam	CL-ML, ML	A-4	0	0	100	100	95-100	75-90	20-30	NP-10
			3-22	Silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-90	20-35	5-15
			22-60	Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	6	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Mcrae	3	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Travessilla	3	D	0-2	Loam	CL-ML, ML	A-4	0	0-10	90-100	85-100	65-85	55-75	20-30	NP-10
			2-12	Sandy loam, fine sandy loam, loam	ML, SM	A-4	0	0-10	90-100	85-100	55-80	40-70	20-30	NP-5

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			12-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Tullock	2	A	0-8	Fine sandy loam	ML, SM	A-4	0	0	100	100	75-95	35-55	20-25	NP-5
			8-28	Fine sandy loam	ML, SM	A-4	0	0	100	100	75-95	35-55	20-25	NP-5
			28-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Havre	1	B	0-9	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			9-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Mu—Midway-Nihill gravelly loam														
Midway	60	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Nihill	25	B	0-8	Gravelly loam	CL-ML, GM, ML, SM	A-4	0	0-10	70-85	60-75	50-65	40-60	20-30	NP-10
			8-40	Gravelly loam, channery loam, very gravelly loam	GC-GM, GM, SC-SM, SM	A-1, A-2, A-4	0	0-15	40-80	30-70	25-60	20-50	20-30	NP-10
			40-60	Stratified extremely gravelly sandy loam to very gravelly loam	GC-GM, GM	A-1, A-2	0	0-25	45-60	40-55	30-45	20-35	15-30	NP-10
Bainville	10	D	0-4	Loam	CL-ML	A-4	0	0	90-100	85-100	65-85	55-75	25-30	5-10
			4-19	Loam, clay loam, silty clay loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-100	60-90	55-85	25-35	5-15
			19-60	Unweathered bedrock	—	—	—	—	—	—	—	—	—	—

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

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

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX F:

DESIGN CRITERIA

DOWL

Wastewater Lift Station Design

Project Name: Lift Station Design
Project Number: 4524.11355
Project Location: Hysham Rest Area
Client: MDT

Flow Rate

Design Average Daily Flow= 45.1 gpm
Design Population= 840
Peaking Factor, P= 3.848 per DEQ-2 11.24

$$PeakingFactor = \frac{18 + \sqrt{P/1000}}{4 + \sqrt{P/1000}}$$

Peak Design Flow Rate, Q= 100 gpm

Velocity Check (at peak design flow)

At peak design flow the a minimum scour velocity of 2 ft/s must be maintained, DEQ-2 48.1

$$Q = Velocity \times Area$$

Nominal Pipe Diameter= 3
Inside Pipe Diameter= 3 inches

Velocity, v= 4.54 ft/s O.K.

Design Volume of Wet Well

$$Volume, V = \frac{Time \times FlowRate}{4}$$

Number of Pumps= 2
Starts per Hour= 1
Cycle Time per Pump, T= 30 min./cycle

Volume, V= 750 gallons
100.27 ft^3

Wet Well Size

	Length (ft)	Width (ft)	Estimated Depth (ft)	
Square Vault	5	5	4.01	
	6	6	2.79	
	7	7	2.05	
	Diameter (ft)	Area (ft^2)	Estimated Depth (ft)	
Round Vault	5	19.63	5.11	← Design Wet Well
	6	28.27	3.55	
	7	38.48	2.61	

Forced Main Volume Check

Length of Force Main, L= 1480 ft

Force Main Volume= 543.42 gallons

Approximately xxxx of the forced main pipeline will be flushed with each pump cycle (assuming no inflow during pumping.) Actual flushing will be greater.

DRAINFIELD AREA CALCULATIONS
For
Hysham Rest Area
NE1/4, NW ¼, SW1/4, SEC. 5, T5N, R36E
Treasure County, MT

I. Daily Design Flow:

(On-site flow Data)

1. Summer time average number of people per day (combined) (Door counts for 6/2013 - 8/2013) = 1,246 people per day.

2. Summer Time Average of Gallons of water usage per day (combined 6/2013 - 8/2013) = 1019.4 gallons per day (not used for sizing of drainfield).

3. Water usage per person 1.5 gpd/person.

4. The future wastewater flow rates are estimated using the growth rate equation noted below.

   (Current Wastewater Flows)*(1 + [Growth Rate Decimal Form]) $^{\text{Number of Years}}$ = Design Year Wastewater Flows

   [(1,246 people per day * 1.5 gpd/person) * (1+ [2%])^22 years] = 2,889.44gallons per day of effluent flow.

   A 2.0 percent growth rate over a 22-year period has been agreed upon by DOWL and MDT and has been used to estimate the 22 year flow rate. The proposed flow rate was calculated from on-site door counters data projected over a 22-year design period.

   A combined wastewater flow rate projected out 20 years is 2,889.44 gallons per day.

TOTAL = 2,890 gallons

II. Drainfield Requirements:

Based on percolation rates between 6 and 15 min/inch and the existence of sandy lean clay(sandy loam) soils in the test pits, MDEQ specifies an application rate of 0.5 gallons per day (gpd) per square feet (ft^2).

The proposed effluent flow rate was calculated from door counters, this equates to 2,890 gpd. An application rate of 0.5 gpd/ft^2 used for sizing purposes as well as an infiltration area discount factor of 50% for advanced treatment.

Use: 2,890 gpd/0.5 gpd/ft^2 = 5,780 sf $\Rightarrow$ 5,780 sf * 0.5 = 2,890 sf

TOTAL = 2,890 square feet required

III. Lateral Requirements:

(2,890 sf) / (3 ft trench "infiltrator") = 963.33 lnft

TOTAL = 964 lineal feet required

IV. Total Drainfield / 100% Replacement Area:

Use ten, 100 foot, 2.0 inch drainfield laterals in three foot wide "infiltrator" gravelless drainfield septic chambers in a "standard depth trench" at seven feet on center (minimum). Thus the drainfield area required will be 100 feet by 63 feet. See Site Plan Attached.

TOTAL DRAINFIELD AREA = 160 feet x 63 feet

V. Septic Tank Sizing:

(From Circular DEQ 4, section 5.1.6.3)

The septic tank is sized based on a combined flow from each rest facility that is projected out 22 years (**2,890** gallons per day).

(3,386 gallons per day) x 2.5 septic tank multiplier = 7,225 gallon tank minimum.

Use minimum **7,500 gallon** liquid volume capacity. Tank must be reinforced concrete with effluent filter.

VI. Dose Tank Sizing:

(From Circular DEQ 4, 7.2.10.1 A)

The dose tank is sized so that the both rest area's wastewater flows can be accommodated. 575gpd (dose volume) + 723gpd (25% average daily flow) + 835.5 gallons (pump submergence) = 2130.5 gallons.

Use minimum **2,500 gallon** liquid volume capacity. The dose tank must be reinforced concrete. See enclosed site plan.

Hysham Rest Area
Pump Selection for Pressurized System
PROJECT: Design for 100' X 63' (10 laterals at 50')

Orifice Size	0.125	inches	
Residual Head at Last Orifice	5.00	feet	
Lateral Length	50	feet	
Total Number of Laterals per Cell	10		
Orifice Spacing	5.00	feet	
Distributing Valve Model (# of Zones)	1		None used
Lift to Manifold	10	feet	
Discharge Assembly Size	2.00	inches	
Transport Line Size	2.00	inches	
Pipe Class/Schedule	40		
Transport Length	50	feet	
Manifold Size	2.00	inches	
Pipe Class/Schedule	40		
Length of Distribution Header	63.00	feet	
Lateral Size	2.00	inches	
Pipe Class/Schedule	40		
Flow Meter	none		None used
'Add-on' Friction Losses	0.00	feet	

Calculation		
Minimum Flow Rate per Orifice	0.43 gpm	
Number of Orifices per Zone	100	
Total Actual Flow Rate	43.3 gpm	
Number of Laterals per Zone	10	
Total Dynamic Head:		
Lift to Manifold	10.0 feet	
Residual Head at Last Orifice	5.0 feet	
Frictional Head Losses:		
Head Loss in Transport Pipe	1.5 feet	
ead Loss through Discharge Assembly	3.7 feet	
Head Loss in Distribution Header	0.5 feet	
Head Loss in Laterals	0.0 feet	
'Add-on' Friction Losses	0.0 feet	
Head Loss through Distributing Valve	0.0 feet	None Used
Head Loss through Flow Meter	0.0 feet	None Used
Size Pump for:		
TOTAL FLOW RATE	**43.3 gpm**	
	@	
TOTAL DYNAMIC HEAD	**20.8 feet**	

SPD50H/100H - Submersible Effluent Pump

Details

Pump Characteristics

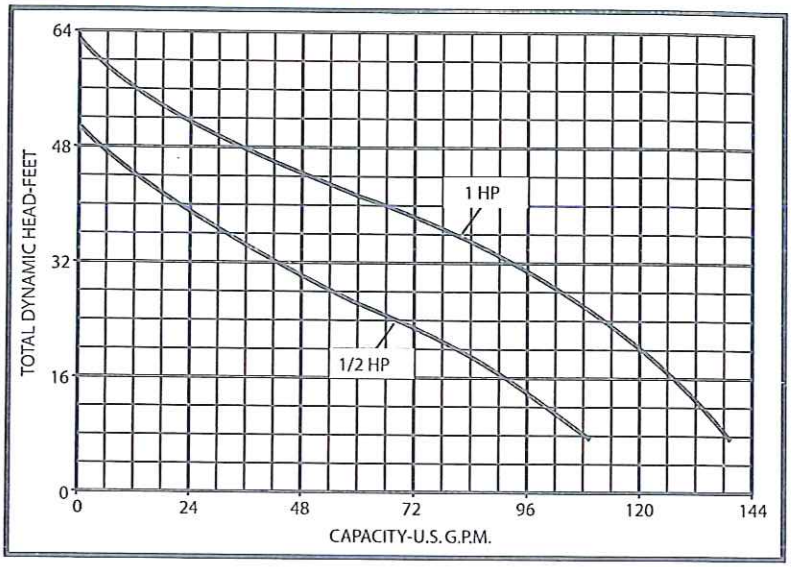
Pump/Motor Unit	Submersible				
Manual Models (50)	MH1	MH2	MH6	MH4	MH5
Automatic Models	AH1	AH2	-	-	-
Horsepower	1/2				
Full Load Amps	14.0	7.0	4.0	1.8	1.5
Motor Type	Capacitor Start		Three-Phase		
R.P.M.	3450				
Phase Ø	1		3		
Voltage	115	230	200	460	575
Manual Models (100)	MH2	MH6	MH3	MH4	M5
Automatic Models	AH2	-	-	-	-
Horsepower	1				
Full Load Amps	9.9	5.5	5.2	2.5	1.5
Motor Type	Cap.	Three-Phase			
R.P.M.	3450				
Phase Ø	1	3			
Voltage	230	200	230	460	575
Hertz	60				
Operation	Intermittent				
Temperature	140°F Max Fluid Temp.				
NEMA Design	B				
Insulation	Class B				
Discharge Size	2" NPT (3" opt.)				
Solids Handling	3/4"				
Unit Weight	73 lbs.				

Power Cord: SPD50H 14/3, SJTW-A, 1o, 115V=10' std. (20' opt.)-14/4, STW-A, 1o, 115V=10' (20' opt.)-16/3, STW-A, 1o, 230V=20' std.-16/4, STW-A, 1o, 230V=20' std. SPD100H 16/3, STW-A, 1o, 230V=20' std.-16/4, STW-A, 1o, 230V=20' std.-18/5, STW-A, 3o, 200V, 230V, 460V or 575V=20' std.

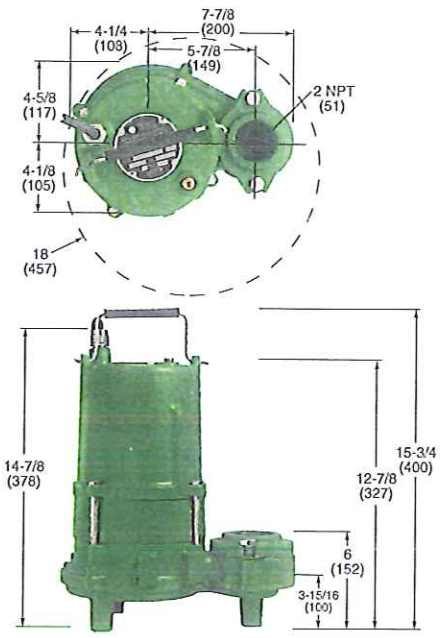
Materials of Construction

Handle	Steel
Lubricating Oil	Dielectric Oil
Motor Housing	Cast Iron
Seal Housing	Cast Iron
Pump Casing	Cast Iron
Shaft	Stainless Steel
Mechanical Shaft Seal	Seal Faces: Carbon/Ceramic Seal Body: Brass Spring: Stainless Steel Bellows: Buna-N
Impeller	Cast Iron
Upper Bearing	Single Row Ball Bearing
Lower Bearing	Single Row Ball Bearing
Base	Cast Iron
Fasteners	Stainless Steel

Performance Data



Dimensional Data



All dimensions in inches. Metric for international use. Component dimensions may vary ± 1/8 inch. Dimensional data not for construction purpose unless certified. Dimensions and weights are approximate. On/Off level adjustable. We reserve the right to make revisions to our product and their specifications without notice.

HYDROMATIC®
Pentair Water

SSPMA Certified PUMP

– Your Authorized Local Distributor –

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740 East 9th Street Ashland, Ohio 44805
Tel: 419-289-3042 Fax: 419-281-4087

www.hydromatic.com

CANADA
269 Trillium Drive Kitchener, Ontario, Canada N2G 4W5
Tel: 519-896-2163 Fax: 519-896-6337

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Item # W-02-6130 2.5M 3/05

Dosing System Design and Specifications
Hysham Rest Area

Transport Pipe

Transport pipe Length (feet)	50.00
Transport pipe Inside Diameter (inches)	2.00
Transport pipe Volume (gallons)	**8.16**

Manifold Pipe

Manifold pipe Length (feet)	63.00
Manifold pipe Inside Diameter (inches)	2.00
Manifold Volume (gallons)	**10.28**

Drainfield Laterals

Length of each Distribution pipe (feet)	50.00
Distribution pipe Inside Diameter	2.00
Number of Laterals (Distribution pipes)	10.00
Distance Between Laterals (feet)	7.00
Trench Width (feet)	3.00
Distribution pipe Volume (gallons)	**81.59**

Dose Volume

Transport pipe + Manifold pipe (gallons)	18.44
Low end Dose Volume = (Distribution pipe Volume x 5) + (Transport pipe + Manifold pipe)	426.41
High end Dose Volume = (Distribution pipe Volume x 10) + (Transport pipe + Manifold pipe)	834.38
Specified Dose Volume (gallons)	**575.00**

Dose Tank

Daily Wastewater Flow (gallons)	2890
25% of daily flow	722.5
Reserve Capacity (25% of daily flow)	722.5
Capacity per foot (gallons) 2500 gallon tank	539
Reserve Capacity Required Height (feet)	1.34
Float Interval (feet)	1.07
Pump Submergence Required (feet)	1.50
Minimum Tank Height Required (feet)	3.91
Design doses per day	5.0

Dose System (see following Pump Selection table and chart)

Pump	SPD 50H
Orifice spacing (feet)	5
Residual head at last orifice (feet)	5
Flow Rate (gpm)	44
Dose Duration (minutes) must be < 15 minutes	13.07

TOTAL HEADLOSS IN A PRESSURE LATERAL

DOWL

NAME: Hysham Rest Area
JOB #: 24.11355
DATE: 25-Aug-15
BY: William Dreyer
FILE #: Drainfield First Lateral(Two Zones)

Orifice opening	=	0.125 in.
Inside Diam. Perf. PVC	=	2.000 in.
Residual Pressure	=	5.000 ft.
Hazen Constant (67350^1.85) =		855903022.7
Constant (C)	=	4.727 ft.
Constant (I.D./12)	=	0.1667 ft.
Constant (c^4.87)	=	0.000162332 ft.
Incremental Orifice Spacing =		5.00 ft.
No. of Laterals	=	10.00 ea.

ORIFICE NO.	ORIFICE PRESSURE (ft) (ft.)	ORIFICE FLOW (gpm)	SEGMENT FLOW (gpm)	SEGMENT H-LOSS (ft.)	SEGMENT LENGTH (ft.)	TOTAL LENGTH (ft)	SUM OF H-LOSS (ft.)	INCREASE IN FLOW (%)
1	5.0000	0.4325	0.432539399	0.0000	2.5	50.00	0.0000	0.00%
2	5.0000	0.4325	0.865079579	0.0001	5	47.50	0.0001	0.00%
3	5.0001	0.4325	1.297625387	0.0003	5	42.50	0.0004	0.00%
4	5.0004	0.4326	1.730183108	0.0005	5	37.50	0.0009	0.00%
5	5.0009	0.4326	2.162761115	0.0007	5	32.50	0.0016	0.00%
6	5.0016	0.4326	2.595369775	0.0010	5	27.50	0.0026	0.01%
7	5.0026	0.4327	3.028021382	0.0013	5	22.50	0.0039	0.01%
8	5.0039	0.4327	3.460730104	0.0017	5	17.50	0.0056	0.02%
9	5.0056	0.4328	3.893511942	0.0021	5	12.50	0.0077	0.02%
10	5.0077	0.4329	4.326384686	0.0026	5	7.50	0.0103	0.03%
11	5.0103	0.4330	4.759367888	0.0015	2.5	2.50	0.0118	0.04%

Total flow per lateral = 4.7594 gpm

Parameters Used
Orifice Equation Q = 12.38(d^2)(H^0.5)
leadloss Equation H(segment) = 0.000995(L/d^4.87)Q^1.85

Water Demand Estimate Using Fixture Values

(Based on AWWA M22 Manual, Second Edition)

Facility Name: Hysham Rest Area

Building address or number:

Residential or Non-Residential: Non-Residential

Minimum Pressure (psi): 35

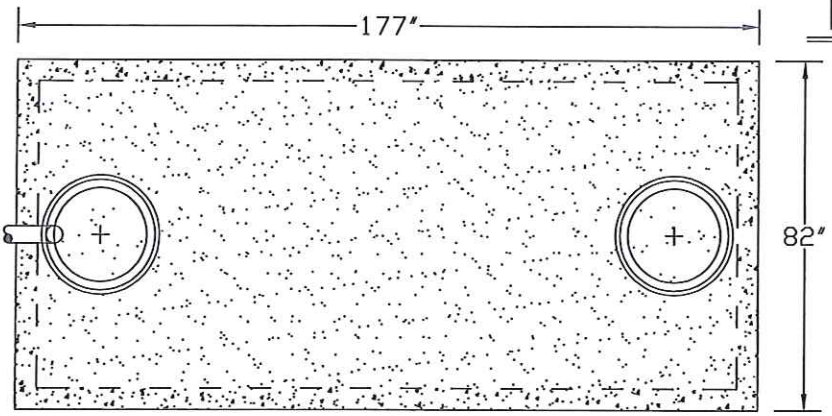
Fixture or Appliance	Fixture Value (at 60 psi)	Number of Fixtures	Subtotal Fixture Value
Toilet (tank)	4	14	56
Toilet (flush valve)	35	0	0
Urinal (wall or stall)	16	6	96
Urinal (flush valve)	35		0
Bidet	2		0
Shower (single head)	2.5	0	0
Sink (lavatory)	1.5	14	21
Kitchen Sink	2.2	0	0
Utility Sink	4	2	8
Dishwasher	2	0	0
Bathtub	8	0	0
Clothes Washer	6	0	0
Hose connections (with 50 ft of hose)			
1/2 in.	5	4	20
5/8 in.	9		0
3/4 in.	12		0
Miscellaneous			
Bedpan washers	10		0
Drinking fountains	2		0
Dental units	2		0
Combined Fixture Value			201
Demand (gpm)			61
Pressure Adjustment Factor			0.74
Total Adjusted demand (gpm)			45.1

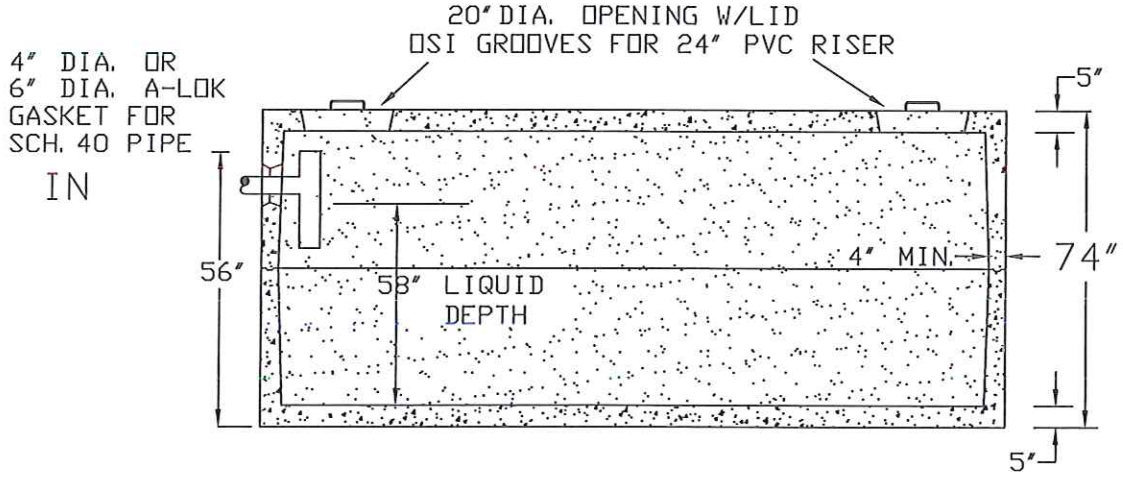
ANDERSON
PRECAST & SUPPLY INC.
80 EAST VALLEY CENTER, BOZEMAN MT 59718
(406) 586-5087 FAX (406) 586-6015

CONCRETE IS 5000 PSI @ 28 DAYS
CEMENT IS TYPE V, WITH MAX C3A OF 8%, PER MT DEQ-4
NORMALLY SET IN TWO PIECES
EACH SEGMENT OF TANK IS POURED MONOTHICALLY
WEIGHT OF TANK IS APPROXIMATELY 11,000 LBS.
REINFORCING = #2 REMESH GRADE 80
MAXIMUM EARTH COVER IS 6 FEET
THIS TANK MUST BE PLACED ON COMPACTED 3/4" ROAD-BASE OR SIMULAR MATERIAL. MINIMUM RELATIVE COMPACTION IS 95%. DO NOT USE FLOWABLE BACKFILL MATERIALS SUCH AS 3/4" WASHED GRAVELS.
TANK MUST BE BACKFILLED TO TOP BEFORE WATERTESTING.
TANK JOINT SEALED w/1" dia. CONSEAL
ALL HANDLES ARE 1/4" SMOOTH STEEL

THIS TANK MAY BE USED AS A DOSE TANK OR RECIRCULATION TANK - NOT A SEPTIC TANK

TOP VIEW





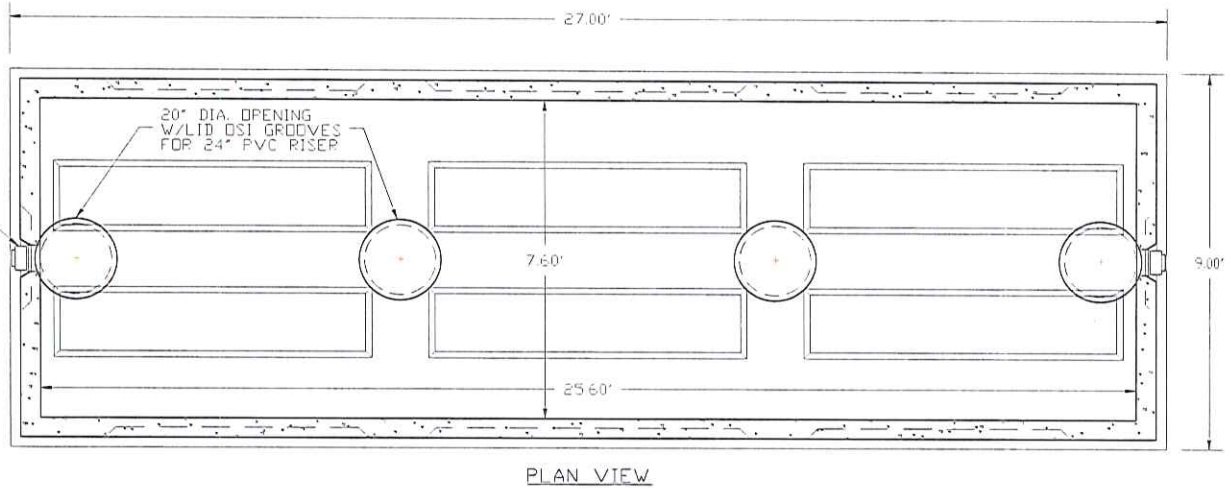
SIDE VIEW

NTS
08/13/09 Rev.

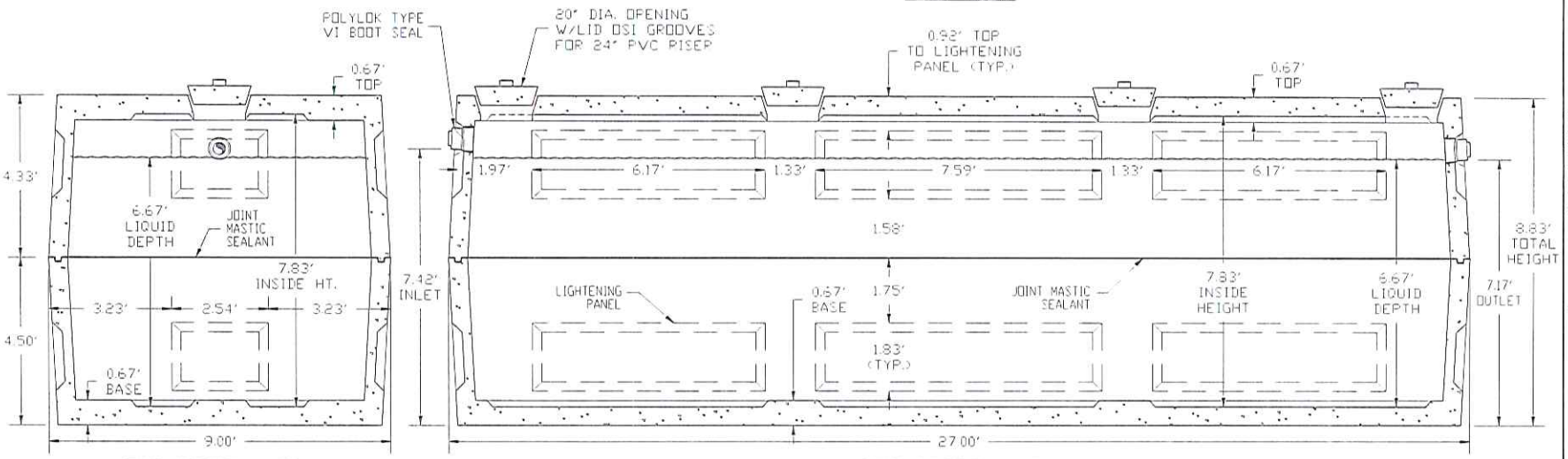
PROJECT X X	ENGINEER X X
DRAWING 2,500 GALLON SINGLE COMPARTMENT DOSE TANK	CONTRACTOR X X

TANK COMPONENT WEIGHTS (APPROXIMATE)

TOP SECTION:	43,000 LBS.
BOTTOM SECTION	43,500 LBS.



PLAN VIEW



END SECTION VIEW

SIDE SECTION VIEW

10,000 GALLON TANK - SINGLE COMPARTMENT

125 GAL. PER VERT. FT

ANDERSON PRECAST & SUPPLY

Montana's Precast Solution

Engineer's Stamp

Engineer

Contractor

Project Name and Location

PROJECT NAME

PROJECT LOCATION

Issued / Revised

--

Drawing Title

10,000 GALLON SEPTIC/DOSE TANK NON-TRAFFIC

PROJECT NOTES:

GENERAL CONSTRUCTION NOTES
CONCRETE: 5,000 PSI @ 28 DAYS.
CEMENT IS TYPE V, WITH MAX C3A OF 5% PER MT DEQ-4. SET IN PLACE W/CONCAL CS-162 OR CS-190.
PHOENIX 3868 WATERPROOFING USED BEHIND BRICKMOLD + PER ENGINEER.
MAXIMUM EARTH COVER IS 4'-0" FEET
THIS TANK MUST BE PLACED ON COMPACTED 3/4" ROAD-BASE OR SIMILAR MATERIAL. MINIMUM RELATIVE COMPACTION IS 95%. DO NOT USE FLOWABLE BACKFILL MATERIALS SUCH AS 3/4" WASHED GRAVELS. TANK MUST BE BACKFILLED TO TOP BEFORE WATERTESTING PER MT DEQ-4

Sheet No.

SINGLE

Drawn By MAP N.T.S.

Commercial Biotube® Effluent Filters

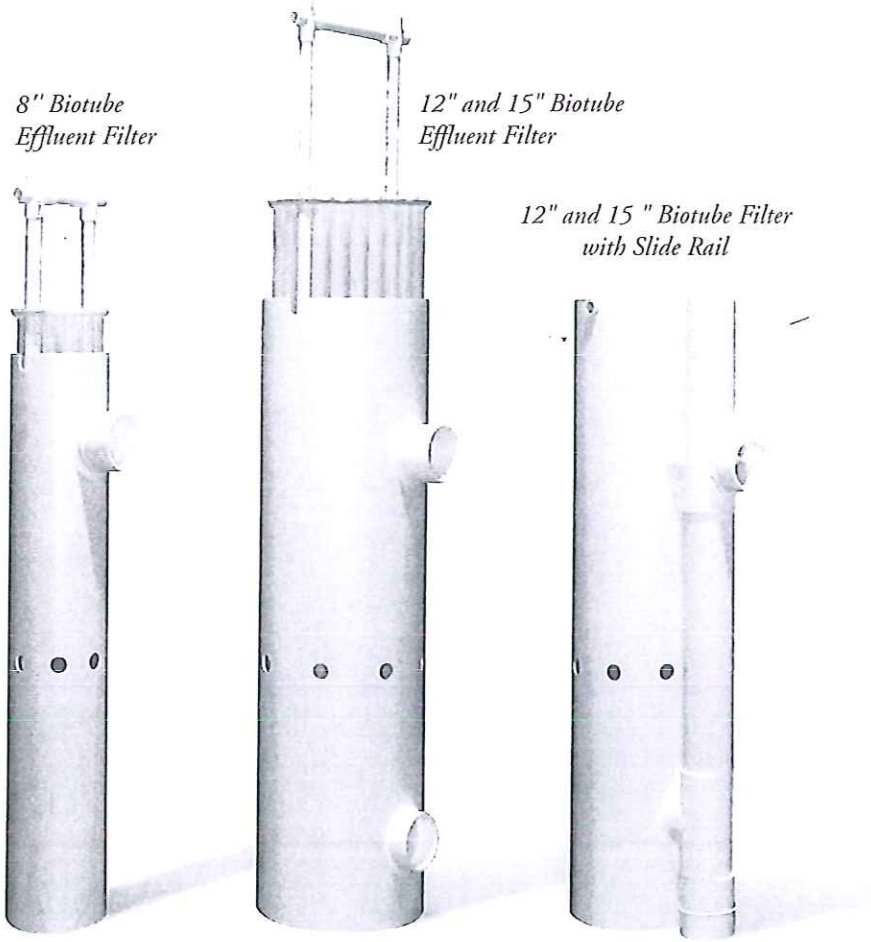
Applications

Our patented* Biotube Effluent Filters in 8", 12", and 15" diameter sizes are ideal for large residential, commercial, and community applications. They prevent large solids from leaving the tank, dramatically improving wastewater quality and extending the life of downstream treatment systems.

8" Biotube Effluent Filter

12" and 15" Biotube Effluent Filter

12" and 15 " Biotube Filter with Slide Rail



Orenco's commercially-sized effluent filters are the only effluent filters on the market capable of handling large wastewater flows. Standard models have up to 52 ft² of filter area, to resist clogging while providing maximum long-term protection. Large filter area increases the time between cleanings.

*Covered by patent numbers 5,492,635 and 4,439,323

To Order

Call your nearest Orenco Systems®, Inc. distributor. For nearest distributor, call Orenco at 1-800-348-9843 or go to www.orenco.com and click on "Distributor Locator."

APS-FTL-1
Rev. 3.0 © 10/02
Orenco Systems®, Inc.

Standard Features & Benefits

- The only large, commercial-size effluent filter available
- Removes about two-thirds of suspended solids, on average, extending drain-field life
- Flow modulating discharge orifices to limit flow rate leaving tank, mitigating surges and increasing retention time
- Extendible cartridge handle, simplifies filter removal
- Easy to clean by simply hosing off filter cartridge
- Corrosion-proof construction, to ensure long life

Optional Features & Benefits

- Alarm available, to signal the need for cleaning
- Slide Rail System available, required when there is only one tank access to the effluent filter compartment
- Multiple filters may be used to accommodate larger flows

Biotube Filtering Process

Effluent from the relatively clear zone of the septic tank, between the scum and sludge layers, horizontally enters the Biotube Effluent Filter through inlet holes in the housing. Effluent then enters the annular space between the housing and the Biotubes, utilizing the Biotubes' entire surface for filtering. Particles larger than the Biotube's mesh are prevented from leaving the tank.

Orenco Systems®
Incorporated

Changing the Way the World Does Wastewater®

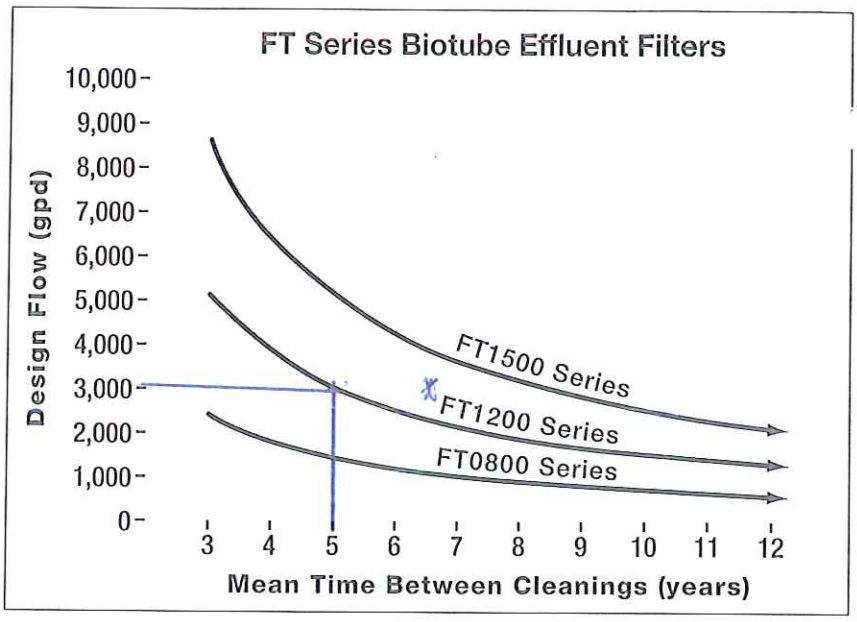
www.orenco.com
www.vericomm.net

Select Biotube Filter to Match Design Flow and Desired Cleaning Interval

This chart shows the relationship between Biotube Filter size (diameter), design flow, and mean time between cleanings. The larger the filter and the smaller the flow, the longer you can go between cleanings. For example, a typical 3-year cleaning frequency would require an 8" filter for up to 2,500 gpd, a 12" filter for up to 5,000 gpd, and a 15" filter for up to 8,500 gpd.

Modulating orifice calculations are also required for applications with surge flows.

See NDA-FT-FT-1 for more information.



Model Codes for Ordering

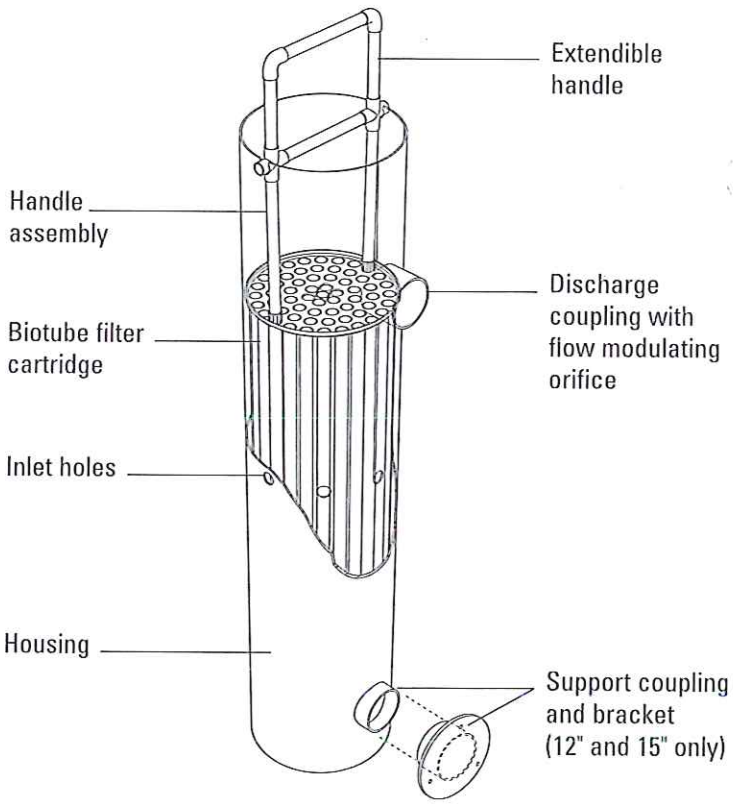
8", 12" and 15" Biotube

FT ☐ 12 60 - 36 ☐

- Add codes for standard options:
  A = float bracket
  R = slide rail (12" and 15" only)
- Cartridge height, 36" standard
- Housing height (inches)
  54 = Tank MLL*, 46" - 63"
  60 = Tank MLL*, 64" - 84"
  66 = Tank MLL*, 85" - 112"
- Filter diameter (inches):
  08 = 8"
  12 = 12"
  15 = 15"
- P = 1/16" filtration
  Blank = 1/8" filtration
- Biotube effluent filter series

* MLL = Minimum Liquid Level = Invert of Outlet to Tank Floor

8", 12", and 15" Biotube Effluent Filter

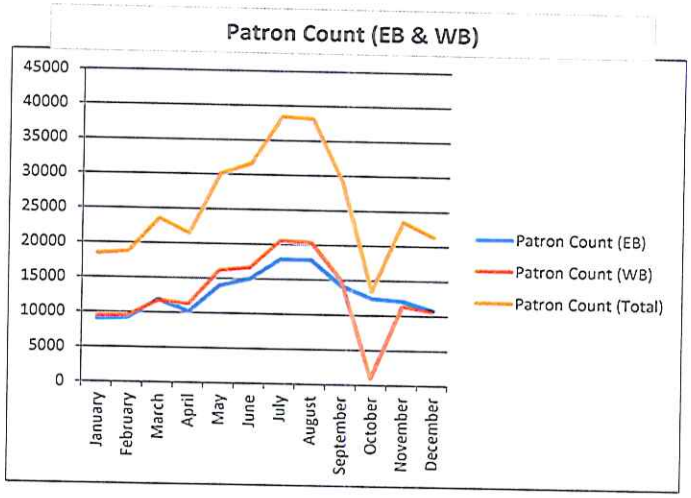


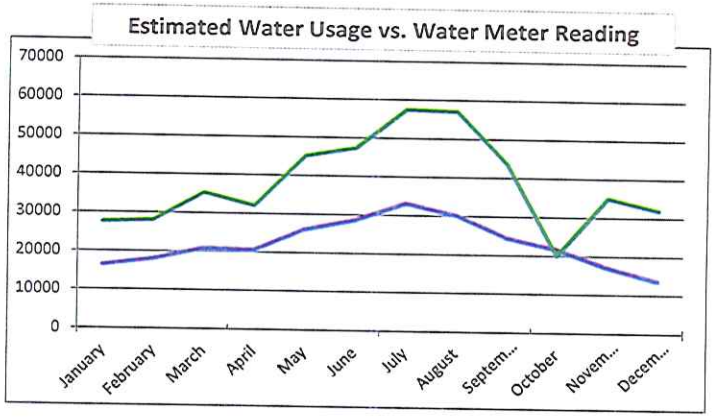
Distributed By:

Hysham Rest Area [illegible]on and Water Usage

Rest Area:	Hysham
Month:	Year Total
Year:	2013

Date	Combined Door Count	Patron Count (EB)	Patron Count (WB)	Patron Count (Total)	Combined Water Meter Reading (gpd)	Estimated Water Usage (Patron Count x 1.5 gal/Patron Count)
January	36642	9000	9321	18321	16806	27482
February	37362	9208	9473	18681	17960	28022
March	46978	11852	11637	23489	20860	35234
April	42700	10166	11184	21350	20430	32025
May	60068	13924	16110	30034	25670	45051
June	63074	14987	16550	31537	28580	47306
July	76671	17853	20483	38336	33870	57503
August	76110	17806	20250	38055	30100	57083
September	58077	14191	14848	29039	24530	43558
October	26648	12422	902	13324	20810	19986
November	46758	12109	11270	23379	17040	35069
December	42545	10766	10507	21273	18620	31909
	Annual Average	425	420			
	Summer Average	550	623			
	Peak	822	843			





INFILTRATOR®
water technologies

Quick4™ CHAMBER SYSTEMS

The Quick4® High Capacity Chamber

Quick4® Series

The Quick4® High Capacity Chamber fits in a 36" wide trench and is ideal for curved or straight systems. It features the patent-pending Contour Swivel Connection™ which permits turns up to 15°, right or left. The MultiPort™ endcap allows multiple piping options and eliminates pipe fittings. The chamber's four-foot length provides optimal installation flexibility.

Chamber Benefits:

- Advanced contouring connections swivel up to 15°, right or left
- Latching mechanism allows for quick installation
- Compact nesting provides more trench length in an equivalent stack height
- Four-foot chambers are easy to handle and install
- The Quick4 High Capacity Chamber supports wheel loads of 16,000 lbs/axle with only 12" of cover
- Certified by the International Association of Plumbing and Mechanical Officials (IAPMO)

MultiPort Endcap Benefits:

- Tear-out seals on inlet ports provide a tight fit to the pipe
- Eight molded-in inlets/outlets allow for maximum piping flexibility
- Fits on either end of the Quick4 High Capacity Chamber

APPROVED in _____

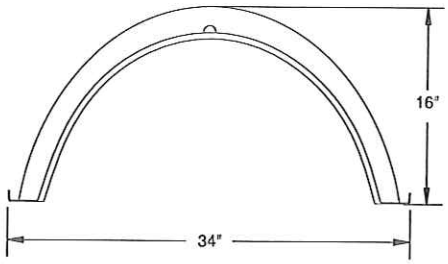
Quick4® Series

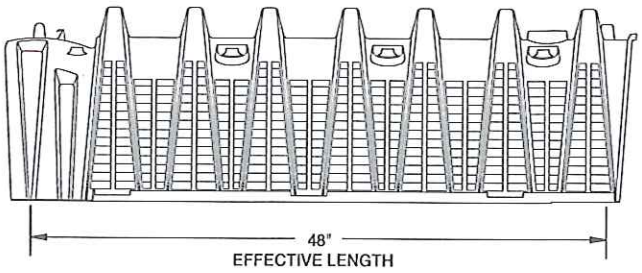
Because installations are faster with Quick4 chambers, you save on heavy equipment operation and labor.

Quick4® Series

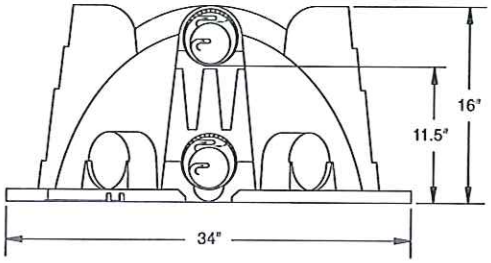
Quick4 CHAMBER SYSTEMS

Quick4 High Capacity Chamber

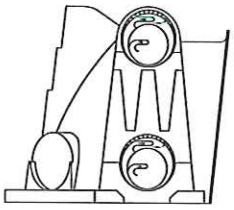




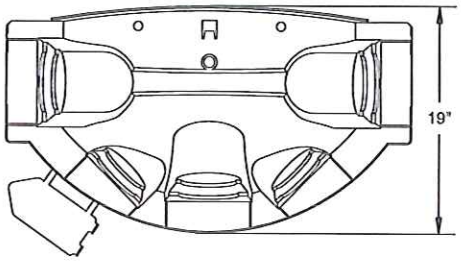
MultiPort EndCap



FRONT VIEW

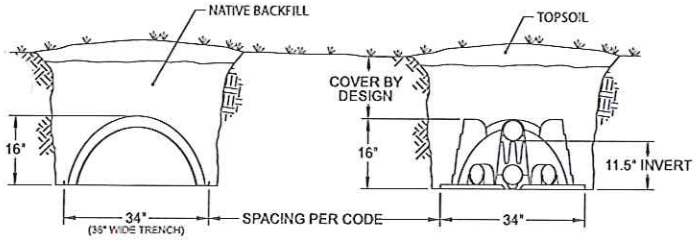


SIDE VIEW



TOP VIEW

Typical Trench View



Quick4® High Capacity Chamber Specifications	
Size	34"W x 53"L x 16"H (864 mm x 1346 mm x 406 mm)
Effective Length	48" (1219 mm)
Louver Height	12.2" (310 mm)
Storage Capacity	62 gal (235 L)
Invert Height	11.5" (292 mm)

INFILTRATOR WATER TECHNOLOGIES STANDARD LIMITED WARRANTY

(a) The structural integrity of each chamber, endcap and other accessory manufactured by Infiltrator ("Units"), when installed and operated in a leachfield of an onsite septic system in accordance with Infiltrator's instructions, is warranted to the original purchaser ("Holder") against defective materials and workmanship for one year from the date that the septic permit is issued for the septic system containing the Units; provided, however, that if a septic permit is not required by applicable law, the warranty period will begin upon the date that installation of the septic system commences. To exercise its warranty rights, Holder must notify Infiltrator in writing at its Corporate Headquarters in Old Saybrook, Connecticut within fifteen (15) days of the alleged defect. Infiltrator will supply replacement Units for Units determined by Infiltrator to be covered by this Limited Warranty. Infiltrator's liability specifically excludes the cost of removal and/or installation of the Units.

(b) THE LIMITED WARRANTY AND REMEDIES IN SUBPARAGRAPH (a) ARE EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE UNITS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE

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Butyl Rubber Sealant

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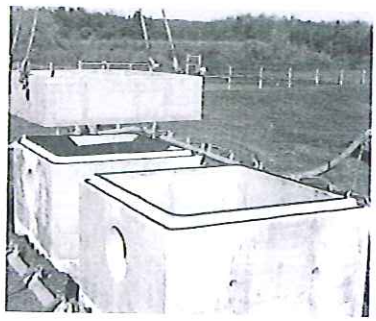

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- Sealed joints will not shrink, harden or oxidize upon aging.
- Controlled flow resistance for application ease.
- No priming normally necessary. When confronted with difficult installation conditions, such as wet concrete or temperatures below 40°F (4°C), priming the concrete will improve the bonding action. Consult Concrete Sealants for the proper primer to meet your application.

Hydrostatic Strength

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Specifications

ConSeal CS-202 meets or exceeds all of the requirements of Federal Specification SS-S-210 (210-A), AASHTO M-198B, and ASTM C-990-91.

Physical Properties

Description

	Spec	Required	CS-202
Color			Black
Specific Gravity, 77°F	ASTM D71	1.15-1.50	1.20
Ductility, 77°F	ASTM D113	5.0 min.	12
Penetration, cone 77°F (25°C), 150 gm, 5 sec.	ASTM D217	50-100 mm	60-65 mm
Penetration, cone 32°F (0°C), 150 gm, 5 sec.	ASTM D217	40 mm min.	50-55 mm
Flash Point, C.O.C., °F	ASTM D92	350°F min.	425°F
Fire Point, C.O.C., °F	ASTM D92	375°F min.	450°F

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Butyl Rubber Sealant

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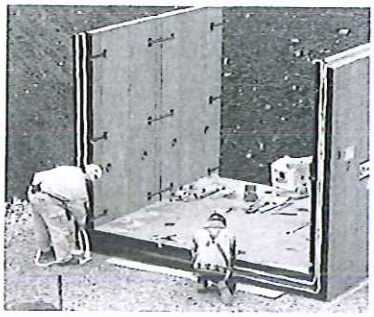

Butyl Rubber Sealant for All Precast Concrete Structures - Meets ASTM C-990

Chemical Composition

Description

	Spec	Required	CS-202
Hydrocarbon plastic content % by weight	ASTM D297	50% min.	52%
Inert mineral filler % by weight	AASHTO T11	30% min.	35%
Volatile Mater % by weight	ASTM D6	2% max.	1.2%
Non-extractable, carbon-based material			11.8%
Recycled Content, % by weight			
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Post Industrial:			15.57%

Immersion Testing

30-Day Immersion Testing: No visible deterioration when tested in 5% Caustic Potash, 5% Hydrochloric Acid, 5% Sulfuric Acid, and 5% saturated Hydrogen Sulfide.

One Year Immersion Testing: No visible deterioration when tested in 5% Formaldehyde, 5% Formic Acid, 5% Sulfuric Acid, 5% Hydrochloric Acid, 5% Sodium Hydroxide, 5% Hydrogen Sulfide, and 5% Potassium Hydroxide.

Limited Warranty

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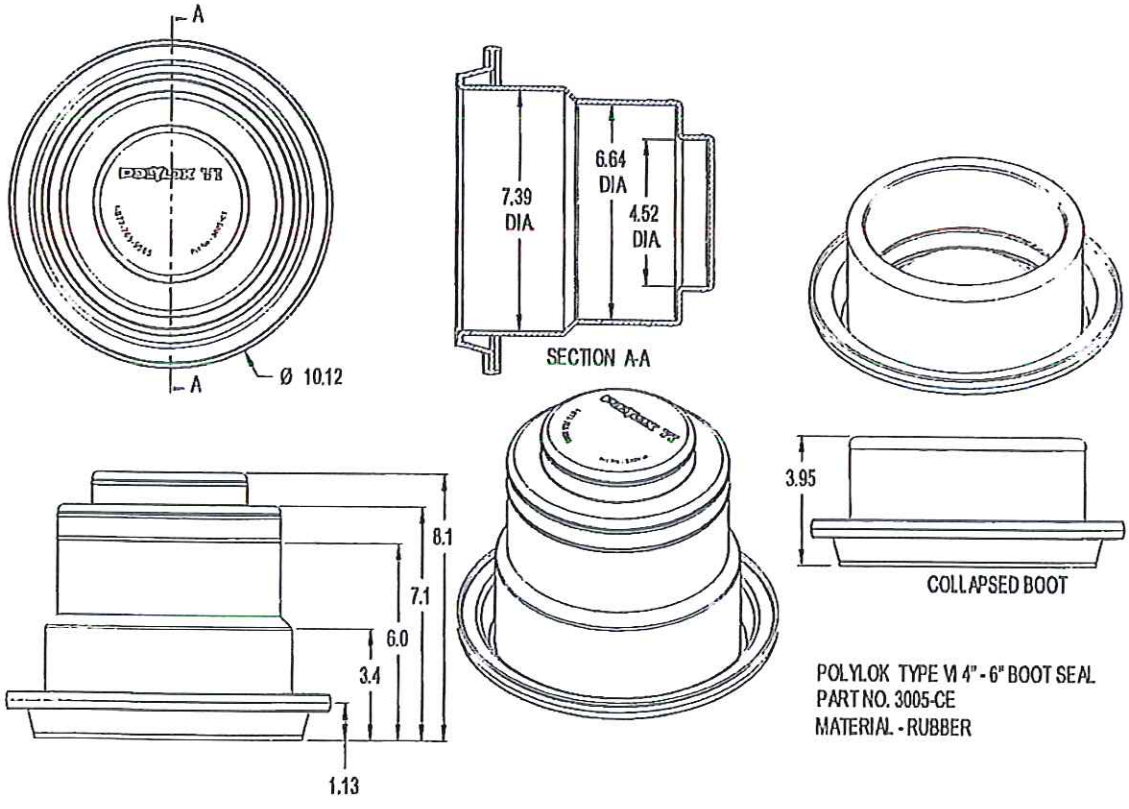
The flexible pipe connector shall be cast-in and be the primary entry or exit connector to assure watertight integrity of the pipe connection in the structure. The flexible pipe connector material shall be manufactured of rubber base material EPDM or equal.

The flexible pipe connector will be secured with an adjustable stainless steel series 300 non-magnetic stainless steel. The clamp will be installed on the outer portion of the seal and torque the adjustment screw securely to insure the flexible pipe connector is firmly compressed onto the pipe to insure a watertight connection.

The installation of the flexible pipe connector into the structure and external pipe into the connector shall be in strict conformance with the recommendations of the manufacturer. The seal shall be cast into a concrete structure built to ASTM 1227 guidelines and use the mandrel / seal combination supplied by the manufacturer.



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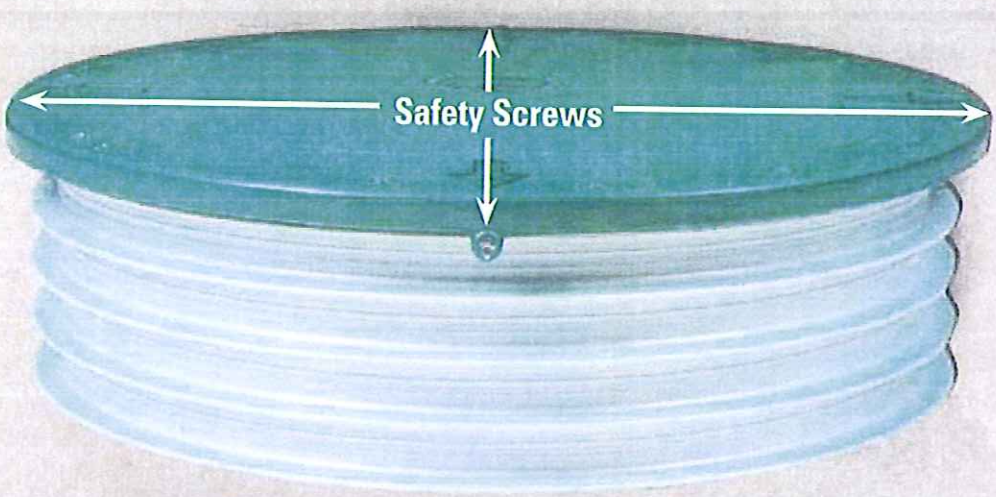

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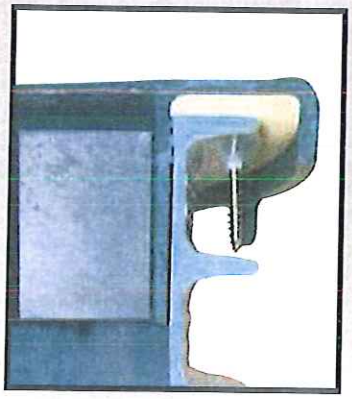
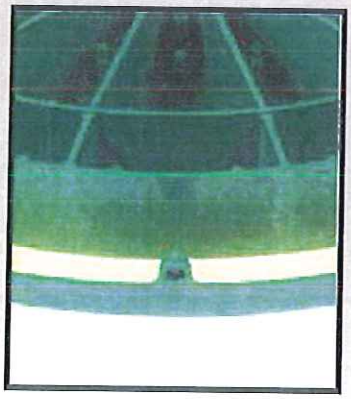


Secured by 6 Vertical and 4 Horizontal Safety Screws. Screws Included.



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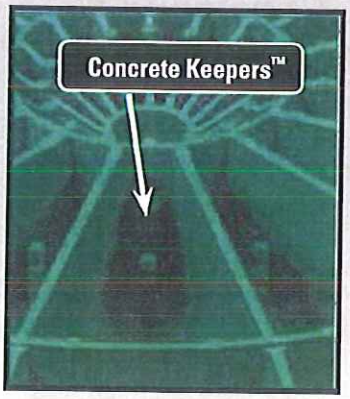

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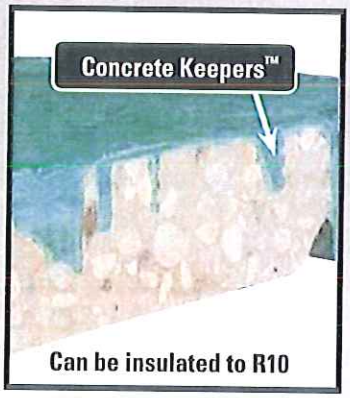

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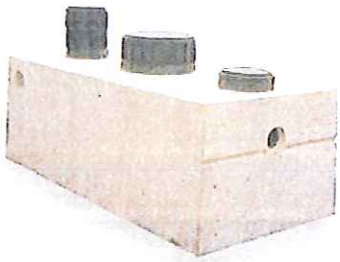

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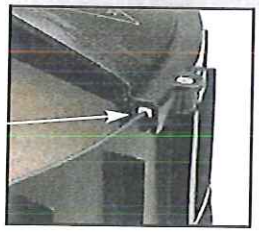

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APPENDIX G:

SOILS &

GEOTECHNICAL REPOR

DOWL

Hysham Rest Area
IM 94-2(36)65
UPN 8200000

PRELIMINARY GEOTECHNICAL AND MATERIALS REPORT

MDT Activity 106

Prepared for:

MONTANA DEPARTMENT OF TRANSPORTATION
2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Prepared by:

DOWL HKM
2090 Stadium Drive
Bozeman, MT 59715

September 17, 2014

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1.0 INTRODUCTION

This Preliminary Geotechnical report as developed in support of Phase I of the Hysham Rest Area project in order to evaluate and design new water/wastewater systems and to obtain permitting of the systems through the Montana Department of Environmental Quality (MDEQ) for the future full reconstruction of the rest area. Future improvements are anticipated to include new water and wastewater systems, new building facilities, and updated parking facilities.

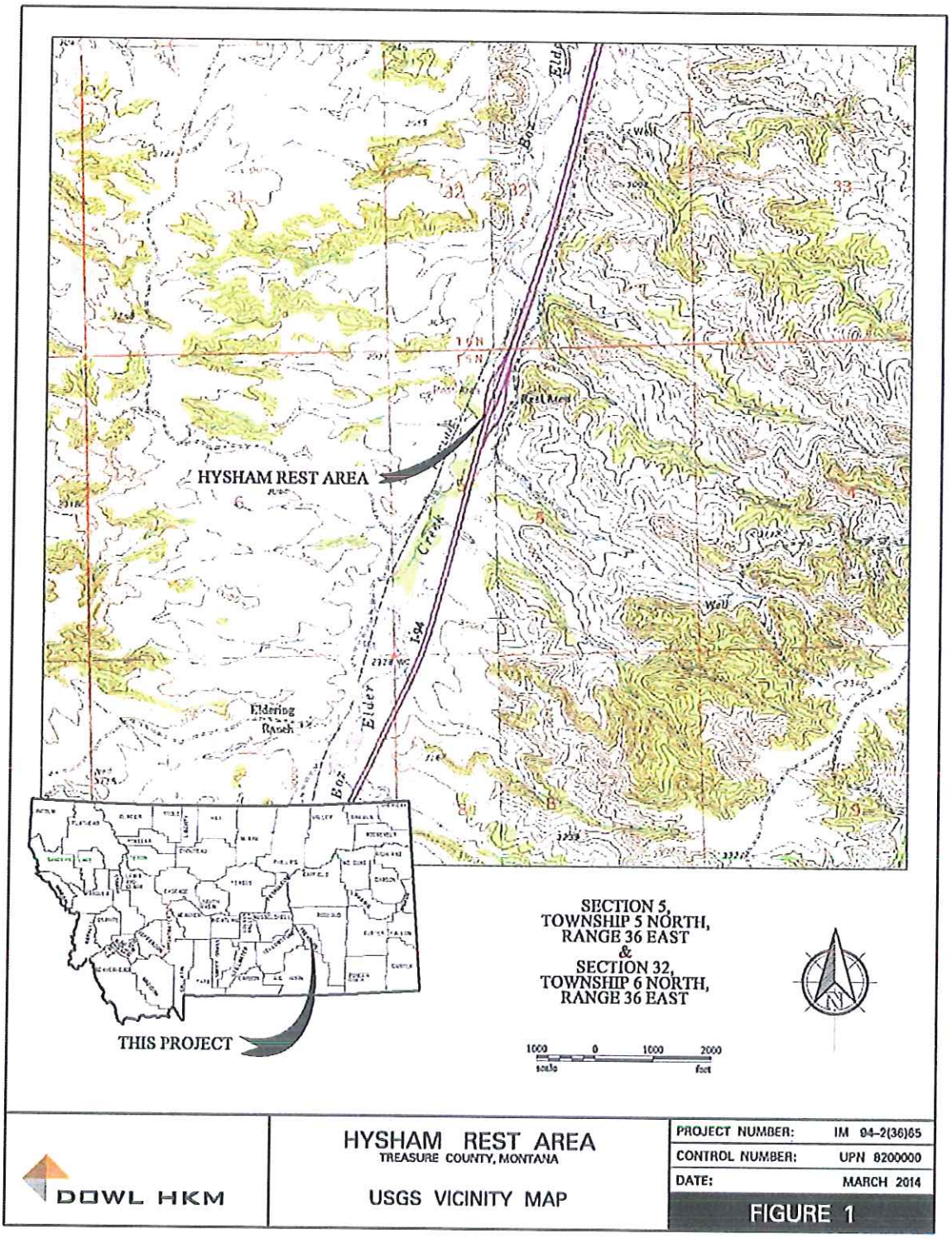
This report is intended to satisfy Montana Department of Transportation (MDT) Consultant Activity 106. The results of the evaluation are presented in this Preliminary Geotechnical and Materials Report. The purpose of this report is to present preliminary information regarding soil and groundwater conditions and to provide preliminary recommendations for design of the new wastewater disposal drainfields for the Hysham Rest Area project. The preliminary recommendations include design and construction of the proposed wastewater disposal systems.

1.1 Project Background

The Hysham Rest Area consists of two separate rest area sites located on each side of Interstate 94 (I-94), approximately 5 miles south/southwest of Hysham in Treasure County, Montana. The rest area serving the eastbound (EB) direction of travel and the rest area serving the westbound (WB) direction of travel are both located at approximate reference post (RP) 65. Interstate 94. A site vicinity map showing the project location is presented in Figure 1.

In an effort to develop rest area guidelines that more accurately reflect conditions specific to Montana, MDT initiated a research project with WTI that culminated in the completion of the *Rest Area Use: Data Acquisition and Usage Estimation Report* (2011). As part of this study, water flow/usage data and door counts were collected at nearly all MDT-maintained rest areas on Montana highways, with recommendations for estimating water usage and facility demand usage factors based on a cross-section of representative rest areas. The WTI method is used in this report to determine rest area usage needs at the Hysham Rest Area

Figure 1 Vicinity Map



2.0 SITE INVESTIGATION

The site investigation conducted for this project site included the review of existing information and field explorations. The field exploration consisted of a reconnaissance of the project site, pavement borings and subsurface excavation of test pits at potential drainfield sites. The visual reconnaissance included observation of surface conditions such as apparent geologic hazards, drainage conditions, and performance of existing water and wastewater systems.

2.1 Document Review

The geotechnical document review included a cursory review of pertinent documents provided for the project. The documents reviewed included:

- *Geologic Map of the Hysham 30' x 60' Quadrangle,*
- *Natural Resources Conservation Service (NRCS) Web Soils Survey, Treasure County Area*
- *Well Logs for Existing Wells, Montana's Groundwater Information Center (GWIC)*
- *Door Counts & Water Usage,* 2013, *(Montana Department of Transportation)*

2.2 Drainage Inspection

A visual inspection of the current storm water facilities was performed on March 2014 and June, 2014. The visual inspection evaluated storm water influences in regard to plants and soils near current and potential water /wastewater facilities. The site had no indications of standing water in close proximity to the public well and wastewater drainfield. The rest area has drainages that runs along the northwest and southeast side of the rest area locations. It is recommended that these areas will have to be addressed further in the storm water design and grading plan for Phase II of this project.

2.3 Subsurface Exploration

The field exploration consisted of excavating six test pits (TP1 through TP-6) and three percolation tests. The six (6) test pits were excavated utilizing a Caterpillar rubber tire backhoe. The test pits were excavated at accessible locations to depths ranging from 8 to 10 feet. The excavation termination was based on estimation of proposed drainfield trench depth and possible indicators/or lack of indicators of limiting layers such as groundwater, dense clay, or bedrock. The test pits were excavated at locations which would provide an optimal wastewater disposal area for the sites (see Table 1).

Table 1 Exploration Plan Summary Hysham Rest Area			
Test Pit	**Station**	**Depth**	**Intent of Exploration**
TP-1	See Site Plan	8'	Verify existing soil condition
TP-2	See Site Plan	9'	Verify existing soil condition
TP-3	See Site Plan	10'	Verify existing soil condition
TP-4	See Site Plan	10'	Proposed Drainfield Replacement Area
TP-5	See Site Plan	8.5'	Proposed Drainfield Replacement Area
TP-6	See Site Plan	9.0'	Proposed Drainfield Replacement Area

The test pit locations were selected by DOWL HKM's engineers based on elevations and prominent site features. A DOWL HKM engineer directed excavation operations, and recorded lithology and other soil conditions. At select intervals, soil samples were collected, by removing soil from selected soil horizon. Test pit locations are shown on the Preliminary Site Plan in Appendix A.

During the excavation of the test pits, specific attention was placed on limiting layer indicators such as mottling, root depth, residual calcium carbonate, dense clays, moisture content and bedrock. The test pits were backfilled and the surface was restored to its previous state.

3.0 LABORATORY TESTING

The lithology and soil conditions are presented in the test pit logs. The stratification contacts shown on the test pit logs represent approximate boundaries between soil types. Logs of the Test Pits are presented in Appendix B.

Soil samples collected during the field investigation were returned to DOWL HKM's materials laboratory. Representative soil samples were selected for laboratory testing after careful visual examination and consideration of the design criteria. Soil samples were classified in accordance with AASHTO and the Unified Soil Classification System (USCS).

The following tests were performed as part of this project:

Table 2 Laboratory Testing Hysham Rest Area	
Test	**Purpose of Test**
Atterberg Limits	To determine soil characteristics for classification and determine behavior conditions of silts and clays corresponding to varying moisture content.
Particle-Size Distribution	To determine the grain sizes of the soils for classification and identification of physical characteristics.

Laboratory test results are presented on the test pit logs which are located in Appendix B and on individual laboratory test reports in Appendix G.

DOWL HKM acknowledges that laboratory soil classes are not provided for each soil profile or subgrade. The soils were visually classified in the field in accordance with ASTM D 2488 (Visual- Manual Procedure). The field exploration and testing program was developed and supervised by a DOWL HKM professional engineer. Decisions regarding sampling and specific tests performed on individual samples were based on experience, requirements of the project, project site design features, geologic variability, field conditions encountered while excavation and other factors. The tests completed on the samples selected are considered representative of the conditions encountered in the field.

Table 3
Soil Classification

HYSHAM REST AREA
PHASE 1

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

GEOTECHNICAL INVESTIGATION

DOWL HKM

LAB NUMBER	LOCATION	DEPTH RANGE	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND NO. 200(0.075 mm) TO NO. 4(4.76 mm)	GRAVEL NO. 4(4.76 mm) TO 3 IN.(76.2 mm)	COBBLES 3 IN.(76.2 mm) TO 5 IN.(127 mm)	OVERSIZE LARGER THAN 5 IN.(127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	MAXIMUM DRY UNIT WEIGHT(D698)-pcf	OPTIMUM MOISTURE CONTENT - %	OVERSIZE SPEC. GRAV.(D4UC)	ABSORPTION	MINUS #4 SPECIFIC GRAVITY	LA Abrasion-Grading A, % Loss	CALIFORNIA BEARING RATIO	NATURAL MOISTURE - %	Resistivity (Ohm-Cm) Natural Moisture	Resistivity (Ohm-Cm) Saturated	pH	WATER SOLUBLE SO4 - %
29633	TP-5	1.5-2.0'	SM		30.3	69.1	0.6			30	5								7.7				

4.0 SITE RECONNAISSANCE

A geotechnical reconnaissance of the site was performed by Jennifer Pinkerton, a geotechnical engineer with DOWL HKM, on June 26, 2014. The following sections present the findings of the document review and notable site conditions observed within the project site area.

4.1 Geologic Setting

The site is located on Cretaceous Age deposits. The area is generally mapped as sandstone and shales as depicted on the geologic map in appendix D. The alluvium in this area generally consists of:

1. **Kl Lance Formation (Upper Cretaceous)**
   Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

2. **Kfh Fox Hills Formation (Upper Cretaceous)**
   Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

3. **Kb Bearpaw Shale (Upper Cretaceous)**
   Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500.

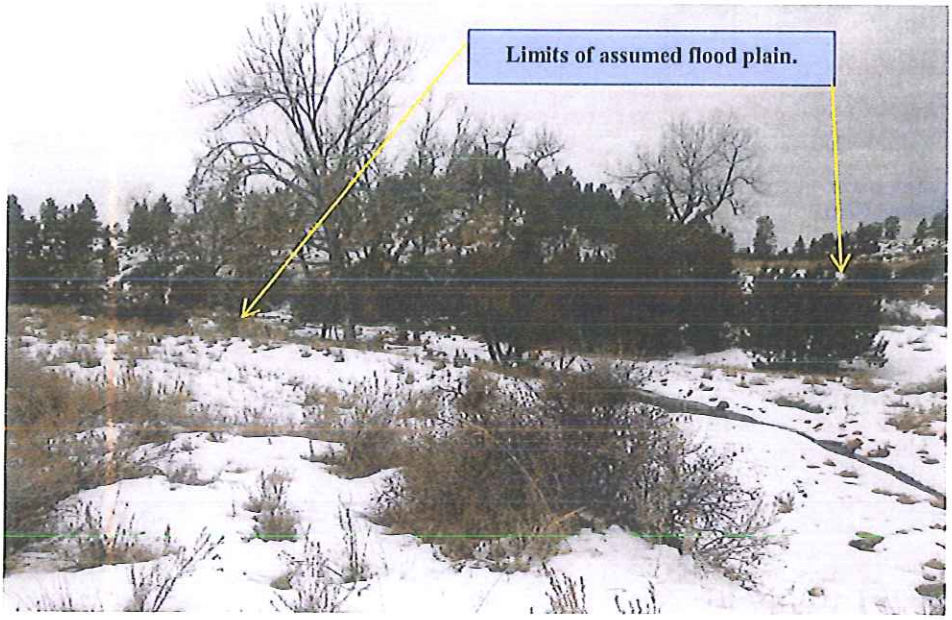
The prominent geologic features at the sites are a drainage area located southeast portion of the eastbound rest area, a large sandstone out cropping located due east of the eastbound rest area and Box Elder Creek located west of the westbound rest area. The sandstone outcropping and Box Elder Creek contributed to the sand and gravel deposits throughout the sites. No other prominent geologic features were observed in the immediate vicinity of the project site corridor. Based on visual examination, the surficial soils consist of silt, clay, sand, and gravel associated with the formations within the rest area sites.

4.2 Topography/Floodplain

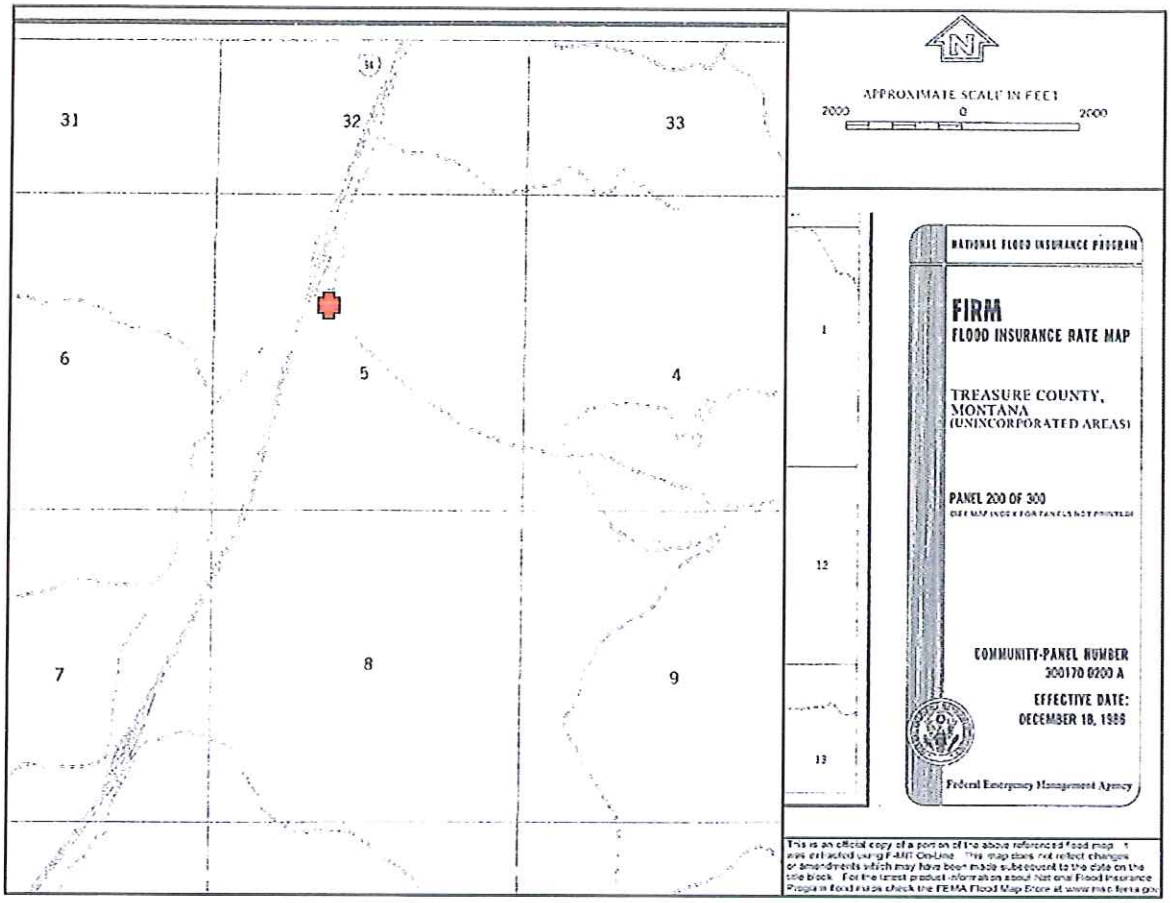
The proposed wastewater system sites are located on gently sloping Cretaceous Age deposits. The wastewater system will be located in an area with approximately 2% to 4% slope (see Site Plan).

Flooding risk from Box Elder Creek was assessed from published FEMA maps and visual verifications of channel characteristics, vegetation growth and bank elevation. As seen in Figures 2, the project site is located outside of the FEMA-designated 100-year flood plain. The proposed wastewater system site is located approximately 520 feet southwest of the potential floodplain boundary of Box Elder Creek. The proposed wastewater system is located in areas above any potential flooding inundation.

Photo 1. View of Box Elder Creek bordering westbound rest area, looking southwest.



The proposed drainfield areas are located such that stormwater and spring melt runoff should not pose any flooding risk to the drainfield. As a precaution, a Phase II drainage plan should be designed to divert any stormwater and spring melt runoff away from the proposed drainfield.



4.3 Site Condition

The majority of the proposed wastewater site alignment occurs over Upper Cretaceous deposits of sandstone, sandy shales and silty shales. Based on the NRCS soil survey, the majority of subgrade soils beneath the project site consist of soils classifying as McRae and Havre Loam (1 to 4 percent slope), McRae and Bainville Loam (8-20 percent slope) and McRae and Havre Loam (4 to 8 percent slope).

The topography generally increases in elevation from the north to the south end of the project. The project site area is surrounded by pasture and native grassland.

An area of the investigation focus is located in the northeastern portion of the project site where the proposed drainfield is located. In this area, soils were found to range from lean clays with sand/gravels (sandy silt loam). These types of soils are fine enough to filter and treat wastewater but not too fine to constrict or limit permeability. Percolation rates in this area ranged from 6 minutes per inch to 15 minutes per inch. Based on the site's subsurface conditions, the new wastewater system will be more than capable of handling the anticipated effluent flows.

4.4 Wetlands

A wetland delineation was not completed for this project. However, a drainage swale was identified adjacent to the project area but outside of the area proposed for disturbance. The drainage swale is located southeast of the eastbound rest area site and drains about half of the eastbound rest area. Continuous flow in the swale was absent during the investigation.

All construction activities will remain outside the boundary of the potential drainage/riparian area. The drainage area will not be impacted by proposed construction activities.

4.5 Hazardous Materials

All project work, maintenance practices, and the placement of staging areas should be conducted so as to avoid impacts to the drainage areas located within or adjacent to the project site. All chemicals and wastes associated with this project's construction, such as fuels, oils, coolants, hydraulic fluids, solvents, paints, etc., are to be carefully contained and stored 50 feet (15 meters) away from the top of drainage areas. Specific sampling or testing for hazardous materials was not conducted as part of this investigation. No visibly obvious hazardous materials were observed at the areas of investigation.

5.0 SUBSURFACE CONDITIONS

5.1 Existing

Currently the existing rest area has two individual wastewater treatment systems. The rest area's drainfields are located on the northeastern and northwestern portions of the sites. The drainfields did not show signs of problems and/or failure.

5.2 Soil Conditions

Subgrade soils beneath the proposed wastewater system site consist of soils classifying sandy silt loams and sandy loams (USDA)/ (lean clays (USCS). Most of these soils were observed to depths ranging from 0.5 to 10 feet. The deeper soils were generally, medium stiff in consistency, grey to brown, low plasticity and contained varying amounts of sands, clays, silts, and gravels.

5.3 Groundwater

Groundwater or groundwater indicators were not observed at depths ranging from 1 to 10 feet in the six test pits. DOWL HKM found the eastbound aquifer to be located in the Bearpaw shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. These logs indicate that the existing public wells located water at an interval depth of 6 to 200 feet below

ground surface. Sandy clays, Sandy silts, gravels dominate the upper 10 feet of the wells. Shale and sandstone layers are found from 25 feet to 200 feet. Based on the information presented in the well logs, it appears that the aquifer is found in a confined/semi confined aquifer formation. .

5.4 Borrow Source and Topsoil Survey

Borrow source investigation and topsoil surveys are not included in the project scope and were not performed. However a total of eight (8) exploration e borings were performed within the rest area pavements for informational purposes. The soil descriptions shown on the boring logs are based on field classification in accordance with ASTM Standards D 2488 (Visual Manual–Procedure). Laboratory testing was not conducted on any of the exploration boring samples. The stratigraphic contacts shown on the individual borehole logs represent the approximate boundaries between soil types. The actual transitions may be more gradual or abrupt. The soil and groundwater conditions depicted are only for the specific dates and locations reported, and therefore, are not necessarily representative of other locations and times. The logs of the borings are included in Appendix B. The boring locations are shown on the attached Site Plan.

6.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

The engineering analysis consisted of a review of existing geologic and geotechnical information, investigation of subsurface conditions, and applying the results to project design considerations. The following sections present recommendations for the wastewater system design. The recommendations presented herein are based on available project site information to date and are intended to assist in final planning and design.

6.1 Drainfield Sizing and Design

Based on percolation rates of 15 min/inch and the existence of silt loam to sandy loam soils in the test pits, MDEQ specifies an application rate of 0.5 gallons per day (gpd) per square feet (ft^2).

The future wastewater flow rates are estimated using the growth rate equation noted below.

(Current Wastewater Flows)*(1 + [Growth Rate]) Number of Years = Design Year Wastewater Flows.

(1,470 peak visits*1.5gals/visits) *(1+ [2%])^22 years=

A 2.0 percent growth rate over a 22-year period has been agreed upon by DOWL HKM and MDT and has been used to estimate the 22 year flow rate. The proposed flow rate was calculated from on-site meters and door counters data projected over a 22-year design period.

Assumptions:

1. Flow rate of 3,408 gpd of effluent, and
2. An application rate of 0.5 gpd/ft2, and
3. An infiltration area discount factor of 50% for secondary treatment.

Use: 3,408 gpd/0.5 gpd/ft^2 = 6,817.77 sf $\Rightarrow$ 6818 sf * 0.5 = 3,409 sf

The proposed site plan (See Appendix A) shows the primary drainfield sizes with the 50% reductions (secondary treatment) and a replacement drainfield area without the 50% reduction. MDEQ will make the final determination on drainfield size reduction. This will be based on treated effluent strength, soil conditions and non-degradation to groundwater.

Table 4
Drainfield Design

Description	Lateral length (ft)	Trench Width (ft)	Trench Length (ft)	Number of Laterals	Distance Between Laterals (ft)	Primary Drainfield Area (ft^2)	Replacement Drainfield Area (ft^2)	System Type
Public Drainfield	100'	3'	100'	12	7'	100'x77'	100'x154'	Secondary Treatment Pressure Dosed, Leaching Chambers

The primary drainfield has been located and designed so that all minimum separation distance requirements are met. The replacement drainfield location and design also meet these criteria.

The installer must construct the drainfield per manufacturer's instructions and all regulatory standards according to Gravelless Absorption Trenches of Circular DEQ-4. The construction and placement of the pressure distribution drainfield will be according to the attached plans and the dimensions shown in Table 5.

All laterals (Infiltrator Chambers) are to be installed perpendicular to ground slope with clean-out risers on the ends. A total of 1,200 lineal feet of Infiltrator Chambers (or approved equal) is required to be installed in standard 3-foot wide trenches at a minimum of 7 feet on center. Each lateral is 100 feet long.

Cleanouts are to be provided at the end of each lateral. The cleanouts are to be at the finished grade and a metal location marker or plastic valve cover must be provided for each cleanout. Cleanouts are constructed from either a long-sweep elbow or two 45-degree bends.

Use a minimum of 12 inches of soil to cap the entire drainfield. The minimum drainfield cap is a 3:1 or flatter slope away from the drainfield area. Only grass (native or turf) is to be used over the entire area of the drainfield.

6.2 Slope Stability

Slopes observed along the alignment generally appeared stable and no significant slope instability or failure was observed. A slope stability analysis was not performed.

6.3 Photographs

Photographs taken during the investigation are presented in Appendix H.

6.4 Special Provisions

This project will include elements that are not adequately specified in the MDT Standard Specifications. The final project specifications should include additional special provisions for the following items:

1. Septic Tank Installation
2. Drainfield Installation

7.0 LIMITATIONS

The conclusions and recommendations presented in this report assume that site conditions are not substantially different than those exposed by the explorations. If during construction, subsurface conditions different from those encountered in the explorations are observed or appear to be present, DOWL HKM should be advised at once to review those conditions and reconsider recommendations where necessary.

If there is a substantial lapse of time between submission of this report and the start of work at the site, and if conditions have changed due to natural causes or construction operations at or near the site, this report should be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions.

This report was prepared for the use of the Montana Department of Transportation and its consultants for this project. It should be made available to prospective contractors for information on factual data only and not as a warranty of subsurface conditions.

Any conclusions by a construction contractor or bidder relating to construction means, methods, techniques, sequences or costs based upon the information provided in this report are not the responsibility of the Montana Department of Transportation or DOWL HKM

8.0 REFERENCES

Lopez, D.A., Berg, R.B., & Lonn, J.D., (2000) *Geologic Map of Hysham 30' x 60' Quadrangle, Montana.*

Montana Bureau of Mines and Geology, Groundwater Information Center, Well Logs, accessed June 2014.

Montana Department of Environmental Quality (2013) Circular DEQ-4 –*Montana Standards for Subsurface Wastewater Treatment Systems*

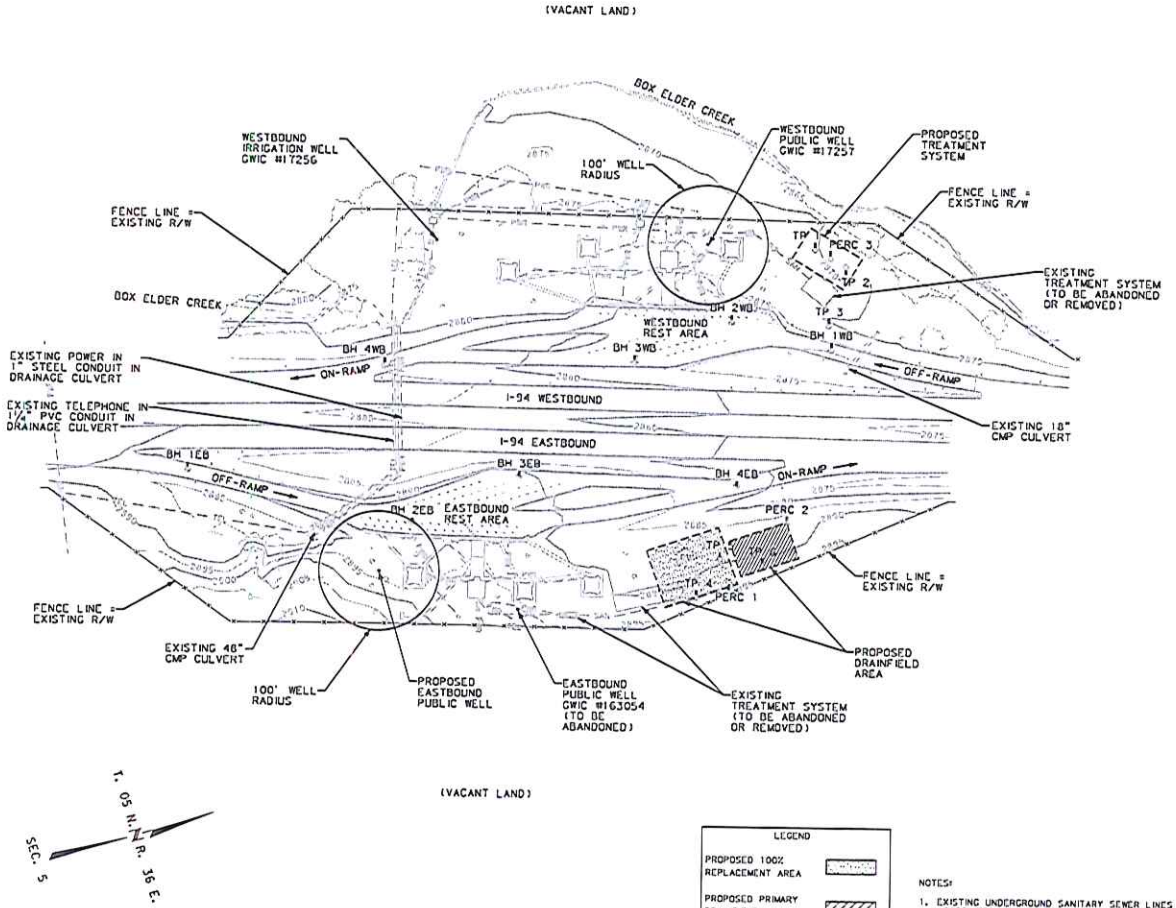
Natural Resources Conservation Service, *Web Soil Survey National Cooperative Soil Survey, Treasure County, accessed June 2014.*

Western Transportation Institute, (February 2011), *Rest Area Use: Data Acquisition and Usage Estimation.*

APPENDIX A

SITE PLAN

DOWL HKM



LEGEND

- PROPOSED 100% REPLACEMENT AREA
- PROPOSED PRIMARY DRAINFIELD
- PERC TEST
- TEST PIT
- BORE HOLE

NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.
3. PROPOSED FACILITIES ARE APPROXIMATE.

SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\MDMisc Drawings\SITE PLAN.D	DESIGNED BY	T. BECKEN-GADDO	9/16/2014	SITE PLAN	
1		9/17/2014	REVIEWED BY	B. DREYER	9/16/2014	TREASURE COUNTY	HYSHAM REST AREA - MONTANA
		3:40:19 PM ADeckengadd	CHECKED BY	B. DREYER	9/16/2014		CSF=0.9993521803 / UPN 8200000 / IM 94-2(136)165 / SHEET 1 OF 1

APPENDIX B

LOG OF TEST PITS/PERCOLATION TEST & LOGS OF EXPOLORATION BORINGS

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-1	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726387.6 Easting:2537398.6	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENE-TROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
	Surface Elevation: 2870.7 Datum: NAD83						
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.8	2869.9						
	Lean Clay (CL), stiff, slightly moist, gray to brown		2869.5				USDA Classification Fine Sandy Loam Common Organics
1.5							
2.5	2868.2						
	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded		2868				USDA Classification Coarse Sands
3							
			2866.5				47" - End of Organics
4.5							
			2865				
6							
			2863.5				
7.5							
8.0	2862.7						
	Test Pit Terminated at 8.0 feet						No groundwater or limiting layer observed in test pit
9							
10.5							

DOWL HKM
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Bozeman, Montana 59715
Telephone: (406) 586-8834
www.dowlhkm.com

STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-2	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726428.2 Easting: 2537440.2	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
	Surface Elevation: 2868.1 Datum: NAD83					
0	12" +/- Topsoil, Lean Clay (CL), stiff, moist, black					Many Organics
1.0	2867.1					
	Lean Clay (CL), stiff, moist, gray to brown	2866.5				USDA Classification Fine Sandy Loam Common Organics
1.5						
2.0	2866.1					
	Poorly Graded Gravel with Sand (GP), loose to dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded	2865				USDA Classification Coarse Sands
3						
						49" - End of Organics
4.5		2863.5				
6		2862				
6.5	2861.6					
	Lean Clay (CL), soft, moist to very moist, gray to brown					USDA Classification Sandy Clay Loam
7.5		2860.5				
9	9.0 2859.1					
	Test Pit Terminated at 9.0 feet					No groundwater or limiting layer observed in test pit
0.5						

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CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-3	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726372.1 Easting: 2537527.9	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
	Surface Elevation: 2871.2 Datum: NAD83					
0	12" +/- Topsoil, Lean Clay (CL), stiff, moist, black	2871				Many Organics
1.0	2870.2					
	Lean Clay (CL), stiff, slightly moist, gray to brown	2869.5				USDA Classification Fine Sandy Loam Common Organics
1.5						
3	3.0 2868.2	2868				
	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded					USDA Classification Coarse Sand
4.5		2866.5				54" - End of Organics
5.0	2866.2					
	Lean Clay (CL), stiff, moist, gray to brown					USDA Classification Fine Sandy Loam
5.8	2865.4					
6	Poorly Graded Gravel with Sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded	2865				USDA Classification Coarse Sand
7.5		2863.5				
9		2862				
10.0	2861.2					
	Test Pit Terminated at 10.0 feet					No groundwater or limiting layer observed in test pit
0.5						

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-4	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726029.3 Easting: 2537904.5	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
	Surface Elevation: 2892.5 Datum: NAD83						
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black		2892				Many Organics
0.8	2891.7						
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform						USDA Classification Sandy Silt Loam Common Organics
1.5			2890.5				
3			2889				
							48" - End of Organics
4.5			2887.5				
6			2886				
7.5			2884.5				
9			2883				
10.0	2882.5						
	Test Pit Terminated at 10.0 feet						No groundwater or limiting layer observed in test pit
0.5							

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-5	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726086.1 Easting: 2537854.4	Treasure County, Montana

Surface Elevation: 2888.9 Datum: NAD83

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENE-TROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
0	6" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.5	2888.4						
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform						USDA Classification Sandy Silt Loam Common Organics
			2887.5				
1.5							
			2886				
3							
			2884.5				50" - End of Organics
4.5							
			2883				
6							
			2881.5				
7.5							
8.5	2880.4						
	Test Pit Terminated at 8.5 feet						No groundwater or limiting layer observed in test pit
9							
10.5							

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

Project No.: IM 94-2(36)65	LOG OF TEST PIT TP-6	Sheet 1 of 1

CLIENT	PROJECT
Montana Department of Transportation	Hysham Rest Area - Phase I
TEST PIT LOCATION	**SITE**
Northing: 726150.1 Easting: 2537884.6	Treasure County, Montana

DEPTH (FT.)	MATERIAL DESCRIPTION	GRAPHIC LOG	ELEVATION (FT.)	SAMPLES: BULK/GRAB	SAMPLES: POCKET PENETROMETER, TSF	SAMPLES: M.C. (PL 10 20 30 40 LL)	ADDITIONAL DATA/ REMARKS
	Surface Elevation: 2891.8 Datum: NAD83						
0	9" +/- Topsoil, Lean Clay (CL), stiff, moist, black						Many Organics
0.8			2891				
	Lean Clay with Sand (CL), medium stiff, moist, dark brown, uniform		2890.5				USDA Classification Sandy Silt Loam Common Organics
1.5							
			2889				
3							
							47" - End of Organics
			2887.5				
4.5							
			2886				
6							
			2884.5				
7.5							
			2883				
9	9.0		2882.8				
	Test Pit Terminated at 9.0 feet						No groundwater or limiting layer observed in test pit
10.5							

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STARTED	7/2/2014	FINISHED	7/2/2014
CONTRACTOR	MDT	EXCAVATOR	Backhoe
OPERATOR	Robert	MODEL	N/A
LOGGED BY	J. Pinkerton	APPROVED BY	B. Dreyer

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near Fence East Bound Test Number PT# 1

Diameter of Test Hole: 6" Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 10:15

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5"

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)
10:18 am	10:33 am	15min	23"	24"	1"	15
10:33 am	10:48 am	15min	23"	23.3/4"	3/4"	20
10:48 am	11:03 am	15min	23"	24"	1"	15
11:03 am	11:18 am	15min	23"	24"	1"	15

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.

William Dreyer	William Dreyer	7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near on Ramp East Bound Test Number PT# 2

Diameter of Test Hole: 6" Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 10:18

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5 ft

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)
10:20 am	10:35 am	15min	21 3/4"	24 1/2"	2 3/4"	5.45
10:35 am	10:50 am	15min	21 3/4"	24.1/4"	2 1/2"	6
10:50 am	11:05 am	15min	21 3/4"	24 1/4"	2 1/2"	6
11:05 am	11:20 am	15min	21 3/4"	24 1/4"	2 1/2"	6

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.

William Dreyer		7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
PERCOLATION TEST FORM

Owner Name: MDT

Project Name Hysham Rest Area

Lot of Tract Number Near Off Ramp West Bound Existing Drainfield Test Number PT# 3

Diameter of Test Hole: 6" Depth of Test Hole: 3.0 ft

Date and Time Soak Period Began: 7/16/2014 Ended: 7/26/2014 – 11:45

Date Test Began: 7/16/2014

Distance of the reference point above the bottom of the hole: 4.5 ft

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)
11:50 am	11:52 am	2 min	21 1/4"	26"	4 3/4"	0.42

20 gallons of water in 10 minutes was use. Based on DEQ 4 the soils are considered Sandy Graves and the test can be stopped.

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.

William Dreyer		7/16/14
Name (printed)	Signature	Date

Company DOWL HKM

LOG OF BORING

DOWL HKM

Boring 8200000-B-1 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725280.9 ft **Coordinates** E: 2537458.8 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2888.6 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BD	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.7 *2887.9*						
2 *2886.6*			53		16 - 14 - 8		BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.	2.2 *2886.4*						
4 *2884.6*			80		3 - 5 - 5		Lean CLAY with sand (CL), medium stiff to stiff, moist to wet, yellow to brown. possible organic zones.							
6 *2882.6*			87		2 - 3 - 5									
8 *2880.6*														
10 *2878.6*			73		9 - 11 - 10		Poorly-Graded GRAVEL with sand (GP), medium dense, dry, yellow to gray, fine to coarse grained, rounded to subrounded.	9.0 *2879.6*						
								10.5 *2878.1*						

Boring Depth: 10.5 ft, *Elevation: 2878.1 ft*

Water Level Observations		Remarks:
▽ During Drilling: Not Encountered	▽ After Drilling: *0*	
▽ After Drilling: *0*		

(2) MDT LOG OF BORING - MDT_REVISED_2009+(CPT_IMPORT).GDT - 9/17/14 14:14 - H:\24111355\GEOTECH LOGS\HYSHAM REST STOP GEOTECH LOGS.GPJ

DOWL HKM

LOG OF BORING

Boring 8200000-B-2 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725613.3 ft **Coordinates** E: 2537649 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2892.7 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.5 2892.2						
2 2890.7							BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.							
			100		5 - 6 - 8		Lean CLAY with sand (CL), stiff to soft, moist, gray to brown. occasional pebbles observed.	2.5 2890.2						
4 2888.7														
			100		2 - 3 - 2									
6 2886.7														
8 2884.7														
			100		2 - 2 - 2									
10 2882.7														
								10.5 2882.2						

Boring Depth: 10.5 ft, *Elevation: 2882.2 ft*

Water Level Observations		Remarks:
▽ After Drilling: 0	▽ During Drilling: Not Encountered ▼ After Drilling: 0	

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DOWL HKM

LOG OF BORING

Boring 8200000-B-3 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725806.1 ft **Coordinates** E: 2537624.6 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2890.4 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.6 *2889.8*						
2 *2888.4*			53		11 - 16 - 27		BASE COURSE, Well-Graded GRAVEL with sand (GW), dense, moist, gray, fine to coarse grained, angular to subangular.	2.6 *2887.8*						
4 *2886.4*			80		2 - 3 - 3		Lean CLAY (CL), medium stiff, moist, yellow to brown.	5.0 *2885.4*						
6 *2884.4*			100		1 - 3 - 2		Lean CLAY with sand (CL), medium stiff, moist, yellow to brown. scattered pebbles and 2" silty sand layers.							
8 *2882.4*														
10 *2880.4*			100		2 - 3 - 2			10.5 *2879.9*						

Boring Depth: 10.5 ft, *Elevation: 2879.9 ft*

Water Level Observations		Remarks:
▽ During Drilling: Not Encountered	▽ After Drilling: *0*	
▼ After Drilling: *0*		

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DOWL HKM

LOG OF BORING

Boring 8200000-B-4 EB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726148.1 ft **Coordinates** E: 2537743.9 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2881.8 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) / Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) / Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.	0.7 *2881.1*						
2 *2879.8*			67		10 - 12 - 8		BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), medium dense, moist, gray, fine to coarse grained, angular to subangular.							
							Lean CLAY (CL), stiff, moist, dark brown.	2.6 *2879.2*						
4 *2877.8*			80		5 - 6 - 7									
							Lean CLAY with sand (CL), medium stiff, moist, dark brown.	5.0 *2876.8*						
6 *2875.8*			100		3 - 3 - 2									
8 *2873.8*														
10 *2871.8*			100		3 - 3 - 3		Lean CLAY with sand (CL), medium stiff, moist, dark brown. silty sand seams.	9.5 *2872.3*						
12 *2869.8*														
							Lean CLAY with gravel (CL), medium dense, moist, dark brwon, coarse grained, rounded to subrounded.	12.5 *2869.3*						
14 *2867.8*							Poorly-Graded GRAVEL with sand (GP), dense, dry to moist, yellow to brown, fine to coarse grained, rounded to subrounded.	14.0 *2867.8*						
			27		15 - 16 - 16			15.5 *2866.3*						

Boring Depth: 15.5 ft, *Elevation: 2866.3 ft*

Water Level Observations		
▽ After Drilling: *0*	▽ During Drilling: Not Encountered ▼ After Drilling: *0*	Remarks:

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LOG OF BORING

Boring 8200000-B-1 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726364.2 ft **Coordinates** E: 2537569 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2875.2 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), medium dense, moist, gray, fine to coarse grained, angular to subangular.	0.6 2874.6						
2 2873.2			67		9 - 5 - 9									
							Lean CLAY (CL), stiff to very stiff, moist, gray to brown.	2.3 2872.9						
4 2871.2			100		6 - 6 - 7									
6 2869.2			100		7 - 7 - 9									
							Poorly-Graded GRAVEL with sand (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded. Water table observed at 14.0 feet.	6.8 2868.4						
8 2867.2														
10 2865.2			80		8 - 9 - 10									
12 2863.2														
14 2861.2							▽							
			100		1 - 4 - 8		Lean CLAY (CL), soft, wet, gray to brown.	14.2 2861.0						
							Poorly-Graded GRAVEL with clay (GP-GC), medium dense, wet, yellow to brown, coarse grained, rounded to subrounded.	15.0 2860.2						
								15.5 2859.7						

Boring Depth: 15.5 ft, *Elevation: 2859.7 ft*

Water Level Observations		
▽ After Drilling: *0*	▽ During Drilling: **14.0 ft** ***(2861.2 ft)***	Remarks:
	▽ After Drilling: *0*	

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LOG OF BORING

Boring 8200000-B-2 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726219 ft **Coordinates** E: 2537476.9 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2877.4 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with sand (GW), medium dense, moist, gray, fine to coarse grained, angular to subangular.	0.6 *2876.8*						
2 *2875.4*			80		14 - 16 - 13									
							Lean CLAY with sand (CL), medium stiff to stiff, moist, gray to brown.	2.2 *2875.2*						
			67		4 - 3 - 3									
4 *2873.4*														
6 *2871.4*			100		2 - 5 - 5									
8 *2869.4*							Poorly-Graded GRAVEL with sand (GP), loose to very dense, dry, yellow to brown, fine to coarse grained, rounded to subrounded.	8.0 *2869.4*						
10 *2867.4*			0		11 - 19 - 31									
							Boring Depth: 10.5 ft, *Elevation: 2866.9 ft*	10.5 *2866.9*						

Water Level Observations		Remarks:
▽ After Drilling: *0*	▽ During Drilling: **Not Encountered** ▽ After Drilling: *0*	

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LOG OF BORING

Boring 8200000-B-3 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 726044.8 ft **Coordinates** E: 2537495.7 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2877.6 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with sand (GW), moist, gray, fine to coarse grained, angular to subangular.	0.6 *2877.0*						
2 *2875.6*							Sandy Lean CLAY (CL), soft, moist, yellow to brown.	2.2 *2875.4*						
4 *2873.6*			100		4 - 2 - 2									
							Poorly-Graded GRAVEL (GP), medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded.	5.0 *2872.6*						
6 *2871.6*			100		9 - 17 - 13									
8 *2869.6*							Poorly-Graded GRAVEL (GP), Cobbles, medium dense, moist, yellow to brown, fine to coarse grained, rounded to subrounded.	8.0 *2869.6*						
10 *2867.6*			67		8 - 12 - 9									
							Boring Depth: 10.5 ft, *Elevation: 2867.1 ft*	10.5 *2867.1*						

Water Level Observations		Remarks:
▽ After Drilling: *0*	▽ During Drilling: Not Encountered ▽ After Drilling: *0*	

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LOG OF BORING

Boring 8200000-B-4 WB

Project: Hysham Rest Area		**Rig:** CME 45 **Hammer:** Auto	**Boring Location** N: 725644.8 ft **Coordinates** E: 2537381.6 ft	**Station:** **Offset:**
Project Number: IM 94-2(36)65	**UPN:** 8200000	**Boring Diameter:** 7.5"	**System:** MT S.P. (E) **Datum:** NAD83	**Top of Boring Elevation:** 2885.3 ft
Date Started: 6/13/14	**Date Finished:** 6/13/14	**Drilling Fluid:** None	**Location Source:** Surveyed	**Elevation Source:** Surveyed
Driller: Wade Reynolds **Logger:** Greg Underhill		**Abandonment Method:** Backfilled with Cuttings	**Township, Range, and Section:** 5N 36E 5 - BA	

Depth (ft) Elev. (ft)	Operation	Sample Type	Recovery (%)	RQD (%)	Blow Count	Lithology	Material Description	Depth (ft) Elev. (ft)	MC (%)	LL	PL	-200 (%)	DD	Remarks and Other Tests
							Asphalt, black.							
							BASE COURSE, Well-Graded GRAVEL with clay and sand (GW-GC), dense, moist, gray, fine to coarse grained, angular to subangular.	0.6 *2884.7*						
2 *2883.3*			80		10 - 17 - 14									
							Lean CLAY (CL), stiff, moist, gray to brown.	2.3 *2883.0*						
			0		6 - 4 - 6									
4 *2881.3*														
6 *2879.3*			100		3 - 4 - 5									
							Lean CLAY with gravel (CL), stiff to medium stiff, moist, gray to brown, coarse grained, rounded to subrounded.	7.0 *2878.3*						
8 *2877.3*							Lean CLAY with sand (CL), medium stiff, moist, gray to brown.	8.0 *2877.3*						
10 *2875.3*			100		3 - 3 - 3									
							Boring Depth: 10.5 ft, *Elevation: 2874.8 ft*	10.5 *2874.8*						

Water Level Observations		Remarks:
▽ After Drilling: *0*	▽ During Drilling: Not Encountered ▽ After Drilling: *0*	

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DOWL

Materials Testing Laboratory
Montana: Billings, Bozeman
North Dakota: Dickinson
Wyoming: Gillette, Lander,
Laramie, Sheridan

SOIL DENSITY SUMMARY

TEST #	TEST DATE	Sta	LOCATION	OFFSET	Below FG	LAB		FIELD						COMMENTS
						MAX DENS.	OPT. M %	% Moist	Dry DENS	Moist Var	% COMP	% REQ	Test BY	
1	8/26/15	-	3'S/10'E of NW Corner	-	4'	139.3	6.2	5.5	137.2	-0.7	98.5	98	TM	
2	"	-	3'S/15'W of NE Corner	-	4'	139.3	6.2	5.8	138.7	-0.4	99.6	98	TM	
3	"	-	5'N/3'W of SE Corner	-	4'	139.3	6.2	5.9	139.0	-0.3	99.8	98	TM	
4	"	-	15'N/20'W of SE Corner	-	4'	139.3	6.2	5.6	139.3	-0.6	100.0	98	TM	
5	"	-	3'N/4'E of SW Corner	-	4'	139.3	6.2	5.4	137.1	-0.8	98.4	98	TM	

1401 Gold Ave.

Craig Paulson
Bozeman Materials Lab Manager

APPENDIX C

NRCS SOILS INFORMATION

United States Department of Agriculture

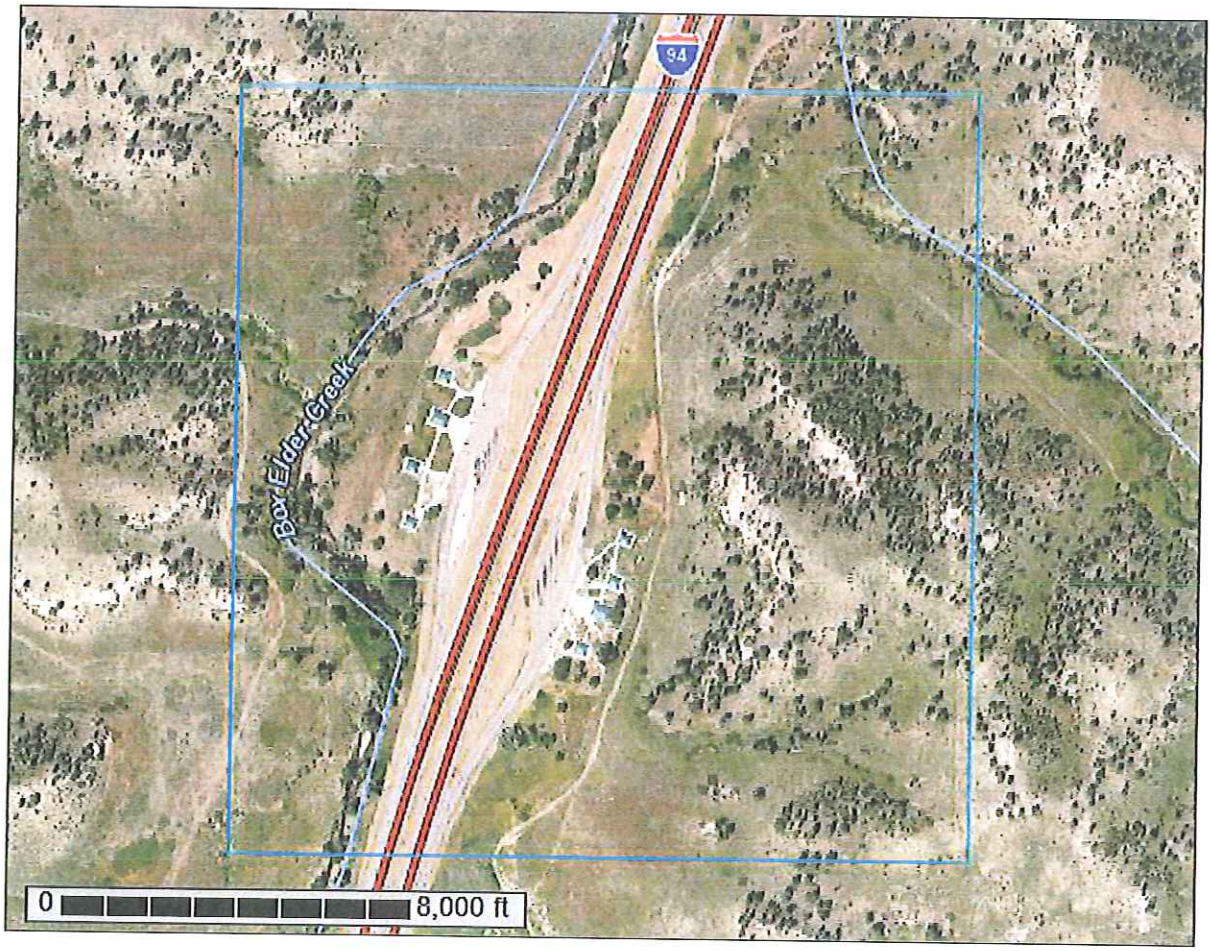
NRCS

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 Treasure County, Montana

Hysham Rest Area



September 17, 2014

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 (http://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.

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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.

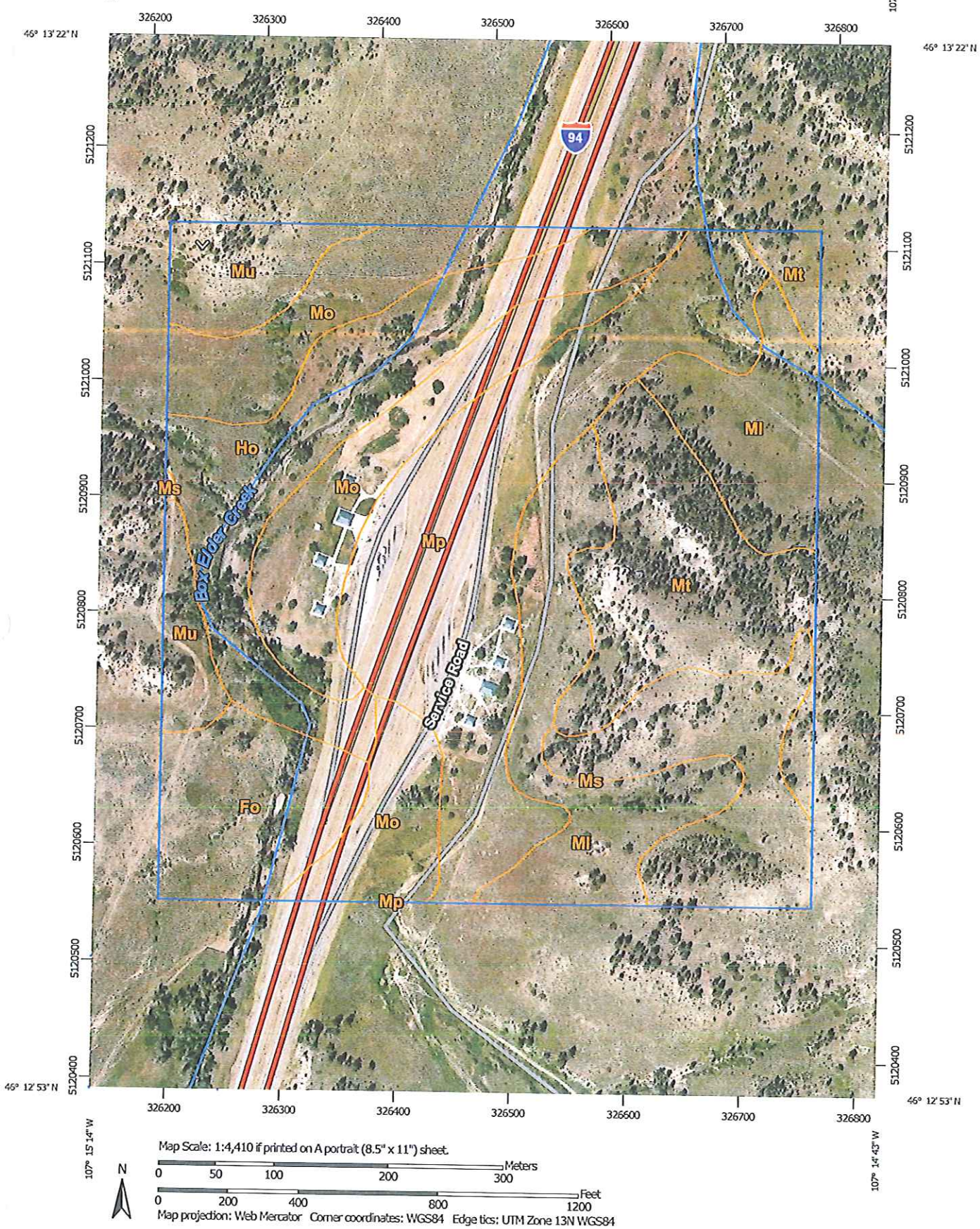
While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the 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 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.


107° 15' 14" W
107° 14' 43" W
46° 13' 22" N
46° 12' 53" N
326200
326300
326400
326500
326600
326700
326800
5121200
5121100
5121000
5120900
5120800
5120700
5120600
5120500
5120400
94
Mu
Mo
Mt
Ml
Ho
Ms
Mp
Fo
Box Elder Creek
Service Road
Map Scale: 1:4,410 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 200 400 800 1200
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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

Treasure County, Montana (MT103)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	5.8	7.0%
Ho	Havre and Lohmiller soils	10.8	13.1%
Ml	McRae-Bainville loams, 8 to 20 percent slopes	12.5	15.2%
Mo	McRae and Havre loams, 1 to 4 percent slopes	14.7	17.9%
Mp	McRae and Havre loams, 4 to 8 percent slopes	16.6	20.1%
Ms	Midway clay loam, 15 to 35 percent slopes	6.9	8.4%
Mt	Midway-Bainville complex	10.3	12.6%
Mu	Midway-Nihill gravelly loam	4.6	5.6%
Totals for Area of Interest		82.3	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.

Treasure County, Montana

Fo—Fort Collins loam, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: clfp
Mean annual precipitation: 10 to 13 inches
Frost-free period: 110 to 135 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Fort Collins

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 4 inches: loam
Bt - 4 to 12 inches: clay loam
Bk - 12 to 60 inches: loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Arvada

Percent of map unit: 5 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Beckton

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear

Ho—Havre and Lohmiller soils

Map Unit Setting

National map unit symbol: clgg
Elevation: 1,800 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Havre and similar soils: 30 percent
Havre and similar soils: 30 percent
Harlem and similar soils: 30 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Harlem

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

A - 0 to 8 inches: clay loam
C1 - 8 to 40 inches: stratified clay to silty clay loam
C2 - 40 to 60 inches: stratified silty clay loam to fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Very slightly saline to slightly saline (4.0 to 8.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Description of Havre

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 8 inches: loam
C - 8 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 8 inches: clay
C - 8 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional

Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Minor Components

Bowdoin

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Havre

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Overflow (ov) rru 58a-e 10-14" p.z. (R058AE007MT)

Glendive

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear

MI—McRae-Bainville loams, 8 to 20 percent slopes

Map Unit Setting

National map unit symbol: clhj
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 50 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Mcrae and similar soils: 65 percent
Bainville and similar soils: 25 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Bainville

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and siltstone

Typical profile

A - 0 to 4 inches: loam
C - 4 to 26 inches: silt loam
Cr - 26 to 60 inches: weathered bedrock

Properties and qualities

Slope: 8 to 20 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Cherry

Percent of map unit: 4 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 4 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Havre

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Mo—McRae and Havre loams, 1 to 4 percent slopes

Map Unit Setting

National map unit symbol: clhm
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcrae and similar soils: 50 percent
Havre and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 7 inches: loam
C1 - 7 to 39 inches: stratified fine sandy loam to clay loam
C2 - 39 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)

Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Lohmiller

Percent of map unit: 5 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Mp—McRae and Havre loams, 4 to 8 percent slopes

Map Unit Setting

National map unit symbol: clhn
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcrae and similar soils: 50 percent
Havre and similar soils: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcrae

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 4 inches: loam
Bw - 4 to 10 inches: clay loam
Bk - 10 to 39 inches: clay loam
C - 39 to 60 inches: clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches

Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Description of Havre

Setting

Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 7 inches: loam
C1 - 7 to 39 inches: stratified fine sandy loam to clay loam
C2 - 39 to 60 inches: stratified fine sandy loam to clay loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)
Available water storage in profile: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Minor Components

Cherry

Percent of map unit: 3 percent
Landform: Alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 2 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Ms—Midway clay loam, 15 to 35 percent slopes

Map Unit Setting

National map unit symbol: clhq
Elevation: 1,900 to 4,500 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 39 to 48 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Minor Components

Bainville

Percent of map unit: 8 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Mcrae

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Cherry

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Nunn

Percent of map unit: 4 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Lohmiller

Percent of map unit: 3 percent
Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Rock outcrop

Percent of map unit: 3 percent

Mt—Midway-Bainville complex

Map Unit Setting

National map unit symbol: clhr
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 37 to 50 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 50 percent
Bainville and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 30 to 65 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Description of Bainville

Setting

Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and siltstone

Typical profile

A - 0 to 3 inches: loam
C - 3 to 22 inches: silt loam
Cr - 22 to 60 inches: weathered bedrock

Properties and qualities

Slope: 35 to 65 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Minor Components

Cherry

Percent of map unit: 6 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey (cy) rru 58a-e 10-14" p.z. (R058AE002MT)

Mcrae

Percent of map unit: 3 percent
Landform: Hills
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Travessilla

Percent of map unit: 3 percent
Landform: Hills
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear

Tullock

Percent of map unit: 2 percent
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy-steep (systp) rru 58a-e 10-14" p.z. (R058AE006MT)

Havre

Percent of map unit: 1 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-e 10-14" p.z. (R058AE001MT)

Mu—Midway-Nihill gravelly loam

Map Unit Setting

National map unit symbol: clhs
Elevation: 1,900 to 4,700 feet
Mean annual precipitation: 10 to 13 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 110 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 60 percent
Nihill and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from mudstone

Typical profile

A - 0 to 2 inches: clay loam
C - 2 to 16 inches: clay
Cr - 16 to 60 inches: bedrock

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey-steep (cystp) rru 58a-e 10-14" p.z. (R058AE005MT)

Description of Nihill

Setting

Landform: Hillslopes
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Gravelly alluvium

Typical profile

A - 0 to 8 inches: gravelly loam
C - 8 to 40 inches: very gravelly loam
2C - 40 to 60 inches: stratified extremely gravelly sandy loam to very gravelly loam

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well 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: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Silty-steep (sistp) rru 58a-e 10-14" p.z. (R058AE004MT)

Minor Components

Bainville

Percent of map unit: 10 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Shallow (sw) rru 58a-e 10-14" p.z. (R058AE019MT)

Rock outcrop

Percent of map unit: 5 percent

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Building Site Development

Building site development interpretations are designed to be used as tools for evaluating soil suitability and identifying soil limitations for various construction purposes. As part of the interpretation process, the rating applies to each soil in its described condition and does not consider present land use. Example interpretations can include corrosion of concrete and steel, shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping.

Shallow Excavations (Hysham Rest Area)

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

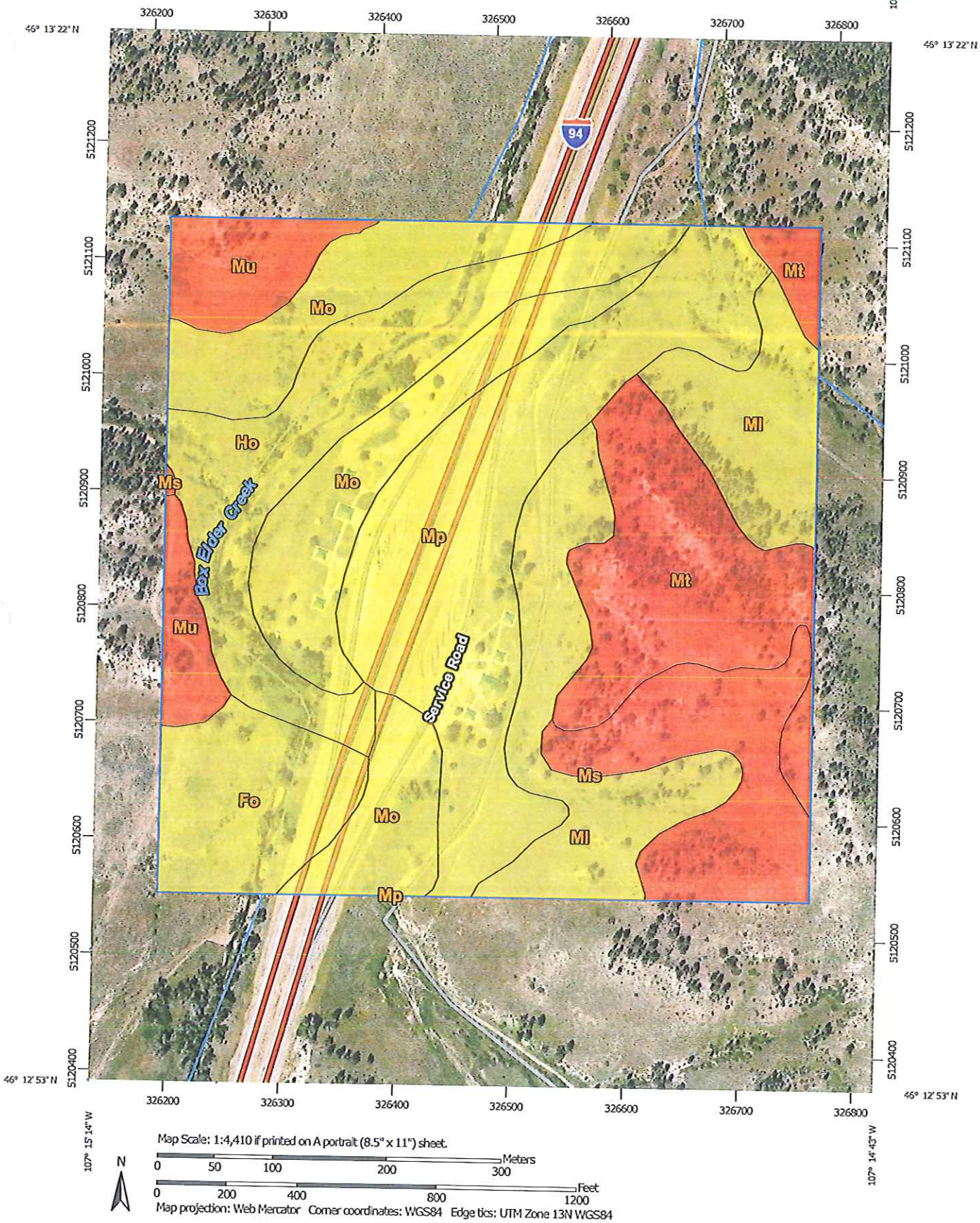
"Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Shallow Excavations (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Shallow Excavations (Hysham Rest Area)

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Dusty (0.33)	5.8	7.0%
				Unstable excavation walls (0.01)		
			Arvada (5%)	Unstable excavation walls (0.51)		
				Dusty (0.40)		
			Beckton (5%)	Unstable excavation walls (0.51)		
				Dusty (0.42)		
				Too clayey (0.13)		
Ho	Havre and Lohmiller soils	Somewhat limited	Harlem (30%)	Flooding (0.60)	10.8	13.1%
				Dusty (0.31)		
				Too clayey (0.13)		
				Unstable excavation walls (0.01)		
			Havre (30%)	Flooding (0.60)		
				Dusty (0.16)		
				Unstable excavation walls (0.01)		
			Havre (30%)	Flooding (0.60)		
				Dusty (0.21)		
				Unstable excavation walls (0.01)		
			Havre (3%)	Flooding (0.80)		
				Dusty (0.14)		
				Unstable excavation walls (0.01)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Somewhat limited	McRae (65%)	Slope (0.96)	12.5	15.2%
				Dusty (0.34)		
				Unstable excavation walls (0.01)		
			Bainville (25%)	Slope (0.96)		
				Depth to soft bedrock (0.79)		

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Dusty (0.50)		
				Unstable excavation walls (0.01)		
			Cherry (4%)	Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (4%)	Slope (0.63)		
				Dusty (0.25)		
				Unstable excavation walls (0.01)		
			Havre (2%)	Dusty (0.15)		
				Unstable excavation walls (0.01)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Dusty (0.34)	14.7	17.9%
				Unstable excavation walls (0.01)		
			Havre (45%)	Dusty (0.17)		
				Unstable excavation walls (0.01)		
			Lohmiller (5%)	Dusty (0.19)		
				Unstable excavation walls (0.01)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Dusty (0.34)	16.6	20.1%
				Unstable excavation walls (0.01)		
			Havre (45%)	Dusty (0.32)		
				Unstable excavation walls (0.01)		
			Cherry (3%)	Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (2%)	Dusty (0.19)		
				Unstable excavation walls (0.01)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Depth to soft bedrock (1.00)	6.9	8.4%

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Bainville (8%)	Depth to soft bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.24)		
				Unstable excavation walls (0.01)		
			Lohmiller (3%)	Slope (1.00)		
				Dusty (0.25)		
				Unstable excavation walls (0.01)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Depth to soft bedrock (1.00)	10.3	12.6%
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Bainville (35%)	Slope (1.00)		
				Depth to soft bedrock (0.97)		
				Dusty (0.50)		
				Unstable excavation walls (0.01)		
			Travessilla (3%)	Depth to hard bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.05)		
				Unstable excavation walls (0.01)		
			Tullock (2%)	Slope (1.00)		
				Depth to soft bedrock (0.64)		
				Unstable excavation walls (0.01)		
				Dusty (0.00)		

Shallow Excavations— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Depth to soft bedrock (1.00)	4.6	5.6%
				Slope (1.00)		
				Unstable excavation walls (0.51)		
				Dusty (0.41)		
			Nihill (25%)	Slope (1.00)		
				Dusty (0.22)		
				Unstable excavation walls (0.01)		
			Bainville (10%)	Depth to soft bedrock (1.00)		
				Slope (1.00)		
				Dusty (0.24)		
				Unstable excavation walls (0.01)		
Totals for Area of Interest					82.3	100.0%

Shallow Excavations— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Somewhat limited	60.4	73.4%
Very limited	21.9	26.6%
Totals for Area of Interest	82.3	100.0%

Rating Options—Shallow Excavations (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component

typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Construction Materials

Construction materials interpretations are tools designed to provide guidance to users in selecting a site for potential source of various materials. Individual soils or groups of soils may be selected as a potential source because they are close at hand, are the only source available, or they meets some or all of the physical or chemical properties required for the intended application. Example interpretations include roadfill, sand and gravel, topsoil and reclamation material.

Gravel Source (Hysham Rest Area)

Gravel consists of natural aggregates (2 to 75 millimeters in diameter) suitable for commercial use with a minimum of processing. It is used in many kinds of construction. Specifications for each use vary widely. Only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

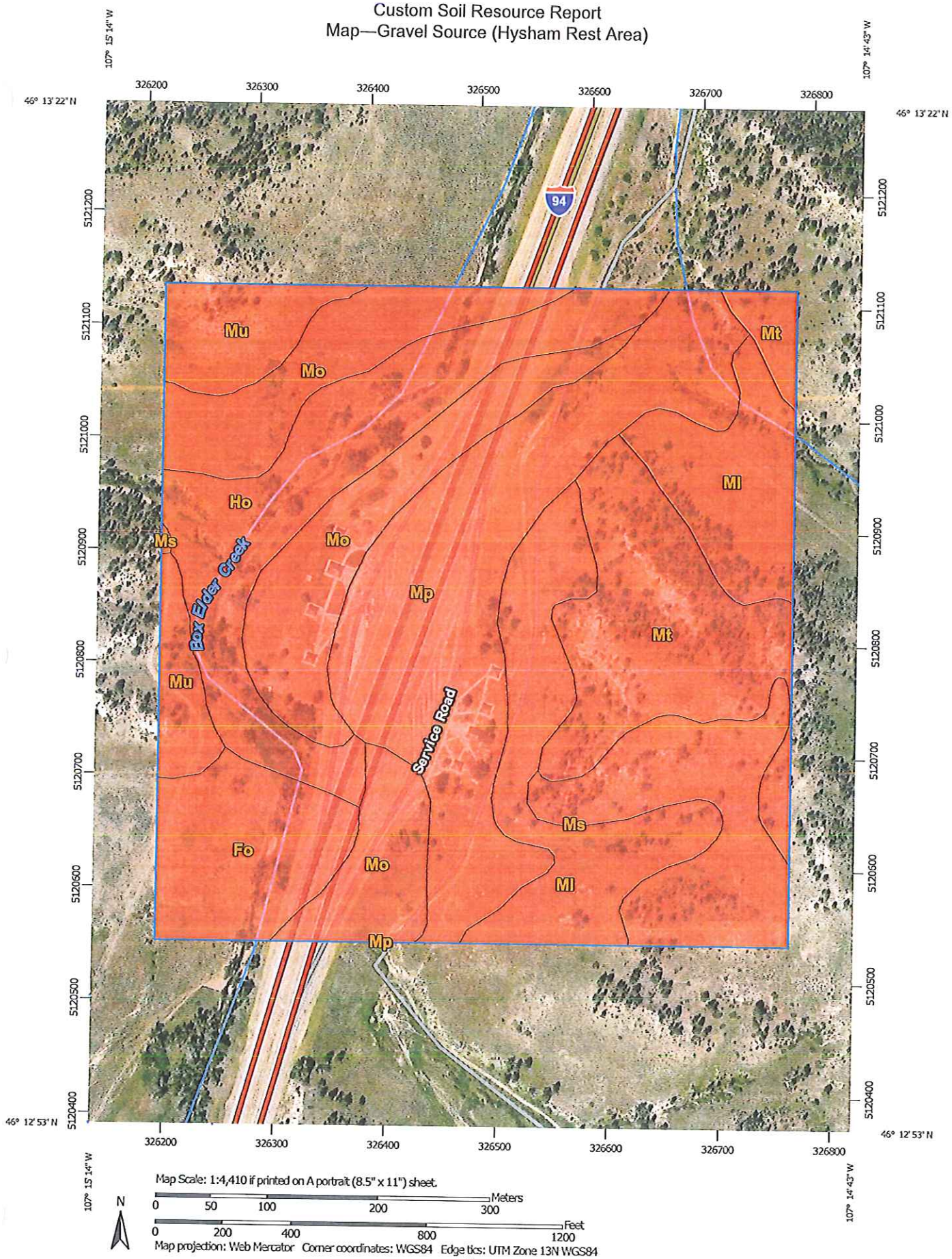
The properties used to evaluate the soil as a source of gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains gravel, the soil is considered a likely source regardless of thickness. The assumption is that the gravel layer below the depth of observation exceeds the minimum thickness. The ratings are for the whole soil, from the surface to a depth of about 6 feet. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be gravel.

The soils are rated "good," "fair," or "poor" as potential sources of gravel. A rating of "good" or "fair" means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Gravel Source (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Poor
- Fair
- Good
- Not rated or not available

Soil Rating Lines
- Poor
- Fair
- Good
- Not rated or not available

Soil Rating Points
- Poor
- Fair
- Good
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Gravel Source (Hysham Rest Area)

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	Poor	Fort Collins (90%)	Bottom layer (0.00)	5.8	7.0%
				Thickest layer (0.00)		
			Arvada (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Beckton (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Ho	Havre and Lohmiller soils	Poor	Harlem (30%)	Bottom layer (0.00)	10.8	13.1%
				Thickest layer (0.00)		
			Havre (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (30%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Bowdoin (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Poor	McRae (65%)	Bottom layer (0.00)	12.5	15.2%
				Thickest layer (0.00)		
			Bainville (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Lohmiller (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Poor	McRae (50%)	Bottom layer (0.00)	14.7	17.9%
				Thickest layer (0.00)		
			Havre (45%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (5%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Poor	McRae (50%)	Bottom layer (0.00)	16.6	20.1%
				Thickest layer (0.00)		
			Havre (45%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Ms	Midway clay loam, 15 to 35 percent slopes	Poor	Midway (70%)	Bottom layer (0.00)	6.9	8.4%
				Thickest layer (0.00)		
			Bainville (8%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			McRae (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Nunn (4%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Lohmiller (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mt	Midway-Bainville complex	Poor	Midway (50%)	Bottom layer (0.00)	10.3	12.6%
				Thickest layer (0.00)		
			Bainville (35%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Cherry (6%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Travessilla (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			McRae (3%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Tullock (2%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
			Havre (1%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Mu	Midway-Nihill gravelly loam	Poor	Midway (60%)	Bottom layer (0.00)	4.6	5.6%
				Thickest layer (0.00)		
			Nihill (25%)	Bottom layer (0.00)		
				Thickest layer (0.00)		

Gravel Source— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Bainville (10%)	Bottom layer (0.00)		
				Thickest layer (0.00)		
Totals for Area of Interest					82.3	100.0%

Gravel Source— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Poor	82.3	100.0%
Totals for Area of Interest	82.3	100.0%

Rating Options—Gravel Source (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Sanitary Facilities

Sanitary Facilities interpretations are tools designed to guide the user in site selection for the safe disposal of sewage and solid waste. Example interpretations include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Septic Tank Absorption Fields (Hysham Rest Area)

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

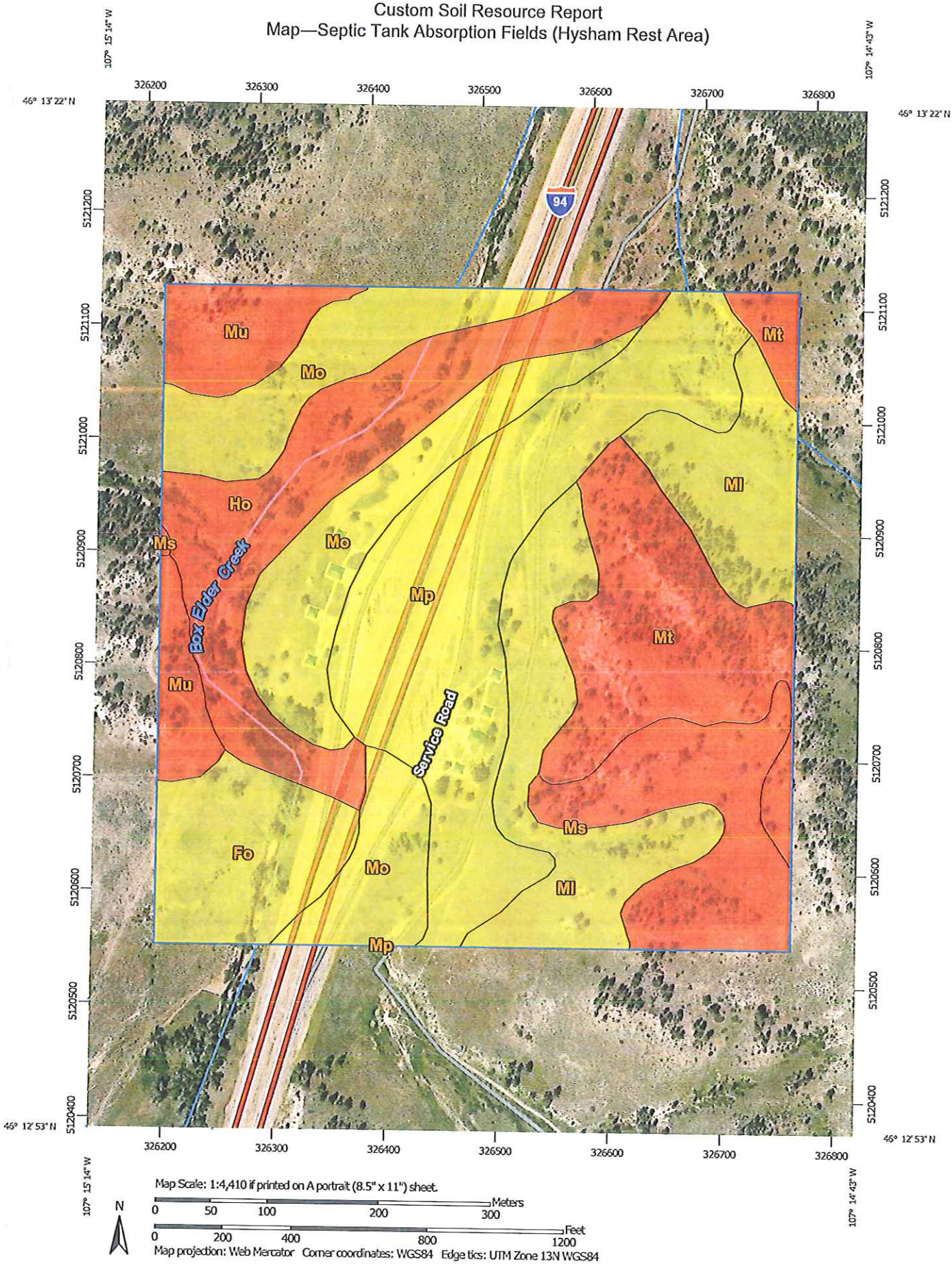
Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown

for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Septic Tank Absorption Fields (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Septic Tank Absorption Fields (Hysham Rest Area)

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Slow water movement (0.50)	5.8	7.0%
Ho	Havre and Lohmiller soils	Very limited	Harlem (30%)	Flooding (1.00)	10.8	13.1%
				Slow water movement (1.00)		
			Havre (30%)	Flooding (1.00)		
				Slow water movement (0.50)		
			Havre (30%)	Flooding (1.00)		
				Slow water movement (0.50)		
			Bowdoin (4%)	Slow water movement (1.00)		
				Flooding (0.40)		
			Glendive (3%)	Filtering capacity (1.00)		
				Flooding (0.40)		
			Havre (3%)	Flooding (1.00)		
				Slow water movement (0.50)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Somewhat limited	McRae (65%)	Slope (0.96)	12.5	15.2%
				Slow water movement (0.50)		
			Cherry (4%)	Slow water movement (0.50)		
			Lohmiller (4%)	Slope (0.63)		
				Slow water movement (0.50)		
			Havre (2%)	Slow water movement (0.50)		
				Flooding (0.40)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Slow water movement (0.50)	14.7	17.9%

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Havre (45%)	Slow water movement (0.50)		
			Lohmiller (5%)	Slow water movement (0.50)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Slow water movement (0.50)	16.6	20.1%
			Havre (45%)	Slow water movement (0.50)		
			Cherry (3%)	Slow water movement (0.50)		
			Lohmiller (2%)	Slow water movement (0.50)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Depth to bedrock (1.00)	6.9	8.4%
				Slope (1.00)		
			Bainville (8%)	Depth to bedrock (1.00)		
				Slope (1.00)		
			Nunn (4%)	Slow water movement (1.00)		
			Lohmiller (3%)	Slope (1.00)		
				Slow water movement (0.50)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Depth to bedrock (1.00)	10.3	12.6%
				Slope (1.00)		
			Bainville (35%)	Slope (1.00)		
				Depth to bedrock (1.00)		
			Travessilla (3%)	Depth to bedrock (1.00)		
				Slope (1.00)		
			Tullock (2%)	Slope (1.00)		
				Depth to bedrock (1.00)		
				Filtering capacity (1.00)		
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Depth to bedrock (1.00)	4.6	5.6%
				Slope (1.00)		

Septic Tank Absorption Fields— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Nihill (25%)	Slope (1.00)		
				Seepage, bottom layer (1.00)		
				Slow water movement (0.50)		
			Bainville (10%)	Depth to bedrock (1.00)		
				Slope (1.00)		
Totals for Area of Interest					82.3	100.0%

Septic Tank Absorption Fields— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Somewhat limited	49.6	60.3%
Very limited	32.7	39.7%
Totals for Area of Interest	82.3	100.0%

Rating Options—Septic Tank Absorption Fields (Hysham Rest Area)

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a

percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Water Management

Water Management interpretations are tools for evaluating the potential of the soil in the application of various water management practices. Example interpretations include pond reservoir area, embankments, dikes, levees, and excavated ponds.

Subsurface Water Management, Outflow Quality (Hysham Rest Area)

The ratings for Subsurface Water Management, Outflow Quality are based on the soil properties that affect the capacity of the soil to convey surface and subsurface water and on the properties that affect water quality. The properties that affect the conveyance and water quality include salinity, sodicity, soil reaction, soil taxonomic great group placement, gypsum content, shrink-swell potential, soil saturation, and surface erosion.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor water quality can be expected.

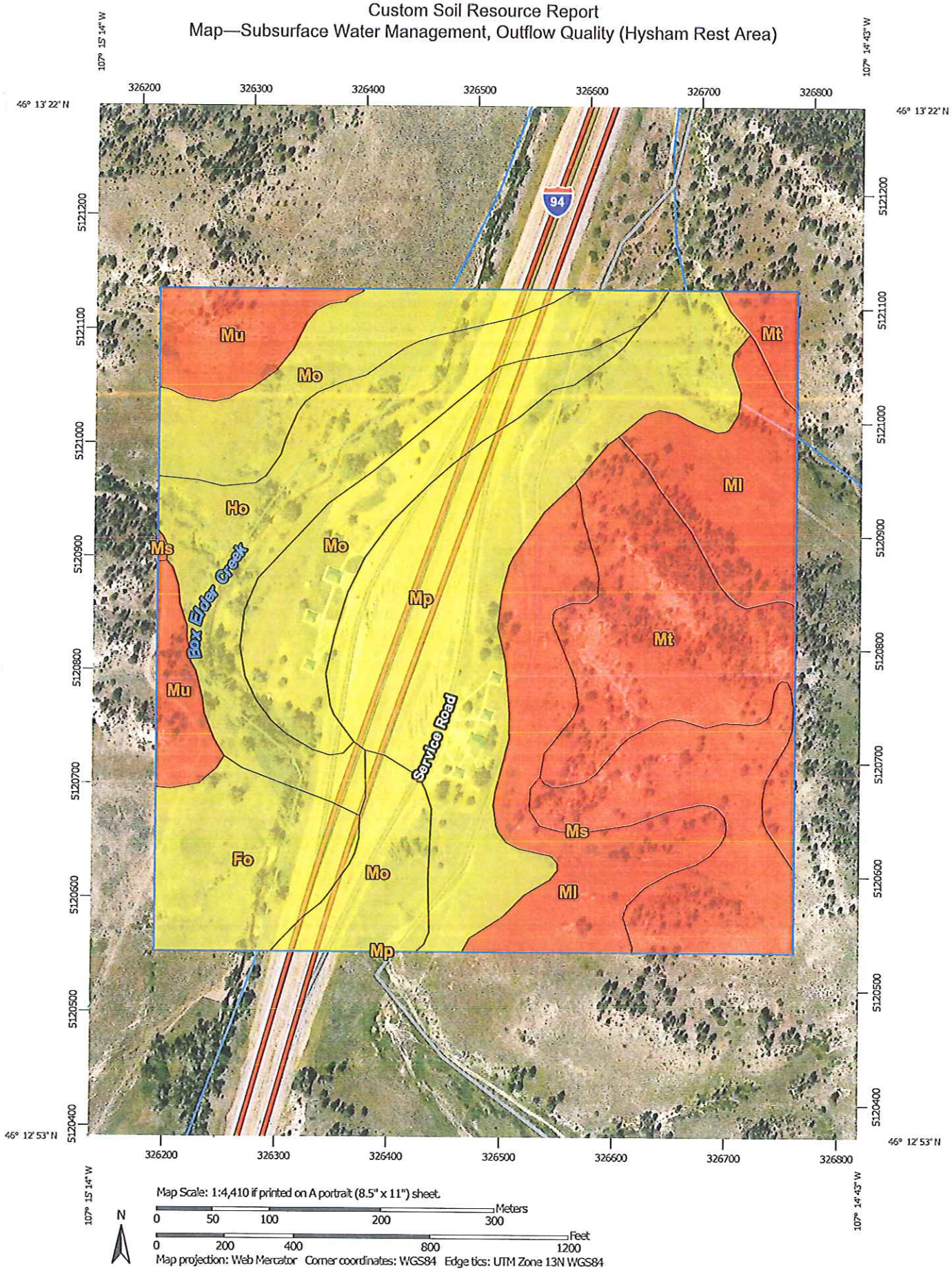
Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are

determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as that listed for the map unit. The percent composition of each component in a particular map unit is given so that the user will realize the percentage of each map unit that has the specified rating.

A map unit may have other components with different ratings. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Subsurface Water Management, Outflow Quality (Hysham Rest Area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

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 1:20,000.

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: http://websoilsurvey.nrcs.usda.gov
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: Treasure County, Montana
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 12, 2011—Jul 29, 2011

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.

Tables—Subsurface Water Management, Outflow Quality (Hysham Rest Area)

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Fo	Fort Collins loam, 1 to 4 percent slopes	Somewhat limited	Fort Collins (90%)	Pesticide and nutrient movement (0.22)	5.8	7.0%
Ho	Havre and Lohmiller soils	Somewhat limited	Harlem (30%)	Excess Salt (0.06)	10.8	13.1%
			Havre (30%)	Pesticide and nutrient movement (0.22)		
			Glendive (3%)	Pesticide and nutrient movement (0.22)		
			Havre (3%)	Pesticide and nutrient movement (0.22)		
MI	McRae-Bainville loams, 8 to 20 percent slopes	Very limited	McRae (65%)	Water Erosion (1.00)	12.5	15.2%
				Pesticide and nutrient movement (0.22)		
			Bainville (25%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
Mo	McRae and Havre loams, 1 to 4 percent slopes	Somewhat limited	McRae (50%)	Pesticide and nutrient movement (0.22)	14.7	17.9%
			Havre (45%)	Pesticide and nutrient movement (0.22)		
			Lohmiller (5%)	Pesticide and nutrient movement (0.00)		
Mp	McRae and Havre loams, 4 to 8 percent slopes	Somewhat limited	McRae (50%)	Pesticide and nutrient movement (0.22)	16.6	20.1%
				Water Erosion (0.10)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Havre (45%)	Water Erosion (0.23)		
				Pesticide and nutrient movement (0.22)		
			Cherry (3%)	Pesticide and nutrient movement (0.22)		
			Lohmiller (2%)	Pesticide and nutrient movement (0.00)		
Ms	Midway clay loam, 15 to 35 percent slopes	Very limited	Midway (70%)	Water Erosion (1.00)	6.9	8.4%
				Pesticide and nutrient movement (0.29)		
			Bainville (8%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
				Excess Salt (0.01)		
			McRae (6%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Lohmiller (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
Mt	Midway-Bainville complex	Very limited	Midway (50%)	Water Erosion (1.00)	10.3	12.6%
				Pesticide and nutrient movement (0.29)		
			Bainville (35%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		

Subsurface Water Management, Outflow Quality— Summary by Map Unit — Treasure County, Montana (MT103)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
			Travessilla (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			McRae (3%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Tullock (2%)	Pesticide and nutrient movement (1.00)		
				Water Erosion (1.00)		
Mu	Midway-Nihill gravelly loam	Very limited	Midway (60%)	Water Erosion (1.00)	4.6	5.6%
				Pesticide and nutrient movement (0.29)		
			Nihill (25%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
			Bainville (10%)	Water Erosion (1.00)		
				Pesticide and nutrient movement (0.22)		
				Excess Salt (0.01)		
Totals for Area of Interest					**82.3**	**100.0%**

Subsurface Water Management, Outflow Quality— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Somewhat limited	47.9	58.2%
Very limited	34.4	41.8%
Totals for Area of Interest	**82.3**	**100.0%**

Rating Options—Subsurface Water Management, Outflow Quality (Hysham Rest Area)

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Sanitary Facilities

This folder contains a collection of tabular reports that present soil interpretations related to sanitary facilities. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Sanitary facilities interpretations are tools designed to guide the user in site selection for the safe disposal of sewage and solid waste. Example interpretations include septic tank absorption fields, sewage lagoons, and sanitary landfills.

Sewage Disposal (Hysham Rest Area)

This table shows the degree and kind of soil limitations that affect septic tank absorption fields and sewage lagoons. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches or between a depth of 24 inches and a restrictive layer is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, saturated hydraulic conductivity (Ksat), depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Saturated hydraulic conductivity (Ksat) is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a Ksat rate of more than 14 micrometers per second are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Sewage Disposal (Hysham Rest Area)

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Fo—Fort Collins loam, 1 to 4 percent slopes					
Fort collins	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Arvada	5	Very limited		Not limited	
		Slow water movement	1.00		
Beckton	5	Very limited		Not limited	
		Slow water movement	1.00		
Ho—Havre and Lohmiller soils					
Harlem	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	1.00		
Havre	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
Havre	30	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
Bowdoin	4	Very limited		Somewhat limited	
		Slow water movement	1.00	Flooding	0.40
		Flooding	0.40		
Glendive	3	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.40	Flooding	0.40
Havre	3	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
MI—McRae-Bainville loams, 8 to 20 percent slopes					
Mcrae	65	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Bainville	25	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Cherry	4	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Lohmiller	4	Somewhat limited		Very limited	
		Slope	0.63	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Havre	2	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
		Flooding	0.40	Flooding	0.40
Mo—McRae and Havre loams, 1 to 4 percent slopes					
Mcrae	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Havre	45	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
				Slope	0.08
Lohmiller	5	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Mp—McRae and Havre loams, 4 to 8 percent slopes					
Mcrae	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Havre	45	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.92
				Seepage	0.50
Cherry	3	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Lohmiller	2	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Ms—Midway clay loam, 15 to 35 percent slopes					
Midway	70	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Bainville	8	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	0.50
Cherry	6	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Mcrae	6	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Nunn	4	Very limited		Somewhat limited	
		Slow water movement	1.00	Slope	0.92
Lohmiller	3	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Rock outcrop	3	Not rated		Not rated	

Sewage Disposal–Treasure County, Montana					
Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
Mt—Midway-Bainville complex					
Midway	50	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Bainville	35	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
				Seepage	0.50
Cherry	6	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Mcrae	3	Somewhat limited		Very limited	
		Slope	0.96	Slope	1.00
		Slow water movement	0.50	Seepage	0.50
Travessilla	3	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to hard bedrock	1.00
		Slope	1.00	Slope	1.00
Tullock	2	Very limited		Very limited	
		Slope	1.00	Depth to soft bedrock	1.00
		Depth to bedrock	1.00	Slope	1.00
		Filtering capacity	1.00	Seepage	1.00
Havre	1	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
		Flooding	0.40	Flooding	0.40
Mu—Midway-Nihill gravelly loam					
Midway	60	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
Nihill	25	Very limited		Very limited	
		Slope	1.00	Slope	1.00
		Seepage, bottom layer	1.00	Seepage	1.00
		Slow water movement	0.50		
Bainville	10	Very limited		Very limited	
		Depth to bedrock	1.00	Depth to soft bedrock	1.00
		Slope	1.00	Slope	1.00
				Seepage	0.50
Rock outcrop	5	Not rated		Not rated	

Soil Chemical Properties

This folder contains a collection of tabular reports that present soil chemical properties. The reports (tables) include all selected map units and components for each map unit. Soil chemical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

Chemical Soil Properties (Hysham Rest Area)

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg

concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Fo—Fort Collins loam, 1 to 4 percent slopes								
Fort collins	0-4	15-20	—	6.6-7.8	0	0	0	0
	4-12	20-25	—	7.4-8.4	0	0	0	0
	12-60	15-20	—	7.9-9.0	5-15	0	0.0-2.0	0
Arvada	0-6	15-20	—	6.6-7.8	0	0	0.0-2.0	0
	6-17	25-35	—	7.4-9.0	0	0	1.0-8.0	10-20
	17-60	20-25	—	7.9-9.0	5-15	0	8.0-16.0	13-30
Beckton	0-6	20-25	—	6.6-7.8	0	0	0.0-2.0	0
	6-22	25-35	—	7.4-9.0	0	0	1.0-8.0	10-20
	22-60	20-25	—	7.9-9.0	5-15	0	8.0-16.0	13-30

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Ho—Havre and Lohmiller soils								
Harlem	0-8	20-25	—	7.4-8.4	1-5	0	2.0-4.0	0
	8-40	25-30	—	7.4-8.4	5-10	0	2.0-4.0	0
	40-60	15-20	—	7.9-9.0	5-10	0	4.0-8.0	0
Havre	0-8	15-20	—	7.4-8.4	1-5	0	0.0-2.0	0
	8-60	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
Havre	0-8	25-30	—	7.4-8.4	1-5	0	0.0-2.0	0
	8-60	15-20	—	7.4-8.4	1-5	0	0.0-4.0	0
Bowdoin	0-7	30-50	—	7.4-9.0	1-5	0	8.0-16.0	5-13
	7-42	35-55	—	7.4-9.0	1-5	0	8.0-16.0	13-30
	42-62	30-45	—	7.9-9.0	1-5	0	8.0-16.0	13-30
Glendive	0-8	10-15	—	7.4-8.4	0	0	0.0-2.0	0
	8-18	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	18-60	1.0-5.0	—	7.4-8.4	5-10	0	0.0-4.0	0
Havre	0-5	15-20	—	7.4-8.4	1-5	0	0.0-2.0	0
	5-60	15-25	—	7.4-8.4	1-10	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
MI—McRae-Bainville loams, 8 to 20 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Bainville	0-4	15-20	—	6.6-7.8	1-5	0	0	0
	4-26	10-15	—	7.4-8.4	5-10	0	0.0-4.0	0
	26-60	—	—	—	—	—	—	—
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Lohmiller	0-7	15-20	—	6.6-8.4	0	0	0	0
	7-60	10-15	—	6.6-8.4	0-5	0	0	0
Havre	0-9	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	9-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

SECTION 02540 – SEPTIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract apply to this Section.

B. Codes and Standards:
1. Install the Work described in the Specifications and the Drawings to comply with the requirements of legally constituted authorities having jurisdiction, including local and state codes and ordinances. The codes and ordinances having jurisdiction over the Work, serve as minimum requirements. Follow the requirements of the Drawings and Specifications if in excess of the codes and ordinances.
2. The Work is governed by the following codes and standards:
   a. Montana Department of Environmental Quality. (MDEQ)
   b. National Electrical Code (NEC).
   c. Occupational Safety and Health Act (OSHA).
   d. Environmental Protection Agency (EPA)
   e. State of Montana Fire Marshal
   f. Treasure County Health Department (TCHD)
   g. Montana Public Works Standard Specifications (MPWSS)

1.2 SUBMITTALS

A. Product Data for each type of pipe, pipe accessory, pumps, tanks, tank accessory, manhole, manhole accessory, frame and cover specified.

B. Project Record Documents: Accurately record the following.

C. Actual locations of pipe runs, connections, manholes, cleanouts, and invert elevations.

D. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.3 SUMMARY

A. This Section includes:
1. Septic tanks.
2. Sewage/effluent pump.
3. Distribution piping.
4. Dosing chamber.
5. Pressure Pipe.
6. Leaching piping.
7. Drainfield materials.
8. Drainfield fill materials.

B. The purpose of the Specifications and Drawings is to set forth the requirements for an On-Site Public Waste Water Treatment System for the Hysham Rest Area in Treasure County, MT. Design work, if required, is to be furnished by the Contractor and must be accomplished by a licensed professional. The installer must be qualified and licensed to install Sewage Treatment Systems in Treasure County, MT.

C. The Contractor shall furnish all labor, materials, equipment, tools, transportation and supplies required to complete work in accordance with the plans, specifications, and terms of the contract and provide a complete and satisfactory system. Perform excavation, back filling, compacting, and grading operations, as required for below-grade improvements and to achieve contours and elevations per Plans and Specifications. Provide trenching, installation, backfill operations and all mechanical, electrical and utility work. Provide suitable sub-base materials, bedding fill materials for water and sewer components lines, drainfield trenches, tank installation, etc. Provide suitable fill from off-site if on-site quantities or quality are insufficient.

D. The work covered by this contract is generally identified as follows:

1. Contractor shall excavate to the lines and grades as shown on the plans and specifications. The excavation shall meet all safety requirements, permit adequate inspection and permit the construction of various contiguous components required.
2. Contractor shall remove abandoned piping, boulders, undesirable or deleterious materials encountered during the excavation process.
3. Excavated materials shall be stockpiled in locations that allow construction to proceed. Excess excavated material or materials that cannot be conveniently stockpiled on the site shall be removed to a location selected by the Owner, and shall then be returned to the site as necessary to be used as random backfill.
4. Excavation of all trenches and pits shall be sloped or otherwise supported in a safe manner in accordance with applicable state and federal safety requirements.
5. Contractor shall excavate all material and set tanks to elevations shown on the plans and profiles.
6. The excavated and surrounding area shall be protected from any and all surface water. Pumps and related appurtenances shall be readily available to remove ground and surface waters. Standing water will not be permitted in the excavation. Temporary ditches or drains shall be constructed to control ground and surface waters and protect the site.
7. The Engineer shall be notified daily when the site is being prepared and ready for aggregate placement, pouring, etc., in ample time for inspection and approval.
8. The excavated "bearing area" shall be protected from freeze/thaw or wet/dry conditions.
9. If unexpected soft or yielding sub-grade is encountered the Engineer shall be notified.
10. Upon completion of excavation and placement of materials as described, the Contractor shall notify Engineer that sub-grade soils are ready for testing. Contractor will not proceed until excavation, fill placement and compaction has been approved by the Engineer.
11. During cold weather, excavate to expose only as much soil as it is possible to protect from freezing. Fill material shall not be placed over frozen materials. Where freezing is likely ground shall be covered and insulated.
12. If natural clays are present, excavation work must be undertaken carefully to minimize disturbance due to moisture, construction equipment and foot traffic. If any soils become disturbed, they shall be removed prior to placing fill material or constructing foundation elements. If, during the course of construction, any native clays are encountered in areas which would directly or indirectly affect the structural integrity of the sewer treatment system components. The contractor shall remove and stockpile these clay layers, then replace and compact to maximum density with

a more suitable structural fill material. All imported fill materials shall be tested for proper density by the Engineer. After the recommendations of the soil testing laboratory have been reviewed and approved by the Engineer, the work may proceed.

13. Install pumps, controls, alarms etc., as required for onsite sewer system operations. Provide installation, wiring, and all site work, mechanical work and electrical work.
14. Each pump has been sized based on hydraulic analysis and pump performance curves.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Precast Concrete Septic Tanks/Manholes:

1. Description: Precast, reinforced-concrete tank with internal baffles and covers; designed for structural loading according to ASTM C 890 and made according to ASTM C 1227.
   a. Inlet and Outlet Access: 24 inches in diameter, reinforced concrete access lids with steel lift rings. Include access centered over inlet and outlet.
   b. Manhole: 48 inches in diameter, reinforced-concrete access lid with steel lift rings.
   c. Concrete must be 4000 PSI at 28 days.
   d. Cement is type V, with max C3A of 8%per MT DEQ-4
   e. Each tank segment must be pour monothically.
   f. Reinforcing of tanks is #4 grade 60 rebar.
   g. Maximum earth cover is 6 feet.
   h. Tanks must be placed on compacted ¾" road-base or similar material. Minimum relative compaction is 95%. Do not use flow backfill material such as ¾ washed gravels.
   i. Tanks must be backfilled to top before water testing.
   j. Tanks must be sealed with 1" diameter conseal.
   k. All tanks must be water tight. Tanks used for commercial facilities, multiple-user systems or public systems must be tested in place for water tightness. Water tightness testing for concrete tanks may be conducted using a water test or vacuum test.
      i. Water testing must be conducted by sealing the outlets, filling the septic tank to its operational level, and allowing the tank to stand for at least eight (8) hours. If there is a measurable loss (2 inches or more), refill the tank and let stand for another 8 hours. If there is again a measurable loss, the tank must be rejected.
      ii. Vacuum testing must be conducted by sealing all inlets, outlets, and accesses, then introducing a vacuum of 4 inches of mercury. If the vacuum drops in the first 5 minutes, it must be brought back to 4 inches of mercury. If the septic tank fails to hold the vacuum at 4 inches of mercury for 5 minutes, the tank must be rejected

B. Drainfield Dosing Tanks:
1. Description: Single or Double-chamber precast, reinforced-concrete tank with internal baffles and covers
   a. Risers shall be required for access to internal vaults and access into the

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mo—McRae and Havre loams, 1 to 4 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Havre	0-7	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	7-39	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	39-60	15-25	—	7.4-9.0	1-5	0	2.0-8.0	0
Lohmiller	0-20	20-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	20-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mp—McRae and Havre loams, 4 to 8 percent slopes								
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	0-10	0	0.0-2.0	0
	10-39	15-20	—	7.4-8.4	5-15	0	0.0-2.0	0
	39-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Havre	0-7	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	7-39	15-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	39-60	15-25	—	7.4-9.0	1-5	0	2.0-8.0	0
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Lohmiller	0-20	20-25	—	7.4-8.4	1-5	0	0.0-2.0	0
	20-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Ms—Midway clay loam, 15 to 35 percent slopes								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Bainville	0-3	10-15	—	7.4-9.0	5-10	0	0.0-4.0	0
	3-15	5.0-10	—	7.4-9.0	10-15	0	0.0-4.0	1-5
	15-60	—	5.0-10	—	15-25	—	2.0-8.0	1-5
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	5-10	0	0.0-2.0	0
	10-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Nunn	0-6	20-25	—	6.1-7.8	0	0	0	0
	6-14	25-30	—	6.6-8.4	0	0	0	0
	14-60	20-25	—	7.4-9.0	5-15	0	0	1-5
Lohmiller	0-7	15-20	—	6.6-8.4	0	0	0	0
	7-60	10-15	—	6.6-8.4	0-5	0	0	0
Rock outcrop	—	—	—	—	—	—	—	—

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mt—Midway-Bainville complex								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Bainville	0-3	15-20	—	6.6-7.8	1-5	0	0	0
	3-22	10-15	—	7.4-8.4	5-10	0	0.0-4.0	0
	22-60	—	—	—	—	—	—	—
Cherry	0-3	15-20	—	6.1-7.8	0	0	0	0
	3-14	10-15	—	6.6-7.8	0	0	0	0
	14-40	10-15	—	7.4-8.4	5-15	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-9.0	3-12	0	0.0-4.0	0
Mcrae	0-4	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	4-10	15-20	—	7.4-8.4	5-10	0	0.0-2.0	0
	10-60	10-15	—	7.4-9.0	5-15	0	0.0-4.0	0
Travessilla	0-2	10-15	—	6.6-8.4	0	0	0	0
	2-12	5.0-10	—	7.4-9.0	5-10	0	0.0-2.0	0
	12-60	—	—	—	—	—	—	—
Tullock	0-8	10-15	—	7.9-8.4	1-5	0	0	0
	8-28	5.7-13	—	7.9-8.4	5-10	0	0	0
	28-60	—	—	—	—	—	—	—
Havre	0-9	15-20	—	6.1-8.4	1-5	0	0.0-2.0	0
	9-60	15-25	—	7.4-9.0	1-5	0	0.0-4.0	0

Chemical Soil Properties–Treasure County, Montana								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Mu—Midway-Nihill gravelly loam								
Midway	0-2	20-25	—	6.6-7.8	0	0	0	0
	2-16	20-25	—	7.4-8.4	5-10	0	0	0
	16-60	—	—	—	—	—	—	—
Nihill	0-8	15-20	—	6.6-8.4	0	0	0.0-2.0	0
	8-40	15-20	—	7.4-8.4	0	0	0.0-2.0	0
	40-60	5.0-10	—	7.4-8.4	5-15	0	0.0-2.0	0
Bainville	0-4	10-15	—	7.4-9.0	5-10	0	0.0-4.0	0
	4-19	5.0-10	—	7.4-9.0	15-25	1-5	2.0-8.0	1-5
	19-60	—	—	—	—	—	—	—
Rock outcrop	—	—	—	—	—	—	—	—

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties (Hysham Rest Area)

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the

surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

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.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba).

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Fo—Fort Collins loam, 1 to 4 percent slopes														
Fort collins	90	B	0-4	Loam	CL-ML	A-4	0	0	100	100	85-95	60-75	25-30	5-10
			4-12	Clay loam, loam	CL	A-6	0	0	100	100	85-95	65-80	25-35	10-15
			12-60	Loam, clay loam	CL-ML	A-4	0	0	100	100	85-95	60-75	25-30	5-10
Arvada	5	D	0-6	Loam	CL-ML	A-4	0	0	80-100	75-100	60-90	50-80	25-30	5-10
			6-17	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	90-100	90-100	85-100	75-95	40-60	20-40
			17-60	Clay loam, sandy clay loam, clay	CH, CL, SC	A-6, A-7	0	0	90-100	90-100	80-95	45-75	35-55	15-35
Beckton	5	D	0-6	Clay loam	CL	A-6	0	0	80-100	75-100	65-95	60-90	25-40	10-20
			6-22	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	90-100	90-100	85-100	75-95	40-60	20-40
			22-60	Clay loam, sandy clay loam, clay	CH, CL, SC	A-6, A-7	0	0	90-100	90-100	80-95	45-75	35-55	15-35

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Ho—Havre and Lohmiller soils														
Harlem	30	C	0-8	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	70-90	35-45	15-20
			8-40	Stratified clay to silty clay loam	CH, CL	A-7	0	0	100	100	95-100	85-95	40-65	20-40
			40-60	Stratified silty clay loam to fine sandy loam	CL, CL-ML	A-4, A-6	0	0	100	100	85-95	60-75	20-40	5-15
Havre	30	B	0-8	Loam	CL-ML, ML	A-4	0	0	100	100	80-95	60-75	20-30	NP-10
			8-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15
Havre	30	C	0-8	Clay	CH, CL	A-6, A-7	0	0	100	100	85-100	75-95	35-55	15-30
			8-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15
Bowdoin	4	D	0-7	Clay	CH	A-7	0	0	100	100	90-100	80-95	60-85	30-55
			7-42	Clay	CH	A-7	0	0	100	100	90-100	80-95	60-85	30-55
			42-62	Clay	CH	A-7	0	0	100	100	90-100	80-95	55-80	30-50
Glendive	3	B	0-8	Fine sandy loam	ML, SM	A-4	0	0	100	100	70-85	40-55	—	NP
			8-18	Stratified very fine sandy loam to silt loam	ML	A-4	0	0	100	95-100	85-95	60-85	25-35	NP-5

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			18-60	Extremely gravelly loamy sand, very gravelly sand, extremely gravelly sand	GP, GP-GM	A-1	0	0-5	30-45	20-35	10-25	0-10	—	NP
Havre	3	B	0-5	Loam	CL-ML, ML	A-4	0	0	100	100	80-95	60-75	20-30	NP-10
			5-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	50-70	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
MI—McRae-Bainville loams, 8 to 20 percent slopes														
Mcrae	65	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Bainville	25	C	0-4	Loam	CL-ML, ML	A-4	0	0	100	100	95-100	75-90	20-30	NP-10
			4-26	Silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-90	20-35	5-15
			26-60	Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	4	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Silt loam, clay loam, loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Lohmiller	4	B	0-7	Clay loam	CL	A-6	0	0-5	85-100	80-100	65-90	60-80	30-35	10-15
			7-60	Loam, clay loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	85-100	80-100	65-90	60-80	25-35	5-15
Havre	2	B	0-9	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			9-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mo—McRae and Havre loams, 1 to 4 percent slopes														
Mcrae	50	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Havre	45	B	0-7	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			7-39	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
			39-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Lohmiller	5	C	0-20	Clay loam	CL	A-6	0	0	100	100	85-100	75-95	30-40	10-20
			20-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mp—McRae and Havre loams, 4 to 8 percent slopes														
Mcrae	50	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-39	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			39-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Havre	45	B	0-7	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			7-39	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
			39-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Cherry	3	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Lohmiller	2	C	0-20	Clay loam	CL	A-6	0	0	100	100	85-100	75-95	30-40	10-20
			20-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-6, A-4	0	0	100	100	80-95	60-80	20-35	5-15

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Ms—Midway clay loam, 15 to 35 percent slopes														
Midway	70	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Bainville	8	D	0-3	Loam	CL-ML	A-4	0	0	90-100	85-100	65-85	55-75	25-30	5-10
			3-15	Loam, clay loam, silty clay loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-100	60-90	55-85	25-35	5-15
			15-60	Unweathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	6	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Mcrae	6	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Nunn	4	C	0-6	Clay loam	CL	A-6	0	0	100	95-100	85-100	70-80	25-40	10-20
			6-14	Silty clay, silty clay loam, clay	CL	A-7	0	0	100	95-100	95-100	90-95	40-50	20-30

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			14-60	Silty clay loam, clay loam, silt loam	CL	A-6, A-7	0	0	100	95-100	95-100	85-95	30-50	10-25
Lohmiller	3	B	0-7	Clay loam	CL	A-6	0	0-5	85-100	80-100	65-90	60-80	30-35	10-15
			7-60	Loam, clay loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	85-100	80-100	65-90	60-80	25-35	5-15

Engineering Properties–Treasure County, Montana															
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
Mt—Midway-Bainville complex														
Midway	50	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Bainville	35	C	0-3	Loam	CL-ML, ML	A-4	0	0	100	100	95-100	75-90	20-30	NP-10
			3-22	Silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-90	20-35	5-15
			22-60	Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Cherry	6	B	0-3	Clay loam	CL	A-6	0	0	95-100	90-100	80-100	60-80	30-35	10-15
			3-14	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			14-40	Loam, silt loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	75-95	55-80	25-35	5-15
			40-60	Sandy loam, silt loam	CL-ML, ML	A-4	0	0	90-100	85-100	70-90	50-75	20-30	NP-10
Mcrae	3	B	0-4	Loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	70-95	50-70	25-35	5-15
			4-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
			10-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-10	90-100	80-100	75-95	50-70	25-35	5-15
Travessilla	3	D	0-2	Loam	CL-ML, ML	A-4	0	0-10	90-100	85-100	65-85	55-75	20-30	NP-10
			2-12	Sandy loam, fine sandy loam, loam	ML, SM	A-4	0	0-10	90-100	85-100	55-80	40-70	20-30	NP-5

Engineering Properties–Treasure County, Montana														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
			12-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Tullock	2	A	0-8	Fine sandy loam	ML, SM	A-4	0	0	100	100	75-95	35-55	20-25	NP-5
			8-28	Fine sandy loam	ML, SM	A-4	0	0	100	100	75-95	35-55	20-25	NP-5
			28-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Havre	1	B	0-9	Loam	CL-ML	A-4	0	0	100	100	80-95	60-90	20-30	5-10
			9-60	Stratified fine sandy loam to clay loam	CL, CL-ML	A-4, A-6	0	0	100	100	80-95	60-80	20-35	5-15
Mu—Midway-Nihill gravelly loam														
Midway	60	D	0-2	Clay loam	CL	A-6, A-7	0	0	100	100	90-100	80-90	30-45	10-20
			2-16	Silty clay loam, clay loam, clay	CH, CL	A-7	0	0	100	100	90-100	70-95	40-60	15-35
			16-60	Bedrock	—	—	—	—	—	—	—	—	—	—
Nihill	25	B	0-8	Gravelly loam	CL-ML, GM, ML, SM	A-4	0	0-10	70-85	60-75	50-65	40-60	20-30	NP-10
			8-40	Gravelly loam, channery loam, very gravelly loam	GC-GM, GM, SC-SM, SM	A-1, A-2, A-4	0	0-15	40-80	30-70	25-60	20-50	20-30	NP-10
			40-60	Stratified extremely gravelly sandy loam to very gravelly loam	GC-GM, GM	A-1, A-2	0	0-25	45-60	40-55	30-45	20-35	15-30	NP-10
Bainville	10	D	0-4	Loam	CL-ML	A-4	0	0	90-100	85-100	65-85	55-75	25-30	5-10
			4-19	Loam, clay loam, silty clay loam	CL, CL-ML	A-4, A-6	0	0	90-100	85-100	60-90	55-85	25-35	5-15
			19-60	Unweathered bedrock	—	—	—	—	—	—	—	—	—	—

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.

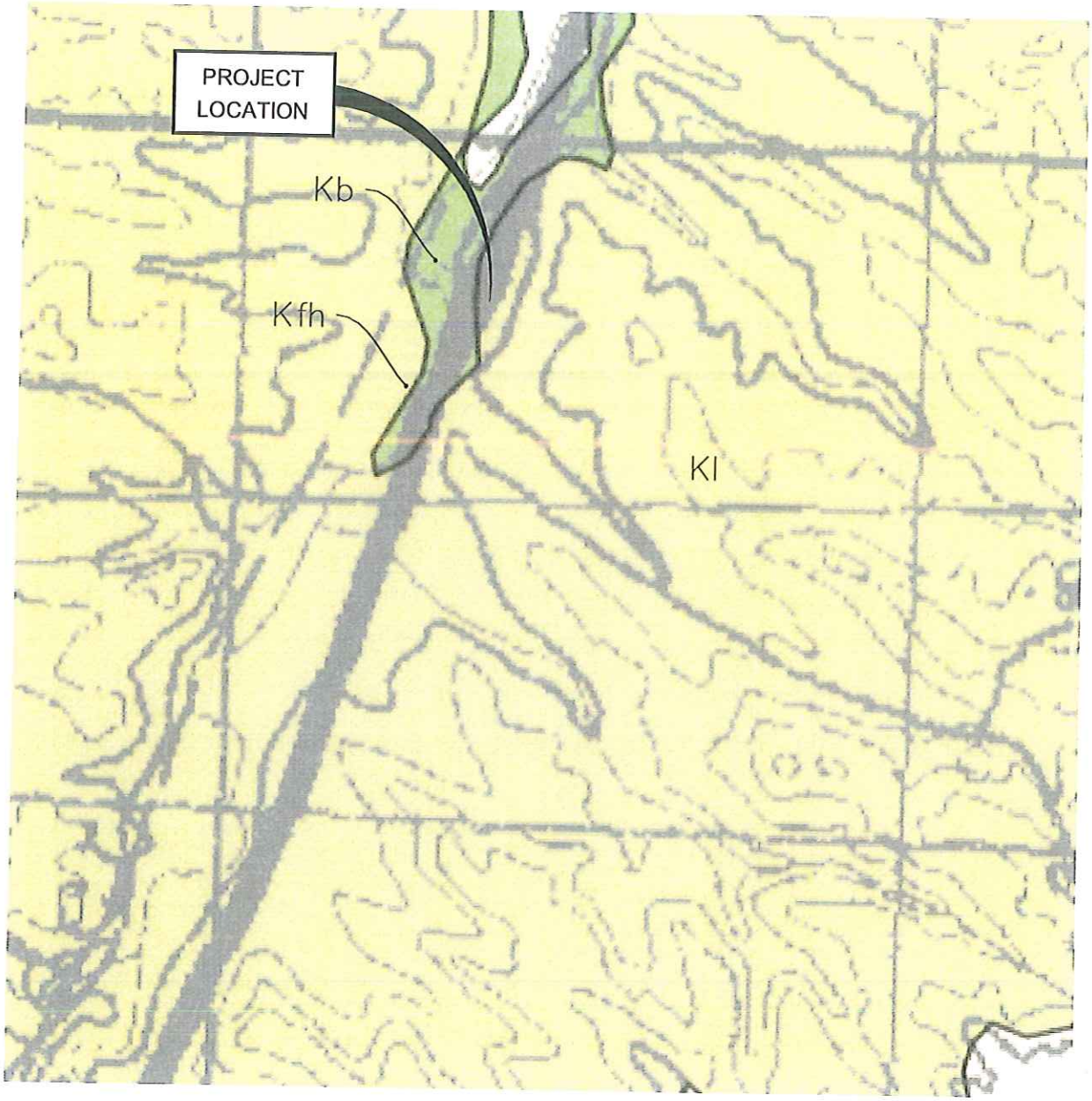
United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

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

APPENDIX D

GEOLOGIC MAP OF HYSHAM
30' x 60' quadrangle



MAP UNITS

Kl - Lance Formation (Upper Cretaceous)

Kfh - Fox Hills Formation (Upper Cretaceous)

Kb - Bearpay Shale (Upper Cretaceous)

DOWL HKM
2090 Stadium Drive
406-586-6834
Bozeman, Montana 59715
www.dowlhkm.com

HYSHAM REST AREA
GEOLOGIC SURVEY MAP

PROJECT	24.11355.01
DATE	09/18/2014

FIGURE #1

O:\24\116\ACT 106\GEOLOGIC FIGURE.dwg PLOT DATE 2014-9-18 13:42 SAVED DATE 2014-09-18 13:24 USER: bduffey

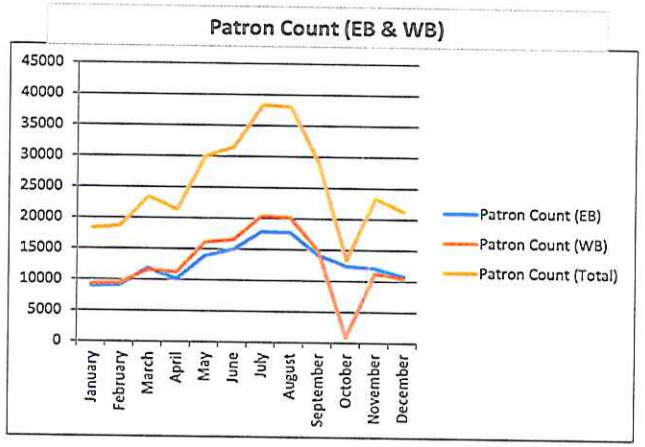
APPENDIX E

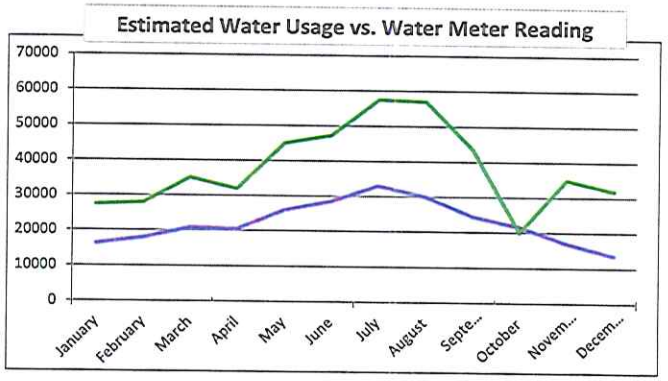
HYSHAM REST AREA FLOW DATA

Hysham Rest Area Patron and Water Usage

Rest Area:	Hysham
Month:	Year Total
Year:	2013

Date	Combined Door Count	Patron Count (EB)	Patron Count (WB)	Patron Count (Total)	Combined Water Meter Reading (gpd)	Estimated Water Usage (Patron Count x 1.5 gal/Patron Count)
January	36642	9000	9321	18321	18300	27482
February	37362	9208	9473	18681	17950	28022
March	46978	11852	11637	23489	20850	35234
April	42700	10166	11184	21350	20430	32025
May	60068	13924	16110	30034	25970	45051
June	63074	14987	16550	31537	28580	47306
July	76671	17853	20483	38336	33070	57503
August	76110	17806	20250	38055	30100	57083
September	58077	14191	14848	29039	24530	43558
October	26648	12422	902	13324	21610	19986
November	46758	12109	11270	23379	17040	35059
December	42545	10766	10507	21273	13620	31909
	Annual Average	425	420			
	Summer Average	550	623			
	Peak	822	843			





APPENDIX F

EXISTING WELL LOGS

MONTANA WELL LOG REPORT

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

Other Options

Go to GWIC website
Plot this site on a topographic map
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:13 PM)

Site Name: HYSHAM REST AREA WESTBOUND
GWIC Id: 17257
DNRC Water Right: W163867-00

Section 1: Well Owner(s)

1) MT DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT N/A [06/25/1999]
2) MONTANA HIGHWAY COMMISSION (MAIL)
C/O WALT RAFFELSON
CUSTER MT 59024 [01/31/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	SW¼ NW¼ NE¼ NW¼

County: TREASURE **Geocode:**

Latitude	Longitude	Geomethod	Datum
46.2197	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2865			

Measuring Point Altitude	Method	Datum	Date Applies
2866.6			9/23/1997 12:16:00 PM

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

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, January 28, 1966

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	65	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	63	6				20 LB STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
63	65	0			OPEN HOLE

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 65
Static Water Level: 14
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
28 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 43 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 NE OF RESTROOMS NEAR PICNIC TABLE SAMPLING PT -FAUCET ON FRONT OF RESTROOM BLDG OR UNDERGROUND SPRINKLER SYSTEM OUTLETS WESTBOUND REST AREA ACCESSED UTILITY ROOM WITH CARETAKER HYSHAM RESTAREA I94 WEST

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	5	GRAYISH TAN SANDY SILT
5	15	CHANGES TO GRAY SANDY CLAY
15	20	TRACES OF GRAVEL
20	25	GRAY SANDY CLAY SOME SURFACE WATER
25	35	GRAY SHALE
35	55	BLUISH GRAY CLAY
55	63	SOME TRACES GRAVEL. INCREASING AMOUNTS OF SAND TO COARSE ROCK AT 63 FT.
63	65	BOTTOMED HOLE IN GRAVEL AND DARK GRAY SAND

Driller Certification

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

Name:

Company: FOX
License No: -
Date Completed: 1/28/1966

MONTANA WELL LOG REPORT

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

Other Options

Go to GWIC website
Plot this site on a topographic map
View hydrograph for this site
View field visits for this site
View scanned well log (6/7/2010 1:21:07 PM)

Site Name: HYSHAM REST AREA EASTBOUND
GWIC Id: 163054

Section 1: Well Owner(s)

1) HYSHAM REST STOP EAST BOUND (MAIL)
N/A
N/A MT N/A [03/14/2003]
2) MONTANA DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT 59105 [09/23/1997]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SE¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2184	107.2493	NAV-GPS	NAD27

Ground Surface Altitude	Method	Datum	Date
2900			

Measuring Point Altitude	Method	Datum	Date Applies
2901.4			9/23/1997 11:25:00 AM

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

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, August 18, 1988

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	35.5	10
25	200	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	35.5	7				23LB STEEL
25	200	4		165.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
28	200	4		1/8	SLOTS

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 200
Static Water Level: 46.89
Water Temperature:

Air Test *

50 gpm with drill stem set at _ feet for 2 hours.
Time of recovery 1 hours.
Recovery water level 40 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 EAST OF BUILDING RESTROOMS AT PICNIC TABLES USED UTILITY SINK FAUCET FOR CHEM NEED TO CONTACT CARETAKER FOR ACCESS NEWEST WELL AT REST AREAS 2 OLDER SHALLOW WELLS ON WEST SIDE IRRIGATION PIPES ACROSS TO THIS SIDE

Section 9: Well Log

Geologic Source

211LHUD - LANCE-HELL CREEK UNDIFFERENTIATED

From	To	Description
0	28	SILT CLAY
28	35	BROWN SANDSTONE
35	50	LIGHT SHALE
50	81	LIGHT SANDSTONE
81	121	SHALE
121	160	GREY SANDSTONE
160	173	GREY SHALE
170	200	GREY SANDSTONE

Driller Certification

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

Name: WILLIAM KUPFNER
Company: ROCK CREEK DRILLING INC
License No: WWC-300
8/18/1988

Date Completed:

MONTANA WELL LOG REPORT

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

Other Options

Go to GWIC website
Plot this site on a topographic map
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:42 PM)

Site Name: MONTANA HIGHWAY COMMISSION - HYSHAM WESTBOUND IRRIGATION
GWIC Id: 17256

Section 1: Well Owner(s)

1) MONTANA HIGHWAY COMMISSION (MAIL)
HELENA
N/A N/A N/A [02/03/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SW¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2186	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2870			

Measuring Point Altitude	Method	Datum	Date Applies
2871.7			9/23/1997 9:30:00 AM

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

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, February 03, 1966

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	61.5	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 75
Static Water Level: 24
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
16 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 40 feet.

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

Section 8: Remarks

IRRIGATION ONLY WELL BOTH REST AREAS PUMP RUNNING ALL NIGHT

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	10	TAN TO GRAY SANDY SILT WITH SOME CLAY
10	34	GRAY SANDY REWORKED SHALE WITH SOME GRAVEL
34	60	GRAY CLAY
60	61.5	GRAY SANDY SHALE
61.5	70	BOTTOM OF CASING SHOE. SOFT GRAY SANDSTONE
70	75	GRAY SANDY GRAVEL

Driller Certification

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

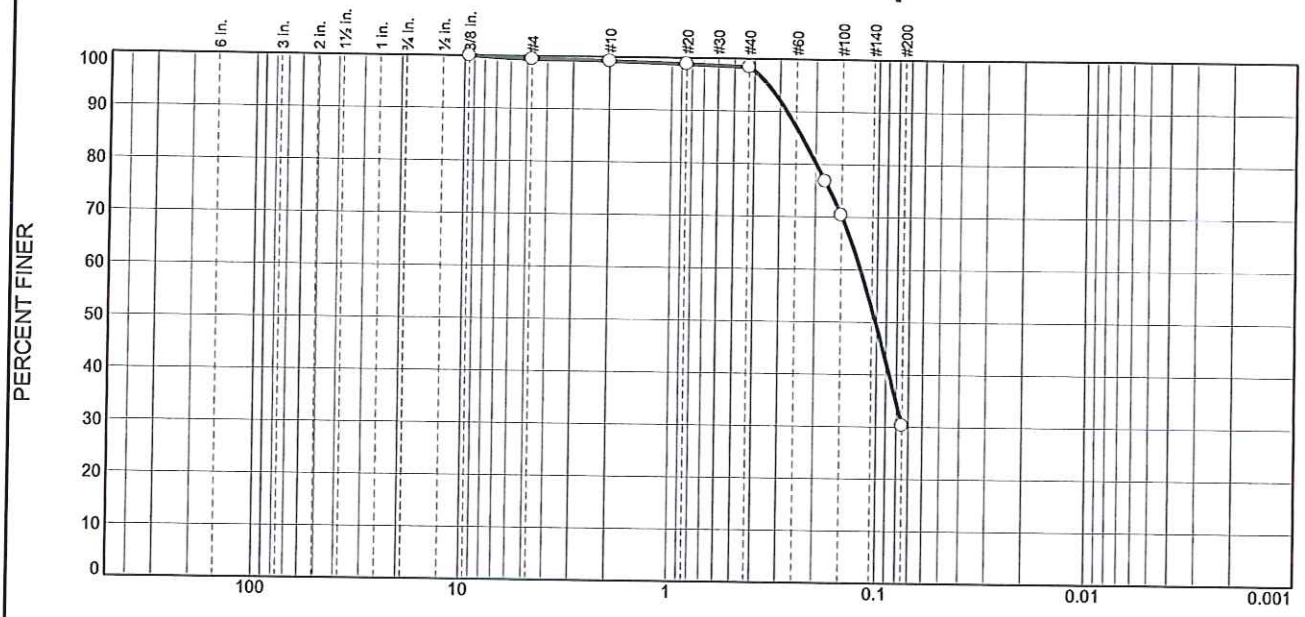
Name:
Company: FOX
License No: -

Date Completed: 2/3/1966

APPENDIX G

LABORATORY TEST RESULTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	0.2	0.8	68.1	30.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.375	100.0		
#4	99.4		
#10	99.2		
#20	98.8		
#40	98.4		
#80	76.8		
#100	70.4		
#200	30.3		

* (no specification provided)

Material Description

silty sand

Atterberg Limits (ASTM D 4318)

PL= 25 LL= 30 PI= 5

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 0.2770 D_{85}= 0.2328 D_{60}= 0.1206
D_{50}= 0.1015 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sampled By:DOWL HKM

Date Received: **Date Tested:** 9/17/14

Tested By: MC

Checked By: MC

Title: Lab Manager

Location: TP-5
Sample Number: 29633 **Depth:** 1.5-2.0' **Date Sampled:**

BILLINGS, MONTANA

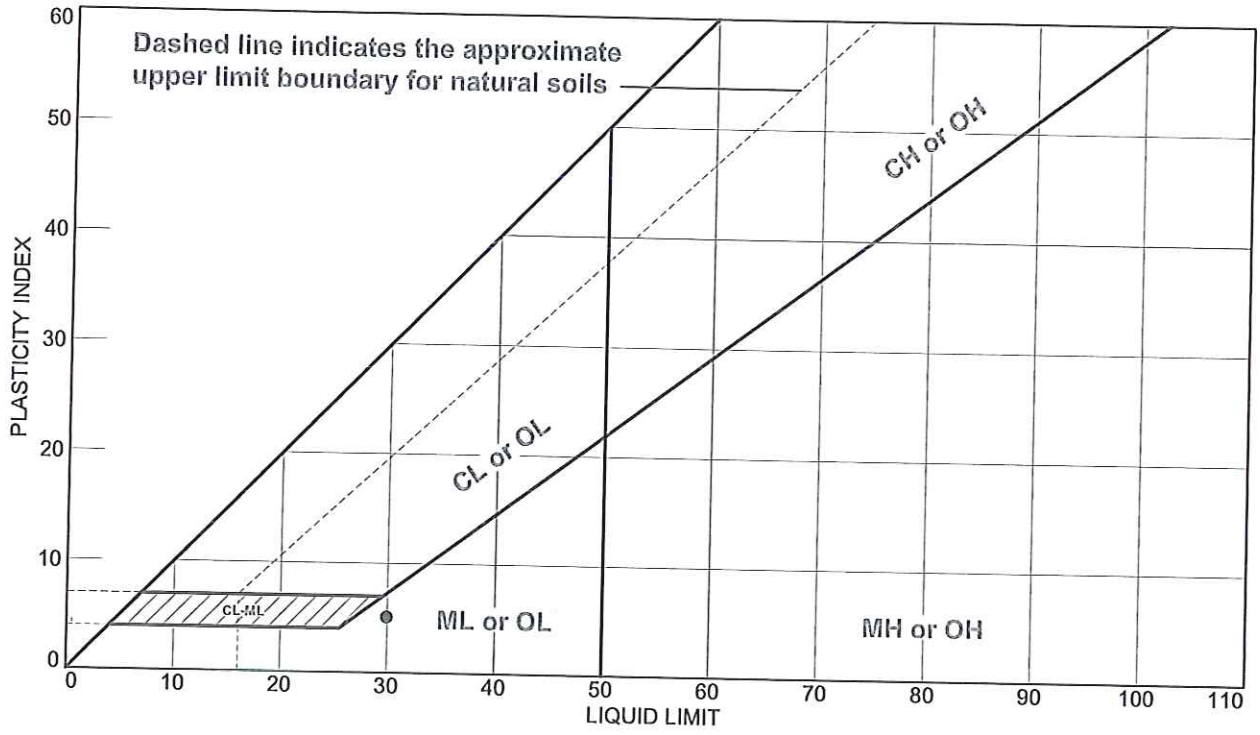
DOWL HKM

Client: MDOT
Project: Hysham Rest Area Phase 1

Project No: 4524.11355.01 **Figure** 01

Tested By: _____ **Checked By:** _____

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●		29633	1.5-2.0'		25	30	5		SM

BILLINGS, MONTANA

DOWL HKM

Client: MDOT

Project: Hysham Rest Area Phase 1

Project No.: 4524.11355.01

Figure 01

Tested By: _____ **Checked By:** _____

SUMMARY OF PHYSICAL PROPERTIES TEST RESULTS

DOWL HKM

LAB NUMBER	LOCATION	DEPTH RANGE	CLASSIFICATION SYMBOL	SMALLER THAN 0.005 mm	0.005 to 0.074 mm	SAND NO. 200(0.075 mm) TO NO. 4(4.76 mm)	GRAVEL NO. 4(4.76 mm) TO 3 IN.(76.2 mm)	COBBLES 3 IN.(76.2 mm) TO 5 IN.(127 mm)	OVERSIZE LARGER THAN 5 IN.(127 mm)	LIQUID LIMIT - %	PLASTICITY INDEX - %	MAXIMUM DRY UNIT WEIGHT(D698)-pcf	OPTIMUM MOISTURE CONTENT - %	OVERSIZE SPEC. GRAV.(BULK)	ABSORPTION	MINUS #4 SPECIFIC GRAVITY	LA Abrasion-Grading A, % Loss	CALIFORNIA BEARING RATIO	NATURAL MOISTURE - %	Resistivity (Ohm-Cm) Natural Moisture	Resistivity (Ohm-Cm) Saturated	pH	WATER SOLUBLE SO4 - %
29633	TP-5	1.5-2.0'	SM		30.3	69.1	0.6			30	5								7.7				

APPENDIX H

PHOTOGRAPHS

Hysham Rest Area

Test Pit #1

July 2, 2014

Hysham Rest Area

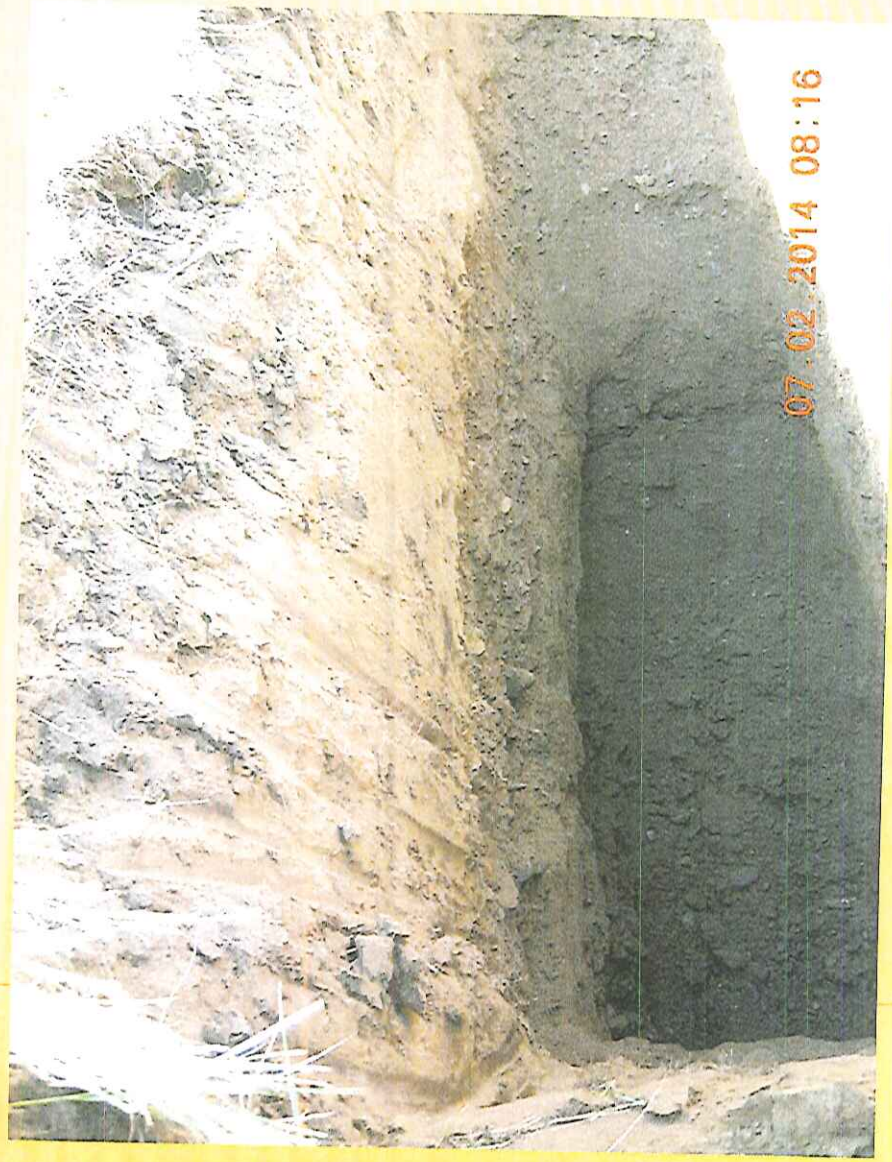
Test Pit #2

July 2, 2014

Hysham Rest Area

Test Pit #3

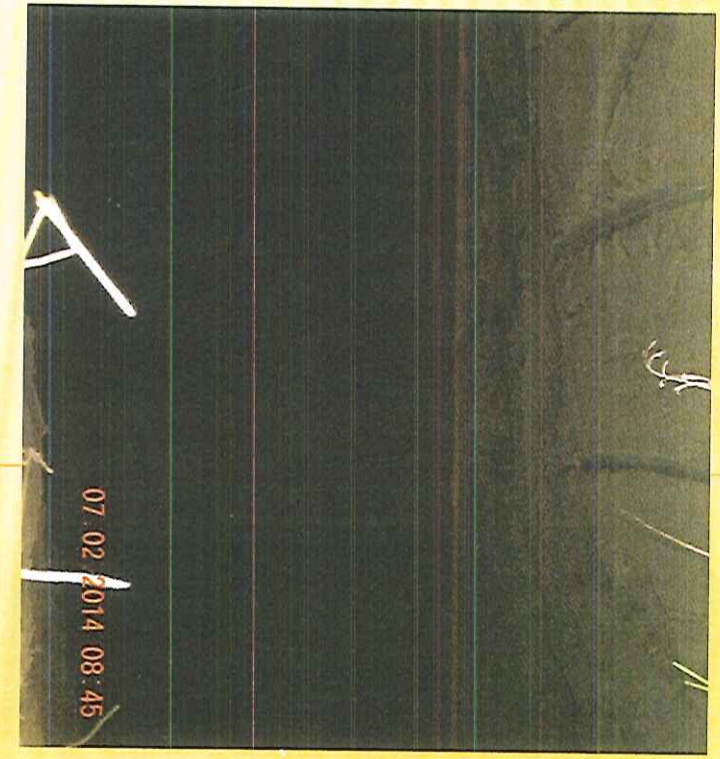
July 2, 2014



Hysham Rest Area

Test Pit #4

July 2, 2014



Hysham Rest Area

Test Pit #5

July 2, 2014

Hysham Rest Area

Test Pit #6

July 2, 2014

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX H:

FLOOD INFORMATION

DOWL

DOWL HKM

Address:
2090 Stadium Drive
Bozeman, Montana 59715

Phone: (406) 586-8834 Fax: (406) 586-1730

MEMORANDUM

To: Kevin Malone, PE
MDT Project Manager

From: William Dreyer, PE
DOWL HKM - Project Manager

Date: September 15, 2014

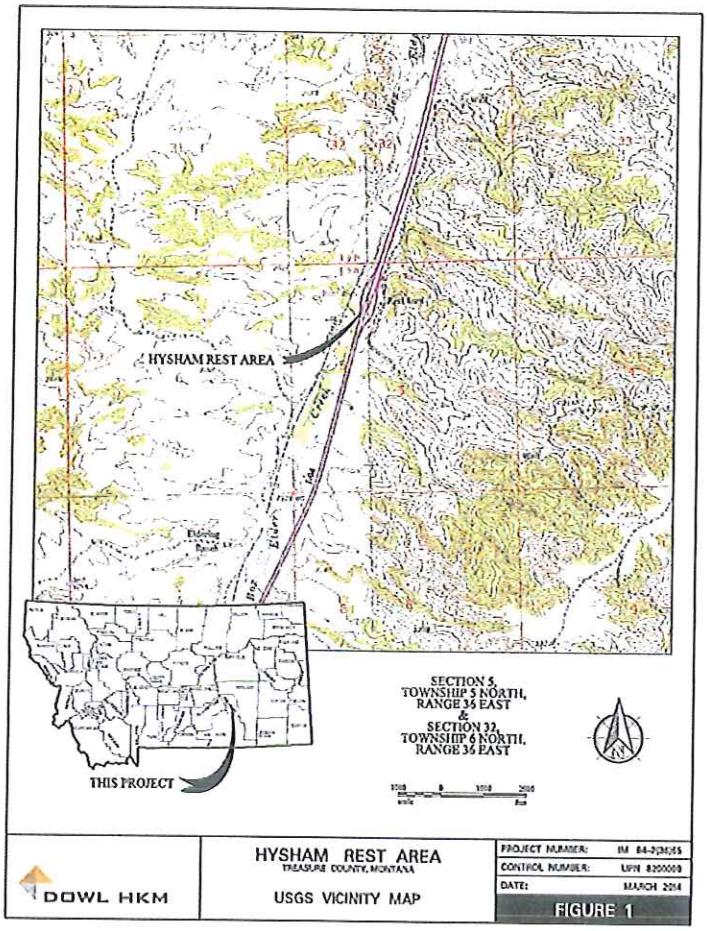
Subject: Hysham Rest Area (IM 94-2(36)65; UPN 8200000)
Preliminary Hydraulics Memo (MDT Activity 170)

INTRODUCTION

This preliminary hydraulics memo was developed in support of Phase I of the Hysham Rest Area project. The Montana Department of Transportation (MDT) is planning to reconstruct the existing Hysham Rest Area on Interstate 94 (I-94), approximately 5 miles south/southwest of Hysham in Treasure County, Montana. As part of the Preliminary Hydraulics evaluation, the memorandum is intended to identify existing hydraulics, and provide initial recommendations for the design of the water and wastewater systems for Hysham's EB and WB rest areas. A detailed hydraulics report will need to be prepared under the Phase II portion of this project. Proposed improvements for Phase I encompass permitting of water and wastewater systems. Phase II improvements are expected to include a full reconstruction of the rest areas, and will be developed by others.

The Hysham Rest Area consists of two separate rest area sites located on each side of Interstate 94 (I-94) in Treasure County, MT. The rest area serving the eastbound (EB) direction of travel and the rest area serving the westbound (WB) direction of travel are both located at reference post (RP) 418.8.

Figure 1. Hysham Vicinity Map



STORM WATER INSPECTION

A visual inspection of the current storm water facilities was performed March, 2014 as well as June 2014. The visual inspection was intended to identify storm water influences in regard to current and future potable water facilities and wastewater facilities. History of standing water was not identified in close proximity to the existing wells and/or the currently proposed wastewater system locations at either site. The eastbound and westbound areas are located toward the bottom of a hill within the Box Elder Creek drainage area. Storm water is currently diverted via culverts to drainage swales located on both sides of the westbound site. One ephemeral drainage was identified adjacent to the project area and outside of the area proposed for disturbance. Both drainages were sparsely wooded.

A drainage swale (Photo 1) located off of the off ramp on the eastbound rest area drains a portion of the eastbound rest area. Intermittent pools of standing water and wetland vegetation were observed within the bottom of the swale, but continuous flow was absent during the investigation.

A portion of the eastbound drainage area (Photo 2) drains the southwest portion of the rest area. A defined drainage swale was observed, but flow was absent during the time of the investigation.

Photo 1. Looking southwest of the eastbound rest area (drainage swale)

Photo 2. Looking northeast of the eastbound rest area (drainage swale)

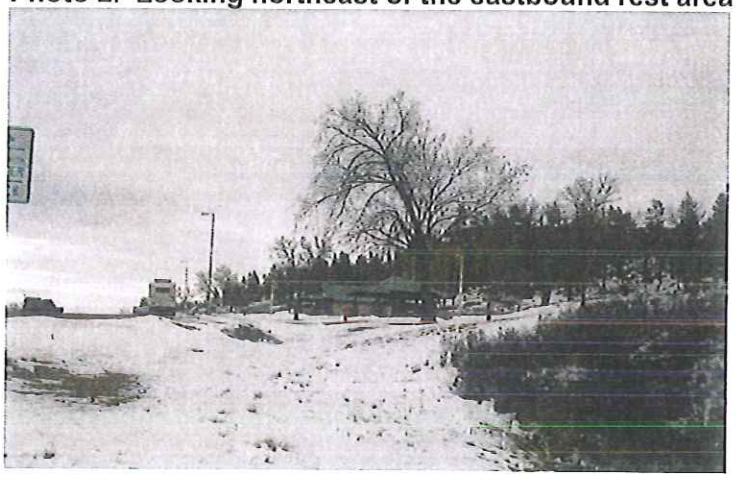


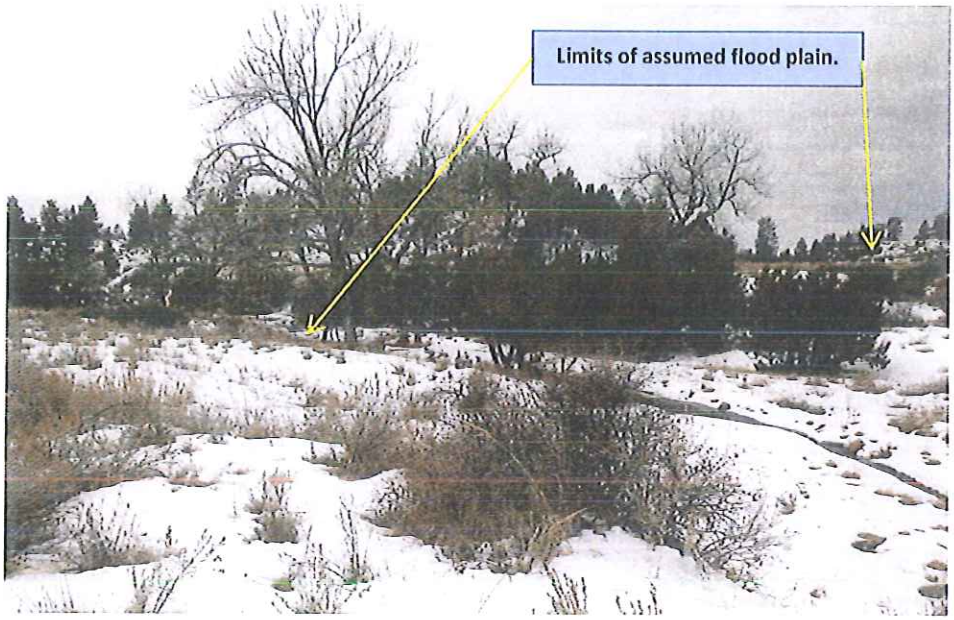
Photo 3. Drainage Culvert looking north on eastbound rest area

The Phase II site design will need to identify changes, if any, to the site drainage, and provide adequate drainage around the water and wastewater facilities.

The proposed wastewater system sites will be located on gently sloping Cretaceous Age deposits and will be in an area with approximately 2% to 3% slope (see Drainage Plan).

Flooding risk from Box Elder Creek was assessed from published FEMA maps and visual verifications of channel characteristics, vegetation growth and bank elevation. As seen in Figures 2 and 3, the project site is located outside of the FEMA-designated 100-year flood plain. The proposed wastewater system site is located approximately 520 feet southwest of the potential floodplain boundary of Box Elder Creek. The proposed wastewater system is located in areas above any potential flooding inundation.

Photo 4. View of Box Elder Creek bordering westbound rest area, looking southwest.



The proposed drainfield areas are located such that storm water and spring melt runoff should not pose any flooding risk to the drainfield. As a precaution, a Phase II drainage plan should be designed to divert any storm water and spring melt runoff away from the proposed drainfield.

Figure 2: FEMA Flood Map Index

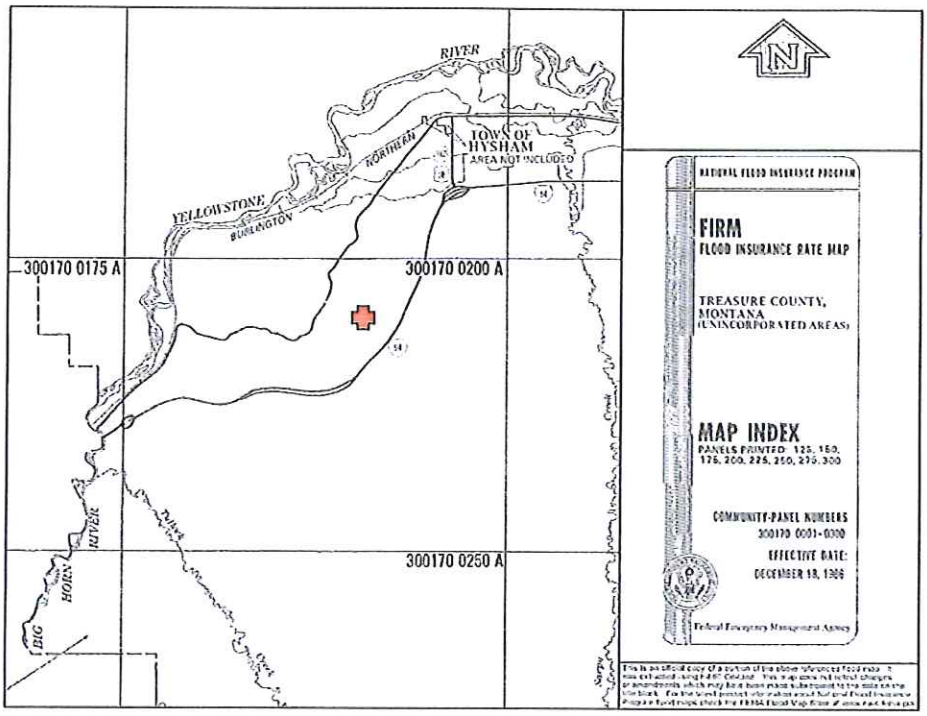
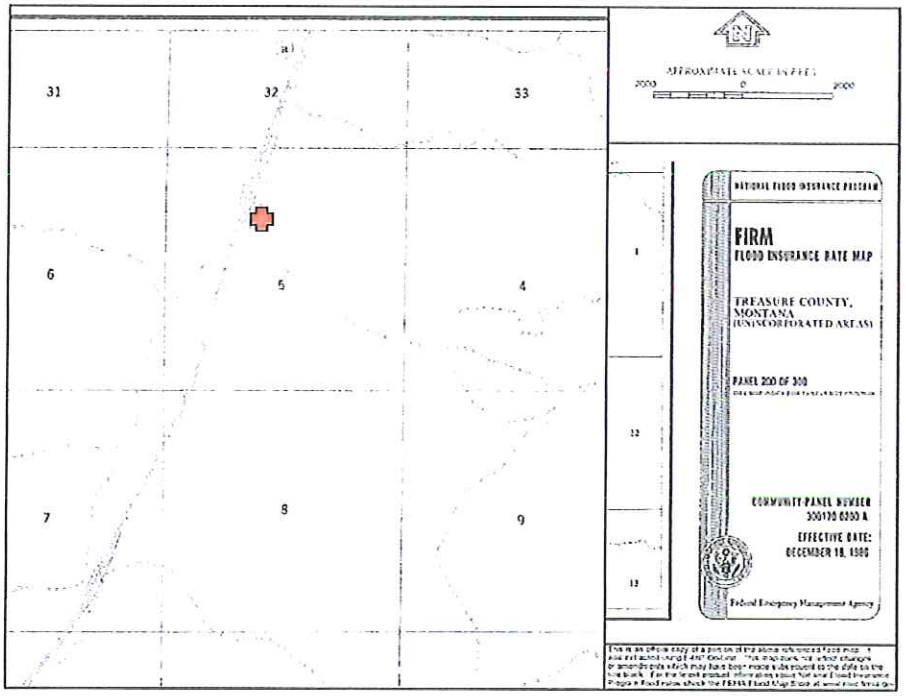


Figure 3: FEMA Flood Map



STORM WATER MANAGEMENT

Storm water run-off from the area around the drainfield can be diverted via sheet flow, or can be channelized to low areas that will be developed through the Phase II site grading design. The Phase II design of the rest area may incorporate retention/detention ponds to control the quantity of site runoff as well as providing water quality treatment, should proper separation from the water and wastewater systems be maintained. Consideration should also be given to the need of an oil-water separator in final design for collection and treatment of accidental spills from the parking areas, prior to discharge into the retention area. Final design of these storm water controls can be developed under Phase II design efforts.

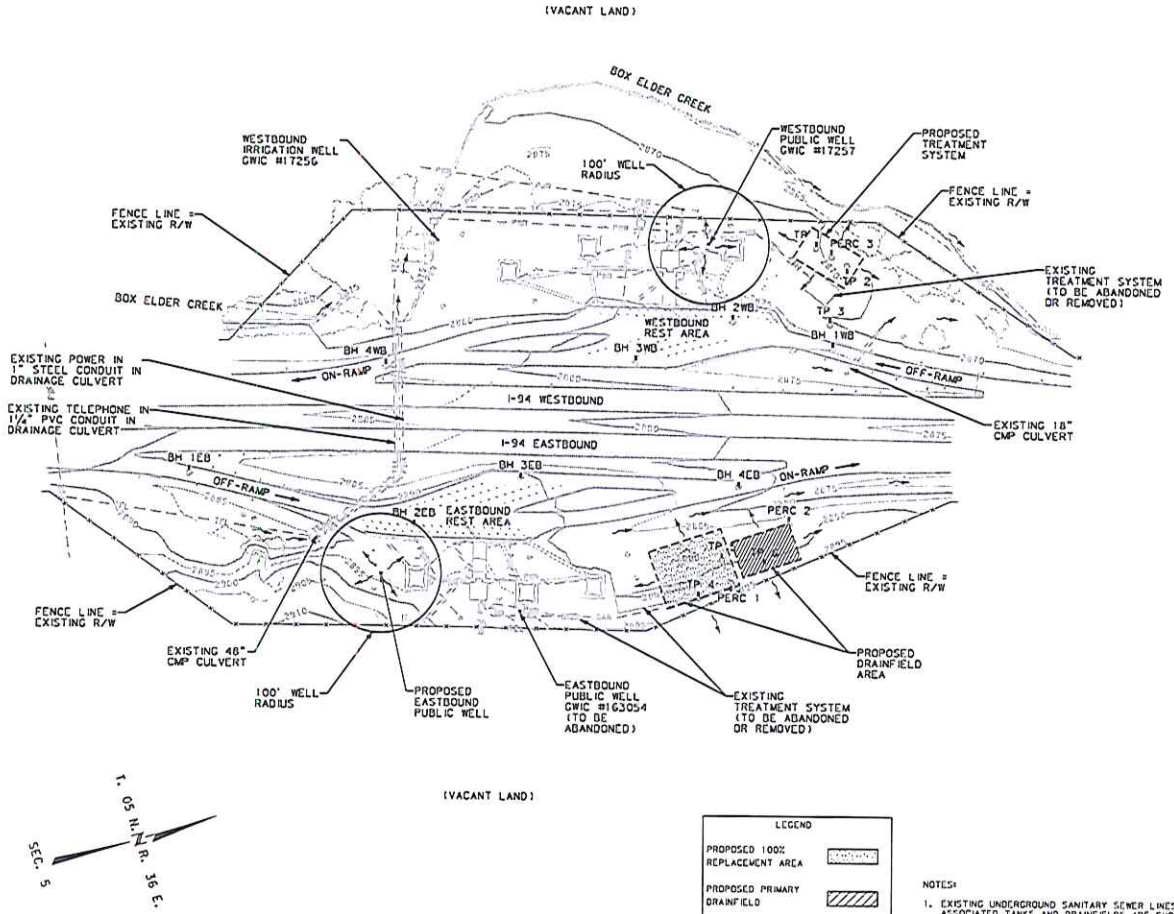
CONCLUSION:

The Hysham Rest Area sites are located beyond the estimated floodplain of Box Elder Creek. The existing drinking water wells and proposed wastewater areas are located such that existing drainage patterns for storm water and snowmelt runoff should not pose a flooding risk. The final grading and drainage plan developed under Phase II can be designed to divert any storm water and snowmelt runoff away from the proposed water and wastewater systems. The final rest area design should take into account the calculated runoff from the final site layout and incorporate storm water runoff quantity and quality control measures in accordance with MDT Hydraulics Design criteria. Storm water control measures will similarly need to be designed for the entirety of the rest area reconstruction.

APPENDIX A

STORM WATER MANAGEMENT PLAN

DOWL HKM



LEGEND

- PROPOSED 100% REPLACEMENT AREA
- PROPOSED PRIMARY DRAINFIELD
- FLOW ARROW
- PERC TEST
- TEST PIT
- BORE HOLE

NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.
3. PROPOSED FACILITIES ARE APPROXIMATE.

STORM WATER PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\STORM WATER PLAN.DGN	DESIGNED BY	T BECKEN-GADDO	9/16/2014	STORM WATER PLAN	
1		9/17/2014	REVIEWED BY	B DREYER	9/16/2014		
		3:47:27 PM Allechengadd	CHECKED BY	B DREYER	9/16/2014	TREASURE COUNTY	

MYSHAM REST AREA - MONTANA		IM 94-2(36)65
CSF=0.9993521803	UPN 8200000	SHEET 1 OF 1

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX I:

OWNER CERTIFICATION

DOWL

Public Wastewater System
Construction Inspection Certification

I, _____, of Montana Department of Transportation, I hereby certify that a professional engineer will be retained for construction inspection during the installation of the public wastewater system and will certify completion in accordance with the approved plans and prepare as-built drawings for submittal to MDEQ within 90 days of project completion.

_____ _____

Montana Department of Transportation Date

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX J:

SITE PHOTOS

DOWL

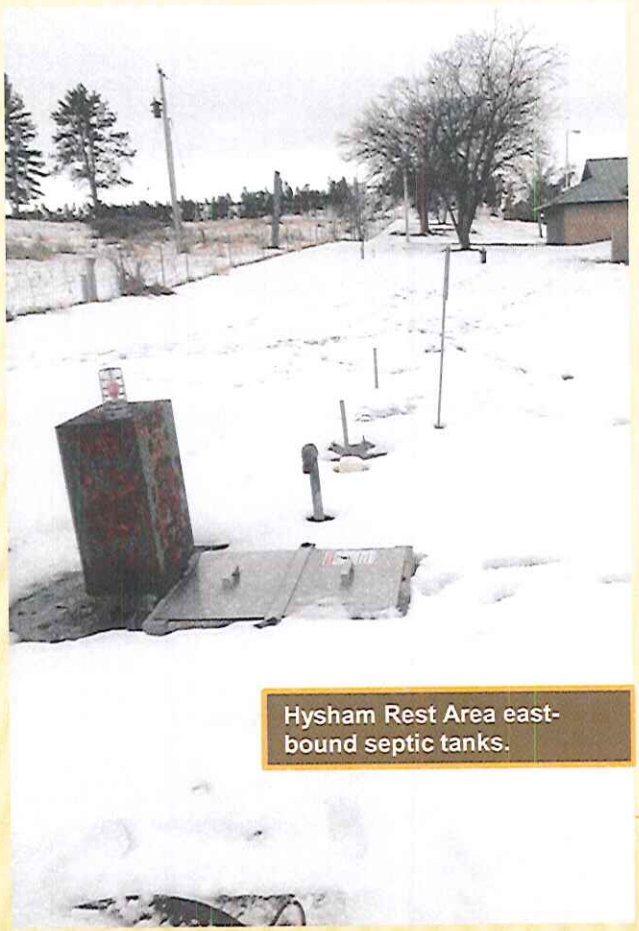
Hysham Rest Area

Wastewater Photos

Shared drainfield for Hysham Rest Area located on the east-bound site.

Hysham Rest Area

Wastewater Photos



Hysham Rest Area east-bound septic tanks.

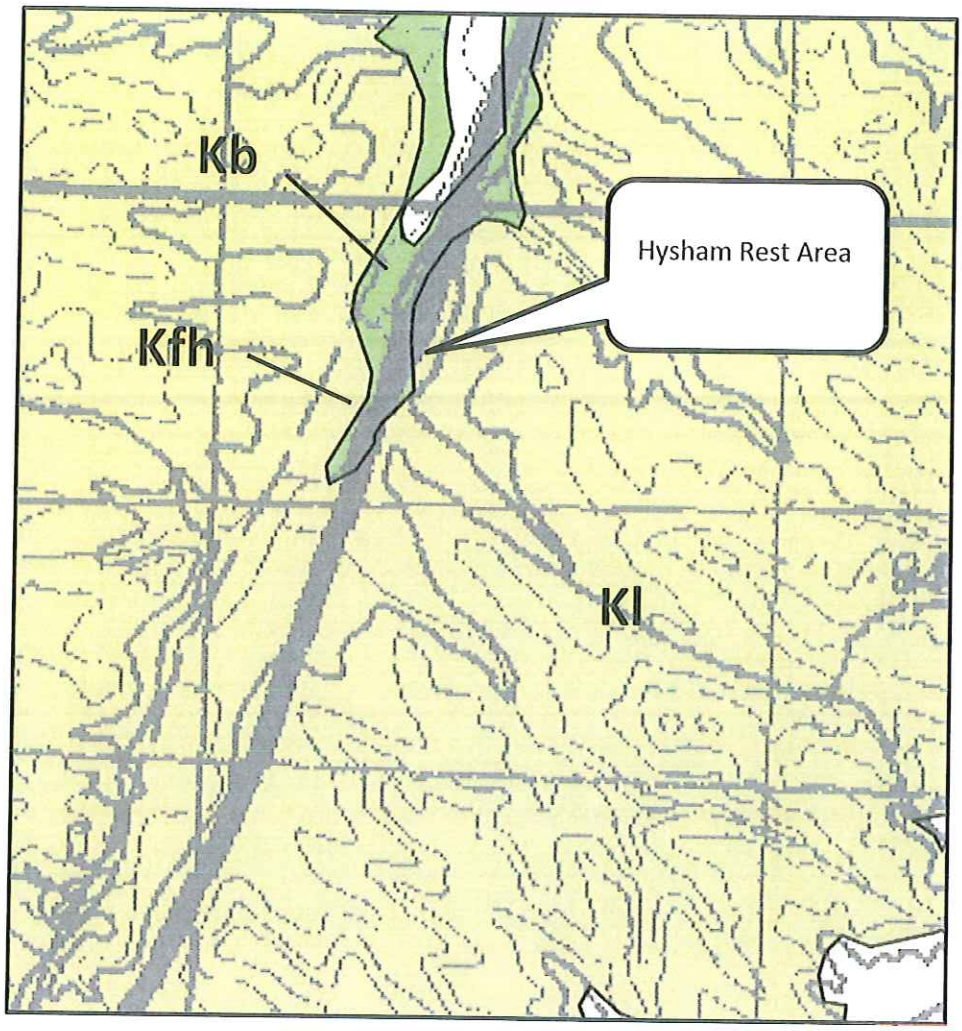
Hysham Rest Area west-bound septic tanks.

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX K:

GEOLOGIC MAP

DOWL



Hysham Rest Area General Geologic Map

Montana Bureau of Mines and Geology
Open File No. 486

Geologic Map of the Hysham 30' x 60' Quadrangle, Eastern Montana

Susan M. Vuke, Edith M. Wilde,
and Robert N. Bergantino

2003

Kl Lance Formation (Upper Cretaceous)
Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

Kfh Fox Hills Formation (Upper Cretaceous)
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

Kb Bearpaw Shale (Upper Cretaceous)
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500 ft.

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX L:

LOCAL HYDROGEOLOGY DATA

DOWL

Hysham Rest Area
IM 94-2(36)65
UPN 8200000

HYDROGEOLOGIC INVESTIGATION REPORT

MDT Activity 134

Prepared for:

MONTANA MDT DEPARTMENT OF TRANSPORTATION

2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Prepared by:

DOWL

2090 Stadium Drive

Bozeman, MT 59715

August, 2015

H:\24\11355\134\DEQ water system\Groundwater Investigation Report.docx

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AQTESOLVE Pumping Test Analysis Results

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Hysham Rest Area Groundwater Surface Map

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Hysham Rest Area Water Quality Results

APPENDIX E

Hysham Rest Area East Bound Well Memo

1 INTRODUCTION

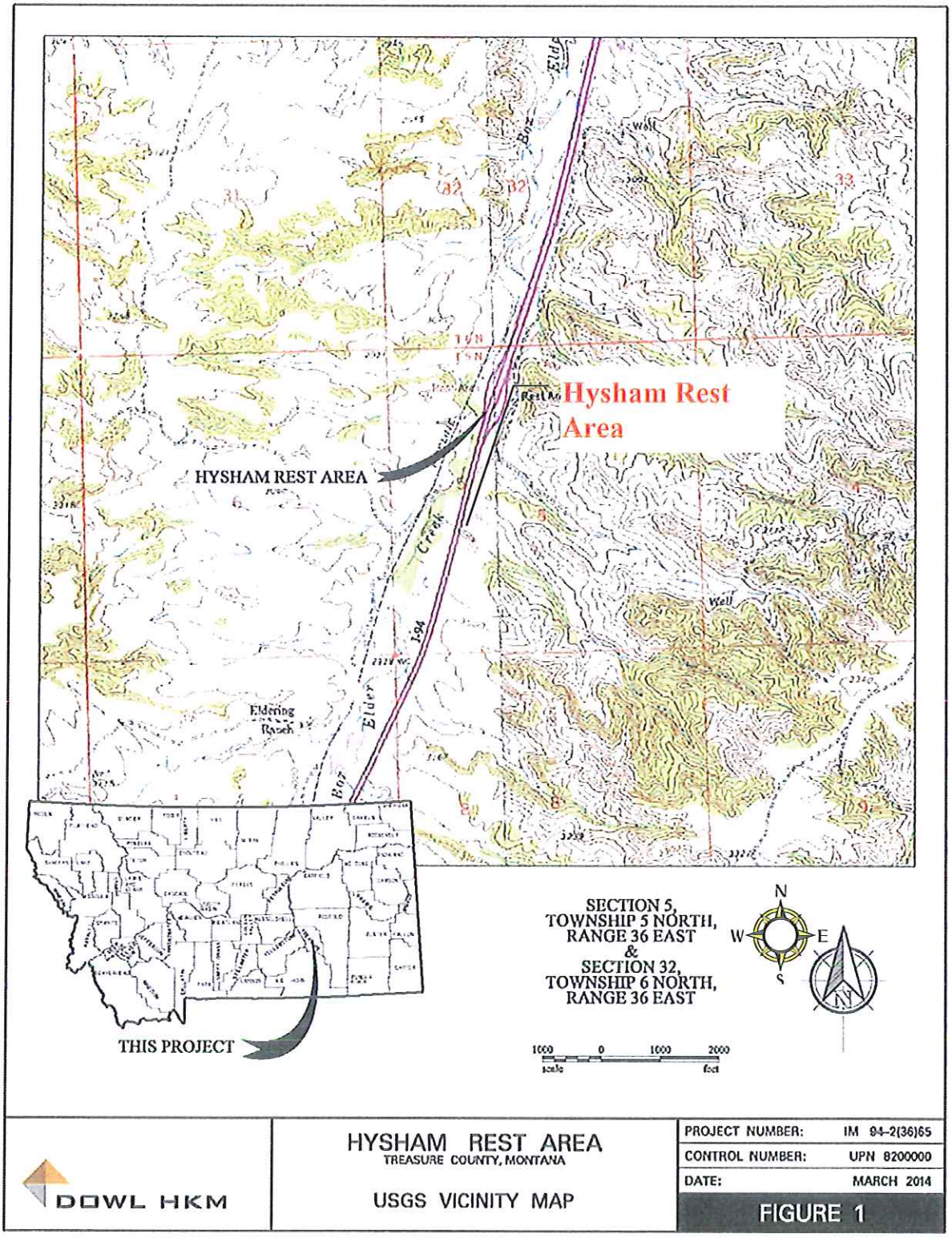
This Hydrogeologic Investigation report has been prepared by DOWL on behalf of Montana Department of Transportation (MDOT). It summarizes the results of on-site investigations performed June 13, 2014 at the Hysham Rest Areas south of Hysham, Montana.

This work was done in support of Phase I of the Hysham Rest Area project to evaluate site conditions and design a wastewater treatment and disposal system for the Rest Areas. This work is also being done to support the applications prepared and submitted to the Montana Department of Environmental Quality (MDEQ). The Rest Areas will continue to utilize two existing Public Water Supply (PWS) wells and one irrigation well for water supply and irrigation respectively.

The key water related issue being evaluated is if the utilization of an on-site septic system will negatively impact down gradient groundwater quality. During this investigation groundwater and aquifer conditions at the site were evaluated to support the Non Degradation analyses required for the permitting and installation of the proposed on-site Public Wastewater System (PWWS).

The project area is located approximately 5 miles south/southwest of Hysham in Treasure County within Section 5, Township 5 North, Range 36 East. The project limits will include the eastbound and the westbound rest areas, entrance and exit ramps, and a portion of I-94 approaching and departing the rest areas. Precise project limits will be determined during the design phase of the project, but are expected to remain within the existing MDT right-of-way.

FIGURE 1 SITE LOCATION MAP



DOWL

2 GENERAL GEOLOGY

2.1 LOCAL STRATIGRAPHY

The sedimentary deposits exposed at the Hysham Rest Area consist of Cretaceous deposits. The area is generally mapped as sandstone and shales as depicted on the geologic map.

1. Kl Lance Formation (Upper Cretaceous)
Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

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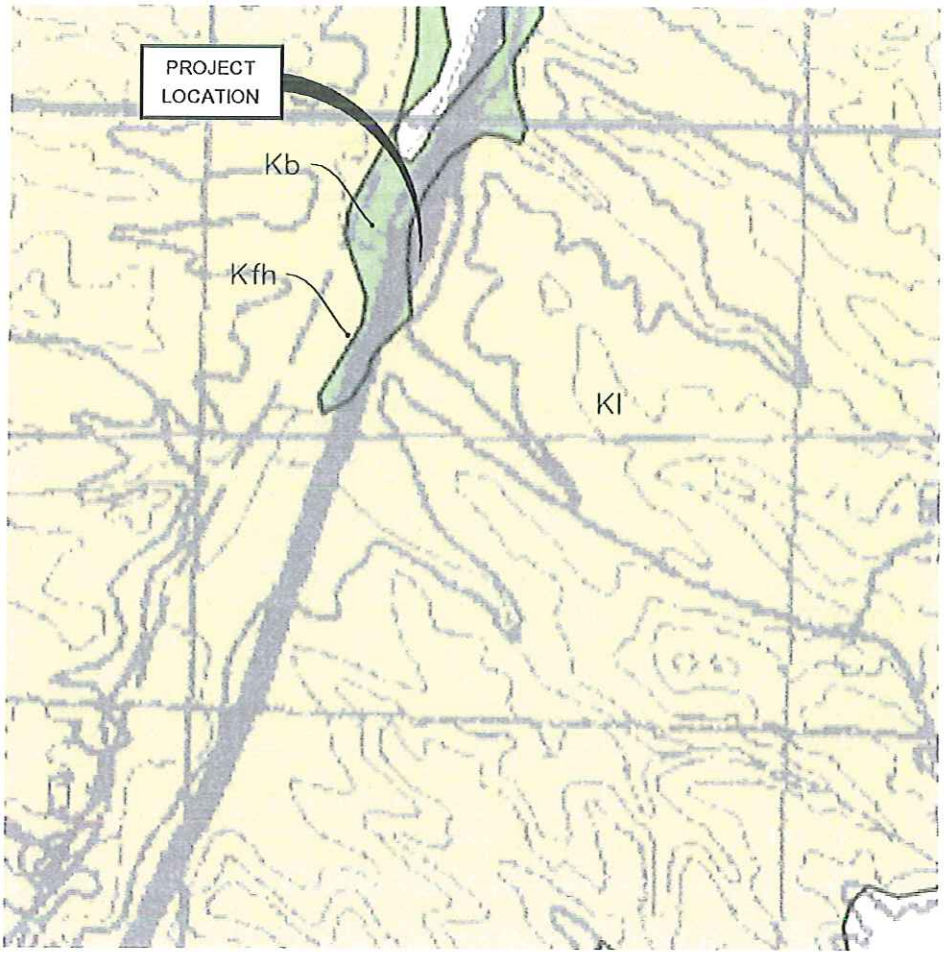
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

3. Kb Bearpaw Shale (Upper Cretaceous)
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500.

The prominent geologic features at the sites are a drainage area located southeast portion of the eastbound rest area, a large sandstone out cropping located due east of the eastbound rest area and Box Elder Creek located west of the westbound rest area. The sandstone outcropping and Box Elder Creek contributed to the sand and gravel deposits throughout the sites. No other prominent geologic features were observed in the immediate vicinity of the project site corridor. Based on visual examination, the surficial soils consist of silt, clay, sand, and gravel associated with the formations within the rest area sites.

FIGURE 2 GEOLOGIC MAP



MAP UNITS

Kl - Lance Formation (Upper Cretaceous)

Kfh - Fox Hills Formation (Upper Cretaceous)

Kb - Bearpay Shale (Upper Cretaceous)

D:\24\11355\01\ACT 106\GEOLOGIC FIGURE.dwg PLOT DATE: 2014-9-18 13:42 SAVED DATE: 2014-09-18 13:24 USER: bdurfey

DOWL HKM

2000 Stadium Drive Bozeman, Montana 59715

HYSHAM REST AREA
GEOLOGIC SURVEY MAP

PROJECT	24.11355.01
DATE	09/18/2014

FIGURE #1

2.2 *Structural Geology*

Within the boundaries of the Hysham Rest Area site, the subsurface deposits generally consist of flat-lying to slightly-tilted alluvial and volcanic deposits. No faulting, folding or other structural features that would affect the presence or distribution of groundwater for this site are present.

3 HYDROGEOLOGY

Groundwater or groundwater indicators were not observed at depths ranging from 1 to 10 feet in the six test pits. DOWL found the eastbound aquifer to be located in the Bearpaw shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. These logs indicate that the existing public wells located water at an interval depth of 6 to 200 feet below ground surface. Sandy clays, Sandy silts, gravels dominate the upper 10 feet of the wells. Shale and sandstone layers are found from 25 feet to 200 feet. Based on the information presented in the well logs, it appears that the aquifer is found in a confined/semi confined aquifer formation. .

The constant rate pumping test, (further discussed below) shows that ample quantities of groundwater are available for development in these formations.

4 TEST WELLS

No test wells were installed for this work. Existing Rest Area wells provided adequate hydrogeologic information to evaluate and characterize this site.

5 WATER QUANTITY

To determine the aquifer parameters to be used for the non degradation analyses the three existing wells at the Rest Area were equipped with monitoring equipment, see

Appendix B Figure 1. On June 13, 2014 a constant rate pumping test was conducted. Well #1, which is the public drinking well at the west bound rest area was pumped, while Well #2 which is the PWS well at the east bound rest area was used as an observation well as well as Well #3, which is the irrigation well at the west bound rest area.

While pumping, detailed records of the pumping rate and pumping level were documented for later analysis. Data was collected with: a Solinst water lever meter, and Solinst Leveloggers. Flow was measured with a bucket and stop watch.

5.1 Well #1 Constant Discharge Rate Pumping Tests

On June 13, 2014 at 12:25, the constant rate pumping test of Well #1 began. Well #1 was pumped at 10 gpm for the duration of the test. The test concluded on June 13, 2014 at 2:00 lasting approximately 95.67 minutes. By the end of the test there was approximately 12 feet of drawdown in the pumping well, Well #1 and no change in Well #2 or Well 3.

AQTESOLV for Windows was utilized to evaluate both the drawdown and recovery portion of the test in Well #1. Standard procedures and analytical methods most applicable to all the wells construction and aquifer type were used. For the evaluation, the Hantush–Jacob method for a partially penetrating well in a leaky confined aquifer was used. Parameter values for these evaluations are consistent with published values for the aquifer conditions identified. See Table 2. Table 1 and Figures 2 and 3 of Appendix B further display these analyses.

TABLE 1 PUMPING AND RECOVERY TEST RESULTS

	[T] Transmissivity (ft^2/day)	[K] Hydraulic Conductivity (ft/day)	[b] Aquifer Thickness (feet)	[S] Storage Coefficient (dimensionless)
Well #1	336.82	33.68	10	0.8321

Inherently, long-term constant-rate tests provide average aquifer characteristics of the zone of aquifer influenced by the pumped well. This is known as the zone of influence. As pumping continues, the zone of influence becomes larger until the aquifer is able to provide the quantity of water demanded by the well. Consequently, the effects observed at both the pumping well and observation well are an average of all the discrete effects within the wells zone of influence. Therefore the aquifer parameter determined from a long term constant rate test are appropriate for characterizing the average conditions of the site. While this 1.6 hour test is not considered long compared to typical tests, the results show that the aquifer had largely stabilized to meet the demands of the pumping well , (10 gpm). Consequently the pumping test was stopped and the recovery levels in the observation well were tracked. Results from both the pumping and recovery portion on the test match well with each other and the test is considered adequate for the purposes of this investigation.

6 WATER QUALITY

Water quality was tested and results are included in this report.

7 GROUNDWATER MAPPING

According to the project site survey and groundwater level monitoring records from each of the existing wells, the direction that groundwater is flowing is north 24 east and the gradient is 0.0068 ft/ft, (see Appendix C Figure 1). This figure represents the

groundwater surface on June 13, 2014, and was generated using SURFER software.

8 SURFACE WATER

Surface water features exist nearby and include the Box Elder Creek to the northwest. This feature does not adversity affect the design and permitting effort for the proposed wastewater system.

9 CONCLUSIONS AND OBSERVATIONS

Drillers logs conditions and analysis of pumping test data show that the formations are viable aquifers, and that the aquifers are in a leaky confined condition. Wastewater discharge from proposed septic system will eventually interact with the groundwater in the alluvial terrace deposits aquifer. Therefore, a non-degradation analysis has been performed.

APPENDIX A

WELL LOGS

APPENDIX A

Ground Water Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Natural Resources Building Room 329
Butte Montana 59701-8997
Ph: (406) 496-4336 Fx: (406) 496-4343

GWIC Data > Well Construction Data > Township: 05N Range: 36E Sec: 5

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by sending us an Email at **GWIC@mtech.edu**. If you wish to view a one page report for a particular site, click the hyperlinked **Gwic Id** for that well. Scroll to the right of your screen to view all the data. All data displayed on the screen may not show up when printed.

Retrieval Statistics*

Field	Max	Min	Avg
Total Depth (ft)	280.00	65.00	155.00
Static Water Level (ft)	46.89	14.00	28.30
Yield (gpm)	50.00	10.00	26.00

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Did you know about...

Other GWIC data

GWIC has 3 water quality sample(s) for this area.
GWIC has 5 field visit(s) for this request area.
GWIC has 4 water level(s) for this request area.

Thanks, Just take me back to the menu.

Other MBMG data

MBMG has 411 publications available for TREASURE county.
MBMG has 0 abandoned mine record(s) for this request area.

Gwic Id	PDF	DNRC WR	Site Name	Twn	Rng	Sec	Q Sec	Ver?	Type	Td	Swl	Pwl	Rwl	Yield	Test	Date	Use
179372			LLOYD, CLEAVE	05N	36E	5	B	No	WELL	280.00				10.00	BAILER	2/4/1947	STOCKWATER
17257		W163867-00	HYSHAM REST AREA WESTBOUND	05N	36E	5	BABC	Yes	WELL	65.00	14.00	43.00		28.00	PUMP	1/28/1966	PUBLIC WATER SUPPLY
17256			MONTANA HIGHWAY COMMISSION - HYSHAM WESTBOUND IRRIGATION	05N	36E	5	BACB	Yes	WELL	75.00	24.00	40.00		16.00	PUMP	2/3/1966	PUBLIC WATER SUPPLY
163054			HYSHAM REST AREA EASTBOUND	05N	36E	5	BADB	Yes	WELL	200.00	46.89		40.00	50.00	AIR	8/18/1988	PUBLIC WATER SUPPLY

End of Report.
4 record(s) listed.

Items of Note:

[1]This report is restricted to site types of WELL, BOREHOLE, SPRING, COAL BED METHANE WELL, PETWELL, PIEZOMETER.

[2]A single well record (a distinct GWIC Id) may be represented by more than one line in this report if more than one performance test was conducted on the well at the time of drilling.

Explanation of Columns:

GWIC Id = Key field for the GWIC database. Links to one page reports.
PDF = Are scanned documents available through the Document Manager?

- = Yes, click on the icon to download the PDF file.
- = No, well was submitted electronically. No paper record exists.
- = No, record does have a known well log but it is not scanned yet.
- = No, record may or may not have a document to scan. Metadata is unclear.
- = No, record was created from a source other than a well log. No paper record exists.

DNRC WR = Water right number assigned to this site by Department of Natural Resources and Conservation.
Site Name = Current owner name assigned to GWIC record.
Location = Location of site in Montana township, range, section, and quarter-section coordinates.
Ver? = Has this location been verified by field staff?
Type = Type of site assigned to GWIC record.
Td = Total depth of well in feet below ground.
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface.
Pwl = Pumping water level in feet below ground.
Rwl = Recovery water level in feet below ground.
Yield = Yield in gallons per minute.
Test = Type of performance test reported.
Date = Completion date of well/borehole.
Use = Reported use of water.

Disclaimer:

The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date 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 [7/21/2015 3:27:34 PM]. 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.

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MONTANA WELL LOG REPORT

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

Other Options

Return to menu
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:13 PM)

Site Name: HYSHAM REST AREA WESTBOUND
GWIC Id: 17257
DNRC Water Right: W163867-00

Section 1: Well Owner(s)

1) MT DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT N/A [06/25/1999]
2) MONTANA HIGHWAY COMMISSION (MAIL)
C/O WALT RAFFELSON
CUSTER MT 59024 [01/31/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	SW¼ NW¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2197	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2865			

Measuring Point Altitude	Method	Datum	Date Applies
2866.6			9/23/1997 12:16:00 PM

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, January 28, 1966

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	65	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	63	6				20 LB STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
63	65	0			OPEN HOLE

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 65
Static Water Level: 14
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
28 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 43 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 NE OF RESTROOMS NEAR PICNIC TABLE SAMPLING PT -FAUCET ON FRONT OF RESTROOM BLDG OR UNDERGROUND SPRINKLER SYSTEM OUTLETS WESTBOUND REST AREA ACCESSED UTILITY ROOM WITH CARETAKER HYSHAM RESTAREA I94 WEST

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	5	GRAYISH TAN SANDY SILT
5	15	CHANGES TO GRAY SANDY CLAY
15	20	TRACES OF GRAVEL
20	25	GRAY SANDY CLAY SOME SURFACE WATER
25	35	GRAY SHALE
35	55	BLUISH GRAY CLAY
55	63	SOME TRACES GRAVEL. INCREASING AMOUNTS OF SAND TO COARSE ROCK AT 63 FT.
63	65	BOTTOMED HOLE IN GRAVEL AND DARK GRAY SAND

Driller Certification

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

Name:

Company: FOX
License No: -
Date Completed: 1/28/1966

Log No. 39 340' Lt. of Sta. 675+92, Project I-94-2(10)63 103 05 N 36 E 5 BAPC Treasure

GW 2

Approved Stock Form—State Publishing Co., Helena, Montana—42329

File No.....

TRIPLICATE

RECEIVED FEB 16 1966 Montana Bureau of Mines and Geology

3

103 T. 5 N. R. 36 E. 5 BAPC 02

County Treasure

LOG

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CO
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Top of Ground

Greyish tan sandy silt.

(Elev. above sea level) 2371.68 ft.

5.0' Change to grey sandy clay.

15.0' Traces of gravel.

20.0' Grey sandy clay; some surface water.

25.0' Grey shale.

35.0' Bluish grey clay.

55.0' Some traces gravel. Increasing amounts of sand to coarse rock @ 63.0 ft.

63.0' Bottom of casing.

65.0 Bottomed hole in gravel & dark grey sand.

Show exact depth of bottom.

Owner Montana Highway Commission Address Helena, Montana

Driller Montana Highway Department Address Helena, Montana

Date of Notice of appropriation of groundwater January 31, 1966

Date well started January 24, 1965 Date completed January 28, 1965

Type of well Churn drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐ Industrial ☐ Drainage ☐ Other ☐

Rest Area Water Supply.

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6"	5" ID Steel 19.88 lbs. per ft.	0.0'	63.0'	NONE		

N / W / E / S

SE 1/4 NW 1/4 Sec. 5 T. 5 N. R. 36 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

LA

Static Water Level for non-flowing well 14.0 feet.

Shut-in Pressure for Flowing Well

Pumping Water Level 43 feet at 20 gal. per minute.

Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e.: Lot, Block and Addition).

WATER ANALYSIS

PH	7.5	
CO_2	5.4	p.p.m.
Calcium & Magnesium Bicarbonates	220	p.p.m.
Sodium Bicarbonate	90	p.p.m.

Water is basic

None required

Driller's License Number

Lehman B. Fox

Driller's Signature Natl. Engr.

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located, tissue copy to be retained by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

M: 17257

MONTANA WELL LOG REPORT

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Other Options

Return to menu
View hydrograph for this site
View field visits for this site
View scanned well log (6/7/2010 1:21:07 PM)

Site Name: HYSHAM REST AREA EASTBOUND
GWIC Id: 163054

Section 1: Well Owner(s)

1) HYSHAM REST STOP EAST BOUND (MAIL)
N/A
N/A MT N/A [03/14/2003]
2) MONTANA DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT 59105 [09/23/1997]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SE¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2184	107.2493	NAV-GPS	NAD27

Ground Surface Altitude	Method	Datum	Date
2900			

Measuring Point Altitude	Method	Datum	Date Applies
2901.4			9/23/1997 11:25:00 AM

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, August 18, 1988

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	35.5	10
25	200	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	35.5	7				23LB STEEL
25	200	4		165.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
28	200	4		1/8	SLOTS

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 200
Static Water Level: 46.89
Water Temperature:

Air Test *

50 gpm with drill stem set at _ feet for 2 hours.
Time of recovery 1 hours.
Recovery water level 40 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 EAST OF BUILDING RESTROOMS AT PICNIC TABLES USED UTILITY SINK FAUCET FOR CHEM NEED TO CONTACT CARETAKER FOR ACCESS NEWEST WELL AT REST AREAS 2 OLDER SHALLOW WELLS ON WEST SIDE IRRIGATION PIPES ACROSS TO THIS SIDE

Section 9: Well Log

Geologic Source

211LHUD - LANCE-HELL CREEK UNDIFFERENTIATED

From	To	Description
0	28	SILT CLAY
28	35	BROWN SANDSTONE
35	50	LIGHT SHALE
50	81	LIGHT SANDSTONE
81	121	SHALE
121	160	GREY SANDSTONE
160	173	GREY SHALE
170	200	GREY SANDSTONE

Driller Certification

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

Name: WILLIAM KUPFNER
Company: ROCK CREEK DRILLING INC
License No: WWC-300
8/18/1988

Date Completed:

05N36E05BADB

Form No. 603 (R 6 87)

Hysham E.B.

File No. _____

WELL LOG REPORT

State law requires that this form be filed by the water well driller within 60 days after completion of the well.

1. WELL OWNER
Name State Board Land

2. CURRENT MAILING ADDRESS
P.O. Box 20451
Billings Mt. 59104-0451

3. WELL LOCATION
County Treasure
Township 5 N/S Range 36 E/W
NWSE NE ¼ SE ¼ ¼ Section 5
Lot Lot 3 Block
Subdivision NE¼ of SW¼ Lot 3
Tract Number

NWSE

4. PROPOSED USE Domestic ☐ Stock ☐ Irrigation ☐
Other(s) specify Grazing

5. DRILLING METHOD
_____ cable, X air rotary,
_____ forward rotary, _____ reverse rotary, _____ jetted,
_____ other (specify) _____

6. WELL LOG

Depth (ft.) From	To	Formation
0	28	silty clay
28	35	weathered sandstone
35	50	light shale
50	81	light sandstone
81	121	shale
121	160	dark sandstone
160	175	gray shale
175	200	gray sandstone

ATTACH ADDITIONAL SHEETS IF NECESSARY

7. WELL CONSTRUCTION AND COMPLETION

Size of drilled hole	Size and PSI Rating of casing	From (feet)	To (feet)	Perforations X / Screen	Kind Size	From (feet)	To (feet)
10 3/4	9" 25#	4.18'	55.5'				
6 1/8	4½ PVC 16.6#	25	200		Blank	25	200

Was casing left open end? X Yes ___ No
Was a packer or seal used? ___ Yes X No
If so, what material _____
Was the well gravel packed? ___ Yes X No
To what depth was the well grouted? 20 ft
Material used in grouting Cement
Well head completion: Pitless adapter
___ Yes X No
Top casing 18 in. or greater above grade?
X Yes ___ No

8. WELL TEST DATA
The pump test information request in this section is required for all wells. All depth measurements shall be from the top of the well casing unless otherwise specified.

All wells under 100 gpm must be tested for a minimum of one hour and provide the following information:

a) Air X Pump _____ Bailer _____
b) Static water level immediately before testing 40 ft. If flowing; closed-in pressure _____ psi _____ gpm
Controlled by: _____ valve, _____ reducers, _____ other, (specify) _____
c) Depth at which pump is set for test 185 ft
d) The pumping rate and means of discharge (i.e., bailing, (airlift,) pumping)
50 gpm
e) Maximum drawdown during the test 200 ft
f) Duration of test: Pumping time 2 hrs
Recovery time _____ hrs
g) Recovery water level 40 ft
Amount of time after pumping recovery level water data was taken _____ hrs

Wells intended to yield 100 gpm or more shall be tested for a period of 8 hours or more. The test shall follow the development of the well, and shall be conducted continuously at a constant discharge at least as great as the intended appropriation. In addition to the above information, water level data shall be collected and recorded on the Department's "Aquifer Test Data" form included in each packet of well logs.

NOTE: All wells shall be equipped with an access port ½ inch minimum or a pressure gauge that will indicate the shut in pressure of a flowing well. Removable caps are acceptable as access ports.

9. WAS WELL PLUGGED OR ABANDONED? ___ Yes X No
If yes, how? _____

10. DATE COMPLETED 8-17-88

11. DRILLER/CONTRACTOR'S CERTIFICATION
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Date 10-19-88
Rocky Creek Drilling
Print Name
R.R. 1 Box 295 Joliet MT
Address
Signature 300
License No.

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
1520 EAST SIXTH AVENUE HELENA, MONTANA 59620-2301 444-6810

DNRC

Hysham RA-
Eastbound
01694

DEPARTMENT COPY
DRILLER: Please give this copy to the well owner to complete reverse side
OWNER: Complete reverse side and send to DNRC when the well is completed and the water has been used beneficially for the intended purpose.

163054

MONTANA WELL LOG REPORT

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Other Options

Return to menu
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:42 PM)

Site Name: MONTANA HIGHWAY COMMISSION - HYSHAM WESTBOUND IRRIGATION
GWIC Id: 17256

Section 1: Well Owner(s)

1) MONTANA HIGHWAY COMMISSION (MAIL)
HELENA
N/A N/A N/A [02/03/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SW¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2186	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2870			

Measuring Point Altitude	Method	Datum	Date Applies
2871.7			9/23/1997 9:30:00 AM

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, February 03, 1966

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	61.5	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 75
Static Water Level: 24
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
16 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 40 feet.

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

Section 8: Remarks

IRRIGATION ONLY WELL BOTH REST AREAS PUMP RUNNING ALL NIGHT

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	10	TAN TO GRAY SANDY SILT WITH SOME CLAY
10	34	GRAY SANDY REWORKED SHALE WITH SOME GRAVEL
34	60	GRAY CLAY
60	61.5	GRAY SANDY SHALE
61.5	70	BOTTOM OF CASING SHOE. SOFT GRAY SANDSTONE
70	75	GRAY SANDY GRAVEL

Driller Certification

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

Name:
Company: FOX
License No: -

Date Completed: 2/3/1966

GW 2 Log No. 40 285' Rt. 673+00, Project I-94-2(10)55 103 OSN 366 SB Treasure

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File No.....

TRIPLICATE

103 T. 5 N., R. 36 E. 5 BD

County Treasure

LOG

Casing Stickup - 18"
Top of Ground

(Elev. above sea level 2893.20 ±);

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER C(
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Tan to grey sandy silt, with some clay.

10.0'

Grey sandy reworked shale, with some gravel.

Owner Montana Highway Commission Address Helena, Montana

Driller Montana Highway Dept. Address Helena, Montana

Date of Notice of appropriation of groundwater February 9, 1966

Date well started January 20, 1966 Date completed February 3, 1966

Type of well drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐ Industrial ☐ Drainage ☐ Other ☐

Rest Area Water Supply

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

34.0'

Grey clay.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6"	6" ID Steel 19.88 lbs. per ft.	0.0'	61.5'	NONE		

LA

60.0'

61.5' Grey sandy shale. Bottom of casing shoe.

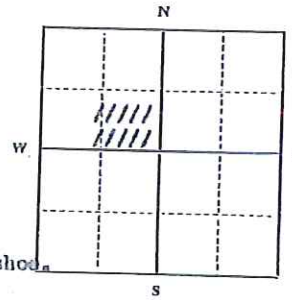
Soft grey sandstone.

70.0

Grey sandy gravel.

75.0 Bottomed hole in grey sandy gravel.

Show exact depth of bottom.



SE-1/4 NW 1/4 Sec. 5 T. 5 N. R. 36 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 24.0 feet.

Shut-in Pressure for Flowing Well ____

Pumping Water Level 50.0 feet at 16 gal. per minute.

Discharge in gal. per min. of flowing well ____

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e.: Lot, Block and Addition).

WATER ANALYSIS

pH	7.5	
CO_2	52	p.p.m.
Calcium & Magnesium Bicarbonates	352	p.p.m.
Sodium Bicarbonates	42	p.p.m.

Water is basic

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located, tissue copy to be retained by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

None required
Driller's License Number

Lehman B. Fox
Driller's Signature Matls. Engr.

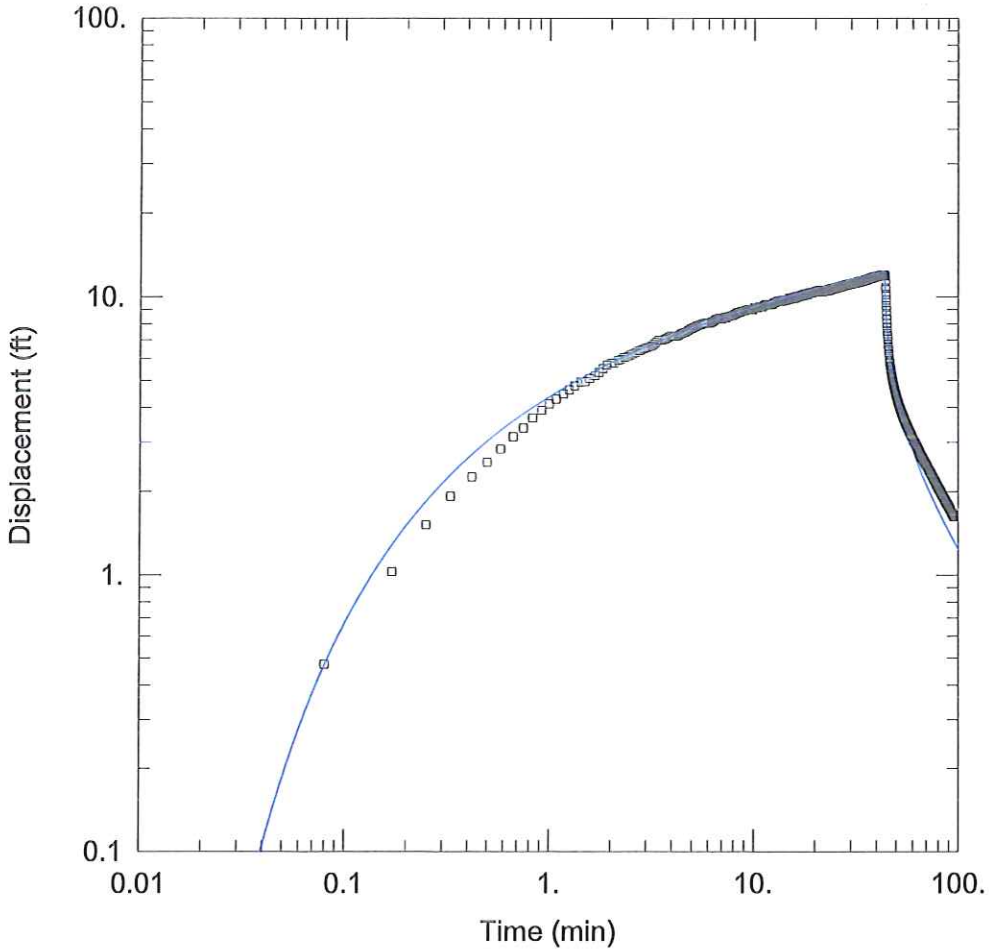
M-17256

APPENDIX B

Well 1 Pumping Test Drawdown and Recovery

TABLE 1 AQTESOLVE Pumping Test Analysis Results

APPENDIX B



PWS WELL PERFORMANCE TEST

Data Set: H:\24\11355\106\Ground_Surface Water Monitoring\Hysham West Bound.aqt
Date: 07/22/15 Time: 15:19:46

PROJECT INFORMATION

Company: DOWL HKM
Client: MDT
Project: 4524,11408
Location: Hysham West Bound Rest Stop
Test Well: PWS Well
Test Date: 6-12-14

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PWSWell	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PWSWell	0	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 0.2339 ft^2/min
r/B = 1.0E-5
b = 10. ft

S = 0.8321
Kz/Kr = 1.0E-5

Data Set: C:\Users\jpotts\Documents\hysham\Ground_Surface Water Monitoring\Hysham West Bound.aqt
Title: PWS Well Performance Test
Date: 09/05/14
Time: 12:25:05

PROJECT INFORMATION

Company: DOWL HKM
Client: MDT
Project: 4524,11408
Location: Columbus West Bound Rest Stop
Test Date: 6-12-14
Test Well: PWS Well

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b'): 1. ft
Aquitard Thickness (b"): 1. ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: PWSWell

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.25 ft
Well Radius: 0.3 ft

Partially Penetrating Well
Depth to Top of Screen: 8. ft
Depth to Bottom of Screen: 10. ft

No. of pumping periods: 3

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	10.	95.67	0.
43.58	0.		

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: PWSWell

X Location: 0. ft
Y Location: 0. ft

Radial distance from PWSWell: 0. ft

Partially Penetrating Well
Depth to Top of Screen: 8. ft
Depth to Bottom of Screen: 10. ft

No. of Observations: 1148

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.08	0.4754	47.92	4.986
0.17	1.028	48.	4.952
0.25	1.517	48.08	4.923
0.33	1.924	48.17	4.894
0.42	2.255	48.25	4.862
0.5	2.544	48.33	4.836
0.58	2.839	48.42	4.806
0.67	3.138	48.5	4.779
0.75	3.378	48.58	4.753
0.83	3.673	48.67	4.726
0.92	3.901	48.75	4.699

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.	4.116	48.83	4.673
1.08	4.298	48.92	4.649
1.17	4.48	49.	4.624
1.25	4.63	49.08	4.603
1.33	4.789	49.17	4.581
1.42	4.942	49.25	4.553
1.5	4.954	49.33	4.531
1.58	5.088	49.42	4.512
1.67	5.221	49.5	4.487
1.75	5.344	49.58	4.47
1.83	5.528	49.67	4.447
1.92	5.681	49.75	4.427
2.	5.76	49.83	4.408
2.08	5.791	49.92	4.39
2.17	5.905	50.	4.367
2.25	5.952	50.08	4.349
2.33	6.048	50.17	4.329
2.42	6.097	50.25	4.313
2.5	6.172	50.33	4.293
2.58	6.247	50.42	4.277
2.67	6.313	50.5	4.256
2.75	6.393	50.58	4.24
2.83	6.449	50.67	4.224
2.92	6.514	50.75	4.207
3.	6.572	50.83	4.193
3.08	6.618	50.92	4.178
3.17	6.663	51.	4.159
3.25	6.758	51.08	4.143
3.33	6.86	51.17	4.127
3.42	6.957	51.25	4.112
3.5	6.99	51.33	4.096
3.58	6.979	51.42	4.078
3.67	7.032	51.5	4.065
3.75	7.115	51.58	4.051
3.83	7.157	51.67	4.038
3.92	7.235	51.75	4.024
4.	7.256	51.83	4.011
4.08	7.217	51.92	3.996
4.17	7.222	52.	3.983
4.25	7.259	52.08	3.97
4.33	7.3	52.17	3.956
4.42	7.367	52.25	3.941
4.5	7.41	52.33	3.929
4.58	7.444	52.42	3.915
4.67	7.479	52.5	3.902
4.75	7.56	52.58	3.89
4.83	7.614	52.67	3.877
4.92	7.668	52.75	3.863
5.	7.718	52.83	3.852
5.08	7.772	52.92	3.839
5.17	7.788	53.	3.825
5.25	7.862	53.08	3.814
5.33	7.884	53.17	3.804
5.42	7.922	53.25	3.791
5.5	7.935	53.33	3.779
5.58	7.973	53.42	3.767
5.67	8.008	53.5	3.757
5.75	8.05	53.58	3.746
5.83	8.054	53.67	3.732
5.92	8.072	53.75	3.722
6.	8.015	53.83	3.711
6.08	8.036	53.92	3.703
6.17	8.096	54.	3.693
6.25	8.136	54.08	3.681
6.33	8.159	54.17	3.669
6.42	8.219	54.25	3.66
6.5	8.275	54.33	3.647
6.58	8.316	54.42	3.639
6.67	8.312	54.5	3.627
6.75	8.365	54.58	3.618
6.83	8.307	54.67	3.609
6.92	8.306	54.75	3.599
7.	8.311	54.83	3.588

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
7.08	8.399	54.92	3.577
7.17	8.411	55.	3.571
7.25	8.428	55.08	3.56
7.33	8.4	55.17	3.551
7.42	8.486	55.25	3.542
7.5	8.482	55.33	3.531
7.58	8.485	55.42	3.523
7.67	8.552	55.5	3.511
7.75	8.537	55.58	3.502
7.83	8.534	55.67	3.496
7.92	8.559	55.75	3.486
8.	8.633	55.83	3.478
8.08	8.665	55.92	3.469
8.17	8.674	56.	3.458
8.25	8.744	56.08	3.454
8.33	8.79	56.17	3.443
8.42	8.774	56.25	3.436
8.5	8.818	56.33	3.424
8.58	8.806	56.42	3.418
8.67	8.845	56.5	3.411
8.75	8.868	56.58	3.399
8.83	8.909	56.67	3.392
8.92	8.9	56.75	3.385
9.	8.912	56.83	3.377
9.08	8.934	56.92	3.369
9.17	8.966	57.	3.359
9.25	8.968	57.08	3.353
9.33	8.959	57.17	3.343
9.42	9.016	57.25	3.333
9.5	8.999	57.33	3.326
9.58	8.991	57.42	3.319
9.67	9.015	57.5	3.311
9.75	8.99	57.58	3.302
9.83	8.969	57.67	3.295
9.92	8.983	57.75	3.287
10.	9.074	57.83	3.281
10.08	9.123	57.92	3.273
10.17	9.155	58.	3.264
10.25	9.159	58.08	3.259
10.33	9.145	58.17	3.252
10.42	9.099	58.25	3.241
10.5	9.153	58.33	3.234
10.58	9.203	58.42	3.225
10.67	9.234	58.5	3.218
10.75	9.215	58.58	3.215
10.83	9.179	58.67	3.203
10.92	9.168	58.75	3.197
11.	9.204	58.83	3.192
11.08	9.257	58.92	3.184
11.17	9.291	59.	3.176
11.25	9.31	59.08	3.168
11.33	9.377	59.17	3.161
11.42	9.361	59.25	3.153
11.5	9.399	59.33	3.148
11.58	9.406	59.42	3.14
11.67	9.35	59.5	3.136
11.75	9.391	59.58	3.129
11.83	9.335	59.67	3.122
11.92	9.354	59.75	3.114
12.	9.362	59.83	3.107
12.08	9.371	59.92	3.101
12.17	9.388	60.	3.097
12.25	9.409	60.08	3.086
12.33	9.401	60.17	3.079
12.42	9.471	60.25	3.075
12.5	9.52	60.33	3.069
12.58	9.52	60.42	3.062
12.67	9.539	60.5	3.054
12.75	9.556	60.58	3.046
12.83	9.567	60.67	3.042
12.92	9.597	60.75	3.034
13.	9.64	60.83	3.027
13.08	9.62	60.92	3.024

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
13.17	9.642	61.	3.016
13.25	9.673	61.08	3.01
13.33	9.668	61.17	3.003
13.42	9.652	61.25	3.
13.5	9.642	61.33	2.99
13.58	9.631	61.42	2.988
13.67	9.601	61.5	2.978
13.75	9.644	61.58	2.972
13.83	9.747	61.67	2.968
13.92	9.77	61.75	2.964
14.	9.712	61.83	2.955
14.08	9.653	61.92	2.95
14.17	9.706	62.	2.945
14.25	9.699	62.08	2.939
14.33	9.705	62.17	2.932
14.42	9.725	62.25	2.926
14.5	9.719	62.33	2.922
14.58	9.767	62.42	2.912
14.67	9.765	62.5	2.907
14.75	9.819	62.58	2.904
14.83	9.842	62.67	2.898
14.92	9.899	62.75	2.892
15.	9.903	62.83	2.885
15.08	9.81	62.92	2.882
15.17	9.803	63.	2.875
15.25	9.888	63.08	2.867
15.33	9.927	63.17	2.864
15.42	9.953	63.25	2.858
15.5	9.866	63.33	2.854
15.58	9.863	63.42	2.848
15.67	9.946	63.5	2.841
15.75	10.01	63.58	2.837
15.83	9.989	63.67	2.832
15.92	9.896	63.75	2.826
16.	9.96	63.83	2.822
16.08	10.05	63.92	2.815
16.17	10.06	64.	2.811
16.25	9.966	64.08	2.806
16.33	9.956	64.17	2.801
16.42	10.03	64.25	2.795
16.5	10.07	64.33	2.791
16.58	10.01	64.42	2.785
16.67	10.06	64.5	2.778
16.75	10.13	64.58	2.775
16.83	10.11	64.67	2.768
16.92	10.05	64.75	2.762
17.	10.06	64.83	2.757
17.08	10.11	64.92	2.753
17.17	10.17	65.	2.747
17.25	10.09	65.08	2.744
17.33	10.08	65.17	2.736
17.42	10.2	65.25	2.731
17.5	10.23	65.33	2.728
17.58	10.2	65.42	2.721
17.67	10.12	65.5	2.715
17.75	10.14	65.58	2.714
17.83	10.25	65.67	2.708
17.92	10.28	65.75	2.704
18.	10.19	65.83	2.699
18.08	10.18	65.92	2.694
18.17	10.26	66.	2.689
18.25	10.31	66.08	2.684
18.33	10.24	66.17	2.679
18.42	10.2	66.25	2.672
18.5	10.25	66.33	2.67
18.58	10.27	66.42	2.663
18.67	10.34	66.5	2.659
18.75	10.33	66.58	2.653
18.83	10.36	66.67	2.651
18.92	10.35	66.75	2.644
19.	10.36	66.83	2.639
19.08	10.39	66.92	2.633
19.17	10.34	67.	2.629

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
19.25	10.29	67.08	2.624
19.33	10.32	67.17	2.618
19.42	10.39	67.25	2.617
19.5	10.39	67.33	2.609
19.58	10.44	67.42	2.606
19.67	10.42	67.5	2.602
19.75	10.37	67.58	2.597
19.83	10.42	67.67	2.593
19.92	10.47	67.75	2.587
20.	10.49	67.83	2.582
20.08	10.47	67.92	2.578
20.17	10.41	68.	2.575
20.25	10.44	68.08	2.566
20.33	10.51	68.17	2.565
20.42	10.43	68.25	2.56
20.5	10.47	68.33	2.559
20.58	10.56	68.42	2.554
20.67	10.54	68.5	2.546
20.75	10.53	68.58	2.543
20.83	10.5	68.67	2.542
20.92	10.49	68.75	2.534
21.	10.53	68.83	2.532
21.08	10.55	68.92	2.53
21.17	10.6	69.	2.526
21.25	10.56	69.08	2.52
21.33	10.53	69.17	2.518
21.42	10.55	69.25	2.51
21.5	10.45	69.33	2.505
21.58	10.41	69.42	2.504
21.67	10.4	69.5	2.498
21.75	10.46	69.58	2.496
21.83	10.51	69.67	2.49
21.92	10.47	69.75	2.487
22.	10.45	69.83	2.482
22.08	10.5	69.92	2.478
22.17	10.44	70.	2.474
22.25	10.54	70.08	2.473
22.33	10.48	70.17	2.468
22.42	10.45	70.25	2.463
22.5	10.5	70.33	2.458
22.58	10.58	70.42	2.454
22.67	10.57	70.5	2.451
22.75	10.49	70.58	2.446
22.83	10.52	70.67	2.441
22.92	10.59	70.75	2.439
23.	10.52	70.83	2.436
23.08	10.52	70.92	2.428
23.17	10.61	71.	2.429
23.25	10.65	71.08	2.425
23.33	10.6	71.17	2.42
23.42	10.56	71.25	2.415
23.5	10.64	71.33	2.411
23.58	10.55	71.42	2.406
23.67	10.63	71.5	2.404
23.75	10.69	71.58	2.401
23.83	10.64	71.67	2.397
23.92	10.6	71.75	2.391
24.	10.61	71.83	2.389
24.08	10.69	71.92	2.383
24.17	10.67	72.	2.382
24.25	10.64	72.08	2.378
24.33	10.7	72.17	2.375
24.42	10.74	72.25	2.37
24.5	10.68	72.33	2.367
24.58	10.65	72.42	2.363
24.67	10.69	72.5	2.358
24.75	10.76	72.58	2.353
24.83	10.76	72.67	2.351
24.92	10.7	72.75	2.347
25.	10.73	72.83	2.346
25.08	10.75	72.92	2.342
25.17	10.71	73.	2.336
25.25	10.78	73.08	2.333

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
25.33	10.82	73.17	2.335
25.42	10.74	73.25	2.325
25.5	10.81	73.33	2.322
25.58	10.82	73.42	2.318
25.67	10.74	73.5	2.315
25.75	10.79	73.58	2.314
25.83	10.86	73.67	2.307
25.92	10.8	73.75	2.305
26.	10.79	73.83	2.3
26.08	10.82	73.92	2.296
26.17	10.86	74.	2.293
26.25	10.9	74.08	2.292
26.33	10.9	74.17	2.287
26.42	10.85	74.25	2.286
26.5	10.83	74.33	2.283
26.58	10.82	74.42	2.277
26.67	10.9	74.5	2.273
26.75	10.88	74.58	2.27
26.83	10.86	74.67	2.267
26.92	10.91	74.75	2.264
27.	10.96	74.83	2.261
27.08	10.9	74.92	2.257
27.17	10.86	75.	2.253
27.25	10.93	75.08	2.252
27.33	10.97	75.17	2.246
27.42	10.94	75.25	2.243
27.5	10.91	75.33	2.239
27.58	10.94	75.42	2.236
27.67	10.98	75.5	2.231
27.75	10.98	75.58	2.231
27.83	10.96	75.67	2.224
27.92	10.97	75.75	2.221
28.	11.03	75.83	2.22
28.08	10.98	75.92	2.217
28.17	10.94	76.	2.212
28.25	11.04	76.08	2.208
28.33	11.01	76.17	2.204
28.42	10.99	76.25	2.201
28.5	11.07	76.33	2.2
28.58	10.98	76.42	2.199
28.67	10.99	76.5	2.193
28.75	11.09	76.58	2.188
28.83	11.05	76.67	2.185
28.92	11.1	76.75	2.183
29.	11.04	76.83	2.177
29.08	11.1	76.92	2.176
29.17	11.1	77.	2.172
29.25	11.04	77.08	2.168
29.33	11.04	77.17	2.166
29.42	11.12	77.25	2.165
29.5	11.08	77.33	2.158
29.58	11.05	77.42	2.157
29.67	11.12	77.5	2.155
29.75	11.15	77.58	2.149
29.83	11.08	77.67	2.146
29.92	11.11	77.75	2.143
30.	11.17	77.83	2.142
30.08	11.11	77.92	2.135
30.17	11.11	78.	2.133
30.25	11.17	78.08	2.13
30.33	11.19	78.17	2.128
30.42	11.13	78.25	2.123
30.5	11.1	78.33	2.121
30.58	11.17	78.42	2.117
30.67	11.22	78.5	2.114
30.75	11.21	78.58	2.109
30.83	11.14	78.67	2.108
30.92	11.15	78.75	2.106
31.	11.18	78.83	2.103
31.08	11.22	78.92	2.1
31.17	11.25	79.	2.095
31.25	11.25	79.08	2.092
31.33	11.21	79.17	2.09

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
31.42	11.17	79.25	2.087
31.5	11.19	79.33	2.084
31.58	11.22	79.42	2.081
31.67	11.25	79.5	2.081
31.75	11.27	79.58	2.076
31.83	11.26	79.67	2.071
31.92	11.25	79.75	2.068
32.	11.23	79.83	2.065
32.08	11.24	79.92	2.063
32.17	11.31	80.	2.06
32.25	11.28	80.08	2.057
32.33	11.24	80.17	2.054
32.42	11.33	80.25	2.051
32.5	11.35	80.33	2.051
32.58	11.27	80.42	2.046
32.67	11.29	80.5	2.042
32.75	11.33	80.58	2.04
32.83	11.34	80.67	2.039
32.92	11.29	80.75	2.034
33.	11.33	80.83	2.031
33.08	11.4	80.92	2.028
33.17	11.34	81.	2.025
33.25	11.29	81.08	2.024
33.33	11.36	81.17	2.019
33.42	11.41	81.25	2.018
33.5	11.39	81.33	2.016
33.58	11.33	81.42	2.011
33.67	11.34	81.5	2.01
33.75	11.42	81.58	2.004
33.83	11.42	81.67	2.003
33.92	11.36	81.75	2.
34.	11.42	81.83	1.997
34.08	11.4	81.92	1.997
34.17	11.38	82.	1.99
34.25	11.43	82.08	1.991
34.33	11.47	82.17	1.984
34.42	11.38	82.25	1.982
34.5	11.4	82.33	1.984
34.58	11.48	82.42	1.98
34.67	11.42	82.5	1.974
34.75	11.48	82.58	1.976
34.83	11.47	82.67	1.972
34.92	11.43	82.75	1.969
35.	11.44	82.83	1.966
35.08	11.5	82.92	1.961
35.17	11.51	83.	1.961
35.25	11.44	83.08	1.956
35.33	11.47	83.17	1.954
35.42	11.51	83.25	1.95
35.5	11.56	83.33	1.95
35.58	11.52	83.42	1.946
35.67	11.49	83.5	1.942
35.75	11.49	83.58	1.942
35.83	11.49	83.67	1.94
35.92	11.52	83.75	1.935
36.	11.56	83.83	1.931
36.08	11.6	83.92	1.932
36.17	11.57	84.	1.928
36.25	11.53	84.08	1.926
36.33	11.57	84.17	1.922
36.42	11.62	84.25	1.919
36.5	11.6	84.33	1.919
36.58	11.57	84.42	1.914
36.67	11.6	84.5	1.913
36.75	11.64	84.58	1.91
36.83	11.64	84.67	1.907
36.92	11.6	84.75	1.907
37.	11.61	84.83	1.903
37.08	11.68	84.92	1.901
37.17	11.68	85.	1.898
37.25	11.68	85.08	1.896
37.33	11.64	85.17	1.894
37.42	11.64	85.25	1.891

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
37.5	11.62	85.33	1.887
37.58	11.65	85.42	1.883
37.67	11.7	85.5	1.882
37.75	11.74	85.58	1.88
37.83	11.74	85.67	1.877
37.92	11.74	85.75	1.876
38.	11.74	85.83	1.873
38.08	11.7	85.92	1.871
38.17	11.69	86.	1.868
38.25	11.7	86.08	1.865
38.33	11.71	86.17	1.862
38.42	11.72	86.25	1.861
38.5	11.74	86.33	1.858
38.58	11.79	86.42	1.855
38.67	11.81	86.5	1.854
38.75	11.75	86.58	1.849
38.83	11.72	86.67	1.846
38.92	11.77	86.75	1.848
39.	11.82	86.83	1.842
39.08	11.79	86.92	1.842
39.17	11.82	87.	1.84
39.25	11.78	87.08	1.834
39.33	11.74	87.17	1.836
39.42	11.76	87.25	1.833
39.5	11.77	87.33	1.83
39.58	11.75	87.42	1.825
39.67	11.78	87.5	1.826
39.75	11.81	87.58	1.821
39.83	11.84	87.67	1.82
39.92	11.85	87.75	1.817
40.	11.81	87.83	1.814
40.08	11.78	87.92	1.812
40.17	11.83	88.	1.809
40.25	11.89	88.08	1.812
40.33	11.89	88.17	1.81
40.42	11.87	88.25	1.806
40.5	11.9	88.33	1.799
40.58	11.9	88.42	1.799
40.67	11.84	88.5	1.798
40.75	11.86	88.58	1.796
40.83	11.86	88.67	1.793
40.92	11.83	88.75	1.79
41.	11.84	88.83	1.789
41.08	11.86	88.92	1.789
41.17	11.87	89.	1.785
41.25	11.92	89.08	1.783
41.33	11.93	89.17	1.78
41.42	11.95	89.25	1.78
41.5	11.93	89.33	1.775
41.58	11.91	89.42	1.775
41.67	11.97	89.5	1.77
41.75	11.97	89.58	1.769
41.83	11.94	89.67	1.769
41.92	11.94	89.75	1.764
42.	11.94	89.83	1.764
42.08	11.9	89.92	1.761
42.17	11.88	90.	1.757
42.25	11.91	90.08	1.754
42.33	11.97	90.17	1.754
42.42	12.	90.25	1.752
42.5	11.93	90.33	1.748
42.58	11.91	90.42	1.746
42.67	11.97	90.5	1.744
42.75	12.02	90.58	1.741
42.83	12.01	90.67	1.739
42.92	11.98	90.75	1.736
43.	11.96	90.83	1.736
43.08	11.97	90.92	1.735
43.17	11.94	91.	1.731
43.25	11.98	91.08	1.73
43.33	11.99	91.17	1.726
43.42	11.94	91.25	1.725
43.5	11.98	91.33	1.722

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
43.58	11.97	91.42	1.72
43.67	11.89	91.5	1.719
43.75	11.86	91.58	1.715
43.83	11.9	91.67	1.712
43.92	11.89	91.75	1.712
44.	11.88	91.83	1.707
44.08	11.87	91.92	1.708
44.17	11.36	92.	1.702
44.25	10.75	92.08	1.703
44.33	10.21	92.17	1.698
44.42	9.73	92.25	1.696
44.5	9.305	92.33	1.695
44.58	8.924	92.42	1.693
44.67	8.58	92.5	1.693
44.75	8.278	92.58	1.686
44.83	8.008	92.67	1.687
44.92	7.767	92.75	1.685
45.	7.555	92.83	1.684
45.08	7.362	92.92	1.682
45.17	7.192	93.	1.679
45.25	7.034	93.08	1.677
45.33	6.893	93.17	1.676
45.42	6.766	93.25	1.673
45.5	6.646	93.33	1.67
45.58	6.539	93.42	1.669
45.67	6.436	93.5	1.667
45.75	6.341	93.58	1.662
45.83	6.256	93.67	1.661
45.92	6.171	93.75	1.66
46.	6.094	93.83	1.66
46.08	6.02	93.92	1.656
46.17	5.949	94.	1.654
46.25	5.884	94.08	1.649
46.33	5.822	94.17	1.65
46.42	5.758	94.25	1.648
46.5	5.701	94.33	1.647
46.58	5.648	94.42	1.644
46.67	5.595	94.5	1.643
46.75	5.54	94.58	1.643
46.83	5.492	94.67	1.639
46.92	5.448	94.75	1.639
47.	5.401	94.83	1.634
47.08	5.356	94.92	1.633
47.17	5.314	95.	1.633
47.25	5.274	95.08	1.63
47.33	5.233	95.17	1.627
47.42	5.195	95.25	1.628
47.5	5.159	95.33	1.625
47.58	5.12	95.42	1.623
47.67	5.086	95.5	1.621
47.75	5.052	95.58	1.618
47.83	5.017	95.67	1.621

SOLUTION

Pumping Test
Aquifer Model: Leaky
Solution Method: Hantush-Jacob

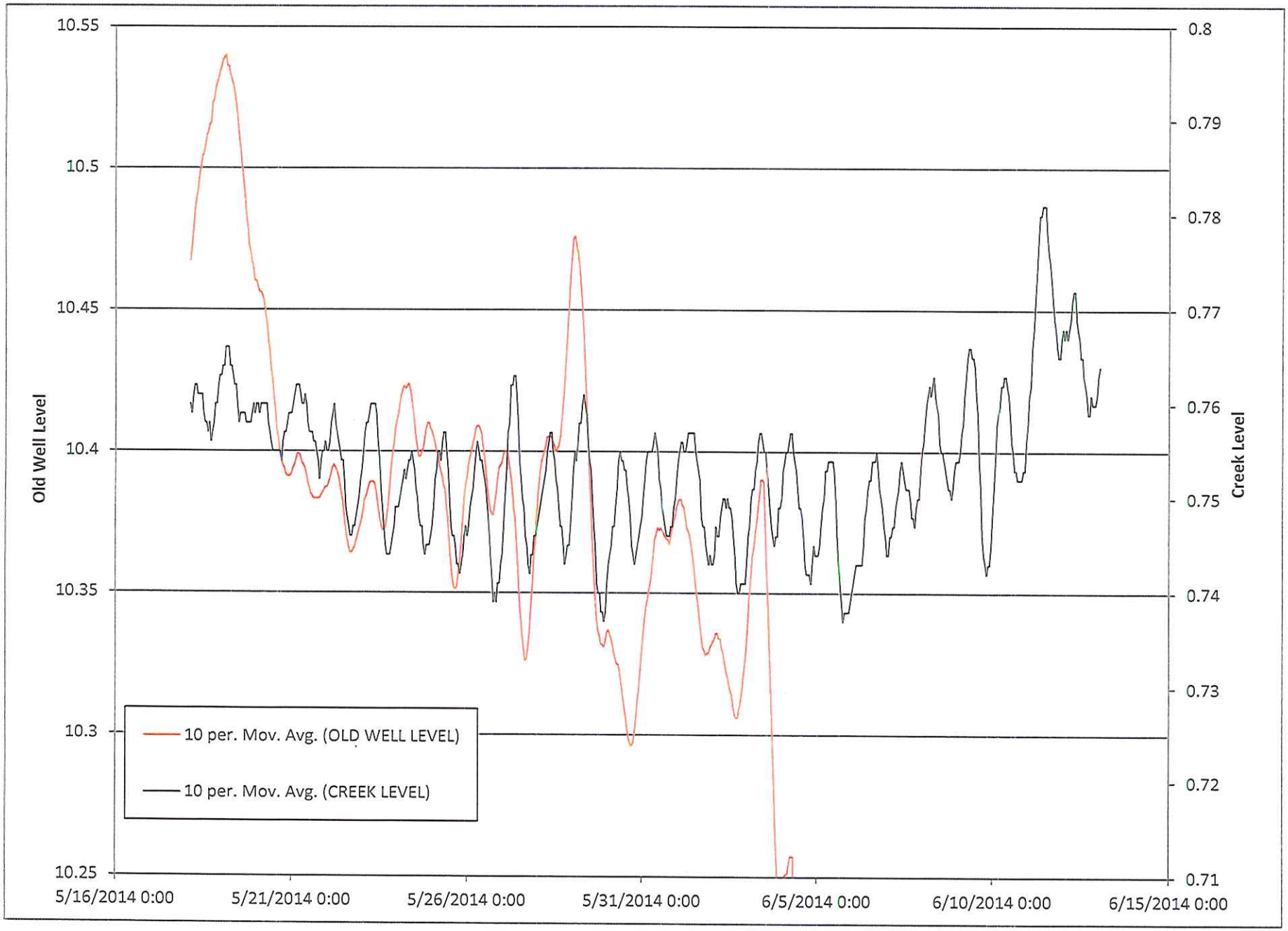
VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.1926	ft^2/min
S	0.9559	
r/B	1.0E-5	
Kz/Kr	1.	
b	10.	ft

K = T/b = 0.01926 ft/min (0.009784 cm/sec)
Ss = S/b = 0.09559 1/ft
K'/b' = 2.14E-10 min^{-1}

K' = 2.14E-10 ft/min


10.55
10.5
10.45
10.4
10.35
10.3
10.25
Old Well Level
0.8
0.79
0.78
0.77
0.76
0.75
0.74
0.73
0.72
0.71
Creek Level
5/16/2014 0:00
5/21/2014 0:00
5/26/2014 0:00
5/31/2014 0:00
6/5/2014 0:00
6/10/2014 0:00
6/15/2014 0:00
10 per. Mov. Avg. (OLD WELL LEVEL)
10 per. Mov. Avg. (CREEK LEVEL)

APPENDIX C

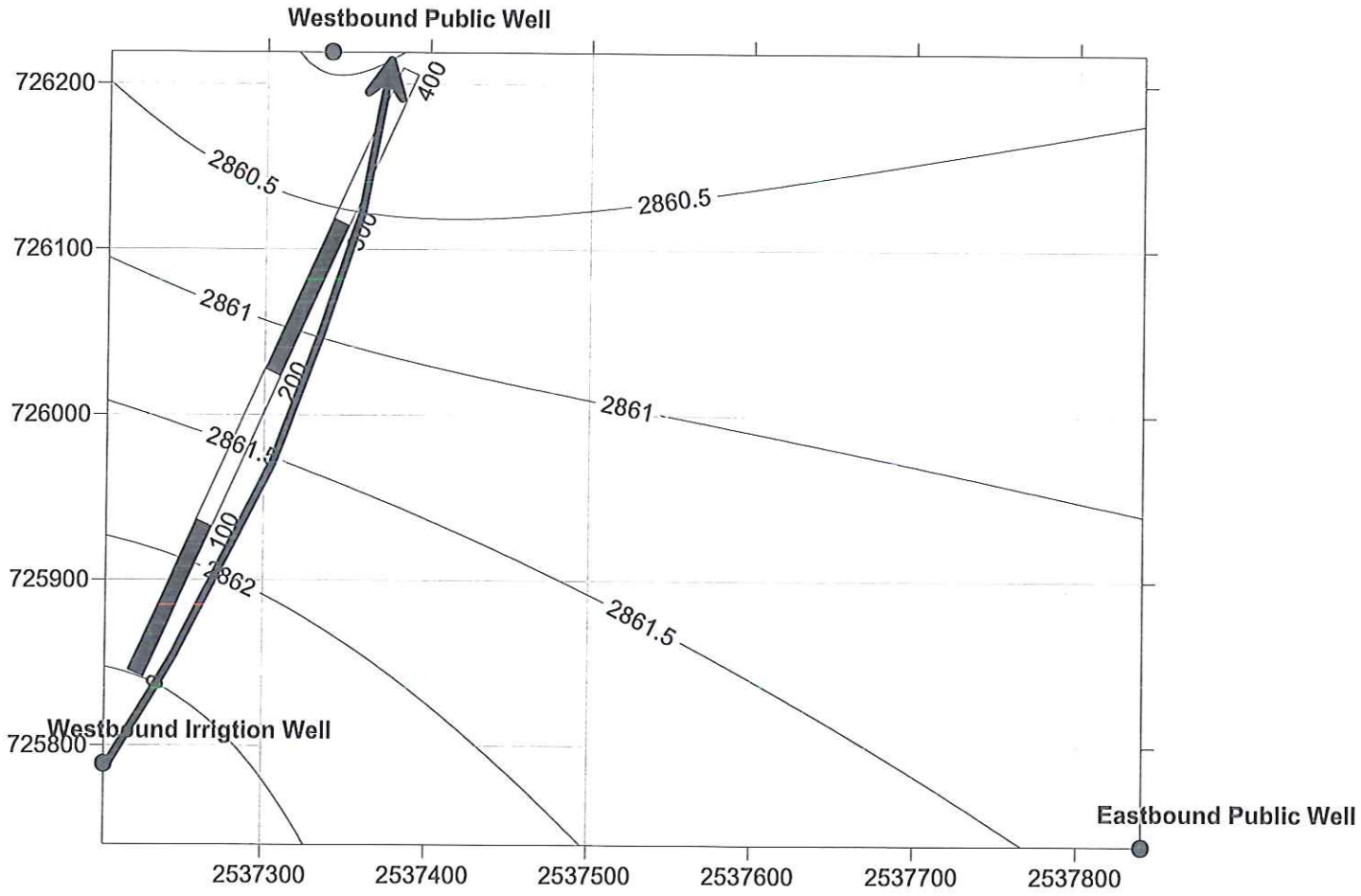
Hysham Rest Area Groundwater Surface Map

APPENDIX C

Hyshanm Rest Stop
Groundwater Elevation Contour Map
6/13/2014

Groundwater Flow Direction
North 24 Degrees East

Groundwater Gradient
(2862.5 - 2860.5)/310 = 0.0065



APPENDIX D

Hysham Rest Area Water Quality Results

APPENDIX D

ENERGY LABORATORIES
www.energylab.com
Analytical Excellence Since 1952
Helena, MT 877-472-0711 • Billings, MT 800-735-4489 • Casper, WY 888-235-0515
Gillette, WY 866-686-7175 • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

ANALYTICAL SUMMARY REPORT

June 23, 2014

DOWL HKM
2090 Stadium Dr
Bozeman, MT 59715-0616

Work Order: B14061281

Project Name: Hysham Rest Stop

Energy Laboratories Inc Billings MT received the following 2 samples for DOWL HKM on 6/13/2014 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B14061281-001	Hysham Rest Stop West	06/13/14 10:40	06/13/14	Drinking Water	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water Alkalinity Bacteria, Private Water Supply Conductivity Hardness as CaCO3 Anions by Ion Chromatography Nitrogen, Nitrite Nitrogen, Nitrate + Nitrite Nitrogen, Nitrate pH Drinking Water Metals Digestion by EPA 200.2 Preparation, Dissolved Filtration Solids, Total Dissolved
B14061281-002	Hysham Rest Area East	06/13/14 12:50	06/13/14	Drinking Water	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water Alkalinity Bacteria, Private Water Supply Conductivity Mercury, Drinking Water Hardness as CaCO3 Anions by Ion Chromatography Nitrogen, Nitrite Nitrogen, Nitrate + Nitrite Nitrogen, Nitrate pH Drinking Water Metals Digestion by EPA 200.2 Preparation, Dissolved Filtration Digestion, Mercury by CVAA Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Cindy Rohrer
Laboratory Co-Manager

Digitally signed by
Cindy Rohrer
Date: 2014.06.23 09:12:15 -06:00

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client:	DOWL HKM	**Report Date:**	06/23/14
Project:	Hysham Rest Stop	**Collection Date:**	06/13/14 10:40
Client Sample ID:	Hysham Rest Stop West	**Received Date:**	06/13/14 15:12
Sampled By:	Jim Potts	**Matrix:**	Drinking Water
Lab ID:	B14061281-001E		

Analyses	Result	Units	Safe/Unsafe	Qualifier	Method	Analysis Date / By
MICROBIOLOGICAL						
Coliform, Total	Absent	per 100ml	SAFE		A9223	06/13/14 16:53 / ldv
Coliform, E-Coli	Absent	per 100ml			A9223	06/13/14 16:53 / ldv

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

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

Method Reference: E - EPA / MCAWW Methodology A - Standard Methods 19th Ed.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop
Client Sample ID: Hysham Rest Area East
Sampled By: Jim Potts
Lab ID: B14061281-002E

Report Date: 06/23/14
Collection Date: 06/13/14 12:50
Received Date: 06/13/14 15:12
Matrix: Drinking Water

Analyses	Result	Units	Safe/Unsafe	Qualifier	Method	Analysis Date / By
MICROBIOLOGICAL						
Coliform, Total	Absent	per 100ml	SAFE		A9223	06/13/14 16:53 / ldv
Coliform, E-Coli	Absent	per 100ml			A9223	06/13/14 16:53 / ldv

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

Method Reference: E - EPA / MCAWW Methodology A - Standard Methods 19th Ed.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop
Lab ID: B14061281-001
Client Sample ID: Hysham Rest Stop West

Report Date: 06/23/14
Collection Date: 06/13/14 10:40
DateReceived: 06/13/14
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1		A4500-H B	06/13/14 16:29 / cnm
Conductivity @ 25 C	1550	umhos/cm		5		A2510 B	06/13/14 16:29 / cnm
Solids, Total Dissolved TDS @ 180 C	1050	mg/L		20		A2540 C	06/17/14 15:26 / pjw
INORGANICS							
Alkalinity, Total as CaCO3	393	mg/L		4		A2320 B	06/13/14 21:54 / bas
Chloride	13	mg/L		1		E300.0	06/17/14 09:43 / rbf
Sulfate	444	mg/L	D	5		E300.0	06/17/14 09:43 / rbf
Fluoride	0.2	mg/L		0.1		E300.0	06/19/14 00:17 / rbf
Hardness as CaCO3	379	mg/L		1		A2340 B	06/17/14 13:36 / sln
NUTRIENTS							
Nitrogen, Nitrite as N	ND	mg/L		0.05		E353.2	06/13/14 16:35 / jbm
Nitrogen, Nitrate as N	ND	mg/L		0.05		Calculation	06/18/14 12:32 / sln
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	10	E353.2	06/17/14 14:38 / jbm
METALS, DISSOLVED							
Calcium	81	mg/L		1		E200.7	06/16/14 20:52 / mas
Magnesium	43	mg/L		1		E200.7	06/16/14 20:52 / mas
Potassium	4	mg/L		1		E200.7	06/16/14 20:52 / mas
Sodium	234	mg/L		1		E200.7	06/16/14 20:52 / mas
METALS, TOTAL							
Antimony	ND	mg/L		0.001	0.006	E200.8	06/16/14 13:03 / amm
Arsenic	ND	mg/L		0.001	0.01	E200.8	06/16/14 13:03 / amm
Barium	ND	mg/L		0.05	2	E200.8	06/16/14 13:03 / amm
Beryllium	ND	mg/L		0.001	0.004	E200.8	06/16/14 13:03 / amm
Cadmium	ND	mg/L		0.001	0.005	E200.8	06/16/14 13:03 / amm
Chromium	ND	mg/L		0.005	0.1	E200.8	06/16/14 13:03 / amm
Iron	0.68	mg/L		0.02		E200.7	06/16/14 12:40 / mas
Manganese	0.257	mg/L		0.001		E200.7	06/16/14 12:40 / mas
Mercury	ND	mg/L		0.0001	0.002	E200.8	06/16/14 13:03 / amm
Nickel	ND	mg/L		0.01		E200.8	06/16/14 13:03 / amm
Selenium	ND	mg/L		0.001	0.05	E200.8	06/16/14 13:03 / amm
Thallium	ND	mg/L		0.0005	0.002	E200.8	06/16/14 13:03 / amm

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop
Lab ID: B14061281-002
Client Sample ID: Hysham Rest Area East

Report Date: 06/23/14
Collection Date: 06/13/14 12:50
DateReceived: 06/13/14
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.4	s.u.	H	0.1		A4500-H B	06/13/14 17:24 / cnm
Conductivity @ 25 C	1750	umhos/cm		5		A2510 B	06/13/14 17:24 / cnm
Solids, Total Dissolved TDS @ 180 C	1240	mg/L		20		A2540 C	06/17/14 15:28 / pjw
INORGANICS							
Alkalinity, Total as CaCO3	427	mg/L		4		A2320 B	06/13/14 22:09 / bas
Chloride	17	mg/L		1		E300.0	06/17/14 10:28 / rbf
Sulfate	544	mg/L	D	5		E300.0	06/17/14 10:28 / rbf
Fluoride	0.1	mg/L		0.1		E300.0	06/20/14 03:05 / rbf
Hardness as CaCO3	512	mg/L		1		A2340 B	06/17/14 13:36 / sln
NUTRIENTS							
Nitrogen, Nitrite as N	0.19	mg/L		0.05		E353.2	06/13/14 16:37 / jbm
Nitrogen, Nitrate as N	ND	mg/L		0.05		Calculation	06/18/14 12:32 / sln
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	10	E353.2	06/17/14 14:41 / jbm
METALS, DISSOLVED							
Calcium	105	mg/L		1		E200.7	06/16/14 20:55 / mas
Magnesium	61	mg/L		1		E200.7	06/16/14 20:55 / mas
Potassium	5	mg/L		1		E200.7	06/16/14 20:55 / mas
Sodium	239	mg/L		1		E200.7	06/16/14 20:55 / mas
METALS, TOTAL							
Antimony	ND	mg/L		0.001	0.006	E200.8	06/19/14 18:13 / amm
Arsenic	0.005	mg/L		0.001	0.01	E200.8	06/19/14 18:13 / amm
Barium	ND	mg/L		0.05	2	E200.8	06/19/14 18:13 / amm
Beryllium	ND	mg/L		0.001	0.004	E200.8	06/19/14 18:13 / amm
Cadmium	ND	mg/L		0.001	0.005	E200.8	06/19/14 18:13 / amm
Chromium	ND	mg/L		0.005	0.1	E200.8	06/19/14 18:13 / amm
Iron	16.2	mg/L		0.02		E200.7	06/20/14 03:01 / mas
Manganese	0.437	mg/L		0.001		E200.8	06/19/14 18:13 / amm
Mercury	ND	mg/L		0.0001	0.002	E245.1	06/20/14 14:12 / ser
Nickel	0.01	mg/L		0.01		E200.8	06/19/14 18:13 / amm
Selenium	ND	mg/L		0.001	0.05	E200.8	06/19/14 18:13 / amm
Thallium	ND	mg/L		0.0005	0.002	E200.8	06/19/14 18:13 / amm

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R225504
Lab ID: MBLK		Method Blank				Run: MAN-TECH_140613A				06/13/14 21:28
Alkalinity, Total as CaCO3		ND	mg/L	4.0						
Lab ID: LCS		Laboratory Control Sample				Run: MAN-TECH_140613A				06/13/14 21:36
Alkalinity, Total as CaCO3		99.5	mg/L	4.0	99	90	110			
Lab ID: B14061277-002ADUP		Sample Duplicate				Run: MAN-TECH_140613A				06/13/14 21:47
Alkalinity, Total as CaCO3		ND	mg/L	4.0					10	
Lab ID: B14061281-001AMS		Sample Matrix Spike				Run: MAN-TECH_140613A				06/13/14 22:02
Alkalinity, Total as CaCO3		551	mg/L	4.0	93	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2510 B									Analytical Run: PHSC _101-B_140613A	
Lab ID: SC 150		Continuing Calibration Verification Standard								06/13/14 09:13
Conductivity @ 25 C		150	umhos/cm	5.0	100	90	110			
Lab ID: SC 5000		Continuing Calibration Verification Standard								06/13/14 09:15
Conductivity @ 25 C		4940	umhos/cm	5.0	99	90	110			
Lab ID: CCV - SC 1413		Continuing Calibration Verification Standard								06/13/14 13:29
Conductivity @ 25 C		1410	umhos/cm	5.0	100	90	110			
Lab ID: CCV - SC 1413		Continuing Calibration Verification Standard								06/13/14 16:44
Conductivity @ 25 C		1400	umhos/cm	5.0	99	90	110			
Method: A2510 B										Batch: R225437
Lab ID: SC 20000		Continuing Calibration Verification Standard				Run: PHSC _101-B_140613A				06/13/14 09:18
Conductivity @ 25 C		19900	umhos/cm	5.0	99	90	110			
Lab ID: SC 2nd 1413		Laboratory Control Sample				Run: PHSC _101-B_140613A				06/13/14 09:21
Conductivity @ 25 C		1360	umhos/cm	5.0	96	90	110			
Lab ID: MBLK		Method Blank				Run: PHSC _101-B_140613A				06/13/14 16:05
Conductivity @ 25 C		4.00	umhos/cm	5.0						
Lab ID: B14061268-001ADUP		Sample Duplicate				Run: PHSC _101-B_140613A				06/13/14 16:10
Conductivity @ 25 C		34000	umhos/cm	5.0				0.1	10	
Lab ID: B14061281-001ADUP		Sample Duplicate				Run: PHSC _101-B_140613A				06/13/14 16:31
Conductivity @ 25 C		1550	umhos/cm	5.0				0.0	10	
Lab ID: MBLK		Method Blank				Run: PHSC _101-B_140613A				06/13/14 17:21
Conductivity @ 25 C		3.00	umhos/cm	5.0						
Lab ID: B14061281-002ADUP		Sample Duplicate				Run: PHSC _101-B_140613A				06/13/14 17:26
Conductivity @ 25 C		1760	umhos/cm	5.0				0.5	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C									Batch: TDS140617A	
Lab ID: MB-1_140617A		Method Blank				Run: BAL #11_140617B			06/17/14 15:23	
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	3						
Lab ID: LCS-2_140617A		Laboratory Control Sample				Run: BAL #11_140617B			06/17/14 15:24	
Solids, Total Dissolved TDS @ 180 C		2020	mg/L	10	101	90	110			
Lab ID: B14061281-001A MS		Sample Matrix Spike				Run: BAL #11_140617B			06/17/14 15:26	
Solids, Total Dissolved TDS @ 180 C		2990	mg/L	10	97	90	110			
Lab ID: B14061277-001A DUP		Sample Duplicate				Run: BAL #11_140617B			06/17/14 15:27	
Solids, Total Dissolved TDS @ 180 C		2160	mg/L	10		90	110	0.4	5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B									Analytical Run: PHSC _101-B_140613A	
Lab ID: pH 8	Initial Calibration Verification Standard								06/13/14 09:10	
pH		7.95	s.u.	0.10	99	98	102			
Lab ID: CCV - pH 7	Continuing Calibration Verification Standard								06/13/14 13:41	
pH		6.99	s.u.	0.10	100	98	102			
Lab ID: CCV - pH 7	Continuing Calibration Verification Standard								06/13/14 16:42	
pH		7.00	s.u.	0.10	100	98	102			
Method: A4500-H B									Batch: R225437	
Lab ID: B14061281-001ADUP	Sample Duplicate					Run: PHSC _101-B_140613A			06/13/14 16:31	
pH		7.54	s.u.	0.10				0.4	3	
Lab ID: B14061281-002ADUP	Sample Duplicate					Run: PHSC _101-B_140613A			06/13/14 17:26	
pH		7.45	s.u.	0.10				0.0	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP203-B_140616A	
Lab ID: ICV	6	Continuing Calibration Verification Standard							06/16/14 11:46	
Calcium		25.0	mg/L	1.0	100	95	105			
Iron		2.49	mg/L	0.020	100	95	105			
Magnesium		25.3	mg/L	1.0	101	95	105			
Manganese		2.49	mg/L	0.010	100	95	105			
Potassium		24.9	mg/L	1.0	100	95	105			
Sodium		25.0	mg/L	1.0	100	95	105			
Method: E200.7									Batch: R225546	
Lab ID: MB-6500DIS140616A	6	Method Blank				Run: ICP203-B_140616A			06/16/14 12:10	
Calcium		ND	mg/L	0.01						
Iron		ND	mg/L	0.004						
Magnesium		ND	mg/L	0.003						
Manganese		ND	mg/L	0.0005						
Potassium		ND	mg/L	0.08						
Sodium		ND	mg/L	0.03						
Lab ID: LFB-6500DIS140616A	6	Laboratory Fortified Blank				Run: ICP203-B_140616A			06/16/14 12:13	
Calcium		51.1	mg/L	1.0	102	85	115			
Iron		5.04	mg/L	0.020	101	85	115			
Magnesium		52.4	mg/L	1.0	105	85	115			
Manganese		5.12	mg/L	0.010	102	85	115			
Potassium		52.0	mg/L	1.0	104	85	115			
Sodium		51.9	mg/L	1.0	104	85	115			
Lab ID: B14061188-001AMS2	6	Sample Matrix Spike				Run: ICP203-B_140616A			06/16/14 12:50	
Calcium		60.8	mg/L	1.0	107	70	130			
Iron		5.32	mg/L	0.020	105	70	130			
Magnesium		56.3	mg/L	1.0	109	70	130			
Manganese		5.37	mg/L	0.0010	107	70	130			
Potassium		53.7	mg/L	1.0	104	70	130			
Sodium		57.7	mg/L	1.0	109	70	130			
Lab ID: B14061188-001AMSD	6	Sample Matrix Spike Duplicate				Run: ICP203-B_140616A			06/16/14 12:53	
Calcium		61.0	mg/L	1.0	108	70	130	0.4	20	
Iron		5.37	mg/L	0.020	106	70	130	1.0	20	
Magnesium		56.6	mg/L	1.0	110	70	130	0.5	20	
Manganese		5.39	mg/L	0.0010	108	70	130	0.4	20	
Potassium		54.6	mg/L	1.0	106	70	130	1.7	20	
Sodium		57.7	mg/L	1.0	109	70	130	0.1	20	
Lab ID: B14061320-002BMS2	6	Sample Matrix Spike				Run: ICP203-B_140616A			06/16/14 21:12	
Calcium		119	mg/L	1.0	106	70	130			
Iron		10.6	mg/L	0.020	105	70	130			
Magnesium		110	mg/L	1.0	107	70	130			
Manganese		10.7	mg/L	0.0010	107	70	130			
Potassium		108	mg/L	1.0	107	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM **Report Date:** 06/23/14
Project: Hysham Rest Stop **Work Order:** B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: R225546
Lab ID: B14061320-002BMS2	6	Sample Matrix Spike				Run: ICP203-B_140616A				06/16/14 21:12
Sodium		112	mg/L	1.4	106	70	130			
Lab ID: B14061320-002BMSD	6	Sample Matrix Spike Duplicate				Run: ICP203-B_140616A				06/16/14 21:22
Calcium		119	mg/L	1.0	106	70	130	0.3	20	
Iron		10.7	mg/L	0.020	106	70	130	0.5	20	
Magnesium		111	mg/L	1.0	107	70	130	0.6	20	
Manganese		10.7	mg/L	0.0010	107	70	130	0.2	20	
Potassium		108	mg/L	1.0	107	70	130	0.1	20	
Sodium		113	mg/L	1.4	106	70	130	0.4	20	
Method: E200.7										Analytical Run: ICP203-B_140619A
Lab ID: ICV		Continuing Calibration Verification Standard								06/19/14 10:21
Iron		2.46	mg/L	0.020	99	95	105			
Method: E200.7										Batch: 80682
Lab ID: MB-80682		Method Blank				Run: ICP203-B_140619A				06/20/14 02:31
Iron		ND	mg/L	0.004						
Lab ID: LCS-80682		Laboratory Control Sample				Run: ICP203-B_140619A				06/20/14 02:35
Iron		2.52	mg/L	0.020	101	85	115			
Lab ID: B14061092-019AMS3		Sample Matrix Spike				Run: ICP203-B_140619A				06/20/14 02:55
Iron		3.67	mg/L	0.020	106	70	130			
Lab ID: B14061092-019AMSD		Sample Matrix Spike Duplicate				Run: ICP203-B_140619A				06/20/14 02:58
Iron		3.61	mg/L	0.020	104	70	130	1.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS202-B_140616A	
Lab ID: QCS	10	Initial Calibration Verification Standard							06/16/14 11:05	
Antimony		0.0495	mg/L	0.050	99	90	110			
Arsenic		0.0514	mg/L	0.0050	103	90	110			
Barium		0.0495	mg/L	0.10	99	90	110			
Beryllium		0.0249	mg/L	0.0010	99	90	110			
Cadmium		0.0255	mg/L	0.0010	102	90	110			
Chromium		0.0509	mg/L	0.010	102	90	110			
Mercury		0.00196	mg/L	0.0010	98	90	110			
Nickel		0.0522	mg/L	0.010	104	90	110			
Selenium		0.0526	mg/L	0.0050	105	90	110			
Thallium		0.0486	mg/L	0.10	97	90	110			
Method: E200.8										Batch: R225574
Lab ID: LFB	10	Laboratory Fortified Blank				Run: ICPMS202-B_140616A			06/16/14 11:10	
Antimony		0.0454	mg/L	0.050	91	85	115			
Arsenic		0.0498	mg/L	0.0050	100	85	115			
Barium		0.0496	mg/L	0.10	99	85	115			
Beryllium		0.0486	mg/L	0.0010	97	85	115			
Cadmium		0.0495	mg/L	0.0010	99	85	115			
Chromium		0.0499	mg/L	0.010	100	85	115			
Mercury		0.000970	mg/L	0.0010	97	85	115			
Nickel		0.0494	mg/L	0.010	99	85	115			
Selenium		0.0490	mg/L	0.0050	98	85	115			
Thallium		0.0496	mg/L	0.10	99	85	115			
Lab ID: LRB	10	Method Blank				Run: ICPMS202-B_140616A			06/16/14 11:38	
Antimony		ND	mg/L	1E-05						
Arsenic		ND	mg/L	6E-05						
Barium		ND	mg/L	4E-05						
Beryllium		ND	mg/L	1E-05						
Cadmium		ND	mg/L	1E-05						
Chromium		ND	mg/L	3E-05						
Mercury		ND	mg/L	5E-06						
Nickel		ND	mg/L	6E-05						
Selenium		ND	mg/L	0.0003						
Thallium		ND	mg/L	1E-05						
Lab ID: B14061281-001CMS	10	Sample Matrix Spike				Run: ICPMS202-B_140616A			06/16/14 13:06	
Antimony		0.0458	mg/L	0.0010	92	70	130			
Arsenic		0.0519	mg/L	0.0010	103	70	130			
Barium		0.0651	mg/L	0.050	91	70	130			
Beryllium		0.0482	mg/L	0.0010	96	70	130			
Cadmium		0.0478	mg/L	0.0010	96	70	130			
Chromium		0.0515	mg/L	0.0050	102	70	130			
Mercury		0.000900	mg/L	0.00010	90	70	130			
Nickel		0.0495	mg/L	0.010	93	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R225574
Lab ID: B14061281-001CMS	10	Sample Matrix Spike				Run: ICPMS202-B_140616A				06/16/14 13:06
Selenium		0.0514	mg/L	0.0010	103	70	130			
Thallium		0.0486	mg/L	0.00050	97	70	130			
Lab ID: B14061281-001CMSD	10	Sample Matrix Spike Duplicate				Run: ICPMS202-B_140616A				06/16/14 13:12
Antimony		0.0478	mg/L	0.0010	96	70	130	4.2	20	
Arsenic		0.0536	mg/L	0.0010	106	70	130	3.2	20	
Barium		0.0670	mg/L	0.050	95	70	130	2.8	20	
Beryllium		0.0496	mg/L	0.0010	99	70	130	2.9	20	
Cadmium		0.0492	mg/L	0.0010	98	70	130	2.9	20	
Chromium		0.0532	mg/L	0.0050	105	70	130	3.1	20	
Mercury		0.000911	mg/L	0.00010	91	70	130	1.2	20	
Nickel		0.0513	mg/L	0.010	96	70	130	3.4	20	
Selenium		0.0536	mg/L	0.0010	107	70	130	4.3	20	
Thallium		0.0506	mg/L	0.00050	101	70	130	4.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS202-B_140619A	
Lab ID: QCS	10	Initial Calibration Verification Standard							06/19/14 09:47	
Antimony		0.0501	mg/L	0.050	100	90	110			
Arsenic		0.0512	mg/L	0.0050	102	90	110			
Barium		0.0502	mg/L	0.10	100	90	110			
Beryllium		0.0251	mg/L	0.0010	100	90	110			
Cadmium		0.0256	mg/L	0.0010	102	90	110			
Chromium		0.0510	mg/L	0.010	102	90	110			
Manganese		0.254	mg/L	0.010	102	90	110			
Nickel		0.0507	mg/L	0.010	101	90	110			
Selenium		0.0508	mg/L	0.0050	102	90	110			
Thallium		0.0492	mg/L	0.10	98	90	110			
Method: E200.8									Batch: 80682	
Lab ID: MB-80682	10	Method Blank				Run: ICPMS202-B_140619A			06/19/14 17:42	
Antimony		5E-05	mg/L	1E-05						
Arsenic		ND	mg/L	6E-05						
Barium		ND	mg/L	4E-05						
Beryllium		ND	mg/L	1E-05						
Cadmium		ND	mg/L	1E-05						
Chromium		0.0004	mg/L	3E-05						
Manganese		0.0001	mg/L	2E-05						
Nickel		0.0002	mg/L	6E-05						
Selenium		ND	mg/L	0.0003						
Thallium		ND	mg/L	1E-05						
Lab ID: LCS-80682	10	Laboratory Control Sample				Run: ICPMS202-B_140619A			06/19/14 17:44	
Antimony		0.540	mg/L	0.0010	108	85	115			
Arsenic		0.537	mg/L	0.0010	107	85	115			
Barium		0.542	mg/L	0.050	108	85	115			
Beryllium		0.253	mg/L	0.0010	101	85	115			
Cadmium		0.268	mg/L	0.0010	107	85	115			
Chromium		0.528	mg/L	0.0050	106	85	115			
Manganese		2.62	mg/L	0.0010	105	85	115			
Nickel		0.534	mg/L	0.010	107	85	115			
Selenium		0.537	mg/L	0.0010	107	85	115			
Thallium		0.535	mg/L	0.00050	107	85	115			
Lab ID: B14061092-019AMS3	10	Sample Matrix Spike				Run: ICPMS202-B_140619A			06/19/14 18:03	
Antimony		0.538	mg/L	0.0010	108	70	130			
Arsenic		0.521	mg/L	0.0010	104	70	130			
Barium		0.583	mg/L	0.050	109	70	130			
Beryllium		0.249	mg/L	0.0010	100	70	130			
Cadmium		0.266	mg/L	0.0010	106	70	130			
Chromium		0.517	mg/L	0.0050	103	70	130			
Manganese		2.64	mg/L	0.0010	102	70	130			
Nickel		0.523	mg/L	0.010	102	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: 80682
Lab ID: B14061092-019AMS3	10	Sample Matrix Spike				Run: ICPMS202-B_140619A				06/19/14 18:03
Selenium		0.511	mg/L	0.0010	102	70	130			
Thallium		0.527	mg/L	0.00050	105	70	130			
Lab ID: B14061092-019AMSD	10	Sample Matrix Spike Duplicate				Run: ICPMS202-B_140619A				06/19/14 18:05
Antimony		0.536	mg/L	0.0010	107	70	130	0.4	20	
Arsenic		0.520	mg/L	0.0010	104	70	130	0.2	20	
Barium		0.574	mg/L	0.050	107	70	130	1.5	20	
Beryllium		0.248	mg/L	0.0010	99	70	130	0.3	20	
Cadmium		0.262	mg/L	0.0010	105	70	130	1.6	20	
Chromium		0.509	mg/L	0.0050	102	70	130	1.5	20	
Manganese		2.61	mg/L	0.0010	101	70	130	1.1	20	
Nickel		0.526	mg/L	0.010	103	70	130	0.5	20	
Selenium		0.519	mg/L	0.0010	104	70	130	1.6	20	
Thallium		0.524	mg/L	0.00050	105	70	130	0.6	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E245.1									Analytical Run: HGCV202-B_140620A	
Lab ID: QCS		Initial Calibration Verification Standard							06/20/14 13:59	
Mercury		0.00202	mg/L	0.00010	101	90	110			
Method: E245.1									Batch: 80739	
Lab ID: MB-80739		Method Blank				Run: HGCV202-B_140620A			06/20/14 14:04	
Mercury		ND	mg/L	1E-05						
Lab ID: LCS-80739		Laboratory Control Sample				Run: HGCV202-B_140620A			06/20/14 14:06	
Mercury		0.00202	mg/L	0.00010	101	85	115			
Lab ID: B14061281-002CMS		Sample Matrix Spike				Run: HGCV202-B_140620A			06/20/14 14:13	
Mercury		0.00183	mg/L	0.00010	92	70	130			
Lab ID: B14061281-002CMSD		Sample Matrix Spike Duplicate				Run: HGCV202-B_140620A			06/20/14 14:15	
Mercury		0.00186	mg/L	0.00010	93	70	130	1.6	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC202-B_140616A	
Lab ID: ICV	3	Initial Calibration Verification Standard							06/16/14 11:02	
Chloride		24.8	mg/L	1.0	99	90	110			
Sulfate		96.9	mg/L	1.0	97	90	110			
Fluoride		11.7	mg/L	0.12	93	90	110			
Method: E300.0									Batch: R225603	
Lab ID: ICB	3	Method Blank				Run: IC202-B_140616A			06/16/14 11:17	
Chloride		ND	mg/L	0.06						
Sulfate		ND	mg/L	0.2						
Fluoride		ND	mg/L	0.03						
Lab ID: LFB	3	Laboratory Fortified Blank				Run: IC202-B_140616A			06/16/14 11:32	
Chloride		24.3	mg/L	1.0	97	90	110			
Sulfate		96.9	mg/L	1.1	97	90	110			
Fluoride		11.8	mg/L	0.13	94	90	110			
Lab ID: B14061281-001AMS	3	Sample Matrix Spike				Run: IC202-B_140616A			06/17/14 09:58	
Chloride		136	mg/L	1.3	98	90	110			
Sulfate		927	mg/L	5.3	97	90	110			
Fluoride		62.9	mg/L	0.66	100	90	110			
Lab ID: B14061281-001AMSD	3	Sample Matrix Spike Duplicate				Run: IC202-B_140616A			06/17/14 10:13	
Chloride		139	mg/L	1.3	101	90	110	2.4	20	
Sulfate		921	mg/L	5.3	95	90	110	0.6	20	
Fluoride		64.1	mg/L	0.66	102	90	110	1.8	20	
Lab ID: B14061006-002AMS	3	Sample Matrix Spike				Run: IC202-B_140616A			06/18/14 23:01	
Chloride		62.6	mg/L	1.0	98	90	110			
Sulfate		2130	mg/L	2.1		90	110			A
Fluoride		25.4	mg/L	0.26	99	90	110			
Lab ID: B14061006-002AMSD	3	Sample Matrix Spike Duplicate				Run: IC202-B_140616A			06/18/14 23:16	
Chloride		62.7	mg/L	1.0	98	90	110	0.2	20	
Sulfate		2140	mg/L	2.1		90	110	0.5	20	A
Fluoride		25.5	mg/L	0.26	100	90	110	0.4	20	
Lab ID: B14061268-001AMS	3	Sample Matrix Spike				Run: IC202-B_140616A			06/20/14 02:19	
Chloride		496	mg/L	5.3	99	90	110			
Sulfate		36800	mg/L	21		90	110			A
Fluoride		228	mg/L	2.6	91	90	110			
Lab ID: B14061268-001AMSD	3	Sample Matrix Spike Duplicate				Run: IC202-B_140616A			06/20/14 02:34	
Chloride		489	mg/L	5.3	97	90	110	1.5	20	
Sulfate		37000	mg/L	21		90	110	0.6	20	A
Fluoride		225	mg/L	2.6	90	90	110	1.2	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2										Analytical Run: FIA203-B_140613B
Lab ID: ICV		Initial Calibration Verification Standard								06/13/14 16:03
Nitrogen, Nitrite as N		3.07	mg/L	0.30	101	90	110			
Method: E353.2										Batch: R225503
Lab ID: MBLK		Method Blank				Run: FIA203-B_140613B				06/13/14 16:04
Nitrogen, Nitrite as N		ND	mg/L	0.006						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA203-B_140613B				06/13/14 16:06
Nitrogen, Nitrite as N		0.511	mg/L	0.050	102	90	110			
Lab ID: B14061146-003AMS		Sample Matrix Spike				Run: FIA203-B_140613B				06/13/14 16:26
Nitrogen, Nitrite as N		0.526	mg/L	0.050	103	90	110			
Lab ID: B14061146-003AMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_140613B				06/13/14 16:27
Nitrogen, Nitrite as N		0.528	mg/L	0.050	103	90	110	0.4	10	
Method: E353.2										Analytical Run: FIA204-B_140617B
Lab ID: ICV		Initial Calibration Verification Standard								06/17/14 13:27
Nitrogen, Nitrate+Nitrite as N		13.1	mg/L	0.060	91	90	110			
Method: E353.2										Batch: R225633
Lab ID: MBLK		Method Blank				Run: FIA204-B_140617B				06/17/14 13:28
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.003						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA204-B_140617B				06/17/14 13:29
Nitrogen, Nitrate+Nitrite as N		1.03	mg/L	0.010	103	90	110			
Lab ID: B14061281-001DMS		Sample Matrix Spike				Run: FIA204-B_140617B				06/17/14 14:39
Nitrogen, Nitrate+Nitrite as N		1.01	mg/L	0.010	101	90	110			
Lab ID: B14061281-001DMSD		Sample Matrix Spike Duplicate				Run: FIA204-B_140617B				06/17/14 14:40
Nitrogen, Nitrate+Nitrite as N		0.990	mg/L	0.010	99	90	110	2.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

DOWL HKM

B14061281

Login completed by: Randa Nees
Date Received: 6/13/2014

Reviewed by: BL2000\jmueller
Received by: dlf

Reviewed Date: 6/16/2014
Carrier name: Hand Del

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

Standard Reporting Procedures:

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

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

Contact and Corrective Action Comments:

Temp Blank temperature for Cooler 1 was 2.0°C and Cooler 2 was 3.2°C.

Samples for Nitrate as N and Nitrate+Nitrite were received at pH ~ 7. 2 mL of sulfuric acid was added to each sample in the laboratory to preserve to pH<2.

Samples for Dissolved Metals/Hardness were subsampled, filtered and preserved to pH <2 with 2 mL of nitric acid per 250 mL in the laboratory. According to 40CFR136, samples for Dissolved Metals should be filtered and preserved within 15 minutes of collection.

Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Page 1 of 1

Company Name: Dowl HKM

Report Mail Address (Required): 2090 Stadium Drive, Bozeman, MT 59715

☐ No Hard Copy Email:

Invoice Address (Required): AA

☐ No Hard Copy Email:

Special Report/Formats:
☐ DW ☐ EDD/EDT (Electronic Data)
☐ POTW/WWTP Format:
☐ State: ☐ LEVEL IV
☐ Other: ☐ NELAC

Project Name, PWS, Permit, Etc.: Hysham Rest Stop

Sample Origin State: MT

EPA/State Compliance: Yes ☐ No ☐

Contact Name: Bill Dreyer Phone/Fax: 586-8814 Cell:

Sampler: (Please Print) Jim Potts

Invoice Contact & Phone: AA

Purchase Order:

Quote/Bottle Order:

ANALYSIS REQUESTED

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids Vegetation Bioassay Other
(DW) Drinking Water

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Bottle Order 208773	DW Drinking Water	SEE ATTACHED
1 Hysham Rest Stop West	6-13-14	10:40	GW	X	X	
2 Hysham Rest Stop East	6-13-14	12:50	GW	X	X	
3						
4						
5						
6						
7						
8						
9						
10						

Standard Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments:

Shipped by: Hand

Cooler ID(s): TB

Receipt Temp: 2.0 / 3.2 °C

On Ice: (Y) N

Custody Seal: On Bottle Y (N) On Cooler Y (N)

Intact Y N

Signature Match Y N

LABORATORY USE ONLY: 1406128-001 2 002

Custody Record MUST be Signed

Relinquished by (print): Jim Potts Date/Time: 6-13-14 Signature:

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: 6/13/14 1512 Signature:

Received by Laboratory: Date/Time: Signature:

Sample Disposal: Return to Client: Lab Disposal:

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

ERGY
www.energylab.com
Analytical Excellence Since 1952
Helena, MT [illegible]-0711 • Billings, MT 800-735-4489 • Casper, WY 888-235-0515
Gillette, WY 866-686-7[illegible] • Rapid City, SD 888-672-1225 • College Station, TX 888-690-2218

BOTTLE ORDER 80833

SHIPPED TO: DOWL HKM

Contact: Bill Dreyer
2090 Stadium Drive
Bozeman MT 59715
Phone: (406) 586-8834
Project:

Order Created by: Gina McCartney
Shipped From: Billings, MT
Ship Date: 6/6/2014
VIA: Ground

Bottle Size/Type	Bottles Per Samp	Method	Tests	Critical Hold Time	Preservative	Notes	Num of Samp
DW (4 Sets)							
1 Liter Plastic	1	A2320 B	Alkalinity			Cl, SO4 & F by E300.0	1
		A2510 B	Conductivity				
		E300.0	Anions by Ion Chromatography				
		E353.2	Nitrogen, Nitrite	48 hrs			
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Dissolved			Will be Filtered and Preserved in lab for Ca, Mg, K & Na	1
		A2340 B	Hardness as CaCO3				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Drinking Water		HNO3	Sb, As, Ba, Be, Cd, Cr, Fe, Mn, Hg, Ni, Se, Tl	1
250 mL Plastic	1	E353.2	Nitrogen, Nitrate + Nitrite		H2SO4		1
		Calculation	Nitrogen, Nitrate				
100 mL Plastic Sterile	1	A9223	Bacteria, Private Water Supply	48 hrs			1
WW (4 Sets)							
1 Liter Plastic	1	A5210 B	Biochemical Oxygen Demand, 5 Day	48 hrs			1

.er Plastic	1	A2320 B	Alkalinity			Cl	1
		E300.0	Anions by Ion Chromatography				
		A2510 B	Conductivity				
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
		A2540 D	Solids, Total Suspended				
500 mL Plastic	1	E350.1	Nitrogen, Ammonia		■ H2SO4		1
		E353.2	Nitrogen, Nitrate + Nitrite				
		E351.2	Nitrogen, Total Kjeldahl				
		Calculation	Nitrogen, Total (TKN+NO3+NO2)				
		E365.1	Phosphorus, Total				
		E410.4	Chemical Oxygen Demand				
40 mL Clear Glass VOA	1	A4500-Cl G	Chlorine, Residual	2.4 hrs		Zero headspace	1
1 Liter Clear Glass Narrow Mouth	2	E1664A	Oil & Grease, Gravimetric		▒ H2SO4		1

■ HNO3 - Nitric Acid ▒ H2SO4 - Sulfuric Acid ■ NaOH - Sodium Hydroxide

■ ZnAc - Zinc Acetate ■ HCl - Hydrochloric Acid ☐ H3PO4 - Phosphoric Acid

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

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

Corrosive Chemicals: Nitric, Sulfuric, Phosphoric, Hydrochloric Acids and Sodium Hydroxide. Zinc Acetate is a skin irritant.

Subcontracting of sample analyses to an outside laboratory may be required. If so, Energy Laboratories will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

APPENDIX E
Hysham Rest Area East Bound Well Memo

APPENDIX E

DOWL HKM

Address:
2090 Stadium Drive
Bozeman, Montana 59715

Phone: (406) 586-8834 Fax: (406) 586-1730

MEMORANDUM

To: Kevin Malone, PE
MDT Project Manager

From: William Dreyer, PE,
DOWL HKM - Project Manager

Date: June 8, 2014

Subject: Hysham Rest Area
Public Well replacement

On June 13, 2014 the East Bound Well at the Hysham Rest Area was pumped to determine its capacity and quality. The well was pumped for a total of 35 minutes at a rate of 12 gpm (gallons per minute). After thirty minutes of pumping, the water level dropped to the pump intake, causing the pump to pump both air and water; about the same time, the pumped water turned red. Water samples were collected, the pump was turned off, and the rate of water level recovery was monitored.

Testing shows that this well has very limited capacity and that its quality is poor due to turbidity. Attached is the well log, a schematic of the well log, lithology log, and a preliminary interpretation of the geologic formation (s) that the well is likely completed in.

Due to the low capacity and poor quality of this well, it is recommended to evaluate the potential for replacing and relocating the existing well. A preliminary investigation of the geologic formations present at the site was conducted and a portion of the geologic map for this area is attached. A description of the geologic formations is also attached. In addition, Mr. Doug Askin of Askins Drilling from Miles City was contacted to discuss the condition of the existing well and the potential for either improving or replacing the well.

According to this preliminary investigation, and Mr. Askin's opinion, it is recommended to chlorinate and abandon the existing well, and replace it. According to Mr. Askin's experience with wells in this vicinity, there is good potential for a new well with good water quality, if properly constructed and completed in the Fox Hills Formation. Note, the quantity (or volume) that a new well would produce cannot be predicted.

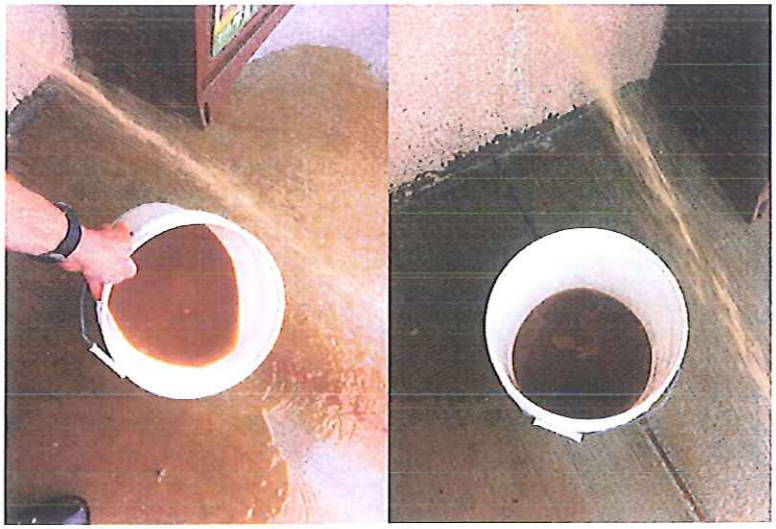
The likely problem with the existing well is that it may be completed too shallow and that it also was not properly constructed. The slotted PVC casing that extends from 25' to 200' allows shallow and deep groundwater to mix, which may be the primary cause for the sever discoloration of the water. In addition the annular space between the 4" PVC casing and 6" borehole allows water to freely travel vertically up and down during pumping cycles, which erodes the borehole and further adding to the sever discoloration of the water.

In order to replace this well, it is recommended to relocate it according the conceptual plan being developed for Rest Area. For a well to be successful at this location it will need to be completed in the Fox Hills Sandstone. Consequently, the presence and approximate depth of the Fox Hills needs to be verified. The

attached geologic map is generalized, therefore it does not display the discrete details of the geologic formations, particularly the Fox Hills formation.

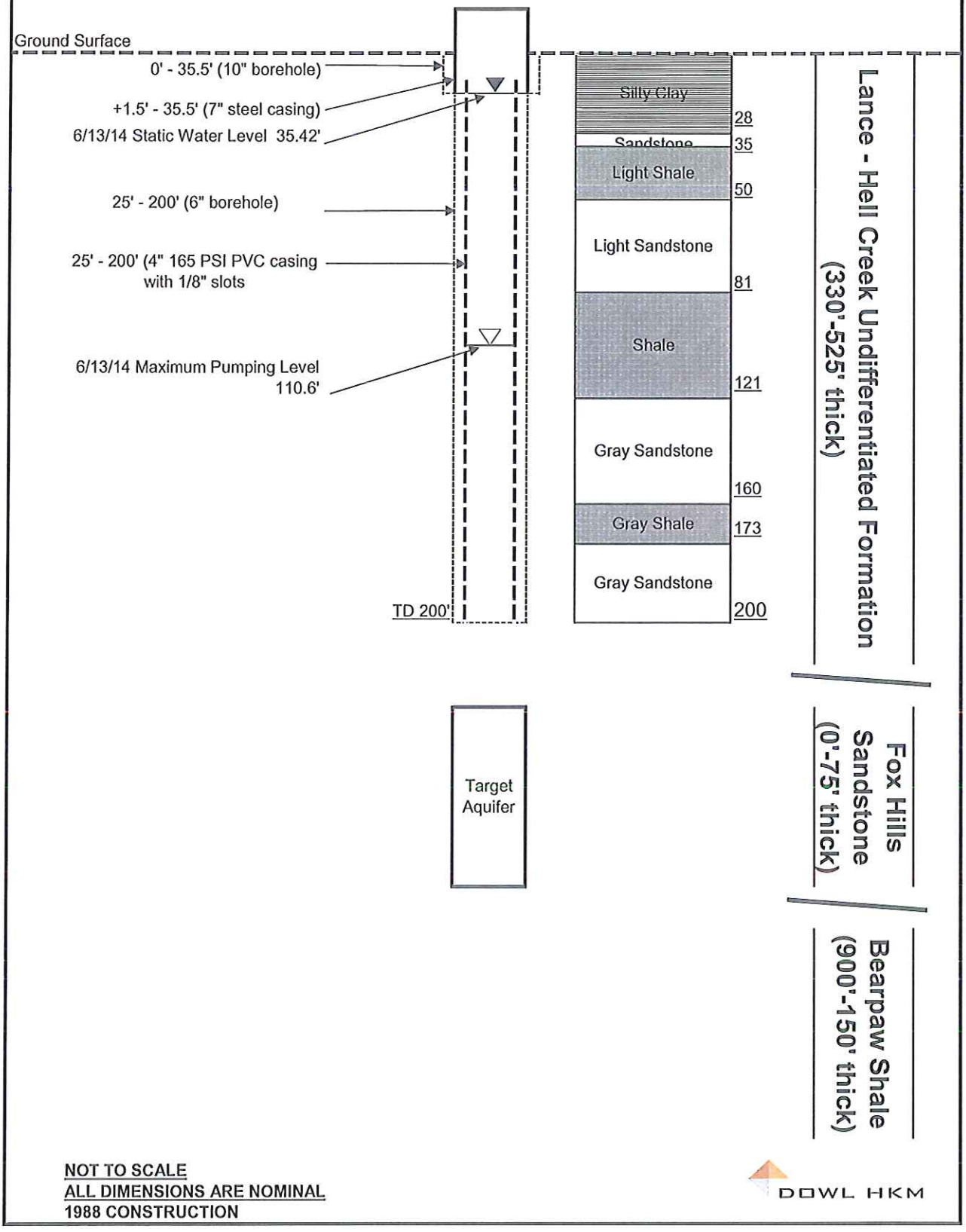
Permitting a new public drinking water well requires the following:

1) Updating the Source Water Protection Plan (PWS 6)
2) Conducting an evaluation of the potential for groundwater to be influenced by surface water (PWS 5)
3) Developing a set of plans and specifications to replace and abandon the old well
4) Preparing a Design Report
5) MDEQ approval to replace the well
6) Hiring a drilling contractor
7) Testing the new well for quantity and quality
8) Reporting well performance and "as-built" drawings to MDEQ
9) Abandoning the old well.



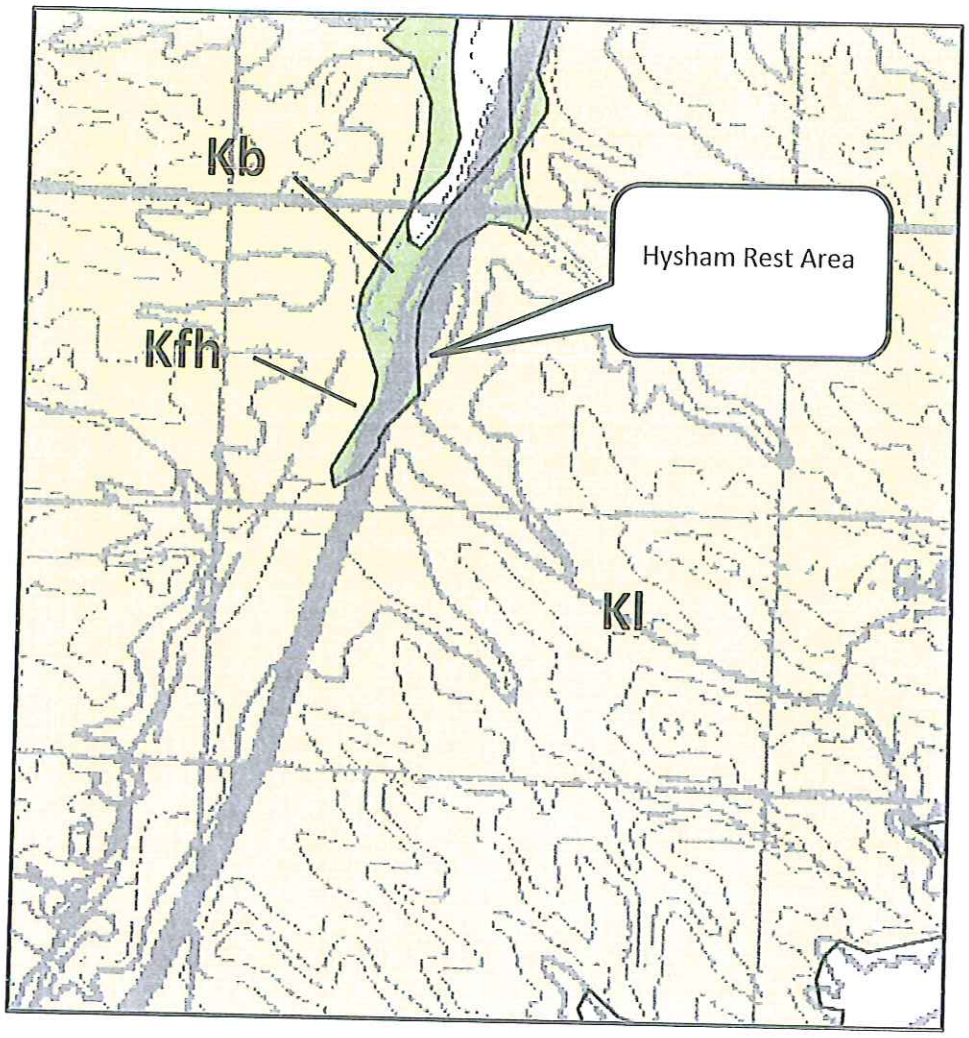
Photos 1 & 2: Discolored water from the east-bound Hysham Rest Area

Hysham East Bound Rest Stop Well Diagram



NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL
1988 CONSTRUCTION

DOWL HKM



Hysham Rest Area General Geologic Map

Montana Bureau of Mines and Geology
Open File No. 486

Geologic Map of the Hysham 30' x 60' Quadrangle, Eastern Montana

Susan M. Vuke, Edith M. Wilde,
and Robert N. Bergantino

2003

Kl Lance Formation (Upper Cretaceous)
Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

Kfh Fox Hills Formation (Upper Cretaceous)
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

Kb Bearpaw Shale (Upper Cretaceous)
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500 ft.

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX M:

NON-DEGRADATION

DOWL

Non-Degradation Analysis Report

for:

Hysham Rest Area

Treasure County, Montana

Owner:

Montana Department of Transportation
2701 Prospect Avenue
Helena, Mt 59620

DEQ Submittal

Project Number
24.11355

1 INTRODUCTION

This report has been prepared to accompany the Public Waste Water Application for a new public wastewater system.

Results of the non-degradation analysis and resulting wastewater treatment system design are all discussed in the following portions of the report. Three copies of the site plan are included in the original submittal.

1.1 Soil Profile

The field exploration consisted of excavating six test pits (TP1 through TP-6) and three percolation tests. The six (6) test pits were excavated utilizing a Caterpillar rubber tire backhoe. The test pits were excavated at accessible locations to depths ranging from 8 to 10 feet. The excavation termination was based on estimation of proposed drainfield trench depth and possible indicators/or lack of indicators of limiting layers such as groundwater, dense clay, or bedrock. The test pits were excavated at locations which would provide an optimal wastewater disposal area for the sites (see Table 1).

Table 1
Exploration Plan Summary
Hysham Rest Area

Test Pit	Station	Depth	Intent of Exploration
TP-1	See Site Plan	8'	Verify existing soil condition
TP-2	See Site Plan	9'	Verify existing soil condition
TP-3	See Site Plan	10'	Verify existing soil condition
TP-4	See Site Plan	10'	Proposed Drainfield Replacement Area
TP-5	See Site Plan	8.5'	Proposed Drainfield Replacement Area
TP-6	See Site Plan	9.0'	Proposed Drainfield Replacement Area

The test pit locations were selected by DOWL engineers based on elevations and prominent site features. A DOWL engineer directed excavation operations, and recorded lithology and other soil conditions. At select intervals, soil samples were collected, by removing soil from selected soil horizon. Test pit locations are shown on the Preliminary Site Plan in Appendix B.

During the excavation of the test pits, specific attention was placed on limiting layer indicators such as mottling, root depth, residual calcium carbonate, dense clays, moisture content and bedrock. The test pits were backfilled and the surface was restored to its previous state.

Subgrade soils beneath the proposed wastewater system site consist of soils classifying sandy silt loams and sandy loams (USDA)/ (lean clays (USCS). Most of these soils were observed to depths ranging from 0.5 to 10 feet. The deeper soils were generally, medium stiff in consistency, grey to brown, low plasticity and contained varying amounts of sands, clays, silts, and gravels.

The lithology and soil conditions are presented in the test pit logs. The stratification contacts shown on the test pit logs represent approximate boundaries between soil types.

1.2 Depth to Seasonal High Groundwater

Groundwater or groundwater indicators were not observed at depths ranging from 1 to 10 feet in the six test pits. DOWL HKM found the eastbound aquifer to be located in the Bearpaw shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. These logs indicate that the existing public wells located water at an interval depth of 6 to 200 feet below ground surface. Sandy clays, Sandy silts, gravels dominate the upper 10 feet of the wells. Shale and sandstone layers are found from 25 feet to 200 feet. Based on the information presented in the well logs, it appears that the aquifer is found in a confined/semi confined aquifer formation. .

1.3 Percolation Test Results

Two percolation tests were conducted on the property in accordance with MDEQ Percolation Test Procedure I. They were found to have a percolation rate from 6 to 15 min/inch.

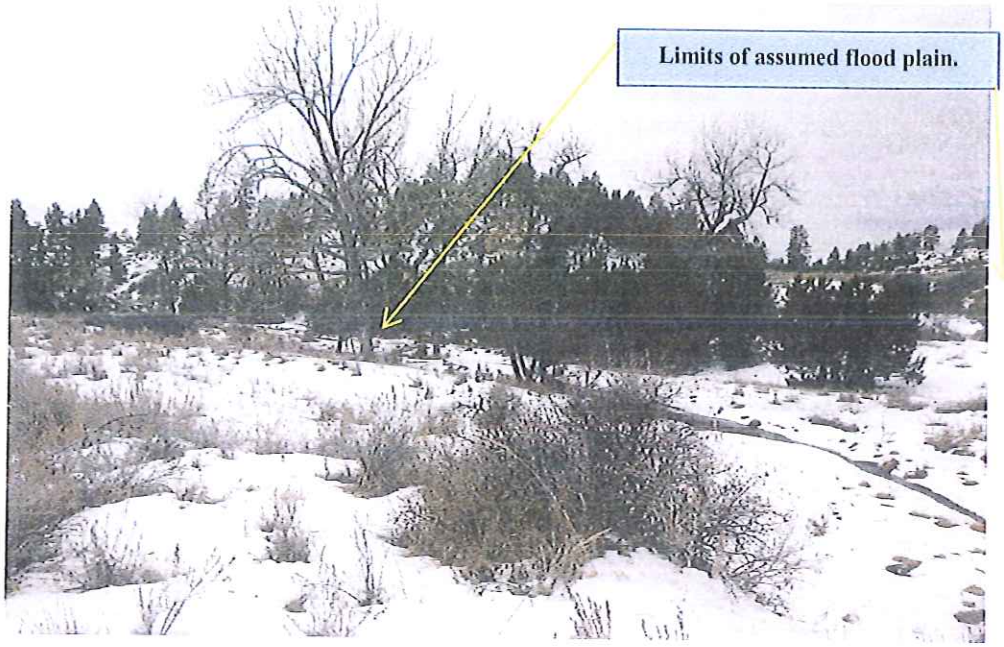
1.4 Type and Percent of Land Slope

The proposed wastewater system sites are located on gently sloping Cretaceous Age deposits. The wastewater system will be located in an area with approximately 2% to 4% slope (see Site Plan).

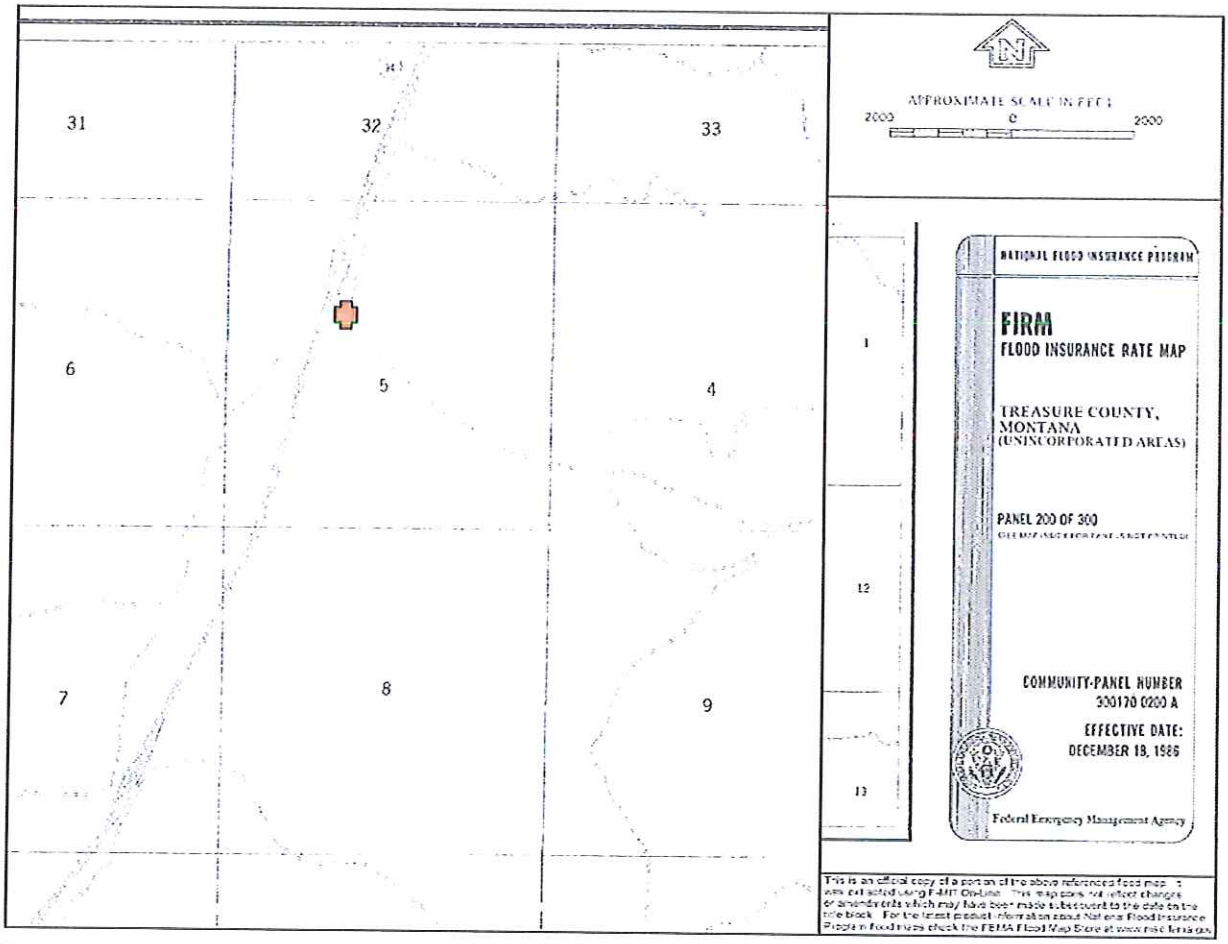
1.5 Flooding Potential

Flooding risk from Box Elder Creek was assessed from published FEMA maps and visual verifications of channel characteristics, vegetation growth and bank elevation. As seen in Figures 2, the project site is located outside of the FEMA-designated 100-year flood plain. The proposed wastewater system site is located approximately 520 feet southwest of the potential floodplain boundary of Box Elder Creek. The proposed wastewater system is located in areas above any potential flooding inundation.

Photo 1. View of Box Elder Creek bordering westbound rest area, looking southwest.



The proposed drainfield areas are located such that stormwater and spring melt runoff should not pose any flooding risk to the drainfield. As a precaution, a Phase II drainage plan should be designed to divert any stormwater and spring melt runoff away from the proposed drainfield.



2 NON-DEGRADATION

The values for the parameters used in this analysis were chosen from actual field data when possible, substantiated estimates from existing information when available, and default values where necessary.

2.1 NITRATE ANALYSIS

2.1.1 Geologic Setting

The site is located on Cretaceous Age deposits. The area is generally mapped as sandstone and shales as depicted on the geologic map.

1. Kl Lance Formation (Upper Cretaceous)
Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

2. Kfh Fox Hills Formation (Upper Cretaceous)
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

3. Kb Bearpaw Shale (Upper Cretaceous)
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500.

The prominent geologic features at the sites are a drainage area located southeast portion of the eastbound rest area, a large sandstone out cropping located due east of the eastbound rest area and Box Elder Creek located west of the westbound rest area. The sandstone outcropping and Box Elder Creek contributed to the sand and gravel deposits throughout the sites. No other prominent geologic features were observed in the immediate vicinity of the project site corridor. Based on visual examination, the surficial soils consist of silt, clay, sand, and gravel associated with the formations within the rest area sites.

2.1.2 Hydraulic Conductivity

On 6/13/2014, the constant rate pumping test of Well #1 began. Well #1 was pumped at 10 gpm for the duration of the test. The test concluded on 6/13/2014, lasting approximately 95.67 minutes. By the end of the test there was approximately 12 feet of drawdown in the pumping well, Well #1. The response observed fits well with the analytical methods utilized in AQTESOLV.

AQTESOLV for Windows was utilized to evaluate both the drawdown and recovery portion of the test. Standard procedures and analytical methods most applicable to all the wells construction and aquifer type were used. For all evaluations, the Hantush–Jacob method for a partially penetrating well in a leaky confined aquifer fractured. Parameter values for these evaluations are consistent with published values for the aquifer conditions identified.

TABLE 1 WELL PUMPING AND RECOVERY TEST RESULTS

	[T] Transmissivity (ft^2/day)	[K] Hydraulic Conductivity (ft/day)	[b] Aquifer Thickness (feet)	[S] Storage Coefficient (dimensionless)
W-1 Pumped Well*	336.82	33.68	10	0.8321

Constant Rate Tests Summary

Inherently, long-term constant-rate tests provide average aquifer characteristics of the zone of aquifer influenced by the pumped well. This is known as the zone of influence. As pumping continues, the zone of influence becomes larger until the aquifer is able to provide the quantity of water demanded by the well. Therefore the aquifer parameter determined from a long term constant rate test are appropriate for characterizing the average conditions of the site.

2.1.3 Hydraulic Gradient

According to the project site survey and groundwater level monitoring records from each of the existing wells, the direction that groundwater is flowing is north 24 east and the gradient is 0.0068 ft/ft.

Hydraulic Gradient = 0.0068 ft/ft

2.1.4 Aquifer Thickness

The default value of 15 feet was used for the mixing depth.

2.1.5 Down-gradient Mixing Zone Distance

The standard mixing zone for a public drainfield such as this is 500 feet as per ARM 17.30.517(1)(d)(viii).

2.1.6 Background Nitrate Concentration

An average background nitrate concentration of 0.19 mg/l was obtained from a sample out of the west bound well.

2.1.7 Nitrates in Effluent

Do to the high effluent strength waste that is seen in typical rest areas, the normal default value of 50mg/l will not be used. Instead we have back calculated the treated effluent concentration that is needed to achieve a 10.0 mg/l concentration (EPA standards) at the end of the 500 foot mixing zone. The 10.0 mg/l was directed from MDEQ. The reasoning for the EPA standard was that the proposed wastewater system is considered a replacement system and that the 10 mg/l was used for other rest areas around the state of Montana. ARM 17.30.702(11) states that a Level II system must provide at least 60% removal of total nitrogen. The treated effluent concentration value of 26 mg/l is used in the analysis.

2.1.8 Average Yearly Precipitation

The average annual precipitation for this area is 13.2 inches per year (obtained from Annual Precipitation information of Hysham MT.)

2.1.9 Quantity of Effluent

Base on non-degradation requirements, the design flow proposed system is 2,890 gpd. This is equivalent to 385.82 ft^3/day for calculation purposes.

Nitrate Analysis Results

According to calculations utilizing the model outlined in MDEQ's "HOW TO PERFORM A NONDEGRADATION ANALYSIS FOR SUBSURFACE WASTEWATER TREATMENT SYSTEMS" an **Nt value of 9.65 mg/L** was established for the proposed public drainfield (See calculations). The secondary treatment must treat the effluent concentration to a 26 mg/l to achieve a 10.0 mg/l concentration at the end of the 500 foot mixing zone.

2.2 PHOSPHORUS BREAKTHROUGH ANALYSIS

2.2.1 Soil Weight

100 lb/ft^3. This is an approximate value based on soil weight tables.

2.2.2 Effluent Phosphorus Concentration

The wastewater on average has a total phosphorous equating to 6.44 lbs/year, and was used in this analysis.

2.2.3 Depth to Limiting Layer from Bottom of Drainfield Laterals

Depth to liming layer used in the calculations is as follows:
Depth of east bound well (48.90 feet) - depth of drainfield laterals (2 feet) = **46.90 feet**

2.2.4 Distance to Surface Water

The closest surface water to the public drainfield, is Box Elder Creek, which is located just to the northwest of the proposed drainfield, approximately 746 feet from the drainfield.

2.2.5 Absorption

A default value of 200 ppm has been used since no phosphate analysis has been done for the site.

Phosphorous Analysis Results

The phosphorous breakthrough calculations are presented. The results indicate that the minimum 50-year phosphorous breakthrough is achieved for the proposed community drainfield.

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

NITRATE SENSITIVITY ANALYSIS

Model Updated 01/24/96

SITE NAME: Hysham
COUNTY: Treasure County
LOT #: Rest Area
NOTES: Public System (MDT)

VARIABLES	DESCRIPTION	VALUE	UNITS
K	Hydraulic Conductivity	33.7	ft/day
I	Hydraulic Gradient	0.007	ft/ft
D	Depth of Aquifer (usually constant)	15.0	ft
L	Mixing Zone Length (see ARM 17.30.517(1)(d)(viii)	500	ft
Y	Width of Drainfield Perpendicular to Ground Water Flow	100	ft
Ng	Background Nitrate (as Nitrogen)	0.19	mg/L
Nr	Nitrate (as Nitrogen) in Precipitation (usually constant)	1.0	mg/L
Ne	Nitrates in Effluent (50 for conventional; 24 for level II)	26	mg/L
#I	Number of Single Family Homes on the Drainfield	1.0	
QI	Quantity of Effluent per Single Family Home (constant)	385.82	ft3/day
P	Precipitation	13.2	in/year
V	Percent of Precipitation Recharging Ground Water (usually constant)	0.20	

EQUATIONS			
W	Width of Mixing Zone Perpendicular to Ground Water Flow = (0.175)(L)+(Y)	187.50	ft
Am	Cross Sectional Area of Aquifer Mixing Zone = (D)(W)	2812.50	ft2
As	Surface Area of Mixing Zone = (L)(W)	93750.00	ft2
Qg	Ground Water Flow Rate = (K)(I)(Am)	615.71	ft3/day
Qr	Recharge Flow Rate = (As)(P/12/365)(V)	56.51	ft3/day
Qe	Effluent Flow Rate = (#I)(QI)	385.82	ft3/day

SOLUTION

Nt	**Nitrate (as Nitrogen) Concentration at End of Mixing Zone =((Ng)(Qg)+(Nr)(Qr)+(Ne)(Qe)) / ((Qg)+(Qr)+(Qe))**	**9.65**	**mg/L**

BY: BD
DATE: August 28, 2015

G:\WPB\SUBDIV\WORKSPAC\NDEG\NSA.XLS *REV. 12/98*

PHOSPHOROUS BREAKTHROUGH ANALYSIS

PROJECT Hysham Rest Area
COUNTY: Treasure County
LOCATION
NOTES: Proposed Public System

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	100.0	ft
L	Length of Primary Drainfield's Long Axis	100.0	ft
W	Width of Primary Drainfield's Short Axis	63.0	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*(well measurements)	46.9	ft (from east bound well log)
D	Distance from Drainfield to Surface Water	746.0	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils,	0.5	ft
Ne	1.0 ft for fine soils)**		
Sw	Soil Weight (usually constant)	100.0	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200.0	ppm
#I	Number of Single Family Homes on the Drainfield	14.5	
CONSTANTS			
PI	Phosphorous Load per Single Family Home (constant)	6.44	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+6	
EQUATIONS			
Pt	Total Phosphorous Load = (PI)(#I)	93.06	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	29540700.0	lbs
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	6.2E+06	lbs
P	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	7141.1	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	76.7	years

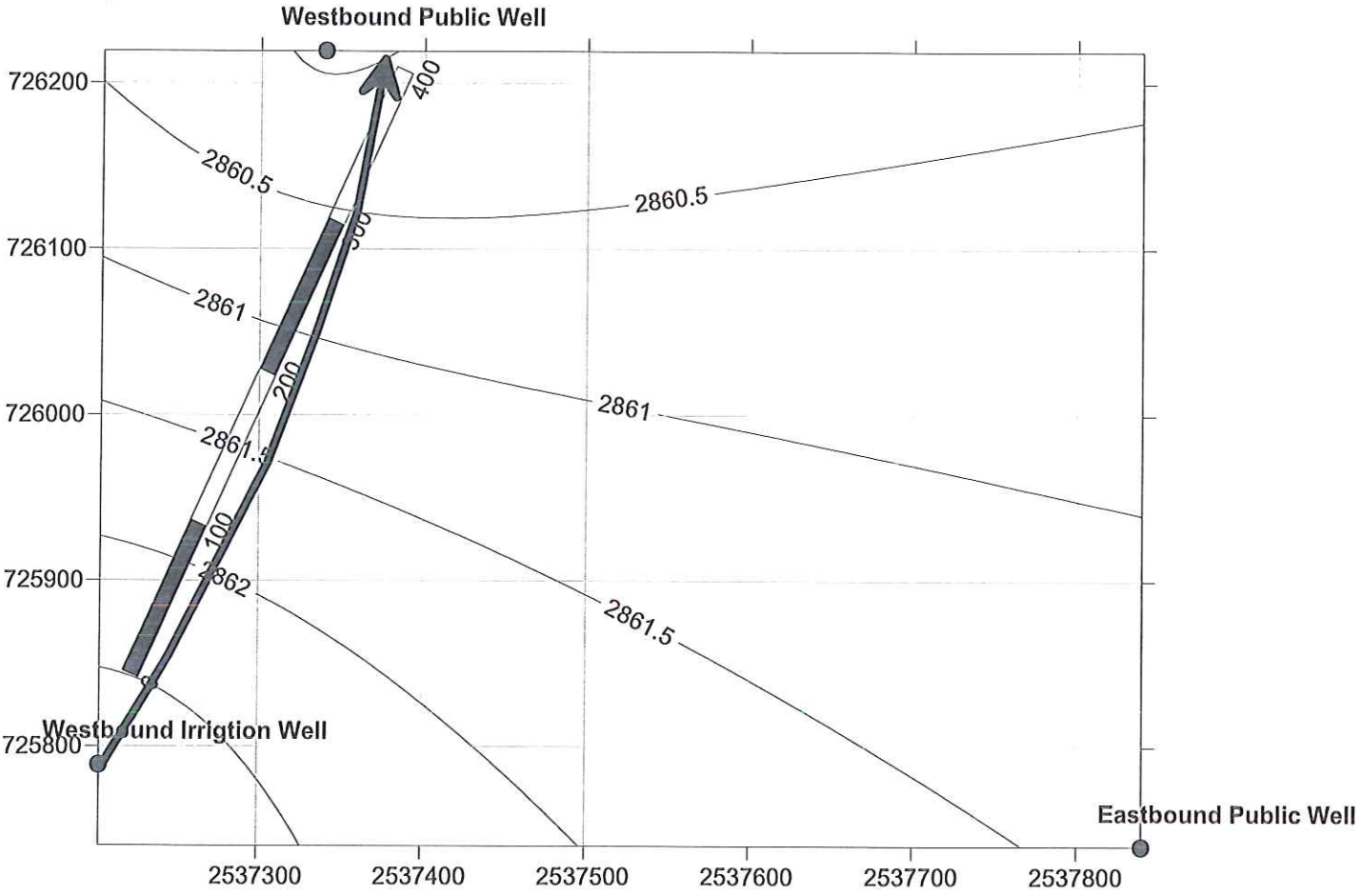
BY: BD
DATE: 8/28/2015

NOTES: ** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*
*** Material type is usually based on test pit. A soil that contains more than 35% silt and clay sized particles is considered fine grained.*

Hyshanm Rest Stop
Groundwater Elevation Contour Map
6/13/2014

Groundwater Flow Direction
North 24 Degrees East

Groundwater Gradient
(2862.5 - 2860.5)/310 = 0.0065



HYSHAM, MONTANA (244358)

Period of Record Monthly Climate Summary

Period of Record : 11/01/1945 to 01/20/2015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.1	39.6	49.5	61.7	71.2	80.0	89.1	87.8	76.3	63.8	46.8	36.4	61.3
Average Min. Temperature (F)	9.0	14.1	21.9	32.1	41.9	50.3	56.1	53.7	43.4	33.2	21.6	12.8	32.5
Average Total Precipitation (in.)	0.47	0.40	0.77	1.42	2.32	2.21	1.31	0.95	1.21	1.10	0.54	0.49	13.19
Average Total SnowFall (in.)	7.2	5.0	5.4	2.9	0.8	0.0	0.0	0.0	0.3	1.6	4.6	6.8	34.5
Average Snow Depth (in.)	2	1	0	0	0	0	0	0	0	0	0	1	0

Percent of possible observations for period of record.
Max. Temp.: 98.6% Min. Temp.: 98% Precipitation: 98% Snowfall: 88.8% Snow Depth: 62.7%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

Specifications For:

COLUMBUS REST AREA

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Wastewater System Improvements

DEQ SUBMITTAL

Prepared By :

DOWL

2090 Stadium Drive
Bozeman, MT 59715

Specifications For:

COLUMBUS REST AREA

MONTANA MDT DEPARTMENT OF TRANSPORTATION

2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Wastewater System Improvements

DEQ SUBMITTAL

Prepared By:

DOWL

2090 Stadium Drive
Bozeman, MT 59715

DOWL Project #:24.11355

Approved By:

_____

TECHNICAL SPECIFICATIONS FOR PUBLIC SEWER SYSTEM

PROJECT: Columbus Rest Area
Stillwater County Montana

OWNER: Montana Department of Transportation
2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

ENGINEER: DOWL
2090 Stadium Drive
Bozeman, MT 59715
(406) 586-8834

JOB NO.: 24.11356.1

February, 2015

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SECTION 02540 WASTEWATER INSTALLATION
SECTION 02740 STEEL ENCASED CROSSINGS

DIVISION 2

SITEWORK

SECTION 02540 – WASTEWATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01 Specification Section, apply to this Section.

B. Codes and Standards:
1. Install the Work described in the Specifications and the Drawings to comply with the requirements of legally constituted authorities having jurisdiction, including local and state codes and ordinances. The codes and ordinances having jurisdiction over the Work, serve as minimum requirements. Follow the requirements of the Drawings and Specifications if in excess of the codes and ordinances.
2. The Work is governed by the following codes and standards:
   a. Montana Department of Environmental Quality. (MDEQ)
   b. National Electrical Code (NEC).
   c. Occupational Safety and Health Act (OSHA).
   d. Environmental Protection Agency (EPA)
   e. State of Montana Fire Marshal
   f. Stillwater Health Department (SHD)
   g. Montana Public Works Standard Specifications (MPWSS)

1.2 SUBMITTALS

A. Product Data for each type of pipe, pipe accessory, pumps, tanks, tank accessory, manhole, manhole accessory, frame and cover specified.

B. Division 1 - Closeout Requirements: Procedures for closeout submittals.

C. Project Record Documents: Accurately record the following.

D. Actual locations of pipe runs, connections, manholes, cleanouts, and invert elevations.

E. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.3 SUMMARY

A. This Section includes:
1. Septic tanks.
2. Sewage/effluent pump.
3. Distribution piping.
4. Dosing chamber.
5. Pressure Pipe.
6. Leaching piping.
7. Drainfield materials.
8. Drainfield fill materials.

B. The purpose of the Specifications and Drawings is to set forth the requirements for an On-Site Public Waste Water Treatment System for the Columbus Rest Area in Stillwater County, MT. Design work, if required, is to be furnished by the Contractor and must be accomplished by a licensed professional. The installer must be qualified and licensed to install Sewage Treatment Systems in Stillwater County, MT.

C. The Contractor shall furnish all labor, materials, equipment, tools, transportation and supplies required to complete work in accordance with the plans, specifications, and terms of the contract and provide a complete and satisfactory system. Perform excavation, back filling, compacting, and grading operations, as required for below-grade improvements and to achieve contours and elevations per Plans and Specifications. Provide trenching, installation, backfill operations and all mechanical, electrical and utility work. Provide suitable sub-base materials, bedding fill materials for water and sewer components lines, drainfield trenches, tank installation, etc. Provide suitable fill from off-site if on-site quantities or quality are insufficient.

D. The work covered by this contract is generally identified as follows:
1. Contractor shall excavate to the lines and grades as shown on the plans and specifications. The excavation shall meet all safety requirements, permit adequate inspection and permit the construction of various contiguous components required. All areas of the construction site to be covered by fills, structures or roads shall be stripped to a minimum depth of six inches or to deeper depths to remove any grasses, roots, remaining vegetation or other undesirable or deleterious materials.
2. Contractor shall remove abandoned piping, boulders, undesirable or deleterious materials encountered during the excavation process.
3. Excavated materials shall be stockpiled in locations that allow construction to proceed. Excess excavated material or materials that cannot be conveniently stockpiled on the site shall be removed to a location selected by the Owner, and shall then be returned to the site as necessary to be used as random backfill.
4. Excavation of all trenches and pits shall be sloped or otherwise supported in a safe manner in accordance with applicable state and federal safety requirements.
5. Contractor shall excavate all material and set tanks to elevations shown on the plans and profiles.
6. The excavated and surrounding area shall be protected from any and all surface water. Pumps and related appurtenances shall be readily available to remove ground and surface waters. Standing water will not be permitted in the excavation. Temporary ditches or drains shall be constructed to control ground and surface waters and protect the site.
7. The Engineer shall be notified daily when the site is being prepared and ready for aggregate placement, pouring, etc., in ample time for inspection and approval.
8. The excavated "bearing area" shall be protected from freeze/thaw or wet/dry conditions.
9. If unexpected soft or yielding sub-grade is encountered the Engineer shall be notified.
10. Upon completion of excavation and placement of materials as described, the Contractor shall notify Engineer that sub-grade soils are ready for testing. Contractor will not proceed until excavation, fill placement and compaction has been approved by the Engineer.
11. During cold weather, excavate to expose only as much soil as it is possible to

protect from freezing. Fill material shall not be placed over frozen materials. Where freezing is likely ground shall be covered and insulated.

12. If natural clays are present, excavation work must be undertaken carefully to minimize disturbance due to moisture, construction equipment and foot traffic. If any soils become disturbed, they shall be removed prior to placing fill material or constructing foundation elements. If, during the course of construction, any native clays are encountered in areas which would directly or indirectly affect the structural integrity of the sewer treatment system components. The contractor shall remove and stockpile these clay layers, then replace and compact to maximum density with a more suitable structural fill material. All imported fill materials shall be tested for proper density by the Engineer. After the recommendations of the soil testing laboratory have been reviewed and approved by the Engineer, the work may proceed.
13. Install pumps, controls, alarms etc., as required for onsite sewer system operations. Provide installation, wiring, and all site work, mechanical work and electrical work.
14. Each pump has been sized based on hydraulic analysis and pump performance curves.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Precast Concrete Septic Tanks/Manholes:

1. Description: Precast, reinforced-concrete tank with internal baffles and covers; designed for structural loading according to ASTM C 890 and made according to ASTM C 1227.
   a. Inlet and Outlet Access: 24 and 30 inches in diameter, reinforced concrete access lids with steel lift rings. Include access centered over inlet and outlet.
   b. Manhole: 48 inches in diameter, reinforced-concrete access lid with steel lift rings.
   c. Concrete must be 4000 PSI at 28 days.
   d. Cement is type V, with max C3A of 8%per MT DEQ-4
   e. Each tank segment must be pour monothically.
   f. Reinforcing of tanks is #4 grade 60 rebar.
   g. Maximum earth cover is 6 feet.
   h. Tanks must be placed on compacted ¾" road-base or similar material. Minimum relative compaction is 95%. Do not use flow backfill material such as ¾ washed gravels.
   i. Tanks must be backfilled to top before water testing.
   j. Tanks must be sealed with 1" diameter conseal.
   k. All tanks must be water tight. Tanks used for commercial facilities, multiple-user systems or public systems must be tested in place for water tightness. Water tightness testing for concrete tanks may be conducted using a water test or vacuum test.
      i. Water testing must be conducted by sealing the outlets, filling the septic tank to its operational level, and allowing the tank to stand for at least eight (8) hours. If there is a measurable loss (2 inches or more), refill the tank and let stand for another 8 hours. If there is again a measurable loss, the tank must be rejected.

ii. Vacuum testing must be conducted by sealing all inlets, outlets, and accesses, then introducing a vacuum of 4 inches of mercury. If the vacuum drops in the first 5 minutes, it must be brought back to 4 inches of mercury. If the septic tank fails to hold the vacuum at 4 inches of mercury for 5 minutes, the tank must be rejected

B. Drainfield Dosing Tanks:

1. Description: Precast, reinforced-concrete tank with internal baffles and covers

a. Risers shall be required for access to internal vaults and access into the septic tanks for pumping. All risers shall be constructed watertight. The risers shall be attached to the tanks such that a watertight seal is provided. Risers shall extend three inches (3") above original grade to allow for settlement and to ensure positive drainage away from the access. Risers for inspection ports shall be a minimum of 24 inches in nominal diameter. Risers containing pumping assemblies or electrical splice boxes shall be a minimum of 30 inches in diameter and shall be sufficient diameter to allow removal of internal vaults without removing splice boxes, etc. All other risers shall be a minimum of 24 inches in nominal diameter and shall vary in height depending on the depth of bury on the various tanks. Adhesive required to adhere the PVC or fiberglass risers to either fiberglass or ABS tank adapter shall be either a two-part epoxy, Model MA320 or approved equal, or a single component adhesive Model ADH100 or approved equal. To ensure product compatibility, risers, lids and attachment components shall be supplied by a single manufacture.

b. Cleanout Risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of ½-inch. Risers shall extend to three inches above the ground surface to allow for settlement and shall have a minimum nominal diameter of 24 inches. See section 3b below for adhesive requirements.

c. Outlet risers shall be ribbed PVC as manufactured by Orenco Systems, Inc. or engineer-approved equal. The material shall be PVC as per ASTM D-1784 and tested in accordance with AASHTO M304M-89. The risers shall be constructed of non-corrosive material and designed to be buried in soil. Risers shall have a minimum stiffness of 10 psi, when tested according to ASTM D2412. Risers shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of ½-inch. Risers shall be at least 12" high, shall have a minimum nominal diameter of 30" when used in a simplex pumping application and shall be factory-equipped with the following:

i. Electrical and Discharge Grommets: EPDM grommets shall be installed by the manufacturer for discharging piping, vent piping, and/or the electrical conduit to assure a watertight seal. The grommets shall be installed at the factory by the manufacturer of the access risers.

ii. Adhesive: When bonding to concrete or fiberglass grooves, a two-part epoxy =, one quart required per 30-inch diameter riser, Model

ADHP10 or ADHQ10, or approved equal shall be used. When bonding to a flanged riser tank adapter, either a two-part epoxy, Model MA320 or equal, or a single component adhesive Model ADH100 or approved equal shall be used.

d. One lid shall be furnished with each access riser. Manufacturer shall provide evidence that lids have been used successfully in continuous field service for minimum of five years to demonstrate long-term integrity and suitability for the application. Lids shall be waterproof, corrosion resistant and UV resistant. Lids shall be flat, with no noticeable upward dome. A crown or dome or no more than 1/8-inch is allowable. Lids shall not allow water to pond on them. Lids shall have a green non-skid finish. Self-lubricating plastics, such as polyethylene, shall not be considered non-skid without addition of a non-skid coating. Lids shall form a watertight seal with the top of riser. Lids shall be capable of withstanding a truck wheel load (36 square inches) of 2500 pounds for 60 minutes with a maximum vertical deflection of 1-1/2-inch. Lids shall be provided with tamper-resistant stainless steel fasteners and a tool for fastener removal. Tamper-resistant fasteners include recessed drives, such as hex, Torx, and square. Fasteners that can be removed with common screwdrivers, such as slotted and Phillips, or fasteners that can be removed with standard tools, such as pliers or crescent wrenches, are not considered tamper-resistant. To prevent a tripping hazard, fasteners shall not extend above the surface of the lid.

e. Riser installation shall be accomplished according to the manufacturer's instructions.

C. Distribution Piping:

1. PVC Sewer Pipe and Fittings: ASTM D 3034, SDR 35, non-perforated, for solvent-cement or elastomeric gasket joints.
   a. Solvent Cement: ASTM D 2564.
   b. Gaskets: ASTM F 477, elastomeric seal.
   c. Transport Piping / Fittings:
2. All transport piping and fittings from the dosing tank to the drainfield shall meet a minimum pressure rating of Schedule 40.
3. Sub-grade fill material: Imported gravel or suitable native materials as determined through soil testing, graded for intended use as sub-base for concrete work specified and/or sewage treatment system component bedding.
4. Washed rock - 3/4" - 2 1/2". Pipe bedding, and tank bedding. No pipe bedding, or tank bedding shall be placed upon wet, muddy, yielding or unapproved underlying layer(s) and/or "base area".
5. Transport pipe must be a minimum of 2" diameter PVC SCH 40 pressure pipe
6. Drainfield lateral must be a minimum of 2" diameter PVC SCH40 pressure pipe

D. Wastewater Pump and Pump Controller System:

1. All pumping systems shall be supplied by a reputable manufacturer with at least five years of experience in supplying equipment for onsite wastewater treatment systems. Systems shall be approved equal, composed of:
2. The pumping system components consist of:
   a. Discharge Hose and Valve Assembly

i. 1.50-inch or 2-inch diameter, 150 psi PVC ball valve, 150 psi PVC check valve, PVC flex hose with minimum working pressure rating of 64 psi, and Schedule 40 PVC pipe. When pumping downhill, include anti-siphon assembly.

ii. Each pump will be connected to a control panel with audible and visible alarm. Pumps and control panels for the dose tank are specified on the enclosed Drawing.

b. Effluent Pumps

i. Effluent Pumps shall meet all flow rate requirements and be, single phase, 60 Hz, two-wire motor, with 10 foot long extra heavy duty (SO) electrical cord with ground (min). Pumps shall be UL and CSA listed as an effluent pump. Pumps shall be provided with a non-prorated five-year warranty. Pump removal and installation will be facilitated at the quick coupling in the top of each dose tank.

c. Float Switch Assembly

i. Use a four switch floats system mounted on a PVC stem attached to the filter cartridge. The floats must be adjustable and must be removable without removing the pump vault. The high- and low-level alarms, on and off function shall be preset as shown in the engineer's plans. Each float lead shall be secured with a nylon strain relief bushing at the splice box. The flats shall be UL or CSA listed and shall be rated for a minimum of 5.0A @ 120 VAC.

ii. Floats/switches shall be provided in the locations shown on enclosed drawings. The float/switch assembly shall operate the pumps on/off cycle and overflow alarm.

d. Electrical Splice Box

i. An UL approved for wet locations electrical box equipped with six electrical cord grips and a 1-inch outlet fitting is required. Also it shall include UL listed waterproof butt splice connectors. The use of a UL-approved conduit seal kit shall be required to prevent the passage of gases, vapors, or flames through the conduit.

e. Control Panel

i. The pump control panel shall be mounted on a post or exterior wall nearest the tank and pump. If mounting to an exterior wall, try to select an outbuilding where the sound of the motor contactor engaging will not be noticed. If an outbuilding wall isn't available, installation should include use of sound-deadening installation. (Post and panel mounting assemblies are acceptable.) The control panel shall be located within 50 feet and in sight of the pump motor or shall be provided with a lockable disconnect switch. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance. Each overflow alarm shall consist of a flashing red light and nameplate mounted on each Control Panel.

f. Drainfield

i. All components shall be supplied by a reputable manufacturer with at least five years experience in supplying equipment for onsite wastewater treatment systems. References must be available on request from the engineer.

g. Drainfield Absorption Fill Materials

i. Aggregate Filtering Material:

i) Round River Rock, 3/4" - 1-1/2".

ii) 3/8-inch Pea Rock, per State's Department of Transportation Standard Specifications.

ii. Cap/Topsoil: Sandy loam material.

iii. Vegetation Cover:

i) Grass compatible with adjacent ground cover.

ii) No shrubs or trees.

iv. Filter Mat. Approved Geotextile filter fabric (entire drainfield - top, sides).

v. Runoff berm: Topsoil

vi. Leaching Chamber. 36"ϕ Corrugated Polyethylene Pipe from approved suppliers:

i) Advanced Drainage Systems Inc. (ADS).

ii) Hancor.

iii) Prinsco.

iv) Quality Culvert Inc.

v) Infiltrator

vii. Clean Out Box:

i) Clean out box shall be identified by stamping "sewer" on the cover.

ii) Clean out box shall be applied products (series 910L with stronger load strength "T" cover), Carson-Brooks Plastics (model 910 with "T" cover) or equal.

iii) The cap shall be placed above grade. Slots extend below filter fabric to base

PART 3 - EXECUTION

3.1 EXAMINATION/WASTEWATER SYSTEM CONSTRUCTION AND TESTING

A. Provide labor, materials, tools, equipment, supplies, and services to perform the work

described on the Drawings and in each Division of the Specifications for the On-Site Sewer Treatment System.

B. Description of Work includes, but is not limited to the following:
1. Survey the area for septic tank system installation. Locate and mark existing utilities, underground structures, and aboveground obstructions before beginning and avoid disruption of and damage to services.
2. Examine soil structure, materials, and conditions.
3. Installation of septic tanks, dose tank, and associated components, plumbing, etc..
4. Install precast concrete septic tanks level according to ASTM C 891.
5. Excavate trenches 36 inches in width and 12-36 inches in dept., for a single trench.
6. Use pipes, fittings, and joining methods, for all piping sizes, according to the following applications:
   a. Install solid SCH 40 PVC piping to connect septic tank, dosing tank, and header for the absorption field with closed joints.
   b. Install perforated pipe for absorption field. Install 1 1/2" SCH 40 pipe with 1/8" orifices within a 36" wide gravelless chamber.
7. Join and install solvent-cement type PVC pipe and fittings according to ASTM D 2855 and ASTM F 402.
8. Absorption Field Installation:
   a. Numerous construction methods must be followed per State/Local Health Department Administrative Code for Private Sewage Disposal Systems.
   b. Install 3" SCH. 40 transport line. All pumping system components shall be installed in accordance with the manufacturer's recommendations, the engineer's plans, and all state and local regulations.
   c. Install pressurized drainfield.
9. Acceptance Tests
   a. After the installation of the wastewater system and pump equipment, the waste water system shall be given a field test under design conditions. The CONTRACTOR shall conduct the field test. Results of the field test will be provided to the ENGINEER. All defects or defective equipment revealed by the test shall be corrected or replaced promptly at no additional expense to the OWNER, and if necessary, the test shall be repeated until acceptable results are obtained.
10. Warranty:
   b. The pipes, tanks and pump unit or any part thereof shall be warranted against defects in material or workmanship within one year from date of substantial completion. Defective units or parts shall be replaced with a new or manufactured part at no cost to OWNER.

END OF SECTION 02540

SECTION 02740 – STEEL ENCASED CROSSINGS

PART 1 - GENERAL

1.01 WORK INCLUDED:

The work covered by this section includes providing a steel pipe sleeve, herein after also referred to as the casing, through which water mains hereinafter also referred to as the carrier pipe, will be placed. Also included is installing this casing by directional drilling operation, and installing the wastewater transport line through the casing.

If unforeseen conditions or obstacles are encountered the CONTRACTOR shall immediately discuss the matter with the ENGINEER for resolution. There shall be no damages paid for delays during the time where the resolution is being reached.

In cases where a specific permit is required and the conditions are included as part of the contract documents, the permit conditions shall govern over these general specifications in the case of a conflict.

1.02 RELATED WORK:

A. Section 02540 – Septic Systems

1.03 SUBMITTALS:

Submittals will be required for all materials in accordance with this section.

Before commencing work on the boring and jacking/directional drilling operation, the CONTRACTOR shall present evidence to prove to the satisfaction of the ENGINEER that he (or his subcontractor) has had previous experience in pipe installation of this nature. This requirement shall include the superintendent for this work. The CONTRACTOR shall employ a superintendent that is able to furnish satisfactory evidence of previous experience with this type of work, and shall keep this superintendent continuously employed until the casing pipe installation is completed.

PART 2 - PRODUCTS

2.01 STEEL CASINGS:

A. Steel Pipe Sleeve. Shall meet ASTM A139 or A570, Grade B, with a minimum yield stress of 35,000 psi. Wall thickness shall be sufficient to withstand jacking forces without deformation, with a minimum wall thickness of 0.375-inch. Pipe need not be new if it is in good, sound condition and approved by the ENGINEER. The outside and inside of the casing shall be smooth.

The casing pipe shall have an inside diameter approximately 3 inches greater than the pipe bells, or larger if necessary to accommodate pipe skids and installation.

The casing shall have straight welded seams (not spiral welds).

The casing segment shall be exactly the same length as the auger sections (i.e., if 10-foot auger sections are used the casing segment shall be exactly 10 feet). The casing ends shall be precise perpendicular cuts.

B. Joints. All joints shall be welded. All field welded joints shall comply with AWS Code for procedures of manual shielded metal arc welding for appearance, quality of welds made, and methods used in correcting welding work. A minimum of two passes must be used when welding the joint.

The invert of the casing shall be smooth and allow for easy placement of the carrier pipe on skids.

Welding methods shall assure the continuous casing is straight.

2.02 SKIDS:

The spacing between the skids shall not exceed 7 feet. Provide at least 3 skids per 20-foot joint, or 6 skids per 40-foot joint. A closer spacing shall be used if recommended by the manufacturer. Skids are to be at least 8 inches wide. The skids shall be firmly attached to the pipes so they do not slide when the pipe is installed.

Skids shall be made of HDPE material manufactured by injection molding. The skids shall include projections of sufficient height to keep the bells from touching the casing, while not leaving a gap of more than 2 inches to the top of the steel casing. The projections shall be centered around the spacer so the pipe is fully supported in all positions (even if the pipe twists from how it is originally inserted into the casing). The spacer and projections shall be designed to adequately carry the pipe totally filled with water. The skids shall be designed for the application. Casing spacers shall be "RACI" type as marketed by Public Works Marketing Inc., Dallas, Texas, 214-340-4226, or approved equal.

Once installed, the skids must completely isolate (as determined by the Engineer) a metal carrier pipe from the casing. If there is continuity between the two pipes, the carrier pipe shall be reinstalled.

2.03 END SEALS:

Casing end seals shall be 1/8-inch thick synthetic rubber with stainless steel bands and clamps, for a watertight seal. The end seal shall be Model C by Pipeline Seal and Insulator, or Model AC by Advance Products, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General: No construction in the property of the controlling agency shall be started until construction coordination has been finalized with that agency. Permits required by the appropriate agency shall be followed. Shoring, sheeting or other approved construction shall be required for the excavation of jacking or boring pits. Such shoring construction shall be designed for a live load plus earth pressure. Where shoring construction is required within the R-O-W, sufficient drawings and specifications on shoring construction shall be submitted by the CONTRACTOR to the Agency as applicable for their approval before any excavation is commenced. Traffic control shall be in place.

B. Boring and Jacking: Boring and jacking of casing pipe shall be accomplished in such a manner that there will be no damage to the roadway section, and in accordance with the applicable permits and -Construction Traffic Control. Boring is to be a mechanical augering or drilling of the soil. The

casing is to be jacked close enough behind the boring operation so there is no caving of soil from above. Any indication that the material above or adjoining the hole being bored is caving into the opening and being removed, shall be sufficient reason to stop the work and require an improved method of installation be used. Repairs acceptable to the owner of the road must be made if soil is removed outside of the casing. Removal of the material from the bored hole by washing or sluicing will not be permitted. All excess excavated material shall be disposed of in a manner approved by the ENGINEER.

The casing shall be jacked into place for that length shown on the plans.

The end of the pipe opposite the jacking pit shall not deviate from: (a) the horizontal alignment shown on the plan sheet by more than 1 foot in either direction; (b) the vertical alignment shall not deviate from the indicated elevation and slope by more than 3 inches from that specified. In addition, no high points shall be created in or adjacent to the carrier pipe inside the casing (or adjacent to the casing) that are not shown on the drawings. Also the grade for a gravity line shall be such that it does not impact the design of the line.

The CONTRACTOR shall coordinate his work so traffic will not be closed during the construction of the casing crossing. The CONTRACTOR shall also furnish and maintain the necessary safety precautions.

C. Excavation: Trench excavation and backfilling operations shall conform in all respects to applicable portions of these specifications. Laying and jointing of the casing pipe shall conform to the recommendations of the manufacturer of the pipe used.

The casing pipe shall be installed as shown on the plans with care being taken to disturb as little of the shoulder embankment as possible. Embankment backfill shall be compacted to no less than 95% of maximum density at ±2% of optimum moisture as determined by ASTM D698. The CONTRACTOR's installation and backfilling operations shall be completed in a manner acceptable to the ENGINEER and owner of the road being crossed.

D. Carrier Pipe Installation: Following installation of the casing it shall be thoroughly cleaned before the carrier pipe is placed. The carrier pipe shall be installed in the casing on skids to facilitate installation and to provide support for pipe between joints as shown on plans. The carrier pipe shall be installed in a smooth operation without jerking. Skids shall remain in the place on the pipe they are installed. After installation of the pipe in the casing, the ends of the casing shall be closed with rubber end seals as indicated on the drawings.

E. Recommendations: The following are recommended practices for the installation of the bored and jacked steel casing.

1. The CONTRACTOR should inspect the site before the bid opening to verify his proposed approach.
2. A small diameter pilot hole should first be bored to verify alignment and grade.
3. A guiding method should be used on the head of the auger to control grade. This method should include a system that also monitors line and grade.
4. A water level system should be attached to the casing and used to monitor grade as the casing is being installed. The CONTRACTOR should track and record the progress of the grade of the bore at least every 10 feet. The cutting head should be adjusted as necessary based on the results of this monitoring.

5. The boring operation should proceed upgrade.
6. The CONTRACTOR should evaluate the procedure he is proposing to auger bore the casing following the digging of the boring pits and make necessary changes so he can install the casing in compliance with the specifications.
7. An approved lubricant (such as bentonite slurry) should be used on the outside of the casing to help the jacking process.
8. A leading edge band should be used on the cutting head.
9. The cutting head should be kept inside the front edge of the casing and the leading edge of the auger should fit tightly inside the casing.
10. Drainage is to be maintained away from the boring pit including the use of a berm if needed. Sides of the pit are to be shored as necessary.
11. A base of gravel should be used if the floor of the bore pit appears to be at all unstable. The machine should not move vertically or laterally during boring.
12. A firm backstop should be provided.
13. The receiving pit should be dug to at least the depth of the top of the pipe once the boring operation gets within 10 feet of the receiving pit.
14. After placing the first casing section, the line and grade must be carefully checked to verify it is correct.
15. Auger flights between sections are to be continuous.
16. The casing should be placed before the pipe within 500 feet of the casing is placed so that if minor adjustments in the grade of the pipeline are agreeable to the ENGINEER, they can be made in the transition to and from the casing.
17. The quantity of soil removed from the casing shall be measured to verify it is the correct amount for removing soil only within the casing.

F. Rebore or caving: If a rebore is required, the casing shall be left in-place and filled with flowable fill (lean concrete) by methods acceptable to both the ENGINEER and the owner of the highway, railroad or ditch.

If caving occurs ahead of the auger and outside of the casing the operation must stop and this must be fully repaired to the satisfaction of both the ENGINEER and owner of the highway, railroad or ditch.

END OF SECTION 02740

APPENDIX H:

MDEQ Water Report

DEQ
Montana Department
of Environmental Quality

Steve Bullock, Governor

Airport Business Park • 1371 Rimtop Dr. • Billings, MT 59105-9702 • Website: www.deq.mt.gov

Bill Dreyer, PE
DOWL
2090 Stadium Drive
Bozeman, Montana 59715

January 13, 2016

Re: Hysham Rest Area (Eastbound) Replacement Well – Treasure County **EQ# 16-1083**

Dear Mr. Dreyer:

Plans and specifications for the subject project have been reviewed by personnel of the Public Water Supply Section and were found to be satisfactory. Approval of these plans is hereby given; a copy of the plans bearing the approval stamp of the Department is enclosed. Approval is based on the design report, plans, and specifications received September 11, 2015 and on additional information and revised plans received January 11, 2016. The plans were reviewed in accordance with Department design standard DEQ-3. This project approval includes the following improvements to the water system serving the Hysham Rest Area (Eastbound), PWSID MT0001694, in Treasure County:

- Drilling, developing, and test pumping a replacement public water supply well with an anticipated capacity of approximately 35 gpm to serve the facility;
- Installation of two (2) hydropneumatic tanks with a nominal volume of approximately 119 gallons and a 35-50 psi well pump pressure control;
- Installation of four (4) parallel particulate filters (NSF-approved housing and cartridges); and
- Installation of valves, fittings, and appurtenances as shown on the approved plans.

The following information is required prior to final approval and use of the well:

1. A hydraulic analysis, based on the aquifer pumping test and selected pumping unit, demonstrating that the system will be capable of supplying the peak instantaneous demand while meeting the minimum pressure required in DEQ-3, 8.1.1.
2. A final assessment for proposed groundwater sources that may be under the direct influence of surface water, prepared in accordance with PWS-5 (DEQ-3, 1.1.6.e) and a final source water delineation report prepared in accordance with PWS-6 (DEQ-3, 1.1.6.f) if field results differ substantially from the originally-submitted information.
3. Water quality sample results demonstrating compliance with DEQ-3, 3.2.2.1 (microbiological quality, two or more samples more than 72 hours after disinfection), and DEQ-3, 3.2.2.2 (physical and chemical, collected prior to disinfection).
4. Yield and drawdown test results demonstrating compliance with DEQ-3, 3.2.4.1 submitted in both paper and electronic formats on DRNC Form 633.
5. A copy of the completed well log (DEQ-3, 3.2.4.3).

Approval is given with the understanding that any deviation from the approved plans and specifications will be submitted to the Department for reappraisal and approval. Prior to operation of the public water system, certification must be submitted to the Department that the system, or portion of the system constructed, altered, or extended to that date, was completed in substantial accordance with plans and specifications approved by the department and there are no deviations from the design standards of the applicable circulars other than those previously approved by the Department. Within 90 days following completion of the project, a complete set of "as-built" record drawings must be signed, stamped and submitted to the Department. For a system or any portion of a system designed by a professional engineer, an engineer shall sign and submit the certification letter and "as-built" drawings to the Department. It is further understood that construction will be completed within three years of this date. If more than three years elapse before completing construction, plans and specifications must be resubmitted and approved before construction begins. This three-year expiration period does not extend any compliance schedule requirements pursuant to a Department enforcement action against a public water or sewage system.

Failure to abide by the above conditions is considered a significant violation of the Montana Public Water Supply Laws (PWSL), and the administrative rules promulgated there under. The applicant is responsible for compliance with all other applicable federal, state, local, and tribal law, regulations, and ordinances, including but not limited to, the Montana Water Use Act, Mont. Code Ann. Title 85, Chapter 2.

The applicant is responsible for compliance with all applicable federal, state, local, and tribal law, regulations, and ordinances. Approval in this document is limited solely to the matters therein specifically contained and does not constitute approval, implied or otherwise, for the purposes of any other law, regulation, or ordinance.

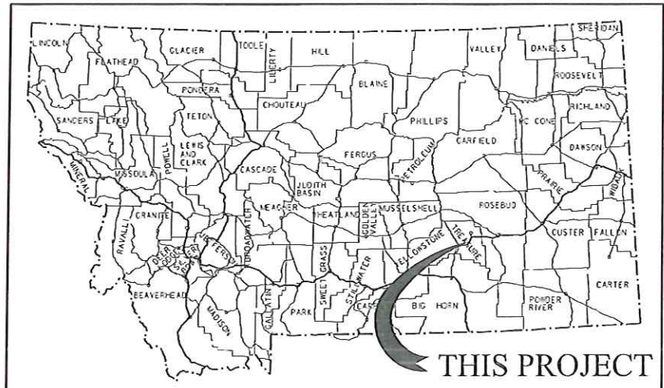
Department approval of this project covers only those portions of the plans and specifications that are subject to the Department's review authority under the Public Water Supply Laws (MCA 75-6) and the Administrative Rules promulgated thereunder (ARM 17.38). This approval does not cover items found within the plans and specifications that are outside of the Department's review authority, including but not limited to, electrical work, architecture, site grading or water and sewer service connections.

If I can offer any further information or assistance, please feel free to contact me at (406) 247-4455 or mwaite@mt.gov.

Sincerely,

Matthew Waite, PE
Permitting and Compliance Division
Billings Regional Office

cc: Douglas Lieb, MDT
DNRC – Billings
Treasure County Sanitarian
File



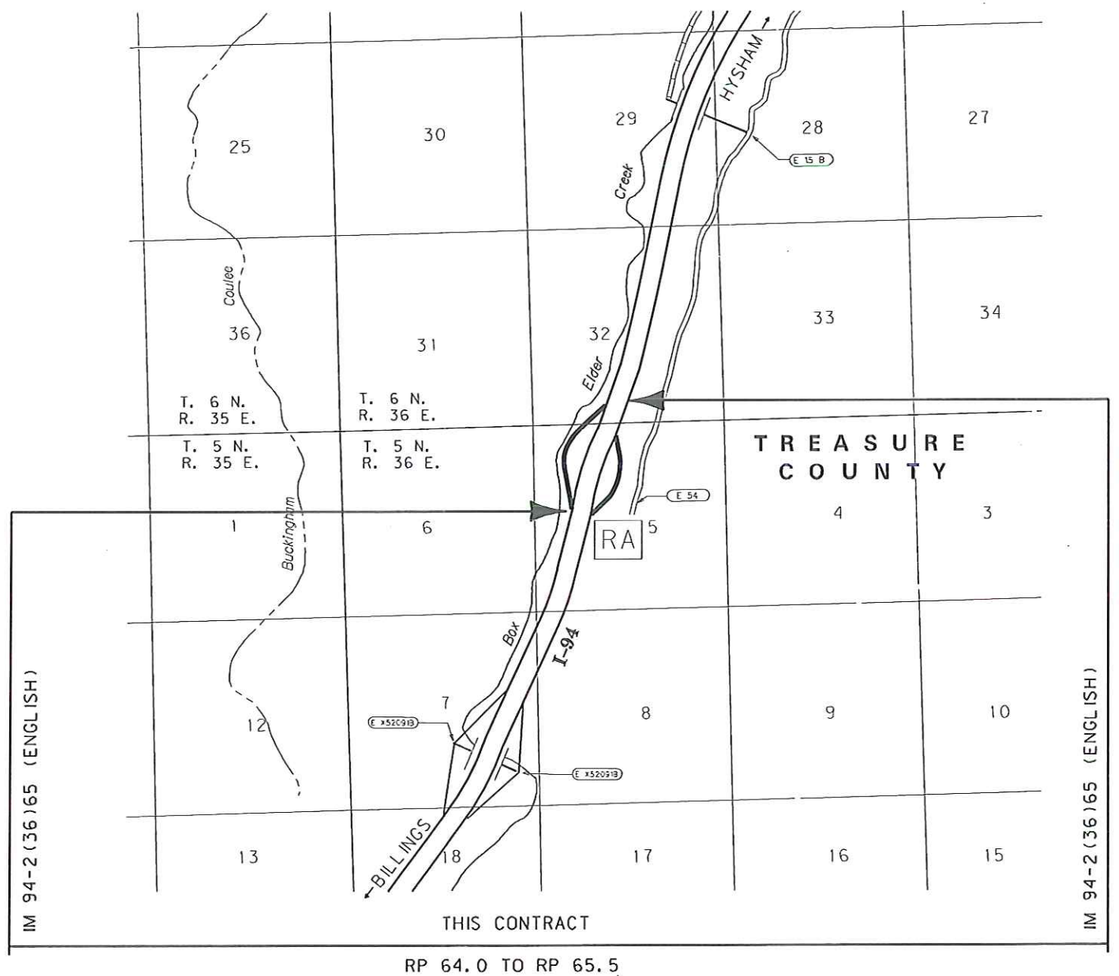
MONTANA DEPARTMENT OF TRANSPORTATION

FEDERAL AID PROJECT IM 94-2(36)65
WATER MDEQ PERMITTING
HYSHAM REST AREA - MONTANA
TREASURE COUNTY

PRESENT 2014 A.D.T.	= 4,940
LETTING 2016 A.D.T.	= 5,140
DESIGN 2036 A.D.T.	= 7,650
D.H.V.	= 880
TRUCKS	= 27.3%
V.	= 70 MPH
18 KIP ESAL'S	= 827
GROWTH RATE	= 2.0%

CSF=0.9993521809

LENGTH N/A MILES



RP 64.0 TO RP 65.5

APPROVED
Montana Department of
Environmental Quality
Permitting and Compliance Division
M. Waik 1/13/2016
Reviewer Date

RECEIVED
JAN 11 2016
MT DEPT OF ENVIRONMENTAL QUALITY
BILLINGS REGIONAL OFFICE

PLANS PREPARED BY
DOWL
2090 STADIUM DRIVE
BOZEMAN, MONTANA 59715
(406) 586-8834

MONTANA
WILLIAM R. DREYER
No. 13853 PE
12/29/15
LICENSED PROFESSIONAL ENGINEER

ASSOCIATED PROJECT AGREEMENT NUMBERS	
R/W & I.C.	
P.E.	IM 94-2(36)65

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTTTLZ20	DESIGNED BY	T BECKEN-GADDO	10/16/2015	WATER PLANS
2		10/16/2015	REVIEWED BY	B DREYER	10/16/2015	
		2:57:54 PM dolfscher	CHECKED BY	T CORMIER	10/16/2015	UPN 8200000

EQ16-1234

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EXISTING SITE PLANS	SHEET NO.
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NOTES	2
CONTROL DIAGRAM	3
DETAILS	4-6
OVERALL SITE PLAN	
MECHANICAL ROOM DETAILS	
PROPOSED PUBLIC WELL DETAIL	

DOWL

LINEAR AND LEVEL DATA

BEARING SOURCE

GRID -- MONTANA COORDINATE SYSTEM NAD83-2011

LEVEL DATUM SOURCE

NAVD88 (GNSS DERIVED ELEVATIONS USING GEOID 12A AND HOLDING NGS MARK A555)

NOTES

UTILITIES

CALL THE UTILITIES UNDERGROUND LOCATION CENTER (811) OR OTHER NOTIFICATION SYSTEM FOR THE MARKING AND LOCATION OF ALL LINES AND SERVICE BEFORE EXCAVATING. ALL CLEARANCES OR DEPTHS PROVIDED FOR UTILITIES ARE FROM EXISTING GROUND LINE.

WETLANDS

WETLANDS MAY EXIST ADJACENT TO THE ROADWAY AND BEYOND THE PROJECT LIMITS. A WETLAND DELINEATION HAS NOT BEEN COMPLETED FOR THIS PROJECT. IMPACTS TO WETLAND AREAS ARE NOT ANTICIPATED IN ASSOCIATION WITH THE PROPOSED WORK. NO PERMITS HAVE BEEN OBTAINED. ANY ACTION IMPACTING WETLAND AREAS WITHOUT THE APPROPRIATE PERMITTING IS THE RESPONSIBILITY OF THE CONTRACTOR.

SOILS INFORMATION

SOILS INFORMATION ON THE PLAN AND PROFILE SHEETS IS A BRIEF SUMMARY OF THE SOILS CLASSES. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.

GEOTECHNICAL BORING / SOIL SURVEY LEGEND

- MATERIAL IS LABELED AT THE BOTTOM OF THE LAYER
- A MINUS (-) OFFSET INDICATES A DIRECTION LEFT OF PROJECT CENTERLINE
- THE GEOTECHNICAL TEST PITS WERE CONDUCTED FOR WASTEWATER DESIGN PURPOSES

BH # (GEOTECHNICAL BORING) TP # (GEOTECHNICAL TEST PIT) PERC # (PERCOLATION TEST)

COMBINATION SCALE FACTOR

ALL COORDINATES ARE STATE PLANE (SEE CONTROL DIAGRAM).
CSF IS 0.9993521809.

R/W SURVEY LEGEND

- EXISTING CONCRETE R/W MONUMENT
- EXISTING METAL R/W REFERENCE PIN
- EXISTING STATION MARKER

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTTTLZ20	DESIGNED BY	T BECKEN-GADDO	10/16/2015	WATER PLANS		HYSHAM REST AREA - MONTANA		IM 94-2(36)165
		10/16/2015	REVIEWED BY	B DREYER	10/16/2015					
1		2:57:55 PM dofscher	CHECKED BY	T CORMIER	10/16/2015	TREASURE COUNTY		CSF=0.9993521809	UPN 8200000	SHEET 2 OF 6

CONTROL DIAGRAM

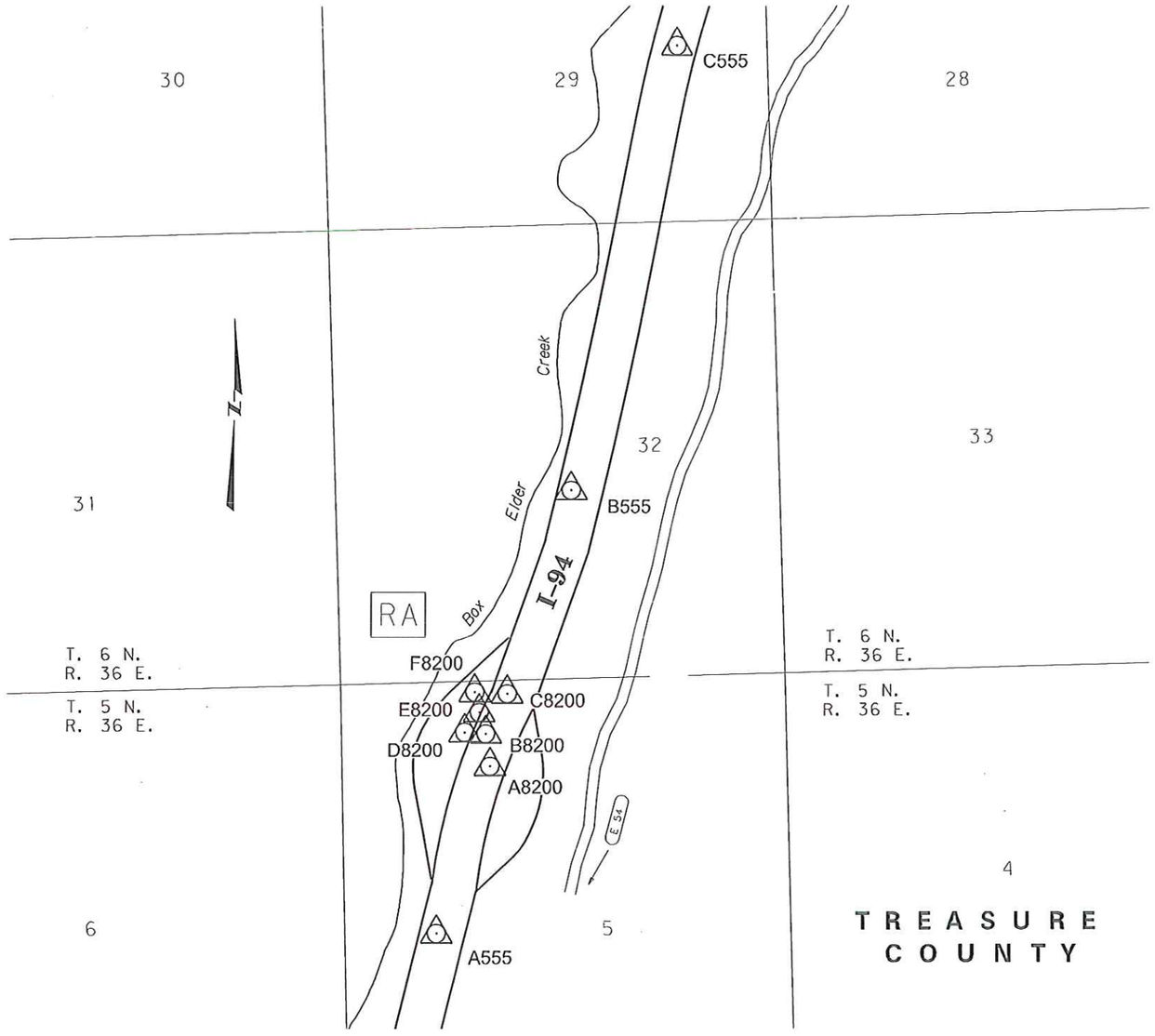
SCALE: N/A

NOTE:
THIS PROJECT IS ON THE MONTANA COORDINATE SYSTEM NAD83-2011.
NORTHING AND EASTING COORDINATES ARE EXPRESSED IN UNITS OF INTERNATIONAL FEET AND ELEVATIONS ARE IN UNITS OF U.S. SURVEY FEET.

DIMENSIONS SHOWN ON THE PLANS ARE GRID. ALL SURVEY AND STAKING REQUIRE THE USE OF A COMBINATION SCALE FACTOR (CSF) TO CONVERT GRID DIMENSIONS TO GROUND DIMENSIONS (GRID DISTANCE ⅝ CSF = GROUND DISTANCE).
THE CSF FOR THIS PROJECT IS 0.9993521809.

CONTROL ABSTRACT

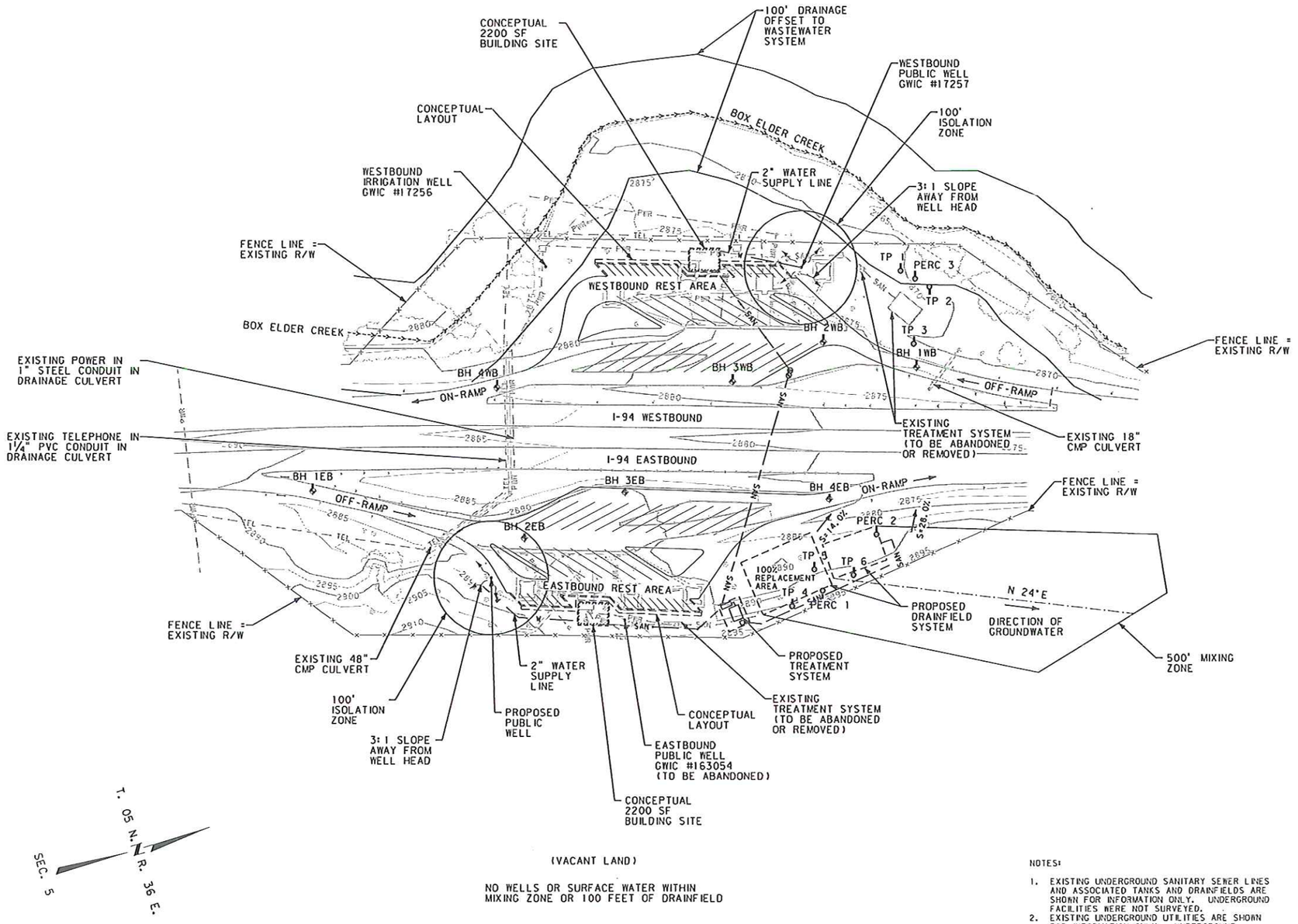
POINT NAME/NUMBER	N OR Y COORDINATE	E OR X COORDINATE	POINT ELEVATION	LOCATION AND DESCRIPTION
A8200	725,426.577	2,537,663.876	2,901.27	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "A8200 2014", for the east bound I-94 rest area, on a small bench south of the maintained grass area, 90 ft. E-SE of the east edge of pavement, 76 ft. se of a metal sign post(no camping) . Set a metal witness post and MDT sticker 3 ft. north of the cap.
B8200	725,804.962	2,537,612.307	2,890.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "B8200 2014", for the east bound I-94 rest area, near the center (N-S) of the rest area, 1 ft. west of the top back of curb for the tractor trailer parking area, in the grass area, on top of a small hill between the east bound I-94 guard rail and the tr/tr parking area, 45 ft. north of an angle point in along the west edge of the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
C8200	726,275.214	2,537,865.555	2,893.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "C8200 2014", for the east bound I-94 rest area, 380 ft. north of the north most picnic table, on a small hill above where the exit ramp for the rest area meets the east bound lane of I-94, 28 ft. west of the N-S r/w fence. Set a metal witness post and MDT sticker 3 ft. north of the cap.
D8200	725,822.290	2,537,361.381	2,881.85	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "D8200 2014", for the west bound I-94 rest area, near the south most end of the rest area, 7 ft. west of the edge of pavement, 35 ft. northwest of the south most nose of the curbing between the car and truck lanes leaving the rest area, west bound onto I-94. Set a metal witness post and MDT sticker 3 ft north of the cap.
E8200	726,056.134	2,537,534.645	2,879.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "E8200 2014", for the west bound I-94 rest area, near the center (N-S) of the tractor/trailer parking area, on the grass slope between the west bound edge of pavement and the tr/tr parking lot, 10 ft. west of the I-94 edge of pavement, 26 ft. east of the eop for the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
F8200	726,293.950	2,537,481.604	2,876.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "F8200 2014", for the west bound I-94 rest area, near the north end of the rest area, 1 ft. north of the edge of pavement, 33 ft. north of the north most end of the concrete sidewalk next to the handicap parking stall. Set a metal witness post and MDT sticker 3 ft. east of the cap.
A555	723,475.593	2,537,037.718	2,929.16	A ngs stainless steel rod in a monument box with a lid marked "A555 1981", on the east bound side of I-94, near milepost 64.4, 100 ft. southeast of the centerline of the east bound lane, 1.2 ft. west-northwest of an ngs witness post, 1.6 ft. west-northwest of the r/w fence.
B555	728,660.461	2,538,613.291	2,869.74	A ngs stainless steel rod in a monument box with a lid marked "B555 1981", on the east bound side of I-94, near milepost 65.35, 113 ft. E-SE of the centerline of the east bound lane, 1.6 ft. west-northwest of the r/w fence
C555	733,871.091	2,539,864.383	2,814.30	A ngs stainless steel rod in a monument box with a lid marked "C555 1981", on the east bound side of I-94, near milepost 66.4, 93 ft. E-SE of the centerline of the east bound lane, 1.75 ft. west-northwest of the r/w fence.



3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTTRVZ20	DESIGNED BY	T BECKEN-GADDO	10/16/2015	WATER PLANS	HYSHAM REST AREA - MONTANA	IM 94-2(36)65
2		10/16/2015	REVIEWED BY	B DREYER	10/16/2015			
		2:58:28 PM dofischer	CHECKED BY	T CORMIER	10/16/2015	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 3 OF 6

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD



T. 05 N. R. 36 E.
SEC. 5

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD

NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.
3. FOR PHASE II OF THE HYSHAM REST AREA PROJECT, ALL WELL APPARATUS SHALL BE REMOVED AND THE WELL CASING AS WELL AS THE APPARATUS SHALL BE SCRUBBED AND AN ACID WASH TO THE CASING IS REQUIRED.

OVERALL SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

DOWL

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ20	DESIGNED BY	T BECKEN-CADDO	8/26/2015	WATER PLANS	HYSHAM REST AREA - MONTANA / IM 94-2(36)65
2		10/16/2015	REVIEWED BY	B DREYER	8/26/2015		
		2:59:05 PM dofischer	CHECKED BY	T CORMIER	8/26/2015	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 4 OF 6

GENERAL NOTES

1. INSTALL ALL EQUIPMENT IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
2. PROVIDE UNISTRUT CHANNEL & TUBING CLAMPS FOR WALL MOUNTING & SUPPORT OF PIPING.
3. INTERIOR PVC PIPE SHALL BE SCH. 40 SOCKET WELD EXCEPT WHERE THREADED COUPLING OR VALVE CONNECTIONS ARE NEEDED.

PT-1 PRESSURE TANK

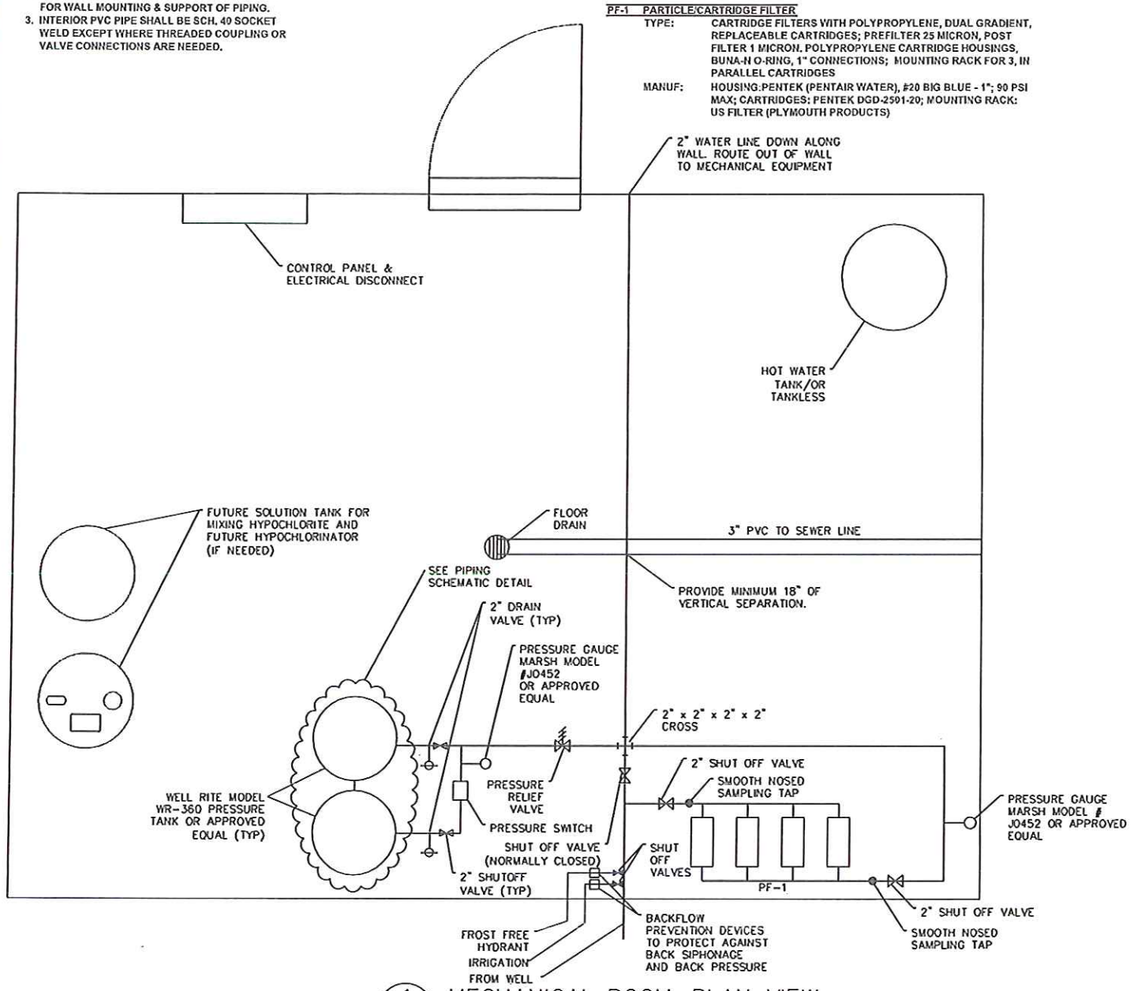
TYPE: PRE-CHARGED BLADDER TYPE 35-50 PSIG;

MANUF: WELL RITE MODEL WR-360

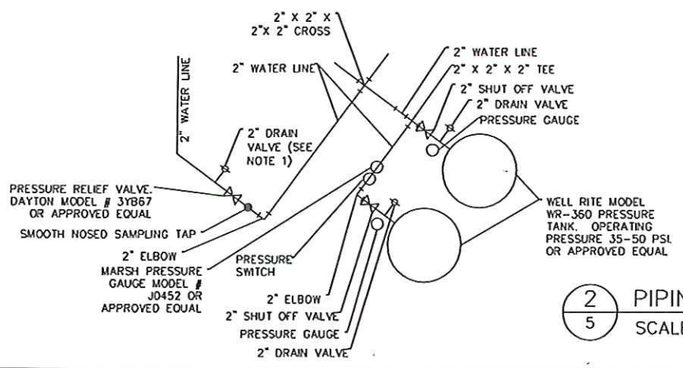
PF-1 PARTICLE/CARTRIDGE FILTER

TYPE: CARTRIDGE FILTERS WITH POLYPROPYLENE, DUAL GRADIENT, REPLACEABLE CARTRIDGES; PREFILTER 25 MICRON, POST FILTER 1 MICRON, POLYPROPYLENE CARTRIDGE HOUSINGS, BUNA-N O-RING, 1" CONNECTIONS; MOUNTING RACK FOR 3, IN PARALLEL CARTRIDGES

MANUF: HOUSING:PENTEK (PENTAIR WATER), #20 BIG BLUE - 1"; 90 PSI MAX; CARTRIDGES: PENTEK DGD-2501-20; MOUNTING RACK: US FILTER (PLYMOUTH PRODUCTS)



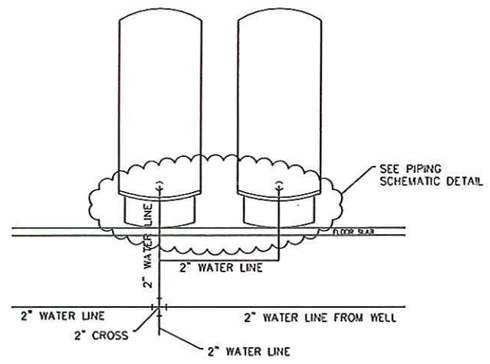
1/5 MECHANICAL ROOM–PLAN VIEW
SCALE :NTS



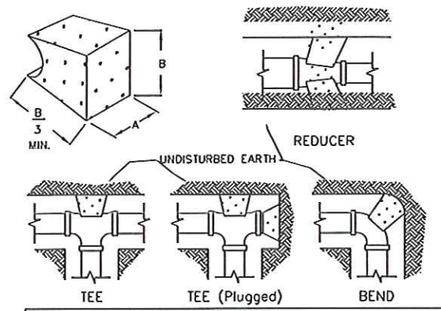
NOTE:
1. DISCHARGE PIPING SHALL BE DIRECTED TO FLOOR DRAIN BELOW.

2. AIR RELEASE PROVIDED BY PLUMBING FIXTURES.

2/5 PIPING SCHEMATIC
SCALE :NTS



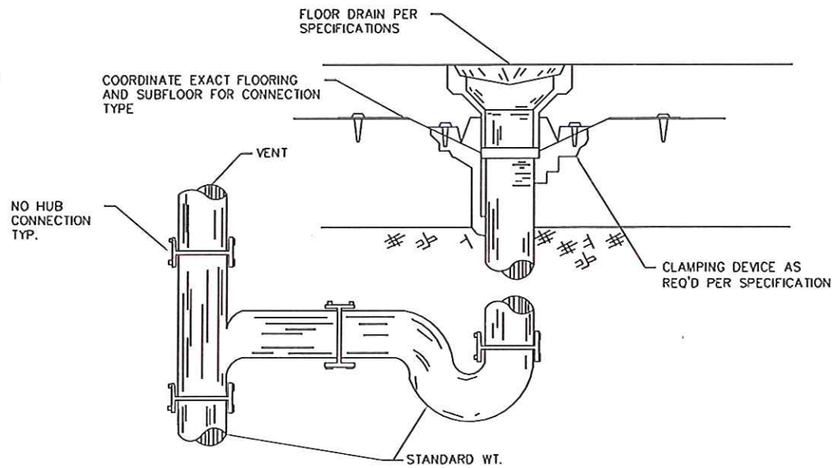
3/5 MECHANICAL ROOM–PROFILE VIEW
SCALE :NTS



DIMENSIONS FOR THRUST BLOCKING								
FITTING SIZES	TEES & PLUGS		90° BEND		45° BEND & WYES		REDUCERS & 22 1/2° BEND	
	A	B	A	B	A	B	A	B
2"-4"	1'-10"	1'-5"	1'-10"	1'-6"	1'-8"	1'-0"	1'-7"	0'-6"
6"	2'-3"	1'-11"	2'-8"	2'-4"	2'-0"	1'-8"	1'-9"	1'-0"
8"	3'-0"	2'-6"	3'-6"	3'-2"	2'-8"	2'-3"	2'-0"	1'-6"
10"	3'-8"	3'-3"	4'-4"	4'-0"	3'-3"	2'-10"	2'-5"	2'-0"
12"	4'-3"	4'-0"	5'-1"	4'-10"	3'-10"	3'-6"	2'-9"	2'-6"
14"	5'-8"	4'-1"	6'-9"	5'-0"	5'-0"	3'-8"	3'-7"	2'-7"
16"	6'-3"	4'-10"	7'-8"	5'-9"	5'-9"	4'-2"	4'-5"	2'-9"

NOTE:
THIS TABLE IS BASED ON 150 PSI MAIN PRESSURE
1500 PSF SOIL BEARING PRESSURE

4/5 THRUST BLOCKING FOR PRESSURE MAIN
SCALE : NTS



5/5 FLOOR DRAIN DETAIL
SCALE :NTS

NOTES:

1. FOR PHASE II OF THE HYSHAM REST AREA PROJECT, ALL WELL APPARATUS SHALL BE REMOVED AND THE WELL CASING AS WELL AS THE APPARATUS SHALL BE SCRUBBED AND AN ACID WASH TO THE CASING IS REQUIRED.

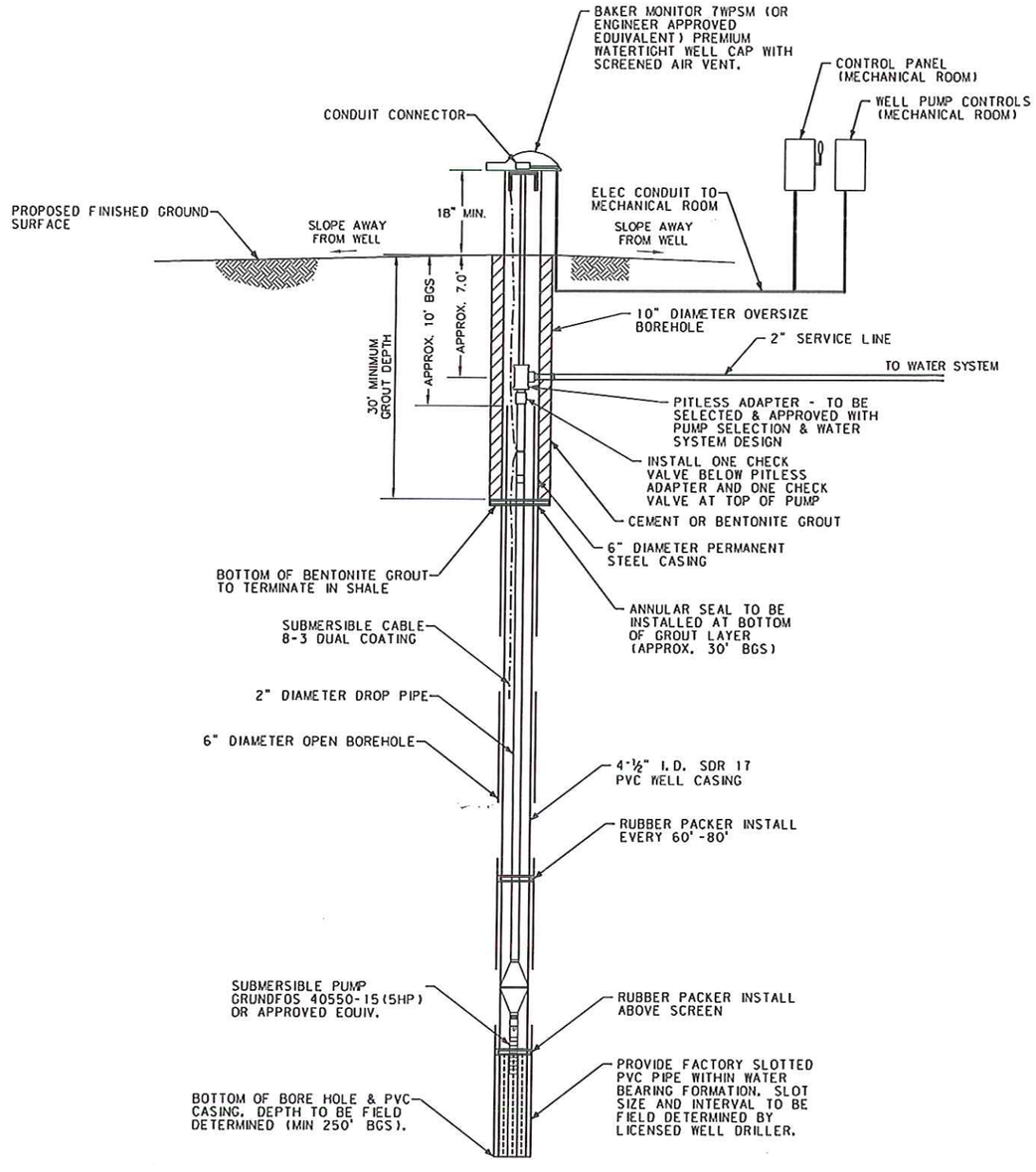
MECHANICAL ROOM DETAILS

NO SCALE

DOWL

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ20	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WATER PLANS	
1		10/16/2015	REVIEWED BY	B DREYER	8/26/2015		
		2:59:06 PM dolf.scher	CHECKED BY	T CORMIER	8/26/2015	TREASURE COUNTY	

HYSHAM REST AREA - MONTANA		IM 94-2(36)65
CSF=0.9993521809	UPN 8200000	SHEET 5 OF 6



1/6 WELL SYSTEM DETAIL
SCALE : NTS

NOTES:

1. ALL WELL WORK AND CONNECTIONS SHALL BE CONDUCTED BY A MONTANA STATE LICENSED WELL DRILLER AS OUTLINED IN MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (MDEQ).
2. CONTRACTOR TO VERIFY THAT ALL WELL WORK, WELL COMPONENTS, AND CONNECTIONS MEET ALL APPLICABLE STANDARDS INCLUDING BUT NOT LIMITED TO MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY.
3. IT IS CRITICAL THAT THE WELL BE DRILLED IN THE EXACT MDEQ APPROVED LOCATION. FINISHED GROUND ELEVATION OF WELL TO BE STAKED BY OTHERS.
4. YIELD AND DRAWDOWN TESTS, CONDUCTED IN ACCORDANCE WITH MDEQ STANDARDS SHALL BE CONDUCTED ON THE WELL. REFER TO WELL SPECIFICATIONS FOR STEP TEST AND CONSTANT RATE TEST.
5. ALL PIPING, CONNECTIONS, FITTINGS, AND VALVES SHALL CONFORM TO THE LATEST AWWA OR ANSI/NSF STANDARDS.
6. WELL CAP TO BE LOCKED IN PLACE WITH A LONG SHANK PADLOCK.
7. WATER SAMPLES MUST BE OBTAINED BY WELL DRILLER DURING THE TEST PUMPING PROCEDURE, PRIOR TO DISINFECTION, AND DELIVER WATER SAMPLES TO STATE APPROVED LABORATORY PER DIRECTION OF THE ENGINEER. (REFER TO SPECIFICATIONS).
8. THE WELL LOG & WATER TEST RESULTS MUST ALL BE SUBMITTED TO THE ENGINEER AND MDEQ.
9. INITIAL SCOPE OF WORK INCLUDES DRILLING WELL TO SPECIFICATIONS, DEVELOPING WELL, PUMP TESTING, WATER SAMPLING, WELL DISINFECTION, AND PUMP INSTALLATION.
10. WELL MUST ALSO BE DISINFECTED UPON INSTALLATION OF PERMANENT WELL PUMP, PIPING, ELECTRICAL WIRING, ETC.
11. THE BACTERIOLOGICAL TEST RESULTS REQUIRED DURING PERMANENT WELL PUMP INSTALLATION SHALL BE TAKEN MORE THAN 72 HOURS AFTER DISINFECTION.

PROPOSED PUBLIC WELL DETAIL

EASTBOUND

NO SCALE

DOWL

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ20	DESIGNED BY	T BECKEN-GADDO	8/26/2015	WATER PLANS	HYSHAM REST AREA - MONTANA	IM 94-2(36)65
1		10/16/2015	REVIEWED BY	B DREYER	8/26/2015			
		2:59:07 PM dofischer	CHECKED BY	T CORMIER	8/26/2015	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 6 OF 6

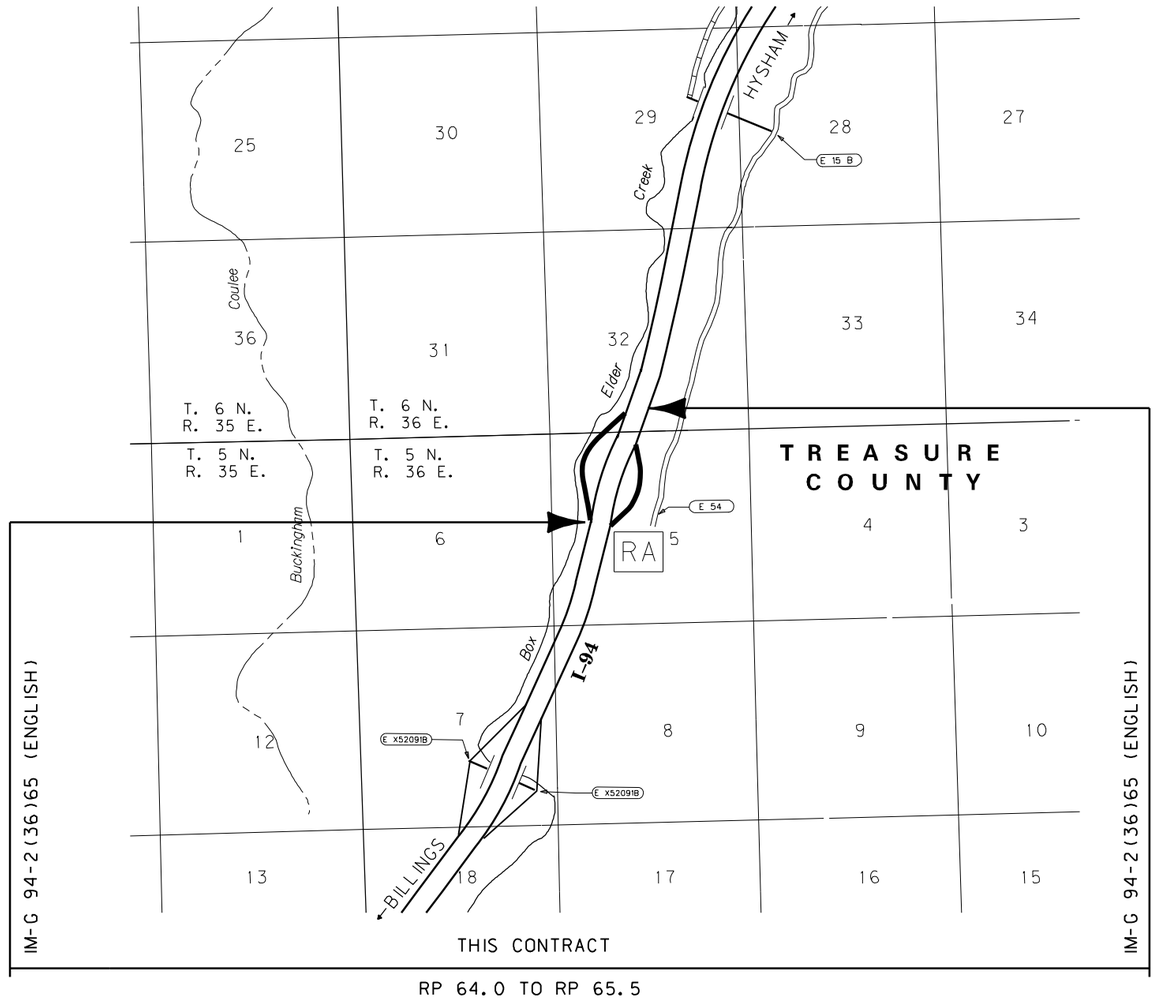
MONTANA DEPARTMENT OF TRANSPORTATION

FEDERAL AID PROJECT IM-G 94-2(36)65
WATER MDEQ PERMITTING
HYSHAM REST AREA - MONTANA
TREASURE COUNTY

PRESENT 2014	A.D.T.	= 4,940
LETTING 2016	A.D.T.	= 5,140
DESIGN 2036	A.D.T.	= 7,650
	D.H.V.	= 880
	TRUCKS	= 27.3%
	V.	= 70 MPH
	18 KIP ESAL'S	= 827
	GROWTH RATE	= 2.0%

CSF=0.9993521809

LENGTH N/A MILES



RP 64.0 TO RP 65.5

MDEQ APPROVED

PLANS PREPARED BY

DOWL

2090 STADIUM DRIVE
BOZEMAN, MONTANA 59715
(406) 586-8834

ASSOCIATED PROJECT AGREEMENT NUMBERS	
R/W & I.C.	
P.E.	IM-G 94-2(36)65

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTTTLZ20.dgn	DESIGNED BY	D FISCHER	7/22/2016
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016
		11:58:52 AM dofischer	CHECKED BY	T CORMIER	7/22/2016
					WATER PLANS
					UPN 8200000

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EXISTING SITE PLANS	SHEET NO.
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NOTES	2
CONTROL DIAGRAM	3
DETAILS	4-6
OVERALL SITE PLAN	
MECHANICAL ROOM DETAILS	
PROPOSED PUBLIC WELL DETAIL	

LINEAR AND LEVEL DATA

BEARING SOURCE

GRID -- MONTANA COORDINATE SYSTEM NAD83-2011

LEVEL DATUM SOURCE

NAVD88 (GNSS DERIVED ELEVATIONS USING GEOID 12A AND HOLDING NGS MARK A555)

NOTES

UTILITIES

CALL THE UTILITIES UNDERGROUND LOCATION CENTER (811) OR OTHER NOTIFICATION SYSTEM FOR THE MARKING AND LOCATION OF ALL LINES AND SERVICE BEFORE EXCAVATING. ALL CLEARANCES OR DEPTHS PROVIDED FOR UTILITIES ARE FROM EXISTING GROUND LINE.

WETLANDS

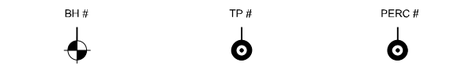
WETLANDS MAY EXIST ADJACENT TO THE ROADWAY AND BEYOND THE PROJECT LIMITS. A WETLAND DELINEATION HAS NOT BEEN COMPLETED FOR THIS PROJECT. IMPACTS TO WETLAND AREAS ARE NOT ANTICIPATED IN ASSOCIATION WITH THE PROPOSED WORK. NO PERMITS HAVE BEEN OBTAINED. ANY ACTION IMPACTING WETLAND AREAS WITHOUT THE APPROPRIATE PERMITTING IS THE RESPONSIBILITY OF THE CONTRACTOR.

SOILS INFORMATION

SOILS INFORMATION ON THE PLAN AND PROFILE SHEETS IS A BRIEF SUMMARY OF THE SOILS CLASSES. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.

GEOTECHNICAL BORING / SOIL SURVEY LEGEND

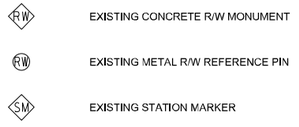
- MATERIAL IS LABELED AT THE BOTTOM OF THE LAYER
- A MINUS (-) OFFSET INDICATES A DIRECTION LEFT OF PROJECT CENTERLINE
- THE GEOTECHNICAL TEST PITS WERE CONDUCTED FOR WASTEWATER DESIGN PURPOSES



COMBINATION SCALE FACTOR

ALL COORDINATES ARE STATE PLANE (SEE CONTROL DIAGRAM).
CSF IS 0.9993521809.

R/W SURVEY LEGEND



CONTROL DIAGRAM

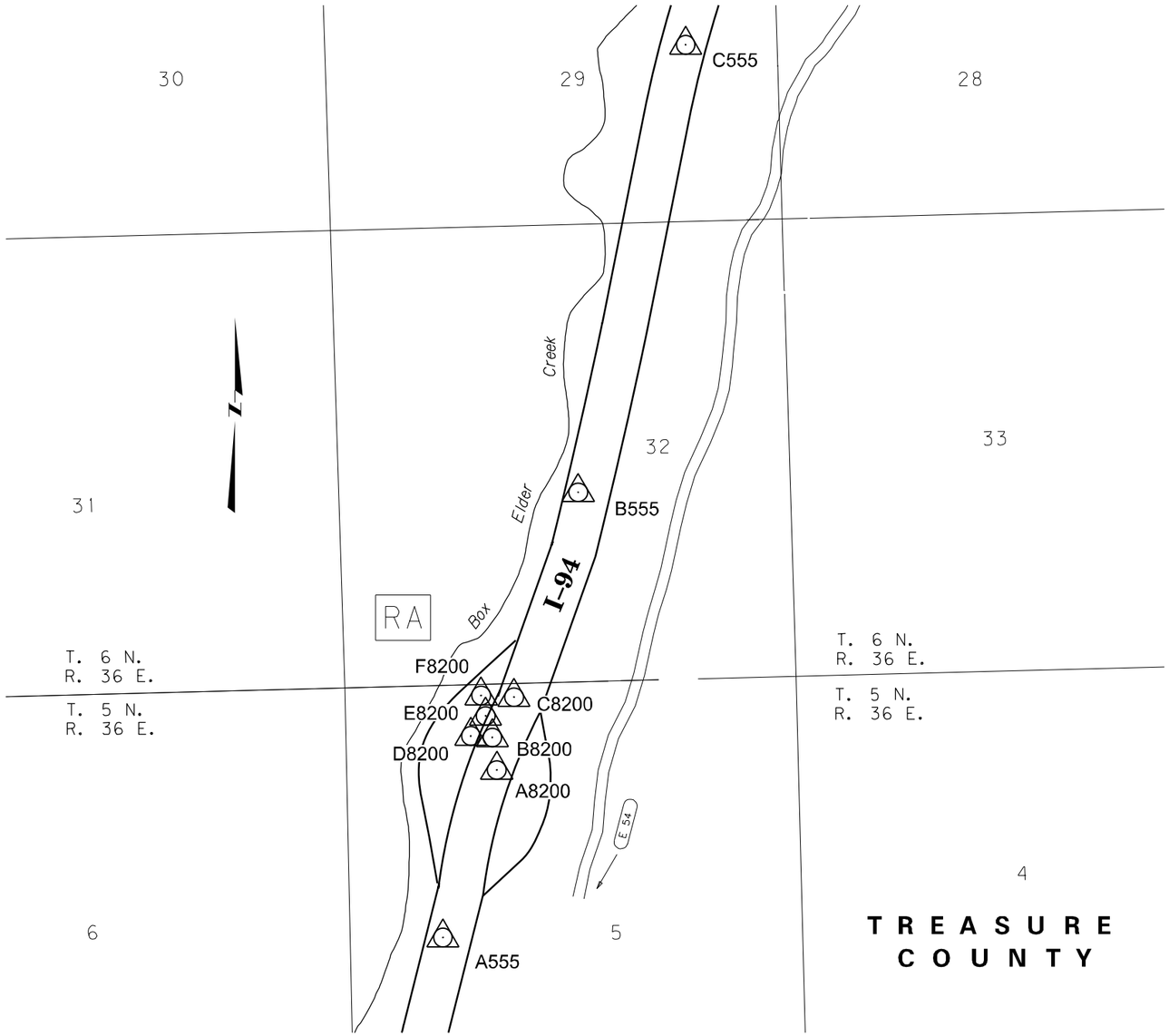
SCALE: N/A

NOTE:
THIS PROJECT IS ON THE MONTANA COORDINATE SYSTEM NAD83-2011.
NORTHING AND EASTING COORDINATES ARE EXPRESSED IN UNITS OF INTERNATIONAL FEET AND ELEVATIONS ARE IN UNITS OF U.S. SURVEY FEET.

DIMENSIONS SHOWN ON THE PLANS ARE GRID. ALL SURVEY AND STAKING REQUIRE THE USE OF A COMBINATION SCALE FACTOR (CSF) TO CONVERT GRID DIMENSIONS TO GROUND DIMENSIONS (GRID DISTANCE % CSF = GROUND DISTANCE).
THE CSF FOR THIS PROJECT IS 0.9993521809.

CONTROL ABSTRACT

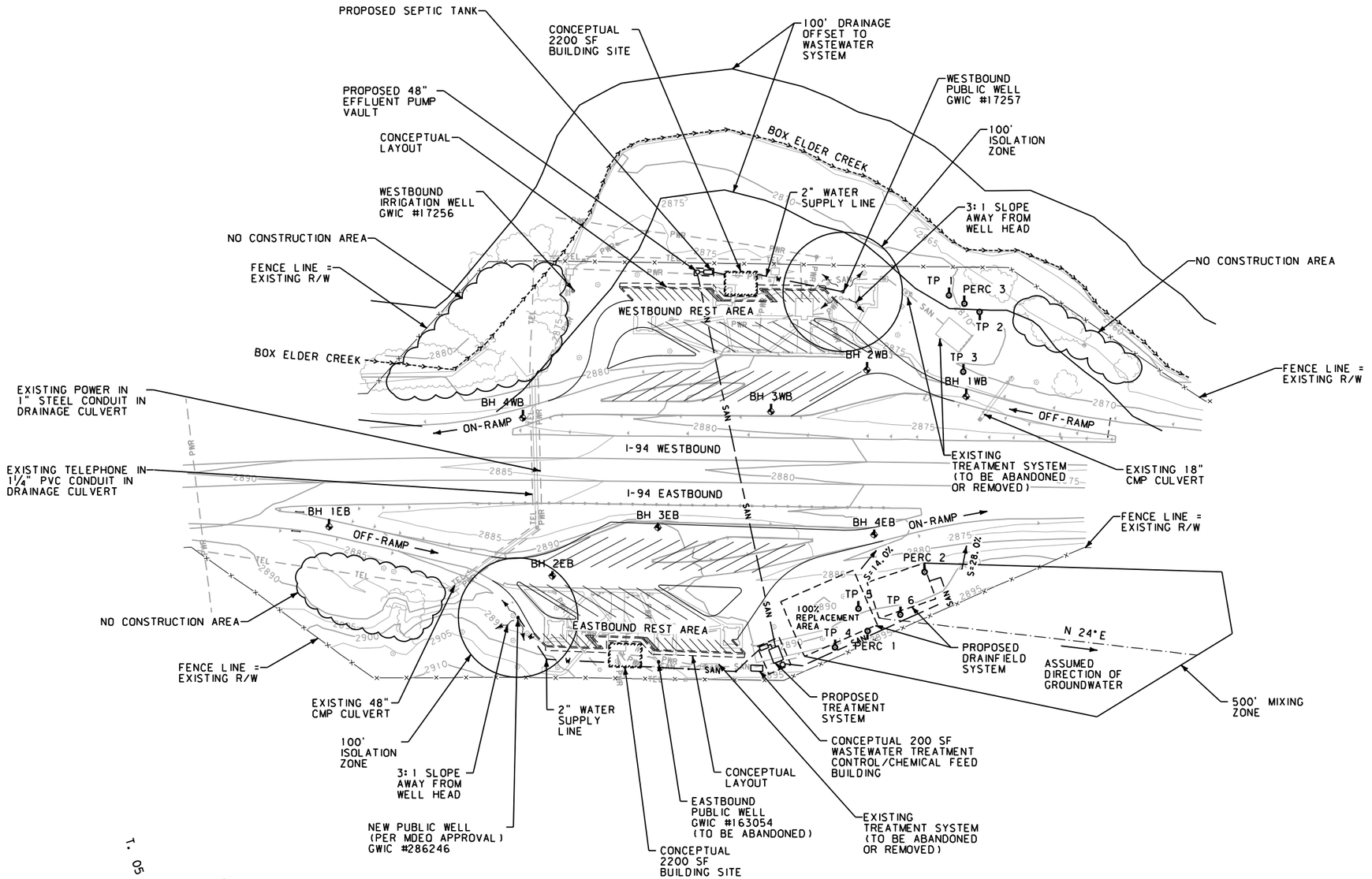
POINT NAME/NUMBER	N OR Y COORDINATE	E OR X COORDINATE	POINT ELEVATION	LOCATION AND DESCRIPTION
A8200	725,426.577	2,537,663.876	2,901.27	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "A8200 2014", for the east bound I-94 rest area, on a small bench south of the maintained grass area, 90 ft. E-SE of the east edge of pavement, 76 ft. se of a metal sign post(no camping) . Set a metal witness post and MDT sticker 3 ft. north of the cap.
B8200	725,804.962	2,537,612.307	2,890.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "B8200 2014", for the east bound I-94 rest area, near the center (N-S) of the rest area, 1 ft. west of the top back of curb for the tractor trailer parking area, in the grass area, on top of a small hill between the east bound I-94 guard rail and the tr/tr parking area, 45 ft. north of an angle point in along the west edge of the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
C8200	726,275.214	2,537,865.555	2,893.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "C8200 2014", for the east bound I-94 rest area, 380 ft. north of the north most picnic table, on a small hill above where the exit ramp for the rest area meets the east bound lane of I-94, 28 ft. west of the N-S r/w fence. Set a metal witness post and MDT sticker 3 ft. north of the cap.
D8200	725,822.290	2,537,361.381	2,881.85	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "D8200 2014", for the west bound I-94 rest area, near the south most end of the rest area, 7 ft. west of the edge of pavement, 35 ft. northwest of the south most nose of the curbing between the car and truck lanes leaving the rest area, west bound onto I-94. Set a metal witness post and MDT sticker 3 ft north of the cap.
E8200	726,056.134	2,537,534.645	2,879.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "E8200 2014", for the west bound I-94 rest area, near the center (N-S) of the tractor/trailer parking area, on the grass slope between the west bound edge of pavement and the tr/tr parking lot, 10 ft. west of the I-94 edge of pavement, 26 ft. east of the eop for the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
F8200	726,293.950	2,537,481.604	2,876.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "F8200 2014", for the west bound I-94 rest area, near the north end of the rest area, 1 ft. north of the edge of pavement, 33 ft. north of the north most end of the concrete sidewalk next to the handicap parking stall. Set a metal witness post and MDT sticker 3 ft. east of the cap.
A555	723,475.593	2,537,037.718	2,929.16	A ngs stainless steel rod in a monument box with a lid marked "A555 1981", on the east bound side of I-94, near milepost 64.4, 100 ft. southeast of the centerline of the east bound lane, 1.2 ft. west-northwest of an ngs witness post, 1.6 ft. west-northwest of the r/w fence.
B555	728,660.461	2,538,613.291	2,869.74	A ngs stainless steel rod in a monument box with a lid marked "B555 1981", on the east bound side of I-94, near milepost 65.35, 113 ft. E-SE of the centerline of the east bound lane, 1.6 ft. west-northwest of the r/w fence
C555	733,871.091	2,539,864.383	2,814.30	A ngs stainless steel rod in a monument box with a lid marked "C555 1981", on the east bound side of I-94, near milepost 66.4, 93 ft. E-SE of the centerline of the east bound lane, 1.75 ft. west-northwest of the r/w fence.



3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTTRVZ20.dgn	DESIGNED BY	D FISCHER	7/22/2016	WATER PLANS	HYSHAM REST AREA - MONTANA	IM-C 94-2(36)65
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016			
		11:59:27 AM dofischer	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 3 OF 6

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD



(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD

NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.
3. FOR PHASE II OF THE HYSHAM REST AREA PROJECT, ALL WELL APPARATUS SHALL BE REMOVED AND THE WELL CASING AS WELL AS THE APPARATUS SHALL BE SCRUBBED AND AN ACID WASH TO THE CASING IS REQUIRED.

OVERALL SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ20.DGN	DESIGNED BY	D FISCHER	7/22/2016	WATER PLANS	HYSHAM REST AREA - MONTANA / IM-C 94-2(36)65
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016		
		12:00:16 PM doflscher	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 4 OF 6

DOWL

GENERAL NOTES

1. INSTALL ALL EQUIPMENT IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
2. PROVIDE UNISTRUT CHANNEL & TUBING CLAMPS FOR WALL MOUNTING & SUPPORT OF PIPING.
3. INTERIOR PVC PIPE SHALL BE SCH. 40 SOCKET WELD EXCEPT WHERE THREADED COUPLING OR VALVE CONNECTIONS ARE NEEDED.

PT-1 PRESSURE TANK

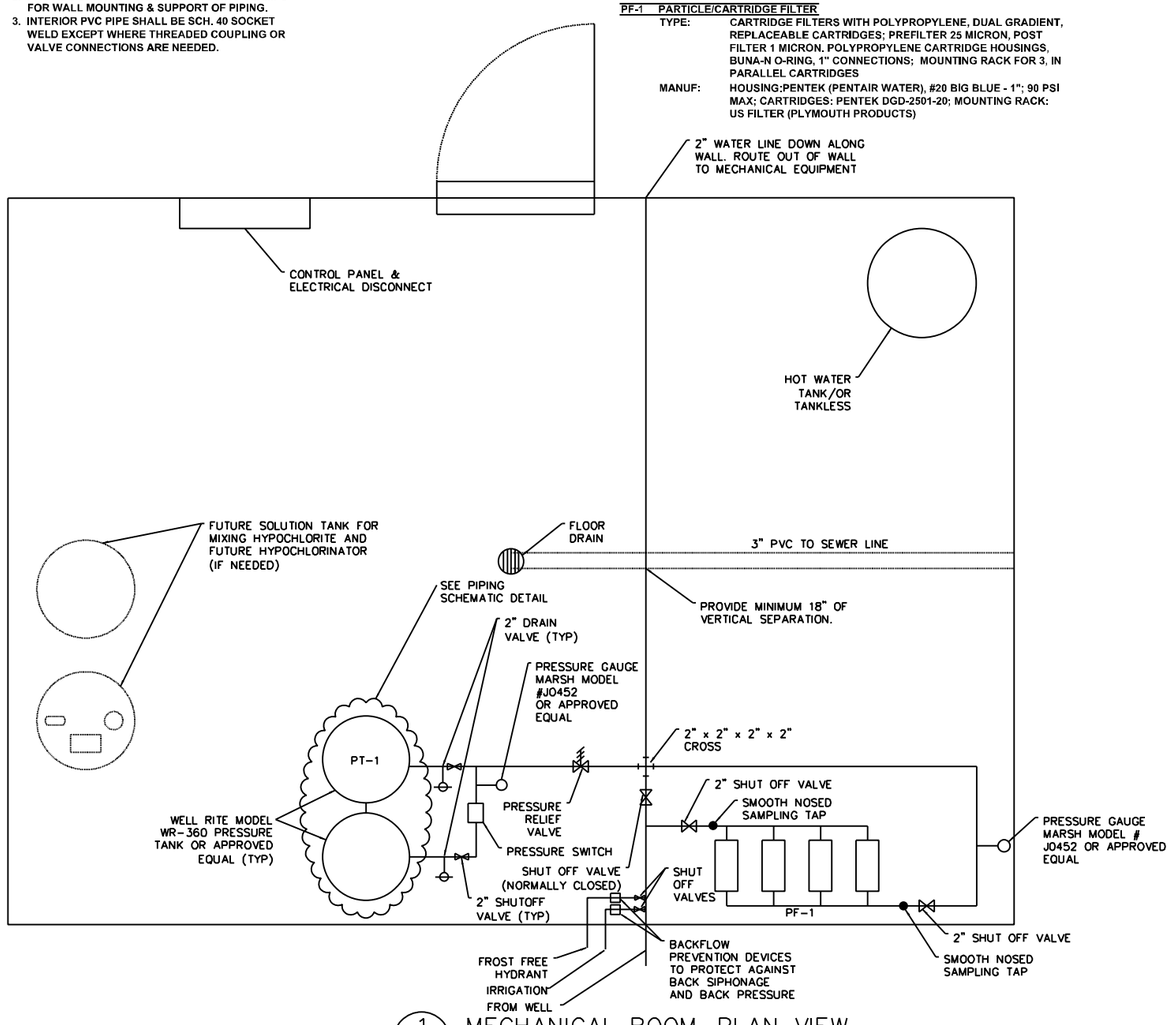
TYPE: PRE-CHARGED BLADDER TYPE 35-50 PSIG;

MANUF: WELL RITE MODEL WR-360

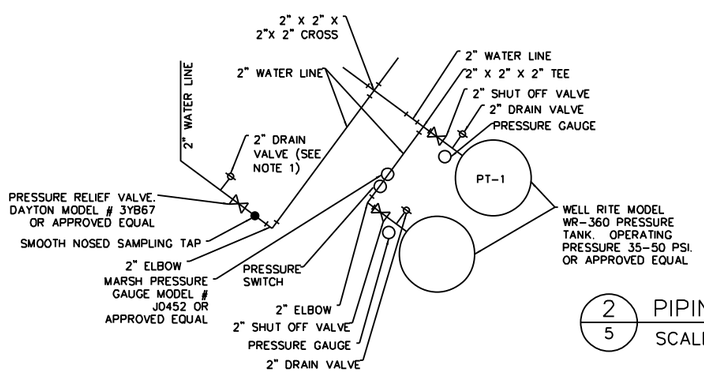
PF-1 PARTICLE/CARTRIDGE FILTER

TYPE: CARTRIDGE FILTERS WITH POLYPROPYLENE, DUAL GRADIENT, REPLACEABLE CARTRIDGES; PREFILTER 25 MICRON, POST FILTER 1 MICRON. POLYPROPYLENE CARTRIDGE HOUSINGS, BUNA-N O-RING, 1" CONNECTIONS; MOUNTING RACK FOR 3, IN PARALLEL CARTRIDGES

MANUF: HOUSING:PENTEK (PENTAIR WATER), #20 BIG BLUE - 1"; 90 PSI MAX; CARTRIDGES: PENTEK DGD-2501-20; MOUNTING RACK: US FILTER (PLYMOUTH PRODUCTS)



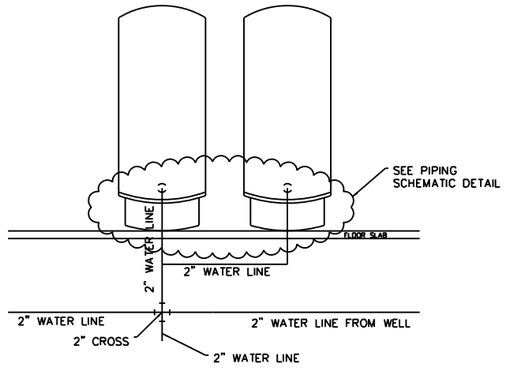
1/5 MECHANICAL ROOM–PLAN VIEW
SCALE : NTS



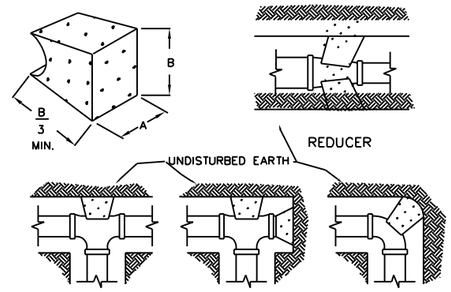
NOTE:
1. DISCHARGE PIPING SHALL BE DIRECTED TO FLOOR DRAIN BELOW.

2. AIR RELEASE PROVIDED BY PLUMBING FIXTURES.

2/5 PIPING SCHEMATIC
SCALE : NTS



3/5 MECHANICAL ROOM–PROFILE VIEW
SCALE : NTS

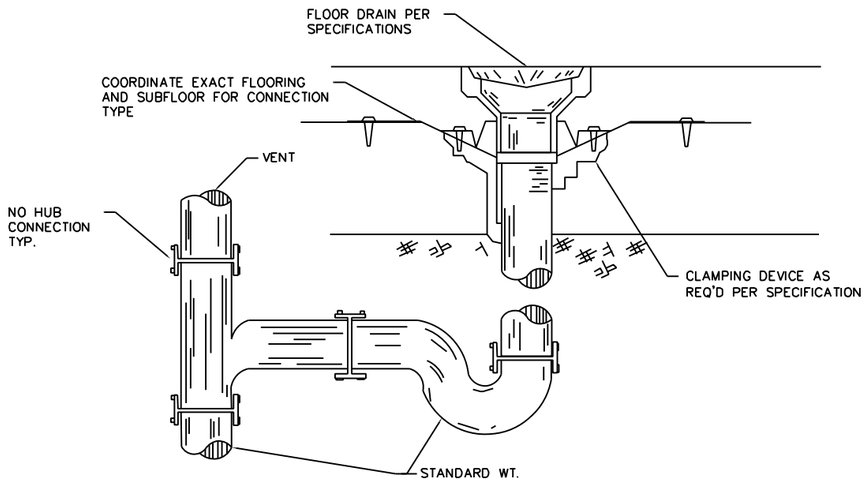


DIMENSIONS FOR THRUST BLOCKING

FITTING SIZES	TEES & PLUGS		90° BEND		45° BEND & WYES		REDUCERS & 22 1/2° BEND	
	A	B	A	B	A	B	A	B
2"–4"	1'–10"	1'–5"	1'–10"	1'–6"	1'–8"	1'–0"	1'–7"	0'–6"
6"	2'–3"	1'–11"	2'–8"	2'–4"	2'–0"	1'–8"	1'–9"	1'–0"
8"	3'–0"	2'–6"	3'–6"	3'–2"	2'–8"	2'–3"	2'–0"	1'–6"
10"	3'–8"	3'–3"	4'–4"	4'–0"	3'–3"	2'–10"	2'–5"	2'–0"
12"	4'–3"	4'–0"	5'–1"	4'–10"	3'–10"	3'–6"	2'–9"	2'–6"
14"	5'–8"	4'–1"	6'–9"	5'–0"	5'–0"	3'–8"	3'–7"	2'–7"
16"	6'–3"	4'–10"	7'–8"	5'–9"	5'–9"	4'–2"	4'–5"	2'–9"

NOTE:
THIS TABLE IS BASED ON 150 PSI MAIN PRESSURE
1500 PSF SOIL BEARING PRESSURE

4/5 THRUST BLOCKING FOR PRESSURE MAIN
SCALE : NTS



5/5 FLOOR DRAIN DETAIL
SCALE : NTS

NOTES:

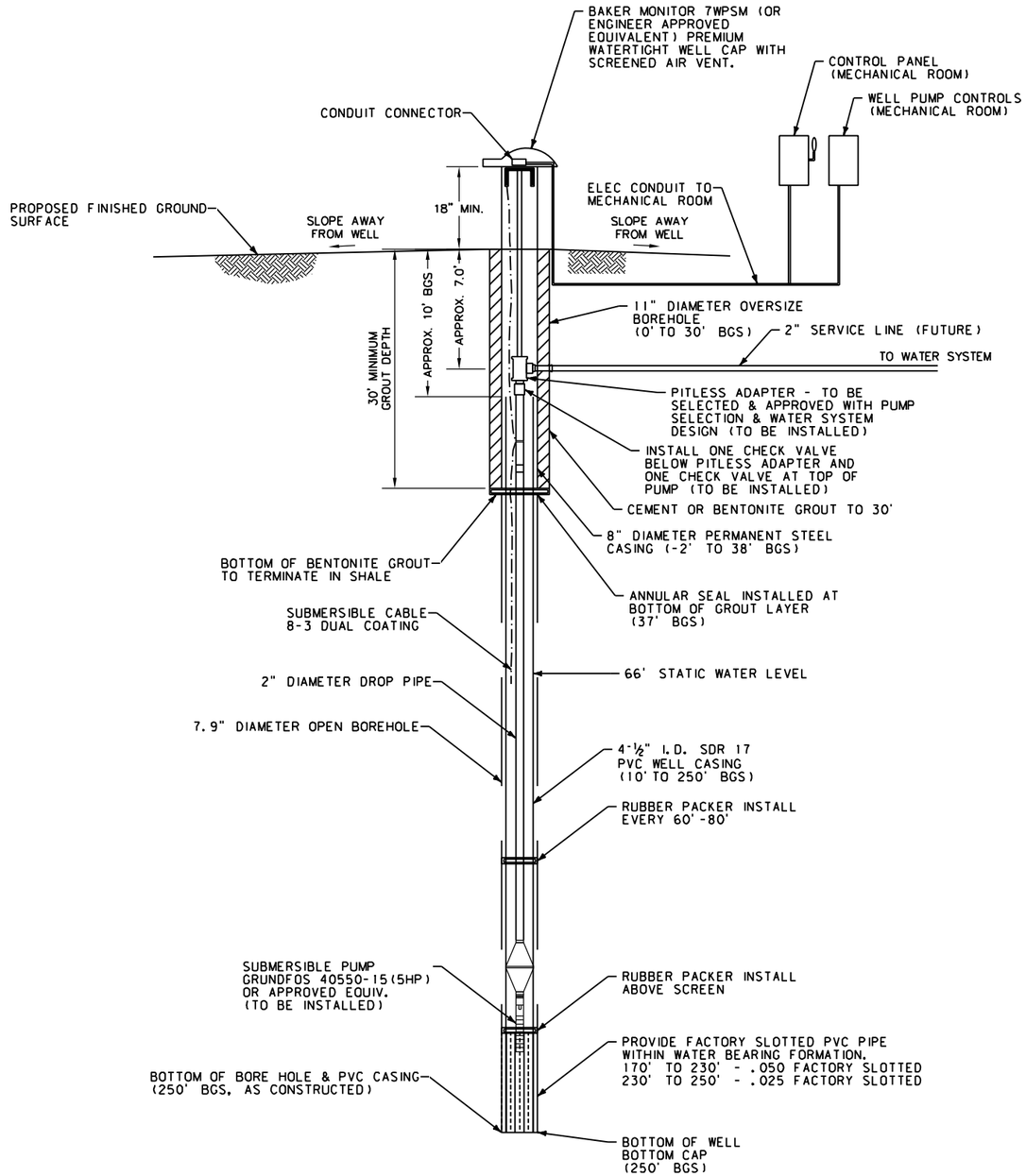
1. FOR PHASE II OF THE HYSHAM REST AREA PROJECT, ALL WELL APPARATUS SHALL BE REMOVED AND THE WELL CASING AS WELL AS THE APPARATUS SHALL BE SCRUBBED AND AN ACID WASH TO THE CASING IS REQUIRED.

MECHANICAL ROOM DETAILS

NO SCALE

3 / 1	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ20.dgn	DESIGNED BY	D FISCHER	7/22/2016	WATER PLANS
		7/22/2016	REVIEWED BY	B DREYER	7/22/2016	
		12:00:17 PM doflscher	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY

HYSHAM REST AREA - MONTANA		IM-C 94-2(36)65
CSF=0.9993521809	UPN 8200000	SHEET 5 OF 6



1/6 WELL SYSTEM DETAIL (WELL INSTALLED)
SCALE :NTS

NOTES:

1. ALL WELL WORK AND CONNECTIONS SHALL BE CONDUCTED BY A MONTANA STATE LICENSED WELL DRILLER AS OUTLINED IN MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (MDEQ).
2. CONTRACTOR TO VERIFY THAT ALL WELL WORK, WELL COMPONENTS, AND CONNECTIONS MEET ALL APPLICABLE STANDARDS INCLUDING BUT NOT LIMITED TO MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY.
3. IT IS CRITICAL THAT THE WELL BE DRILLED IN THE EXACT MDEQ APPROVED LOCATION. FINISHED GROUND ELEVATION OF WELL TO BE STAKED BY OTHERS.
4. YIELD AND DRAWDOWN TESTS, CONDUCTED IN ACCORDANCE WITH MDEQ STANDARDS SHALL BE CONDUCTED ON THE WELL. REFER TO WELL SPECIFICATIONS FOR STEP TEST AND CONSTANT RATE TEST.
5. ALL PIPING, CONNECTIONS, FITTINGS, AND VALVES SHALL CONFORM TO THE LATEST AWWA OR ANSI/NSF STANDARDS.
6. WELL CAP TO BE LOCKED IN PLACE WITH A LONG SHANK PADLOCK.
7. WATER SAMPLES MUST BE OBTAINED BY WELL DRILLER DURING THE TEST PUMPING PROCEDURE, PRIOR TO DISINFECTION, AND DELIVER WATER SAMPLES TO STATE APPROVED LABORATORY PER DIRECTION OF THE ENGINEER. (REFER TO SPECIFICATIONS).
8. THE WELL LOG & WATER TEST RESULTS MUST ALL BE SUBMITTED TO THE ENGINEER AND MDEQ.
9. INITIAL SCOPE OF WORK INCLUDES DRILLING WELL TO SPECIFICATIONS, DEVELOPING WELL, PUMP TESTING, WATER SAMPLING, WELL DISINFECTION, AND PUMP INSTALLATION.
10. WELL MUST ALSO BE DISINFECTED UPON INSTALLATION OF PERMANENT WELL PUMP, PIPING, ELECTRICAL WIRING, ETC.
11. THE BACTERIOLOGICAL TEST RESULTS REQUIRED DURING PERMANENT WELL PUMP INSTALLATION SHALL BE TAKEN MORE THAN 72 HOURS AFTER DISINFECTION.

PROPOSED PUBLIC WELL DETAIL

EASTBOUND

NO SCALE

DOWL

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\UT\8200000UTDETZ20.dgn	DESIGNED BY	D FISCHER	7/22/2016	WATER PLANS	WELL AS CONSTRUCTED
1		7/22/2016	REVIEWED BY	B DREYER	7/22/2016	TREASURE COUNTY	
		12:00:18 PM dofischer	CHECKED BY	T CORMIER	7/22/2016		

HYSHAM REST AREA - MONTANA		IM-C 94-2(36)65
CSF=0.9993521809	UPN 8200000	SHEET 6 OF 6

Specifications For:

HYSHAM REST AREA

RECEIVED
JAN 11 2016
DEPT OF ENVIRONMENTAL QUALITY
BILLINGS REGIONAL OFFICE

MONTANA MDT DEPARTMENT OF TRANSPORTATION

2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Water Supply System Improvements

December, 2015

DEQ SUBMITTAL

Prepared By :

DOWL
2090 Stadium Drive
Bozeman, MT 59715

Specifications For:

HYSHAM REST AREA

MONTANA MDT DEPARTMENT OF TRANSPORTATION

2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Water Supply System Improvements

December 2015

APPROVED
Montana Department of
Environmental Quality
Permitting and Compliance Division

M. Waite 1/13/2016
Reviewer Date

MONTANA
WILLIAM
R. DREYER
No. 13853 PE
12/29/15
LICENSED
PROFESSIONAL ENGINEER

DEQ SUBMITTAL

Prepared By:

DOWL Project #:24.11356

Approved By:

DOWL

EQ16-1234

2090 Stadium Drive
Bozeman, MT 59715

TABLE OF CONTENTS

Hysham Rest Area (MDT)
Public Water Supply System Improvements

DIVISION 2 – SITE WORK

02510	Water Distributions	Included Herein
02525	Water Supply Wells, Pumps and Storage	Included Herein

Division 15 –Mechanical

15430	Plumbing Specialties	Included herein

END OF SECTION

DIVISION 2

SITEWORK

SECTION 02510 – WATER DISTRIBUTION

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for domestic and fire service.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. NSF Compliance:

   1. Comply with NSF 14 for plastic potable-water-service piping.
   2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including dry hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including dry hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

E. Protect flanges, fittings, and specialties from moisture and dirt.

F. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Contracting Officer no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Contracting Officer's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 COPPER FITTINGS

A. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.

B. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and threaded ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Flanges: ASME 16.1, Class 125, cast iron.

2.4 PVC PIPE AND FITTINGS

A. PVC, ASTM D2241 Pipe: Class 200 SDR 21 solvent weld joint or with bell end with gasket, and with spigot end.
1. Push-on-Joint, PVC Fittings: ASTM D1784; Class 200 conforming to SDR 21.

a. Gaskets: ASTM F477, rubber.

2.5 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, but are not limited to, the following:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; Dresser Piping Specialties.

c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
d. Hays Fluid Controls; a division of ROMAC Industries Inc.
e. JCM Industries.
f. Smith-Blair, Inc.
g. Viking Johnson.

3. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

a. Standard: AWWA C219.
b. Center-Sleeve Material: Ductile iron
c. Gasket Material: Natural or synthetic rubber.
d. Pressure Rating: 150 psig (1035 kPa) minimum.
e. Metal Component Finish: Corrosion-resistant coating or material.

2.6 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:

1. Standards: ASTM A 674 or AWWA C105.
2. Form: Tube.
3. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
4. Color: Natural

2.7 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amcast Industrial Corporation; Lee Brass Co.
b. Ford Meter Box Company, Inc. (The); Pipe Products Div.
c. Jones, James Company.
d. Master Meter, Inc.
e. McDonald, A. Y. Mfg. Co.
f. Mueller Co.; Water Products Div.
g. Red Hed Manufacturing & Supply.

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.8 WATER METERS

A. See Plumbing plans and specifications.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping unless specifically called for in the drawings.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Water-service piping NPS 3/4 to NPS 3 shall be the following:
1. Copper, type K annealed, meeting AWWA Standard C800.

3.3 PIPING INSTALLATION

A. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

B. Bury piping with minimum depth of cover as indicated in the drawings.

C. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

D. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

E. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.4 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

A. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.6 CONNECTIONS

A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water-distribution piping to existing water mains as indicated in the drawings.

3.7 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Slowly fill pipline with water and apply pressure by means of a pump connected to the pipe through a corporation stop or other means approved by the CONTRACTING OFFICER. The pump, piping and necessary apparatus shall be furnished by the CONTRACTOR. All air shall be expelled from the pipeline before applying the specified test pressure. The length of time for a combination pressure and leakage test shall be a minimum of two hours. The test pressure to be used shall be one and one-half times the working pressure, with a minimum of 125 psi for all lines except as otherwise noted in the contract drawings. Final test pressure shall be approved by the CONTRACTING OFFICER.

2. Allowable Leakages: The allowable leakage during the duration of the test shall not exceed the amount as determined from the following formula as appropriate:

Ductile Iron and PVC Pipe: $L = (S \times D \times P^{0.5})/140{,}000$

L = leakage in gallons per hour

S = length of pipe tested in feet

D = the nominal diameter of the pipe in inches

P = the average test pressure during the test in pounds per square inch

Leakage is defined as the quantity of water to be supplied into the pipe, or any valved section thereof, necessary to maintain the specified test pressure after the pipe has been filled with water and air expelled.

3. Test Results: Should any test of pipe laid disclose leakage greater than that specified above, the CONTRACTOR shall locate and repair the defective joints until the leakage is within the specified allowance. The CONTRACTOR may fully backfill the pipe trench prior to the hydrostatic test. However, it shall be understood to be the CONTRACTOR's risk if the pipe will not reach the test results specified herein. If this occurs he must find the leaks and do the required excavation and pipe repair even though a fully backfilled trench will make this more involved and difficult. Any section of pipe which fails the leakage test shall be repaired at the CONTRACTOR's expense. This section shall be retested after repairs are made.

C. Prepare reports of testing activities.

3.8 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 2 Section "Earthwork."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Division 2 Section "Piped Utilities - Basic Materials and Methods" for identifying devices.

3.9 CLEANING & DISINFECTION OF WATER MAINS

A. General: Disinfection of water mains shall be done in accordance with "AWWA Standard for Disinfecting Water Mains", AWWA C651. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times.

B. Chlorination:

1. Form of Chlorine and Means of Application: Before being placed in service, all new water distribution systems and repaired portions of, or extensions to, existing systems shall be chlorinated. If the available water is more alkaline than pH 8, the holding time in the main shall be increased at the discretion of the CONTRACTING OFFICER.

2. Form of Applied Chlorine: Any of the following methods of procedure shall be followed, subject to the approval of the CONTRACTING OFFICER.

a. Liquid Chlorine: A chlorine gas water mixture shall be applied by means of a solution feed chlorinating device, or, if approved by the CONTRACTING OFFICER, the dry gas may be fed directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorination devices for feeding solutions of the chlorine gas or the gas itself must provide means for preventing the backflow of water into the chlorine cylinder.

b. Chlorine Bearing Compound in Water: On approval of the CONTRACTING OFFICER, a mixture of water and a chlorine bearing compound of known chlorine content may be substituted as an alternative for liquid chlorine. Acceptable chlorine bearing compounds are calcium hypochlorite (65% available chlorine by weight) and sodium hypochlorite (5 to 15% available chlorine).

A 5 percent solution of the powder shall be prepared consisting of 5 percent of powder to 95 percent of water by weight, due attention being given to the chlorine content of the product used. This calcium hypochlorite and water mixture, first made into a paste and then thinned to a slurry with clean water, shall be injected or pumped into the newly laid pipe after preliminary flushing. If sodium hypochlorite is used, mix the solution, as purchased, with water to obtain the desired concentration of chlorine and feed into the pipe under treatment in the same manner as is used for feeding other hypochlorites.

A. If chlorine is applied after pipe laying, the preferred point of application of the chlorinating agent shall be at the beginning of the pipeline extension or any valved section of it and through a corporation stop inserted in the top of the newly laid pipe. The water injector for delivering the chlorine bearing water into the pipe should be supplied from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension.

1. Rate of Application: Water from the existing distribution system or other source of supply shall be controlled so as to flow slowly into the newly laid pipeline. The chlorine mixture shall be in such proportion to the amount of water required to fill the pipe that the chlorine dose applied shall be at least 25 ppm, or enough to meet the provisions under the retention period. This may require as much as 100 ppm of chlorine in the water left in the line after chlorination.

2. Preventing Reverse Flow: Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

3. Retention Period: Treated water shall be retained in the pipe long enough to destroy all nonsporeforming bacteria. This period should be at least 24 hours and preferably longer, as may be directed. After the chlorine treated water has been retained for the required time, the chlorine residual at the pipe extremities and at other representative points should be at least 25 ppm.

4. Chlorinating Valves and Hydrants: In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent.

5. Final Flushing and Test: Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the placement water throughout its length shall, upon test, be proved acceptable to the public health authority having jurisdiction. Samples should never be taken from an unsterilized hose or from a fire hydrant because such samples seldom meet current bacteriological standards. Two tests shall be taken, 24 hours apart and separately submitted to a laboratory. Both tests shall provide passing results for bacteriological quality before the main can be placed in service. Collect samples from each main and each branch.

B. Chlorinated water flushed from the system shall be disposed of in a manner not to pollute any surface water. Chlorinated water shall either be allowed to percolate into the ground, or be de-chlorinated using sodium thiosulfite before it reaches a surface water body, or another method satisfactory to the CONTRACTING OFFICER.

1. Repetition of Procedure: Should the initial treatment fail to result in the conditions specified above, the chlorination procedure shall be repeated until such results are obtained.

C. Connection to Existing Waterlines: Where fittings and valves are to be installed in existing lines which must be put back into service as soon as the installation is complete, the interior of the fittings and valves shall be swabbed with a 5 percent chlorine solution immediately prior to assembly. After assembly, thoroughly flush the line.

D. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 02525 – WATER SUPPLY WELL AND WELL PUMP

PART - I GENERAL

1.2 SUMMARY

A. Work includes:
1. Completion of the new well.
2. Installation of submersible pump in the well and well pump controls.
3. Abandonment of the existing well.
4. As a minimum, each component, equipment, material, and method of construction shall meet standards set forth in the Board of Water Well Contractors Title 36, Chapter 21, ARM., and according to CIRCULAR DEQ-3 .
5. This water well must be constructed by a licensed Water Well Contractor and be in accordance with the Board of Water Well Contractors - Montana Codes Annotated, Administrative Rules of Montana (Title 37, Chapter 43, MCA and Title 36, Chapter 21, ARM, latest edition).

Domestic water supply for the site improvements shall be facilitated by the construction of a new on-site public water supply well. The water supply well shall be certified by an engineer for verification of construction according to this well specification. No water system will be allowed to connect to the water supply well prior to certification by a professional engineer or prior to approval of the well pump, drop pipe and electrical, pitless adapter, water line, and water system by MDEQ.

The work to be done hereunder includes the furnishing of all labor, materials, transportation, tools, supplies, equipment and appurtenances, unless hereinafter specifically accepted, necessary for the complete and satisfactory construction, development, testing, cleaning and disinfection of the proposed water supply well.

Under these specifications, it is the intent to construct a new water supply well to public water supply standards to allow for testing to determine aquifer properties and suitability of the well to service the public water supply system. This water well shall eventually supply water to the Hysham Rest Area for domestic purposes. The actual yield has yet to be determined; however, the maximum yield from the new well will be 35 gallons per minute (gpm). The new well intake shall be constructed with a minimum well intake depth of 250 ft below ground surface (anticipated depth of water bearing formation is over 250 ft below ground surface). The final well depth and production rate may vary depending on the types of geologic formations encountered. The CONTRACTOR shall provide a submersible test pump capable of the 52.5 gpm (1.5 x 35 gpm) or the maximum flow determined for each site, with a Total Dynamic Head as measured at each site for the purposes of aquifer testing. This pump shall be provided for aquifer testing only and shall not be permanently installed for domestic use.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.4 PERMITS, CERTIFICATES, LAWS & ORDINANCES:

The Contractor shall, at his own expense, procure all licenses and permits required of him by law for the execution of this work. He shall also comply with all federal, state and local laws, ordinances, rules and regulations relating to the performance of the work. The Owner shall provide all lands, right-of-ways, and permits required for the performance of, and access to, the work under this contract.

1.5 WARRANTY AND GUARANTEES:

The Contractor shall warranty and guarantee to the well owner that all construction materials and equipment shall be new unless otherwise specified and that all work shall be in good quality and free from faults or defects and in accordance with the requirements of the drilling agreement and of any inspections, tests or approvals referred to in the drilling agreement (ARM 36.21.663). These warranties and guarantees are void if the well owner does not give timely notice to the Contractor of all unsatisfactory work, all faulty or defective work and all work not conforming to the requirements of the drilling agreement or such inspections, tests or approvals. The warranty or guarantee period shall be a minimum of one year from the date of completion of the well.

1.6 LOCATION:

The well to be constructed hereunder shall be drilled in the location that is approved by MDEQ and shown on the approved site plan drawing (most recent approval). In order to ensure continued protection of the proposed well site, a 100' radius well protection zone has been indicated on the plan sheet. No sewer lines, septic tanks, holding tanks, nor any structure used to convey or retain industrial, or sanitary waste may be located within the proposed well's 100-foot radius protection zone. The location of this well must also conform to ARM 36.21.638, which states the following: (or the more restrictive for public wells):

A. At a minimum, unless contamination risk is evident, water wells shall not be located within:
   1. 100 feet of septic tanks, and underground storage tanks and associated lines,
   2. 100 feet of drainfields, seepage pits or cesspools, or other site treatment systems.

B. Water wells should not be located within:
   1. 10 feet of property lines unless property protected by easement or agreement;
   2. 100 feet of sewer lines with permanent watertight joints

1.7 LOCAL CONDITIONS:

Before the local conditions are disturbed on the site, the Contractor shall promptly notify the Owner in writing of:

A. Surface or subsurface conditions at the site that differ significantly from those indicated in this contract;

B. Unknown or unusual physical conditions at the site that differ from those ordinarily encountered.

The Owner shall promptly investigate the conditions and if he finds that such conditions do significantly differ and cause an increase or decrease in the cost of or the time required for the performance of this contract, an equitable adjustment shall be made and the contract modified accordingly.

1.8 BOUNDARIES OF WORK:

The Owner shall provide land or right-of-ways for the work specified in this contract and make suitable provisions for ingress and egress. The Owner shall not cause the Contractor to enter or occupy with men, tools, equipment or material, any ground outside the property of the Owner without the written consent of the Owner of such ground. Other Contractors and employees or agents of the Owner may for all necessary purposes enter upon the premises used by the Contractor, providing the operations of other Contractors do not interfere with the actual drilling operations. The Contractor shall conduct his work so as to not impede unnecessarily any work being done by others on or adjacent to the site.

1.9 PROTECTION OF SITE:

The Contractor shall remove from the site all unused materials. Water pumped from the well shall be conducted to a place where it will be possible to dispose of the water without damage to property or the creation of a nuisance. Cleanup and restoration of the site should be covered by a drilling agreement. The well shall be protected by the Contractor from pollution during construction in accordance with ARM 36.21.637.

Except as otherwise provided herein, the Contractor shall protect all structures, walks, pipelines, trees, shrubbery, lawns, etc, during the progress of the work. Upon completion of the work, the Contractor shall restore the site as nearly as possible to its original condition, including the replacement, at the Contractor's sole expense, of any facility or landscaping which has been damaged beyond restoration to its original condition or destroyed. The Owner shall provide land or right-of-ways for water disposal facilities.

1.10 WELL LOG REPORTS:

The licensed Water Well Contractor shall prepare a well log report form for each of the proposed water wells. The Contractor shall supply a copy of the well log report to the Owner, Engineer, and such agencies as reported by sections 85- 2-516 and 85-2-517, MCA, and maintain a copy as a record in his own files. The well log report should conform to ARM 36.2 1.639.

1.11 GENERAL DESCRIPTION OF WELL CONSTRUCTION:

The completed water well shall consist of the following principal items (all items are approximate only):

A. 10" dia oversized borehole from 0'- 30'; for cement grout;
B. 7 7/8" diameter oversized borehole to shale (anticipated 25' – 250' bgs, approximately for bentonite grout.
C. 6" dia (nominal) permanent steel well casing with drive shoe from 0' - 250' (min); or to confining layer.
D. Suitable bridge, packer, or bentonite seal at bottom of oversized borehole;
E. Cement grout from 0' - 25';
F. Bentonite grout from 25' – confining layer';
G. Open Hole, with 4-1/2" nominal, SDR17, NSF Certified Potable Water PVC well casing. PVC slots are dependent on aquifer location, (slot size and interval to be field determined by licensed well driller)
H. Vented sanitary well cap assembly with screened air vent.

1.12 COMPETENT WORKMEN:

The Contractor shall employ only competent workmen for the execution of the water well construction. All workmen shall be under the direct supervision of a Water Well Contractor that is licensed with the State of Montana.

1.13 REFERENCED SPECIFICATIONS:

The publications listed below are referenced throughout the water well section of this plans and specifications document. These publications are referred to in this document by basic designation only.

A. BOARD OF WATER WELL CONTRACTORS (ARM):

ARM 36.2 1.634 Definitions
ARM 36.2 1.635 Public, Community, Non-Community Public, and Multi-Family Water Supply Wells
ARM 36.21.636 Drilling Agreement
ARM 36.21.637 Protection Of Site
ARM 36.2 1.638 Location Of Wells
ARM 36.2 1.639 Well Log Reports
ARM 36.2 1.640 Well Casing
ARM 36.2 1.641A Casing Depth
ARM 36.2 1.642 Steel Casing Joints ARM 36.2 1.643 Temporary Casing
ARM 36.21.644 Casing Shoe
ARM 36.2 1.645 Plastic Casing
ARM 36.21.646 Plastic Casing Joints
ARM 36.2 1.647 Top Terminal Height
ARM 36.2 1.648 Casing Openings
ARM 36.21.649 Casing Centralizers
ARM 36.2 1.650 Casing Perforations
ARM 36.21.65 1 Movement of Casing After Sealing
ARM 36.2 1.652 Well Screens
ARM 36.2 1.653 Well Development Procedures
ARM 36.2 1.654 Sealing Of Casing – General
ARM 36.2 1.655 Consolidated Formations
ARM 36.21.656 Unconsolidated Formations without Significant Clay Beds
ARM 36.21.657 Unconsolidated Formations with Clay Beds
ARM 36.2 1.661 Temporary Capping ARM 36.2 1.662 Disinfection
ARM 36.2 1.663 Warranty And Guarantees
ARM 36.21.664 Tests For Yield And Drawdown
ARM 36.2 1.665 Access Port
ARM 36.21.667 Sampling Of Formations ARM 36.2 1.668 Water Samples
ARM 36.2 1.669 Plumbness And Alignment Test
ARM 36.21.670 Permanent Abandonment
ARM 36.2 1.679 Dry or Inadequate Well Holes

B. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM):

ASTM A-120 Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses

ASTM C-150 Specification for Portland Cement.

C. AMERICAN WATER WORKS ASSOCIATION (AWWA):

AWWA A100 Standard for Plumbness and Alignment

1.14. MANAGERIAL, TECHNICAL, AND FINANCIAL RESPONSIBILITIES

The Montana Department of Transportation shall oversee the continued operation, maintenance, and water quality monitoring of individual wells within the subject property.

Contractor shall provide Engineer with manufacturer information (including, but not limited to: model number, material specifications, maintenance frequency and requirements, etc. This information shall be provided for all equipment used for construction of the proposed wells (including, but not limited to: well, steel casing, cement grout (0'-25'), bentonite grout (25'-250' bgs), open borehole with PVC casing, well cap, etc.)

PART - 2. PRODUCTS

2.1 MATERIALS

A. WELL CASING: The permanent steel and PVC well casing shall conform with ARM 36.21.640 and ARM 36.21.645.

a. A 6" diameter (nominal size) steel casing in a new or like new condition, being free of pits, breaks, or contamination, is to be used and shall meet minimum ASTM A-120 specifications for line pipe. This casing is to have a minimum outside diameter of 6.625"and a minimum wall thickness of 0.250". All steel casing joints (ARM 36.21.642) shall be welded or screw coupled and shall be watertight. The welding of the casing joints shall be done in accordance with the recommended standards of the American Welding Society. The weld shall be a full penetration weld at least equal in thickness to the wall thickness of the casing. Welded casing joints shall have a tensile strength equal to or greater than that of the casing. Sufficient passes of continuous weld shall be applied so that the finished surface at the area of fusion is built up to the surface of the adjoining pipe. When driven, the casing pipe must be equipped with a drive shoe in accordance with ARM 36.21.644.

b. A 4.5" diameter (nominal size) SDR 17, PVC well casing shall be new, NSF Certified for use with potable water, non-reject, and in accordance with ARM 36.21.645. This casing shall be solvent free CertainTeed Certa-Lok or approved equal. The PVC casing shall extend from a minimum of 24' (or overlap with the 6" steel casing a minimum of 4') to approximately 250'.

B. SEAL: An impervious seal such as a bridge, packer, or thick bentonite layer shall be placed at the bottom of the oversized borehole. This impervious seal shall separate the cement grout from the water bearing formation. This seal shall be of material that will not impart taste, odor, toxic substance or bacterial contamination to the well water. Lead packers may not be used.

C. CEMENT SEALING GROUT: The sealing material must meet the requirements of ARM 36.21.634(33). The cement sealing grout shall be a portland cement grout that conforms to ASTM C-150. This grout shall contain a minimum of 5.3 sacks of portland cement per cubic yard and a maximum of 6 gallons of water per 94 lb sack

of cement. The maximum slump shall be 4". Up to 5% by weight of bentonite clay may be used to improve flow and reduce shrinkage. No sand or gravel is to be used in cement grout. The mixture, method of mixing, and the consistency of the grout shall be approved by the Engineer.

D. VENTED WELL CAP ASSEMBLY: The top of the well casing shall be covered with a factory manufactured, vented well cap or fabricated vent cap assembly. This cap will protect the well from the entry of rain water, foreign objects, and contamination. The cap and vent assembly shall be corrosion resistant and manufactured with a vent pipe oriented downward to prevent the entry of rain water. The down-turned end of the vent pipe shall be covered with a 24 mesh non-corrosive screen. The vented well cap assembly shall be of such design and strength as to be vandal resistant.

E. CENTRALIZERS: Well casing that is sealed into an oversize bore hole shall be equipped with centering guides (centralizers) to ensure proper centering of the casing. Casings shall be centered in the sealed interval. Centralizers shall be made of steel at least 1/4" in thickness, and shall be evenly spaced in groups of 3 or 4 in 20 foot intervals or less.

F. DRILLING FLUIDS & ADDITIVES: All drilling fluids and additives must be approved by the National Sanitation Foundation (NSF) or a similar ANSI accredited laboratory/organization.

G. TYPES OF DRILLING MEDIUM: Types of drilling medium acceptable for the drilling of this water well are:

1. Fresh Water
2. Air
3. Environmentally safe, fresh water based, bentonite drilling slurry

H. FLUID ADDITIVES: Additives to drilling fluids acceptable for the drilling of this water well are:

1. Inorganic phosphates
2. Surfactants, drilling detergents, foaming agents

I. WELL PUMP (Submersible): General: The new pump for the well shall be a submersible pump capable of transmitting the quantities of water required. **(Note: Pump model and performance specifications noted are preliminary and for bidding purposes. Upon completion of the well, the pump design will be revised to reflect actual available yields and required design pumping criteria based upon pump testing of the new well.)**

1. Manufacturers:
   a. Grundfos
   b. Goulds

2. Provide an all stainless steel pump, impeller, motor coupling. An integral check shall be included at the discharge end of the pump. Pump discharge size shall be 2-inch.

The pump shall be capable of providing at least 35 gpm for peak demand and a specified working pressure of 300-feet, TDH.

J. ELECTRICAL & CONTROLS
1. Manufacturers
   a. Alderon Industries
   b. Franklin Electric

2. General: Electrical equipment necessary to control the on/off cycles of the pump and operation of the pump shall be provided and installed by the CONTRACTOR. The electrical controls for the new well pump shall include all electrical control panel, electrical equipment protectors, , cables, and all equipment necessary to install and operate the pumping system according to manufacturer's specifications Control panel to be mounted in the rest area's maintenance room.

3. Control Panel (Alderon Model 1412CD)
   a. Water well control panel shall be NEMA 4X; (UL 508A)
   b. HOA Switch
   c. Green Pump Run Indicator
   d. Fused Control Disconnect
   e. IEC Motor Contractor
   f. Field Wiring Terminal Block

4. Pump Cable: The underground power cable from the control panel to the well head shall be (UF Underground Feeder Cable), and shall be sized according to the pump setting depth and distance from the well head to the power supply. The Submersible pump power cable shall be PVC Submersible Pump Cable 600 Volt, 60-degree C Flat Jacketed Heavy Duty wire.

K. PITLESS UNIT:
1. Manufacturers:
   a. Maass
   b. Boshart

2. General: The Pitless adapters shall be capable of transmitting the quantities of water required. The pitless unit is to be a weld on and water tight to the casing. Dimensions are to match the casing size, and accommodate the column pipe below the pitless adaptor.

L. DROP PIPE
1. Manufacturers:
   a. Certainteed

2. General: The drop pipe shall be Schedule 80 (ASTM D1785) threaded PVC (KWIK-SET).

PART 3 – EXECUTION

3.1 EQUIPMENT: The drilling equipment shall be in good operating condition. The depth

of the proposed water wells is expected to be between 250'. Drilling bits shall be sized for the hole diameter specified. The drilling equipment shall be capable of drilling to a depth of 500'.

3.2 WASTE PIT: The Contractor shall construct his own waste pit for the containment of drilling fluids and wastewater. It shall be the responsibility of the Contractor to clean up the well site upon the completion of the work and restore the surface area to a near natural condition.

3.3 GROUNDWATER DISPOSAL: All groundwater that is discharged during the drilling, developing, and testing procedures shall be disposed of on the site's native soil, in a location where it will be possible to dispose of the water without damage to property or the creation of a nuisance for any other parties.

3.4 PROTECTION OF WATER QUALITY: The Contractor shall take necessary precautions to prevent environmental contaminants (petroleum hydrocarbons, hazardous substances, etc.) and water having undesirable physical or chemical characteristics from entering the underlying aquifer through the drill hole. All water used in drilling operations shall be clean, potable water. In the event that the well becomes contaminated or that water having undesirable physical or chemical characteristics does enter the well due to the neglect of the Contractor, he shall at his own expense, perform such work or supply such casings, seals, sterilizing agents or other materials as may be necessary to eliminate the contamination.

3.5 PROCEDURE FOR GENERAL WELL CONSTRUCTION:

A. CONSTRUCTION OVERVIEW: The Contractor shall be responsible for leveling or grading the site as required for access and placement of all drilling equipment. The proposed well shall be drilled by the air rotary method. The material displaced by the bit shall be removed by a circulating drilling medium.

The well shall be drilled to the following diameters:

Approximate Depth	Borehole Diameter
00' - 30'	10"
30' – 250 (min)'	7 7/8"

The well shall contain the following sized casings:

Approximate Depth Range	Nominal Size
00' – 250 (min)'	6" (permanent)

B. BOREHOLE (OVERSIZED): According to the sealing requirements presented in the Board of Water Well Contractors - Montana Codes Annotated, Administrative Rules of Montana, an oversized borehole, which is no less than 3" wider than the permanent steel well casing, must extend a minimum of 25' below land surface. The oversized borehole for this water well shall be **10"** in diameter and extend to a depth of approximately 30'.

The remaining oversize borehole shall be 7 7/8" in diameter and extend to a depth of approximately 250' below land surface (or first confining layer).

C. PERMANENT WELL CASING INSTALLATION:

The permanent 6" (nominal) steel well casing shall be lowered into the oversized borehole. This casing shall extend above the "proposed" finished ground surface no less than 18". All the casing joints shall be welded or screw coupled and shall be watertight. If welded casing joints are used, the weld shall be a full penetrating weld at least equal in thickness to the wall thickness of the casing. Welded casing joints shall have a tensile strength equal to or greater than that of the casing.

The permanent 4.5" (nominal) SDR 17, PVC well casing shall be lowered into the oversize borehole to an approximate depth of 250' where the top of the screen section begins. The casing shall be solvent free CertainTeed Certa-Lok or approve equal.

D. BOREHOLE (REGULAR): A **6"** diameter borehole shall be drilled from 30' to at least 250' (minimum). If this hole will not remain open during drilling, the **6"** diameter casing shall be driven along with the boring bit.

E. TEMPORARY CAPPING: At all times during the drilling operation, the Contractor shall protect the well in such a manner as to effectively prevent either tampering with the well or the entrance of foreign matter into it. Upon its completion, he shall provide and set a substantial screwed, flanged or welded cap specified by and satisfactory to the Engineer (ARM 36.21.661).

F. SEAL: An impervious seal such as a bridge, packer, or bentonite layer shall be placed at the bottom of the oversized borehole. The purpose of this seal is to prevent the cement grout from infiltrating into the producing formations via the outside of the well casing and reducing the output of the well.

G. SEALING & CEMENT GROUTING: Due to the consolidated deposits that underlie the east bound rest area, the cement grouting of the well annular opening, which is the space between the oversized borehole and the permanent casing, should conform with ARM 36.21.655. If it is determined that the underlying formation is unconsolidated, the Engineer shall be consulted, and ARM 36.21.656 through ARM 36.21.660 shall be adhered to as appropriate.

25 ft per B. Dreyer email 1/12/16

This water well shall be watertight to such a depth as may be necessary to exclude pollution, but in no case shall the cement sealing grout be less than ~~18-ft~~ 25' in depth from the ground surface. The annular opening between the permanent **6"** steel casing and the **10"** oversized borehole shall be filled with cement grout to a minimum depth of 30' in order to exclude pollution and with bentonite grout from 30' to 120' (approx.). The length of bentonite grout for this well shall be approximately 30'- 120'. At the bottom of the oversized borehole, a seal shall be placed to prevent the downward movement of the grout into the aquifer. This seal can either be a bridge, packer, or layer of bentonite.

Before proceeding with the placing of the grout, the Contractor shall secure the Engineer's approval of the method he proposes to use before starting the work. No

method will be approved that does not specify the forcing of grout from the bottom of the annular space up towards the surface. The grouting shall be done continuously and in such a manner as will ensure the entire filling of the annular space in one operation. No drilling operations or other work in the well will be permitted until the grout has firmly set. The minimum setting time shall be 72 hours and this may be reduced if the Contractor can demonstrate that the cement grout has taken an adequate set as determined by curing a sample of grout under similar conditions to that placed in the well. Quick setting cement may be used to accelerate setting time. The general specifications for water well sealing shall conform to ARM 36.21.654.

H. TERMINAL WELL CONSTRUCTION: The terminal well construction shall conform with ARM 36.21.647. The vented well cap assembly should be installed on the well casing at a point no less than 18" above the "proposed" finished ground surface. The ground surface immediately surrounding the cap assembly shall be graded so as to drain surface water away from the well. There will not be a well house constructed at the well head. The site is not subject to flooding. Protection from physical damage must be provided.

I. CASING PERFORATIONS: Depending on available well yield as measured during pump testing, it may be necessary that casing perforations be installed in order to maximize aquifer and well yield (35 gpm maximum). Since the well intake is required to be more than 250' below ground surface (bgs), the casing perforations must be at least 250' bgs, which will likely occur based on anticipated depth to water bearing sand formation of >250'. The CONTRACTOR shall contact the ENGINEER prior to installing any well casing perforations (if necessary). If perforations are necessary, they shall be within the aquifer formation itself. However, the location of the perforations for the well are currently unknown. Perforations shall be installed according to ARM 36.21.650.

3.6 ADDITIONAL WELL CONSTRUCTION REQUIREMENTS:

A. LOG OF WELL: The Contractor must adhere to all requirements of ARM 36.21.639. A licensed Montana water well contractor/driller shall prepare a well log report form for each well drilled. The contractor/driller shall supply a copy of the well log report to the water well owner and such agencies as required by sections 85-2-516 and 85-2-517, MCA, and maintain a copy as a record in his files. The Contractor shall keep an accurate log of the well and record all of the well drilling operations which shall provide all required information including but not limited to:

1. The reference point for all depth measurements;
2. The depth at which each change of formation occurs;
3. The depth at which the first water was encountered;
4. The location and thickness of each aquifer;
5. The identification of the material of which each aquifer is composed;
6. The depth interval from which each water sample was taken;
7. The depth of the static water level (SWL) and observable changes in SWL with well depth;
8. Total depth of completed well;
9. Location limits of lost circulation zones;

10. Depth of well seal;
11. The nominal diameter of well bore;
12. The quantity of cement grout installed for the surface seal;
13. The depth and description of the well casing;
14. Data regarding the casing perforations; and
15. Development and pump test records.

B. STRATIGRAPHIC LOG: A stratigraphic log shall be prepared to accompany the set of drilling samples, noting: (1) depth; (2) strata thickness; and (3) Lithology, including size, range, and shape of constituent particles, as well as particle roundness and rock type. The material shall be described according to the U.S.G.S. standard grade size scale as follows:

MATERIAL CLASSIFICATION
Gravel
Very coarse sand
Coarse sand
Medium sand
Fine sand
Very fine sand
Silt and Clay

C. SAMPLING OF FORMATIONS: Geological data must be determined in accordance with ARM 36.21.667 except that samples must be collected at intervals of five feet or less. Upon completion, a copy of the well log must be submitted to the Engineer for submittal to MDEQ and shall be supplemented with a driller's log and accurate geological location such as latitude and longitude or GIS coordinates as determined by GPS. The Contractor shall secure representative samples of all materials encountered in the formations drilled in the well. These samples shall be taken as required by the following:

1. one sample at the beginning of each change in material encountered; and
2. samples should be taken in the water-bearing aquifer(s).

Care shall be taken to accurately determine the depth of the material sampled. Materials encountered during the sampling shall be so indicated on the well log report form.

D. PLUMBNESS & ALIGNMENT: The borehole and well casing shall be set round, plumb and true to line as defined herein. The completed well shall be sufficiently plumb and straight so that there will be no interference with installation, alignment, operation or future removal of the permanent pump. To demonstrate the compliance of the work with this requirement, the Contractor shall furnish all labor, tools and equipment and shall make the tests described by, and to the satisfaction of, the Engineer. Tests for plumbness and alignment must be made after the complete construction of the well and before its acceptance by the Engineer. Additional tests, however, may be made by the Contractor during the performance of the work. Plumbness and alignment tests shall be described as listed below. This public water well shall be tested for plumbness and alignment in accordance with AWWA A100.

The Engineer may waive the requirements of this section for plumbness if, in his judgment:

1. The Contractor has exercised all possible care in constructing the well and the defect is due to circumstances beyond his control;
2. The utility of the completed well will not be materially affected; or
3. The cost for necessary remedial measures will be excessive.

In no event will the provisions of this section with respect to alignment be waived.

METHOD A PLUMBNESS

Plumbness and alignment shall be tested by lowering a section of pipe or dummy into the well to a depth equal with the lowest anticipated pump setting. The outer diameter of the plumb shall not be more than Y2" smaller than the **6"** diameter permanent well casing and borehole. If a dummy is used, it shall consist of a rigid spindle with three rings, each ring being not more than Y2" smaller than the **6"** diameter permanent casing and borehole. The rings shall be truly cylindrical and shall be spaced one at each end of the dummy and one in the center thereof. The central member of the dummy shall be rigid so that it will maintain the alignment of the axis of the rings. Should the dummy fail to move freely throughout the length of the well casing and borehole to a depth equal with the lowest anticipated pump setting or should the well vary from the vertical in excess of 2/3 the smallest inside diameter of the casing per 150' of depth, the plumbness and alignment of the well shall be corrected by the Contractor at his own expense and, should he fail to correct such faulty alignment or plumbness, the Engineer may refuse to accept the well.

METHOD B PLUMBNESS

Plumbness shall be tested by lowering into the well casing and borehole to a depth equal with the lowest anticipated pump setting, a cylindrical plumb bob (12"-14" in length) and measuring the displacement of the plumb line at the top of the casing as described hereinafter. The cylindrical plumb bob shall have an outside diameter not less than 1/4" smaller than the inside diameter of the **6"** permanent casing and borehole and shall be heavy enough to stretch the plumb line taut. A wire cable makes a good line that does not kink easily.

The line may be suspended from the derrick of a drilling machine or from a tripod with a winch. An adjustable guide shall be provided so that the plumb bob will hang in the exact center of the top of the well casing. The guide block shall be mounted so that the vertical distance from the centerline of the guide to the top of the casing is exactly 10'. With the plumb bob adjusted exactly in the center of the casing at the top, the test is conducted by lowering the plumb bob at 10' intervals and recording the distance that the plumb line moves off center at the top of the casing. Drift of the casing in inches at any depth is the measured displacement in inches of the plumb line multiplied by the total length in feet of the line between the guide block and plumb bob. This value is then divided by the fixed distance in feet between the guide block and top of casing (10').

Should the drift of the casing between any two measurements at 10' intervals exceed 1/2" or should the well vary from the vertical in excess of the smallest inside diameter of

the casing per 150' of depth, the plumbness and alignment of the well shall be corrected by the Contractor at his own expense and, should he fail to correct such faulty alignment or plumbness, the Engineer may refuse to accept the well.

E. WATER SAMPLES: To determine the chemical and bacteriological quality of the groundwater which will be available from each well and its suitability for intended uses, water samples shall be obtained during or immediately following construction and development (ARM 36.21.668). Sample bottles containing the samples shall be clearly marked indicating the location of the well, the date and time taken, and the depth from which the sample was collected. After construction has been complete and more than 72 hours after disinfection, two or more samples from the well must be gathered and submitted to a laboratory certified by the Department of Public Health and Human Services for microbiological analysis with satisfactory results reported to MDEQ prior to placing the well into service. These water samples shall be packed to prevent breakage and analyzed as quickly as possible.

Prior to sending the samples for analysis, the Contractor shall verify locations and certifications of labs with the Water Quality Division in Helena, Montana, Phone: (406) 444-4549. The following tests are required:

The individual wells must be monitored for:

1. Nitrates and Conductivity.
2. Coliform bacteria
3. Constituents of ARM 17.38.216:

    a) Total Alkalinity
    b) Calcium
    c) p H
    d) Sodium
    e) Iron
    f) Manganese
    g) Hardness
    h) Specific Conductance
    i) Sulphate
    j) Chloride
    k) Magnesium

4. Phase 2 – Phase 5 constituents for public water supply wells, as regulated in the state of Montana.

The quality of the water samples must meet the limitations set forth by the MDEQ - Water Quality Division before the well source can be placed into service. Private certified labs shall be used for analyses of the above parameters to encourage prompt service and prevent time delays in startup. The Contractor is to pay for all testing, sampling and shipping costs as required herein. All certified test results shall be submitted to the Owner, the Engineer, and MDEQ - Water Quality Division. If the following laboratories have maintained State certification, they can perform the required analyzes:

Energy Laboratories 1107 South
Broadway Billings, MT 59107 Phone:
(406) 252-6325

Note: The Contractor will need to indicate to the laboratory that certified tests are required for both Nitrates and Conductivity, and Bacteria. Certification criteria may change for the above labs over time. It is the Contractor's responsibility to verify this prior to submitting water samples.

The Contractor shall send instructions with the samples that are submitted to the laboratory, requiring that the analysis be as per State of Montana requirements.

3.7 WELL DEVELOPMENT:

A. GENERAL: Upon completion of the well and before conducting the yield and drawdown tests, the Contractor shall surge and develop the well to remove all fines, drill cuttings, mud, drilling fluids, and additives. The method of developing and length of time of development shall be determined by the Contractor, Engineer, or Well Owner dependent on the type of water bearing formation encountered. The well development shall employ appropriate techniques designed to bring the well to its maximum production capacity and to optimize the well efficiency, specific capacity, stabilization of aquifer material and control of suspended solids. The development work should be started slowly and gently and increase in vigor as the well is developed.

3.8 PERFORMANCE OR PUMP TESTING:

A. PUMP TESTING - GENERAL: After the well has been completely constructed, developed and cleaned, the Contractor shall notify the Engineer and Owner and shall make the necessary arrangements for conducting a final pumping test. Yield and drawdown tests must be performed on each well after construction or subsequent treatment and prior to placement of the permanent pump.

The Contractor shall furnish and install necessary pumping equipment capable of pumping to the required point of discharge at a maximum capacity. The final production capacity of the well will be determined partly based on the results of the test pumping procedure. The maximum design capacity would be 35 gpm; thus, if possible, the pumping capacity shall be 52.5 gpm (1.5 times the anticipated maximum well pump capacity). The pumping level shall be field determined depending on the static water level and drawdown in the well. Throttling devices shall be provided to control the discharge to match the capacity of the aquifer and stabilize the drawdown. The pumping unit shall be complete with drive unit controls and appurtenances and shall be capable of being operated without interruption for a minimum period of 24 hours. The test may be terminated if stabilized drawdown occurs for at least six hours during the test. If a design pumping rate of 35 gpm is achievable, the minimum stabilized drawdown period must be at least eight hours. The Contractor shall furnish a power source to drive the pump.

B. YIELD AND DRAWDOWN TEST: Yield and drawdown tests shall conform with ARM 36.21.664. These tests shall:

1. Be performed in the well after construction or subsequent treatment and prior to placement of the permanent pump;
2. Have the test methods clearly indicated in the project specifications;
3. Have a test pump capacity, at maximum anticipated drawdown, at least 1.5 times the maximum quantity anticipated;
4. Perform Step Test to determine flow rate during 24-hour constant rate test. Step Test shall include up to four (4) variable flow rates, at 1 hour per each flow rate, as directed by engineer
5. Provide for constant rate pumping at 1.5 times the anticipated pumping rate for at least 24 hours. The anticipated pumping rate is a maximum of 35 gpm; therefore, the design pumping rate is 52.5 gpm (if possible). Data collection shall begin at time zero. The test may be terminated if

stabilized drawdown occurs for at least 8 hours during the test

6. Provide the following data:

a. Static water level immediately before testing begins;
b. Starting time and ending time for each test cycle;
c. Pumping rate and means of discharge;

e. Test pump capacity-head characteristics;
f. Depth of test pump setting;
g. Maximum drawdown;
h. Pumping water levels taken so as to provide at least 10 evenly spaced data points per log cycle of time (in minutes) on a time-drawdown plot; and
i. Water recovery levels taken so as to provide at least 10 evenly spaced data points per log cycle of time (in minutes) on a time-drawdown plot.
j. Recovery level and time of recovery

All pump test data must be reported to the MDEQ. To demonstrate adequate water quantity, MDEQ may require that pump test results be submitted for review and approval prior to construction of the public water supply system.

C. WATER LEVEL MEASUREMENTS: Water-level measurements shall be obtained prior to, during, and after the pump test in order to acquire background information (static water levels), the effects of pumping (pumping water levels), and a profile of recovery of the water level from the pumping level to the original state. The measurement frequency of water levels during pumping shall be such that adequate definition of the time vs. drawdown data is made available. The constant rate test shall maintain a record of drawdown and yield by taking readings at 1 minute intervals for the first 10 minutes, 5 minute intervals for the next 20 minutes, 10 minute intervals for the remainder of the 24-hour test.

The Yield and Drawdown testing shall include coordination between the engineer and the well driller. The monitor probes will be provided by the engineer, and will be installed by the engineer, in cooperation with the well driller. The well driller shall provide adequate access to the well (well cap unlocked and accessible), installation of the well pump, power supply, discharge piping (to include 100' minimum discharge downgradient from well), flow control valve, flow meter (instantaneous reading and totalizer), and assistance during pump start-up, pump testing, and shut down. The well driller shall provide adequate space such that the engineer can install the monitoring probe, or accommodate installation of monitor probe simultaneous to test pump installation and removal.

The engineer shall set up testing frequency and calibrate monitoring probes (pressure transducers), take periodic static water level readings, perform data collection, download, and complete post-processing. The report for the Yield and Drawdown will be completed by the engineer, for submittal to MDEQ.

D. PUMP TEST INTERRUPTION: The CONTRACTOR shall conduct the pumping test without any interruption or fluctuation that will affect the accuracy of the

requiredpumping results. The anticipated pump capacity for the well shall be 67% of the design test capacity of the well.

3.9 CLEANING AND DISINFECTING:

A. GENERAL: Well disinfection shall be provided in accordance with ARM 36.21.662. After the well has been completely constructed and tested, it shall be thoroughly cleaned of all foreign substances, including tools, timbers, rope, debris of any kind, cement, oil, grease, joint dope and scum. The well casing shall be thoroughly swabbed, using alkalis if necessary, to remove oil, grease or joint dope. Following the completion of the water well,; the well and its equipment shall be disinfected by thoroughly agitating and mixing in the well a solution containing enough chlorine to leave a residual of 25 ppm throughout the well after a period of 24 hours. After the completion of the disinfection operation, the well shall be pumped to adequately flush the well of the disinfectant. Two or more water samples shall then be obtained in sterilized containers and shipped to a state certified analytical laboratory bacteriological analysis (per Specification 3.6.5 above). If samples prove to be unsatisfactory, the Contractor shall be required to repeat the disinfectant process until satisfactory results are obtained, unless the cause of pollution can be attributed to other sources. Final disinfection shall also occur after the pumping equipment has been installed, per the procedures described above (to be performed per separate contract).

3.10 SITE CLEANUP:

A. GENERAL: The Contractor shall restore the drill area to a state of cleanliness. Drilling cuttings shall be removed and disposed of away from the site. Waste pits shall be pumped out and backfilled with material from the original excavation.

3.11 WELL PUMP AND EQUIPMENT INSTALLATION:

The pump, pitless unit, electrical, and mechanical equipment shall be installed in strict accordance with the written instructions provided by the manufacturer and conform to the Uniform Plumbing Code.

A. The well pump shall be set at approximately 240 feet below ground surface (tentative), or as determined by the pump test.

B. Pump power cable shall be secured to column pipe at intervals no greater than 10 feet to allow free access of water level measurement probe in wells. The power cable shall be placed inside a PVC electrical conduit in the water line trench, where applicable.

C. Acceptance Tests: After the installation of the pump equipment, the pumps shall be given a field test under design conditions. The CONTRACTOR shall conduct the field test. Results of the field test will be provided to the ENGINEER. All defects or defective equipment revealed by the test shall be corrected or replaced promptly at no additional expense to the OWNER, and if necessary, the test shall be repeated until acceptable results are obtained. The pump shall be capable of supplying the volume of water indicated on the manufactures pump curve.

3.11 EXISTING WELL PLUGGING AND ABANDONMENT:

A. In the event that the CONTRACTOR fails to complete the well to the designed depth, or should he abandon the well because of loss of his tools or equipment down hole, or for any other cause related to deficiencies in his equipment or performance, the CONTRACTOR shall plug and abandon the well in accordance with Montana Department of Natural Resources and Conservation, Board of Water Well Contractors standards.

B. Abandonment Of Existing Well. Abandonment shall be according to Title 36, Chapter 21, ARM, part 36.21.670 parts (1) through (6). Abandonment shall be conducted in two steps. First, the well shall be completely filled with positively displaced concrete or positively displaced bentonite grouting and plugging material to within the last 6 feet of the surface. Second, the casing shall be cut off at least 3 feet below finished grade. Contractor shall coordinate with the Engineer for scheduling this work. As an alternate, the contractor shall remove the casing after it has been filled with sealing material

SECTION 02525 – WATER SUPPLY WELL AND WELL PUMP

DIVISION 15

Mechanical

SECTION 15430 – PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following plumbing specialties:
1. Water filters.
2. Drain valves.
3. Miscellaneous piping specialties.
4. Floor drains.
5. Well pressure tanks.

B. Related Sections include the following:
1. Division 15 Section "Meters and Gages" for water meters, thermometers, and pressure gages.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.
4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
1. Domestic Water Piping: 125 psig (860 kPa).
2. Sanitary Waste and Vent Piping: 10 foot head of water (30 kPa).

1.5 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
1. Backflow preventers and water regulators.
2. Balancing valves, water filters, and strainers.
3. Thermostatic water mixing valves and water tempering valves.
4. Water hammer arresters, air vents, and trap seal primer valves and systems.
5. Drain valves, hose bibbs, and hydrants.
6. Outlet boxes and washer-supply outlets.
7. Cleanouts and floor drains.
8. Vent caps, vent terminals, and roof flashing assemblies.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field test reports.

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:
1. Water filters.
2. Water valves.

E. Sustainable Submittals:
1. Product Data Energy and Atmosphere - Optimize Energy Performance: Documentation required indicating that equipment efficiency meets or exceed ASHRAE 90.1.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated.

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:
1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

F. Energy Efficiency: Meet or exceed ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 NOT USED

2.3 WATER VALVES

A. Available Manufacturers:
1. Heat-Timer Corporation.
2. Holby Valve Co., Inc.
3. Sparco, Inc.
4. Watts Industries, Inc.; Water Products Div.
5. Symmons.

B. General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.

C. System Water Valves: Piston or discs controlling both hot- and cold water flow, capable of limited antiscald protection. Include threaded inlets and outlet.
1. Finish: Rough bronze.

D. Limited-Volume, Water Tempering Valves: Solder-joint inlets and NPS 3/4 (DN 20) maximum outlet.

2.4 OUTLET BOXES

A. Available Manufacturers:
1. Acorn Engineering Company.
2. Gray, Guy Manufacturing Co., Inc.
3. IPS Corporation.
4. LSP Products Group.
5. Oatey.
6. Plastic Oddities, Inc.
7. Symmons Industries, Inc.
8. Zurn Industries, Inc.; Jonespec Div.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

C. Reinforcement: 2 by 4 inch (38 by 89 mm) fire-retardant-treated-wood blocking between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry."

2.5 DRAIN VALVES

A. Hose-End Drain Valves: MSS SP-110, NPS 3/4 (DN 20) ball valve, rated for 400 psig (2760 kPa) minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.
1. Inlet: Threaded or solder joint.
2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.
3. Hose-End Drain Valve: MSS SP-80, gate valve, Class 125, ASTM B 62 bronze body, with NPS 3/4 (DN 20) threaded or solder-joint inlet and ASME B1.20.7, garden-hose threads on outlet and cap. Hose bibbs are prohibited for this application.

2.6 MISCELLANEOUS PIPING SPECIALTIES

A. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig (860 kPa); integral or field-installed, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.
1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
2. Finish for Service Areas: Rough bronze.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Wheel handle or operating key.
5. Operation for Service Areas: Operating key.
6. Operation for Finished Rooms: Operating key.
7. Include operating key with each operating-key hose bibb.
8. Include integral wall flange with each chrome- or nickel-plated hose bibb.

B. Air Vents: Float type for automatic air venting.
1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded NPS 3/8 (DN 10) minimum inlet; 125 psig (860 kPa) minimum pressure rating at 140 deg F (60 deg C); and threaded vent outlet.
2. Welded Construction: Stainless-steel body with corrosion-resistant metal float, stainless-steel mechanism and seat, threaded NPS 3/8 (DN 10) minimum inlet, 150 psig (1035 kPa) minimum pressure rating, and threaded vent outlet.

C. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

2.7 CLEANOUTS

A. Cleanouts: Comply with ASME A112.36.2M.
1. Application: Floor cleanout, wall cleanout, for installation in exposed piping.
2. Available Products:
   a. Josam Co.
   b. Josam Co., Blucher-Josam Div.
   c. LSP Products Group.
   d. Sioux Chief Manufacturing Co., Inc.
   e. Smith, Jay R. Mfg. Co.
   f. Tyler Pipe, Wade Div.
   g. Watts Industries, Inc., Drainage Products Div.
   h. Zurn Industries, Inc., Jonespec Div.
   i. Zurn Industries, Inc., Specification Drainage Operation.

2.8 FLOOR DRAINS

A. Floor Drains: Comply with ASME A112.21.1M.
1. Application: Floor drain.
2. Available Products:
   a. Josam Co.

b. Josam Co., Blucher-Josam Div.
c. Sioux Chief Manufacturing Co., Inc.
d. Smith, Jay R. Mfg. Co.
e. Tyler Pipe, Wade Div.
f. Watts Industries, Inc., Drainage Products Div.
g. Zurn Industries, Inc., Jonespec Div.
h. Zurn Industries, Inc., Specification Drainage Operation.

2.9 WATER METERS

A. Available Manufacturers
1. Neptune (T-10)
2. Badger

B. Description
1. Magnetic drive, low torque, positive displacement, nutating disc measuring chamber
2. impact resistant register, high copper alloy maincase
3. Units of measure; US Gallons
4. Direct reading register; bronze box and cover
5. Max operating pressure 150 psi.
6. 5/8" standard sizing, unless otherwise indicated.

2.10 WATER FILTER SYSTEM

A. Available Manufacturers
1. US Filter; Plymouth Products
2. Pentek – Pentair Water

B. Description
1. Provide polypropylene cartridge filter housings, Buna-N O-rings;
a. #20 Big Blue; 90 psi
b. 1" inlet/outlet
c. 1 psi pressure loss at 15 gpm
d. Approx. Dims: 7-1/2" diameter x 23 -3/8" length
e. Dual-gradient polypropylene filter cartridges
f. Pre-filter: 25 micron
g. Post filter: 1 micron
h. Approx. Dims: 4.5" diameter x 20" length
i. < 1 psi at 20 gpm (Initial)
j. Pentek DGD-2501-20

C. Accessories
1. Universal Mounting System (UMS-4)
a. Pultruded fiberglass construction
b. Capacity for four (4) filter housings

2.11 WELL PRESSURE TANKS

A. Available Manufactures:

B. Well Rite

1. Amtrol.

C. General:
1. Tank: Deep drawn steel, free of rough spots. Pressure tested for locks and design safety.
2. Diaphragm: Heavy duty butyl diaphragm meeting FDA requirements for potable water supply - meeting NSF Standard 61. Precharge to cut in at 30 psig and off at 50 psig.
3. Tank Liner: 100% corrosion resistant polypropylene.
4. Precharge to cut in at 40 psi and off at 60 psi.
5. Connection: 1-inch NPTF 5-yr Limited Warranty.
6. Accessories
   a. Provide prefab manifold with stainless steel, liquid-filled gauge (0 – 200 psi); Chrome-plated sampling valve, spring-loaded pressure relief (75 psi setting); Nylon bushing for transducer connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35 mm) total depression.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

C. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

D. Fasten recessed-type plumbing specialties to reinforcement built into walls.

E. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

F. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves. .

G. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless

trap is indicated.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 15 Sections.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Connect plumbing specialties and devices that require power according to Division 16 Sections.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15430

Plan Review Fee Record

Date Plans Received	Account Number	EQ Number

Invoice Number	Receipt Number	Check Number	Total Received

PWSID	Public Water Supply Name	Total fee Determined
	Hysham Rest Area	$1,540.00

County	Nearest City	DEQ Review Engineer	Total Fee Due
Treasure	Hysham Rest Area	Clark	$1,540.00

Project Name: Hysham Rest Area Water System

Design Engineer Name / Firm / Address

Name
Address
City

Owner Name / Address

Name MDT
Address
City

Schedule I - DEQ 1

Policies			
	Ultra Violet Disinfection		$700
	Point-of-Use / Point-of-Entry Treatment		$700
Section 1.0	Engineering Report		$280
Section 3.1	Surface Water		
	quality and quantity		$700
	structures		$700
Section 3.2	Groundwater		$840
Section 4.1	Microscreening		$280
Section 4.2	Clarification		
	Standard clarification		$700
	solid contact units		$1,400
Section 4.3	Filtration		
	rapid rate		$1,750
	pressure filtration		$1,400
	diatomaceous earth		$1,400
	slow sand		$1,400
	direct filtration		$1,400
	biologically active filtration		$1,400
	membrane filtration		$1,400
	micro and ultra filtration		$1,400
	bag and cartridge filtration		$420
Section 4.4	Disinfection		$700
Section 4.5	Softening		$700
Section 4.6	Ion Exchange		$700
Section 4.7	Aeration		
	natural draft		$280
	forced draft		$280
	spray / pressure		$280
	packed tower		$700
Section 4.8	Iron and Manganese		$700
Section 4.9	Fluoridation		$700
Section 4.10	Stabilization		$420
Section 4.11	Taste and Odor Control		$560
Section 4.12	Adsorptive Media		$700
Chapter 5	Chemical Application		$980
Chapter 6	Pumping Facilities		$980
Section 7.1	Plant Storage		$980
Section 7.2	Hydropneumatic Tanks		$420
Section 7.3	Distribution Storage		$980
	Number of lots _____	X $70	$0.00
	Non-standard Specifications		$420
	Transmission Distribution (lineal feet) _____	X 0.25	$0.00
	Rural Distribution (lineal feet) _____	X 0.03	$0.00
	Sliplining Existing Mains (lineal feet) _____	X 0.15	$0.00
Chapter 9	Waste Disposal		$700
Appendix A			
	New Systems		$280
	Modifications		$140
Deviations			

Schedule II - DEQ 2

Chapter 10	Engineering Reports and Facility Plans		
	Engineering Reports (minor)		$280
	Comprehensive Facility Plan (major)		$1,400
Chapter 30	Design of Sewers		
	Number of Lots _____	X $70	$0.00
	Non-standard Specifications		$420
	Collection System (lineal feet) _____	X $0.25	$0.00
	Slipping (lineal feet) _____	X $0.15	$0.00
Chapter 40			
	Force Mains (lineal feet) _____	X $0.25	$0.00
	Pumping Station	1000 gpm or less	$700
	Pumping Station	greater than 1000 gpm	$1,400
Chapter 60	Screening Grit Removal		
	Screening Devices & Comminutors		$420
	Grit Removal		$420
	Flow Equalization		$700
Chapter 70	Settling		$1,120
Chapter 80	Sludge Handling		$2,240
Chapter 90	Biological Treatment		$3,360
	Nonaerated Treatment Ponds		$1,120
	Aerated Treatment Ponds		$1,960
Chapter 100	Disinfection		$900
Chapter 120	Irrigation & Rapid Infiltration Systems		$980
Appendix A	Septage	(per design)	$980
Appendix C	Alternative (non-standard) Sewer System	(per design)	$980

Schedule III - DEQ 3

Section 3.2	Ground Water	$840
Chapter 6	Pump Facilities	$420
Chapter 7	Finished Storage / Hydropneumatic Tanks	$420
Chapter 8	Distribution Systems	$420

Schedule IV - DEQ 4

Chapter 4	Pressure Dosing	$280
Chapter 5	Septic Tanks	$280
Chapter 6	Soil Absorption Systems	$280
Chapter 6	Subchapter 6.8 ETA and ET Systems	$700
Chapter 7	Subchapter 7.1, 7.2 & 7.3 Filters	$280
Chapter 7	Subchapter 7.4 Aerobic Treatment	$700
Chapter 7	Subchapter 7.5 Chemical Nutrient-Reduction Systems	$700
Chapter 7	Subchapter 7.6 Alternative Advanced Treatment Systems	$700
Chapter 8	Holding Tanks, Pit Privy, Seepage Pits, Waste Segregation, Experimental Systems	$280
Appendix D		$280
Non-Degradation Review		$420

Schedule V

Spring Box and Collection Lateral	$350

Schedule VI

Cisterns	$420

Other Fees

Plans & Specifications Not Covered ---- hours _____	X $105	$0
Re-review ---- hours _____	X $105	$0

HYSHAM REST AREA
Table of Contents

PART I: Water Design Report

TABLE OF SECTIONS

Appendix A	Location Maps
Appendix B	Hydrogeologic Investigation Report
Appendix C	Site Plan and Design Sheets (Three sets)
Appendix D	Design Criteria
Appendix E	Water Rights
Appendix F	PWS-6 Reports
Appendix G	Owner Construction Certification Form

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

PART 1:

WATER DESIGN REPORT

DOWL

1.0 GENERAL

The Hysham Rest Area is a dual rest area site located adjacent to Interstate 94 and includes entry and exit ramps, paved parking areas, restroom buildings (one each at the westbound and the eastbound sites), and covered picnic shelters.

The Hysham Rest Area site is situated adjacent to rolling hills. The westbound site is located just below the grade of Interstate 94 and the eastbound site is located above the grade of Interstate 94. Both sites are above the grade of the Box Elder Creek.

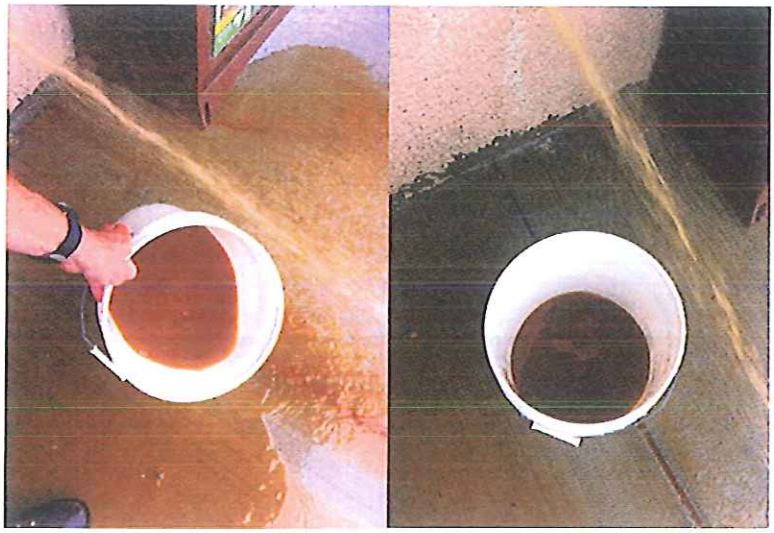
The area adjacent to the Hysham Rest Area is rural and is generally bordered by undeveloped grasslands under private ownership. Water for consumption is provided to the sites through individual wells. Irrigation consists of an individual well and surface water from Box Elder Creek.

The purpose of the overall project is to reconstruct the existing Hysham Rest Area to meet current and future demand. This project was identified by the Rest Area Prioritization Committee for reconstruction due to the age of the facility and the analysis of need and stated objective within the rest area asset management approach.

Anticipated usage through the 22 planning horizon is utilized for the Phase I design as it reflects the typical design life of water and wastewater systems and is the typical timeframe for estimating future traffic volumes.

New water and wastewater systems with increased capacity as well as improved treatment capabilities, updated car and truck parking spaces, and expanded restroom facilities are needed to accommodate current and future demand. Phase I of the project will entail design and approval for anticipated improvements to the water and wastewater systems to be used during subsequent design and construction phases to reconstruct the rest area. Phase I also includes preparation of environmental compliance documentation for full reconstruction of the rest area (Phase II). At this time, Phase II improvements are expected to be developed through a design-build project.

Each rest area site will utilize its own water system. The existing water wells serving the rest areas (east and west bound) are located directly south of the existing east bound structure and northeast of the west bound structure. The west bound well will be utilized in the new water system design. DOWL is proposing to drill a new replacement well due to its quality is poor due from the turbidity.



Photos 1 & 2: Discolored water from the east-bound Hysham Rest Area

The public water supply systems for the Hysham Rest Area will consist of the existing groundwater wells, pressure tanks, controls, and cartridge filters. The Hysham Rest Area will be maintained by the Montana Department of Transportation (MDT).

The Hysham Rest Area is classified as Transient / Non Community facility; therefore, the following information, (according to DEQ 3) has been prepared and submitted.

In addition to this Design Report, the following information has also been provided within this document.

- Hydrogeologic Report
- Water Quality Analysis
- Well Log
- Plans and Details

Groundwater Supply Wells: Two existing drinking groundwater supply wells will pump water from the alluvium/ fractured sandstone (westbound well) and fractured sandstone fractured shale formation eastbound below the site to the buildings' mechanical rooms. The yield of the two wells' water supply is estimated to be between 25 – 35 gpm. The groundwater supply wells will be controlled with standard pressure switches that are operated off of each facility's pressure tank.

Cartridge Filters: The small amount of particles present in the source water will be addressed through a series of cartridge filters. Therefore, a set of four, parallel cartridge filters are included to collect any particulates that may be present within the pumped water. The cartridges are disposable and do not require backwashing. Disposing of the expended cartridges will not require any special hazardous waste handling procedures.

Distribution: The distribution downstream of the pressure tanks will provide water throughout

the buildings.

1.0.b – e
These sections are addressed within the later sections and attachments of this submittal

1.1 DESIGN REPORT

1.1.1 General Information

1.1.1.a Existing Water Works and Sewage Facilities

The nature and extent of the area to be serviced by this public water supply can be described as an improved or expanded highway rest area. The proposed improvements to the rest area include expanding the parking areas, replacing the existing restroom facilities, installing new sanitary sewer treatment, retrofitting the existing groundwater supply with filtration, and connecting the new buildings to the existing groundwater wells.

There are two existing onsite wells currently servicing the existing buildings. The west-bound rest area is supplied by a groundwater well referred to as the "west- bound well" and the east-bound rest area is supplied by a groundwater well referred to as the "east-bound well (to be replaced)." At a minimum, the improved rest area will consist of one (1) new restroom building on each site. The public water supply fits the requirements of a transient, non-community system because it serves a transient population, as well as not being part of an established community. Since there is a non-transient population of less than 25, the system would be classified as transient. Per current water usage data and a combined water flow rate projected out 22 years, the combined water demand is 2890 gallons per day (average summer daily demand).

The design of the upgraded water facility includes filtration. The proposed new water systems will be used to provide a source of potable water for Hysham Rest Area.

1.1.1.b Municipality or Area Served

Area served by the proposed water system consists of MDT's current right of way and will only have capacity for the Hysham Rest Area facilities.

1.1.1.c Name and Mailing Address of the Owner

Owner of the Water System:
Montana Department of Transportation
2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001851
Phone: (406) 444-9369

1.1.1.d New Transient Non Community Systems Information

Since this is an "upgraded" water system, the following information has been provided according to DEQ 3 Appendix A.

a) General
Following is a brief discussion of the Managerial, Technical, and Financial Capability of the water system.

b) Managerial Capability
Montana Department of Transportation (MDT) is the owner of the Water System. MDT will perform the administrative and management duties, operational duties and maintain all the records of the water system.

Private contractors will construct the proposed water system. Upon the completion of the system, water system tests will be conducted and the Project Engineer will certify the system. If necessary, the owner of the system will contract with a licensed operator for the daily operation and maintenance of the water system.

c) Technical, Operational, and Maintenance Capacity
A "DRAFT" Operation and Maintenance Manual is enclosed with this submittal as a separately-bound document.

d) Financial Capacity
The Water System will be constructed by private contractors and financing by the Montana Department of Transportation.

1.1.2 Extent of Water System

The proposed drinking water system will lie entirely upon public property and will serve the Hysham Rest Area facilities. No additional connections will be made to the system other than those proposed within this application. The new water system will be used as a drinking water supply for the Hysham Rest Area.

1.1.3 Alternate Plans

No alternate plans are proposed for the subject water system. The available water source is from two e wells, west bound existing and east bound proposed replacement, which will supply groundwater from the aquifer underlying Hysham Rest Area. The nearest Public Water System is the town of Hysham approximately 5 miles north east of the rest area in Treasure County. Groundwater is the only feasible source of water supply at this location.

1.1.4 Water Use Data

1.1.4. a & b Estimated Population

The derivation of the projected daily average and peak water system demands used as the basis of design is shown in the following calculations. The projected water demand is according to growth projections and based on existing on site door count data. Consequently, the projection is that the water system will serve up to an average of 2,890 gpd.

Daily Design Flow (Domestic Water):

The future water/wastewater flow rates are estimated using the growth rate equation noted below.

(Current Wastewater Flows)*(1 + [Growth Rate Decimal Form]) $^{\text{Number of Years}}$ = Design Year Wastewater Flows

A 2.0 percent growth rates over a 22-year period has been agreed upon by DOWL and MDT and has been used to estimate the 22-year flow rate.

A combined wastewater flow rate projected out 22 years is 2,890 gallons per day. (The flows reflect existing/future low-flow fixtures).

TOTAL DESIGN FLOW = 2,890 gallons

Design Peak Hourly Flow - The instantaneous peak demand is estimated to be:

Peak Demand

As shown in the following table, the peak flow demand based on water fixture count is 31 gallons per minute at each site (Domestic Demand).

Water Demand Estimate Using Fixture Values

(Based on AWWA M22 Manual, Second Edition)

Facility Name	Hysham Rest Area
Building address or number	
Residential or Non-Residential	Non-Residential
Minimum Pressure (psi)	35

Fixture or Appliance	Fixture Value (at 60 psi)	Number of Fixtures	Subtotal Fixture Value
Toilet (tank)	4	14	56
Toilet (flush valve)	35	0	0
Urinal (wall or stall)	16	6	96
Urinal (flush valve)	35		0
Bidet	2		0
Shower (single head)	2.5	0	0
Sink (lavatory)	1.5	14	21
Kitchen Sink	2.2	0	0
Utility Sink	4	2	8
Dishwasher	2	0	0
Bathtub	8	0	0
Clothes Washer	6	0	0
Hose connections (with 50 ft of hose)			
1/2 in.	5	4	20
5/8 in.	9		0
3/4 in.	12		0
Miscellaneous			
Bedpan washers	10		0
Drinking fountains	2		0
Dental units	2		0
Combined Fixture Value			201
Demand (gpm)			61
Pressure Adjustment Factor			0.74
Total Adjusted demand (gpm)			**45.1**

Each Rest Area (West Bound/East Bound) will have 22.6 gpm demand.

DOWL

Peak Domestic Demand at 35 psi (Per chart A-3 AWWA M22)	22.6	gpm	
Multiplier for 35 psi (estimated peak discharge press; Per Table 4.2 AWWA M22)	1.34		
Peak Domestic Demand (instantaneous)	**30.22**	gpm	
Total Peak Instantaneous Demand =	**30.22**	**gpm**	
	(Use 31 gal per min)		

Average Day Demand
The average daily flow is figures from a combined 22 year projection water flow rate that equates to 2,890 gallons per day.

Peak Demand
As shown in the previous table, the peak flow demand is based on water fixtures count at 31 gallons per minute.

Instantaneous Demand
According to the fixture count in the Hysham Rest Area, the peak demand is approximately 31 gpm. To provide for the peak instantaneous demand and to avoid excessive on/off cycles, a 35 gpm well pump, pressure switch and pressure tanks will be utilized.

The peak flow of the well pump is estimated to be between 25 to35 gallons per minute; consequently, to make up the difference for the peak flow, two pressure tanks will be needed for additional water storage during peak demand volumes at both the east and west-bound rest areas. The enclosed plans call for two, WR -360 Well Rite Pressure Tank.

1.1.4. Source Capacity
According to the enclosed pumping test of the existing on-site well, there appears to be ample quantities of groundwater for a Transient / Non-Community Public water supply well (West Bound). Both the Montana Well Log Report and the DNRC water rights are enclosed.

With the combination of the one well and the proposed pressure tanks' storage, the total capacity meets or exceeds the average day, peak day and instantaneous demand for the potable water system.

1.1.5 Sewage System Available
The existing sewage system includes on-site septic systems. All of the wastewater systems will be replaced as part of the project. The wastewater treatment system will be submitted under a separate submittal for review. The proposed improvements to the Hysham Rest Area will utilize an onsite public wastewater system (see wastewater system submittal).

1.1.6 Sources Of Water Supply
The water source for the proposed system is an existing Transient / Non-Community Public

water supply well (west bound) and a new proposed Transient / Non-Community Public water supply well (east bound).

1.1.6. a Sites Considered

The existing and proposed well locations show setbacks to help protect the water supply from potential contaminates. These well locations will include setbacks to proposed wastewater systems, down-gradient parking, and agricultural/industrial sites.

1.1.6.b Site Advantages

The wells are located on Hysham Rest Area's property. The 100-foot control zone is outside of any other underground wet utilities, and is also within Hysham Rest Area's property.

1.1.6. c Elevation

The well heads are in areas, which—upon final grading—will be crowned so that storm water run-off will flow away from the well heads. The natural topography enhances the ability to keep storm water run-off from flowing toward the well heads.

1.1.6. d Sources of Potential Contamination

The well head locations and control zones have no potential contaminate sources. See enclosed PWS-6 reports

1.1.6. e Water Rights

The beneficial water rights for each well are enclosed with this submittal.

1.1.6. f PWS-5 Report

The existing wells are already approved by the Montana Department of Environmental Quality (MDEQ). However the eastbound well is proposed to be replaced, see enclosed plans.

1.1.6. g PWS-6 Report

The PWS-6 reports are enclosed within this submittal.

1.2 PLANS

Plans, including the general layout and detailed plans for the proposed Water System, are included in this submittal (See Appendix D).

1.3 SPECIFICATIONS

Specifications are included with this submittal in a separately bound document.

2.0 DISINFECTION

After final construction, the system shall be disinfected by thoroughly agitating and mixing in the well, a solution containing enough chlorine to give a dosage of 50 mg/l throughout the system for a period of 24 hours.

a) The well shall be pumped at the end of 24 hours to remove all traces of chlorine.
b) Water from disinfection operations shall be discharged to an area established by the contractor to handle this discharge without causing nuisance problems.

2.1 OTHER CONSIDERATIONS

The well heads are in areas, which—upon final grading—will be crowned so that storm water run-off will flow away from the well heads.

3.0 SOURCE DEVELOPMENT

The enclosed groundwater report shows that an adequate quantity of water will be available, and that Hysham Rest Area's well-supplied water will meet all MDEQ requirements.

3.1 SURFACE WATER

Surface Water usage is not proposed for this water system.

3.2 GROUND WATER

See Enclosed Groundwater Investigation Report (Appendix B).

3.2.1 Quantity

3.2.1.1 Source capacity

See enclosed Groundwater Investigation Report.

3.2.2 Quality

MDEQ will determine the minimum treatment required for a groundwater source serving a public water supply to ensure compliance with Title 17, Chapter 38, Sub-Chapter 2, ARM. Page 8 of 25. See attached PWS-6 report.

3.2.2.1 Microbiological quality

Water quality sampling of the existing public wells have been performed over several years, see enclose water quality results.

Sampling of water from the well for laboratory bacteriological analysis shall be performed by the contractor after final water system disinfection, as described in the enclosed specifications. The laboratory shall be certified by MDEQ for bacteriological analysis.

Disinfection:

After final construction of the water systems, they shall be disinfected by thoroughly agitating and mixing in the well, a solution containing enough chlorine to give a dosage of 50 mg/l throughout the well for a period of 24 hours.

The system shall be flushed at the end of 24 hours to remove all traces of chlorine. Water from disinfection operations shall be discharged to an area established by the contractor to handle this discharge without causing nuisance problems.

3.2.2.2 Physical and chemical quality

During the pumping tests, groundwater samples were collected and analyzed for bacteria, conductivity, Nitrate/Nitrite as N as well as other parameters. These results show that groundwater is of good quality. (See enclosed ground water report).

The east bound well at the Hysham Rest Area was pumped to determine its capacity and quality. The well was pumped for a total of 35 minutes at a rate of 12 gpm (gallons per minute). After thirty minutes of pumping, the water level dropped to the pump intake, causing the pump to pump both air and water; about the same time, the pumped water turned red. Water samples were collected, the pump was turned off. Please note that the existing well logs indicated that the well produced around 50 gallon per minute when it was installed.

Testing shows that this well has very limited capacity and that its quality is poor due to turbidity. Enclosed is the well log, a schematic of the well log, lithology log, and a preliminary interpretation of the geologic formation (s) that the well is likely completed in.

Due to the low capacity and poor quality of this well, it is recommended to replace and relocate the existing well. A preliminary investigation of the geologic formations present at the site was conducted and a portion of the geologic map for this area is enclosed. A description of the geologic formations is also attached.

According to this preliminary investigation, it is recommended to chlorinate and abandon the existing well, and replace it. There is good potential for a new well with good water quality, if properly constructed and completed in the Fox Hills Formation.

The assumed problem with the existing east bound well is that it may be completed too shallow and that it also was not properly constructed. The slotted PVC casing that extends from 25' to 200' allows shallow and deep groundwater to mix, which may be the primary cause for the sever discoloration of the water. In addition the annular space between the 4" PVC casing and 6" borehole allows water to freely travel vertically up and down during pumping cycles, which erodes the borehole and further adding to the sever discoloration of the water.

a) See enclosed specification.
b) See enclosed PWS-6 report.

3.2.3 Location

3.2.3.1 Well location

See enclosed PWS-6 report.

3.2.5 General well construction

3.2.5.1 Minimum protected depths.

a) a. The wells have and will have un-perforated casings exceeding the minimum depth of 25 feet. The total depths of the wells are/will be approximately 70 to 250 feet deep. . The minimum desired target yield for the new well is 25 gallons per minute (gpm).

3.2.5.2 Permanent steel casing pipe

The first, surface casing shall be new, non-reject, standard seamless or welded, minimum 6-inch O.D., minimum 0.250-inch thick wall, with a minimum weight of 22.36 lb/ft, conforming to ASTM A 53, Grade B, and in accordance with ARM 36.21.640. The casing may be supplied with threads or beveled ends for welding in accordance with ARM 36.21.642.

3.2.5.3 Nonferrous casing materials

The second, intermediate casing shall be new, non-reject, minimum 4- inch I.D., minimum SCH 40 plastic casing and in accordance with ARM 36.21.645. At the top of the 4-in plastic casing, a 20-ft section of 4.5-inch O.D., minimum 0.237-inthick wall, with a minimum weight of 10.79 lb/ft, conforming to ASTM A53, Grade B, and in accordance with ARM 36.21.640. The steel casing shall be threaded to the plastic casing and be watertight.

3.2.5.4 Packers

N/A

3.2.5.5 Grouting requirements

Neat cement, bentonite chips or high solids bentonite grout will be used.

a) High Solids Bentonite Grout: A commercial high solids bentonite product designed to be used as a water well grouting fluid. The bentonite product has a dry fine of 80 percent minimum passing a No. 200 mesh standard screen and a specific weight of 1.22 grams/cubic centimeter (10.2 pounds/gallon) at 30% solids.

b) Neat Cement Grout: A mixture of not more than 6 gallons of clear water per 94 pound bag of Portland cement. Up to 5 percent, by weight, of bentonite clay may be used to improve flow and reduce shrinkage. No sand or gravel is to be used in cement grout.

3.2.5.7 Development

a) Well development shall be conducted by the contractor to effectively extract from the water bearing formation the maximum practical quantity of fine sand silt or other fine materials. Development shall bring the well to a maximum yield per foot of drawdown without sand production.

b) The method of development and length of time of development shall be determined by the engineer and contractor based on field conditions and experience.

3.2.5.8 Capping requirements

A cast iron, water tight /vented/screened/vandal proof well cap with sanitary well seal is shown on the enclosed plans.

3.2.5.9 Well abandonment

See attached specifications for the abandonment of the existing public well.

3.2.6 Aquifer types and construction methods - special conditions

The well is proposed to be completed in the Fox Hills Sandstone. See enclosed plans and specs.

3.2.7 Well pumps, discharge piping and appurtenances

3.2.7.1 Submersible pumps:

See enclosed plans and specifications.

3.2.7.2 Discharge piping

1-2. The enclosed plans show the control valves and appurtenances located within the mechanical room, which is above the proposed ground surface. The discharge piping is under positive pressure, assuring the protection against entry of any potential contaminant.

3. See Plan Sheets for a shutoff valve, a pressure gauge and a smooth-nosed sampling tap located within the mechanical room on the positive pressure side of the check valve.

4. Due to the small size of the system, additional air release and vacuum relief valves are not needed.

5. Since the proposed systems utilize one well each, the proposed valve system shall work for test pumping.

6. All exposed piping is located within the heated mechanical room to minimize any potential freezing. Since this system is located within a secure mechanical room, damage from vandalism will not be an issue. (See enclosed plans)

3.2.7.3 Pitless well units and adapters

The Pitless adapters shall be capable of transmitting the quantities of water required. The pitless unit is to be a weld on and water tight to the casing. Dimensions are to match the casing size, and accommodate the column pipe below the pitless adaptor.

3.2.7.4 Casing vent

The existing and proposed well caps are/will be water tight/ vented / screen vandal proof with sanitary well seal. See enclosed plans and specs

3.2.7.5 Water level measurement

The 6 inch diameter well castings are large enough to allow for a water level probe to be inserted without the risk of entanglement. An access tube is not necessary in this application.

4.0 TREATMENT

The applicability of this section of Circular DEQ-1 is limited, as the cartridge filters proposed in the water system design are not intended for filtration of surface water or for removal of *Giardia*. The particle filters would capture sediment that may be present in the groundwater source. The cartridge filters are not a requirement to meet any MCL or drinking water quality standard and are purely for polishing of the water and protection of the downstream equipment, water

distribution system, and fixtures. The filters will not be backwashed and will be periodically disposed of when they become plugged and/or pressure loss across the filters is excessive.

5.0 CHEMICAL APPLICATION

N/A

6.0 PUMPING FACILITIES

N/A

7.0 FINISHED WATER STORAGE

The proposed pressure tanks are NSF certified and conforms to standard 61 for drinking water system components. The proposed pressure tank follow current AWWA standards see enclosed specification sheets.

7.1 PRESSURE TANKS

The proposed pressure tanks' maximum operating pressure is 50 psi. The specified pressure tanks have a maximum working pressure of 125 psi at 140° Fahrenheit. See enclosed specification sheets.

$$V = \left(\frac{15 \times Q}{N}\right) \times \left(\frac{(P_H + P_{ATM})(P_L + P_{ATM})}{(P_i + P_{ATM})(P_H - P_L)}\right)$$

Where:

V =	**Hydropneumatic Tank Volume Required (gal)**
Q =	**Flow rate from well/pump (gpm)**
N =	**Number of motor starts per hour; this value is dependent on motor horsepower, but using N=18. This allows the pump to run for approximately 3 minutes per cycle during peak flow conditions.**
P_H =	**High side pressure, psi**
P_L =	**Low side pressure, psi**
P_i =	**Tank precharge pressure, psi (typically P_L-2 psi)**
P_{ATM} =	**Atmospheric pressure, psi (Billings~ 13)**

Hysham:

Q = 35 gpm
P_H = 50 psi
P_L = 30 psi
P_i = 28 psi
Location = Billings

Calculate:

$$V = \left(\frac{15 \times 35}{20}\right) \times \left(\frac{(50 + 13.0)(30 + 13.0)}{(28 + 13.0)(50 - 30)}\right)$$

$$V = (26.25) \times \left(\frac{(63.0)(43)}{(41)(20.0)} \right) = (26.25)(3.30) = 86.72 gallons$$

So, the minimum pressure tank volume required is approximately 87 gallons.

7.1.1 Location

As shown within the plans, the tanks are housed within the Hysham Rest Area's mechanical room. The first floor elevation will be approximately 1-2 feet above the proposed finished ground elevation around the building.

7.1.2 System design and sizing

To provide for the peak instantaneous demand and to avoid excessive on/off cycles, a 35 gpm well pump, pressure switch and a pressure tanks will be utilized. According to peak flows and demand times, approximately 88 gallons per minute of storage is needed to adequately address the required demands.

(Minimum Storage Volume Required = (60 gallons/min- 35 gallons/minute) x 3.5 minutes) = 87.5 gallons of additional is storage needed. The enclosed plans call for two pressure tanks.

No chlorine treatment is proposed.

7.1.3 Piping

As shown in the enclosed drawings, the tank in the proposed system has bypass valves to permit operation of the system in the event that a tank is out of service.

7.1.4 Appurtenances

As shown on the enclosed drawings, a 1½" shut off valve and 1½" drain valve is utilized to empty the pressure tanks. The pressure tanks utilize an air valve located on top of the tanks to release and add air pressure.

See enclosed plans for the pressure gage, pressure relieving device and pressure switch that operate the start-stop controls.

The proposed pressure relieving device will prevent the pressure from rising more than 10 percent above the maximum allowable working pressure, (maximum allowable working pressure = 50 psi + (50psi x 0.10) = 55 psi. The proposed pressure release valve can be adjusted from 0 to 400 psi. The discharge capacity of the pressure relieving device is sized to release a maximum flow of 40 gallons per minute. This discharge is greater than the required 35 gallon per minute pumping rate. All discharge water will be captures by the floor drain within the mechanical room. The proposed pressure gages specified have a maximum pressure rating of 160 psi, which is more than the 1.2 times greater than 50 psi maximum, the maximum working pressure (50 psi x 1.2 multiplier = 60 psi).

7.2 OTHER STORAGE SYSTEMS

N/A

7.3 CYSTERNS

N/A

8.0 DISTRIBUTION SYSTEMS

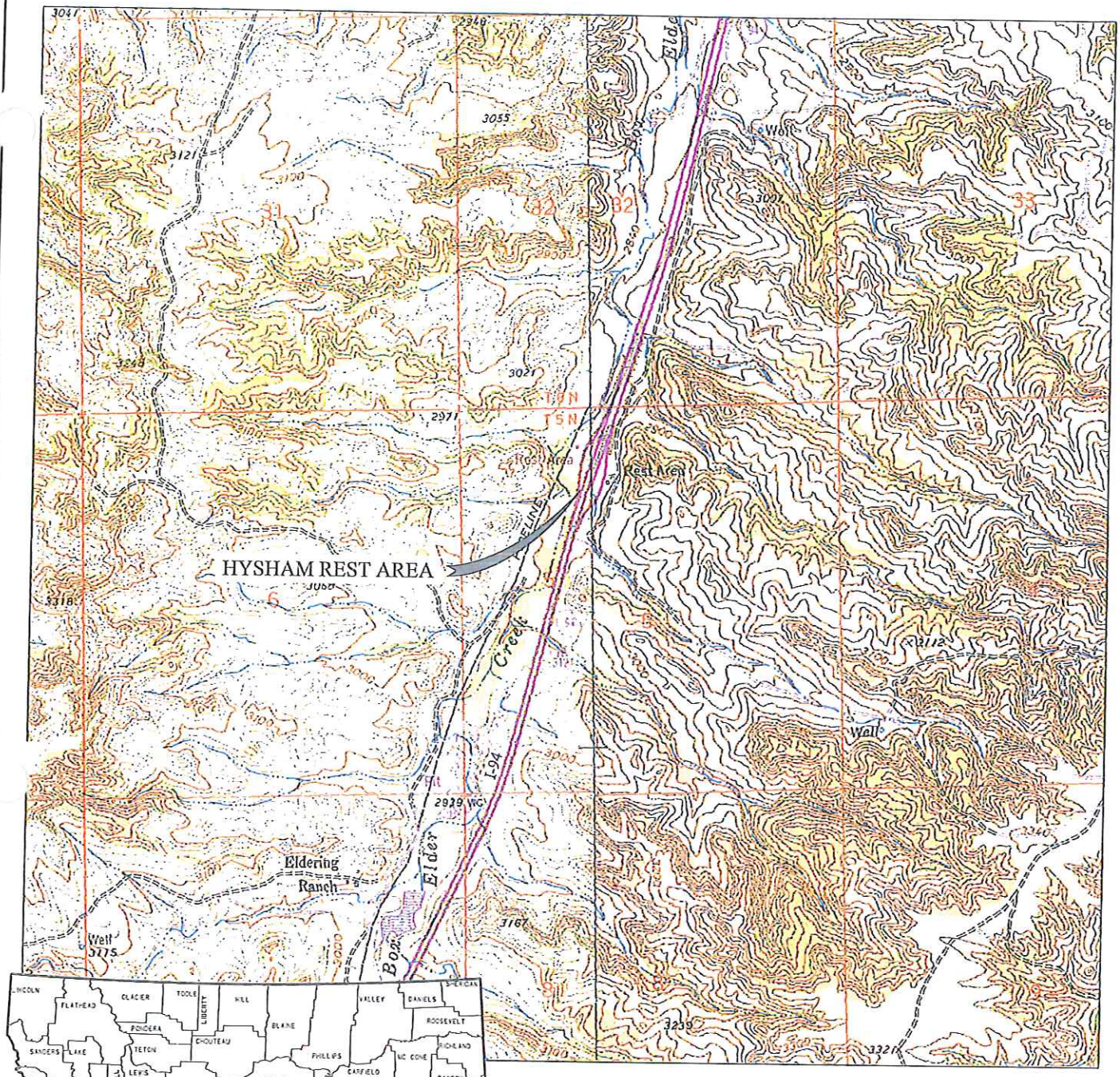
N/A

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX A:

LOCATION MAPS

DOWL



DOWL HKM

HYSHAM REST AREA

TREASURE COUNTY, MONTANA

USGS VICINITY MAP

PROJECT NUMBER:	IM 94-2(36)65
CONTROL NUMBER:	UPN 8200000
DATE:	MARCH 2014

FIGURE 1

DOWL HKM

100' DRAINAGE OFFSET TO WASTE WATER SYSTEM

EXISTING R/W

ON-RAMP

WESTBOUND REST AREA

BOX ELDER CREEK

MILE 65

T. 06 N., R. 36 E., SEC. 32

EXISTING R/W

OFF-RAMP

I-94 WESTBOUND

I-94 EASTBOUND

OFF-RAMP

ON-RAMP

EASTBOUND REST AREA

EXISTING R/W

EXISTING R/W

T. 05 N., R. 36 E., SEC. 5

HYSHAM REST AREA EXISTING SITE LAYOUT

EASTBOUND AND WESTBOUND

SCALE 1"=100'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDDETZ01	DESIGNED BY	T BECKEN-GADDO	2/27/2014	PH. I CONCEPTUAL SITE LAYOUT	HYSHAM REST AREA - MONTANA	IM 94-2(36)165
2		2/28/2014	REVIEWED BY	B DREYER	2/27/2014			
1		3:41:54 PM ABeckengadds	CHECKED BY	B DREYER	2/27/2014	TREASURE COUNTY	UPN 8200000	

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX B:

HYDROGEOLOGIC INVESTIGATION REPORT

DOWL

Hysham Rest Area
IM 94-2(36)65
UPN 8200000

HYDROGEOLOGIC INVESTIGATION REPORT

MDT Activity 134

Prepared for:

MONTANA MDT DEPARTMENT OF TRANSPORTATION

2701 Prospect Avenue
P.O. Box 201001
Helena, MT 59620-1001

Prepared by:

DOWL

2090 Stadium Drive

Bozeman, MT 59715

August, 2015

H:\24\11355\134\DEQ water system\Groundwater Investigation Report.docx

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AQTESOLVE Pumping Test Analysis Results

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Hysham Rest Area Water Quality Results

APPENDIX E

Hysham Rest Area East Bound Well Memo

1 INTRODUCTION

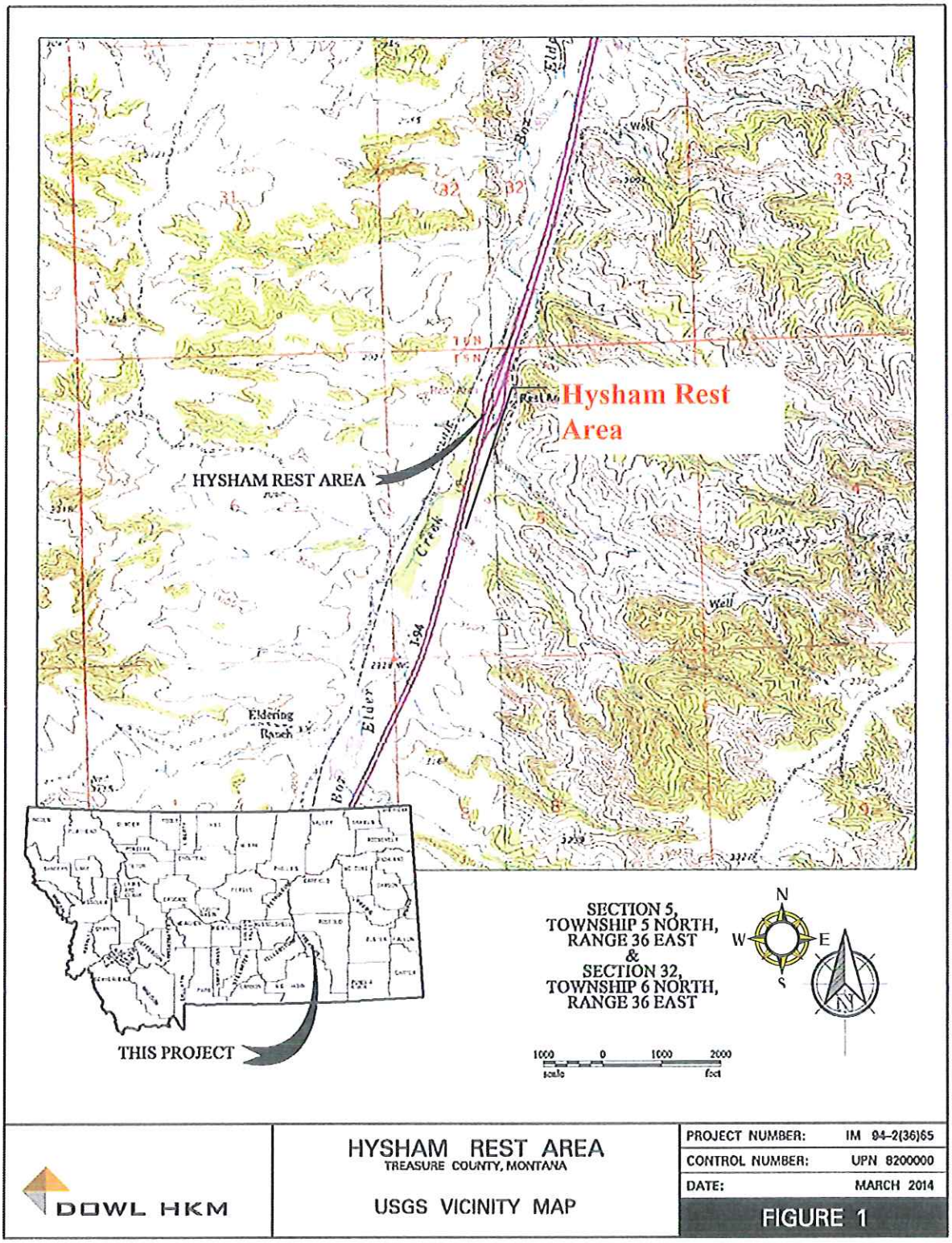
This Hydrogeologic Investigation report has been prepared by DOWL on behalf of Montana Department of Transportation (MDOT). It summarizes the results of on-site investigations performed June 13, 2014 at the Hysham Rest Areas south of Hysham, Montana.

This work was done in support of Phase I of the Hysham Rest Area project to evaluate site conditions and design a wastewater treatment and disposal system for the Rest Areas. This work is also being done to support the applications prepared and submitted to the Montana Department of Environmental Quality (MDEQ). The Rest Areas will continue to utilize two existing Public Water Supply (PWS) wells and one irrigation well for water supply and irrigation respectively.

The key water related issue being evaluated is if the utilization of an on-site septic system will negatively impact down gradient groundwater quality. During this investigation groundwater and aquifer conditions at the site were evaluated to support the Non Degradation analyses required for the permitting and installation of the proposed on-site Public Wastewater System (PWWS).

The project area is located approximately 5 miles south/southwest of Hysham in Treasure County within Section 5, Township 5 North, Range 36 East. The project limits will include the eastbound and the westbound rest areas, entrance and exit ramps, and a portion of I-94 approaching and departing the rest areas. Precise project limits will be determined during the design phase of the project, but are expected to remain within the existing MDT right-of-way.

FIGURE 1 SITE LOCATION MAP



DOWL

2 GENERAL GEOLOGY

2.1 LOCAL STRATIGRAPHY

The sedimentary deposits exposed at the Hysham Rest Area consist of Cretaceous deposits. The area is generally mapped as sandstone and shales as depicted on the geologic map.

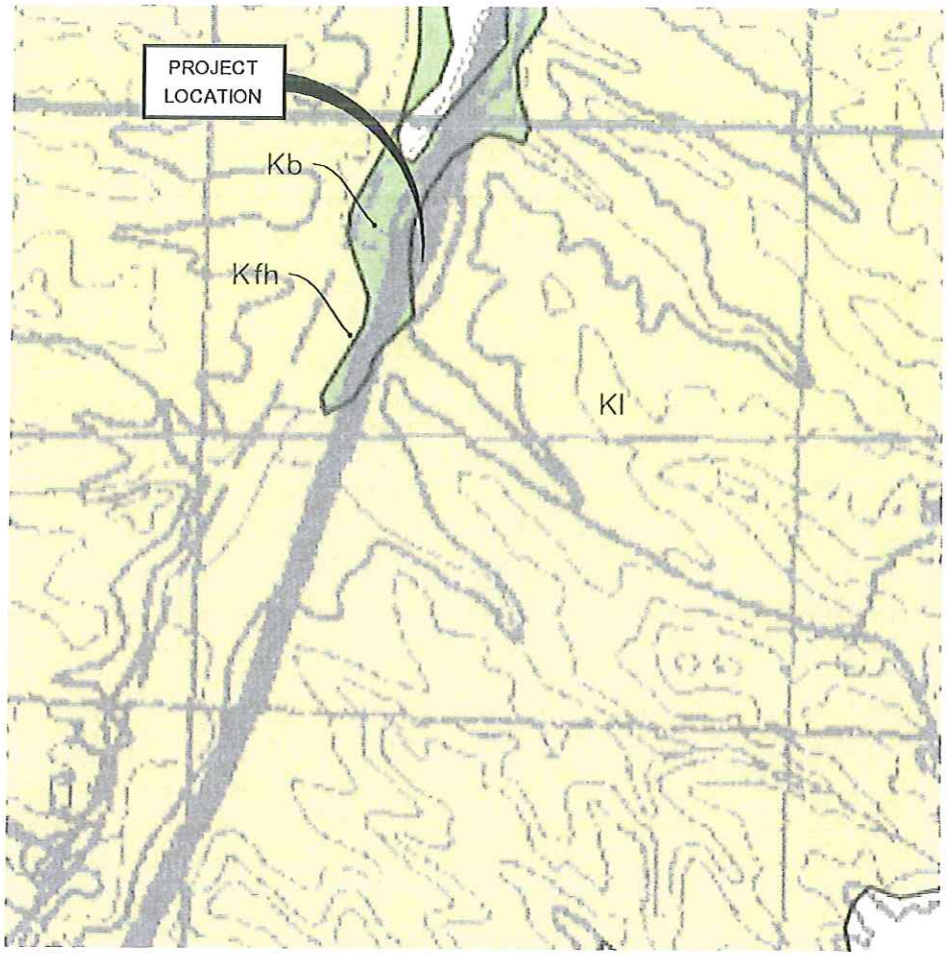
1. Kl Lance Formation (Upper Cretaceous)
Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

2. Kfh Fox Hills Formation (Upper Cretaceous)
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

3. Kb Bearpaw Shale (Upper Cretaceous)
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500.

The prominent geologic features at the sites are a drainage area located southeast portion of the eastbound rest area, a large sandstone out cropping located due east of the eastbound rest area and Box Elder Creek located west of the westbound rest area. The sandstone outcropping and Box Elder Creek contributed to the sand and gravel deposits throughout the sites. No other prominent geologic features were observed in the immediate vicinity of the project site corridor. Based on visual examination, the surficial soils consist of silt, clay, sand, and gravel associated with the formations within the rest area sites.

FIGURE 2 GEOLOGIC MAP



MAP UNITS

Kl - Lance Formation (Upper Cretaceous)

Kfh - Fox Hills Formation (Upper Cretaceous)

Kb - Bearpay Shale (Upper Cretaceous)

DOWL HKM 2000 Stadium Drive Bozeman, Montana 59715	HYSHAM REST AREA GEOLOGIC SURVEY MAP	PROJECT 24.11355.01 DATE 09/18/2014 FIGURE #1

G:\24\11355\01\ACT 100\GEOLOGIC FIGURE.dwg PLOT DATE: 2014-09-18 13:42 SAVED DATE: 2014-09-18 13:24 USER: bduffey

2.2 *Structural Geology*

Within the boundaries of the Hysham Rest Area site, the subsurface deposits generally consist of flat-lying to slightly-tilted alluvial and volcanic deposits. No faulting, folding or other structural features that would affect the presence or distribution of groundwater for this site are present.

3 HYDROGEOLOGY

Groundwater or groundwater indicators were not observed at depths ranging from 1 to 10 feet in the six test pits. DOWL found the eastbound aquifer to be located in the Bearpaw shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. These logs indicate that the existing public wells located water at an interval depth of 6 to 200 feet below ground surface. Sandy clays, Sandy silts, gravels dominate the upper 10 feet of the wells. Shale and sandstone layers are found from 25 feet to 200 feet. Based on the information presented in the well logs, it appears that the aquifer is found in a confined/semi confined aquifer formation. .

The constant rate pumping test, (further discussed below) shows that ample quantities of groundwater are available for development in these formations.

4 TEST WELLS

No test wells were installed for this work. Existing Rest Area wells provided adequate hydrogeologic information to evaluate and characterize this site.

5 WATER QUANTITY

To determine the aquifer parameters to be used for the non degradation analyses the three existing wells at the Rest Area were equipped with monitoring equipment, see

Appendix B Figure 1. On June 13, 2014 a constant rate pumping test was conducted. Well #1, which is the public drinking well at the west bound rest area was pumped, while Well #2 which is the PWS well at the east bound rest area was used as an observation well as well as Well #3, which is the irrigation well at the west bound rest area.

While pumping, detailed records of the pumping rate and pumping level were documented for later analysis. Data was collected with: a Solinst water lever meter, and Solinst Leveloggers. Flow was measured with a bucket and stop watch.

5.1 *Well #1 Constant Discharge Rate Pumping Tests*

On June 13, 2014 at 12:25, the constant rate pumping test of Well #1 began. Well #1 was pumped at 10 gpm for the duration of the test. The test concluded on June 13, 2014 at 2:00 lasting approximately 95.67 minutes. By the end of the test there was approximately 12 feet of drawdown in the pumping well, Well #1 and no change in Well #2 or Well 3.

AQTESOLV for Windows was utilized to evaluate both the drawdown and recovery portion of the test in Well #1. Standard procedures and analytical methods most applicable to all the wells construction and aquifer type were used. For the evaluation, the Hantush–Jacob method for a partially penetrating well in a leaky confined aquifer was used. Parameter values for these evaluations are consistent with published values for the aquifer conditions identified. See Table 2. Table 1 and Figures 2 and 3 of Appendix B further display these analyses.

TABLE 1 PUMPING AND RECOVERY TEST RESULTS

	[T] Transmissivity (ft^2/day)	[K] Hydraulic Conductivity (ft/day)	[b] Aquifer Thickness (feet)	[S] Storage Coefficient (dimensionless)
Well #1	336.82	33.68	10	0.8321

Inherently, long-term constant-rate tests provide average aquifer characteristics of the zone of aquifer influenced by the pumped well. This is known as the zone of influence. As pumping continues, the zone of influence becomes larger until the aquifer is able to provide the quantity of water demanded by the well. Consequently, the effects observed at both the pumping well and observation well are an average of all the discrete effects within the wells zone of influence. Therefore the aquifer parameter determined from a long term constant rate test are appropriate for characterizing the average conditions of the site. While this 1.6 hour test is not considered long compared to typical tests, the results show that the aquifer had largely stabilized to meet the demands of the pumping well , (10 gpm). Consequently the pumping test was stopped and the recovery levels in the observation well were tracked. Results from both the pumping and recovery portion on the test match well with each other and the test is considered adequate for the purposes of this investigation.

6 WATER QUALITY

Water quality was tested and results are included in this report.

7 GROUNDWATER MAPPING

According to the project site survey and groundwater level monitoring records from each of the existing wells, the direction that groundwater is flowing is north 24 east and the gradient is 0.0068 ft/ft, (see Appendix C Figure 1). This figure represents the

groundwater surface on June 13, 2014, and was generated using SURFER software.

8 SURFACE WATER

Surface water features exist nearby and include the Box Elder Creek to the northwest. This feature does not adversity affect the design and permitting effort for the proposed wastewater system.

9 CONCLUSIONS AND OBSERVATIONS

Drillers logs conditions and analysis of pumping test data show that the formations are viable aquifers, and that the aquifers are in a leaky confined condition. Wastewater discharge from proposed septic system will eventually interact with the groundwater in the alluvial terrace deposits aquifer. Therefore, a non-degradation analysis has been performed.

APPENDIX A

WELL LOGS

APPENDIX A

Ground Water Information Center
Montana Bureau of Mines and Geology
Montana Tech of The University of Montana
1300 West Park Street - Natural Resources Building Room 329
Butte Montana 59701-8997
Ph: (406) 496-4336 Fx: (406) 496-4343

You are currently signed in. | 7/21/2015
Sign Out

GWIC Data > Well Construction Data > Township: 05N Range: 36E Sec: 5

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by sending us an Email at **GWIC@mtech.edu**. If you wish to view a one page report for a particular site, click the hyperlinked **Gwic Id** for that well. Scroll to the right of your screen to view all the data. All data displayed on the screen may not show up when printed.

Retrieval Statistics*

Field	Max	Min	Avg
Total Depth (ft)	280.00	65.00	155.00
Static Water Level (ft)	46.89	14.00	28.30
Yield (gpm)	50.00	10.00	26.00

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Did you know about...

Other GWIC data

GWIC has 3 water quality sample(s) for this area.
GWIC has 5 field visit(s) for this request area.
GWIC has 4 water level(s) for this request area.

Thanks, Just take me back to the menu.

Other MBMG data

MBMG has 411 publications available for TREASURE county.
MBMG has 0 abandoned mine record(s) for this request area.

Gwic Id	PDF	DNRC WR	Site Name	Twn	Rng	Sec	Q Sec	Ver?	Type	Td	Swl	Pwl	Rwl	Yield	Test	Date	Use
179372			LLOYD, CLEAVE	05N	36E	5	B	No	WELL	280.00				10.00	BAILER	2/4/1947	STOCKWATER
17257		W163867-00	HYSHAM REST AREA WESTBOUND	05N	36E	5	BABC	Yes	WELL	65.00	14.00	43.00		28.00	PUMP	1/28/1966	PUBLIC WATER SUPPLY
17256			MONTANA HIGHWAY COMMISSION - HYSHAM WESTBOUND IRRIGATION	05N	36E	5	BACB	Yes	WELL	75.00	24.00	40.00		16.00	PUMP	2/3/1966	PUBLIC WATER SUPPLY
163054			HYSHAM REST AREA EASTBOUND	05N	36E	5	BADB	Yes	WELL	200.00	46.89		40.00	50.00	AIR	8/18/1988	PUBLIC WATER SUPPLY

End of Report.
4 record(s) listed.

Items of Note:

[1]This report is restricted to site types of WELL, BOREHOLE, SPRING, COAL BED METHANE WELL, PETWELL, PIEZOMETER.

[2]A single well record (a distinct GWIC Id) may be represented by more than one line in this report if more than one performance test was conducted on the well at the time of drilling.

Explanation of Columns:

GWIC Id = Key field for the GWIC database. Links to one page reports.
PDF = Are scanned documents available through the Document Manager?

- = Yes, click on the icon to download the PDF file.
- = No, well was submitted electronically. No paper record exists.
- = No, record does have a known well log but it is not scanned yet.
- = No, record may or may not have a document to scan. Metadata is unclear.
- = No, record was created from a source other than a well log. No paper record exists.

DNRC WR = Water right number assigned to this site by Department of Natural Resources and Conservation.
Site Name = Current owner name assigned to GWIC record.
Location = Location of site in Montana township, range, section, and quarter-section coordinates.
Ver? = Has this location been verified by field staff?
Type = Type of site assigned to GWIC record.
Td = Total depth of well in feet below ground.
Swl = Static water level in feet above/below ground - Negative values are reported for water levels that are above land surface.
Pwl = Pumping water level in feet below ground.
Rwl = Recovery water level in feet below ground.
Yield = Yield in gallons per minute.
Test = Type of performance test reported.
Date = Completion date of well/borehole.
Use = Reported use of water.

Disclaimer:

The preceding materials represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date 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 [7/21/2015 3:27:34 PM]. 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.

Ground Water Information Center Online © 1998 - 2015
Staff | Privacy Statement

MONTANA WELL LOG REPORT

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

Other Options

Return to menu
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:13 PM)

Site Name: HYSHAM REST AREA WESTBOUND
GWIC Id: 17257
DNRC Water Right: W163867-00

Section 1: Well Owner(s)

1) MT DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT N/A [06/25/1999]
2) MONTANA HIGHWAY COMMISSION (MAIL)
C/O WALT RAFFELSON
CUSTER MT 59024 [01/31/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	SW¼ NW¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2197	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2865			

Measuring Point Altitude	Method	Datum	Date Applies
2866.6			9/23/1997 12:16:00 PM

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, January 28, 1966

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	65	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	63	6				20 LB STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
63	65	0			OPEN HOLE

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 65
Static Water Level: 14
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
28 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 43 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 NE OF RESTROOMS NEAR PICNIC TABLE SAMPLING PT -FAUCET ON FRONT OF RESTROOM BLDG OR UNDERGROUND SPRINKLER SYSTEM OUTLETS WESTBOUND REST AREA ACCESSED UTILITY ROOM WITH CARETAKER HYSHAM RESTAREA I94 WEST

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	5	GRAYISH TAN SANDY SILT
5	15	CHANGES TO GRAY SANDY CLAY
15	20	TRACES OF GRAVEL
20	25	GRAY SANDY CLAY SOME SURFACE WATER
25	35	GRAY SHALE
35	55	BLUISH GRAY CLAY
55	63	SOME TRACES GRAVEL. INCREASING AMOUNTS OF SAND TO COARSE ROCK AT 63 FT.
63	65	BOTTOMED HOLE IN GRAVEL AND DARK GRAY SAND

Driller Certification

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

Name:

Company: FOX
License No: -
Date Completed: 1/28/1966

Log No. 39 340' Lt. of Sta. 675+92, Project I-94-2(10)69 103 05N 36E 5 BAPC Treasure

GW 2

Approved Stock Form—State Publishing Co., Helena, Montana—42329

File No.....

TRIPLICATE

RECEIVED FEB 16 1966 Montana Bureau of Mines and Geology

3

103 T. 5 N. R. 36 E. 5 BAPC 02

County Treasure

LOG

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CO
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Top of Ground

Greyish tan sandy silt.
(Elev. above sea level 2371.68 ft.

5.0' Change to grey sandy clay.

15.0' Traces of gravel.

20.0' Grey sandy clay; some surface water.

25.0' Gray shale.

35.0' Bluish grey clay.

55.0' Some traces gravel. Increasing amounts of sand to coarse rock @ 63.0 ft.

63.0' Bottom of casing.

65.0 Bottomed hole in gravel & dark grey sand.

Show exact depth of bottom.

Owner Montana Highway Commission Address Helena, Montana

Driller Montana Highway Department Address Helena, Montana

Date of Notice of appropriation of groundwater January 31, 1966

Date well started January 24, 1966 Date completed January 28, 1966

Type of well Churn drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐ Industrial ☐ Drainage ☐ Other ☐

Rest Area Water Supply.

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6"	5" ID Steel 19.88 lbs. per ft.	0.0'	63.0'	NONE		

N / W / E / S

LA

SE 1/4
NW 1/4 Sec. 5 T. 5 N. R. 36 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 14.0 feet.

Shut-in Pressure for Flowing Well

Pumping Water Level 43 feet at 20 gal. per minute.

Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e.: Lot, Block and Addition).

WATER ANALYSIS

PH	7.5
CO_2	5.4 p.p.m.
Calcium & Magnesium Bicarbonates	220 p.p.m.
Sodium Bicarbonate	90 p.p.m.
Water is basic	

None required

Driller's License Number

Lehman B. Fox

Driller's Signature Atlg. Engr.

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located, tissue copy to be retained by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

M: 17257

MONTANA WELL LOG REPORT

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

Other Options

Return to menu
View hydrograph for this site
View field visits for this site
View scanned well log (6/7/2010 1:21:07 PM)

Site Name: HYSHAM REST AREA EASTBOUND
GWIC Id: 163054

Section 1: Well Owner(s)

1) HYSHAM REST STOP EAST BOUND (MAIL)
N/A
N/A MT N/A [03/14/2003]
2) MONTANA DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT 59105 [09/23/1997]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SE¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2184	107.2493	NAV-GPS	NAD27

Ground Surface Altitude	Method	Datum	Date
2900			

Measuring Point Altitude	Method	Datum	Date Applies
2901.4			9/23/1997 11:25:00 AM

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, August 18, 1988

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	35.5	10
25	200	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	35.5	7				23LB STEEL
25	200	4		165.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
28	200	4		1/8	SLOTS

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 200
Static Water Level: 46.89
Water Temperature:

Air Test *

50 gpm with drill stem set at _ feet for 2 hours.
Time of recovery 1 hours.
Recovery water level 40 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 EAST OF BUILDING RESTROOMS AT PICNIC TABLES USED UTILITY SINK FAUCET FOR CHEM NEED TO CONTACT CARETAKER FOR ACCESS NEWEST WELL AT REST AREAS 2 OLDER SHALLOW WELLS ON WEST SIDE IRRIGATION PIPES ACROSS TO THIS SIDE

Section 9: Well Log

Geologic Source
211LHUD - LANCE-HELL CREEK UNDIFFERENTIATED

From	To	Description
0	28	SILT CLAY
28	35	BROWN SANDSTONE
35	50	LIGHT SHALE
50	81	LIGHT SANDSTONE
81	121	SHALE
121	160	GREY SANDSTONE
160	173	GREY SHALE
170	200	GREY SANDSTONE

Driller Certification

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

Name: WILLIAM KUPFNER
Company: ROCK CREEK DRILLING INC
License No: WWC-300
8/18/1988

Date Completed:

05N36E05BADB

Form No. 603 (R 8 87)

Hysham E.B.

File No. ______

WELL LOG REPORT

State law requires that this form be filed by the water well driller within 60 days after completion of the well.

1. WELL OWNER
Name: State Montana [illegible]

2. CURRENT MAILING ADDRESS
P.O. Box 20437
Billings Mt 59104-0437

3. WELL LOCATION
County: [illegible]
Township: 5 (N)
Range: 36 (E)
NWSE NE ¼ NW ¼ Section 5
Lot: Lot 3
Subdivision: NE of NW Lot 3
Tract Number:

4. PROPOSED USE Domestic [ ] Stock [ ] Irrigation [ ]
Other (X) specify: [illegible]

5. DRILLING METHOD cable, ___ X air rotary, ___ forward rotary, ___ reverse rotary, ___ jetted, ___ other (specify) ___

6. WELL LOG

Depth (ft.) From	To	Formation
0	28	silty clay
29	35	brown sandstone
35	50	light shale
50	71	light sandstone
71	121	shale
121	160	grey sandstone
160	173	grey shale
173	200	grey sandstone

ATTACH ADDITIONAL SHEETS IF NECESSARY

7. WELL CONSTRUCTION AND COMPLETION

Size of drilled hole	Size and PSI Rating of casing	From (feet)	To (feet)
10 3/4	7" 25#	+1.8'	35.5
6 1/8	4 1/2 PVC 160#	25	200

Perforations: X ___ inches
Screen:

Kind Size	From (feet)	To (feet)
Slot	25	200

Was casing left open end? X Yes ___ No
Was a packer or seal used? ___ Yes X No
If so, what material ___
Was the well gravel packed? ___ Yes X No
To what depth was the well grouted? 20 ft
Material used in grouting: Gravel
Well head completion: Pitless adapter ___ Yes X No
Top casing 18 in. or greater above grade X Yes ___ No

8. WELL TEST DATA

The pump test information requested in this section is required for all wells. All depth measurements shall be from the top of the well casing unless otherwise specified.

All wells under 100 gpm must be tested for a minimum of one hour and provide the following information:

a) Air X Pump ___ Bailer ___
b) Static water level immediately before testing 40 ft. If flowing; closed-in pressure ___ psi ___ gpm
Controlled by: ___ valve, ___ reducers, ___ other, (specify) ___
c) Depth at which pump is set for test 1.150
d) The pumping rate and means of discharge (i.e., bailing, (airlift), pumping) 50 gpm
e) Maximum drawdown during the test 200 ft
f) Duration of test: Pumping time 2 hrs
Recovery time 1 hrs
g) Recovery water level 40 ft
Amount of time after pumping recovery level water data was taken 1 hrs

Wells intended to yield 100 gpm or more shall be tested for a period of 8 hours or more. The test shall follow the development of the well, and shall be conducted continuously at a constant discharge at least as great as the intended appropriation. In addition to the above information, water level data shall be collected and recorded on the Department's "Aquifer Test Data" form included in each packet of well logs.

NOTE: All wells shall be equipped with an access port ½ inch minimum or a pressure gauge that will indicate the shut in pressure of a flowing well. Removable caps are acceptable as access ports.

9. WAS WELL PLUGGED OR ABANDONED? ___ Yes X No
If yes, how? ___

10. DATE COMPLETED 8-17-88

11. DRILLER/CONTRACTOR'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Date: 10-18-88
Firm Name: Rock Creek Drilling
Address: RR1 Box 295 Joliet Mt
Signature: [illegible signature] License No. 300

Hysham RA-
Eastbound
01694

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
1520 EAST SIXTH AVENUE HELENA, MONTANA 59620-2301 444-6610

DNRC

DEPARTMENT COPY
DRILLER: Please give this copy to the well owner to complete reverse side
OWNER: Complete reverse side and send to DNRC when the well is completed and the water has been used beneficially for the intended purpose.

163054

MONTANA WELL LOG REPORT

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

Other Options

Return to menu
View hydrograph for this site
View field visits for this site
View water quality for this site
View scanned well log (6/7/2010 1:20:42 PM)

Site Name: MONTANA HIGHWAY COMMISSION - HYSHAM WESTBOUND IRRIGATION
GWIC Id: 17256

Section 1: Well Owner(s)

1) MONTANA HIGHWAY COMMISSION (MAIL)
HELENA
N/A N/A N/A [02/03/1966]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SW¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2186	107.2513	MAP	NAD27

Ground Surface Altitude	Method	Datum	Date
2870			

Measuring Point Altitude	Method	Datum	Date Applies
2871.7			9/23/1997 9:30:00 AM

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CHURN
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, February 03, 1966

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	61.5	6				STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 75
Static Water Level: 24
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
16 gpm pump rate with _ feet of drawdown after 4 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 40 feet.

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

Section 8: Remarks

IRRIGATION ONLY WELL BOTH REST AREAS PUMP RUNNING ALL NIGHT

Section 9: Well Log

Geologic Source

111ALVM - ALLUVIUM (HOLOCENE)

From	To	Description
0	10	TAN TO GRAY SANDY SILT WITH SOME CLAY
10	34	GRAY SANDY REWORKED SHALE WITH SOME GRAVEL
34	60	GRAY CLAY
60	61.5	GRAY SANDY SHALE
61.5	70	BOTTOM OF CASING SHOE. SOFT GRAY SANDSTONE
70	75	GRAY SANDY GRAVEL

Driller Certification

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

Name:
Company: FOX
License No: -

Date Completed: 2/3/1966

GW 2 Log No. 40 285' Rt. 673+00, Project I-94-2(10)55 103 05N 36E 5BD Treasure

Approved Stock Form—State Publishing Co., Helena, Montana—42329

File No.....

103 T. 5 N. R. 36 E. 5BD

TRIPLICATE

County Treasure

LOG

Casing Stickup = 18"

Top of Ground

(Elev. above sea level 2893.29 ft.)

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER C(
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Tan to grey sandy silt, with some clay.

10.0'

Grey sandy reworked shale, with some gravel.

Owner Montana Highway Commission Address Helena, Montana

Driller Montana Highway Dept. Address Helena, Montana

Date of Notice of appropriation of groundwater February 9, 1966

Date well started January 20, 1966 Date completed February 3, 1966

Type of well drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐ Industrial ☐ Drainage ☐ Other ☐

Rest Area Water Supply

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

34.0'

Grey clay.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6"	6" ID Steel 19.88 lbs. per ft.	0.0'	61.5'	NONE		

LA

60.0'

61.5' Grey sandy shale. Bottom of casing shoe.

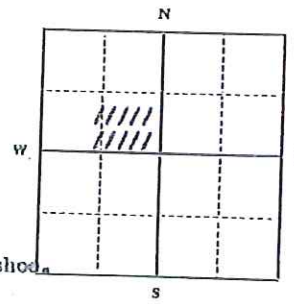
Soft grey sandstone.

70.0

Grey sandy gravel.

75.0 Bottomed hole in grey sandy gravel.

Show exact depth of bottom.



SE-1/4 NW 1/4 Sec. 5 T. 5 N. R. 36 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 24.0 feet.

Shut-in Pressure for Flowing Well.....

Pumping Water Level 50.0 feet at 16 gal. per minute.

Discharge in gal. per min. of flowing well .....

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e.: Lot, Block and Addition).

WATER ANALYSIS

pH	7.5	
CO_2	52	p.p.m.
Calcium & Magnesium Bicarbonates	352	p.p.m.
Sodium Bicarbonates	42	p.p.m.

Water is basic

This form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located, tissue copy to be retained by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

None required
Driller's License Number

Lehman B. Foy
Driller's Signature Hatls. Engr.

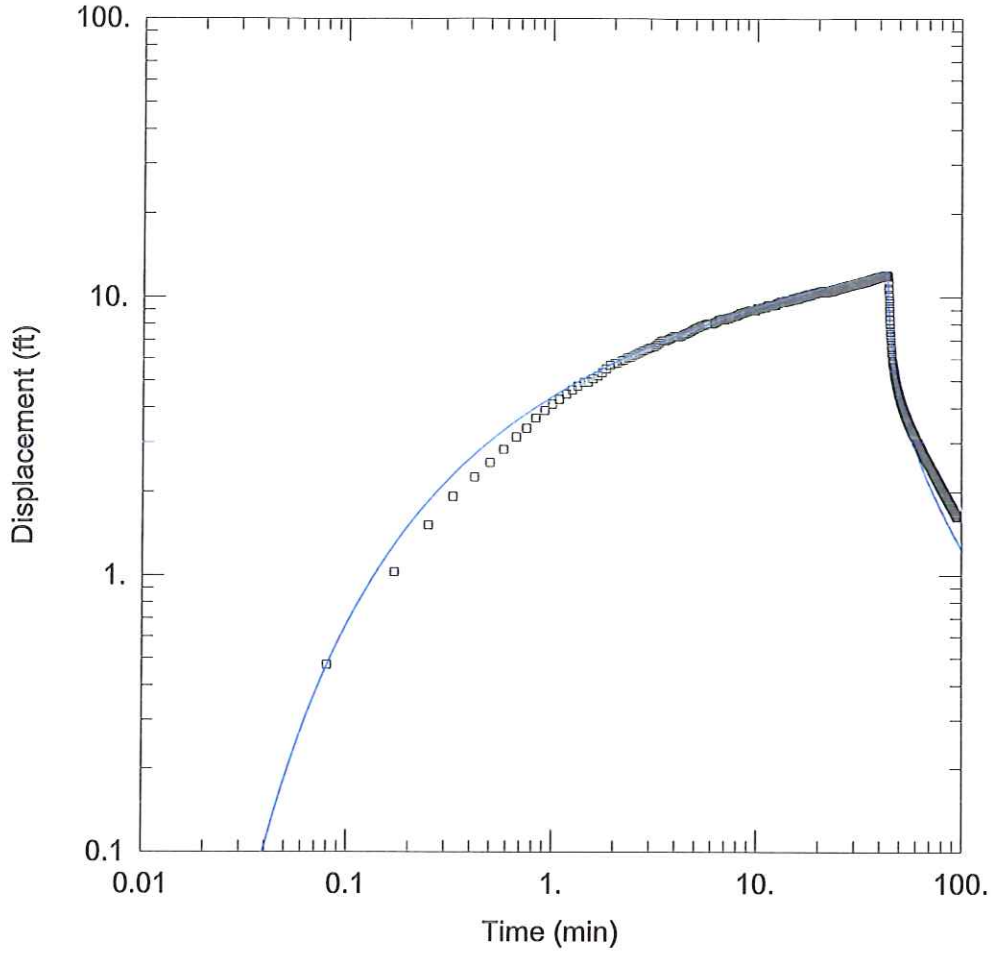
M: 17256

APPENDIX B

Well 1 Pumping Test Drawdown and Recovery

TABLE 1 AQTESOLVE Pumping Test Analysis Results

APPENDIX B



PWS WELL PERFORMANCE TEST

Data Set: H:\24\11355\106\Ground_Surface Water Monitoring\Hysham West Bound.aqt
Date: 07/22/15 Time: 15:19:46

PROJECT INFORMATION

Company: DOWL HKM
Client: MDT
Project: 4524,11408
Location: Hysham West Bound Rest Stop
Test Well: PWS Well
Test Date: 6-12-14

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PWSWell	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
PWSWell	0	0

SOLUTION

Aquifer Model: Leaky
Solution Method: Hantush-Jacob

T = 0.2339 ft^2/min
r/B = 1.0E-5
b = 10. ft

S = 0.8321
Kz/Kr = 1.0E-5

Data Set: C:\Users\jpotts\Documents\hysham\Ground_Surface Water Monitoring\Hysham West Bound.aqt
Title: PWS Well Performance Test
Date: 09/05/14
Time: 12:25:05

PROJECT INFORMATION

Company: DOWL HKM
Client: MDT
Project: 4524,11408
Location: Columbus West Bound Rest Stop
Test Date: 6-12-14
Test Well: PWS Well

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.
Aquitard Thickness (b'): 1. ft
Aquitard Thickness (b"): 1. ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: PWSWell

X Location: 0. ft
Y Location: 0. ft

Casing Radius: 0.25 ft
Well Radius: 0.3 ft

Partially Penetrating Well
Depth to Top of Screen: 8. ft
Depth to Bottom of Screen: 10. ft

No. of pumping periods: 3

Pumping Period Data

Time (min)	Rate (gal/min)	Time (min)	Rate (gal/min)
0.	10.	95.67	0.
43.58	0.		

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: PWSWell

X Location: 0. ft
Y Location: 0. ft

Radial distance from PWSWell: 0. ft

Partially Penetrating Well
Depth to Top of Screen: 8. ft
Depth to Bottom of Screen: 10. ft

No. of Observations: 1148

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
0.08	0.4754	47.92	4.986
0.17	1.028	48.	4.952
0.25	1.517	48.08	4.923
0.33	1.924	48.17	4.894
0.42	2.255	48.25	4.862
0.5	2.544	48.33	4.836
0.58	2.839	48.42	4.806
0.67	3.138	48.5	4.779
0.75	3.378	48.58	4.753
0.83	3.673	48.67	4.726
0.92	3.901	48.75	4.699

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
1.	4.116	48.83	4.673
1.08	4.298	48.92	4.649
1.17	4.48	49.	4.624
1.25	4.63	49.08	4.603
1.33	4.789	49.17	4.581
1.42	4.942	49.25	4.553
1.5	4.954	49.33	4.531
1.58	5.088	49.42	4.512
1.67	5.221	49.5	4.487
1.75	5.344	49.58	4.47
1.83	5.528	49.67	4.447
1.92	5.681	49.75	4.427
2.	5.76	49.83	4.408
2.08	5.791	49.92	4.39
2.17	5.905	50.	4.367
2.25	5.952	50.08	4.349
2.33	6.048	50.17	4.329
2.42	6.097	50.25	4.313
2.5	6.172	50.33	4.293
2.58	6.247	50.42	4.277
2.67	6.313	50.5	4.256
2.75	6.393	50.58	4.24
2.83	6.449	50.67	4.224
2.92	6.514	50.75	4.207
3.	6.572	50.83	4.193
3.08	6.618	50.92	4.178
3.17	6.663	51.	4.159
3.25	6.758	51.08	4.143
3.33	6.86	51.17	4.127
3.42	6.957	51.25	4.112
3.5	6.99	51.33	4.096
3.58	6.979	51.42	4.078
3.67	7.032	51.5	4.065
3.75	7.115	51.58	4.051
3.83	7.157	51.67	4.038
3.92	7.235	51.75	4.024
4.	7.256	51.83	4.011
4.08	7.217	51.92	3.996
4.17	7.222	52.	3.983
4.25	7.259	52.08	3.97
4.33	7.3	52.17	3.956
4.42	7.367	52.25	3.941
4.5	7.41	52.33	3.929
4.58	7.444	52.42	3.915
4.67	7.479	52.5	3.902
4.75	7.56	52.58	3.89
4.83	7.614	52.67	3.877
4.92	7.668	52.75	3.863
5.	7.718	52.83	3.852
5.08	7.772	52.92	3.839
5.17	7.788	53.	3.825
5.25	7.862	53.08	3.814
5.33	7.884	53.17	3.804
5.42	7.922	53.25	3.791
5.5	7.935	53.33	3.779
5.58	7.973	53.42	3.767
5.67	8.008	53.5	3.757
5.75	8.05	53.58	3.746
5.83	8.054	53.67	3.732
5.92	8.072	53.75	3.722
6.	8.015	53.83	3.711
6.08	8.036	53.92	3.703
6.17	8.096	54.	3.693
6.25	8.136	54.08	3.681
6.33	8.159	54.17	3.669
6.42	8.219	54.25	3.66
6.5	8.275	54.33	3.647
6.58	8.316	54.42	3.639
6.67	8.312	54.5	3.627
6.75	8.365	54.58	3.618
6.83	8.307	54.67	3.609
6.92	8.306	54.75	3.599
7.	8.311	54.83	3.588

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
7.08	8.399	54.92	3.577
7.17	8.411	55.	3.571
7.25	8.428	55.08	3.56
7.33	8.4	55.17	3.551
7.42	8.486	55.25	3.542
7.5	8.482	55.33	3.531
7.58	8.485	55.42	3.523
7.67	8.552	55.5	3.511
7.75	8.537	55.58	3.502
7.83	8.534	55.67	3.496
7.92	8.559	55.75	3.486
8.	8.633	55.83	3.478
8.08	8.665	55.92	3.469
8.17	8.674	56.	3.458
8.25	8.744	56.08	3.454
8.33	8.79	56.17	3.443
8.42	8.774	56.25	3.436
8.5	8.818	56.33	3.424
8.58	8.806	56.42	3.418
8.67	8.845	56.5	3.411
8.75	8.868	56.58	3.399
8.83	8.909	56.67	3.392
8.92	8.9	56.75	3.385
9.	8.912	56.83	3.377
9.08	8.934	56.92	3.369
9.17	8.966	57.	3.359
9.25	8.968	57.08	3.353
9.33	8.959	57.17	3.343
9.42	9.016	57.25	3.333
9.5	8.999	57.33	3.326
9.58	8.991	57.42	3.319
9.67	9.015	57.5	3.311
9.75	8.99	57.58	3.302
9.83	8.969	57.67	3.295
9.92	8.983	57.75	3.287
10.	9.074	57.83	3.281
10.08	9.123	57.92	3.273
10.17	9.155	58.	3.264
10.25	9.159	58.08	3.259
10.33	9.145	58.17	3.252
10.42	9.099	58.25	3.241
10.5	9.153	58.33	3.234
10.58	9.203	58.42	3.225
10.67	9.234	58.5	3.218
10.75	9.215	58.58	3.215
10.83	9.179	58.67	3.203
10.92	9.168	58.75	3.197
11.	9.204	58.83	3.192
11.08	9.257	58.92	3.184
11.17	9.291	59.	3.176
11.25	9.31	59.08	3.168
11.33	9.377	59.17	3.161
11.42	9.361	59.25	3.153
11.5	9.399	59.33	3.148
11.58	9.406	59.42	3.14
11.67	9.35	59.5	3.136
11.75	9.391	59.58	3.129
11.83	9.335	59.67	3.122
11.92	9.354	59.75	3.114
12.	9.362	59.83	3.107
12.08	9.371	59.92	3.101
12.17	9.388	60.	3.097
12.25	9.409	60.08	3.086
12.33	9.401	60.17	3.079
12.42	9.471	60.25	3.075
12.5	9.52	60.33	3.069
12.58	9.52	60.42	3.062
12.67	9.539	60.5	3.054
12.75	9.556	60.58	3.046
12.83	9.567	60.67	3.042
12.92	9.597	60.75	3.034
13.	9.64	60.83	3.027
13.08	9.62	60.92	3.024

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
13.17	9.642	61.	3.016
13.25	9.673	61.08	3.01
13.33	9.668	61.17	3.003
13.42	9.652	61.25	3.
13.5	9.642	61.33	2.99
13.58	9.631	61.42	2.988
13.67	9.601	61.5	2.978
13.75	9.644	61.58	2.972
13.83	9.747	61.67	2.968
13.92	9.77	61.75	2.964
14.	9.712	61.83	2.955
14.08	9.653	61.92	2.95
14.17	9.706	62.	2.945
14.25	9.699	62.08	2.939
14.33	9.705	62.17	2.932
14.42	9.725	62.25	2.926
14.5	9.719	62.33	2.922
14.58	9.767	62.42	2.912
14.67	9.765	62.5	2.907
14.75	9.819	62.58	2.904
14.83	9.842	62.67	2.898
14.92	9.899	62.75	2.892
15.	9.903	62.83	2.885
15.08	9.81	62.92	2.882
15.17	9.803	63.	2.875
15.25	9.888	63.08	2.867
15.33	9.927	63.17	2.864
15.42	9.953	63.25	2.858
15.5	9.866	63.33	2.854
15.58	9.863	63.42	2.848
15.67	9.946	63.5	2.841
15.75	10.01	63.58	2.837
15.83	9.989	63.67	2.832
15.92	9.896	63.75	2.826
16.	9.96	63.83	2.822
16.08	10.05	63.92	2.815
16.17	10.06	64.	2.811
16.25	9.966	64.08	2.806
16.33	9.956	64.17	2.801
16.42	10.03	64.25	2.795
16.5	10.07	64.33	2.791
16.58	10.01	64.42	2.785
16.67	10.06	64.5	2.778
16.75	10.13	64.58	2.775
16.83	10.11	64.67	2.768
16.92	10.05	64.75	2.762
17.	10.06	64.83	2.757
17.08	10.11	64.92	2.753
17.17	10.17	65.	2.747
17.25	10.09	65.08	2.744
17.33	10.08	65.17	2.736
17.42	10.2	65.25	2.731
17.5	10.23	65.33	2.728
17.58	10.2	65.42	2.721
17.67	10.12	65.5	2.715
17.75	10.14	65.58	2.714
17.83	10.25	65.67	2.708
17.92	10.28	65.75	2.704
18.	10.19	65.83	2.699
18.08	10.18	65.92	2.694
18.17	10.26	66.	2.689
18.25	10.31	66.08	2.684
18.33	10.24	66.17	2.679
18.42	10.2	66.25	2.672
18.5	10.25	66.33	2.67
18.58	10.27	66.42	2.663
18.67	10.34	66.5	2.659
18.75	10.33	66.58	2.653
18.83	10.36	66.67	2.651
18.92	10.35	66.75	2.644
19.	10.36	66.83	2.639
19.08	10.39	66.92	2.633
19.17	10.34	67.	2.629

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
19.25	10.29	67.08	2.624
19.33	10.32	67.17	2.618
19.42	10.39	67.25	2.617
19.5	10.39	67.33	2.609
19.58	10.44	67.42	2.606
19.67	10.42	67.5	2.602
19.75	10.37	67.58	2.597
19.83	10.42	67.67	2.593
19.92	10.47	67.75	2.587
20.	10.49	67.83	2.582
20.08	10.47	67.92	2.578
20.17	10.41	68.	2.575
20.25	10.44	68.08	2.566
20.33	10.51	68.17	2.565
20.42	10.43	68.25	2.56
20.5	10.47	68.33	2.559
20.58	10.56	68.42	2.554
20.67	10.54	68.5	2.546
20.75	10.53	68.58	2.543
20.83	10.5	68.67	2.542
20.92	10.49	68.75	2.534
21.	10.53	68.83	2.532
21.08	10.55	68.92	2.53
21.17	10.6	69.	2.526
21.25	10.56	69.08	2.52
21.33	10.53	69.17	2.518
21.42	10.55	69.25	2.51
21.5	10.45	69.33	2.505
21.58	10.41	69.42	2.504
21.67	10.4	69.5	2.498
21.75	10.46	69.58	2.496
21.83	10.51	69.67	2.49
21.92	10.47	69.75	2.487
22.	10.45	69.83	2.482
22.08	10.5	69.92	2.478
22.17	10.44	70.	2.474
22.25	10.54	70.08	2.473
22.33	10.48	70.17	2.468
22.42	10.45	70.25	2.463
22.5	10.5	70.33	2.458
22.58	10.58	70.42	2.454
22.67	10.57	70.5	2.451
22.75	10.49	70.58	2.446
22.83	10.52	70.67	2.441
22.92	10.59	70.75	2.439
23.	10.52	70.83	2.436
23.08	10.52	70.92	2.428
23.17	10.61	71.	2.429
23.25	10.65	71.08	2.425
23.33	10.6	71.17	2.42
23.42	10.56	71.25	2.415
23.5	10.64	71.33	2.411
23.58	10.55	71.42	2.406
23.67	10.63	71.5	2.404
23.75	10.69	71.58	2.401
23.83	10.64	71.67	2.397
23.92	10.6	71.75	2.391
24.	10.61	71.83	2.389
24.08	10.69	71.92	2.383
24.17	10.67	72.	2.382
24.25	10.64	72.08	2.378
24.33	10.7	72.17	2.375
24.42	10.74	72.25	2.37
24.5	10.68	72.33	2.367
24.58	10.65	72.42	2.363
24.67	10.69	72.5	2.358
24.75	10.76	72.58	2.353
24.83	10.76	72.67	2.351
24.92	10.7	72.75	2.347
25.	10.73	72.83	2.346
25.08	10.75	72.92	2.342
25.17	10.71	73.	2.336
25.25	10.78	73.08	2.333

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
25.33	10.82	73.17	2.335
25.42	10.74	73.25	2.325
25.5	10.81	73.33	2.322
25.58	10.82	73.42	2.318
25.67	10.74	73.5	2.315
25.75	10.79	73.58	2.314
25.83	10.86	73.67	2.307
25.92	10.8	73.75	2.305
26.	10.79	73.83	2.3
26.08	10.82	73.92	2.296
26.17	10.86	74.	2.293
26.25	10.9	74.08	2.292
26.33	10.9	74.17	2.287
26.42	10.85	74.25	2.286
26.5	10.83	74.33	2.283
26.58	10.82	74.42	2.277
26.67	10.9	74.5	2.273
26.75	10.88	74.58	2.27
26.83	10.86	74.67	2.267
26.92	10.91	74.75	2.264
27.	10.96	74.83	2.261
27.08	10.9	74.92	2.257
27.17	10.86	75.	2.253
27.25	10.93	75.08	2.252
27.33	10.97	75.17	2.246
27.42	10.94	75.25	2.243
27.5	10.91	75.33	2.239
27.58	10.94	75.42	2.236
27.67	10.98	75.5	2.231
27.75	10.98	75.58	2.231
27.83	10.96	75.67	2.224
27.92	10.97	75.75	2.221
28.	11.03	75.83	2.22
28.08	10.98	75.92	2.217
28.17	10.94	76.	2.212
28.25	11.04	76.08	2.208
28.33	11.01	76.17	2.204
28.42	10.99	76.25	2.201
28.5	11.07	76.33	2.2
28.58	10.98	76.42	2.199
28.67	10.99	76.5	2.193
28.75	11.09	76.58	2.188
28.83	11.05	76.67	2.185
28.92	11.1	76.75	2.183
29.	11.04	76.83	2.177
29.08	11.1	76.92	2.176
29.17	11.1	77.	2.172
29.25	11.04	77.08	2.168
29.33	11.04	77.17	2.166
29.42	11.12	77.25	2.165
29.5	11.08	77.33	2.158
29.58	11.05	77.42	2.157
29.67	11.12	77.5	2.155
29.75	11.15	77.58	2.149
29.83	11.08	77.67	2.146
29.92	11.11	77.75	2.143
30.	11.17	77.83	2.142
30.08	11.11	77.92	2.135
30.17	11.11	78.	2.133
30.25	11.17	78.08	2.13
30.33	11.19	78.17	2.128
30.42	11.13	78.25	2.123
30.5	11.1	78.33	2.121
30.58	11.17	78.42	2.117
30.67	11.22	78.5	2.114
30.75	11.21	78.58	2.109
30.83	11.14	78.67	2.108
30.92	11.15	78.75	2.106
31.	11.18	78.83	2.103
31.08	11.22	78.92	2.1
31.17	11.25	79.	2.095
31.25	11.25	79.08	2.092
31.33	11.21	79.17	2.09

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
31.42	11.17	79.25	2.087
31.5	11.19	79.33	2.084
31.58	11.22	79.42	2.081
31.67	11.25	79.5	2.081
31.75	11.27	79.58	2.076
31.83	11.26	79.67	2.071
31.92	11.25	79.75	2.068
32.	11.23	79.83	2.065
32.08	11.24	79.92	2.063
32.17	11.31	80.	2.06
32.25	11.28	80.08	2.057
32.33	11.24	80.17	2.054
32.42	11.33	80.25	2.051
32.5	11.35	80.33	2.051
32.58	11.27	80.42	2.046
32.67	11.29	80.5	2.042
32.75	11.33	80.58	2.04
32.83	11.34	80.67	2.039
32.92	11.29	80.75	2.034
33.	11.33	80.83	2.031
33.08	11.4	80.92	2.028
33.17	11.34	81.	2.025
33.25	11.29	81.08	2.024
33.33	11.36	81.17	2.019
33.42	11.41	81.25	2.018
33.5	11.39	81.33	2.016
33.58	11.33	81.42	2.011
33.67	11.34	81.5	2.01
33.75	11.42	81.58	2.004
33.83	11.42	81.67	2.003
33.92	11.36	81.75	2.
34.	11.42	81.83	1.997
34.08	11.4	81.92	1.997
34.17	11.38	82.	1.99
34.25	11.43	82.08	1.991
34.33	11.47	82.17	1.984
34.42	11.38	82.25	1.982
34.5	11.4	82.33	1.984
34.58	11.48	82.42	1.98
34.67	11.42	82.5	1.974
34.75	11.48	82.58	1.976
34.83	11.47	82.67	1.972
34.92	11.43	82.75	1.969
35.	11.44	82.83	1.966
35.08	11.5	82.92	1.961
35.17	11.51	83.	1.961
35.25	11.44	83.08	1.956
35.33	11.47	83.17	1.954
35.42	11.51	83.25	1.95
35.5	11.56	83.33	1.95
35.58	11.52	83.42	1.946
35.67	11.49	83.5	1.942
35.75	11.49	83.58	1.942
35.83	11.49	83.67	1.94
35.92	11.52	83.75	1.935
36.	11.56	83.83	1.931
36.08	11.6	83.92	1.932
36.17	11.57	84.	1.928
36.25	11.53	84.08	1.926
36.33	11.57	84.17	1.922
36.42	11.62	84.25	1.919
36.5	11.6	84.33	1.919
36.58	11.57	84.42	1.914
36.67	11.6	84.5	1.913
36.75	11.64	84.58	1.91
36.83	11.64	84.67	1.907
36.92	11.6	84.75	1.907
37.	11.61	84.83	1.903
37.08	11.68	84.92	1.901
37.17	11.68	85.	1.898
37.25	11.68	85.08	1.896
37.33	11.64	85.17	1.894
37.42	11.64	85.25	1.891

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
37.5	11.62	85.33	1.887
37.58	11.65	85.42	1.883
37.67	11.7	85.5	1.882
37.75	11.74	85.58	1.88
37.83	11.74	85.67	1.877
37.92	11.74	85.75	1.876
38.	11.74	85.83	1.873
38.08	11.7	85.92	1.871
38.17	11.69	86.	1.868
38.25	11.7	86.08	1.865
38.33	11.71	86.17	1.862
38.42	11.72	86.25	1.861
38.5	11.74	86.33	1.858
38.58	11.79	86.42	1.855
38.67	11.81	86.5	1.854
38.75	11.75	86.58	1.849
38.83	11.72	86.67	1.846
38.92	11.77	86.75	1.848
39.	11.82	86.83	1.842
39.08	11.79	86.92	1.842
39.17	11.82	87.	1.84
39.25	11.78	87.08	1.834
39.33	11.74	87.17	1.836
39.42	11.76	87.25	1.833
39.5	11.77	87.33	1.83
39.58	11.75	87.42	1.825
39.67	11.78	87.5	1.826
39.75	11.81	87.58	1.821
39.83	11.84	87.67	1.82
39.92	11.85	87.75	1.817
40.	11.81	87.83	1.814
40.08	11.78	87.92	1.812
40.17	11.83	88.	1.809
40.25	11.89	88.08	1.812
40.33	11.89	88.17	1.81
40.42	11.87	88.25	1.806
40.5	11.9	88.33	1.799
40.58	11.9	88.42	1.799
40.67	11.84	88.5	1.798
40.75	11.86	88.58	1.796
40.83	11.86	88.67	1.793
40.92	11.83	88.75	1.79
41.	11.84	88.83	1.789
41.08	11.86	88.92	1.789
41.17	11.87	89.	1.785
41.25	11.92	89.08	1.783
41.33	11.93	89.17	1.78
41.42	11.95	89.25	1.78
41.5	11.93	89.33	1.775
41.58	11.91	89.42	1.775
41.67	11.97	89.5	1.77
41.75	11.97	89.58	1.769
41.83	11.94	89.67	1.769
41.92	11.94	89.75	1.764
42.	11.94	89.83	1.764
42.08	11.9	89.92	1.761
42.17	11.88	90.	1.757
42.25	11.91	90.08	1.754
42.33	11.97	90.17	1.754
42.42	12.	90.25	1.752
42.5	11.93	90.33	1.748
42.58	11.91	90.42	1.746
42.67	11.97	90.5	1.744
42.75	12.02	90.58	1.741
42.83	12.01	90.67	1.739
42.92	11.98	90.75	1.736
43.	11.96	90.83	1.736
43.08	11.97	90.92	1.735
43.17	11.94	91.	1.731
43.25	11.98	91.08	1.73
43.33	11.99	91.17	1.726
43.42	11.94	91.25	1.725
43.5	11.98	91.33	1.722

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)
43.58	11.97	91.42	1.72
43.67	11.89	91.5	1.719
43.75	11.86	91.58	1.715
43.83	11.9	91.67	1.712
43.92	11.89	91.75	1.712
44.	11.88	91.83	1.707
44.08	11.87	91.92	1.708
44.17	11.36	92.	1.702
44.25	10.75	92.08	1.703
44.33	10.21	92.17	1.698
44.42	9.73	92.25	1.696
44.5	9.305	92.33	1.695
44.58	8.924	92.42	1.693
44.67	8.58	92.5	1.693
44.75	8.278	92.58	1.686
44.83	8.008	92.67	1.687
44.92	7.767	92.75	1.685
45.	7.555	92.83	1.684
45.08	7.362	92.92	1.682
45.17	7.192	93.	1.679
45.25	7.034	93.08	1.677
45.33	6.893	93.17	1.676
45.42	6.766	93.25	1.673
45.5	6.646	93.33	1.67
45.58	6.539	93.42	1.669
45.67	6.436	93.5	1.667
45.75	6.341	93.58	1.662
45.83	6.256	93.67	1.661
45.92	6.171	93.75	1.66
46.	6.094	93.83	1.66
46.08	6.02	93.92	1.656
46.17	5.949	94.	1.654
46.25	5.884	94.08	1.649
46.33	5.822	94.17	1.65
46.42	5.758	94.25	1.648
46.5	5.701	94.33	1.647
46.58	5.648	94.42	1.644
46.67	5.595	94.5	1.643
46.75	5.54	94.58	1.643
46.83	5.492	94.67	1.639
46.92	5.448	94.75	1.639
47.	5.401	94.83	1.634
47.08	5.356	94.92	1.633
47.17	5.314	95.	1.633
47.25	5.274	95.08	1.63
47.33	5.233	95.17	1.627
47.42	5.195	95.25	1.628
47.5	5.159	95.33	1.625
47.58	5.12	95.42	1.623
47.67	5.086	95.5	1.621
47.75	5.052	95.58	1.618
47.83	5.017	95.67	1.621

SOLUTION

Pumping Test
Aquifer Model: Leaky
Solution Method: Hantush-Jacob

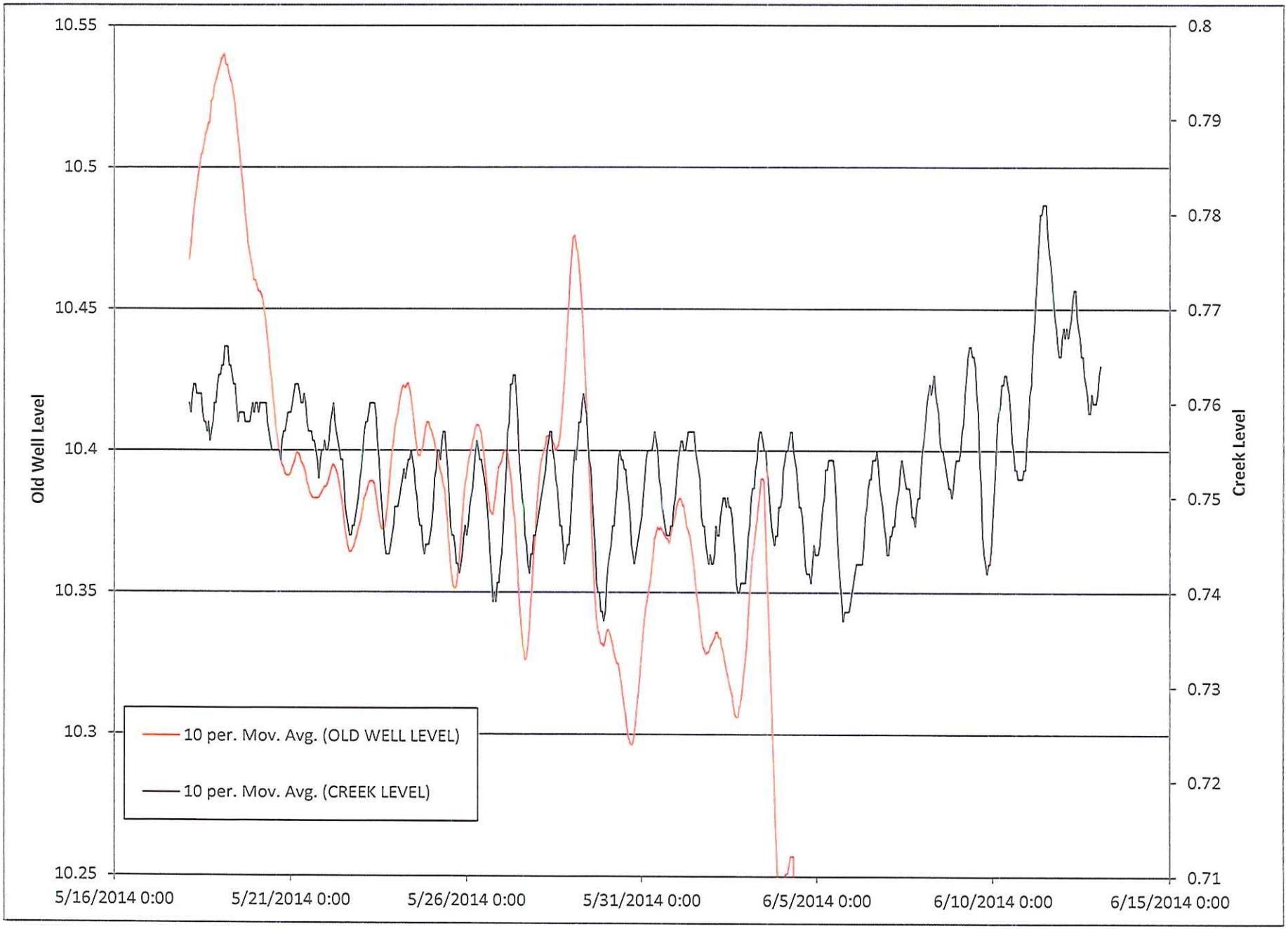
VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.1926	ft^2/min
S	0.9559	
r/B	1.0E-5	
Kz/Kr	1.	
b	10.	ft

K = T/b = 0.01926 ft/min (0.009784 cm/sec)
Ss = S/b = 0.09559 1/ft
K'/b' = 2.14E-10 min^{-1}

K' = 2.14E-10 ft/min


10.55
10.5
10.45
10.4
10.35
10.3
10.25
Old Well Level
0.8
0.79
0.78
0.77
0.76
0.75
0.74
0.73
0.72
0.71
Creek Level
5/16/2014 0:00
5/21/2014 0:00
5/26/2014 0:00
5/31/2014 0:00
6/5/2014 0:00
6/10/2014 0:00
6/15/2014 0:00
10 per. Mov. Avg. (OLD WELL LEVEL)
10 per. Mov. Avg. (CREEK LEVEL)

APPENDIX C

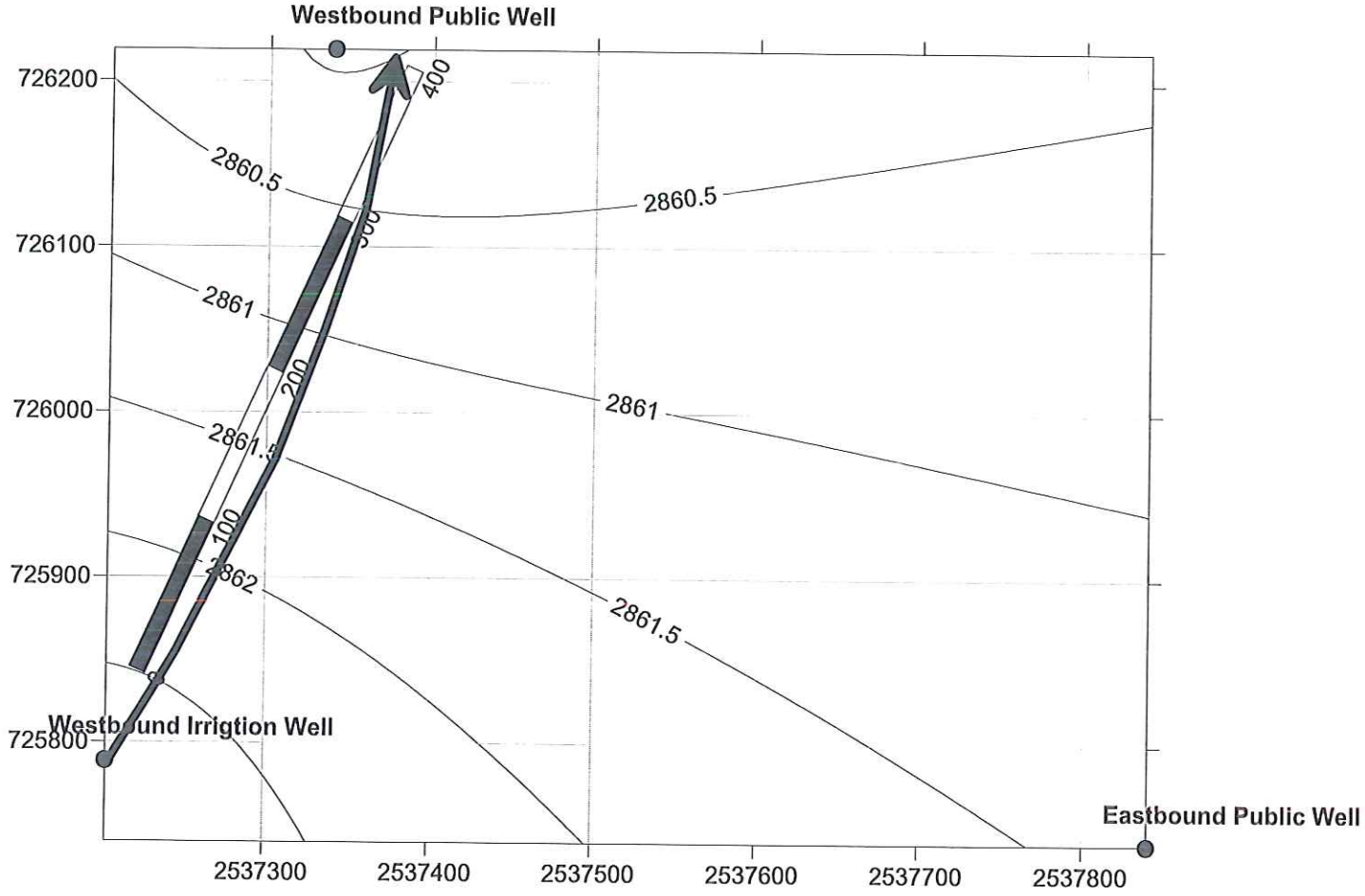
Hysham Rest Area Groundwater Surface Map

APPENDIX C

Hyshanm Rest Stop
Groundwater Elevation Contour Map
6/13/2014

Groundwater Flow Direction
North 24 Degrees East

Groundwater Gradient
(2862.5 - 2860.5)/310 = 0.0065



APPENDIX D

Hysham Rest Area Water Quality Results

APPENDIX D

ANALYTICAL SUMMARY REPORT

June 23, 2014

DOWL HKM
2090 Stadium Dr
Bozeman, MT 59715-0616

Work Order: B14061281

Project Name: Hysham Rest Stop

Energy Laboratories Inc Billings MT received the following 2 samples for DOWL HKM on 6/13/2014 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B14061281-001	Hysham Rest Stop West	06/13/14 10:40	06/13/14	Drinking Water	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water Alkalinity Bacteria, Private Water Supply Conductivity Hardness as CaCO3 Anions by Ion Chromatography Nitrogen, Nitrite Nitrogen, Nitrate + Nitrite Nitrogen, Nitrate pH Drinking Water Metals Digestion by EPA 200.2 Preparation, Dissolved Filtration Solids, Total Dissolved
B14061281-002	Hysham Rest Area East	06/13/14 12:50	06/13/14	Drinking Water	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water Alkalinity Bacteria, Private Water Supply Conductivity Mercury, Drinking Water Hardness as CaCO3 Anions by Ion Chromatography Nitrogen, Nitrite Nitrogen, Nitrate + Nitrite Nitrogen, Nitrate pH Drinking Water Metals Digestion by EPA 200.2 Preparation, Dissolved Filtration Digestion, Mercury by CVAA Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Cindy Rohrer
Laboratory Co-Manager

Digitally signed by
Cindy Rohrer
Date: 2014.06.23 09:12:15 -06:00

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop
Client Sample ID: Hysham Rest Stop West
Sampled By: Jim Potts
Lab ID: B14061281-001E

Report Date: 06/23/14
Collection Date: 06/13/14 10:40
Received Date: 06/13/14 15:12
Matrix: Drinking Water

Analyses	Result	Units	Safe/Unsafe	Qualifier	Method	Analysis Date / By
MICROBIOLOGICAL						
Coliform, Total	Absent	per 100ml	SAFE		A9223	06/13/14 16:53 / ldv
Coliform, E-Coli	Absent	per 100ml			A9223	06/13/14 16:53 / ldv

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

Method Reference: E - EPA / MCAWW Methodology A - Standard Methods 19th Ed.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop
Client Sample ID: Hysham Rest Area East
Sampled By: Jim Potts
Lab ID: B14061281-002E

Report Date: 06/23/14
Collection Date: 06/13/14 12:50
Received Date: 06/13/14 15:12
Matrix: Drinking Water

Analyses	Result	Units	Safe/Unsafe	Qualifier	Method	Analysis Date / By
MICROBIOLOGICAL						
Coliform, Total	Absent	per 100ml	SAFE		A9223	06/13/14 16:53 / ldv
Coliform, E-Coli	Absent	per 100ml			A9223	06/13/14 16:53 / ldv

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

Method Reference: E - EPA / MCAWW Methodology A - Standard Methods 19th Ed.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop
Lab ID: B14061281-001
Client Sample ID: Hysham Rest Stop West

Report Date: 06/23/14
Collection Date: 06/13/14 10:40
DateReceived: 06/13/14
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1		A4500-H B	06/13/14 16:29 / cnm
Conductivity @ 25 C	1550	umhos/cm		5		A2510 B	06/13/14 16:29 / cnm
Solids, Total Dissolved TDS @ 180 C	1050	mg/L		20		A2540 C	06/17/14 15:26 / pjw
INORGANICS							
Alkalinity, Total as CaCO3	393	mg/L		4		A2320 B	06/13/14 21:54 / bas
Chloride	13	mg/L		1		E300.0	06/17/14 09:43 / rbf
Sulfate	444	mg/L	D	5		E300.0	06/17/14 09:43 / rbf
Fluoride	0.2	mg/L		0.1		E300.0	06/19/14 00:17 / rbf
Hardness as CaCO3	379	mg/L		1		A2340 B	06/17/14 13:36 / sln
NUTRIENTS							
Nitrogen, Nitrite as N	ND	mg/L		0.05		E353.2	06/13/14 16:35 / jbm
Nitrogen, Nitrate as N	ND	mg/L		0.05		Calculation	06/18/14 12:32 / sln
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	10	E353.2	06/17/14 14:38 / jbm
METALS, DISSOLVED							
Calcium	81	mg/L		1		E200.7	06/16/14 20:52 / mas
Magnesium	43	mg/L		1		E200.7	06/16/14 20:52 / mas
Potassium	4	mg/L		1		E200.7	06/16/14 20:52 / mas
Sodium	234	mg/L		1		E200.7	06/16/14 20:52 / mas
METALS, TOTAL							
Antimony	ND	mg/L		0.001	0.006	E200.8	06/16/14 13:03 / amm
Arsenic	ND	mg/L		0.001	0.01	E200.8	06/16/14 13:03 / amm
Barium	ND	mg/L		0.05	2	E200.8	06/16/14 13:03 / amm
Beryllium	ND	mg/L		0.001	0.004	E200.8	06/16/14 13:03 / amm
Cadmium	ND	mg/L		0.001	0.005	E200.8	06/16/14 13:03 / amm
Chromium	ND	mg/L		0.005	0.1	E200.8	06/16/14 13:03 / amm
Iron	0.68	mg/L		0.02		E200.7	06/16/14 12:40 / mas
Manganese	0.257	mg/L		0.001		E200.7	06/16/14 12:40 / mas
Mercury	ND	mg/L		0.0001	0.002	E200.8	06/16/14 13:03 / amm
Nickel	ND	mg/L		0.01		E200.8	06/16/14 13:03 / amm
Selenium	ND	mg/L		0.001	0.05	E200.8	06/16/14 13:03 / amm
Thallium	ND	mg/L		0.0005	0.002	E200.8	06/16/14 13:03 / amm

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop
Lab ID: B14061281-002
Client Sample ID: Hysham Rest Area East

Report Date: 06/23/14
Collection Date: 06/13/14 12:50
DateReceived: 06/13/14
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.4	s.u.	H	0.1		A4500-H B	06/13/14 17:24 / cnm
Conductivity @ 25 C	1750	umhos/cm		5		A2510 B	06/13/14 17:24 / cnm
Solids, Total Dissolved TDS @ 180 C	1240	mg/L		20		A2540 C	06/17/14 15:28 / pjw
INORGANICS							
Alkalinity, Total as CaCO3	427	mg/L		4		A2320 B	06/13/14 22:09 / bas
Chloride	17	mg/L		1		E300.0	06/17/14 10:28 / rbf
Sulfate	544	mg/L	D	5		E300.0	06/17/14 10:28 / rbf
Fluoride	0.1	mg/L		0.1		E300.0	06/20/14 03:05 / rbf
Hardness as CaCO3	512	mg/L		1		A2340 B	06/17/14 13:36 / sln
NUTRIENTS							
Nitrogen, Nitrite as N	0.19	mg/L		0.05		E353.2	06/13/14 16:37 / jbm
Nitrogen, Nitrate as N	ND	mg/L		0.05		Calculation	06/18/14 12:32 / sln
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	10	E353.2	06/17/14 14:41 / jbm
METALS, DISSOLVED							
Calcium	105	mg/L		1		E200.7	06/16/14 20:55 / mas
Magnesium	61	mg/L		1		E200.7	06/16/14 20:55 / mas
Potassium	5	mg/L		1		E200.7	06/16/14 20:55 / mas
Sodium	239	mg/L		1		E200.7	06/16/14 20:55 / mas
METALS, TOTAL							
Antimony	ND	mg/L		0.001	0.006	E200.8	06/19/14 18:13 / amm
Arsenic	0.005	mg/L		0.001	0.01	E200.8	06/19/14 18:13 / amm
Barium	ND	mg/L		0.05	2	E200.8	06/19/14 18:13 / amm
Beryllium	ND	mg/L		0.001	0.004	E200.8	06/19/14 18:13 / amm
Cadmium	ND	mg/L		0.001	0.005	E200.8	06/19/14 18:13 / amm
Chromium	ND	mg/L		0.005	0.1	E200.8	06/19/14 18:13 / amm
Iron	16.2	mg/L		0.02		E200.7	06/20/14 03:01 / mas
Manganese	0.437	mg/L		0.001		E200.8	06/19/14 18:13 / amm
Mercury	ND	mg/L		0.0001	0.002	E245.1	06/20/14 14:12 / ser
Nickel	0.01	mg/L		0.01		E200.8	06/19/14 18:13 / amm
Selenium	ND	mg/L		0.001	0.05	E200.8	06/19/14 18:13 / amm
Thallium	ND	mg/L		0.0005	0.002	E200.8	06/19/14 18:13 / amm

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R225504
Lab ID: MBLK		Method Blank				Run: MAN-TECH_140613A				06/13/14 21:28
Alkalinity, Total as CaCO3		ND	mg/L	4.0						
Lab ID: LCS		Laboratory Control Sample				Run: MAN-TECH_140613A				06/13/14 21:36
Alkalinity, Total as CaCO3		99.5	mg/L	4.0	99	90	110			
Lab ID: B14061277-002ADUP		Sample Duplicate				Run: MAN-TECH_140613A				06/13/14 21:47
Alkalinity, Total as CaCO3		ND	mg/L	4.0					10	
Lab ID: B14061281-001AMS		Sample Matrix Spike				Run: MAN-TECH_140613A				06/13/14 22:02
Alkalinity, Total as CaCO3		551	mg/L	4.0	93	80	120			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2510 B									Analytical Run: PHSC _101-B_140613A	
Lab ID: SC 150		Continuing Calibration Verification Standard								06/13/14 09:13
Conductivity @ 25 C		150	umhos/cm	5.0	100	90	110			
Lab ID: SC 5000		Continuing Calibration Verification Standard								06/13/14 09:15
Conductivity @ 25 C		4940	umhos/cm	5.0	99	90	110			
Lab ID: CCV - SC 1413		Continuing Calibration Verification Standard								06/13/14 13:29
Conductivity @ 25 C		1410	umhos/cm	5.0	100	90	110			
Lab ID: CCV - SC 1413		Continuing Calibration Verification Standard								06/13/14 16:44
Conductivity @ 25 C		1400	umhos/cm	5.0	99	90	110			
Method: A2510 B										Batch: R225437
Lab ID: SC 20000		Continuing Calibration Verification Standard				Run: PHSC _101-B_140613A				06/13/14 09:18
Conductivity @ 25 C		19900	umhos/cm	5.0	99	90	110			
Lab ID: SC 2nd 1413		Laboratory Control Sample				Run: PHSC _101-B_140613A				06/13/14 09:21
Conductivity @ 25 C		1360	umhos/cm	5.0	96	90	110			
Lab ID: MBLK		Method Blank				Run: PHSC _101-B_140613A				06/13/14 16:05
Conductivity @ 25 C		4.00	umhos/cm	5.0						
Lab ID: B14061268-001ADUP		Sample Duplicate				Run: PHSC _101-B_140613A				06/13/14 16:10
Conductivity @ 25 C		34000	umhos/cm	5.0				0.1	10	
Lab ID: B14061281-001ADUP		Sample Duplicate				Run: PHSC _101-B_140613A				06/13/14 16:31
Conductivity @ 25 C		1550	umhos/cm	5.0				0.0	10	
Lab ID: MBLK		Method Blank				Run: PHSC _101-B_140613A				06/13/14 17:21
Conductivity @ 25 C		3.00	umhos/cm	5.0						
Lab ID: B14061281-002ADUP		Sample Duplicate				Run: PHSC _101-B_140613A				06/13/14 17:26
Conductivity @ 25 C		1760	umhos/cm	5.0				0.5	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: TDS140617A
Lab ID: MB-1_140617A		Method Blank				Run: BAL #11_140617B				06/17/14 15:23
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	3						
Lab ID: LCS-2_140617A		Laboratory Control Sample				Run: BAL #11_140617B				06/17/14 15:24
Solids, Total Dissolved TDS @ 180 C		2020	mg/L	10	101	90	110			
Lab ID: B14061281-001A MS		Sample Matrix Spike				Run: BAL #11_140617B				06/17/14 15:26
Solids, Total Dissolved TDS @ 180 C		2990	mg/L	10	97	90	110			
Lab ID: B14061277-001A DUP		Sample Duplicate				Run: BAL #11_140617B				06/17/14 15:27
Solids, Total Dissolved TDS @ 180 C		2160	mg/L	10		90	110	0.4	5	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B									Analytical Run: PHSC _101-B_140613A	
Lab ID: pH 8	Initial Calibration Verification Standard								06/13/14 09:10	
pH		7.95	s.u.	0.10	99	98	102			
Lab ID: CCV - pH 7	Continuing Calibration Verification Standard								06/13/14 13:41	
pH		6.99	s.u.	0.10	100	98	102			
Lab ID: CCV - pH 7	Continuing Calibration Verification Standard								06/13/14 16:42	
pH		7.00	s.u.	0.10	100	98	102			
Method: A4500-H B										Batch: R225437
Lab ID: B14061281-001ADUP	Sample Duplicate					Run: PHSC _101-B_140613A			06/13/14 16:31	
pH		7.54	s.u.	0.10				0.4	3	
Lab ID: B14061281-002ADUP	Sample Duplicate					Run: PHSC _101-B_140613A			06/13/14 17:26	
pH		7.45	s.u.	0.10				0.0	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP203-B_140616A
Lab ID: ICV	6	Continuing Calibration Verification Standard								06/16/14 11:46
Calcium		25.0	mg/L	1.0	100	95	105			
Iron		2.49	mg/L	0.020	100	95	105			
Magnesium		25.3	mg/L	1.0	101	95	105			
Manganese		2.49	mg/L	0.010	100	95	105			
Potassium		24.9	mg/L	1.0	100	95	105			
Sodium		25.0	mg/L	1.0	100	95	105			
Method: E200.7										Batch: R225546
Lab ID: MB-6500DIS140616A	6	Method Blank				Run: ICP203-B_140616A				06/16/14 12:10
Calcium		ND	mg/L	0.01						
Iron		ND	mg/L	0.004						
Magnesium		ND	mg/L	0.003						
Manganese		ND	mg/L	0.0005						
Potassium		ND	mg/L	0.08						
Sodium		ND	mg/L	0.03						
Lab ID: LFB-6500DIS140616A	6	Laboratory Fortified Blank				Run: ICP203-B_140616A				06/16/14 12:13
Calcium		51.1	mg/L	1.0	102	85	115			
Iron		5.04	mg/L	0.020	101	85	115			
Magnesium		52.4	mg/L	1.0	105	85	115			
Manganese		5.12	mg/L	0.010	102	85	115			
Potassium		52.0	mg/L	1.0	104	85	115			
Sodium		51.9	mg/L	1.0	104	85	115			
Lab ID: B14061188-001AMS2	6	Sample Matrix Spike				Run: ICP203-B_140616A				06/16/14 12:50
Calcium		60.8	mg/L	1.0	107	70	130			
Iron		5.32	mg/L	0.020	105	70	130			
Magnesium		56.3	mg/L	1.0	109	70	130			
Manganese		5.37	mg/L	0.0010	107	70	130			
Potassium		53.7	mg/L	1.0	104	70	130			
Sodium		57.7	mg/L	1.0	109	70	130			
Lab ID: B14061188-001AMSD	6	Sample Matrix Spike Duplicate				Run: ICP203-B_140616A				06/16/14 12:53
Calcium		61.0	mg/L	1.0	108	70	130	0.4	20	
Iron		5.37	mg/L	0.020	106	70	130	1.0	20	
Magnesium		56.6	mg/L	1.0	110	70	130	0.5	20	
Manganese		5.39	mg/L	0.0010	108	70	130	0.4	20	
Potassium		54.6	mg/L	1.0	106	70	130	1.7	20	
Sodium		57.7	mg/L	1.0	109	70	130	0.1	20	
Lab ID: B14061320-002BMS2	6	Sample Matrix Spike				Run: ICP203-B_140616A				06/16/14 21:12
Calcium		119	mg/L	1.0	106	70	130			
Iron		10.6	mg/L	0.020	105	70	130			
Magnesium		110	mg/L	1.0	107	70	130			
Manganese		10.7	mg/L	0.0010	107	70	130			
Potassium		108	mg/L	1.0	107	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Batch: R225546
Lab ID: B14061320-002BMS2	6	Sample Matrix Spike				Run: ICP203-B_140616A				06/16/14 21:12
Sodium		112	mg/L	1.4	106	70	130			
Lab ID: B14061320-002BMSD	6	Sample Matrix Spike Duplicate				Run: ICP203-B_140616A				06/16/14 21:22
Calcium		119	mg/L	1.0	106	70	130	0.3	20	
Iron		10.7	mg/L	0.020	106	70	130	0.5	20	
Magnesium		111	mg/L	1.0	107	70	130	0.6	20	
Manganese		10.7	mg/L	0.0010	107	70	130	0.2	20	
Potassium		108	mg/L	1.0	107	70	130	0.1	20	
Sodium		113	mg/L	1.4	106	70	130	0.4	20	
Method: E200.7										Analytical Run: ICP203-B_140619A
Lab ID: ICV		Continuing Calibration Verification Standard								06/19/14 10:21
Iron		2.46	mg/L	0.020	99	95	105			
Method: E200.7										Batch: 80682
Lab ID: MB-80682		Method Blank				Run: ICP203-B_140619A				06/20/14 02:31
Iron		ND	mg/L	0.004						
Lab ID: LCS-80682		Laboratory Control Sample				Run: ICP203-B_140619A				06/20/14 02:35
Iron		2.52	mg/L	0.020	101	85	115			
Lab ID: B14061092-019AMS3		Sample Matrix Spike				Run: ICP203-B_140619A				06/20/14 02:55
Iron		3.67	mg/L	0.020	106	70	130			
Lab ID: B14061092-019AMSD		Sample Matrix Spike Duplicate				Run: ICP203-B_140619A				06/20/14 02:58
Iron		3.61	mg/L	0.020	104	70	130	1.8	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS202-B_140616A	
Lab ID: QCS	10	Initial Calibration Verification Standard							06/16/14 11:05	
Antimony		0.0495	mg/L	0.050	99	90	110			
Arsenic		0.0514	mg/L	0.0050	103	90	110			
Barium		0.0495	mg/L	0.10	99	90	110			
Beryllium		0.0249	mg/L	0.0010	99	90	110			
Cadmium		0.0255	mg/L	0.0010	102	90	110			
Chromium		0.0509	mg/L	0.010	102	90	110			
Mercury		0.00196	mg/L	0.0010	98	90	110			
Nickel		0.0522	mg/L	0.010	104	90	110			
Selenium		0.0526	mg/L	0.0050	105	90	110			
Thallium		0.0486	mg/L	0.10	97	90	110			
Method: E200.8									Batch: R225574	
Lab ID: LFB	10	Laboratory Fortified Blank				Run: ICPMS202-B_140616A			06/16/14 11:10	
Antimony		0.0454	mg/L	0.050	91	85	115			
Arsenic		0.0498	mg/L	0.0050	100	85	115			
Barium		0.0496	mg/L	0.10	99	85	115			
Beryllium		0.0486	mg/L	0.0010	97	85	115			
Cadmium		0.0495	mg/L	0.0010	99	85	115			
Chromium		0.0499	mg/L	0.010	100	85	115			
Mercury		0.000970	mg/L	0.0010	97	85	115			
Nickel		0.0494	mg/L	0.010	99	85	115			
Selenium		0.0490	mg/L	0.0050	98	85	115			
Thallium		0.0496	mg/L	0.10	99	85	115			
Lab ID: LRB	10	Method Blank				Run: ICPMS202-B_140616A			06/16/14 11:38	
Antimony		ND	mg/L	1E-05						
Arsenic		ND	mg/L	6E-05						
Barium		ND	mg/L	4E-05						
Beryllium		ND	mg/L	1E-05						
Cadmium		ND	mg/L	1E-05						
Chromium		ND	mg/L	3E-05						
Mercury		ND	mg/L	5E-06						
Nickel		ND	mg/L	6E-05						
Selenium		ND	mg/L	0.0003						
Thallium		ND	mg/L	1E-05						
Lab ID: B14061281-001CMS	10	Sample Matrix Spike				Run: ICPMS202-B_140616A			06/16/14 13:06	
Antimony		0.0458	mg/L	0.0010	92	70	130			
Arsenic		0.0519	mg/L	0.0010	103	70	130			
Barium		0.0651	mg/L	0.050	91	70	130			
Beryllium		0.0482	mg/L	0.0010	96	70	130			
Cadmium		0.0478	mg/L	0.0010	96	70	130			
Chromium		0.0515	mg/L	0.0050	102	70	130			
Mercury		0.000900	mg/L	0.00010	90	70	130			
Nickel		0.0495	mg/L	0.010	93	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: R225574
Lab ID: B14061281-001CMS	10	Sample Matrix Spike				Run: ICPMS202-B_140616A				06/16/14 13:06
Selenium		0.0514	mg/L	0.0010	103	70	130			
Thallium		0.0486	mg/L	0.00050	97	70	130			
Lab ID: B14061281-001CMSD	10	Sample Matrix Spike Duplicate				Run: ICPMS202-B_140616A				06/16/14 13:12
Antimony		0.0478	mg/L	0.0010	96	70	130	4.2	20	
Arsenic		0.0536	mg/L	0.0010	106	70	130	3.2	20	
Barium		0.0670	mg/L	0.050	95	70	130	2.8	20	
Beryllium		0.0496	mg/L	0.0010	99	70	130	2.9	20	
Cadmium		0.0492	mg/L	0.0010	98	70	130	2.9	20	
Chromium		0.0532	mg/L	0.0050	105	70	130	3.1	20	
Mercury		0.000911	mg/L	0.00010	91	70	130	1.2	20	
Nickel		0.0513	mg/L	0.010	96	70	130	3.4	20	
Selenium		0.0536	mg/L	0.0010	107	70	130	4.3	20	
Thallium		0.0506	mg/L	0.00050	101	70	130	4.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS202-B_140619A	
Lab ID: QCS	10	Initial Calibration Verification Standard							06/19/14 09:47	
Antimony		0.0501	mg/L	0.050	100	90	110			
Arsenic		0.0512	mg/L	0.0050	102	90	110			
Barium		0.0502	mg/L	0.10	100	90	110			
Beryllium		0.0251	mg/L	0.0010	100	90	110			
Cadmium		0.0256	mg/L	0.0010	102	90	110			
Chromium		0.0510	mg/L	0.010	102	90	110			
Manganese		0.254	mg/L	0.010	102	90	110			
Nickel		0.0507	mg/L	0.010	101	90	110			
Selenium		0.0508	mg/L	0.0050	102	90	110			
Thallium		0.0492	mg/L	0.10	98	90	110			
Method: E200.8									Batch: 80682	
Lab ID: MB-80682	10	Method Blank				Run: ICPMS202-B_140619A			06/19/14 17:42	
Antimony		5E-05	mg/L	1E-05						
Arsenic		ND	mg/L	6E-05						
Barium		ND	mg/L	4E-05						
Beryllium		ND	mg/L	1E-05						
Cadmium		ND	mg/L	1E-05						
Chromium		0.0004	mg/L	3E-05						
Manganese		0.0001	mg/L	2E-05						
Nickel		0.0002	mg/L	6E-05						
Selenium		ND	mg/L	0.0003						
Thallium		ND	mg/L	1E-05						
Lab ID: LCS-80682	10	Laboratory Control Sample				Run: ICPMS202-B_140619A			06/19/14 17:44	
Antimony		0.540	mg/L	0.0010	108	85	115			
Arsenic		0.537	mg/L	0.0010	107	85	115			
Barium		0.542	mg/L	0.050	108	85	115			
Beryllium		0.253	mg/L	0.0010	101	85	115			
Cadmium		0.268	mg/L	0.0010	107	85	115			
Chromium		0.528	mg/L	0.0050	106	85	115			
Manganese		2.62	mg/L	0.0010	105	85	115			
Nickel		0.534	mg/L	0.010	107	85	115			
Selenium		0.537	mg/L	0.0010	107	85	115			
Thallium		0.535	mg/L	0.00050	107	85	115			
Lab ID: B14061092-019AMS3	10	Sample Matrix Spike				Run: ICPMS202-B_140619A			06/19/14 18:03	
Antimony		0.538	mg/L	0.0010	108	70	130			
Arsenic		0.521	mg/L	0.0010	104	70	130			
Barium		0.583	mg/L	0.050	109	70	130			
Beryllium		0.249	mg/L	0.0010	100	70	130			
Cadmium		0.266	mg/L	0.0010	106	70	130			
Chromium		0.517	mg/L	0.0050	103	70	130			
Manganese		2.64	mg/L	0.0010	102	70	130			
Nickel		0.523	mg/L	0.010	102	70	130			

Qualifiers:

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ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: 80682
Lab ID: B14061092-019AMS3	10	Sample Matrix Spike				Run: ICPMS202-B_140619A				06/19/14 18:03
Selenium		0.511	mg/L	0.0010	102	70	130			
Thallium		0.527	mg/L	0.00050	105	70	130			
Lab ID: B14061092-019AMSD	10	Sample Matrix Spike Duplicate				Run: ICPMS202-B_140619A				06/19/14 18:05
Antimony		0.536	mg/L	0.0010	107	70	130	0.4	20	
Arsenic		0.520	mg/L	0.0010	104	70	130	0.2	20	
Barium		0.574	mg/L	0.050	107	70	130	1.5	20	
Beryllium		0.248	mg/L	0.0010	99	70	130	0.3	20	
Cadmium		0.262	mg/L	0.0010	105	70	130	1.6	20	
Chromium		0.509	mg/L	0.0050	102	70	130	1.5	20	
Manganese		2.61	mg/L	0.0010	101	70	130	1.1	20	
Nickel		0.526	mg/L	0.010	103	70	130	0.5	20	
Selenium		0.519	mg/L	0.0010	104	70	130	1.6	20	
Thallium		0.524	mg/L	0.00050	105	70	130	0.6	20	

Qualifiers:

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ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E245.1									Analytical Run: HGCV202-B_140620A	
Lab ID: QCS		Initial Calibration Verification Standard							06/20/14 13:59	
Mercury		0.00202	mg/L	0.00010	101	90	110			
Method: E245.1									Batch: 80739	
Lab ID: MB-80739		Method Blank				Run: HGCV202-B_140620A			06/20/14 14:04	
Mercury		ND	mg/L	1E-05						
Lab ID: LCS-80739		Laboratory Control Sample				Run: HGCV202-B_140620A			06/20/14 14:06	
Mercury		0.00202	mg/L	0.00010	101	85	115			
Lab ID: B14061281-002CMS		Sample Matrix Spike				Run: HGCV202-B_140620A			06/20/14 14:13	
Mercury		0.00183	mg/L	0.00010	92	70	130			
Lab ID: B14061281-002CMSD		Sample Matrix Spike Duplicate				Run: HGCV202-B_140620A			06/20/14 14:15	
Mercury		0.00186	mg/L	0.00010	93	70	130	1.6	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0									Analytical Run: IC202-B_140616A	
Lab ID: ICV	3	Initial Calibration Verification Standard							06/16/14 11:02	
Chloride		24.8	mg/L	1.0	99	90	110			
Sulfate		96.9	mg/L	1.0	97	90	110			
Fluoride		11.7	mg/L	0.12	93	90	110			
Method: E300.0									Batch: R225603	
Lab ID: ICB	3	Method Blank				Run: IC202-B_140616A			06/16/14 11:17	
Chloride		ND	mg/L	0.06						
Sulfate		ND	mg/L	0.2						
Fluoride		ND	mg/L	0.03						
Lab ID: LFB	3	Laboratory Fortified Blank				Run: IC202-B_140616A			06/16/14 11:32	
Chloride		24.3	mg/L	1.0	97	90	110			
Sulfate		96.9	mg/L	1.1	97	90	110			
Fluoride		11.8	mg/L	0.13	94	90	110			
Lab ID: B14061281-001AMS	3	Sample Matrix Spike				Run: IC202-B_140616A			06/17/14 09:58	
Chloride		136	mg/L	1.3	98	90	110			
Sulfate		927	mg/L	5.3	97	90	110			
Fluoride		62.9	mg/L	0.66	100	90	110			
Lab ID: B14061281-001AMSD	3	Sample Matrix Spike Duplicate				Run: IC202-B_140616A			06/17/14 10:13	
Chloride		139	mg/L	1.3	101	90	110	2.4	20	
Sulfate		921	mg/L	5.3	95	90	110	0.6	20	
Fluoride		64.1	mg/L	0.66	102	90	110	1.8	20	
Lab ID: B14061006-002AMS	3	Sample Matrix Spike				Run: IC202-B_140616A			06/18/14 23:01	
Chloride		62.6	mg/L	1.0	98	90	110			
Sulfate		2130	mg/L	2.1		90	110			A
Fluoride		25.4	mg/L	0.26	99	90	110			
Lab ID: B14061006-002AMSD	3	Sample Matrix Spike Duplicate				Run: IC202-B_140616A			06/18/14 23:16	
Chloride		62.7	mg/L	1.0	98	90	110	0.2	20	
Sulfate		2140	mg/L	2.1		90	110	0.5	20	A
Fluoride		25.5	mg/L	0.26	100	90	110	0.4	20	
Lab ID: B14061268-001AMS	3	Sample Matrix Spike				Run: IC202-B_140616A			06/20/14 02:19	
Chloride		496	mg/L	5.3	99	90	110			
Sulfate		36800	mg/L	21		90	110			A
Fluoride		228	mg/L	2.6	91	90	110			
Lab ID: B14061268-001AMSD	3	Sample Matrix Spike Duplicate				Run: IC202-B_140616A			06/20/14 02:34	
Chloride		489	mg/L	5.3	97	90	110	1.5	20	
Sulfate		37000	mg/L	21		90	110	0.6	20	A
Fluoride		225	mg/L	2.6	90	90	110	1.2	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

A - The analyte level was greater than four times the spike level. In accordance with the method % recovery is not calculated.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL HKM
Project: Hysham Rest Stop

Report Date: 06/23/14
Work Order: B14061281

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2										Analytical Run: FIA203-B_140613B
Lab ID: ICV		Initial Calibration Verification Standard								06/13/14 16:03
Nitrogen, Nitrite as N		3.07	mg/L	0.30	101	90	110			
Method: E353.2										Batch: R225503
Lab ID: MBLK		Method Blank				Run: FIA203-B_140613B				06/13/14 16:04
Nitrogen, Nitrite as N		ND	mg/L	0.006						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA203-B_140613B				06/13/14 16:06
Nitrogen, Nitrite as N		0.511	mg/L	0.050	102	90	110			
Lab ID: B14061146-003AMS		Sample Matrix Spike				Run: FIA203-B_140613B				06/13/14 16:26
Nitrogen, Nitrite as N		0.526	mg/L	0.050	103	90	110			
Lab ID: B14061146-003AMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_140613B				06/13/14 16:27
Nitrogen, Nitrite as N		0.528	mg/L	0.050	103	90	110	0.4	10	
Method: E353.2										Analytical Run: FIA204-B_140617B
Lab ID: ICV		Initial Calibration Verification Standard								06/17/14 13:27
Nitrogen, Nitrate+Nitrite as N		13.1	mg/L	0.060	91	90	110			
Method: E353.2										Batch: R225633
Lab ID: MBLK		Method Blank				Run: FIA204-B_140617B				06/17/14 13:28
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.003						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA204-B_140617B				06/17/14 13:29
Nitrogen, Nitrate+Nitrite as N		1.03	mg/L	0.010	103	90	110			
Lab ID: B14061281-001DMS		Sample Matrix Spike				Run: FIA204-B_140617B				06/17/14 14:39
Nitrogen, Nitrate+Nitrite as N		1.01	mg/L	0.010	101	90	110			
Lab ID: B14061281-001DMSD		Sample Matrix Spike Duplicate				Run: FIA204-B_140617B				06/17/14 14:40
Nitrogen, Nitrate+Nitrite as N		0.990	mg/L	0.010	99	90	110	2.0	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Workorder Receipt Checklist

DOWL HKM

B14061281

Login completed by: Randa Nees
Reviewed by: BL2000\jmueller
Reviewed Date: 6/16/2014

Date Received: 6/13/2014
Received by: dlf
Carrier name: Hand Del

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

Standard Reporting Procedures:

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

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

Contact and Corrective Action Comments:

Temp Blank temperature for Cooler 1 was 2.0℃ and Cooler 2 was 3.2℃.

Samples for Nitrate as N and Nitrate+Nitrite were received at pH ~ 7. 2 mL of sulfuric acid was added to each sample in the laboratory to preserve to pH<2.

Samples for Dissolved Metals/Hardness were subsampled, filtered and preserved to pH <2 with 2 mL of nitric acid per 250 mL in the laboratory. According to 40CFR136, samples for Dissolved Metals should be filtered and preserved within 15 minutes of collection.

Chain of Custody and Analytical Request Record

PLEASE PRINT (Provide as much information as possible.)

Page 1 of 1

Company Name: Dowl HKM

Report Mail Address (Required): 2090 Stadium Drive, Bozeman, MT 59715

☐ No Hard Copy Email:

Invoice Address (Required): AA

☐ No Hard Copy Email:

Special Report/Formats:
☐ DW ☐ EDD/EDT (Electronic Data)
☐ POTW/WWTP Format:
☐ State: ☐ LEVEL IV
☐ Other: ☐ NELAC

Project Name, PWS, Permit, Etc.: Hysham Rest Stop

Sample Origin State: MT

EPA/State Compliance: Yes ☐ No ☐

Contact Name: Bill Dreyer Phone/Fax: 586-8814 Cell:

Sampler: (Please Print) Jim Potts

Invoice Contact & Phone: AA

Purchase Order:

Quote/Bottle Order:

ANALYSIS REQUESTED

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids
Vegetation Bioassay Other
(DW) Drinking Water

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	(Bottle Ord 208773)	(20 Drinking Water)	SEE ATTACHED
1 Hysham Rest Stop West	6-13-14	10:40	GW	X	X	
2 Hysham Rest Stop East	6-13-14	12:50	GW	X	X	
3						
4						
5						
6						
7						
8						
9						
10						

Standard Turnaround (TAT)

RUSH

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

Comments:

Shipped by: hand

Cooler ID(s): TB

Receipt Temp: 2.9 / 3.2 °C

On Ice: (Y) N

Custody Seal: On Bottle Y (N) On Cooler Y (N)

Intact Y N

Signature Match Y N

LABORATORY USE ONLY: B14061281-001 2 002

Custody Record MUST be Signed

Relinquished by (print): Jim Potts Date/Time: 6-13-14 Signature:

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: 6/13/14 1512 Signature:

Received by Laboratory: Date/Time: Signature:

Sample Disposal: Return to Client: Lab Disposal:

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

BOTTLE ORDER 80833

SHIPPED TO: DOWL HKM

Contact: Bill Dreyer
2090 Stadium Drive
Bozeman MT 59715
Phone: (406) 586-8834
Project:

Order Created by: Gina McCartney
Shipped From: Billings, MT
Ship Date: 6/6/2014
VIA: Ground

Bottle Size/Type	Bottles Per Samp	Method	Tests	Critical Hold Time	Preservative	Notes	Num of Samp
DW (4 Sets)							
1 Liter Plastic	1	A2320 B	Alkalinity			Cl, SO4 & F by E300.0	1
		A2510 B	Conductivity				
		E300.0	Anions by Ion Chromatography				
		E353.2	Nitrogen, Nitrite	48 hrs			
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Dissolved			Will be Filtered and Preserved in lab for Ca, Mg, K & Na	1
		A2340 B	Hardness as CaCO3				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Drinking Water		HNO3	Sb, As, Ba, Be, Cd, Cr, Fe, Mn, Hg, Ni, Se, Tl	1
250 mL Plastic	1	E353.2	Nitrogen, Nitrate + Nitrite		H2SO4		1
		Calculation	Nitrogen, Nitrate				
100 mL Plastic Sterile	1	A9223	Bacteria, Private Water Supply	48 hrs			1
WW (4 Sets)							
1 Liter Plastic	1	A5210 B	Biochemical Oxygen Demand, 5 Day	48 hrs			1

.er Plastic	1	A2320 B	Alkalinity			Cl	1
		E300.0	Anions by Ion Chromatography				
		A2510 B	Conductivity				
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
		A2540 D	Solids, Total Suspended				
500 mL Plastic	1	E350.1	Nitrogen, Ammonia		■ H2SO4		1
		E353.2	Nitrogen, Nitrate + Nitrite				
		E351.2	Nitrogen, Total Kjeldahl				
		Calculation	Nitrogen, Total (TKN+NO3+NO2)				
		E365.1	Phosphorus, Total				
		E410.4	Chemical Oxygen Demand				
40 mL Clear Glass VOA	1	A4500-Cl G	Chlorine, Residual	2.4 hrs		Zero headspace	1
1 Liter Clear Glass Narrow Mouth	2	E1664A	Oil & Grease, Gravimetric		▒ H2SO4		1

■ HNO3 - Nitric Acid ▒ H2SO4 - Sulfuric Acid ■ NaOH - Sodium Hydroxide

■ ZnAc - Zinc Acetate ■ HCl - Hydrochloric Acid ☐ H3PO4 - Phosphoric Acid

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

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

Corrosive Chemicals: Nitric, Sulfuric, Phosphoric, Hydrochloric Acids and Sodium Hydroxide. Zinc Acetate is a skin irritant.

Subcontracting of sample analyses to an outside laboratory may be required. If so, Energy Laboratories will utilize its branch laboratories or qualified contract laboratories for this service. Any such laboratories will be indicated within the Laboratory Analytical Report.

APPENDIX E
Hysham Rest Area East Bound Well Memo

APPENDIX E

DOWL HKM

Address:
2090 Stadium Drive
Bozeman, Montana 59715

Phone: (406) 586-8834 Fax: (406) 586-1730

MEMORANDUM

To: Kevin Malone, PE
MDT Project Manager

From: William Dreyer, PE,
DOWL HKM - Project Manager

Date: June 8, 2014

Subject: Hysham Rest Area
Public Well replacement

On June 13, 2014 the East Bound Well at the Hysham Rest Area was pumped to determine its capacity and quality. The well was pumped for a total of 35 minutes at a rate of 12 gpm (gallons per minute). After thirty minutes of pumping, the water level dropped to the pump intake, causing the pump to pump both air and water; about the same time, the pumped water turned red. Water samples were collected, the pump was turned off, and the rate of water level recovery was monitored.

Testing shows that this well has very limited capacity and that its quality is poor due to turbidity. Attached is the well log, a schematic of the well log, lithology log, and a preliminary interpretation of the geologic formation (s) that the well is likely completed in.

Due to the low capacity and poor quality of this well, it is recommended to evaluate the potential for replacing and relocating the existing well. A preliminary investigation of the geologic formations present at the site was conducted and a portion of the geologic map for this area is attached. A description of the geologic formations is also attached. In addition, Mr. Doug Askin of Askins Drilling from Miles City was contacted to discuss the condition of the existing well and the potential for either improving or replacing the well.

According to this preliminary investigation, and Mr. Askin's opinion, it is recommended to chlorinate and abandon the existing well, and replace it. According to Mr. Askin's experience with wells in this vicinity, there is good potential for a new well with good water quality, if properly constructed and completed in the Fox Hills Formation. Note, the quantity (or volume) that a new well would produce cannot be predicted.

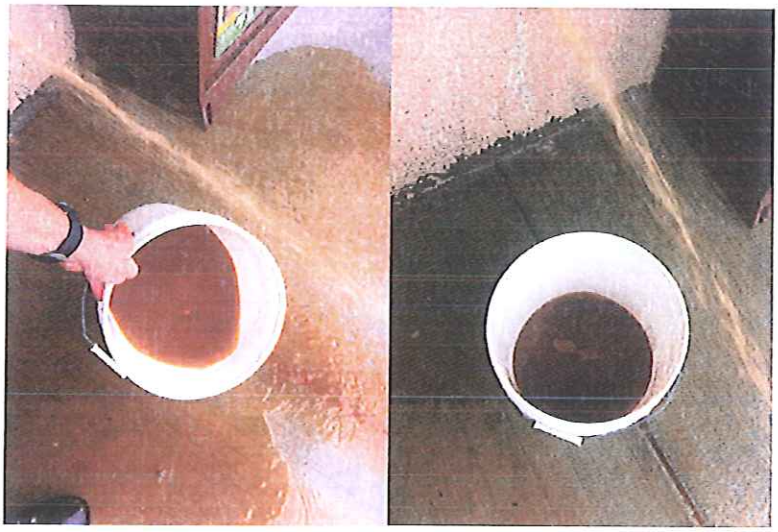
The likely problem with the existing well is that it may be completed too shallow and that it also was not properly constructed. The slotted PVC casing that extends from 25' to 200' allows shallow and deep groundwater to mix, which may be the primary cause for the sever discoloration of the water. In addition the annular space between the 4" PVC casing and 6" borehole allows water to freely travel vertically up and down during pumping cycles, which erodes the borehole and further adding to the sever discoloration of the water.

In order to replace this well, it is recommended to relocate it according the conceptual plan being developed for Rest Area. For a well to be successful at this location it will need to be completed in the Fox Hills Sandstone. Consequently, the presence and approximate depth of the Fox Hills needs to be verified. The

attached geologic map is generalized, therefore it does not display the discrete details of the geologic formations, particularly the Fox Hills formation.

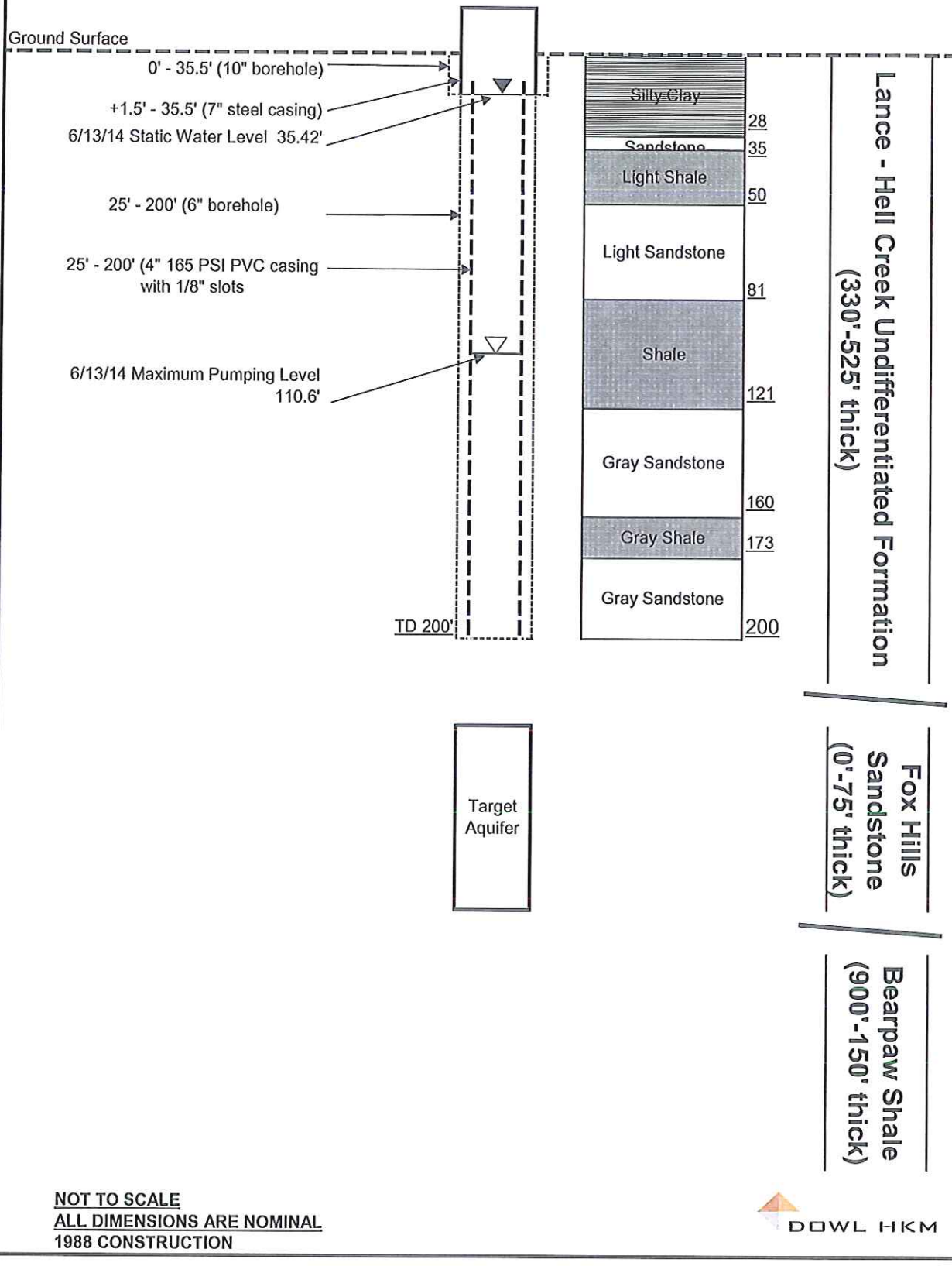
Permitting a new public drinking water well requires the following:

1) Updating the Source Water Protection Plan (PWS 6)
2) Conducting an evaluation of the potential for groundwater to be influenced by surface water (PWS 5)
3) Developing a set of plans and specifications to replace and abandon the old well
4) Preparing a Design Report
5) MDEQ approval to replace the well
6) Hiring a drilling contractor
7) Testing the new well for quantity and quality
8) Reporting well performance and "as-built" drawings to MDEQ
9) Abandoning the old well.



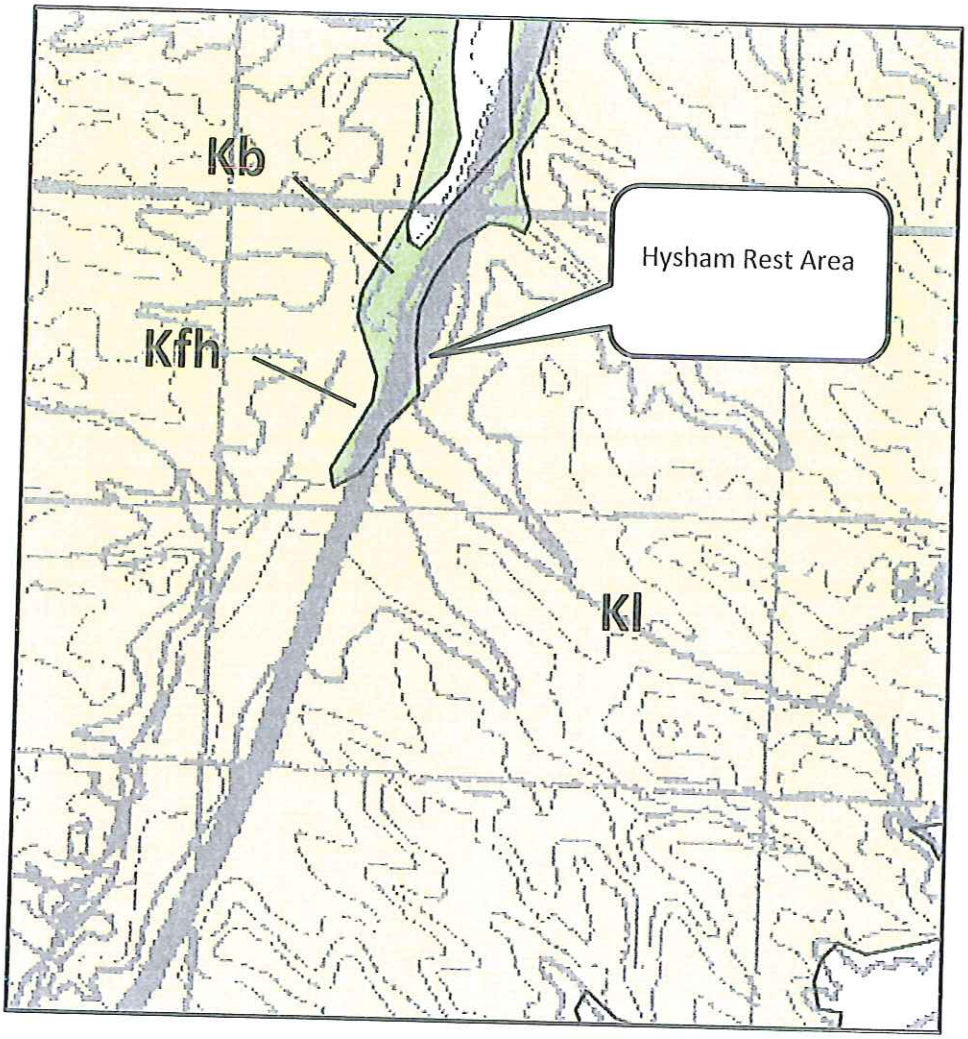
Photos 1 & 2: Discolored water from the east-bound Hysham Rest Area

Hysham East Bound Rest Stop Well Diagram



NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL
1988 CONSTRUCTION

DOWL HKM



Hysham Rest Area General Geologic Map

Montana Bureau of Mines and Geology
Open File No. 486

Geologic Map of the Hysham 30' x 60' Quadrangle, Eastern Montana

Susan M. Vuke, Edith M. Wilde,
and Robert N. Bergantino

2003

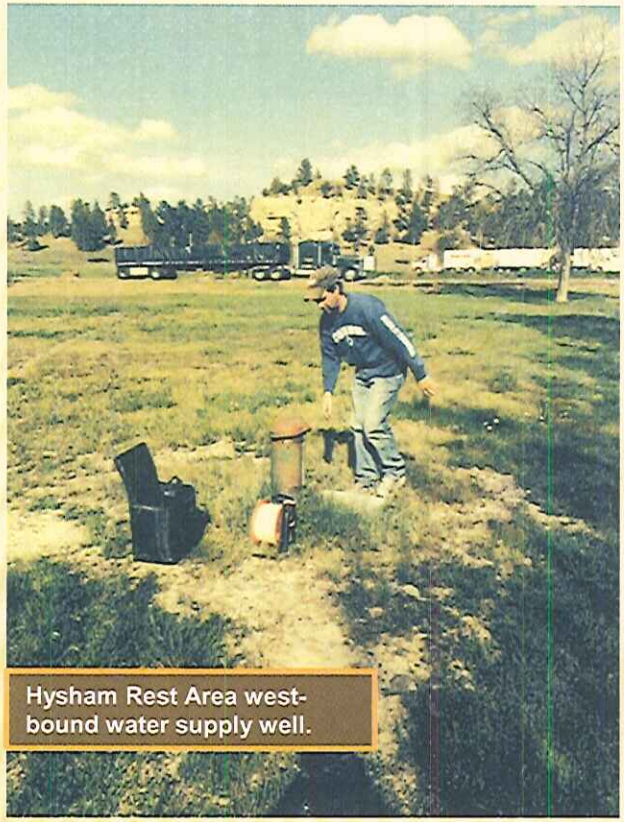
Kl Lance Formation (Upper Cretaceous)
Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

Kfh Fox Hills Formation (Upper Cretaceous)
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

Kb Bearpaw Shale (Upper Cretaceous)
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500 ft.

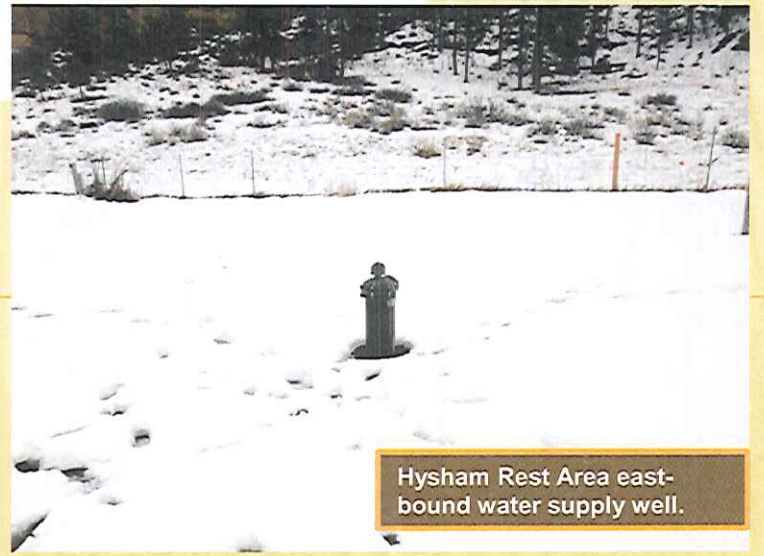
Hysham Rest Area

Water Supply Photos



Hysham Rest Area west-bound water supply well.

Hysham Rest Area west-bound irrigation well.



Hysham Rest Area east-bound water supply well.

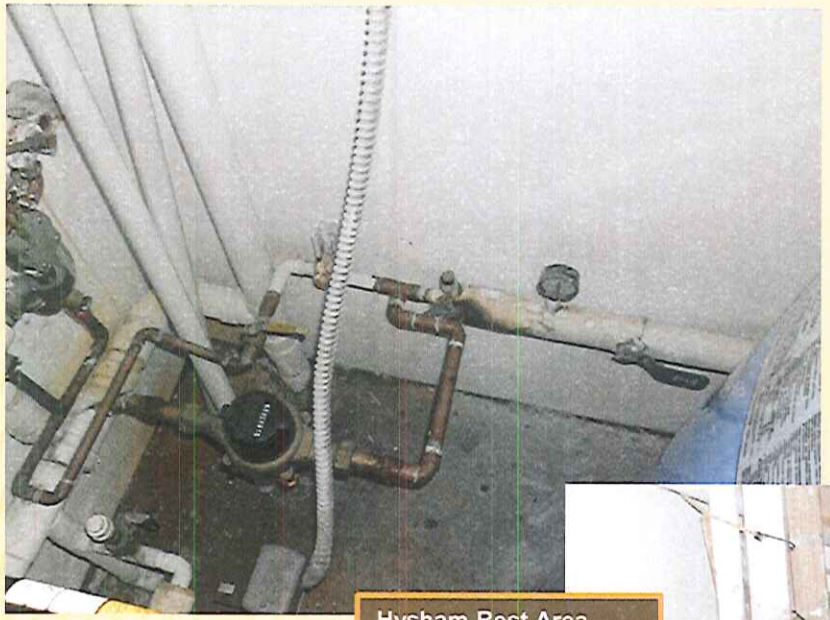
Hysham Rest Area

Water Supply Photos

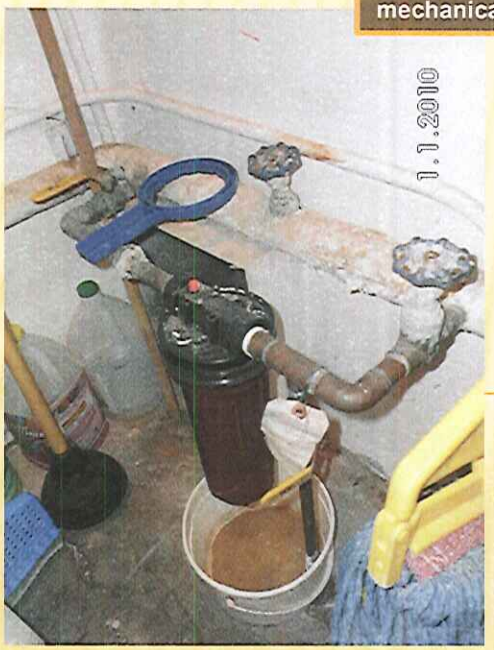
Hysham Rest Area east-bound mechanical room.

Hysham Rest Area

Water Supply Photos



Hysham Rest Area
west-bound
mechanical room.



MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX C:

SITE PLAN &

DESIGN SHEETS

DOWL

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX D:

DESIGN CRITERIA

DOWL

Water Demand Estimate Using Fixture Values

(Based on AWWA M22 Manual, Second Edition)

Facility Name: Hysham Rest Area

Building address or number:

Residential or Non-Residential: Non-Residential

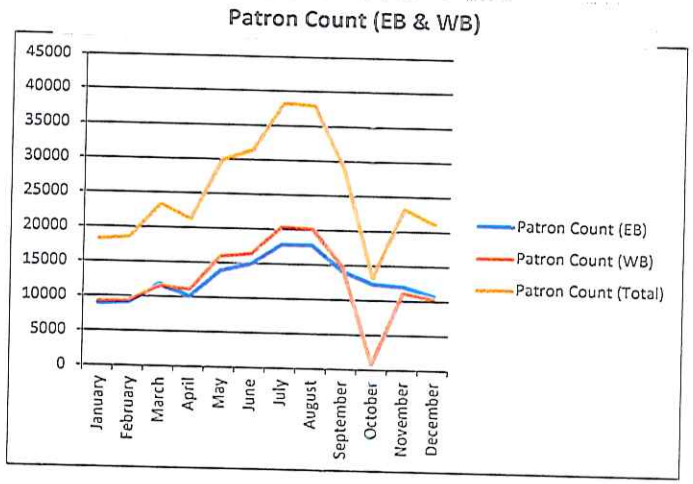
Minimum Pressure (psi): 35

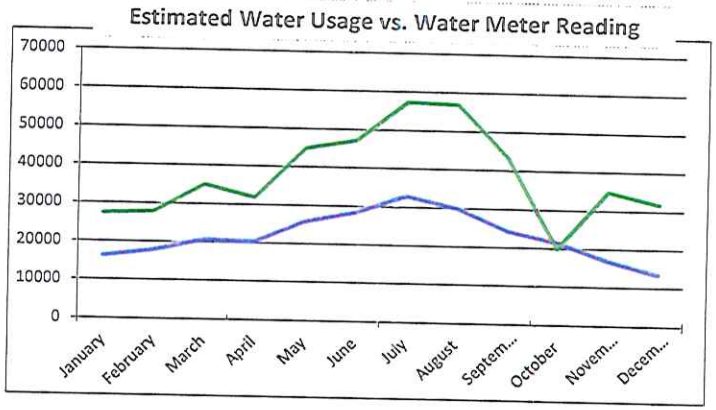
Fixture or Appliance	Fixture Value (at 60 psi)	Number of Fixtures	Subtotal Fixture Value
Toilet (tank)	4	14	56
Toilet (flush valve)	35	0	0
Urinal (wall or stall)	16	6	96
Urinal (flush valve)	35		0
Bidet	2		0
Shower (single head)	2.5	0	0
Sink (lavatory)	1.5	14	21
Kitchen Sink	2.2	0	0
Utility Sink	4	2	8
Dishwasher	2	0	0
Bathtub	8	0	0
Clothes Washer	6	0	0
Hose connections (with 50 ft of hose)			
1/2 in.	5	4	20
5/8 in.	9		0
3/4 in.	12		0
Miscellaneous			
Bedpan washers	10		0
Drinking fountains	2		0
Dental units	2		0
Combined Fixture Value			201
Demand (gpm)			61
Pressure Adjustment Factor			0.74
Total Adjusted demand (gpm)			**45.1**

Hysham Rest Area Patron and Water Usage

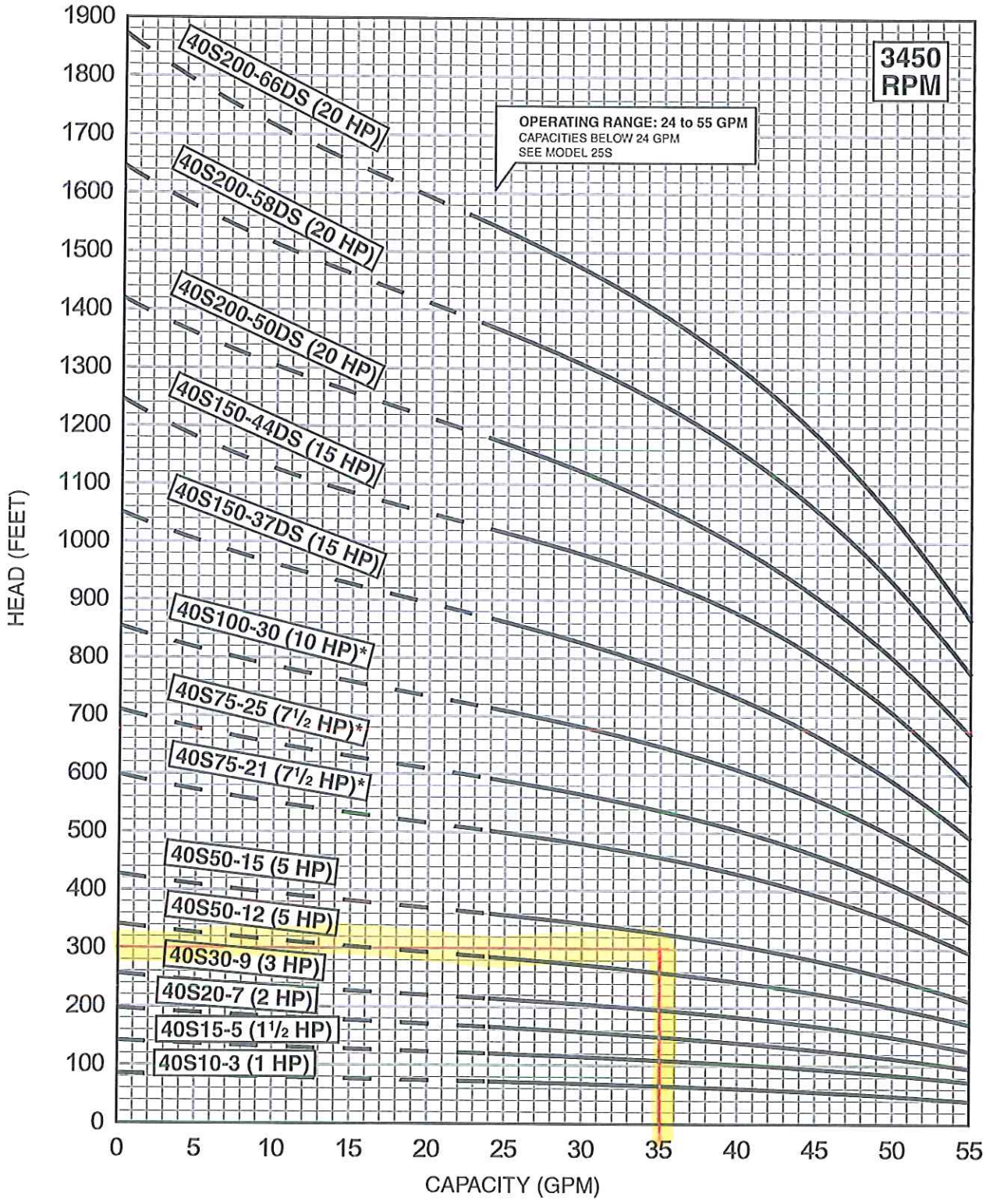
Rest Area:	Hysham
Month:	Year Total
Year:	2013

Date	Combined Door Count	Patron Count (EB)	Patron Count (WB)	Patron Count (Total)	Combined Water Meter Reading (gal)	Estimated Water Usage (Patron Count x 1.5 gal/Patron Count)
January	36642	9000	9321	18321	[illegible]	27482
February	37362	9208	9473	18681	[illegible]	28022
March	46978	11852	11637	23489	[illegible]	35234
April	42700	10166	11184	21350	[illegible]	32025
May	60068	13924	16110	30034	[illegible]	45051
June	63074	14987	16550	31537	[illegible]	47306
July	76671	17853	20483	38336	[illegible]	57503
August	76110	17806	20250	38055	[illegible]	57083
September	58077	14191	14848	29039	[illegible]	43559
October	26648	12422	902	13324	[illegible]	19986
November	46758	12109	11270	23379	[illegible]	35069
December	42545	10766	10507	21273	[illegible]	31909
	Annual Average	425	420			
	Summer Average	550	623			
	Peak	822	843			





FLOW RANGE: 24 - 55 GPM **OUTLET SIZE: 2 " NPT** **NOMINAL DIA. 4"**



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
4" MOTOR STANDARD, 1-10 HP/3450 RPM.
6" MOTOR STANDARD,15-20 HP/3450 RPM.
* Also available with 6" motor.

Performance conforms to ISO 9906. 1999 (E) Annex A
Minimum submergance is 5 feet.

40S EASY SELECTION CHART

40 GPM

SELECTION CHARTS

(Ratings are in GALLONS PER MINUTE-GPM)

FLOW RANGE
(24 TO 55 GPM)

PUMP OUTLET
2 "NPT

				DEPTH TO PUMPING WATER LEVEL (LIFT) IN FEET																										
PUMP MODEL	HP	PSI		20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	340	400	460	520	600	700	800	900	1000	1100
40S10-3	1	20	46.2	33.0																								
		30	69.3																									
		40	92.4																									
		50	116																									
		60	139																									
SHUT-OFF PSI:			0	28	19	11	2																					
40S15-5	1 1/2	0	0				52.0	41.0	24.0																			
		20	46.2	57.0	50.0	37.0	18.0																					
		30	69.3	48.0	34.0	15.0																						
		40	92.4	31.0	11.0																							
		50	116	7.0																								
		60	139																									
SHUT-OFF PSI:			0	52	44	35	26	18	9																			
40S20-7	2	0	0					54.0	49.0	40.0	29.0	15.0																
		20	46.2			53.0	46.0	37.0	25.0	10.0																		
		30	69.3		52.0	45.0	35.0	23.0	8.0																			
		40	92.4	51.0	44.0	33.0	21.0	5.0																				
		50	116	42.0	32.0	18.0	2.0																					
		60	139	30.0	16.0																							
SHUT-OFF PSI:			0	77	68	59	51	42	33	25	16	7																
40S30-9	3	0	0							53.0	47.0	41.0	32.0	22.0														
		20	46.2					51.0	45.0	38.0	29.0	19.0																
		30	69.3				50.0	44.0	37.0	28.0	17.0																	
		40	92.4		54.0	50.0	43.0	35.0	26.0	15.0																		
		50	116	54.0	49.0	42.0	34.0	24.0	13.0																			
		60	139	48.0	41.0	33.0	23.0	11.0																				
SHUT-OFF PSI:			0	102	94	85	76	68	59	50	42	33	24	16	7													
50-12	5	0	0									53.0	49.0	44.0	39.0	32.0	25.0	16.0										
		20	46.2							52.0	48.0	43.0	37.0	30.0	22.0	13.0												
		30	69.3						51.0	47.0	42.0	36.0	29.0	21.0	12.0													
		40	92.4					51.0	46.0	41.0	35.0	28.0	20.0	11.0														
		50	116			54.0	50.0	45.0	40.0	34.0	26.0	18.0	9.0															
		60	139		53.0	49.0	45.0	39.0	33.0	25.0	17.0	8.0																
SHUT-OFF PSI:			0		130	122	113	104	96	87	78	70	61	52	44	35	26	18										
40S50-15	5	0	0											52.0	49.0	46.0	42.0	37.0	26.0									
		20	46.2									51.0	48.0	45.0	40.0	35.0	30.0	24.0										
		30	69.3								51.0	48.0	44.0	40.0	35.0	29.0	23.0	16.0										
		40	92.4							51.0	47.0	43.0	39.0	34.0	28.0	21.0	14.0											
		50	116						50.0	47.0	43.0	38.0	33.0	27.0	20.0	13.0												
		60	139					50.0	46.0	42.0	37.0	32.0	26.0	19.0	12.0													
SHUT-OFF PSI:			0					141	132	124	115	107	98	89	81	72	63	55	37	11								
40S75-21	7 1/2	0	0																49.0	41.0	29.0	15.0						
		20	46.2													53.0	51.0	48.0	43.0	32.0	19.0							
		30	69.3												52.0	50.0	48.0	45.0	39.0	27.0	13.0							
		40	92.4											52.0	50.0	48.0	45.0	42.0	35.0	22.0	6.0							
		50	116										52.0	50.0	47.0	44.0	41.0	38.0	30.0	16.0								
		60	139									51.0	49.0	47.0	44.0	41.0	38.0	34.0	25.0	10.0								
SHUT-OFF PSI:			0									181	172	163	155	146	137	129	111	85	59	33						
40S75-25	7 1/2	0	0																	51.0	45.0	37.0	23.0					
		20	46.2																52.0	47.0	39.0	29.0	14.0					
		30	69.3															54.0	50.0	44.0	35.0	25.0						
		40	92.4														54.0	52.0	48.0	41.0	32.0	21.0						
		50	116													53.0	52.0	50.0	45.0	38.0	28.0							
		60	139												53.0	51.0	49.0	47.0	43.0	34.0	24.0							
SHUT-OFF PSI:			0												203	194	186	177	160	134	108	82	47					
*40S100-30 40S100-30	10	0	0																		53.0	49.0	41.0	27.0				
		20	46.2																	54.0	50.0	44.0	35.0	20.0				
		30	69.3																	52.0	48.0	42.0	32.0	16.0				
		40	92.4																	51.0	46.0	39.0	28.0	12.0				
		50	116																	49.0	43.0	36.0	25.0	8.0				
		60	139																52.0	47.0	41.0	33.0	21.0					
SHUT-OFF PSI:																			222	196	170	144	110	66	23			

* 6" Motor

See 40S performance curves for higher head models.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

DIMENSIONS AND WEIGHTS

MODEL NO.	FIG.	HP	MOTOR SIZE	DISCH. SIZE	DIMENSIONS IN INCHES					APPROX. SHIP WT.
					A	B	C	D	E	
40S10-3	A	1	4"	2" NPT	24.6	11.8	12.8	3.8	3.9	32
40S15-5	A	1 1/2	4"	2" NPT	29.7	13.6	16.1	3.8	3.9	37
40S20-7	A	2	4"	2" NPT	34.5	15.1	19.4	3.8	3.9	41
40S30-9	A	3	4"	2" NPT	43.3	20.6	22.7	3.8	3.9	65
40S50-12	A	5	4"	2" NPT	51.3	23.6	27.7	3.8	3.9	78
40S50-15	A	5	4"	2" NPT	56.2	23.6	32.6	3.8	3.9	84
40S75-21*	A	7 1/2	4"	2" NPT	74.6	29.6	45.0	3.8	3.9	120
40S75-25*	A	7 1/2	4"	2" NPT	81.2	29.6	51.6	3.8	3.9	124
40S100-30*	A	10	4"	2" NPT	103.7	43.9	59.8	3.8	3.9	181
40S150-37DS	A	15	6"	2" NPT	99.5	28.0	71.5	5.4	5.4	244
40S150-44DS	A	15	6"	2" NPT	111.0	28.0	83.0	5.4	5.4	340
40S200-50DS**	B	20	6"	2" MPT	136.0	30.6	105.4	5.4	5.5	319
40S200-58DS**	B	20	6"	2" MPT	149.2	30.6	118.6	5.4	5.5	334
40S200-66DS**	B	20	6"	2" MPT	162.4	30.6	131.8	5.4	5.5	394

NOTES: All models suitable for use in 4" wells, unless otherwise noted.
Weights include pump end with motor in lbs.
* Also available with 6" motor.
** Built into sleeve 2" MPT discharge, 6" min. well dia.

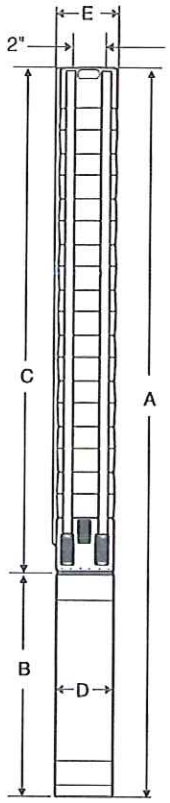


Fig. A

MATERIALS OF CONSTRUCTION

COMPONENT	CYLINDRICAL SHAFT (3-44 Stgs.)	DEEP SET (50-66 Stgs.)
Check Valve Housing	304 Stainless Steel	304 Stainless Steel
Check Valve	304 Stainless Steel	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel	304 Stainless Steel
Impeller	304 Stainless Steel	304 Stainless Steel
Suction Interconnector	304 Stainless Steel	304 Stainless Steel
Inlet Screen	304 Stainless Steel	304 Stainless Steel
Pump Shaft	431 Stainless Steel	431 Stainless Steel
Straps	304 Stainless Steel	304 Stainless Steel
Cable Guard	304 Stainless Steel	304 Stainless Steel
Priming Inducer	304 Stainless Steel	304 Stainless Steel
Coupling	316/431 Stainless Steel **	329/416 Stainless Steel
Check Valve Seat	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Top Bearing	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Impeller Seal Ring	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Intermediate Bearings	NBR/316 Stainless Steel	NBR/316 Stainless Steel
Shaft Washer	LCP (Vectra®)	LCP (Vectra®)
Split Cone	304 Stainless Steel	304 Stainless Steel
Split Cone Nut	304 Stainless Steel	304 Stainless Steel
Sleeve	Not Required	316 Stainless Steel
Sleeve Flange	Not Required	304 Stainless Steel

NOTES: Specifications are subject to change without notice.
Vectra® is a registered trademark of Hoechast Calanese Corporation.
***Stainless Steel option available.**

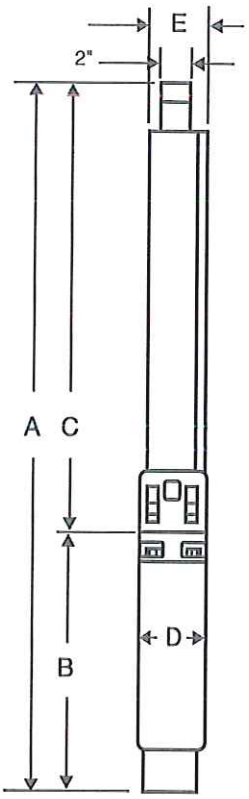
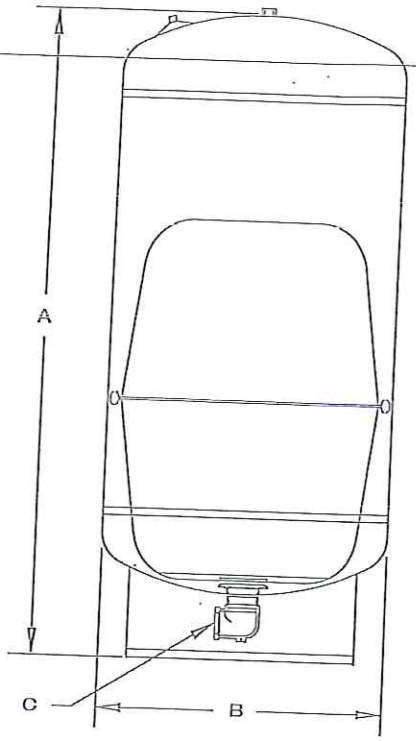


Fig. B

WELL-RITE

MATERIALS OF CONSTRUCTION

- *Tank:* 16 gauge cold rolled steel
- *Finish:* Appliance quality paint for indoor or outdoor installation
- *Water chambers:* Top chamber is 100% butyl rubber, lower water chamber is copolymer polypropylene
- *Connection:* Stainless Steel
- *Testing:* High pressure, seam weld, helium, final precharge check
- *Air valve:* Brass valve with o-ring seal
- *Warranty:* Five year



DIMENSIONS & CAPACITIES

Model	Total Tank Volume		A Height		B Diameter		C Connection	Total Weight	
	gal	liters	in	cm	in	cm		lbs	kilos
WR 45	14	60	22	55.88	16	40.64	1" NPT	28.0	12.7
WR 60	20	80	29	73.66	16	40.64	1" NPT	36.0	16.3
WR 80	26	100	34.5	87.63	16	40.64	1" NPT	41.0	18.6
WR 100	32	120	27.75	70.48	21	53.34	1 1/4" NPT	54.0	24.5
WR 120	33.4	130	42.75	108.58	16	40.64	1 NPT	49.0	22.2
WR 140	44	170	36.25	92.07	21	53.34	1 1/4" NPT	67.0	30.4
WR 200	62	240	48	121.92	21	53.34	1 1/4" NPT	82.0	37.2
WR 240	81	310	62	157.48	21	53.34	1 1/4" NPT	99.0	44.9
WR 260	85	325	44.5	113.03	26	66.04	1 1/4" NPT	121.0	54.9
WR 360	119	450	59.75	150.49	26	66.04	1 1/4" NPT	153.0	69.5

Maximum working pressure 125 psig. Maximum working temperature, internal & external 140° F. Tank pre-charge 38 psig.

QUICK SIZING CHART

Model	Total Tank Volume		Total Drawdown* 20/40		30/50		40/60	
	gal	liters	gal	liters	gal	liters	gal	liters
WR 45	14	60	5.6	21.4	4.8	18.1	4.1	15.6
WR 60	20	80	8.1	30.5	6.8	25.8	5.9	22.3
WR 80	26	100	10.5	39.7	8.9	33.6	7.7	29.0
WR 100	32	120	12.9	48.8	10.9	41.3	9.4	35.7
WR 120	33.4	130	13.3	50.3	11.3	42.6	9.7	36.8
WR 140	44	170	17.7	67.1	15.0	56.8	13.0	49.1
WR 200	62	240	25.0	94.6	21.1	80.0	18.3	69.2
WR 240	81	310	32.6	123.6	27.6	104.5	23.9	90.4
WR 260	85	325	34.3	129.7	29.0	109.7	25.1	94.9
WR 360	119	450	48.0	181.5	40.6	153.6	35.1	132.9

*Total drawdown assumes tank pre-charge set at 2 psi below cut-in pressure. Drawdown can be affected by many factors, including temperature, pressure, and elevation.

> www.flexconind.com
> 781-986-2424
> 300 Pond Street
> Randolph, MA 02368

FLEXCON INDUSTRIES
The Reliable Source®

GRAINGER

printec

Valve,Pressure Relief

Pressure Relief Valve, Maximum Flow 40 GPM, Inlet 1 Inch Male NPT, Outlet 3/4 Inch Female NPT, Pressure Range 0 to 400 PSI, Temperature 180 Degrees Fahrenheit, Valve Material Stainless Steel Ball, Body Material Bronze

Grainger Item #	3YB67
Price (ea.)	$143.65
Brand	DAYTON
Mfr. Model #	3YB67
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	1.45
Usually Ships	Today
Catalog Page No.	3462

Price shown may not reflect your price. Log In or register.

Additional Info

Adjustable Pressure Relief Valves

User sets pressure to maximize discharge performance.

Prevent damage to positive displacement-type pumps if blockage or shutoff occurs during operation.

Some bypass may occur.

Uses: For use with positive displacement pumps only. Not designed for complete shutoff.

- Operate in any position
- Max. temp.: 180 DegreeF

Tech Specs

Item: Valve
Type: Pressure Relief
Max. Flow GPM: 40
Pressure Range (PSI): 0 to 400
Max. Fluid Temp. (F): 180
Body Material: Bronze
Wetted Materials: SS
Inlet Port (In.): 1 (M)NPT
Outlet Port (In.): 3/4 (F)NPT

Notes & Restrictions

Optional Accessories

There are currently no optional accessories for this item.

Alternate Products

Valve,Pressure Relief

Item #: 3YB66
Brand: DAYTON
Usually Ships: Today
Price (ea): $55.25

Repair Parts

WARNING: Not for hot water heaters, boilers, or steam service. Install only on pressure side of pump to relieve pressure. Using valves under or over rated pressure will cause valve to leak.

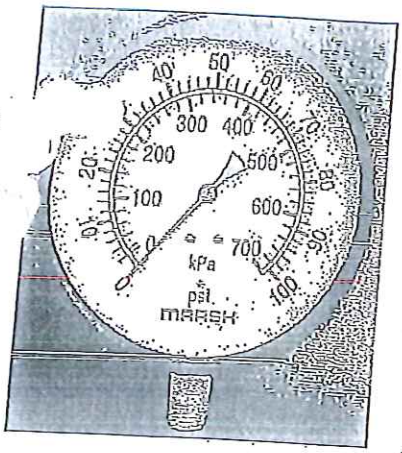
MSDS

This item does not require a Material Safety Data Sheet (MSDS).

Required Accessories

There are currently no required accessories for this item.

A Repair Part may be available for this item. Visit our Repair Parts Center or contact your local branch for more information.



GENERAL SERVICE GAUGE

- Dial Sizes: 1½", 2", 2½", 3½" & 4½"
- Superb quality, economical price
- Pressure ranges to 5000 psi

Marsh Instruments General Service Steel Case Gauges are an economical, general purpose gauge for pressure measurement from vacuum/compound through 5,000 psi. Suited for use with water, oil, air, gas, or other non-corrosive media.

Typical applications include FRLs, compressors, pumps, boilers, regulators, dryers as well as commercial and industrial equipment.

SPECIFICATIONS

ACCURACY
ASME Grade B–±3/2/3% (±2% of range across middle half of scale)

CASE SIZES
1½", 2", 2½", 3½", 4½" diameter

CASE MATERIAL
Steel, black painted

CASE STYLE
CB – Center Back Mount
LM – Lower Mount
UC – U-Clamp Mount
See option tables for Front Flange

TUBE & SOCKET
Copper alloy

MOVEMENT

CONNECTION
¼ NPT

RANGES
30" Hg VAC; Compound 30" Hg vac to 400 psi; 15 to 5,000 psi

DIAL STANDARD
Dual scale psi and kPa

DIAL COLOR
Black markings on white

POINTER
Aluminum, black painted

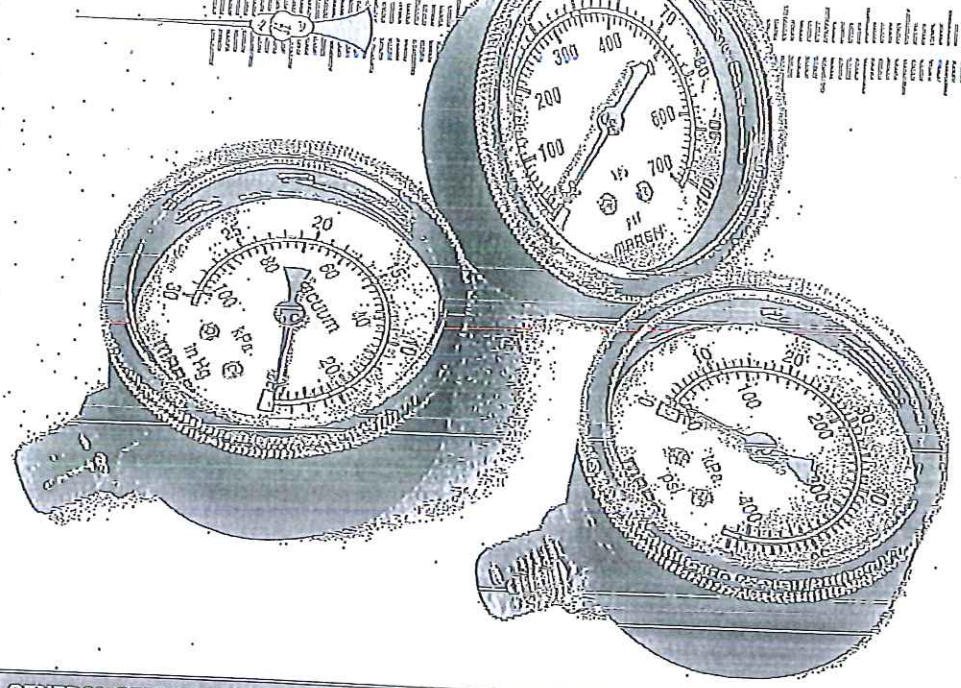
WINDOW
1½", 2", 2½", 3½": acrylic, twist-in Clearlok
4½": flat glass window with steel friction ring

RESTRICTOR
Standard for ranges 1,000 psi and above

STANDARD RANGES & PART NUMBERS

TYPE	GENERAL SERVICE GAUGES						
Size	1½"			2"			
Case Material	Steel			Steel			
Internals	Copper Alloy			Copper Alloy			
Mounting / Case Style	LM	UC	CB	LM	LM	CB	CB
Connection	⅛ NPT	⅛ NPT	⅛ NPT	¼ NPT	¼ NPT	⅛ NPT	¼ NPT
Scale Standard	psi/kPa			psi/kPa			
0 to 30" Hg VAC	J0405	J0505	J0605	J1105	J1405	J1805	J2005
30" Hg VAC to 15 psi							
30" Hg VAC to 30 psi							
30" Hg VAC to 60 psi					J1412		
30" Hg VAC to 100 psi					J1414		
30" Hg VAC to 150 psi							
30" Hg VAC to 200 psi	J0418	J0518	J0618	J1118	J1418	J1818	J2018
30" Hg VAC to 300 psi	J0420	J0520	J0620	J1120	J1420	J1820	J2020
30" Hg VAC to 400 psi	J0424	J0524	J0624	J1124	J1424	J1824	J2024
0 to 15 psi				J1126	J1426	J1826	J2026
0 to 30 psi	J0440	J0540	J0640	J1140	J1440	J1840	J2040
0 to 60 psi	J0442	J0542	J0642	J1142	J1442	J1842	J2042
0 to 100 psi	J0446	J0546	J0646	J1146	J1446	J1846	J2046
0 to 160 psi	J0448	J0548	J0648	J1148	J1448	J1848	J2048
0 to 200 psi	J0452	J0552	J0652	J1152	J1452	J1852	J2052
0 to 300 psi	J0454	J0554	J0654	J1154	J1454	J1854	J2054
0 to 400 psi	J0458	J0558	J0658	J1158	J1458	J1858	J2058
0 to 600 psi				J1160	J1460	J1860	J2060
0 to 1,000 psi					J1464	J1864	
0 to 1,500 psi							
0 to 2,000 psi							
0 to 3,000 psi							
0 to 5,000 psi					J1478	J1878	J2078
					J1482		

General Service

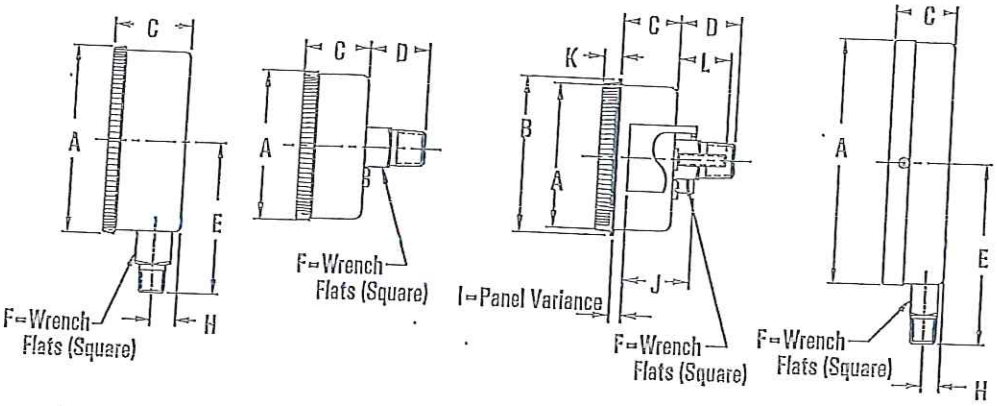


Dial Divisions	General Service 3/2/3% of Span			
Ranges	Figure Intervals		Minor Gradua-tions	
Vacuum	5		1	
COMPOUND				
30" Hg VAC to 15 psi	10	5	2	1
30" Hg VAC to 30 psi	10	10	2	1
30" Hg VAC to 60 psi	10	10	2	2
30" Hg VAC to 150 psi	30	30	5	5
30" Hg VAC to 300 psi	30	50	–	10
PRESSURE				
0 to 15 psi	3		0.2	
0 to 30 psi	5		1	
0 to 60 psi	10		1	
0 to 100 psi	10		2	
0 to 160 psi	20		2	
0 to 200 psi	50		4	
0 to 300 psi	50		5	
0 to 400 psi	50		5	
0 to 600 psi	50		10	
HIGH PRESSURE				
0 to 1,000 psi	200		20	
0 to 1,500 psi	300		20	
0 to 2,000 psi	400		40	
0 to 3,000 psi	500		100	
0 to 4,000 psi	1,000		100	
0 to 5,000 psi	1,000		100	

GENERAL SERVICE GAUGE OPTIONS

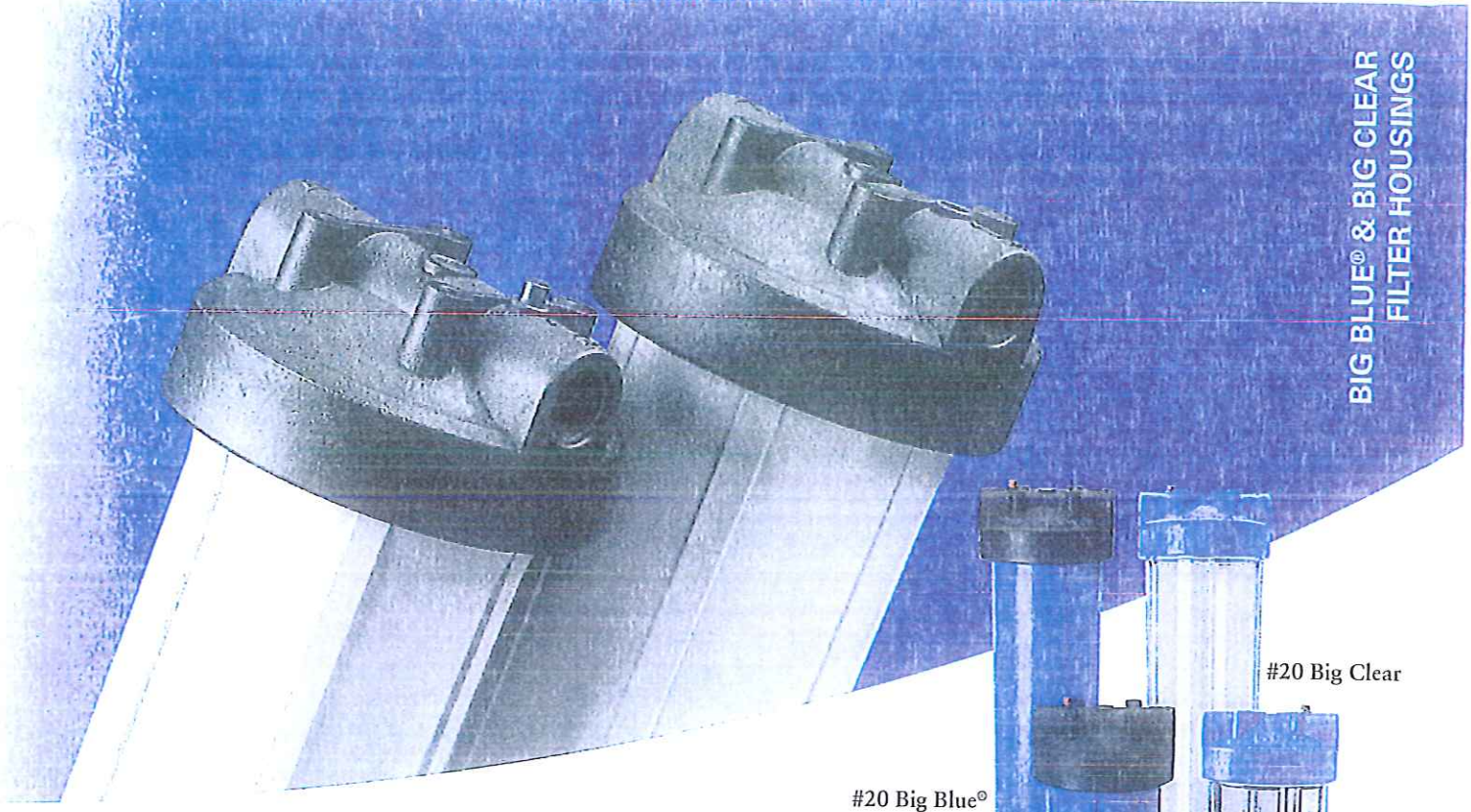
OPTION	TYPE	SUFFIX	AVAILABLE ON MODELS
Restrictors	Add restrictor	H	All models – Consult factory for other sizes
Catalog Dials	psi only	E	See Marsh Price List for minimums
	bar only	L1	
	kg/cm² only	L2	
	kPa only	L3	
	MPa only	L4	
	psi & bar	W1	
	psi & kg/cm²	W2	
	psi & MPa	W4	
Custom Dials	Custom face	M	See Marsh Price List for minimums
Window	Instrument glass w/ring (GS)	F1	1½"- 3½" Consult factory for availability
	Acrylic	F2	4½" Consult factory for availability
Pointer	Adjustable (slotted) pointer (AD)	Z1	2"- 4½" Consult factory for availability
	Max. Hand Assembly (MX)	Z2	2"- 3½" CB or LM only, Consult factory for availability
Increased Accuracy	Grade A: (2/1/2%)	B	All models - 10 piece minimum order
Cases	3 hole front flange (FF)		1½" - 3½" See below for part number
	Part Numbers: 1½"x ⅛" (J07XX), 2"x ⅛" (J25XX), 2"x ¼" (J29XX), 2½" x ⅛" (J61XX), 2½"x ¼" (J63XX), 3½"x ⅛" (J85XX), 3½"x ¼" (J89XX). Consult factory for availability.		
	Stainless steel (SS)	J1	Consult factory for availability
	Brass (BR)	J2	
Rings	Friction ring (external), Polished stainless steel (FC)	A1	1½" to 3½" CB or LM only
	Friction ring (external), black (FB)	A2	1½" to 3½" CB or LM only
	Press ring, black (PB)	A3	2" to 3½" [Panel mount]
	Press ring, chrome (PC)	A4	2" to 3½" [Panel mount]
Special Connections			Consult Factory for availability

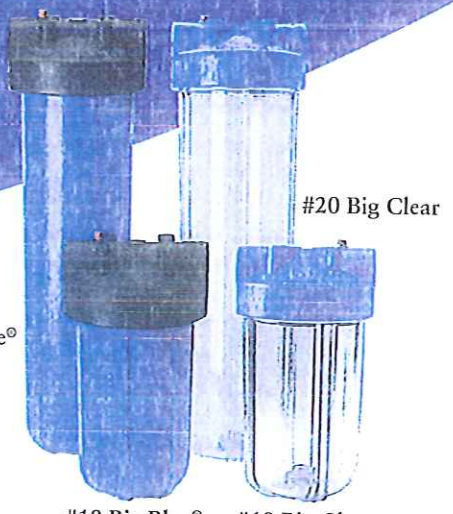
(J90XX Only)



GENERAL SERVICE CASE DIMENSIONS

Part#	Dial Size	Mount	A	B	C	D	E	F	H	I	J	K	L
J04xx	1½	⅛" LM	1.67		.90		1.50	7/16"	.26				
J05xx	1½	⅛" UC	1.60	1.75	.71	.72		7/16"		.06-.37	.81	.19	.63
J06xx	1½	⅛" CB	1.67		.90	.72		7/16"					
J11xx	2.0	⅛" LM	2.20		1.22		1.82	5/16"	.40				
J14xx	2.0	¼" LM	2.20		1.22		1.82	5/16"	.40				
J18xx	2.0	⅛" CB	2.20		1.22	.82		9/16"					
J20xx	2.0	¼" CB	2.20		1.22	.82		9/16"					
J24xx	2.0	⅛" UC	2.06	2.25	.94	.88		9/16"		0-0.43	1.22	.20	.92
J26xx	2.0	¼" UC	2.06	2.25	.94	.88		9/16"		0-0.43	1.22	.20	.92
J40xx	2½	⅛" LM	2.73		1.22		2.10	5/16"	.40				
J46xx	2½	¼" LM	2.73		1.22		2.10	5/16"	.40				
J50xx	2½	⅛" CB	2.73		1.23	.82		9/16"					
J54xx	2½	¼" CB	2.73		1.23	.82		9/16"					
J60xx	2½	⅛" UC	2.58	2.81	.94	.88		9/16"		0-0.43	1.22	.20	.92
J62xx	2½	¼" UC	2.58	2.81	.94	.88		9/16"		0-0.43	1.22	.20	.92
J80xx	3½	¼" LM	3.71		1.22		2.77	5/16"	.40				
J86xx	3½	¼" CB	3.71		1.15	.80		9/16"					
J88xx	3½	¼" UC	3.65	3.98	.91	.87		5/16"		0-0.49	1.10	.24	.92
J90xx	4½	⅛" LM	4.53		1.22		3.16	5/16"	.49				





BIG BLUE® & BIG CLEAR FILTER HOUSINGS

- Large capacity housing suitable for high flow applications
- 10" and 20" lengths available in opaque and clear
- Pressure relief/bleed on inlet side of cap
- Accepts 4½" diameter cartridges

Big Blue® Filter Housings offer the versatility to meet all of your large-capacity filtration needs, including high-flow and heavy-sediment applications. The extra large housing allows for greater cartridge capacity, reducing the number of vessels required for high flow-rate applications. Sumps are constructed of durable reinforced polypropylene and are available in both 10" and 20" lengths.

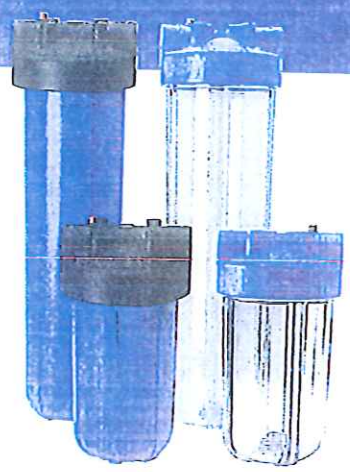
The high-flow polypropylene (HFPP) cap is available with 3/4", 1" or 1½" NPT inlet and outlet ports. The 1¼" internal port allows a greater volume of liquid to pass through the HFPP cap more rapidly.

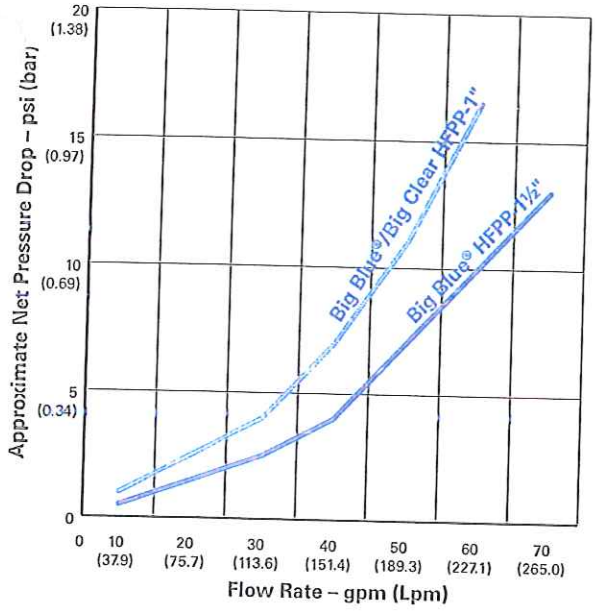
Big Blue® housings are compatible with a broad range of chemicals and are available with or without a pressure relief button. They accept a wide variety of 4½" diameter cartridges.

Big Clear Filter Housings offer on-site examination of flow, performance, and cartridge life and are ideal for a variety of applications. The blue polypropylene caps are available with an optional pressure-relief button on the inlet side to relieve pressure inside the housing when changing filter cartridges.

PENTEK
Pentair Water

BIG BLUE®/BIG CLEAR
Filter Housings





NSF COMPONENT

The 150233, 150234, 150235, 150236, 150237, 150238, 150239, 150240, 150467, 150468, 150469, and 150470 Tested and Certified by NSF International to NSF/ANSI Standard 42 for material and structural integrity requirements.

NOTE: The Big Clear Series of housings are not NSF component listed.

Housing Specifications and Performance Data

Model	Maximum Dimensions	Initial ΔP (psi) @ Flow Rate (gpm)
) Big Blue®–3/4"	13⅛" x 7¼" (333 mm x 184 mm)	2 psi @ 15 gpm (0.1 bar @ 57 Lpm)
0 Big Blue®–1"	13⅛" x 7¼" (333 mm x 184 mm)	1 psi @ 15 gpm (0.1 bar @ 57 Lpm)
10 Big Blue®–1½"	13⅝" x 7¼" (346 mm x 184 mm)	1 psi @ 20 gpm (0.1 bar @ 76 Lpm)
#20 Big Blue®–3/4"	23⅜" x 7¼" (594 mm x 184 mm)	2 psi @ 15 gpm (0.1 bar @ 57 Lpm)
#20 Big Blue®–1"	23⅜" x 7¼" (594 mm x 184 mm)	1 psi @ 15 gpm (0.1 bar @ 57 Lpm)
#20 Big Blue®–1½"	23⅞" x 7¼" (606 mm x 184 mm)	1 psi @ 20 gpm (0.1 bar @ 76 Lpm)
#10 Big Clear–1"*	13½" x 7⅛" (343 mm x 181 mm)	1 psi @ 15 gpm (0.1 bar @ 57 Lpm)
#20 Big Clear–1"*	23 ¾" x 7⅛" (603 mm x 181 mm)	1 psi @ 15 gpm (0.1 bar @ 57 Lpm)

* Not Performance Tested or Certified by NSF.

Materials of Construction

	BIG BLUE®	BIG CLEAR
Housing	Polypropylene	Lexan (#10), Polycarbonate (#20)
Cap	Polypropylene (HFPP)	Polypropylene (HFPP)
Button Assembly	300-series Stainless Steel, EPDM, and Polypropylene	300-series Stainless Steel, EPDM, and Polypropylene
O-Ring	Buna-N	Buna-N
Maximum Temperature	100°F (37.8°C)	100°F (37.8°C)
Maximum Pressure	#10 Big Blue® – 100 psi (6.9 bar) #20 Big Blue® – 90 psi (6.2 bar)	#10 Big Clear – 100 psi (6.9 bar) #20 Big Clear – 90 psi (6.2 bar)

CAUTION: Protect against freezing to prevent cracking of the filter and water leakage.

PENTEK
Pentair Water

502 Indiana Avenue • P.O. Box 1047 • Sheboygan, Wisconsin 53082-1047
Customer Service: 800.645.0267 • Fax: 888.203.7361 • supportspecialist@pentekfiltration.com
International: 920.457.9435 • Fax: 920.457.2417 • international@pentekfiltration.com
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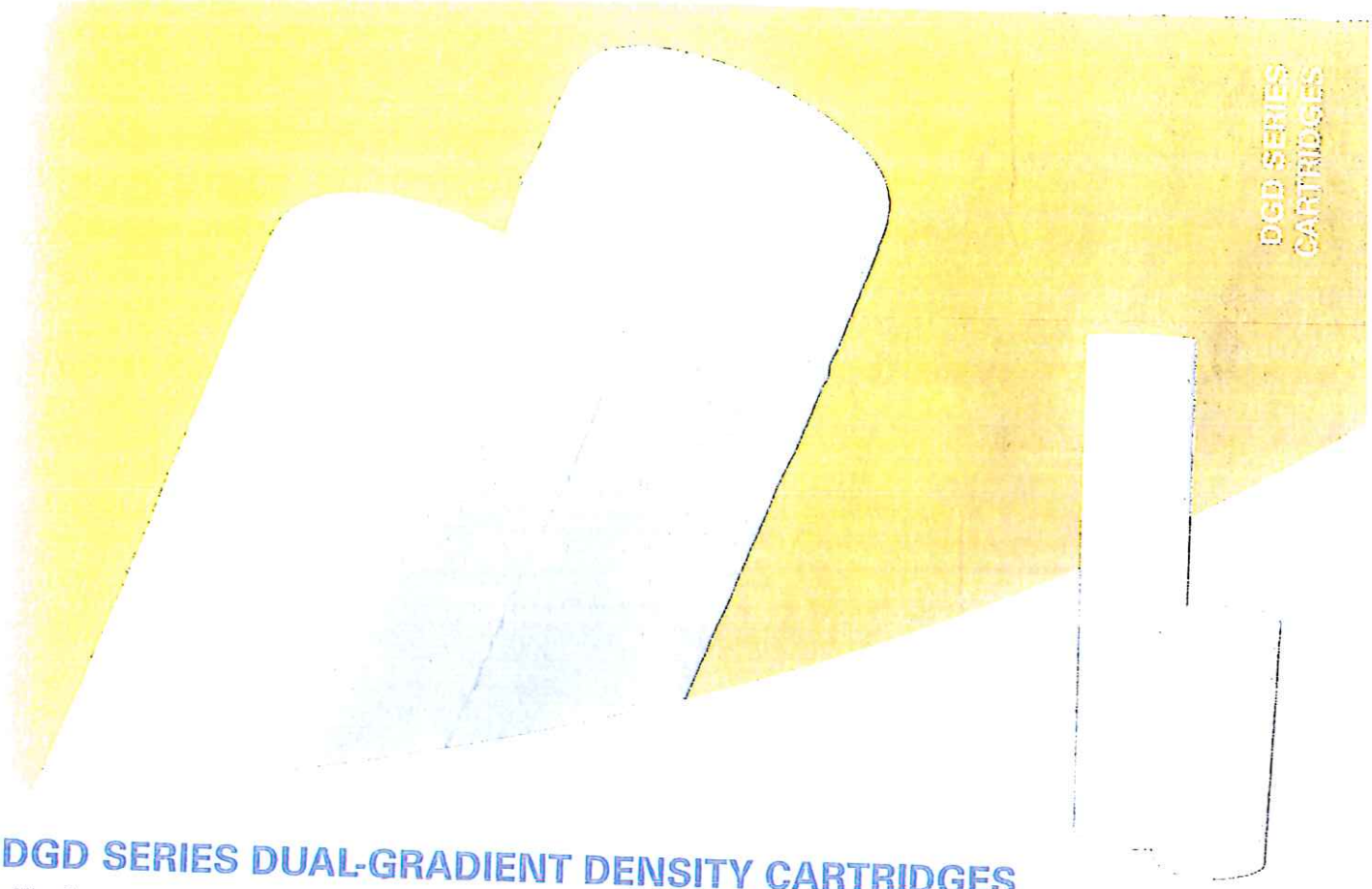


DGD SERIES DUAL-GRADIENT DENSITY CARTRIDGES

- Manufactured from pure 100% polypropylene
- Designed for purity and chemical compatibility
- Spun fibers form a true gradient density from outer to inner surfaces

DGD Series cartridges are manufactured from 100% pure polypropylene and are sized for use in our Big Blue® filter housings.

DGD Series cartridges are designed for purity and will not impart taste, odor or color to the liquid being filtered. Additionally, the polypropylene construction provides superior chemical resistance and is not prone to bacterial attack.

The DGD Series' advanced design combines selective final filtration with appropriate pre-filtration to achieve up to three times the dirt-holding capacity of similar size sediment cartridges and even greater capacity than standard spun or string-wound cartridges.

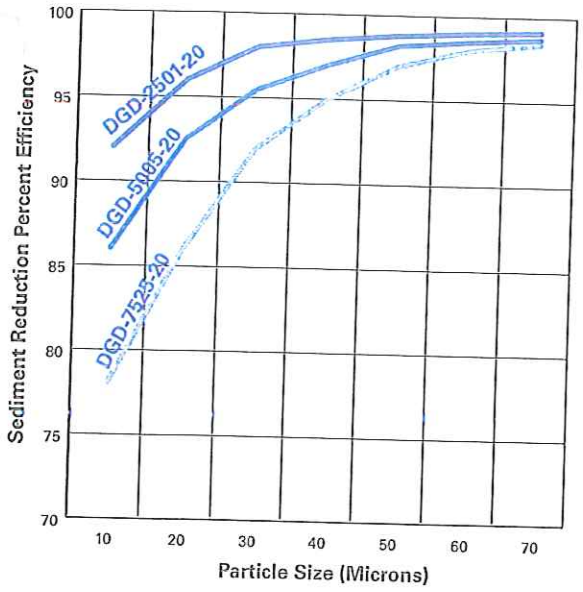
This performance enhancement is achieved by combining two separate gradient layers in one filter.

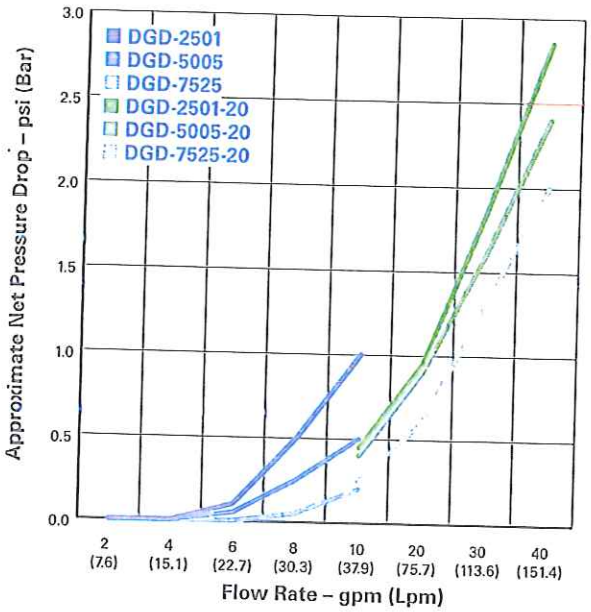
The larger diameter of the pre-filter reduces the particle load to the post filter, allowing it to operate at higher velocities. The effective filter depth is increased to a full 233% of standard spun-polypropylene or string-wound filters. This increased depth provides for very high particulate reduction efficiencies and added loading capacity.

The unique design and performance characteristics of the DGD Series cartridges make them an excellent choice for all residential, rural, municipal and commercial applications.

PENTEK
Pentair Water

DGD SERIES
Dual-Gradient Density Cartridges





Cartridge Specifications and Performance Data

Model	Maximum Dimensions	Micron Rating* (nominal)	Initial ΔP (psi) @ Flow Rate (gpm)
DGD-2501	4½" x 10" (114 mm x 254 mm)	Pre-filter: 25 Post filter: 1	<1 psi @ 10 gpm (<0.1 bar @ 38 Lpm)
DGD-5005	4½" x 10" (114 mm x 254 mm)	Pre-filter: 50 Post filter: 5	<1 psi @ 10 gpm (<0.1 bar @ 38 Lpm)
DGD-7525	4½" x 10" (114 mm x 254 mm)	Pre-filter: 75 Post filter: 25	<1 psi @ 10 gpm (<0.1 bar @ 38 Lpm)
DGD-2501-20	4½" x 20" (114 mm x 508 mm)	Pre-filter: 25 Post filter: 1	<1 psi @ 20 gpm (<0.1 bar @ 76 Lpm)
DGD-5005-20	4½" x 20" (114 mm x 508 mm)	Pre-filter: 50 Post filter: 5	<1 psi @ 20 gpm (<0.1 bar @ 76 Lpm)
DGD-7525-20	4½" x 20" (114 mm x 508 mm)	Pre-filter: 75 Post filter: 25	<1 psi @ 20 gpm (<0.1 bar @ 76 Lpm)

* Based on manufacturer's internal testing

Materials of Construction

Filter Media	Polypropylene
Temperature Rating	40–145°F (4.4–62.8°C)

WARNING: Do not use with water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.

NSF COMPONENT

Tested and Certified by NSF International to NSF/ANSI Standard 42 for material requirements only.

PENTEK
Pentair Water

502 Indiana Avenue • P.O. Box 1047 • Sheboygan, Wisconsin 53082-1047
Customer Service: 800.645.0267 • Fax: 888.203.7361 • supportspecialist@pentekfiltration.com
International: 920.457.9435 • Fax: 920.457.2417 • international@pentekfiltration.com
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MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX E:

WATER RIGHTS

DOWL

FILE

STATEMENTOF CLAIM

42KJ

163868

00

Box Bar Code _____

File Bar Code _____

Date/Initials _____

Form No. 76-O R2/80

RECEIVED
APR 30 1982
DEPT. OF NATURAL RESOURCES AND CONSERVATION

163868

TR-Y

NWT #5850
40.00

STATEMENT OF CLAIM FOR EXISTING WATER RIGHTS
OTHER USES
For the Water Courts of the State of Montana

42KJ

1. Owner of Water Right: MONTANA, STATE OF / DEPT OF HIGHWAYS / 2701 PROSPECT / HELENA MT 59620
   Co-Owner or Other Interest Owner: _____ / _____ / _____ (Middle Initial)
   Address _____
   City _____ State _____ Zip Code _____
   Home Phone No. _____ Business Phone No. _____

2. Person completing form: Hutchison (Last) / William (First) / D. (Middle Initial)
   Address 2701 Prospect Avenue
   City Helena State Montana Zip Code 59620
   Home Phone No. _____ Business Phone No. 449-2584

3. Use: (Check Only One)

FR ☐ Fish Raceways	GE ☐ Geothermal	MN ☐ Mining
FW ☐ Fish & Wildlife	NV ☐ Navigation	PG ☐ Power Generation
CM ☐ Commercial	FP ☐ Fire Protection	RC ☐ Recreation
IN ☐ Industrial	AS ☐ Agricultural Spraying	OT ☒ Other
MC ☐ Municipal	OF ☐ Oil Well Flooding	Explain MDOH Rest Area

4. Source of Water: (Check Only One)
   ☐ Spring Name _____
   ☒ Well Name Hysham Rest Area - Eastbound
   ☐ Stream Name _____ Tributary of _____
   ☐ Lake Name _____ Stream _____
   Tributary of _____
   ☐ Reservoir Name _____ Stream _____
   Tributary of _____

5. Point of Diversion: County Treasure
   SE ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W
   Lot _____, Block _____, Subdivision _____

6. Means of Diversion:
   ☐ Well
   ☒ Pump Capacity 16 gpm
   ☐ Headgate with ditch or pipeline
   ☐ Instream use
   ☐ Other Explain _____

7. Means of Conveyance:
   ☐ Ditch ☐ Instream
   ☒ Pipeline ☐ Other: _____

8. **Place of Use:** County Treasure

☐ Instream ☐ City or Town ☒ Other: Explain MDOH Rest Area

Lot, Block, SE ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Subdivision

9. **Flow rate claimed:** 16

☐ cubic feet per second
☒ gallons per minute
☐ miner's inches

10. **Volume claimed:** 2 acre-feet per year

11. **Period(s) of use:** 3 (Month) / 1 (Day) to 11 (Month) / 30 (Day)

DNRC
12. **Check one:**

☐ Decreed Water Right
☐ Filed Appropriation Right
☒ Use Water Right

Priority date or date of first use: / (Hour) 2 (Month) / 9 ~~14~~ (Day) / 1966 (Year)

13. **Attach** copies of the Decree, Record of Filing or Proof of Use Right.

14. **Attach** copies of aerial photographs, U.S. Geological Survey maps or such other documents necessary to show point of diversion, place of use, place of storage, and conveyance facilities.

15. **Notarized Statement signed by claimant.**

STATE OF MONTANA)
:ss.
County of Lewis and Clark)

I, W. D. Hutchison, having been duly sworn, depose and say that I, being of legal age and being the claimant of this claim of existing water right, and the person whose name is signed to it as the claimant, know the contents of this claim and the matters and things stated there are true and correct.

W D Hutchison

Subscribed and sworn before me, this 30th day of April 19 82.

Kathleen a Ellis
Notary Public for the State of Montana

Residing at Helena, MT

My Commission expires 12/16/83

Approved Stock Form—State Publishing Co., Helena, Montana—42329

File No. 163868

T. 5 N. R. 26 E.

QUADRUPLICATE

County Treasure

LOG

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Casing Setdown = 10'
Top of Ground
(Elev. above sea level 3899.29 ft.)

Tan to grey sandy silt, with some clay.

10.0'

Grey sandy reworked shale, with some gravel.

Owner Montana Bureau of Conservation Address Helena, Montana

Driller Montana Well Drilling Co. Address Helena, Montana

Date of Notice of appropriation of groundwater February 6, 1963

Date well started January 25, 1963 Date completed February 3, 1963

Type of well drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐
Industrial ☐ Drainage ☐ Other ☐

Root Area Here [illegible] 17

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
8"	6" 10 Steel 19.08 lbs. per ft.	0.0'	61.5'	NONE		

94.0'
Grey clay.

60.0'
Grey sandy shale.
61.5' Bottom of casing shoe.

Soft grey sandstone. SE-1/8

70.0
Grey sandy gravel.

75.0 Bottomed hole in grey sandy gravel.

Show exact depth of bottom.

N / W / E / S

NW ¼ Sec. 6 T. 5 N R. 26 E

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for nonflowing well 24.0 feet

Shut-in Pressure for Flowing Well

Pumping Water Level 90.0 feet at 16 gal. per minute

Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 6 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e. Lot, Block, and Addition)

WATER ANALYSES

pH	7.9	
SO_4	52	P.P.M.
Calcium Bicarbonate Hardness	382	P.P.M.
Sodium Bicarbonate	42	P.P.M.

Water is Clear

Form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located, tissue copy to be retained by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

None required
Driller's License Number

Lehman B. Fox
Driller's Signature Helena, Mont.

FORM H. D. 25--2M TRIP.--P-54--HCKEE Log No. 40 205' Rt. Std. 073+00, Project I-94-7(10)89

(Elev. above sea level 2893.2'....)
Top of Ground

MONTANA STATE BOARD OF HEALTH
Division of Environmental Sanitation
Helena, Montana
WELL DRILLER'S REPORT

163868

Tanto grey sandy silt with some clay.

10.0'

Grey, sandy, reworked shale, with some gravel.

34.0'

Grey clay.

50.0'

Grey sandy shale.

61.5' Bottom of casing shoe.

Soft grey sandstone.

70.0'

Grey sandy gravel.

75.0 Bottomed hole in grey sandy gravel.

Driller's Registration No. None Req'd.

Driller Montana Highway Dept. Address Helena, Montana

Owner of Well Montana Highway Commission

Exact Location of Well SE 1/4 NW 1/4, Sec. 5, T.5 N., R.36 E.

Nearest Post Office Hysham County Treasure

Water to be Used for Rest Area Water Supply

Drilling Begun January 28, 1966 Well Finished February 3, 1966

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Casing Record

Size of Pipe	Kind and Weight of Material Used	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6" ID	Steal 19.88 lbs. per ft.	0.0'	61.5'	NONE		

WATER ANALYSIS

pH	7.5	
CO_2	52	p.p.m.
Calcium & Magnesium Bicarbonates	352	p.p.m.
Sodium Bicarbonates	42	p.p.m.
Water is basic		

Describe the type of joints in casing Electric Weld

Describe any screens used None

Capacity of Well 16 gallons per minute
(In Gallons or Barrels)

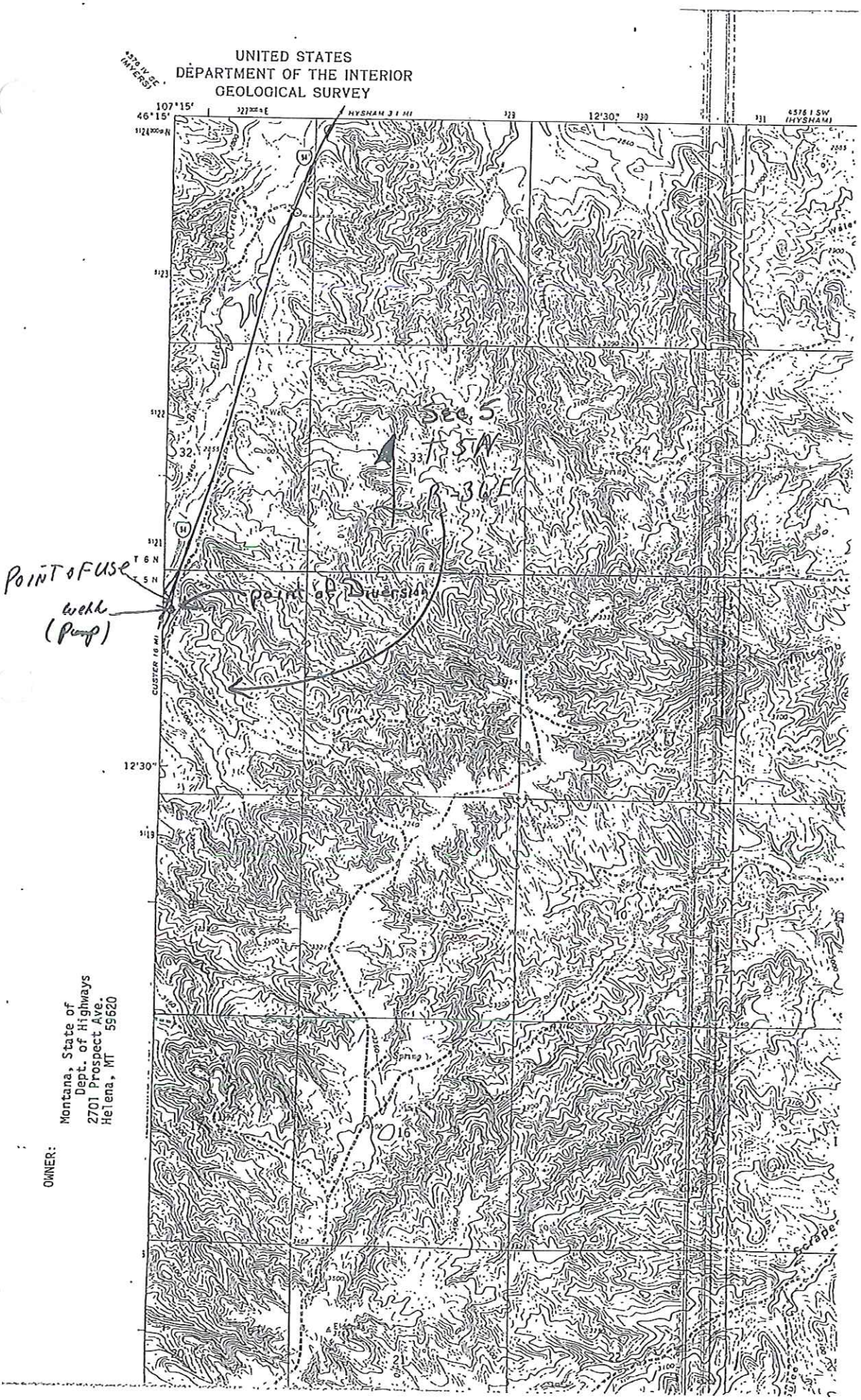
How Determined Pumped
(Pump, Bailer, Weir, Etc)

Signed Harls. Engr.

Date February 10, 1966

TO BE FILLED IN BY DRILLER

Show exact depth of bottom. F/c


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
107°15'
46°15'
12'30"
HYSHAM 31 MI
4576 I SW (HYSHAM)
Sec 5
T5W
R26E
POINT OF USE
well (Pump)
Point of Diversion
T 6 N
T 5 N
CUSTER 16 MI
Montana, State of
Dept. of Highways
2701 Prospect Ave.
Helena, MT 59620
OWNER:

RW 158

163868

WATER WELL REPORT

Location:

County Treasure

Town Hysham East Reat Area

Subdivision SE¼ NW¼

Addition

Section 5

Block

Township 5N

Lot

Range 36 E

Highway Project No.

Right/~~Left~~ Station 285 Ft. Sta. 673+00

Purpose:

Depth of Well 75.0 ft. (feet)

Maintenance Section Headquarters:

☐ Irrigation ☐ Potable

Capacity of Well 16 gallons per minute (gal. per min.)

Notice of Completion of Appropriation Filed With County Clerk and Recorder

Rest Area:

☒ Irrigation ☒ Potable

February 14,1966 (date)

Beautification:

☐ Irrigation ☐ Potable

Well Drillers Report Filed With State Department of Health

February 14,1966 (date)

Remarks:

FORM E. S. 26--2M TRIP.--8-64--McKEE Log No. 40 205' Rt. Sta. 673+00, Project I-94-2(10)55 East Bound

(Elev. above sea level 2699.2'....)
Top of Ground

MONTANA STATE BOARD OF HEALTH
Division of Environmental Sanitation
Helena, Montana
WELL DRILLER'S REPORT

Hyslop Rest Area

163868

Tanto grey sandy silt with some clay.

10.0'

Grey, sandy, reworked shale, with some gravel.

Driller's Registration No. None Req'd.

Driller Montana Highway Dept. Address Helena, Montana

Owner of Well Montana Highway Commission

Exact Location of Well SE 1/4 NW 1/4, Sec. 5, T. 5 N., R. 26 E.

Nearest Post Office Hyslop County Treasure

Water to be Used for Rest Area Water Supply

Drilling Begun January 28, 1966 Well Finished February 3, 1966

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

34.0'

Grey clay.

Casing Record

Size of Pipe	Kind and Weight of Material Used	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6" ID	Steel 19.00 lbs. per ft.	0.0'	61.5'	NONE		
		WATER ANALYSIS				
pH				7.5		
CO_2				52 p.p.m.		
Calcium & Magnesium Bicarbonates				352 p.p.m.		
Sodium Bicarbonates				42 p.p.m.		
Water is basic						

Describe the type of joints in casing Electric Weld

60.0'

Grey sandy shale.

61.5' Bottom of casing shoe.

Describe any screens used None

Soft grey sandstone.

Capacity of Well 16 gallons per minute
(In Gallons or Barrels)

70.0'

How Determined Pumped
(Pump, Bailer, Weir, Etc)

Grey sandy gravel.

Signed Watts, Engr.

75.0 Bottomed hole in grey sandy gravel.

Date February 10, 1966

TO BE RETAINED BY DRILLER

Show exact depth of bottom. F/c

Form WR09
Nov 2-81

163868

REMARK RECORD STATEMENT OF CLAIM CODING FORM

codes	headings	codes	headings
OW	owner information	FR	flow rate remark
PU	purpose clarification	VM	volume remark
SN	source name remark	PE	period of use remark
CL	clarification of land descr.	SB	subdivision name
DM	diversion means	RM	general remark
PR	priority date		

	ACTION	GEN CODE	GEN #	BASIN	ID CODE	ID NUMBER	EXT ID
06	A	N	00	42KJ	W		00

REMARKS: PU01

DOH HIGHWAY REST AREA

REMARKS:

REMARKS:

REMARKS

REMARKS:

STATEMENT OF CLAIM CHECKLIST

FORM TYPE: I S D ⓪

OK	NOT OK		
		Received	
		Basin	
		County	163868
		Division	
		Transmittal	
		Fee	

FORM ITEMS

	OK	NOT OK	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

Checked by D. RICHARD / 6-8-82
Date

DEFICIENT:

____Phoned _____ / _____
Number Date

____Sent Letter _____ / _____
To Date

Correction Deadline: _____
Date

____Form Corrected _____
Date

____Incomplete Form & Correspondence Sent To Helena

☐ See notes on reverse side

NEW 10 90 :

WATER RIGHT DATA BASE CODING FORM
REMARK RECORD

DNRC
Supplemental Document
Claim # 42KJ W163868-00

EFERENCE JUMBER	REMARK CODE & NUMBER	SPECIFIC DATA		
P565	PU01	Highway Rest Area	♦	♦
A5	AM01	Period of Use	♦ 09/16/99	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦
			♦	♦

Form #76-A 5-91

AMENDMENT

TO STATEMENT OF CLAIM

RECEIVED
SEP 16 1999
DEPT. OF NATURAL RESOURCES AND CONSERVATION
BILLINGS OFFICE

Claim number(s): 42KJ W163868-00

Owner(s): Montana, State of Dept of Transportation

I make the following amendment(s) to the above statement of claim(s):

(Complete only those sections that require amendment.)

1. Owner of Water Right: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Co-owner or Other Interest Owner: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Address _____

   City _____ State _____ Zip Code _____

   Home Phone No. ( ) _____ Business Phone No. ( ) _____

2. Purpose (use): _____

   a. If irrigation, method of irrigation use ☐ Sprinkler ☐ Flood ☐ Waterspreading ☐ Subirrigation ☐ Natural Overflow

   b. If domestic, number of households served _____

   c. If stock, total number and type of livestock served _____

3. Source of Water: _____ Tributary of _____

4. Point of Diversion: County _____

   _____ ¼, _____ ¼, _____ ¼, Section _____, T_____N/S, R_____E/W

   Lot_____, Block _____, Subdivision _____

   ☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

   Please attach a map showing all points of diversion for this water right.

5. Means of Diversion: ☐ Well ☐ Instream Use ☐ Dam ☐ Headgate ☐ Pump: Capacity _____ gpm ☐ Other _____

6. Means of Conveyance: ☐ Ditch ☐ Pipeline ☐ Instream Use ☐ Other _____

AMENDMENT

7. Place of Use: County _____

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____Total Acres. Subdivision _____

☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

Please attach map showing entire place of use for this water right.

8. Flow Rate Claimed: _____ ☐ cubic feet per second ☐ gallons per minute ☐ miner's inches

9. Volume Claimed: _____ acre-feet per year

10. Period(s) of Use: Jan. (Month) / 1 (Day) to Dec. (Month) / 31 (Day)

11. Priority Date *(date of first use)*: _____ (Hour) / 2 (Month) / 14 (Day) / 66 (Year)

12. Type of Historical Right: ☐ Decreed Right ☐ Filed Appropriation Right ☐ Use Right

Please attach proof of priority date or type of right.

13. Reasons for Amendment: _____

14. Comments: _____

15. Notarized Statement Signed by Owner:

I, having been duly sworn, depose and say that I, being of legal age and being the owner of this claim of existing water right know the contents of this amendment and that the matters and things stated there are true and correct. *(Only one current owner of the right as listed in the DNRC centralized record system is required to sign, but all owners are encouraged to sign.)*

Signature _____ Date 9/15/99

Signature _____ Date _____

Subscribed and sworn before me this 15 day of SEPTEMBER, 1999

(notary seal)

Residing at Billings, Mt.

My commission expires July 28, 2003

47148

tice of Completion
of groundwater Appropriation
by means of wells

Montana Highway Commission

Sec 5 Twp 5 Range 36 E

STATE OF MONTANA,
County of Treasure } ss.

OFFICE OF RECORDER OF DEEDS.

I hereby certify that the within instrument was filed for record in this office on the 14 day of Feb 1966, at 4 o'clock P.M.

Harvon Hunkins
County Clerk and Recorder of Treasure County

By _____ Deputy.

DNRC
Supplemental Document
CLAIM # 42KJ W163868-00

07/11/94 D.N.R.C. 42KJ-W-163868-00

EXAMINATION WORKSHEET

* *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
PO BOX 201001
HELENA MT 59620-1001

✓ ok ___amended ___rule 2.II. ___DNRC error ___issue
comments: _____

✓ |*|PURPOSE: Institutional

___ok ___amended ✓ rule 5.II. ___DNRC error ___issue
comments: _____

____| |SOURCE: WELL

✓ ok ___amended ___rule 2.VI. ___DNRC error ___issue
data source: USGS topo map Scraper Coulee
WR survey _____ others _____
comments: _____

____ SOURCE TYPE: GROUNDWATER
✓ ok ___not ok comments: _____

| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

✓ ok ___amended ___rule 2.III. ___DNRC error ___issue
___additional PODS: see attached code sheets/amendment form
✓ depth 75 static wtr lvl 24 yield rate 16 csng diam 6.00
comments: _____

____ basin code: 42KJ
✓ ok ___not ok interbasin transfer with basin _____
comments: _____

✓ |*|PRIORITY DATE: FEB ~~09~~ 14 1966

___ok ___amended ___rule 2.VIII. ✓ DNRC error ___issue
comments: _____

✓ |*|TYPE OF RIGHT: ~~USE~~ Filed

___ok ___amended ✓ rule 2.VIII. ___DNRC error ___issue
comments: _____

07/11/94 DNRC EXAMINATION WORKSHEET CONT. 42KJ-W-163868-00

\ | |FLOW RATE: 16.00 GPM (1.42 MI)

__/__ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

_____

____ | |VOLUME: 2.00 acre-feet per year
(feasible vol. = 19.44 AF)
(comparison stat.= 2.46 hrs/day)

__/__ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

_____

__/__ |*| PERIOD OF USE: ~~MAR 1 TO NOV 30~~ Jan 1 Dec 31 (computer array: 001999999970)

__/__ok __/__amended ___rule 5.V. ___DNRC error ___issue
comments: _____

_____

____ | |PLACE OF USE FOR : 01

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SENENW	05	05N	36E	TR

__/__ok ___amended ___rule 5.III. ___DNRC error ___issue
___additional pou parcels: see attached code sheets/amendment form

data source: _____
comments: _____

_____

SUPPLEMENTAL: ___yes __/__no comments: _____

MULTIPLE USE: ___yes (add MU remark) __/__no

__/__ EXISTING REMARKS IN DATABASE: ___ok __/__not ok

~~PU01 MDOH HIGHWAY REST AREA~~

____ fee paid: $40.00 __/__ok ___not ok
____ claim received: 4/30/82 __/__ok ___not ok

* * * *

11/23/99 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

____| |PURPOSE (USE):

PU01 INSTITUTIONAL

PU03 HIGHWAY REST AREA

____| |SOURCE: WELL
SOURCE TYPE: GROUNDWATER

✓ ____|*|PRIORITY DATE: FEBRUARY ~~09~~ 14, 1966
✓ ____| | TYPE OF HISTORICAL RIGHT: ~~USE~~ Filed

____| |FLOW RATE: 16.00 GPM

____| |VOLUME: 2.00 AF

✓ ____| |PERIOD OF USE: ~~MARCH~~ Jan 01 TO ~~NOVEMBER 30~~ Dec 31

____| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

____| |PLACE OF USE FOR :

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SENENW	05	05N	36E	TR

____ GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

____ UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* *
* POTENTIAL ERROR/WARNING MESSAGES *
* invalid purpose code (B02) *
* more than one purpose: (B03) *
* *
* *

11/23/99 DNRC REVIEW ABSTRACT (CONT.) 42KJ-W-163868-00

REVIEWED BY: _____ DATE _____

ADDENDUMS: ___ YES ___ NO (NOS: ___DVRS ___RSRV ___POU ___RMRK ___OWNR)

CODED BY: _____ DATE _____

01/05/00 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

✓ | |PURPOSE (USE): ~~IRRIGATION~~ Institutional "IS" code
~~TYPE OF IRRIGATION SYSTEM: OTHER~~

~~PU01 INSTITUTIONAL~~

PU03 ✓ HIGHWAY REST AREA

____| |SOURCE: WELL
SOURCE TYPE: GROUNDWATER

____|*|PRIORITY DATE: FEBRUARY 14, 1966
____| | TYPE OF HISTORICAL RIGHT: FILED

____| |FLOW RATE: 16.00 GPM (OK)
*** NO ACRES

____| |VOLUME: 2.00 AF
CLIMATIC AREA: 5

____| |PERIOD OF USE: JANUARY 01 TO DECEMBER 31

____| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

✓ ____| |PLACE OF USE FOR IRRIGATION:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
			SE NE NW	05	~~05E~~ 05N	36E.	TR

____ GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

____ UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* *
* POTENTIAL ERROR/WARNING MESSAGES *
* volume value - not water spreading, reservoir, or decreed right (F09) *
* maximum claimed acres = zero (G02) *
* year round irrigation (H03) *
* missing entire place of use (M09) *

01/05/00 DNRC REVIEW ABSTRACT (CONT.) 42KJ-W-163868-00

* * * *

02/09/00 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

____| |PURPOSE (USE): INSTITUTIONAL

~~PU01 INSTITUTIONAL~~

PU03 HIGHWAY REST AREA

____| |SOURCE: WELL
SOURCE TYPE: GROUNDWATER

____|*|PRIORITY DATE: FEBRUARY 14, 1966
____| | TYPE OF HISTORICAL RIGHT: FILED

____| |FLOW RATE: 16.00 GPM

____| |VOLUME: 2.00 AF

____| |PERIOD OF USE: JANUARY 01 TO DECEMBER 31

____| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

____| |PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SENENW	05	05N	36E	TR

____ GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

____ UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* * * * * * * * * * * * * * * *

02/09/00 DNRC REVIEW ABSTRACT (CONT.) 42KJ-W-163868-00

REVIEWED BY: OSR DATE 2/15/00

ADDENDUMS: ___ YES ___ NO (NOS: ___DVRS ___RSRV ___POU ___RMRK ___OWNR)

CODED BY: _____ DATE _____

02/23/00 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

PURPOSE (USE): INSTITUTIONAL

PU01 HIGHWAY REST AREA

SOURCE: WELL
SOURCE TYPE: GROUNDWATER

X PRIORITY DATE: FEBRUARY 14, 1966
TYPE OF HISTORICAL RIGHT: FILED

FLOW RATE: 16.00 GPM

VOLUME: 2.00 AF

PERIOD OF USE: JANUARY 01 TO DECEMBER 31

POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

PLACE OF USE FOR INSTITUTIONAL:

	ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001				SENENW	05	05N	36E	TR

GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* * * * * * * * * * * * * * * *

TEMPORARY PRELIMINARY DECREE
YELLOWSTONE RIVER BETWEEN BIGHORN AND TONGUE RIVERS
BASIN 42KJ
ABSTRACT OF WATER RIGHT CLAIM

WATER RIGHT NUMBER 42KJ-W-163868-00

IMPORTANT NOTICE

YOUR WATER RIGHT AS SHOWN ON THIS ABSTRACT MAY HAVE CHANGES FROM YOUR WATER RIGHT AS CLAIMED OR AMENDED. AN ASTERISK (*) HAS BEEN PLACED NEXT TO EACH ITEM CHANGED BY THE DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION (DNRC) DURING THE EXAMINATION PROCESS. THESE CHANGES ARE AUTHORIZED BY THE MONTANA WATER COURT OR THE WATER RIGHT CLAIM EXAMINATION RULES AS ADOPTED BY THE MONTANA SUPREME COURT.

OBJECTIONS MAY BE FILED ACCORDING TO THE PROCEDURES OUTLINED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
ENVIRONMENTAL SERVICES
PO BOX 201001
HELENA MT 59620-1001

PURPOSE (USE): INSTITUTIONAL

HIGHWAY REST AREA

SOURCE: WELL
SOURCE TYPE: GROUNDWATER

PRIORITY DATE: FEBRUARY 14, 1966
TYPE OF HISTORICAL RIGHT: FILED

FLOW RATE: 16.00 GPM (.04 CFS)

VOLUME: 2.00 AF

PERIOD OF USE: JANUARY 01 TO DECEMBER 31

POINT OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
01			SENENW	05	05N	36E	TREASURE

PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
001			SENENW	05	05N	36E	TREASURE

REMARKS:

THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

****
* THE DNRC EXAMINATION OF THIS CLAIM FOUND NO SIGNIFICANT FACTS, *
* DATA, OR ISSUES TO REPORT TO THE WATER COURT. *
****

FILMED

WATER RIGHT NUMBER 42KJ-W-163868-00 (CONTINUED)

A BETTER UNDERSTANDING OF YOUR CLAIMED WATER RIGHT CAN BE OBTAINED BY COMPARING YOUR RIGHT WITH OTHER CLAIMS IN THE BASIN. FOR EXAMPLE, COMPARE PRIORITY DATES, FLOW RATES, VOLUMES, OR ACRES IRRIGATED. ALSO, YOUR WATER RIGHT MAY BE SUBJECT TO WATER RIGHTS IN ADJOINING BASINS OR SUBBASINS AS WELL AS BEING SUBJECT TO OTHER RIGHTS ON YOUR SOURCE OF SUPPLY. FINALLY, YOUR WATER RIGHT MAY BE SUBJECT TO INDIAN RESERVED AND FEDERAL RESERVED WATER RIGHTS.

COMPLETE DETAILS REGARDING THE DNRC EXAMINATION RESULTS AND RELATED MATERIALS CAN BE REVIEWED AT THE OFFICE LOCATIONS IDENTIFIED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

SEE GENERAL FINDINGS OF FACT AND CONCLUSIONS OF LAW FOR FURTHER EXPLANATION OF YOUR CLAIMED WATER RIGHT. THESE FINDINGS CAN BE FOUND AS INDICATED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY." IF YOU NEED OBJECTION FORMS, OR HAVE QUESTIONS ABOUT WATER COURT PROCEDURES OR CHANGES TO YOUR RIGHT, YOU CAN CONTACT THE WATER COURT BY CALLING 1-800-624-3270 (WITHIN MONTANA ONLY) OR 1-406-586-4364, OR BY WRITING TO P.O. BOX 1389, BOZEMAN MT 59771-1389.

FILMED

FILE

STATEMENT OF CLAIM

42KJ

163867

00

Box Bar Code _____

File Bar Code _____

Date/Initials _____

Form No. 76-O R2/80

163867

TR-Y

42KJ

STATEMENT OF CLAIM FOR EXISTING WATER RIGHTS

OTHER USES

For the Water Courts of the State of Montana

RECEIVED
APR 30 1982
DEPT. OF NATURAL RESOURCES AND CONSERVATION

NWT 45850
40.00

1. Owner of Water Right

Co-Owner or Other Interest Owner: MONTANA, STATE OF / DEPT OF HIGHWAYS / 2701 PROSPECT / HELENA MT 59620

Address _____ / _____ Middle Initial

City _____ / _____ Middle Initial

Zip Code _____

Home Phone No. _____ Business Phone No. _____

2. Person completing form Hutchison (Last) / William (First) / D. (Middle Initial)

Address 2701 Prospect Avenue

City Helena State Montana Zip Code 59620

Home Phone No. _____ Business Phone No. 449-2584

3. Use: (Check Only One)

FR ☐ Fish Raceways	GE ☐ Geothermal	MN ☐ Mining
FW ☐ Fish & Wildlife	NV ☐ Navigation	PG ☐ Power Generation
CM ☐ Commercial	FP ☐ Fire Protection	RC ☐ Recreation
IN ☐ Industrial	AS ☐ Agricultural Spraying	OT ☒ Other
MC ☐ Municipal	OF ☐ Oil Well Flooding	Explain MDOH Rest Area

4. Source of Water: (Check Only One)

☐ Spring Name _____

☒ Well Name Hysham Rest Area - Westbound

☐ Stream Name _____ Tributary of _____

☐ Lake Name _____ Stream _____

Tributary of _____

☐ Reservoir Name _____ Stream _____

Tributary of _____

5. Point of Diversion: County Treasure

NW ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W

Lot _____, Block _____, Subdivision _____

6. Means of Diversion:

☐ Well
☒ Pump Capacity 28 gpm
☐ Headgate with ditch or pipeline
☐ Instream use
☐ Other Explain _____

7. Means of Conveyance:

☐ Ditch ☐ Instream
☒ Pipeline ☐ Other: _____

8. **Place of Use:** County Treasure

☐ Instream ☐ City or Town ☒ Other: Explain MDOH Rest Area

_____ Lot, _____ Block, NW ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W

_____ Lot, _____ Block, _____ ¼ _____ ¼ _____ ¼, Section _____, T _____ N/S, R _____ E/W

_____ Lot, _____ Block, _____ ¼ _____ ¼ _____ ¼, Section _____, T _____ N/S, R _____ E/W

_____ Lot, _____ Block, _____ ¼ _____ ¼ _____ ¼, Section _____, T _____ N/S, R _____ E/W

_____ Lot, _____ Block, _____ ¼ _____ ¼ _____ ¼, Section _____, T _____ N/S, R _____ E/W

Subdivision _____

9. **Flow rate claimed:** 28
☐ cubic feet per second
☒ gallons per minute
☐ miner's inches

10. **Volume claimed:** 5 acre-feet per year

11. **Period(s) of use:** 3 / 1 (Month / Day) to 11 / 30 (Month / Day)

DNRC

12. **Check one:**
☐ Decreed Water Right
☐ Filed Appropriation Right
☒ Use Water Right

Priority date or date of first use
_____ / _____ / ~~2~~ / ~~14~~ 28 / 1966
Hour / Month / Day / Year

13. **Attach** copies of the Decree, Record of Filing or Proof of Use Right.

14. **Attach** copies of aerial photographs, U.S. Geological Survey maps or such other documents necessary to show point of diversion, place of use, place of storage, and conveyance facilities.

15. **Notarized Statement signed by claimant.**

STATE OF MONTANA)
:ss.
County of Lewis and Clark)

I, W. D. Hutchison, having been duly sworn, depose and say that I, being of legal age and being the claimant of this claim of existing water right, and the person whose name is signed to it as the claimant, know the contents of this claim and the matters and things stated there are true and correct.

W D Hutchison

Subscribed and sworn before me, this 30th day of April 19 82

Kathleen A. Ellis
Notary Public for the State of Montana

Residing at Helena, M.T

My Commission expires 12/16/83

Approved Blank Form—State Publishing Co., Helena, Montana—42319

File No. 163867

T. 5 N. R. 38 E.

QUADRUPLICATE

County Treasure

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

RECEIVED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Owner Montana Power Company Address Bolene, Montana

Driller Montana Power Company Address Helena, Montana

Date of Notice of appropriation of groundwater January 31, 1966

Date well started January 27, 1966 Date completed January 28, 1966

Type of well Cable drilled Equipment used Churn drill
(Dug, Driven, bored or drilled) (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐
Industrial ☐ Drainage ☐ Other ☐

Test Area Water Supply.

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

LOG

Top of Ground

Greyish tan sandy silt. (Elev. above sea level 2871.00 ft.)

← 5.0'

Change to grey sandy clay.

← 15.0' Traces of gravel.

← 20.0'

Grey sandy clay; some surface water

← 25.0'

Grey shale.

← 35.0'

Bluish grey clay.

← 55.0' Some traces gravel. Increasing amounts of sand to coarse rock

Total 63.0 ft.

← 60.0' Bottom of casing.

← 63.0 Bottomed hole in gravel & dark grey sand.

Show exact depth of bottom.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6"	5" 18 Steel 19.90 lbs. per ft.	0.0'	60.0'	None		

N / W / E / S

SW 1/4 NW 1/4 Sec. 5 T. 5 N. R. 38 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 14.0 feet.

Shut-in Pressure for Flowing Well

Pumping Water Level 43 feet,
at 28 gal. per minute.

Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e. Lot, Block and Addition).

WATER MONITOR

Pz	7.0	
Cl	5.0	perm.
Caliche & Sandstone Interbedded	280	perm.
Soft Sandstone	90	perm.
Water in Rock		

None required

Driller's License Number

Lehman B. Fox

Driller's Signature

Form to be prepared by driller, and three copies to be filed by the owner with the Clerk and Recorder in the county in which the well is located, tissue copy to be kept by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

POOR COPY

FORM E. S. 20--2529 THIP ... Log No. 35 340' Lt. of Sta. 675+92, Project F-30-2(10)56

(Elev. -5 ... 2871.63) Ft.

MONTANA STATE BOARD OF HEALTH

Division of Environmental Sanitation

Helena, Montana

163867

WELL DRILLER'S REPORT

Driller's Registration No. None req'd.

Driller Montana Highway Department Address Helena, Montana

Owner of Well Montana Highway Commission

Exact Location of Well NE 1/4 SW 1/4, Sec. 7, T. 5 N., R. 36 E.

Nearest Post Office Hysham County Treasure

Water to be Used for Rest Area Water Supply

Drilling Begun January 21, 1966 Well Finished January 28, 1966

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Top ...

Greyish tan silt.

5.0'

To gray sandy clay.

15.0' Traces of gravel.

20.0'

Grey sandy clay, with some surface water.

35.0

Bluish grey clay.

55.0' Some traces of gravel; increasing amounts of sand to coarse rock at 63'

63.0' Bottom of casing.

65.0' Bottomed hole in gravel and dark gray sand.

Casing Record

Size of Pipe	Kind and Weight of Material Used	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6" ID	Steel 19.00 lbs. per ft.	0.0'	63.0'	NONE		

WATER ANALYSIS

pH	7.5	
CO_2	5.4	p.p.m.
Calcium & Magnesium Bicarbonates	280	p.p.m.
Sodium Bicarbonate	90	p.p.m.
Water is basic		

Describe the type of joints in casing... Electric weld

Describe any screens used... None

Capacity of Well... 28 gallons per minute (In Gallons or Barrels)

How Determined... Pumped (Pump, Bailer, Weir, Etc)

Signed... Asst. Engr.

Date... February 10, 1966

CERTIFICATE TO BE RETAINED BY DRILLER

f./c

POOR COPY

Log No. 39 340' Lt. of Sta. 675+92, Project I-94-2(10)63

RECD FEB 16 1966

GW 2

Approved Stock Form—State Publishing Co., Helena, Montana—42329

File No. 163867 W B Hysham Rest Area T. 5 N. R. 36 E.

DUPLICATE

County Treasure

LOG

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Top of Ground

Greyish tan sandy silt.

(Elev. above sea level 2971.68) ft.

5.0' Change to grey sandy clay.

15.0' Traces of gravel.

20.0' Grey sandy clay; some surface water.

25.0' Grey shale.

35.0' Bluish grey clay.

55.0' Some traces gravel. Increasing amounts of sand to coarse rock @ 63.0 ft.

Perf. Casing

63.0' Bottom of casing.

65.0 Bottomed hole in gravel & dark grey sand.

Owner Montana Highway Commission Address Helena, Montana

Driller Montana Highway Department Address Helena, Montana

Date of Notice of appropriation of groundwater January 31, 1966

Date well started January 24, 1966 Date completed January 28, 1966

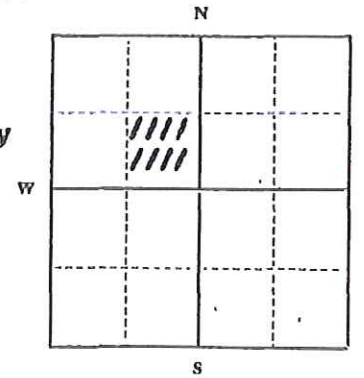
Type of well Churn drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐ Industrial ☐ Drainage ☐ Other ☐

Rest Area Water Supply.

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS		
				Kind Size	From (Feet)	To (Feet)
6"	6" ID Steel 19.00 lbs. per ft.	0.0'	63.0'	NONE		



SE 1/4 NW 1/4 Sec. 5 T. 5 N. R. 36 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 18.0 feet.

Shut-in Pressure for Flowing Well

Pumping Water Level 43 feet at 28 gal. per minute.

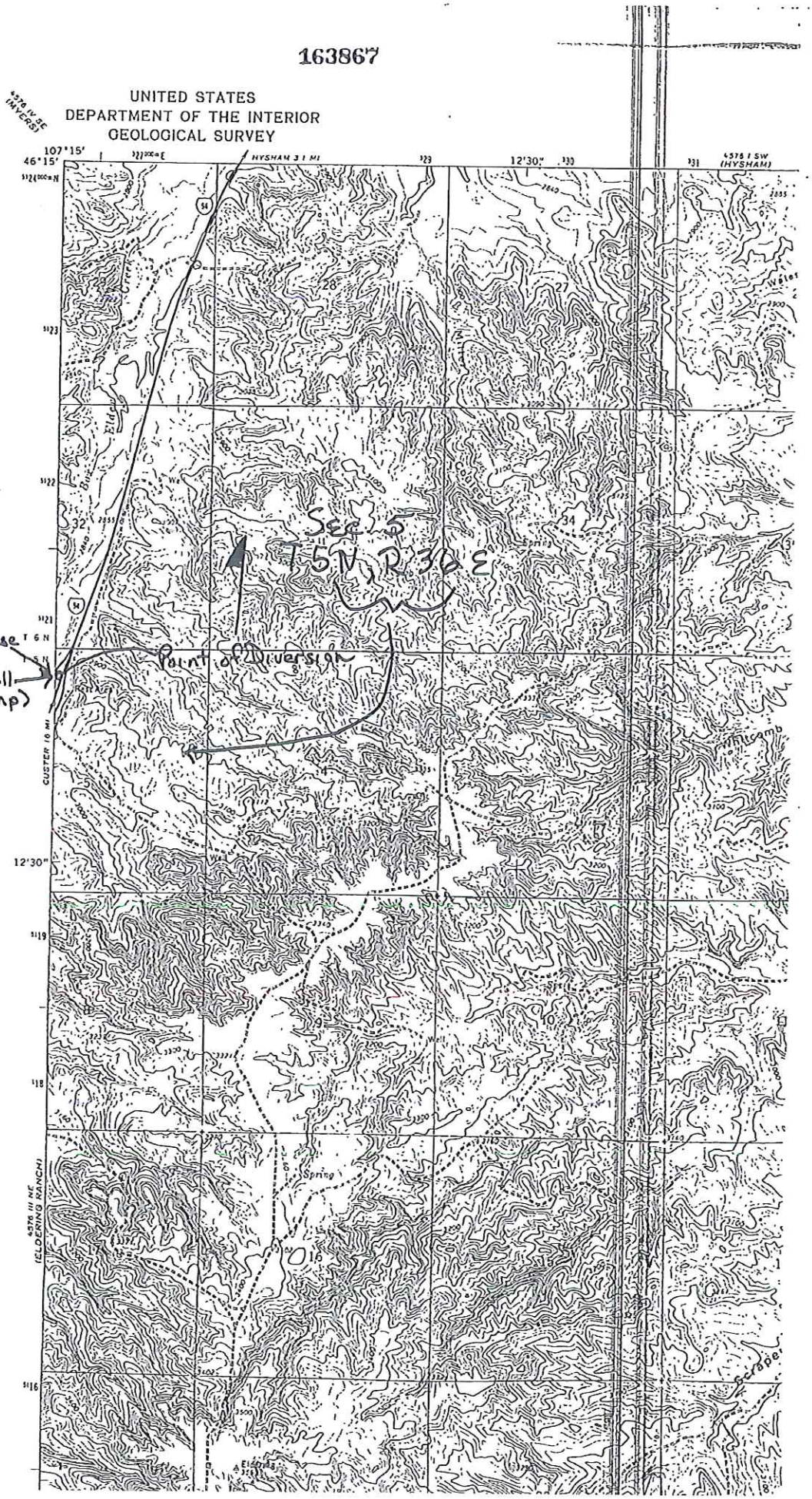
Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

163867



OWNER:
Montana, State of
Dept. of Highways
2701 Prospect Ave.
Helena, MT 59620

RW 158

163867

WATER WELL REPORT

Location:

County Treasure

Town Hysham East Rest Area

Subdivision SE¼ NW¼

Addition

Section 5

Block

Township 5N

Lot

Range 36E

Highway Project No. I-94-2(10)63

~~Right~~/Left Station 340' Sta. 675+92

Purpose:

Maintenance Section Headquarters:

☐ Irrigation ☐ Potable

Rest Area:

☒ Irrigation ☒ Potable

Beautification:

☐ Irrigation ☐ Potable

Depth of Well 65.0 ft. (feet)

Capacity of Well 28 gallons per minute (gal. per min.)

Notice of Completion of Appropriation Filed With County Clerk and Recorder

February 14,1966 (date)

Well Drillers Report Filed With State Department of Health

February 10,1966 (date)

Remarks:

Form WR09
Nov 2-81

163867

REMARK RECORD STATEMENT OF CLAIM CODING FORM

codes	headings	codes	headings
OW	owner information	FR	flow rate remark
PU	purpose clarification	VM	volume remark
SN	source name remark	PE	period of use remark
CL	clarification of land descr.	SB	subdivision name
DM	diversion means	RM	general remark
PR	priority date		

	ACTION	GEN CODE	GEN #	BASIN	ID CODE	ID NUMBER	EXT ID
0 6	A	N	0 0	42KJ	W		0 0

REMARKS. PU01

DOH HIGHWAY REST AREA

REMARKS:

REMARKS:

REMARKS

REMARKS.

STATEMENT OF CLAIM CHECKLIST

FORM TYPE: I S D (O)

OK	NOT OK		
____	____	Received	
____	____	Basin	
____	____	County	
____	____	Division	163867
____	____	Transmittal	
____	____	Fee	
____	____	____	
____	____	____	

FORM ITEMS

	OK	NOT OK	
1	____	____	____
2	____	____	____
3	____	____	____
4	____	____	____
5	____	____	____
6	____	____	____
7	____	____	____
8	____	____	____
9	____	____	____
10	____	____	____
11	____	____	____
12	____	____	____
13	____	____	____
14	____	____	____
15	____	____	____
16	____	____	____

Checked by D. RICHARD / 6-8-82
Date

DEFICIENT:

____Phoned _____ / _____
Number Date

____Sent Letter _____ / _____
To Date

Correction Deadline: _____
Date

____Form Corrected _____
Date

____Incomplete Form & Correspondence Sent To Helena

☐ See notes on reverse side

NEW 10-90

WATER RIGHT DATA BASE CODING FORM
REMARK RECORD

DNRC
Supplemental Document
Claim #42KJ W163867-00

REFERENCE NUMBER	REMARK CODE & NUMBER	SPECIFIC DATA
P565	PU01	Highway Rest Area
A5	AM01	Period of Use 09/16/99

07/11/94 D.N.R.C. 42KJ-W-163867-00

EXAMINATION WORKSHEET

* *

coding

WATER RIGHT NUMBER 42KJ-W-163867-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
PO BOX 201001
HELENA MT 59620-1001

✓ ok ___amended ___rule 2.II. ___DNRC error ___issue
comments: _____

____|X|PURPOSE: Institutional

___ok ___amended ✓ rule 5.II. ___DNRC error ___issue
comments: _____

____| |SOURCE: WELL

✓ ok ___amended ___rule 20VI. ___DNRC error ___issue
data source: USGS topo map Scraper Coulee
WR survey _____ others _____
comments: _____

____ SOURCE TYPE: GROUNDWATER
✓ ok ___not ok comments: _____

|X|POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
✓ WL01			~~NW~~SW NENW	05	05N	36E	TR

___ok ___amended ✓ rule 2.III. ___DNRC error ___issue
___additional PODS: see attached code sheets/amendment form
✓ depth 65 static wtr lvl 14 yield rate 28 csng diam 6.00
comments: _____

____ basin code: 42KJ
✓ ok ___not ok interbasin transfer with basin _____
comments: _____

✓ |*|PRIORITY DATE: ~~JAN 28~~ Feb 14, 1966

___ok ___amended ___rule 2.VIII. ✓ DNRC error ___issue
comments: _____

✓ |X|TYPE OF RIGHT: ~~USE~~ Filed

___ok ___amended ✓ rule 2.VIII. ___DNRC error ___issue
comments: _____

07/11/94 DNRC EXAMINATION WORKSHEET CONT. 42KJ-W-163867-00

__| |FLOW RATE: 28.00 GPM (2.49 MI)

__ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

____| |VOLUME: 5.00 acre-feet per year
(feasible vol. = 34.03 AF)
(comparison stat.= 3.52 hrs/day)

__ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

__/__|X|PERIOD OF USE: ~~MAR 1~~ Jan 1 TO ~~NOV 30~~ Dec 31 (computer array: 001999999970)

__ok __amended ___rule 5.V. ___DNRC error ___issue
comments: _____

__/__|X|PLACE OF USE FOR : 01

	ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001				~~NW~~NENW ~~SW~~	05	05N	36E	TR

___ok ___amended __rule 5.III. ___DNRC error ___issue
___additional pou parcels: see attached code sheets/amendment form

data source: _____
comments: _____

SUPPLEMENTAL: ___yes __no comments: _____

MULTIPLE USE: ___yes (add MU remark) __no

__ EXISTING REMARKS IN DATABASE: ___ok ___not ok

~~PU01 MDOH HIGHWAY REST AREA~~

____ fee paid: $40.00 __ok ___not ok
____ claim received: 4/30/82 __ok ___not ok

* *
questionnaires: type _____ date sent_____completed__yes__no
telephone contact: date _____phone #:_____
letter contact: date _____
interview: date _____
ownership check: date _____
field investigation: date _____approval:_____
water court contact: date _____
General Comments:
Examined by: K. Bonnhoff date 9-7-99
Coding Sheets: __RMRK ___RSRV ___POU ___DVRS ___OWNR ___AMEND ___SUPP

Coded by: _____ Date _____

47147

Notice of Completion of
Groundwater Appropriation
By Means of Wells

Montana Highway Commission

Sec 5 Twp 5 R 36E

STATE OF MONTANA,
County of Treasure } ss.

I, RECORDER OF DEEDS
in and for said County, do hereby certify that the within instrument was filed for record in this office on the 12 day of
Feb, 1966, at 9
o'clock A M

Clerk and Recorder of Treasure County

By _____ Deputy.

DNRC
Supplemental Document
CLAIM # 42KJ W163867-00

Form #76-A 5-91

AMENDMENT

TO STATEMENT OF CLAIM

RECEIVED
SEP 16 1999
DEPT. OF NATURAL RESOURCES AND CONSERVATION
BILLINGS OFFICE

Claim number(s): 42KJ W163867-00

Owner(s): Montana, State of Dept of Transportation

I make the following amendment(s) to the above statement of claim(s):

(Complete only those sections that require amendment.)

1. Owner of Water Right: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Co-owner or Other Interest Owner: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Address _____

   City _____ State _____ Zip Code _____

   Home Phone No. ( ) _____ Business Phone No. ( ) _____

2. Purpose (use): _____

   a. If irrigation, method of irrigation use ☐ Sprinkler ☐ Flood ☐ Waterspreading ☐ Subirrigation ☐ Natural Overflow

   b. If domestic, number of households served _____

   c. If stock, total number and type of livestock served _____

3. Source of Water: _____ Tributary of _____

4. Point of Diversion: County _____

   _____ ¼, _____ ¼, _____ ¼, Section _____, T_____N/S, R_____E/W

   Lot_____, Block _____, Subdivision _____

   ☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

   Please attach a map showing all points of diversion for this water right.

5. Means of Diversion: ☐ Well ☐ Instream Use ☐ Dam ☐ Headgate ☐ Pump: Capacity _____ gpm ☐ Other _____

6. Means of Conveyance: ☐ Ditch ☐ Pipeline ☐ Instream Use ☐ Other _____

AMENDMENT

7. Place of Use: County _____

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____Total Acres. Subdivision _____

☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

Please attach map showing entire place of use for this water right.

8. Flow Rate Claimed: _____ ☐ cubic feet per second ☐ gallons per minute ☐ miner's inches

9. Volume Claimed: _____ acre-feet per year

10. Period(s) of Use: Jan. (Month) / 1 (Day) to Dec. (Month) / 31 (Day)

11. Priority Date *(date of filing use)*: _____ (Hour) / 2 (Month) / 14 (Day) / 66 (Year)

12. Type of Historical Right: ☐ Decreed Right ☐ Filed Appropriation Right ☐ Use Right

Please attach proof of priority date or type of right.

13. Reasons for Amendment: _____

14. Comments: _____

15. Notarized Statement Signed by Owner:

I, having been duly sworn, depose and say that I, being of legal age and being the owner of this claim of existing water right know the contents of this amendment and that the matters and things stated there are true and correct. *(Only one current owner of the right as listed in the DNRC centralized record system is required to sign, but all owners are encouraged to sign.)*

K. Lynn Sauer — Signature — 9/15/99 — Date

_____ — Signature — Date

Subscribed and sworn before me this 15 day of SEPTEMBER, 19 99.

(notary seal)

Brent A. M. Gunn

Residing at Billings, MT.

My commission expires July 28, 2003

/11/01 42KJ-W-163867-00

D.N.R.C.

* * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163867-00

OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
ENVIRONMENTAL SERVICES
PO BOX 201001
HELENA MT 59620-1001

*PURPOSE (USE): INSTITUTIONAL

PU03 HIGHWAY REST AREA

SOURCE: WELL
SOURCE TYPE: GROUNDWATER

*PRIORITY DATE: FEBRUARY 14, 1966
TYPE OF HISTORICAL RIGHT: FILED

FLOW RATE: 28.00 GPM

VOLUME: 5.00 AF

*PERIOD OF USE: JANUARY 01 TO DECEMBER 31

*POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SWNENW	05	05N	36E	TR

WELL DATA: DEPTH 65 SWL 14 YLD 28 CSN 6.00

*PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SWNENW	05	05N	36E	TR

GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* * * * * * * * * * * * * * * *

TEMPORARY PRELIMINARY DECREE
YELLOWSTONE RIVER BETWEEN BIGHORN AND TONGUE RIVERS
BASIN 42KJ
ABSTRACT OF WATER RIGHT CLAIM

WATER RIGHT NUMBER 42KJ-W-163867-00

IMPORTANT NOTICE

YOUR WATER RIGHT AS SHOWN ON THIS ABSTRACT MAY HAVE CHANGES FROM YOUR WATER RIGHT AS CLAIMED OR AMENDED. AN ASTERISK (*) HAS BEEN PLACED NEXT TO EACH ITEM CHANGED BY THE DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION (DNRC) DURING THE EXAMINATION PROCESS. THESE CHANGES ARE AUTHORIZED BY THE MONTANA WATER COURT OR THE WATER RIGHT CLAIM EXAMINATION RULES AS ADOPTED BY THE MONTANA SUPREME COURT.

OBJECTIONS MAY BE FILED ACCORDING TO THE PROCEDURES OUTLINED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
ENVIRONMENTAL SERVICES
PO BOX 201001
HELENA MT 59620-1001

* PURPOSE (USE): INSTITUTIONAL

HIGHWAY REST AREA

SOURCE: WELL
SOURCE TYPE: GROUNDWATER

* PRIORITY DATE: FEBRUARY 14, 1966
TYPE OF HISTORICAL RIGHT: FILED

FLOW RATE: 28.00 GPM (.06 CFS)

VOLUME: 5.00 AF

* PERIOD OF USE: JANUARY 01 TO DECEMBER 31

* POINT OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
01			SWNENW	05	05N	36E	TREASURE

* PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
001			SWNENW	05	05N	36E	TREASURE

REMARKS:

THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

****
* THE DNRC EXAMINATION OF THIS CLAIM FOUND NO SIGNIFICANT FACTS, *
* DATA, OR ISSUES TO REPORT TO THE WATER COURT. *
****

FILMED

TEMPORARY PRELIMINARY DECREE
YELLOWSTONE RIVER BETWEEN BIGHORN AND TONGUE RIVERS
BASIN 42KJ
ABSTRACT OF WATER RIGHT CLAIM

WATER RIGHT NUMBER 42KJ-W-163867-00 (CONTINUED)

A BETTER UNDERSTANDING OF YOUR CLAIMED WATER RIGHT CAN BE OBTAINED BY COMPARING YOUR RIGHT WITH OTHER CLAIMS IN THE BASIN. FOR EXAMPLE, COMPARE PRIORITY DATES, FLOW RATES, VOLUMES, OR ACRES IRRIGATED. ALSO, YOUR WATER RIGHT MAY BE SUBJECT TO WATER RIGHTS IN ADJOINING BASINS OR SUBBASINS AS WELL AS BEING SUBJECT TO OTHER RIGHTS ON YOUR SOURCE OF SUPPLY. FINALLY, YOUR WATER RIGHT MAY BE SUBJECT TO INDIAN RESERVED AND FEDERAL RESERVED WATER RIGHTS.

COMPLETE DETAILS REGARDING THE DNRC EXAMINATION RESULTS AND RELATED MATERIALS CAN BE REVIEWED AT THE OFFICE LOCATIONS IDENTIFIED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

SEE GENERAL FINDINGS OF FACT AND CONCLUSIONS OF LAW FOR FURTHER EXPLANATION OF YOUR CLAIMED WATER RIGHT. THESE FINDINGS CAN BE FOUND AS INDICATED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY." IF YOU NEED OBJECTION FORMS, OR HAVE QUESTIONS ABOUT WATER COURT PROCEDURES OR CHANGES TO YOUR RIGHT, YOU CAN CONTACT THE WATER COURT BY CALLING 1-800-624-3270 (WITHIN MONTANA ONLY) OR 1-406-586-4364, OR BY WRITING TO P.O. BOX 1389, BOZEMAN MT 59771-1389.

FILMED

DNRC Water Right Query System

Water Right	A	WR Type	Status	Purpose	Priority Date yyyymmdd (hhmm)	Src	Src Name	Means of Diversion	Owner	Flow Rate	Volume	Acres	Doc Image	Div Count & map	Use Count & map	Irr Count & map	Res Count & map	Issue Remarks
42KJ 163857 00	A	STATEMENT OF CLAIM	ACTV	INSTITUTIONAL	19660214	G	GROUNDWATER	WELL	MONTANA, STATE OF DEPT OF TRANSPORTATION	28.00 GPM	5.00		View	1	1			
42KJ 163858 00	A	STATEMENT OF CLAIM	ACTV	INSTITUTIONAL	19660214	G	GROUNDWATER	WELL	MONTANA, STATE OF DEPT OF TRANSPORTATION	16.00 GPM	2.00		View	1	1			
42KJ 41852 00	A	STATEMENT OF CLAIM	ACTV	STOCK	19811030	G	GROUNDWATER	WELL	NIX RANCH INC	5.00 GPM			View	1	1			
42KJ 67212 00	A	PROVISIONAL PERMIT	ACTV	IRRIGATION	19880331912	S	BOX ELDER CREEK	PUMP	MONTANA, STATE OF DEPT OF TRANSPORTATION	40.00 GPM	1.00	5	View	1	2	2		

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX F:

PWS-6 REPORTS

DOWL

HYSHAM REST STOP EASTBOUND

Source Water Delineation and Assessment Report

Public Water Supply: PWSID #MT0001694

Hysham Rest Stop Eastbound
Montana Department of Transportation
Treasure County
5 miles south of Hysham, Montana
Interstate 94 Mile Post 64.7
Hysham, Montana

Report Date: July 2001

Contact: John Trewhella
MDT Billings Division
P.O. Box 20437
Billings, Montana 59104-0437
406-657-0246

INTRODUCTION

This delineation and assessment report is intended to meet the technical requirements of the Montana Source Water Protection Program (Montana Department of Environmental Quality [Montana DEQ], 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). Tetra Tech EM Inc. prepared this report under contract with the Montana Department of Transportation (MDT). Information provided by MDT was used in preparing the reports. Well completion information was obtained from the Montana Ground Water Information Center (GWIC). Information on the water supply system was obtained from a sanitary survey prepared on July 23, 1997, by McNenny Environmental Engineering and Consulting (available from Montana DEQ upon request) and from John Trewhella of MDT (McNenny 1997 and Trewhella 2001). Water quality data are derived from the U.S. Environmental Protection Agency (U.S. EPA) Envirofacts Warehouse website (U.S. EPA 2001). Land use information was obtained from the Montana State Library Natural Resource Information Service (NRIS) database (NRIS 2000).

This source water delineation and assessment report includes a site location topographic map and a land use map showing the inventory region of the source water protection area and the land uses and potential contaminant sources within that area (Figures 1 and 2 at end of this report). The report also includes a narrative description of the public water supply (PWS), inventory region delineation, an inventory of land uses and activities that may impact the PWS, and a susceptibility assessment. Well information for the PWS is attached.

PURPOSE

The purpose of this delineation and assessment report is to assess possible threats to the water supply at the MDT Hysham Rest Stop Eastbound located five miles south of Hysham, Montana using information obtained from published reports. Delineation is a process in which areas that contribute water used for drinking are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. The source water protection area is assessed to identify locations or regions where contaminants may be generated, stored, or transported and then to evaluate the potential for contamination of drinking water by these sources.

PUBLIC WATER SUPPLY INFORMATION

The water system at this rest stop is classified as a transient, non-community PWS because it serves 25 or more persons per day but does not regularly serve the same persons for at least six months a year. Ten non-transient persons employed by the MDT are estimated to use the water supply daily. Approximately 400 transient persons are estimated to use the rest stop per day during the summer, 150 persons in winter (Trewhella 2001) resulting in a water supply demand of an estimated 2,050 gallons per day in summer, 750 gallons per day in winter (U.S. EPA 1991).

Facility Description

The Hysham Rest Stop Eastbound is located in Treasure County on the south side of Interstate 94 at milepost 64.7 and services eastbound traffic (Figure 1). The wellhead of the public water supply well is located about 70 feet east of the comfort station. A septic system drain field is located about 140 feet northeast of the public water supply well. The rest stop operates year round.

Public Water Supply System

The rest stop water supply well is located about 70 feet east of the comfort station. Well log information indicates that the well was drilled in August 1988, is cased to 200 feet below ground surface (bgs) with a four-inch PVC casing (McNenny 2001). This well replaced the well that was drilled in 1966 when the site was first developed. The old well has been abandoned and covered over. Static water level was at 47 feet below ground surface in 1988. The GWIC well log is attached to this report. A 1.5 horsepower submersible pump delivers water at about 9 gallons per minute to a WX 302 Well-X-Trol captive air pressure tank located in the utility room of the comfort station, and then to service throughout the building. Another well is used to supply the lawn irrigation system. The two well pump and distribution systems are not connected. The system is capable of supplying about 20,000 users per season (McNenny 1997).

Public Water Supply Quality

MDT is required to monitor the rest stop public water supply for coliform bacteria on a monthly basis and nitrate as nitrogen annually, or if nitrogen is present at concentrations less than 0.5 milligrams per liter (mg/L), once every three years. No health-based water quality violations have been reported to the Environmental Protection Agency within the past five years (U.S. EPA 2001).

According to the Hysham Rest Stop Eastbound Sanitary Survey (McNenny 1997), the well yields good quality water. The sanitary survey recommended that the wellhead conduit should be replaced or repaired. The survey also recommended that the well cap should be replaced with a two-piece gasket and vented-type well cap to prevent migration of surface water down the well bore. This has been completed; subsequent sampling and analysis of the well water has demonstrated that water quality meets state standards (Trewhella 2001).

Source Water Hydrogeology

The Hysham Rest Stop Eastbound is located in the Box Elder Creek drainage (Figure 1). No lithologic information is included in the GWIC well log. However, the well log for the westbound well indicates that sandy clay and silt is found in the upper 20 feet and underlain by gray shale and bluish gray clay. The sanitary survey states that the well casing is perforated from 25 feet bgs to 200 feet bgs (McNenny 1997). This information conflicts with the completion depth of 187 feet bgs noted on the GWIC well log. (This discrepancy was not addressed during this phase of the project). Due to the lack of lithologic or completion information as well as the shallow depth to the top of the perforations, the aquifer is considered to be unconfined unconsolidated alluvium.

DELINEATI N

An inventory region around the well-head and on either side of Box Elder Creek and East Fork Box Elder Creek for 10 miles upstream from the well head has been delineated by the Montana DEQ Source Water Assessment Program personnel for the Hysham Rest Stop Eastbound (Figure 1). The inventory region encompasses the area from which water or contaminants can flow to the well over a period of years. The control zone (100-foot radius from well head) is the most critical area within which direct introduction of contaminants into the well or immediate area can occur. The onsite septic system for the Hysham Eastbound Rest Stop is outside of the well head control zone.

IN ENT R

The Montana Source Water Protection Program requires that land uses and all potential sources of nitrate and microbial contaminants be identified within the control zone and inventory region of non-community, transient public water supplies (Montana DEQ 1999).

Sanitary Survey Information

According to information in the Hysham Rest Stop Eastbound Sanitary Survey, the system appears to be in good working order. No potential sources of microbial contaminants were identified (McNenny 1997).

Land Use

Land use of the Hysham Rest Stop Eastbound inventory region is summarized in Figure 2. Land use information was obtained from the Montana Natural Resources Information System website (NRIS 2000). Other sources of information include existing databases available through Montana DEQ and information provided by MDT.

Land use in the inventory region of the Hysham Rest Stop Eastbound PWS well is primarily grassland pasture, shrubland and deciduous forest. A transportation corridor exists along the highway. No animal feeding operations are located within the Hysham Rest Stop Eastbound inventory region. Septic system density is low throughout the inventory region. Potential sources of nitrate or microbial contaminants include the rest stop septic system, and other septic systems, if any, present in the inventory region.

SUSCEPTI ILIT ASSESSMENT

Susceptibility of source water to contamination is a function of source water sensitivity, the presence of significant potential sources of microbial and nitrate contamination, and the presence of barriers to contamination from the sources. Source water susceptibility is based on the following factors:

Source water sensitivity
Documented water contamination in the previous five years
Presence of potential contaminant sources within the inventory region
Density of potential contaminant sources within the inventory region
Presence and numbers of natural and engineered barriers to contaminant migration

Source Water Sensitivity

Source water sensitivity is defined as the relative ease with which contaminants can migrate to a source aquifer or surface water body. The Hysham Rest Stop Eastbound has a high source water sensitivity rating because the source water aquifer is unconfined unconsolidated alluvium.

Documented water contamination

Records from the U.S. EPA safe drinking water information website indicate that no significant health-based violations have been recorded for coliform bacteria or nitrates in the past five years (U.S. EPA 2001).

Intersystem Source Water Susceptibility

Documented water contamination in the previous five years indicates that the Hysham Rest Stop Eastbound PWS has a high intersystem susceptibility to microbial contaminants. Intersystem susceptibility is determined by source sensitivity and exposure as indicated by documented water contamination. Documented exposure to contaminants regulated for their acute health effects (fecal coliform and nitrate) is given greater weight when determining intersystem susceptibility than exposure to contaminants regulated for non-acute health risks. Intersystem susceptibility of the Hysham Rest Stop Eastbound source water is summari ed in Table 1.

Table 1

Intersystem Source Water Susceptibility Summary

Potential Contaminant	Documented E posure	Source Water Sensitivity[a]	Intersystem Susceptibility[a]
Fecal Coliform	0	High	High
Nitrate	0	High	High
Nonacute contaminants	0	High	High

Notes:

[a] ased on Table 4, Section 5 (Montana DE

HYSHAM REST STOP WESTBOUND

Source Water Delineation and Assessment Report

Public Water Supply: PWSID #MT0002688

Hysham Rest Stop Westbound
Montana Department of Transportation
Treasure County
5 miles south of Hysham, Montana
Interstate 94 Mile Post 64.8
Hysham, Montana

Report Date: July 2001

Contact: John Trewhella
MDT Billings Division
P.O. Box 20437
Billings, Montana 59104-0437
406-657-0246

INTRODUCTION

This delineation and assessment report is intended to meet the technical requirements of the Montana Source Water Protection Program (Montana Department of Environmental Quality [Montana DEQ], 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). Tetra Tech EM Inc. prepared this report under contract with the Montana Department of Transportation (MDT). Information provided by MDT was used in preparing the reports. Well completion information was obtained from the Montana Ground Water Information Center (GWIC). Information on the water supply system was obtained from a sanitary survey prepared on July 23, 1997, by McNenny Environmental Engineering and Consulting (available from Montana DEQ upon request) and from John Trewhella of MDT (McNenny 1997; Trewhella 2001). Water quality data are derived from the U.S. Environmental Protection Agency (U.S. EPA) Envirofacts Warehouse website (U.S. EPA 2001). Land use information was obtained from the Montana State Library Natural Resource Information Service (NRIS) database (NRIS 2000).

This source water delineation and assessment report includes a site location topographic map and a land use map showing the inventory region of the source water protection area and the land uses and potential contaminant sources within that area (Figures 1 and 2 at end of this report). The report also includes a narrative description of the public water supply (PWS), inventory region delineation, an inventory of land uses and activities that may impact the PWS, and a susceptibility assessment. Well information for the PWS is attached.

PURPOSE

The purpose of this delineation and assessment report is to assess possible threats to the water supply at the MDT Hysham Rest Stop Westbound located five miles south of Hysham, Montana using information obtained from published reports. Delineation is a process in which areas that contribute water used for drinking are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. The source water protection area is assessed to identify locations or regions where contaminants may be generated, stored, or transported and then to evaluate the potential for contamination of drinking water by these sources.

PUBLIC WATER SUPPLY INFORMATION

The water system at this rest stop is classified as a transient, non-community PWS because it serves 25 or more persons per day but does not regularly serve the same persons for at least six months a year. Ten non-transient persons employed by the MDT are estimated to use the water supply yearly. Approximately 500 transient persons are estimated to use the rest stop per day during the summer, 200 persons per day in winter, resulting in a water supply demand of an estimated 2550 gallons per week in summer, 1,050 gallons per day in winter (U.S. EPA 1991)

Facility Description

The Hysham Rest Stop Westbound is located in Treasure County on the north side of Interstate 94 at milepost 64.8 and services westbound traffic (Figure 1). The wellhead of the public water supply well is located about 100 feet north of the comfort station. A septic system drain field is located about 200 feet south of the public water supply well. The rest stop operates year round.

Public Water Supply System

The rest stop water supply well is located about 100 feet north of the comfort station. Well log information indicates that the well was drilled in January 1966, is cased to 63 feet below ground surface with a six-inch steel casing, and reaches a total depth of 65 feet (GWIC 2001). Static water level was at 14 feet below ground surface in 1966. The GWIC well log is attached to this report. A 1.5 horsepower submersible pump delivers water at about 9 gallons per minute to a WX 252 Well-X-Trol captive air pressure tank located in the utility room of the comfort station, and then to service throughout the building. Another well is used to supply the lawn irrigation system. The two well pump and distribution systems are not connected. (McNenny 1997).

Public Water Supply Quality

MDT is required to monitor the rest stop public water supply for coliform bacteria on a monthly basis and nitrate as nitrogen annually, or if nitrogen is present at concentrations less than 0.5 milligrams per liter (mg/L), once every three years. No health-based water quality violations have been reported to the Environmental Protection Agency within the past five years (U.S. EPA 2001).

According to the Hysham Rest Stop Westbound Sanitary Survey (McNenny 1997), the well yields good quality water. The sanitary survey recommended that the wellhead should be reconstructed. The plastic casing extension should be removed and a new casing extension welded at least 3 feet to the existing casing. Other recommendations included installation of a new well cap and conduit and backfill of the slightly subsided wellhead to prevent migration of surface water down the well bore.

This has been done; subsequent sampling and analysis of the well water has demonstrated that water quality meets state standards (Trewhella 2001).

Source Water Hydrogeology

The Hysham Rest Stop Westbound is located in the o Elder Creek drainage (Figure 1). Lithologic information is included in the GWIC well log. The well log indicates sandy clay and gray shale is found above 20 feet below ground surface (bgs) and bluish gray clay from 3 to feet bgs. A gravel and sand lense was encountered at 63 to 6 feet bgs. The well casing e ists from the surface to 63 feet bgs. Completion data is absent on the GWIC well log. The aquifer is potentially confined or semi-confined by clay and shale with a combined thickness of about 0 feet.

DELINEATION

An inventory region around the well head and on either side of the o Elder Creek and East Fork o Elder Creek for 10 miles upstream from the well head has been delineated by the Montana DEQ Source Water Assessment Program personnel for the Hysham Rest Stop Westbound (Figure 1). The inventory region encompasses the area from which water or contaminants can flow to the well over a period of years. The control one (100-foot radius from well head) is the most critical area within which direct introduction of contaminants into the well or immediate area can occur. The on-site septic system for the Hysham Westbound Rest Stop is outside of the well head control one.

INVENTORY

The Montana Source Water Protection Program requires that land uses and all potential sources of nitrate and microbial contaminants be identified within the control one and inventory region of non-community, transient public water supplies (Montana DEQ 1999).

Sanitary Survey Information

According to information in the Hysham Rest Stop Westbound Sanitary Survey, the system appears to be in good working order (McNenny 1997). No potential sources of microbial contaminants were identified but samples collected from the PWS well in 199 (U.S. EPA 2001) indicated the presence of coliform bacteria.

Land Use

Land use of the Hysham Rest Stop Westbound inventory region is summari ed in Figure 2. Land use information was obtained from the Montana Natural Resources Information System website (NRIS 2000). ther sources of information include e isting databases available through Montana DEQ and information provided by MDT.

Land use in the inventory region of the Hysham Rest Stop Westbound PWS well is primarily grassland pasture, shrubland and deciduous forest. A transportation corridor e ists along the highway. No animal feeding operations are located within the Hysham Rest Stop Westbound inventory region. Septic system density is low throughout the inventory region. Potential sources of nitrate or microbial contaminants are the rest stop septic system and other septic systems, if any, within the inventory region.

SUSCEPTIBILITY ASSESSMENT

Susceptibility of source water to contamination is a function of source water sensitivity, the presence of significant potential sources of microbial and nitrate contamination, and the presence of barriers to contamination from the sources. Source water susceptibility is based on the following factors:

- Source water sensitivity
- Documented water contamination in the previous five years
- Presence of potential contaminant sources within the inventory region
- Density of potential contaminant sources within the inventory region
- Presence and numbers of natural and engineered barriers to contaminant migration

Source Water Sensitivity

Source water sensitivity is defined as the relative ease with which contaminants can migrate to a source aquifer or surface water body. The Hysham Rest Stop Westbound has a moderate source water sensitivity rating because the source water aquifer is semi-confined unconsolidated alluvium.

Documented water contamination

Records from the U.S. EPA safe drinking water information website indicate that no significant health-based violations have been recorded for coliform bacteria or nitrates in the past five years (U.S. EPA 2001).

Intersystem Source Water Susceptibility

Documented water contamination in the previous five years indicates that the Hysham Rest Stop Westbound PWS has a moderate intersystem susceptibility to microbial contaminants. Intersystem susceptibility is determined by source sensitivity and e posure as indicated by documented water contamination. Documented e posure to contaminants regulated for their acute health effects (fecal coliform and nitrate) is given greater weight when determining intersystem susceptibility than e posure to contaminants regulated for non-acute health risks. Intersystem susceptibility of the Hysham Rest Stop Westbound source water is summari ed in Table 1.

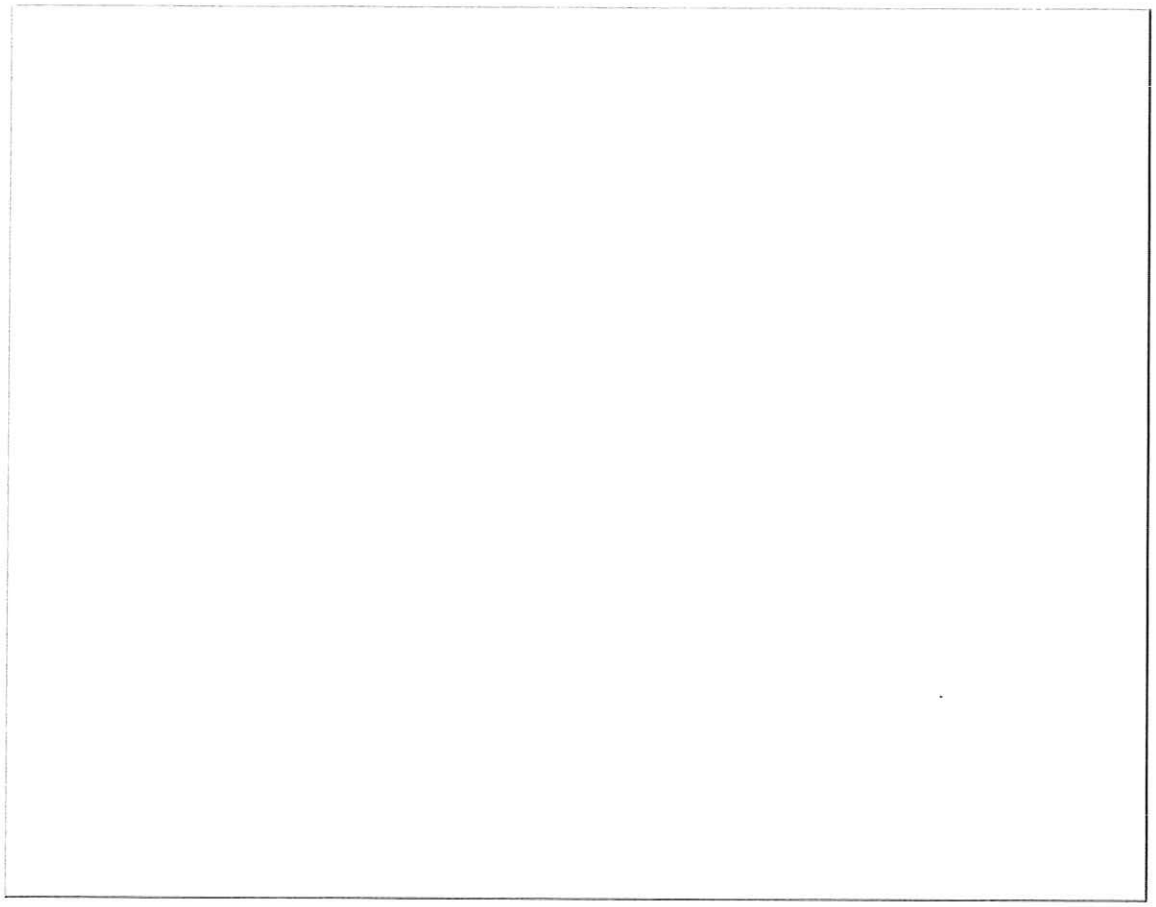
Table 1

Intersystem Source Water Susceptibility Summary

Potential Contaminant	Documented Exposure	Source Water Sensitivity[a]	Intersystem Susceptibility[a]
Fecal Coliform	0	Moderate	Moderate
Nitrate	0	Moderate	Moderate
Nonacute contaminants	0	Moderate	Moderate

Notes:

[a] ased on Table 4, Section 5 (Montana DE



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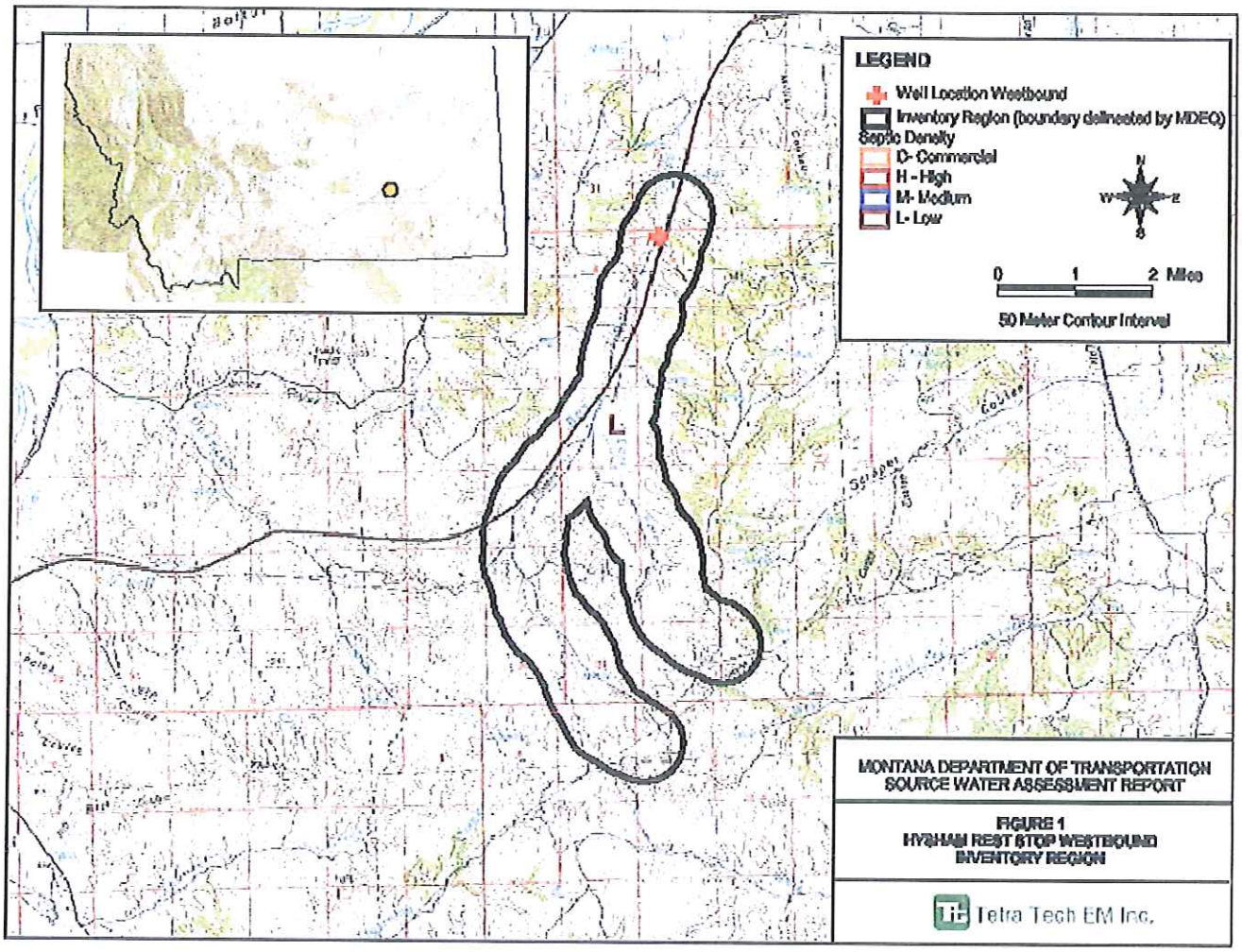
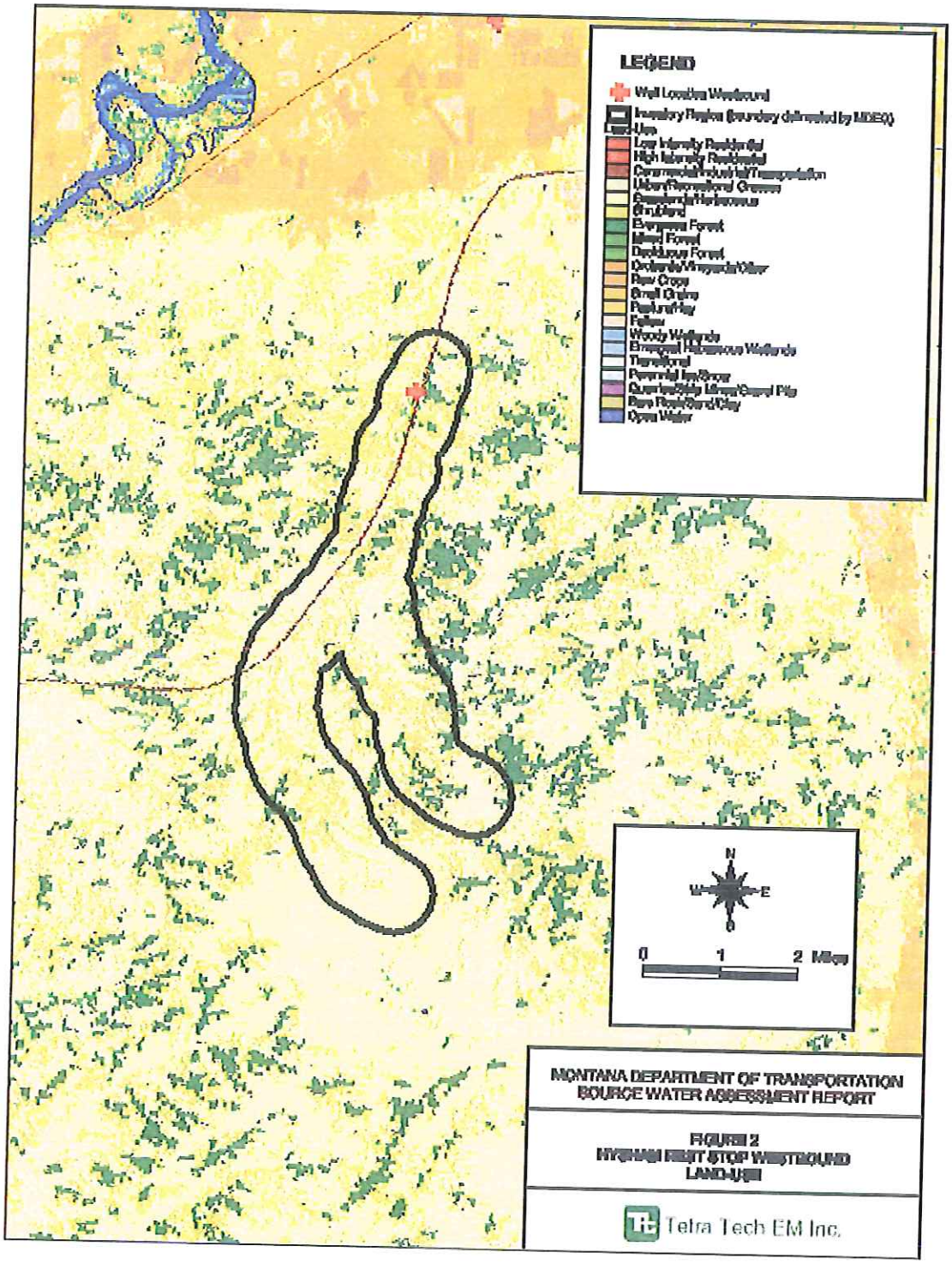

LEGEND
Well Location Westbound
Inventory Region (boundary delineated by MDEQ)
Septic Density
C- Commercial
H - High
M- Medium
L- Low
N
W
E
S
0 1 2 Miles
50 Meter Contour Interval
L
MONTANA DEPARTMENT OF TRANSPORTATION
SOURCE WATER ASSESSMENT REPORT
FIGURE 1
HYSHAM REST STOP WESTBOUND
INVENTORY REGION
Tetra Tech EM Inc.


LEGEND
Well Location Westbound
Inventory Region (boundary delineated by MDEQ)
Land Use
Low Intensity Residential
High Intensity Residential
Commercial/Industrial/Transportation
Urban/Recreational Grasses
Deciduous Forest
Orchards/Vineyards/Other
Row Crops
Small Grains
Pasture/Hay
Fallow
Woody Wetlands
Emergent Herbaceous Wetlands
Transitional
Perennial Ice/Snow
Quarries/Strip Mines/Gravel Pits
Bare Rock/Sand/Clay
Open Water
N
W
E
S
0
1
2 Miles
MONTANA DEPARTMENT OF TRANSPORTATION
SOURCE WATER ASSESSMENT REPORT
FIGURE 2
WYOMAN FIRST STOP WESTBOUND
LAND-USE
Tetra Tech EM Inc.

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX G:

OWNER CONSTRUCTION CERTIFICATION FORM

DOWL

Public Water System
Construction Inspection Certification

I, _____, of Montana Department of Transportation, hereby certify that a professional engineer will be retained for construction inspection during the installation of the public water system and will certify completion in accordance with the approved plans and prepare as-built drawings for submittal to MDEQ within 90 days of project completion.

_____ _____

_____ Date

Montana Department of Transportation

Hysham Rest Area
Project Number: IM 94-2(36)65
UPN 8200

MEMORANDUM OF AGREEMENT
BETWEEN
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY AND
MONTANA DEPARTMENT OF TRANSPORTATION

This Memorandum of Agreement ("MOA") is entered into by and between the State of Montana Department of Environmental Quality ("DEQ"), whose principal place of business is 1520 East Sixth Avenue, P.O. Box 200901, Helena, MT 59620-0901 and the State of Montana Department of Transportation ("MDT"), whose principal place of business is 2701 Prospect, P.O. Box 201001, Helena MT 59620-1001, collectively, "the Parties."

The purpose of this MOA is to identify and set forth certain well head protections for the Public Water Supply well located on MDT-owned land at the East Bound Hysham Rest Area, approximately five (5) miles south/southwest of Hysham in Treasure County, Montana. In order to obtain DEQ approval for this new well, MDT agrees to comply with the setback requirements set forth in DEQ Design Circular 3. A copy is attached as Exhibit A.

MDT further agrees to observe the following restrictions for its property within a 100-foot radius of the well, hereinafter referred to as the Well Isolation Zone:

- No septic system, wastewater disposal system, sewer pipe, sewage lift station, French drain, or class V injection well, shall be located within the Well Isolation Zone
- No wastewater system's groundwater mixing zone shall encroach on the Well Isolation Zone
- No hazardous substances as defined by 75-10-602 MCA, gasoline, liquid fuels, petroleum products, or solvents shall be used or stored within the Well Isolation Zone
- No storm water conveyance or retention structures, injection well, grass infiltration swale, or other storm water structures shall be located within the Well Isolation Zone without an approved MDEQ Deviation.

- No livestock shall be confined, fed, watered, or maintained within the Well Isolation Zone
- No private well shall be constructed within the Well Isolation Zone
- Activities, which may threaten the quality of water in the Well Isolation Zone, are prohibited.
- The application of fertilizers shall be at agronomic rates and applied only during the growing season within the Well Isolation Zone
- No Pet Relief Area shall be located within the Well Isolation Zone

Notices: All notices concerning this MOA shall be sent, in writing by U.S. mail, addressed as designated below:

Montana Department of Environmental Quality
1520 East Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901
Attention: Public Water and Subdivisions Bureau Section Supervisor

Montana Department of Transportation
2701 Prospect
P.O. Box 201001
Helena MT 59620-1001
Attention: Real Estate Services Section Supervisor

Term: This MOA will terminate automatically if MDT ceases to operate its well as a Public Water Supply within the definition of Mont. Code Ann. 75-6-102(14) at this location or if MDT sells its land at this location. MDT must notify DEQ in writing within thirty (30) days of either event.

Modification: This MOA may only be amended in writing by mutual consent of the Parties. Such consent shall not be unreasonably withheld.

Hysham Rest Area
Project Number: IM 94-2(36)65
UPN 8200

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

By: _____ December 4, 2015
Jon Dilliard, Bureau Chief
Public Water and Subdivisions Bureau

Approved for Legal Content:

_____ December 4, 2015
DEQ Legal Counsel

MONTANA DEPARTMENT OF TRANSPORTATION

By: _____ December 9, 2015
Rob Stapley
MDT Right-of-Way Bureau Chief

Approved as to form and content:

_____ December 9, 2015
Lee M. McKenna
MDT Legal Counsel

PUBLIC WELL AND WASTEWATER SETBACKS

FROM	TO PUBLIC WATER SUPPLY WELLS (FEET)	TO SEALED COMPONENTS (1) AND OTHER COMPONENTS (2) (FEET)	TO DRAINFIELDS/SOIL ABSORPTION SYSTEMS (3) (FEET)
PUBLIC OR MULTIUSER WELLS/SPRINGS	---	100 (4)	100
INDIVIDUAL & SHARED DRINKING WELLS	---	50 (4)	100
OTHER WELLS (5)	---	50 (4)	100 (4)
SUCTION LINES	---	50	100
CISTERNS	---	25	50
ROADCUTS, ESCARPMENT	---	10 (6)	25
SLOPES > 35% (7)	---	10 (6)	25
PROPERTY BOUNDARIES	10 (8)	10 (8)	10 (8)
SUBSURFACE DRAINS	---	10	10
WATER MAINS	---	10 (9)	10
DRAINFIELDS/ SOIL ABSORPTION SYSTEMS	100	10	---
FOUNDATION WALLS	---	10	10
SURFACE WATER (10), SPRINGS	100 (4) (11) (12)	50 (4) (11)	100 (4) (11) (13)
FLOODPLAINS	10 (11)	SEALED --- (1) OTHER 100 (2)(4)(11)	100 (11) (14)
MIXING ZONES	100 (4)	---	---
STORM WATER PONDS AND DITCHES (15)	100 (16)	10	25

(1) SEALED COMPONENTS INCLUDE HOLDING TANKS, SEALED PIT PRIVIES, AND THE COMPONENTS ADDRESSED IN DEPT. CIRCULAR DEQ-4, CHAPTERS 4 & 5. SEALED COMPONENTS MUST MEET REQUIREMENTS OF ARM 17.36.322(4).

(2) OTHER COMPONENTS INCLUDE THE COMPONENTS ADDRESSED IN DEPT. CIRCULAR DEQ-4, CHAPTER 7.

(3) ABSORPTION SYSTEMS INCLUDE THE SYSTEMS ADDRESSED IN DEPT. CIRCULAR DEQ-4, CHAPTERS 6 & 8, SUBJECT TO THE LIMITATIONS IN ARM 17.36.321.

(4) A WAIVER OF THIS REQUIREMENT MAY BE GRANTED BY THE DEPARTMENT OF ENVIRONMENTAL QUALITY PURSUANT TO ARM 17.36.601.

(5) OTHER WELLS INCLUDE, BUT ARE NOT LIMITED TO, IRRIGATION AND STOCK WATERING, BUT DO NOT INCLUDE OBSERVATION WELLS AS ADDRESSED IN DEPT. CIRCULAR DEQ-4.

(6) SEWER LINES AND SEWER MAINS MAY BE LOCATED IN ROADWAYS AND ON STEEP SLOPES IF THE LINES AND MAINS ARE SAFEGUARDED AGAINST DAMAGE.

(7) DOWN-GRADIENT OF THE SEALED COMPONENT, OTHER COMPONENT, OR DRAINFIELD/SOIL ABSORPTION SYSTEM.

(8) EASEMENTS MAY BE USED TO SATISFY THE SETBACK TO PROPERTY BOUNDARIES.

(9) UNLESS A WAIVER IS GRANTED BY THE DEPARTMENT PURSUANT TO ARM 17.36.601, SEWER MAINS THAT CROSS WATER MAINS MUST BE LAID WITH A MINIMUM VERTICAL SEPARATION DISTANCE OF 18 INCHES BETWEEN THE MAINS.

(10) FOR PURPOSES OF THIS RULE, "SURFACE WATER" DOES NOT INCLUDE INTERMITTENT STORM WATER.

(11) THE DEPARTMENT MAY REQUIRE MORE SEPARATION FROM THE FLOODPLAIN OR FROM SURFACE WATER OR SPRINGS IF IT DETERMINES THAT SITE CONDITIONS OR WATER QUALITY REQUIREMENTS INDICATE A NEED FOR THE GREATER DISTANCE.

(12) PURSUANT TO ARM 17.36.331, THE REVIEWING AUTHORITY MAY REQUIRE GREATER THAN A 100-FOOT HORIZONTAL SEPARATION BETWEEN A WELL AND SURFACE WATER IF THERE IS A POTENTIAL THAT THE WELL MAY BE INFLUENCED BY CONTAMINANTS IN THE SURFACE WATER.

(13) A WAIVER MAY BE GRANTED BY THE DEPARTMENT, PURSUANT TO ARM 17.36.601, IF THE APPLICANT DEMONSTRATES THAT GROUND WATER FLOW AT THE DRAINFIELD SITE CANNOT FLOW INTO THE SURFACE WATER OR SPRING. THE SETBACK BETWEEN DRAINFIELDS OR SOIL ABSORPTION SYSTEMS TO IRRIGATION DITCHES DOES NOT APPLY IF THE DITCH IS LINED WITH A FULL CULVERT.

(14) AFTER CONSULTATION WITH THE LOCAL HEALTH DEPARTMENT, A WAIVER MAY BE GRANTED BY THE DEPARTMENT, PURSUANT TO ARM 17.36.601, IF THE APPLICANT DEMONSTRATES THAT THE SURFACE WATER OR SPRING SEASONALLY HIGH WATER LEVEL IS AT LEAST A 100-FOOT HORIZONTAL DISTANCE FROM THE DRAINFIELD AND THE BOTTOM OF THE DRAINFIELD WILL BE AT LEAST TWO FEET ABOVE THE MAXIMUM 100-YEAR FLOOD ELEVATION.

(15) STORM WATER PONDS AND DITCHES ARE THOSE STRUCTURES THAT TEMPORARILY HOLD OR CONVEY WATER AS PART OF STORM WATER MANAGEMENT.

(16) THE SETBACK IS 100 FEET FOR PUBLIC WELLS, UNLESS A DEVIATION IS GRANTED UNDER ARM TITLE 17, CHAPTER 38, SUBCHAPTER 1.

(17) SLOPE SURFACE AWAY FROM WELL HEADS WITH 3:1 SLOPE.

NOTES:

TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL WEST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.

EXHIBIT A

MDHQ SETBACK REQUIREMENTS

AMMENDED
HYSHAM REST AREA EASTBOUND
Source Water Delineation and Assessment Report
December 2015

Prepared for:

MDT Billings Division
P.O. Box 20437
Billings, Montana 59104-0437

Prepared By:

DOWL
2090 Stadium Drive
Bozeman, MT. 59718

AMMENDED
HYSHAM REST AREA EASTBOUND

Source Water Delineation and Assessment Report

Public Water Supply: **PWSID #MT0001694**

Hysham Rest Area Eastbound
Montana Department of Transportation
Treasure County
5 miles south of Hysham, Montana
Interstate 94 Mile Post 64.7
Hysham, Montana

Report Date: **December 2015**

Contact: **Ken Hembree**
MDT Billings Division
P.O. Box 20437
Billings, Montana 59104-0437
406-657-0246

Section 1
INTRODUCTION AND PURPOSE

This amended delineation and assessment report is intended to meet the technical requirements of the Montana Source Water Protection Program (Montana Department of Environmental Quality) and the Federal Safe Drinking Water Act (SDWA). Information was obtained from published reports, personnel managing the site, the most recent sanitary survey, the Montana State Library's Natural Resource Information System (NRIS) website, http://nris.mt.gov/gis, and the EPA's Envirofacts System website, http://www.epa.gov/enviro/index.html. The delineation process identifies source water protection regions on a map that contributes to the drinking water for a specific location by evaluating geological, hydrogeologic and hydrologic conditions. The assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, and/or transported, then determining the relative potential for contamination of drinking water by these sources. For a transient public water supply, the regulated contaminants include only microbiological contaminants and nitrate (Montana Department of Environmental Quality (DEQ), 2007)

The purpose of this amendment is to update the existing Source Water Delineation and Assessment Report (SWADAR) for the 2015 replacement well. Continued sediment

problems have necessitated that a replacement well be drilled, completed, developed, tested and connected to the existing water system for the Hysham eastbound rest area.

The existing well completion information was obtained from the Montana Ground Water Information Center (GWIC). Land use information was obtained from the Montana State Library Natural Resource Information Service (NRIS) database.

This source water delineation and assessment report includes a site location topographic map and a land use map showing the inventory region of the source water protection area and the land uses and potential contaminant sources within the proposed public well area. The report also includes a narrative description of the public water supply (PWS), inventory region delineation, an inventory of land uses and activities that may impact the PWS, and a susceptibility assessment. The proposed well information for the PWS is attached.

PURPOSE

This amended SWADAR assesses threats to the water supply at the MDT Hysham rest area eastbound located five miles south of Hysham, Montana using information obtained from published reports. Delineation is a process in which areas that contribute water used for drinking are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. The source water protection area is assessed to identify locations or regions where contaminants may be generated, stored, or transported and then to evaluate the potential for contamination of drinking water by these sources.

Section 2
PUBLIC WATER SUPPLY INFORMATION

The water system at this rest area is classified as a transient, non-community PWS because it serves 25 or more persons per day but does not regularly serve the same persons for at least six months a year. Ten non-transient persons employed by the MDT are estimated to use the water supply daily. Approximately 620 transient persons are estimated to use the rest area per day during the summer, 425 persons averaged throughout the year resulting in a water supply demand of an estimated 930 gallons per day in summer, 638 gallons per day annual average. The projected water demands are according to growth projections and based on existing on-site door count data. Consequently, the projection is that the water system will serve up to an average of 1,445 gpd. (DOWL's Water Design Report 2015)

2.1 Facility Description

The Hysham rest area eastbound is located in Treasure County on the south side of Interstate 94 at milepost 64.7 and services eastbound traffic. The wellhead of the public water supply well is located about 150 feet east of the proposed comfort station. A new

wastewater system is located about 400 feet northeast of the proposed public water supply well. The rest area operates year round.

2.2 Public Water Supply System

The rest area's water supply well is located about 150 feet east of the proposed comfort station. Well log information indicates that the existing well was drilled in August 1988, is cased to 200 feet below ground surface (bgs) with a four-inch PVC casing (McNenny 2001). This well replaced the well that was drilled in 1966 when the site was first developed. The current well will be abandoned. Static water level is approximately 47 feet below ground surface. The GWIC well log is attached to this report. An updated water system is proposed and certifications and as-builts will be submitted to MDEQ prior to use. The new pressure tanks and filters will be located in the utility room of the comfort station. An irrigation well (on the west bound side) is used to supply the lawn irrigation system. The two well systems will not be connected.

2.3 Public Water Supply Quality

MDT is required to monitor the rest area public water supply for coliform bacteria on a monthly basis and nitrate as nitrogen annually, or if nitrogen is present at concentrations less than 0.5 milligrams per liter (mg/L), once every three years.

Currently the existing Eastbound rest area well is limited on quantity and the atheistic quality degrees the harder the well is pumped. With a properly constructed well, the quantity and quality issues should be mitigated. Once the well is drilled, a pump test on the new well will be performed. Water quality samples will be taken and submitted to MDEQ for verification of the water quality.

2.4 Source Water Hydrogeology

DOWL found the eastbound aquifer to be located in the Bearpaw Shale, Lance Formation and Fox Hill formation (Upper Cretaceous), based on the lithologic information from the public well logs. The westbound aquifer is most likely receiving/influencing water from the alluvial gravels below Box Elder Creek. Shale and sandstone layers are found from 25 feet to 200 feet bgs. Based on the information presented in the well logs, it appears that the aquifer is found in a confined/semi-confined aquifer formation. The sanitary survey states that the well casing is perforated from 25 feet bgs to 200 feet bgs (McNenny 1997).

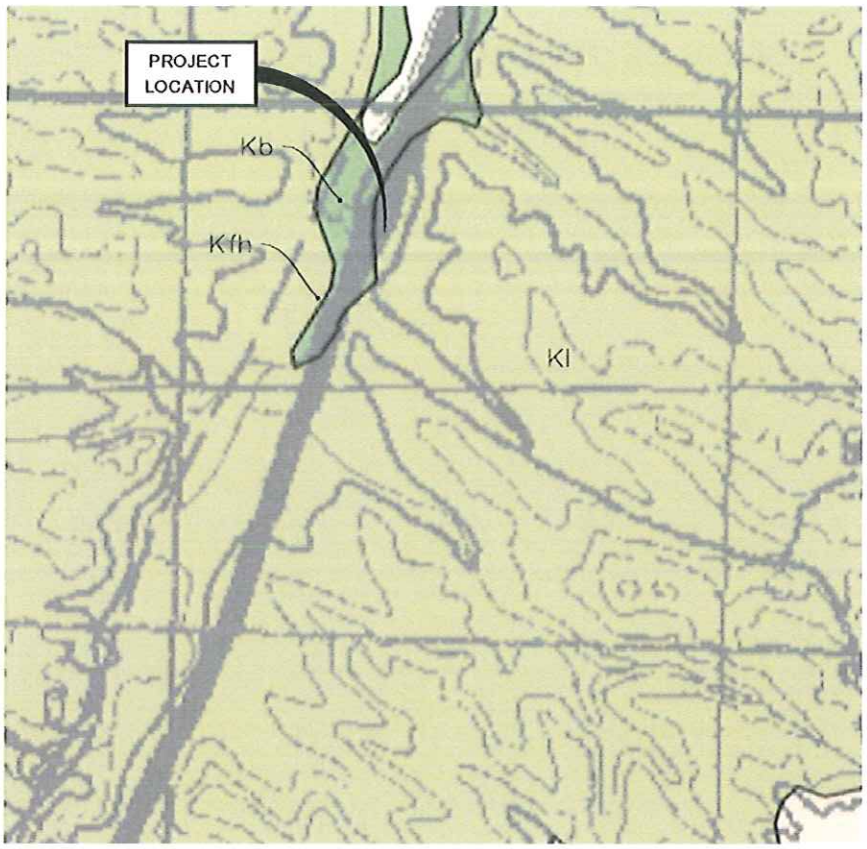
The site is located on Cretaceous Age deposits. The area is generally mapped as sandstone and shales as depicted on the geologic map. The formations in this area generally consists of:

a. Kl Lance Formation (Upper Cretaceous)
Light-orange or light-tan, medium-grained, massive to cross-bedded sandstone in lenses and channels interbedded with light gray or greenish-yellow sandy shale. Calcium carbonate-cemented concretions occur locally in fine-grained sandstone. Crossbedded

conglomerate lenses at the base contain quartzite and limonite pebbles as much as 1 inch in diameter and armored claystone balls as much as 9 inches in diameter. Thickness 330-525 ft.

b. Kfh **Fox Hills Formation (Upper Cretaceous)**
Light-brown or light-orange, thin- to thick bedded, micaceous, fine- to medium-grained sandstone in the upper part and thin bedded siltstone and silty shale in the lower part. Thickness 0-75 ft.

c. Kb **Bearpaw Shale (Upper Cretaceous)**
Dark-brownish-gray, montmorillonitic, fissile shale, and mudstone, with numerous thin bentonite beds and zones of calcareous and less common ferruginous concretions. Most bentonite beds are less than 6 inches thick but some are as much as 4 ft thick in the Vananda area (Berg, 1970). Several intervals contain concretions with *Inoceramus*, *Baculites*, and other fossils. Basal Bearpaw contains fissile shale that is rich in organic matter (Heald, 1927). Thickness 900-1500.



MAP UNITS

Kl - Lance Formation (Upper Cretaceous)

Kfh - Fox Hills Formation (Upper Cretaceous)

Kb - Bearpay Shale (Upper Cretaceous)

DOWL HKM

HYSHAM REST AREA
GEOLOGIC SURVEY MAP

PROJECT	24.11355.01
DATE	09/18/2014

FIGURE #1

Section 3

DELINEATION

Hydrologic Conditions:

An inventory region around the wellhead and on either side of Box Elder Creek and East Fork Box Elder Creek for 10 miles upstream from the well head has been delineated by the

Montana DEQ Source Water Assessment Program personnel for the Hysham rest area eastbound. The inventory region encompasses the area from which water or contaminants can flow to the well over a period of years. The control zone (100-foot radius from wellhead) is the most critical area within which direct introduction of contaminants into the well or immediate area can occur. The onsite septic system for the Hysham eastbound rest area is outside of the wellhead control zone. Based on the lithology, the source water is assigned a "Moderate" sensitivity rank due to the aquifer being in shale and sandstone bedrock formations (from Table 2 – Source Water Sensitivity Table from the Instructions for Completing a Source Water Delineation and Assessment Report and PWS-6 Report for Transient Public Water Supplies).

Well Information:
A cursory review of the existing onsite wells suggests that the proposed well location will provide water that is acceptable for use as a potable water source.

Aquifer Properties:
Sufficient data to calculate aquifer properties of the well is not currently available. Preliminary water quality test results of the existing well reveals that the source water is acceptable for use as a potable water source.
The type and amount of final treatment (if necessary) will be determined after approval and installation of the well.

Section 4
INVENTORY
The Montana Source Water Protection Program requires that land uses and all potential sources of nitrate and microbial pathogens within the control zone and inventory region be identified. The control zone has a radius of 100 feet from the well where spills, leaks, or discharges could migrate quickly to the wellhead. For a transient, non-community public water supply, a simple fixed-radius approach is typically used to delineate the inventory region and all significant potential contaminant sources within that region are assigned a high hazard.

4.1 *Control Region*
The vicinity map identifies the control region. Potential sources of groundwater contamination within the control region could be from animal waste near the well head, waste dumping, spills, or vandalism. The on-site septic tank and drainfield are outside of the control region. Land use within the control region is lawn and undisturbed areas.

4.2 *Inventory Region*
The NRIS dataset was reviewed for any information within the inventory region, or near the site for the following potential contaminates sources:

- Abandoned mines,
- Petroleum Tank Compensations sites,
- Remediation Response Sites,

- Underground Storage Facilities; and
- Hazardous Waste Handlers.

EPA's Envirofacts System (US EPA) was also queried to identify EPA regulated facilities. This system accesses the following databases:

- Resource Conservation and Recovery Information System (RCRIS),
- Biennial Reporting System (BRS),
- Toxic Release Inventory (TRI),
- Permit Compliance System (PCS); and
- Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS).

No potential contamination sources were listed in either the NRIS or EPA databases. Septic system density within the inventory region is low with the only septic systems being the systems that serve the rest area.

4.3 Land Use

Land use of the Hysham rest area eastbound inventory region is summarized in Figure 2. Land use information was obtained from the Montana Natural Resources Information System website (NRIS 2000). Other sources of information include existing databases available through Montana DEQ and information provided by MDT.

Land use in the inventory region of the Hysham rest area eastbound PWS well is primarily grassland pasture, shrub land and deciduous forest. A transportation corridor exists along the highway. No animal feeding operations are located within the Hysham rest area eastbound inventory region. Septic system density is low throughout the inventory region. Potential sources of nitrate or microbial contaminants include the rest area wastewater systems, and other septic systems, if any, present in the inventory region.

4.4 *Buffer Zone*

The existing well log shows that this water system is not under the direct influence of surface water.

Section 5

SUSCEPTIBILITY ASSESSMENT

Susceptibility of source water to contamination is a function of source water sensitivity, the presence of significant potential sources of microbial and nitrate contamination, and the presence of barriers to contamination from the sources. Source water susceptibility is based on the following factors:

- Source water sensitivity
- Documented water contamination in the previous five years
- Presence of potential contaminant sources within the inventory region
- Density of potential contaminant sources within the inventory region
- Presence and numbers of natural and engineered barriers to contaminant migration

Source Water Sensitivity
Source water sensitivity is defined as the relative ease with which contaminants can migrate to a source aquifer or surface water body. The Hysham rest area eastbound has a moderate source water sensitivity rating because the source water aquifer is semi-confined.

Intersystem Source Water Susceptibility
Documented water contamination in the previous five years indicates that the Hysham rest area eastbound PWS has a high intersystem susceptibility to microbial contaminants. Intersystem susceptibility is determined by source sensitivity and exposure as indicated by documented water contamination. Documented exposure to contaminants regulated for their acute health effects (fecal coliform and nitrate) is given greater weight when determining intersystem susceptibility than exposure to contaminants regulated for non-acute health risks. Intersystem susceptibility of the Hysham rest area eastbound source water is summarized in Table 1.

Table 1
Intersystem Source Water Susceptibility Summary

Potential Contaminant	Documented Exposure	Source Water Sensitivity[a]	Intersystem Susceptibility[a]
Fecal Coliform	0	Moderate	Moderate
Nitrate	0	Moderate	Moderate
Nonacute contaminants	0	Moderate	Moderate

Hazard of Potential Contaminant Sources
The hazard posed by potential contaminant sources is a function of the type of and density of contaminant sources within the inventory region. Hazard of contaminant sources within the Hysham rest area eastbound PWS inventory region are summarized in Table 2.

Table 2 Contaminant Source Hazard Rating Determination		
Type of Contaminant Source	**Density within Inventory Region**	**Hazard Rating[a]**
Septic Systems	Less than 50 per square mile	Low
Municipal Sanitary Sewer	Less than 20 percent of region	Low
Cropped Agricultural Land	Less than 20 percent of region	Low
Contaminant Sources within Control Zone (confined aquifer)	None	Low

Notes:
Based on Table 9b, of Montana Source Water Program Guidance

Barriers to Contamination

Barriers to contamination can be natural conditions, engineered structures, or management actions. Natural barriers to a groundwater source may include a continuous clay layer, a deep water table, contaminant attenuation capacity of vadose zone and aquifer materials, and dilution. Engineered barriers provide physical containment or early detection of potential contaminants such as double walled underground storage tanks, spill catchment basins and monitoring wells installed for leak detection. PWS wells that meet state construction standards are considered engineered barriers to contamination in control zones.

Source Water Susceptibility

Susceptibility is determined by the hazard associated with potential contaminant sources and the existence of barriers that may decrease the likelihood that contaminated water will flow to a PWS well or intake. A summary of all significant potential contaminant sources identified in the inventory region, their associated hazard, the presence of barriers, and relative susceptibility ratings is presented in Table 3.
The Hysham rest area eastbound PWS has a moderate susceptibility to the on-site septic system because it is a large capacity system with new construction of the well. There is a moderate susceptibility to contamination from septic systems and Low susceptibility to contamination from cropped agricultural land. Natural, engineered or management barriers include: well constructed in accordance with state construction standards. This is a barrier to contamination within the control zone.

Table 3 Potential Contamination Sources

Potential Source[a]	Contaminant	Hazard	Hazard Rating[b]	Barrier	Susceptibility	Management Recommendation
Septic System	Nitrates, Pathogens	Less than 50 per square mile Leakage of sewage into ground-water	Low	Distance from well to septic system. No septic components within 100-foot radius of control zone. Well is outside a 500' mixing zone from any drainfield.	Moderate	Properly maintain septic system. Provide educational materials to patrons on proper handling and disposal of industrial and household hazardous wastes and recycling.
Animals/pets	Pathogens	Fecal waste from pets	Low	Well is sealed through the confining layers.	Low	Pet area outside of 100 foot control zone.
Spills	Petroleum, solvents, chemicals	Leakage of contaminant into the groundwater	Low	Well is sealed through the confining layers Depth to groundwater	Low	Inspect daily for spills
Vandalism	Petroleum, solvents, chemicals	Direct dumping of contaminant into the well	Low	Locking well cap	Low	Inspect daily
Cropped Agricultural Land	Nitrates	Leaching of fertilizer in to ground water	Low	None All wells are protected by the confining semi-layers.	Low	Do not allow agricultural crops within 100-foot control zones. No crops currently are within the 100-foot zone.

Notes:
[a]Source based on land use within inventory zone.
[b]Hazard rating based on Table 9b
[c]Susceptibility rating based on Tables 9b
NA = Not Applicable

Section 6

Limitations

Identification of potential contaminant sources is limited to those regulated for this class of public water supply and is generally based on readily available information and reports. Unregulated activities or unreported contaminant releases are not be considered in this report. The delineation method utilizes simplifying assumptions that may not fully represent complex ground water flow systems but is intended to be conservative and protective of public health (PWS-6 template, DEQ 2007)".

REFERENCES

GWIC. 2015. Montana School of Technology, University of Montana. Montana Groundwater Information Center website well log reports. http://mbmggwic.mtech.edu/.

DOWL . 2015. MDEQ Public Water Submittal
Hysham rest area eastbound prepared September , 2015.

Montana Department of Environmental Quality (Montana DEQ). 1999. Montana Source Water Protection Program, Approved by EPA in November 1999.

Montana DEQ. 2007. Montana Source Water Assessment Program Website Guidance Documents.

NRIS. 2000. Natural Resource Information System, National Land Cover Data, Version 05-06-2000. Information contributed by the U. S. Geological Survey, the U.S. Environmental Protection Agency, the National Oceanic and Atmospheric Administration. Information distributed by the Natural Resources Information System (NRIS), State of Montana Library.

U.S. EPA. 2001. U.S. Environmental Protection Agency Envirofacts Warehouse Safe Drinking Water Information website at http://www.epa.gov/enviro/index.

Attachments.
Location Map
Hysham rest area eastbound Inventory Region and Land Use
Well Plan
Existing Well Log

MONTANA WELL LOG REPORT

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

Other Options

Return to menu
View hydrograph for this site
View field visits for this site
View scanned well log (6/7/2010 1:21:07 PM)

Site Name: HYSHAM REST AREA EASTBOUND
GWIC Id: 163054

Section 1: Well Owner(s)

1) HYSHAM REST STOP EAST BOUND (MAIL)
N/A
N/A MT N/A [03/14/2003]
2) MONTANA DEPT OF TRANSPORTATION (MAIL)
PO BOX 20437
BILLINGS MT 59105 [09/23/1997]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NW¼ SE¼ NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2184	107.2493	NAV-GPS	NAD27

Ground Surface Altitude	Method	Datum	Date
2900			

Measuring Point Altitude	Method	Datum	Date Applies
2901.4			9/23/1997 11:25:00 AM

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, August 18, 1988

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	35.5	10
25	200	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	35.5	7				23LB STEEL
25	200	4		165.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
28	200	4		1/8	SLOTS

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 200
Static Water Level: 46.89
Water Temperature:

Air Test *

50 gpm with drill stem set at _ feet for 2 hours.
Time of recovery 1 hours.
Recovery water level 40 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 EAST OF BUILDING RESTROOMS AT PICNIC TABLES USED UTILITY SINK FAUCET FOR CHEM NEED TO CONTACT CARETAKER FOR ACCESS NEWEST WELL AT REST AREAS 2 OLDER SHALLOW WELLS ON WEST SIDE IRRIGATION PIPES ACROSS TO THIS SIDE

Section 9: Well Log

Geologic Source
211LHUD - LANCE-HELL CREEK UNDIFFERENTIATED

From	To	Description
0	28	SILT CLAY
28	35	BROWN SANDSTONE
35	50	LIGHT SHALE
50	81	LIGHT SANDSTONE
81	121	SHALE
121	160	GREY SANDSTONE
160	173	GREY SHALE
170	200	GREY SANDSTONE

Driller Certification

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

Name: WILLIAM KUPFNER
Company: ROCK CREEK DRILLING INC
License No: WWC-300
8/18/1988

Date Completed:

05N36E05BADB

Hysham E.B.

File No. ______

WELL LOG REPORT

State law requires that this form be filed by the water well driller within 60 days after completion of the well.

1. WELL OWNER
Name: State Highway Dept

2. CURRENT MAILING ADDRESS
P.O. Box 20437
Billings Mt. 59104-0437

3. WELL LOCATION
County: Treasure
Township: 5 (N)
NWSE NE ¼ NW ¼ Range: 36 (E)W Section: 5
Lot: Lot 3
Subdivision: NE of SW — Lot 3
Tract Number

4. PROPOSED USE Domestic [ ] Stock [ ] Irrigation [ ]
Other specify: Public

5. DRILLING METHOD ____ cable, X air rotary, ____ forward rotary, ____ reverse rotary, ____ jetted, ____ other (specify)

6. WELL LOG

From	To	Formation
0	28	silty Clay
28	35	Gravel in pea & coarse
35	50	light shale
50	71	light sandstone
71	121	shale
121	160	grey sandstone
160	171	grey shale
171	200	grey sandstone

ATTACH ADDITIONAL SHEETS IF NECESSARY

7. WELL CONSTRUCTION AND COMPLETION

Size of drilled hole	Size and est./wt. of casing	From (feet)	To (feet)
10 3/4	9" 25#	+1.8'	35.5
6 1/8	4 1/2 PVC 160 PSI	25	200

Perforations: X
Screen:

Slot Size	From (feet)	To (feet)
5 slot	25	200

Was casing left open end? X Yes ___ No
Was a packer or seal used? ___ Yes X No
If so, what material
Was the well gravel packed? ___ Yes X No
To what depth was the well grouted? 20
Material used in grouting: Gravel
Well head completion: Pitless adapter
Top casing 18 in. or greater above grade ___ Yes X No
___ X Yes ___ No

8. WELL TEST DATA

The pump test information request in this section is required for all wells. All depth measurements shall be from the top of the well casing unless otherwise specified.

All wells under 100 gpm must be tested for a minimum of one hour and provide the following information:

a) Air X Pump ___ Bailer ___
b) Static water level immediately before testing 40 ft. If flowing; closed in pressure ___ psi, ___ gpm
Controlled by: ___ valve, ___ reducers, ___ other (specify)
c) Depth at which pump is set for test 200
d) The pumping rate and means of discharge (i.e., bailing, (airlift), pumping) 30 gpm
e) Maximum drawdown during the test 200 ft
f) Duration of test: Pumping time 2 hrs. Recovery time 1 hrs
g) Recovery water level 40 ft
Amount of time after pumping recovery level water data was taken 1 hrs

Wells intended to yield 100 gpm or more shall be tested for a period of 8 hours or more. The test shall follow the development of the well, and shall be conducted continuously at a constant discharge at least as great as the intended appropriation. In addition to the above information, water level data shall be collected and recorded on the Department's "Aquifer Test Data" form included in each packet of well logs.

NOTE: All wells shall be equipped with an access port ½ inch minimum or a pressure gauge that will indicate the shut in pressure of a flowing well. No movable caps are acceptable as access ports.

9. WAS WELL PLUGGED OR ABANDONED? ___ Yes X No
If yes, how?

10. DATE COMPLETED 8-17-89

11. DRILLER/CONTRACTOR'S CERTIFICATION

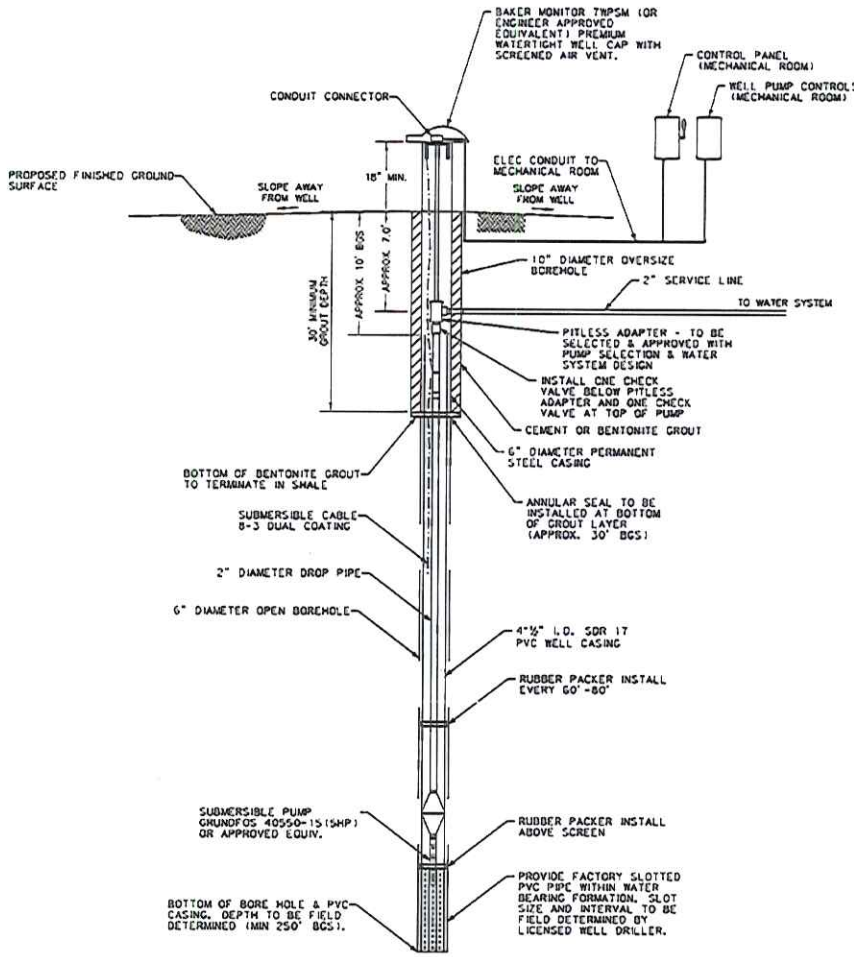
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Date: 10-19-89
Firm Name: Rock Creek Drilling
Address: Rt 1 Box 295 Joliet Mt
Signature: [signature] License: 300

Hysham RA-Eastbound
01694

DEPARTMENT COPY
DRILLER: Please give this copy to the well owner to complete reverse side
OWNER: Complete reverse side and send to DNRC when the well is completed and the water has been used beneficially for the intended purpose.

163054



1/6 WELL SYSTEM DETAIL
SCALE : NTS

NOTES:

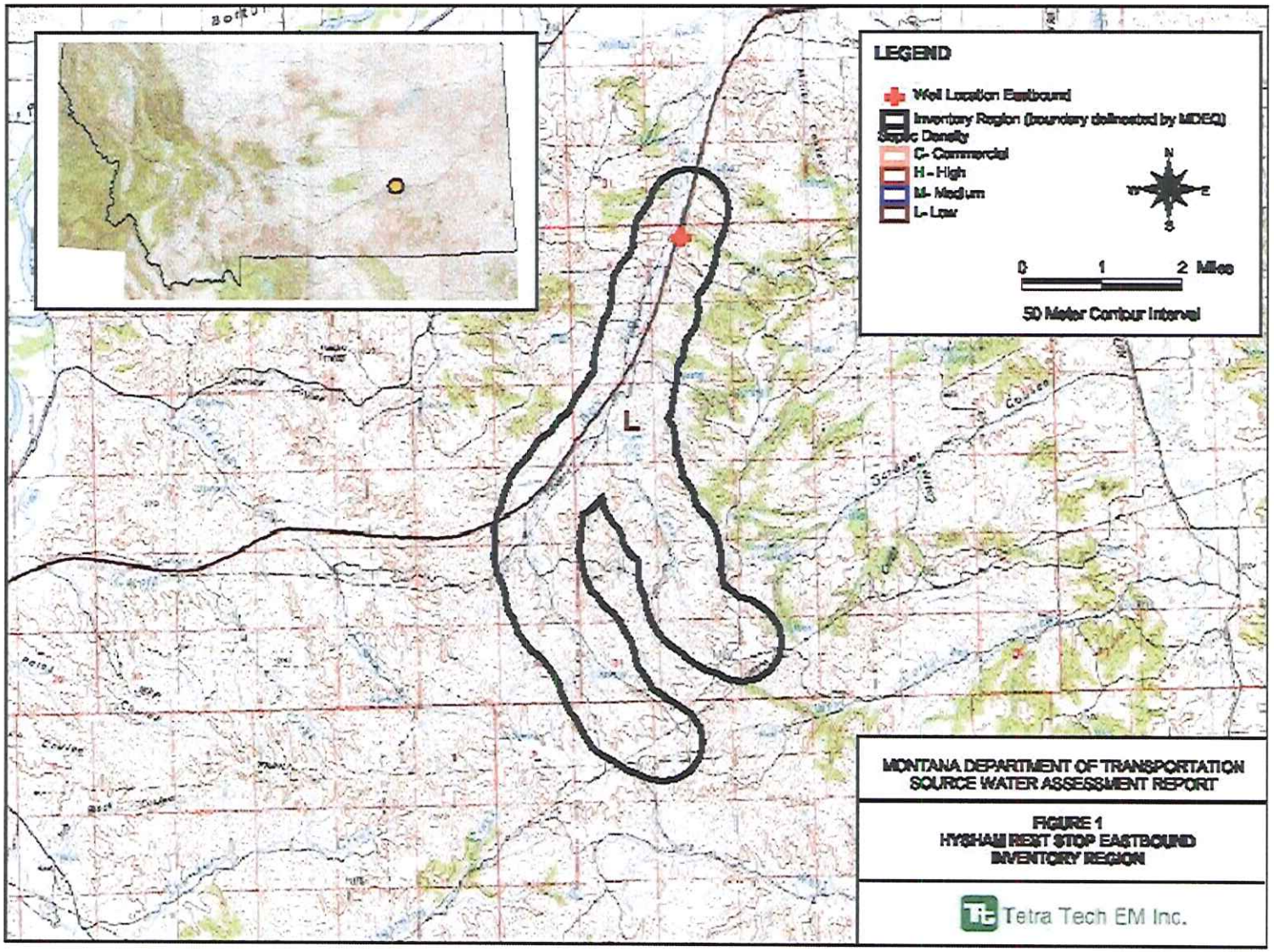
1. ALL WELL WORK AND CONNECTIONS SHALL BE CONDUCTED BY A MONTANA STATE LICENSED WELL DRILLER AS OUTLINED IN MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (MDEQ).
2. CONTRACTOR TO VERIFY THAT ALL WELL WORK, WELL COMPONENTS, AND CONNECTIONS MEET ALL APPLICABLE STANDARDS INCLUDING BUT NOT LIMITED TO MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY.
3. IT IS CRITICAL THAT THE WELL BE DRILLED IN THE EXACT MDEQ APPROVED LOCATION. FINISHED GROUND ELEVATION OF WELL TO BE STAKED BY OTHERS.
4. YIELD AND DRAWDOWN TESTS, CONDUCTED IN ACCORDANCE WITH MDEQ STANDARDS SHALL BE CONDUCTED ON THE WELL. REFER TO WELL SPECIFICATIONS FOR STEP TEST AND CONSTANT RATE TEST.
5. ALL PIPING, CONNECTIONS, FITTINGS, AND VALVES SHALL CONFORM TO THE LATEST AWWA OR ANSI/NSF STANDARDS.
6. WELL CAP TO BE LOCKED IN PLACE WITH A LONG SHANK PADLOCK.
7. WATER SAMPLES MUST BE OBTAINED BY WELL DRILLER DURING THE TEST PUMPING PROCEDURE, PRIOR TO DISINFECTION, AND DELIVER WATER SAMPLES TO STATE APPROVED LABORATORY PER DIRECTION OF THE ENGINEER. (REFER TO SPECIFICATIONS).
8. THE WELL LOG & WATER TEST RESULTS MUST ALL BE SUBMITTED TO THE ENGINEER AND MDEQ.
9. INITIAL SCOPE OF WORK INCLUDES DRILLING WELL TO SPECIFICATIONS, DEVELOPING WELL, PUMP TESTING, WATER SAMPLING, WELL DISINFECTION, AND PUMP INSTALLATION.
10. WELL MUST ALSO BE DISINFECTED UPON INSTALLATION OF PERMANENT WELL PUMP, PIPING, ELECTRICAL WIRING, ETC.
11. THE BACTERIOLOGICAL TEST RESULTS REQUIRED DURING PERMANENT WELL PUMP INSTALLATION SHALL BE TAKEN MORE THAN 72 HOURS AFTER DISINFECTION.

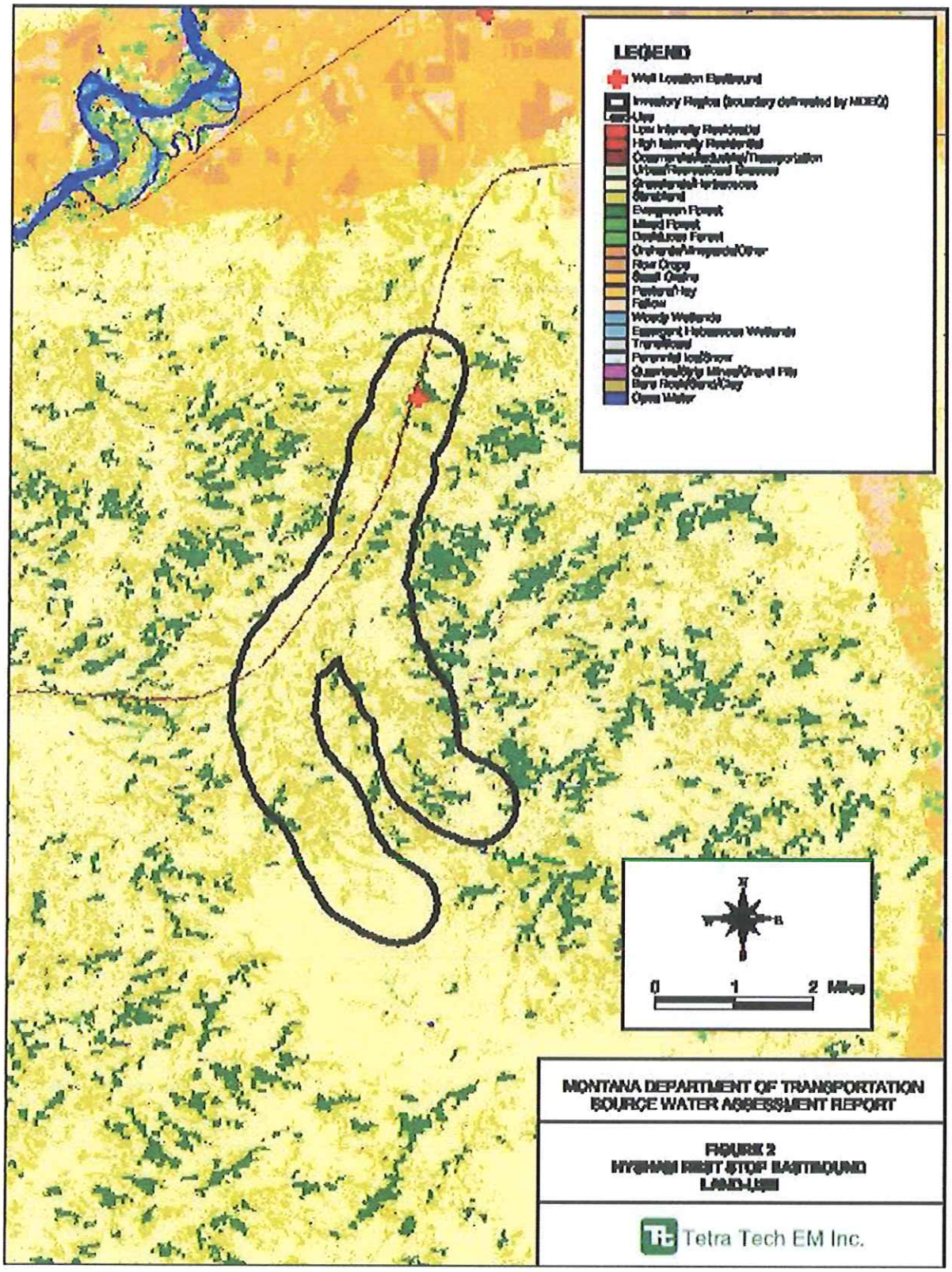
PROPOSED PUBLIC WELL DETAIL

EASTBOUND

NO SCALE

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\A200000\UT\8200000UTDET226	DESIGNED BY	T BECKEN-GADDI	8/26/2015	WATER PLANS	HYSHAM REST AREA - MONTANA	M 94-2(36)65
1		12/17/2015	REVIEWED BY	B GREYER	8/26/2015			
		10:51:04 AM dmischer	CHECKED BY	T COMBER	8/26/2015	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 6 OF 6


LEGEND
Well Location Eastbound
Inventory Region (boundary delineated by MDEQ)
Septic Density
C- Commercial
H - High
M- Medium
L- Low
N
W
E
S
0
1
2 Miles
50 Meter Contour Interval
L
MONTANA DEPARTMENT OF TRANSPORTATION
SOURCE WATER ASSESSMENT REPORT
FIGURE 1
HYSHAM REST STOP EASTBOUND
INVENTORY REGION
Tetra Tech EM Inc.


LEGEND
Well Location Eastbound
Inventory Region (boundary delineated by MDEQ)
Land-Use
Low Intensity Residential
High Intensity Residential
Commercial/Industrial/Transportation
Urban/Recreational Grasses
Grassland/Herbaceous
Shrubland
Evergreen Forest
Mixed Forest
Deciduous Forest
Orchards/Vineyards/Other
Row Crops
Small Grains
Pasture/Hay
Fallow
Woody Wetlands
Emergent Herbaceous Wetlands
Transitional
Perennial Ice/Snow
Quarries/Strip Mines/Gravel Pits
Bare Rock/Sand/Clay
Open Water
N
W
E
S
0
1
2 Miles
MONTANA DEPARTMENT OF TRANSPORTATION
SOURCE WATER ASSESSMENT REPORT
FIGURE 2
HYSHAM REST STOP EASTBOUND
LAND-USE
Tetra Tech EM Inc.

MONTANA
MDT
DEPARTMENT OF TRANSPORTATION

APPENDIX I:

Well Certification / As-Built

DOWL

Hysham Rest Area (East Bound) Public Well

Treasure County, Montana

Record Drawings and Certification

July 2016

Prepared For:

MONTANA MDT DEPARTMENT OF TRANSPORTATION

Prepared By :

DOWL
2090 Stadium Drive
Bozeman, M 59715

DOWL

Hysham Rest Area (Eastbound) Replacement Well Permit EQ# 16-1083 Certification

PREPARED IN ACCORDANCE WITH EQ # 16-1083

FOR

Hysham Rest Area (Eastbound) Replacement Well
Public Water System

Prepared For:
Montana Department of Environmental Quality (MDEQ)
Permitting and Compliance
1371 Rimtop Drive
Billings, MT 59105

Prepared By:
DOWL
2090 Stadium Drive
Bozeman MT. 59715

Background:
The water system design was approved by MDEQ on January 13, 2016. Since that time, the proposed well has been drilled and pump tested to verify the design requirements. Final certification of the entire water system will occur after completion of the Phase II reconstruction of the rest area.

Certification:
I hereby certify that the water system permitted by EQ # 16-1083, has been installed and completed in substantial accordance with plans and specifications approved by the department and there are no deviations from the design standards of the applicable circulars other than those previously approved by the department pursuant to ARM 17.38.101. There are no known defects in the design or construction of the improvements.

William Dreyer

William Dreyer, P.E.

7/21/2016
Date

MONTANA
WILLIAM
R. DREYER
No. 13853 PE
7/21/16
LICENSED
PROFESSIONAL ENGINEER

DOWL

WELL CONSTRUCTION INFORMATION
AND
RECORD DRAWINGS CONSTRUCTION CHANGES

FOR

Hysham Rest Area (Eastbound) Replacement Well (EQ# 16-1083)

According to the Approval EQ# 16-1083, dated January 13, 2016, the following information has been provided, pending partial approval of the replacement well. The item for this certification is specifically, "The drilling, developing, and test pumping of the replacement public water supply well with an anticipated capacity of approximately 35 gprn to serve the facility".

The following information is addressed for approval of the well:

1. A hydraulic analysis, based on the aquifer pumping test and selected pumping unit, demonstrating that the system will be capable of supplying the peak instantaneous demand while meeting the minimum pressure required in DEQ-3, 8.1.1.

The withdrawal rate is proposed to be 35 gpm and less than 10 acre-feet per year. The well was pumped at 40 gpm over 24 hrs. From the data supplied, the new well will be able to meet the capacity required for this facility.

2. A final assessment for proposed groundwater sources that may be under the direct influence of surface water, prepared in accordance with PWS-5 (DEQ-3, 1.1.6.e) and a final source water delineation report prepared in accordance with PWS-6 (DEQ-3, 1.1.6.f) if field results differ substantially from the originally-submitted information.

Field results do not differ substantially from that predicted in the preliminary assessment; consequently a final assessment is not required. The deep completion (250 feet) in the formation, grout seal, and overlying clay and shale formations only diminishes the potential for the drinking water supply to be under the influence of surface water.

3. Water quality sample results demonstrating compliance with DEQ-3, 3.2.2.1 (microbiological quality, two or more samples more than 72 hours after disinfection), and DEQ-3, 3.2.2.2 (physical and chemical, collected prior to disinfection).

Water quality samples have been collected and analyzed according to DEQ-3, 3.2.2.1 and 3.2.2.2 for a non transient- non community public well. Sample results are within the required limitations and a copy of the lab report is attached. Additional samples will be taken once the final rest area improvements have been made and prior to public use.

4. Yield and drawdown test results demonstrating compliance with DEQ-3, 3.2.4.1 submitted in both paper and electronic formats on DRNC Form 633.

Yield and drawdown tests have been conducted and the DNRC Form 633 documenting the test is attached. In addition the CD enclosed has this same data in electronic format.

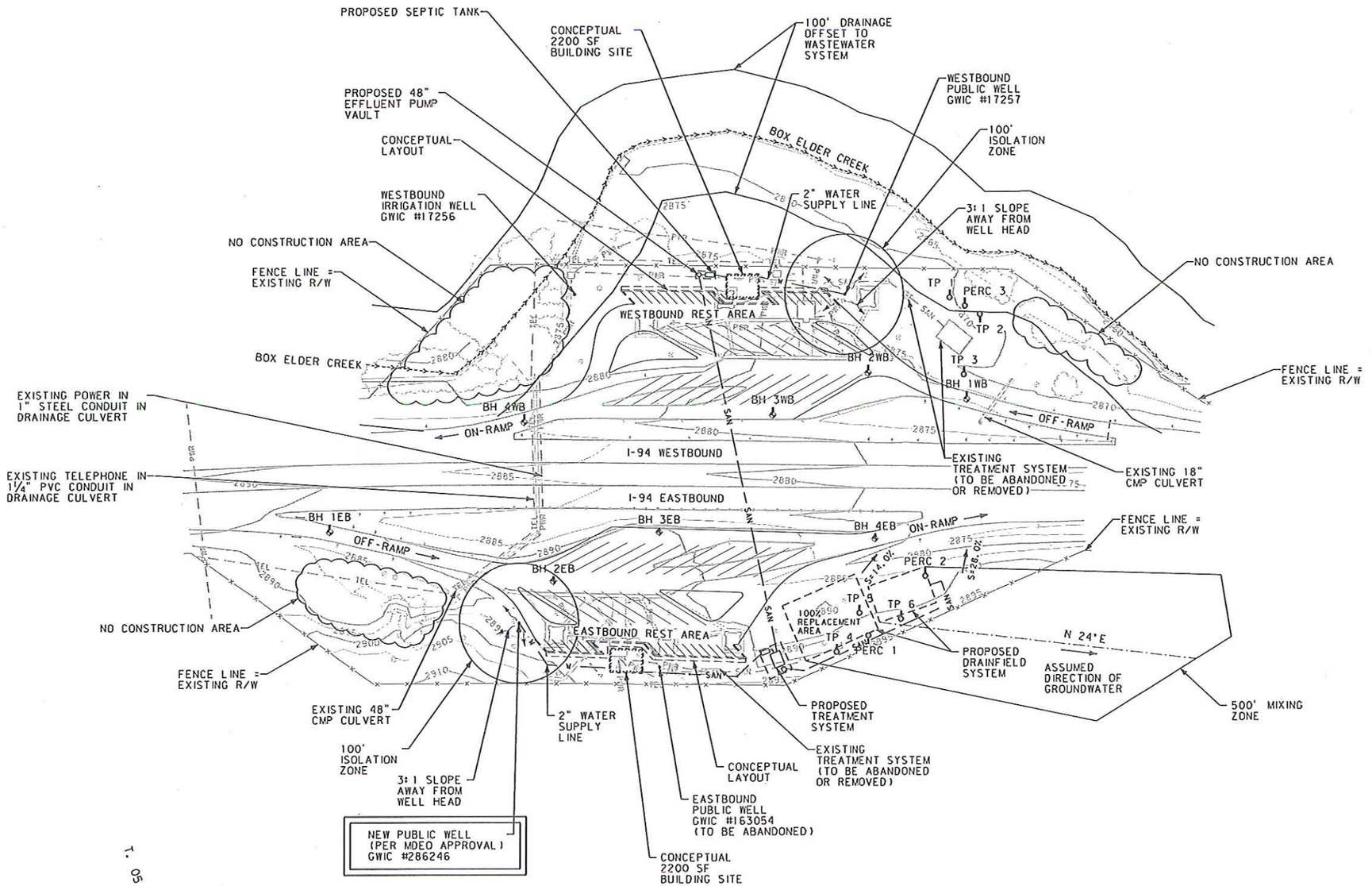
5. A copy of the completed well log (DEQ-3, 3.2.4.3).
A copy of the completed Montana Well Log Report is attached. In addition, an as-built drawing of the new well.

Not completed to MDEQ Approved Plan Set

- The new well will not be put to use until completion of the Phase II reconstruction.
- Installation of two (2) hydropneumatic tanks with a nominal volume of approximately 119 gallons and a 35-50 psi well pump pressure controls will be installed during the Phase II reconstruction.
- Installation of four (4) parallel particulate filters (NSF-approved housing and cartridges); and installation of valves, fittings, and appurtenances as shown on the approved plans will be installed during the Phase II reconstruction..

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD



(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD

NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.
3. FOR PHASE II OF THE HYSHAM REST AREA PROJECT, ALL WELL APPARATUS SHALL BE REMOVED AND THE WELL CASING AS WELL AS THE APPARATUS SHALL BE SCRUBBED AND AN ACID WASH TO THE CASING IS REQUIRED.

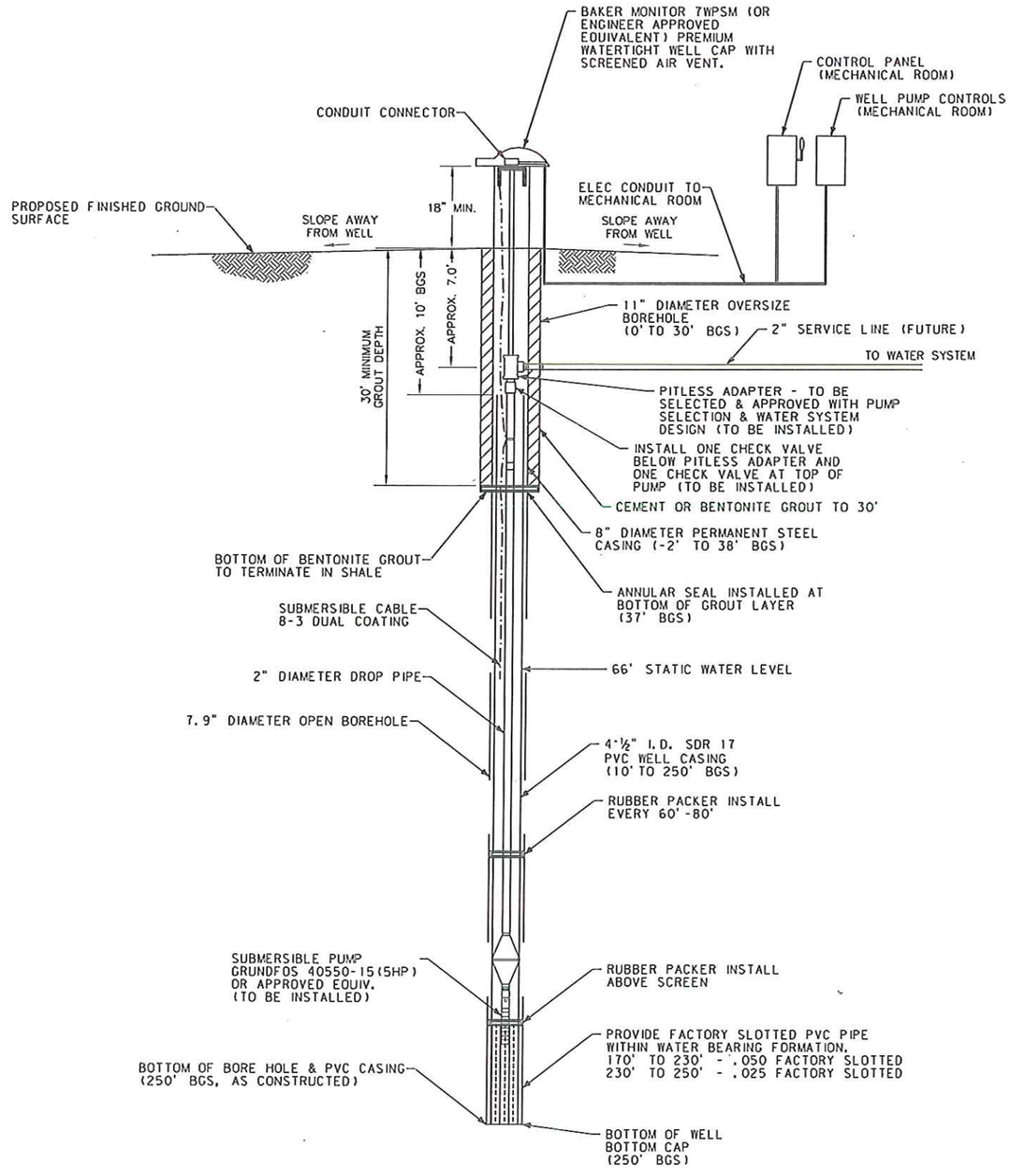
OVERALL CONCEPTUAL SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000UTDETZ20.DGN	DESIGNED BY	D FISCHER	7/21/2016	WATER PLANS	HYSHAM REST AREA - MONTANA	IM-G 94-2(36)65
2		7/21/2016	REVIEWED BY	B DREYER	7/21/2016			
		2:19:19 PM dofischer	CHECKED BY	T CORMIER	7/21/2016	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 1 OF 2

DOWL



1/6 WELL SYSTEM DETAIL (WELL INSTALLED)
SCALE : NTS

NOTES:

1. ALL WELL WORK AND CONNECTIONS SHALL BE CONDUCTED BY A MONTANA STATE LICENSED WELL DRILLER AS OUTLINED IN MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (MDEQ).
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MONTANA
WILLIAM R. DREYER
No. 13853 PE
7/21/16
LICENSED PROFESSIONAL ENGINEER

RECORD DRAWING

THIS DRAWING IS A RECORD OF AVAILABLE CONSTRUCTION INFORMATION AND DOES NOT IMPLY OR WARRANT THAT THE FACILITIES SHOWN ARE "AS BUILT"

SOURCE OF INFORMATION: SITE VISIT & SYSTEM INSPECTION

DRAWINGS REVISED BY: DPF
REVIEWED BY: WRD
DATE: 7/21/2016

PROPOSED PUBLIC WELL DETAIL

EASTBOUND

NO SCALE

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000UTDETZ20.DGN	DESIGNED BY	D FISCHER	7/21/2016	WATER PLANS	HYSHAM REST AREA - MONTANA / IM-C 94-2(36)65
1		7/21/2016	REVIEWED BY	B DREYER	7/21/2016		
		2:19:20 PM dofischer	CHECKED BY	T CORMIER	7/21/2016	TREASURE COUNTY	WELL AS CONSTRUCTED / CSF=0.9993521809 / UPN 8200000 / SHEET 2 OF 2

Hysham Rest Area

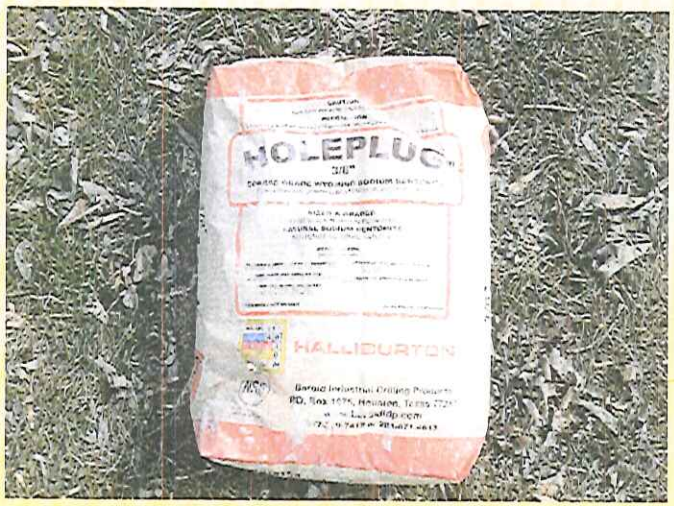
Well Drilling

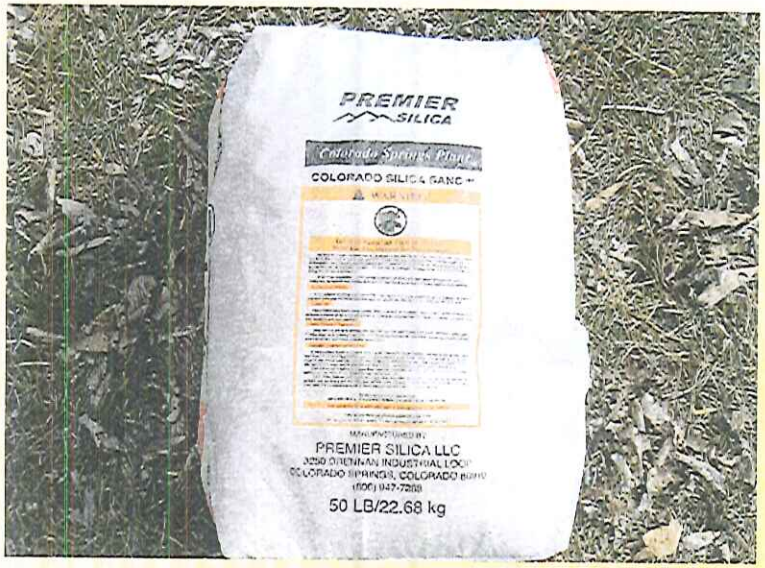
Hysham Rest Area

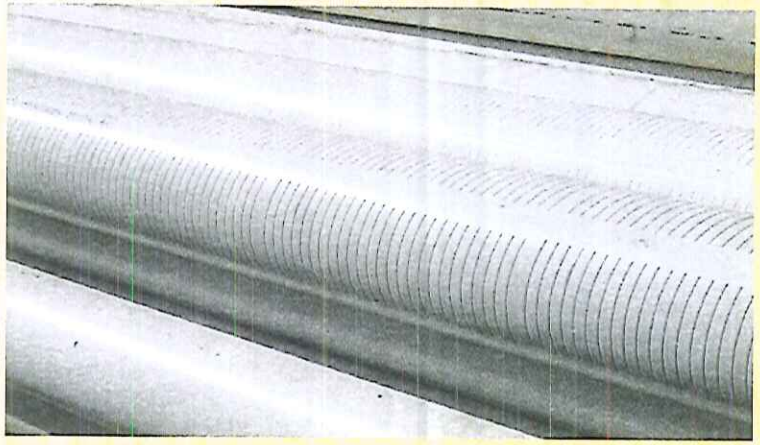
Pump Test

Hysham Rest Area

Materials







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College Station, TX 888.690.2218 • Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

Work Order Receipt Checklist

DOWL

B16040521

Login completed by: Brittaney R. Garza
Reviewed by: BL2000\lvalkenburg
Reviewed Date: 4/7/2016

Date Received: 4/7/2016
Received by: dlf
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	1.1°C On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	Not Applicable ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	Not Applicable ☑

Standard Reporting Procedures:

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

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

Contact and Corrective Action Comments:

None

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College Station, TX 888.690.2218 • Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL
Project: Not Indicated
Client Sample ID: New PWS Well, Hysham Rest Stop E Bound
PWS ID: **Facility ID:** **Sample Point ID:**
Facility Name:
Lab ID: B16040521-001A
Compliance Sample: NO **Sample Type:**

Report Date: 04/11/16
Collection Date: 04/07/16 07:30
Received Date: 04/07/16 11:48
Matrix: Drinking Water
Sampled By: Jim Potts

Analyses	Result	Units	Safe/Unsafe	Qualifier	Method	Analysis Date / By
MICROBIOLOGICAL						
3100 Coliform, Total	Absent	per 100ml	SAFE		A9223	04/07/16 14:05 / ldv
3014 Coliform, E-Coli	Absent	per 100ml			A9223	04/07/16 14:05 / ldv

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

Method Reference: E - EPA / MCAWW Methodology A - Standard Methods 22nd Ed.

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Total Coliform Bacteria

Chain-of-Custody

Payment is expected upon receipt of samples
Total Coliform Bacteria and E. coli analysis by SM 9223B is $20.00 per sample.
***See Notes below and on the back of this form for additional information**

Account Information	
Company/Name:	DOWL
Contact:	Jim Potts / Bill Dreyer
Phone:	539-9565
Mailing Address:	2090 Stadium Drive
City, State, Zip:	Bozeman, MT 59715
Email:	jpotts@dowl.com
How would you like to receive the report:	☐ Hard Copy ☑ Email

Report Address (leave blank if same as Account Information)	
Company/Name:	Same
Contact:	Bill Dreyer
Phone:	Same
Mailing Address:	11
City, State, Zip:	11
Email:	bdreyer@dowl.com
How would you like to receive the report:	☐ Hard Copy ☐ Email

Sample Information

Physical Address of Property:

Sample Site Description				
Source (Well, cistern, etc.)	Site (Kitchen sink, direct, etc.)	Sample Date	Sample Time	FIELD #
New Well at Hysham East Bound Rest STOP	Hysham Rest STOP. E. Bound	4-7-16	7:30	B16040521 001

NOTES STOP

The lab must receive the sample within 30 hours of sampling (Business Hours: Monday through Friday, 8am – 5pm). Contact your laboratory for possible weekend rates if delivering your sample on a Friday.
The Laboratory will be closed on all major holidays and will not accept bacteria samples one day before any major holiday.

Sampler Information

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

Sampler Name (Printed): Jim Potts ***Company (If applicable):*** DOWL

Sampler Signature: Jim Potts

Custody Record MUST be Signed	Relinquished by Signature:	Date/Time:	Received by Laboratory Signature:	Date/Time:
	Jim Potts	4-7-16 11:45	Debbie Ossiel	4/7/16 1148

LABORATORY USE ONLY

Shipped by: Hand	Custody Seals Intact: (Y) N (C) B (Y) N	Receipt Temp: 1.1 °C	Temp Blank: (Y) N	On Ice: (Y) N

Payment Type *(circle one)* CC CASH CHK _____ Amount: $ _____ Receipt Number: _____ *(Applicable to Cash & Check Payments)*

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College Station, TX 888.690.2218 • Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

ANALYTICAL SUMMARY REPORT

April 13, 2016

DOWL
2090 Stadium Dr
Bozeman, MT 59715-0616

Work Order: B16040522

Project Name: Hysham Rest Stop

Energy Laboratories Inc Billings MT received the following 1 sample for DOWL on 4/7/2016 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B16040522-001	New Eastbound Hysham PWS	04/07/16 7:30	04/07/16	Drinking Water	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water Alkalinity Conductivity Mercury, Drinking Water Hardness as CaCO3 Anions by Ion Chromatography Nitrogen, Nitrite Nitrogen, Nitrate + Nitrite Nitrogen, Nitrate pH Drinking Water Metals Digestion by EPA 200.2 Preparation, Dissolved Filtration Digestion, Mercury by CVAA Preparation for TDS Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Supervisor, Wet Chemistry

Digitally signed by
Keri Conter
Date: 2016.04.13 16:44:29 -06:00

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop
Lab ID: B16040522-001
Client Sample ID: New Eastbound Hysham PWS

Report Date: 04/13/16
Collection Date: 04/07/16 07:30
DateReceived: 04/07/16
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.7	s.u.	H	0.1		A4500-H B	04/07/16 15:05 / pjw
Conductivity @ 25 C	2300	umhos/cm		5		A2510 B	04/07/16 15:05 / pjw
Solids, Total Dissolved TDS @ 180 C	1510	mg/L	D	20		A2540 C	04/11/16 10:16 / cnm
INORGANICS							
Alkalinity, Total as CaCO3	508	mg/L		4		A2320 B	04/07/16 22:15 / cnm
Chloride	9	mg/L		1		E300.0	04/08/16 16:23 / cmb
Sulfate	684	mg/L	D	4		E300.0	04/08/16 16:23 / cmb
Fluoride	0.7	mg/L	D	0.4		E300.0	04/08/16 16:23 / cmb
Hardness as CaCO3	11	mg/L		1		A2340 B	04/08/16 16:48 / jbm
NUTRIENTS							
Nitrogen, Nitrite as N	ND	mg/L		0.01		E353.2	04/07/16 15:12 / ajm
Nitrogen, Nitrate as N	ND	mg/L		0.01		Calculation	04/08/16 13:15 / jbm
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	10	E353.2	04/08/16 11:03 / ajm
METALS, DISSOLVED							
Calcium	3	mg/L		1		E200.7	04/08/16 11:51 / rlh
Magnesium	ND	mg/L		1		E200.7	04/08/16 11:51 / rlh
Potassium	1	mg/L		1		E200.7	04/08/16 11:51 / rlh
Sodium	561	mg/L	D	2		E200.7	04/08/16 11:51 / rlh
METALS, TOTAL							
Antimony	ND	mg/L		0.001	0.006	E200.8	04/11/16 16:47 / mas
Arsenic	ND	mg/L		0.001	0.01	E200.8	04/11/16 16:47 / mas
Barium	ND	mg/L		0.05	2	E200.8	04/11/16 16:47 / mas
Beryllium	ND	mg/L		0.001	0.004	E200.8	04/11/16 16:47 / mas
Cadmium	ND	mg/L		0.001	0.005	E200.8	04/11/16 16:47 / mas
Chromium	ND	mg/L		0.005	0.1	E200.8	04/11/16 16:47 / mas
Iron	0.03	mg/L		0.02		E200.7	04/12/16 02:02 / rlh
Manganese	0.009	mg/L		0.001		E200.8	04/11/16 16:47 / mas
Mercury	ND	mg/L		0.0001	0.002	E245.1	04/11/16 15:40 / ser
Nickel	ND	mg/L		0.01		E200.8	04/11/16 16:47 / mas
Selenium	ND	mg/L		0.001	0.05	E200.8	04/11/16 16:47 / mas
Thallium	ND	mg/L		0.0005	0.002	E200.8	04/11/16 16:47 / mas

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R259211
Lab ID: MBLK		Method Blank				Run: MAN-TECH_160407A				04/07/16 20:00
Alkalinity, Total as CaCO3		2	mg/L	2						
Lab ID: LCS		Laboratory Control Sample				Run: MAN-TECH_160407A				04/07/16 20:08
Alkalinity, Total as CaCO3		97.3	mg/L	4.0	95	90	110			
Lab ID: B16040374-001ADUP		Sample Duplicate				Run: MAN-TECH_160407A				04/07/16 20:21
Alkalinity, Total as CaCO3		58.1	mg/L	4.0				0.8	10	
Lab ID: B16040374-002AMS		Sample Matrix Spike				Run: MAN-TECH_160407A				04/07/16 20:36
Alkalinity, Total as CaCO3		404	mg/L	4.0	94	80	120			
Lab ID: B16040431-002ADUP		Sample Duplicate				Run: MAN-TECH_160407A				04/07/16 22:01
Alkalinity, Total as CaCO3		244	mg/L	4.0				0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2510 B										Batch: R259151
Lab ID: SC 2nd 1413		Laboratory Control Sample				Run: PHSC _101-B_160407A				04/07/16 08:16
Conductivity @ 25 C		1410	umhos/cm	5.0	100	90	110			
Lab ID: MBLK		Method Blank				Run: PHSC _101-B_160407A				04/07/16 14:34
Conductivity @ 25 C		2	umhos/cm							
Lab ID: B16040470-001ADUP		Sample Duplicate				Run: PHSC _101-B_160407A				04/07/16 14:40
Conductivity @ 25 C		2810	umhos/cm	5.0				0.2	10	
Lab ID: B16040522-001ADUP		Sample Duplicate				Run: PHSC _101-B_160407A				04/07/16 15:08
Conductivity @ 25 C		2290	umhos/cm	5.0				0.3	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: 98334
Lab ID: MB-98334		Method Blank				Run: BAL #SD-15_160411A			04/11/16 10:12	
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	5						
Lab ID: LCS-98334		Laboratory Control Sample				Run: BAL #SD-15_160411A			04/11/16 10:13	
Solids, Total Dissolved TDS @ 180 C		1060	mg/L	10	106	90	110			
Lab ID: B16040582-006A DUP		Sample Duplicate				Run: BAL #SD-15_160411A			04/11/16 10:13	
Solids, Total Dissolved TDS @ 180 C		3890	mg/L	38				0.3	5	D
Lab ID: B16040714-016A DUP		Sample Duplicate				Run: BAL #SD-15_160411A			04/11/16 10:15	
Solids, Total Dissolved TDS @ 180 C		1520	mg/L	10				0.1	5	

Qualifiers:

RL - Analyte reporting limit.
ND - Not detected at the reporting limit.
D - RL increased due to sample matrix.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B									Analytical Run: PHSC _101-B_160407A	
Lab ID: pH 8	Initial Calibration Verification Standard								04/07/16 08:06	
pH		7.98	s.u.	0.10	100	98	102			
Method: A4500-H B									Batch: R259151	
Lab ID: B16040470-001ADUP	Sample Duplicate					Run: PHSC _101-B_160407A			04/07/16 14:40	
pH		7.02	s.u.	0.10				0.0	3	
Lab ID: B16040522-001ADUP	Sample Duplicate					Run: PHSC _101-B_160407A			04/07/16 15:08	
pH		8.72	s.u.	0.10				0.0	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC METROHM 2_160408A
Lab ID: ICV	3	Initial Calibration Verification Standard								04/08/16 09:39
Chloride		2.13	mg/L	1.0	95	90	110			
Sulfate		8.89	mg/L	1.0	99	90	110			
Fluoride		1.13	mg/L	0.20	100	90	110			
Method: E300.0										Batch: R259254
Lab ID: ICB	3	Method Blank				Run: IC METROHM 2_160408A				04/08/16 09:53
Chloride		ND	mg/L	0.02						
Sulfate		ND	mg/L	0.2						
Fluoride		ND	mg/L	0.006						
Lab ID: LFB	3	Laboratory Fortified Blank				Run: IC METROHM 2_160408A				04/08/16 10:06
Chloride		10.1	mg/L	1.0	101	90	110			
Sulfate		30.2	mg/L	1.0	101	90	110			
Fluoride		3.07	mg/L	0.20	102	90	110			
Lab ID: B16040526-001AMS	3	Sample Matrix Spike				Run: IC METROHM 2_160408A				04/08/16 16:50
Chloride		547	mg/L	3.0	105	90	110			
Sulfate		4140	mg/L	9.1	100	90	110			
Fluoride		157	mg/L	0.91	104	90	110			
Lab ID: B16040526-001AMSD	3	Sample Matrix Spike Duplicate				Run: IC METROHM 2_160408A				04/08/16 17:04
Chloride		548	mg/L	3.0	105	90	110	0.1	20	
Sulfate		4150	mg/L	9.1	100	90	110	0.2	20	
Fluoride		158	mg/L	0.91	104	90	110	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2										Analytical Run: FIA203-B_160407B
Lab ID: ICV		Initial Calibration Verification Standard								04/07/16 15:05
Nitrogen, Nitrite as N		0.509	mg/L	0.010	102	90	110			
Method: E353.2										Batch: R259192
Lab ID: MBLK		Method Blank				Run: FIA203-B_160407B				04/07/16 15:06
Nitrogen, Nitrite as N		ND	mg/L	0.002						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA203-B_160407B				04/07/16 15:07
Nitrogen, Nitrite as N		0.491	mg/L	0.010	98	90	110			
Lab ID: B16040423-001BMS		Sample Matrix Spike				Run: FIA203-B_160407B				04/07/16 15:09
Nitrogen, Nitrite as N		0.514	mg/L	0.010	103	90	110			
Lab ID: B16040423-001BMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_160407B				04/07/16 15:11
Nitrogen, Nitrite as N		0.515	mg/L	0.010	103	90	110	0.2	10	
Method: E353.2										Analytical Run: FIA203-B_160408A
Lab ID: ICV		Initial Calibration Verification Standard								04/08/16 10:34
Nitrogen, Nitrate+Nitrite as N		0.540	mg/L	0.010	96	90	110			
Method: E353.2										Batch: R259224
Lab ID: MBLK		Method Blank				Run: FIA203-B_160408A				04/08/16 10:35
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.005						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA203-B_160408A				04/08/16 10:36
Nitrogen, Nitrate+Nitrite as N		0.988	mg/L	0.010	99	90	110			
Lab ID: B16040495-002BMS		Sample Matrix Spike				Run: FIA203-B_160408A				04/08/16 11:00
Nitrogen, Nitrate+Nitrite as N		1.32	mg/L	0.010	100	90	110			
Lab ID: B16040495-002BMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_160408A				04/08/16 11:01
Nitrogen, Nitrate+Nitrite as N		1.31	mg/L	0.010	100	90	110	0.1	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP203-B_160408A	
Lab ID: ICV	4	Continuing Calibration Verification Standard								04/08/16 08:51
Calcium		25.3	mg/L	1.0	101	95	105			
Magnesium		25.4	mg/L	1.0	102	95	105			
Potassium		25.2	mg/L	1.0	101	95	105			
Sodium		25.2	mg/L	1.0	101	95	105			
Method: E200.7										Batch: R259216
Lab ID: MB-6500DIS160408A	4	Method Blank				Run: ICP203-B_160408A				04/08/16 08:57
Calcium		ND	mg/L	0.02						
Magnesium		ND	mg/L	0.003						
Potassium		ND	mg/L	0.09						
Sodium		ND	mg/L	0.03						
Lab ID: LFB-6500DIS160408A	4	Laboratory Fortified Blank				Run: ICP203-B_160408A				04/08/16 09:05
Calcium		50.3	mg/L	1.0	101	85	115			
Magnesium		50.8	mg/L	1.0	102	85	115			
Potassium		50.0	mg/L	1.0	100	85	115			
Sodium		50.2	mg/L	1.0	100	85	115			
Lab ID: B16040421-001CMS2	4	Sample Matrix Spike				Run: ICP203-B_160408A				04/08/16 11:16
Calcium		370	mg/L	1.0	98	70	130			
Magnesium		306	mg/L	1.0	99	70	130			
Potassium		268	mg/L	1.0	100	70	130			
Sodium		927	mg/L	2.0	89	70	130			
Lab ID: B16040421-001CMSD	4	Sample Matrix Spike Duplicate				Run: ICP203-B_160408A				04/08/16 11:19
Calcium		369	mg/L	1.0	97	70	130	0.1	20	
Magnesium		306	mg/L	1.0	99	70	130	0.1	20	
Potassium		270	mg/L	1.0	100	70	130	0.6	20	
Sodium		940	mg/L	2.0	94	70	130	1.4	20	
Lab ID: MB-98244	4	Method Blank				Run: ICP203-B_160408A				04/08/16 11:37
Calcium		0.04	mg/L	0.02						
Magnesium		ND	mg/L	0.003						
Potassium		0.2	mg/L	0.09						
Sodium		ND	mg/L	0.03						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP203-B_160411A	
Lab ID: ICV	Continuing Calibration Verification Standard								04/11/16 09:15	
Iron		2.54	mg/L	0.020	102	95	105			
Method: E200.7									Batch: 98289	
Lab ID: MB-98289	Method Blank					Run: ICP203-B_160411A			04/12/16 01:55	
Iron		0.005	mg/L	0.002						
Lab ID: LCS-98289	Laboratory Control Sample					Run: ICP203-B_160411A			04/12/16 01:58	
Iron		2.58	mg/L	0.020	103	85	115			
Lab ID: B16040522-001CMS3	Sample Matrix Spike					Run: ICP203-B_160411A			04/12/16 02:13	
Iron		2.69	mg/L	0.020	107	70	130			
Lab ID: B16040522-001CMSD	Sample Matrix Spike Duplicate					Run: ICP203-B_160411A			04/12/16 02:16	
Iron		2.50	mg/L	0.020	99	70	130	7.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Report Date: 04/13/16
Project: Hysham Rest Stop
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS202-B_160411A	
Lab ID: QCS	10 Initial Calibration Verification Standard								04/11/16 16:16	
Antimony		0.0476	mg/L	0.050	95	90	110			
Arsenic		0.0491	mg/L	0.0050	98	90	110			
Barium		0.0486	mg/L	0.10	97	90	110			
Beryllium		0.0246	mg/L	0.0010	98	90	110			
Cadmium		0.0246	mg/L	0.0010	98	90	110			
Chromium		0.0505	mg/L	0.010	101	90	110			
Manganese		0.241	mg/L	0.010	96	90	110			
Nickel		0.0504	mg/L	0.010	101	90	110			
Selenium		0.0484	mg/L	0.0050	97	90	110			
Thallium		0.0491	mg/L	0.10	98	90	110			
Method: E200.8									Batch: 98289	
Lab ID: MB-98289	10 Method Blank					Run: ICPMS202-B_160411A			04/11/16 16:44	
Antimony		6E-05	mg/L	4E-05						
Arsenic		ND	mg/L	9E-05						
Barium		ND	mg/L	0.0003						
Beryllium		ND	mg/L	5E-05						
Cadmium		ND	mg/L	9E-06						
Chromium		0.0003	mg/L	8E-05						
Manganese		ND	mg/L	6E-05						
Nickel		ND	mg/L	9E-05						
Selenium		ND	mg/L	0.0002						
Thallium		ND	mg/L	1E-05						
Lab ID: LCS-98289	10 Laboratory Control Sample					Run: ICPMS202-B_160411A			04/11/16 16:49	
Antimony		0.528	mg/L	0.0010	105	85	115			
Arsenic		0.497	mg/L	0.0010	99	85	115			
Barium		0.550	mg/L	0.050	110	85	115			
Beryllium		0.237	mg/L	0.0010	95	85	115			
Cadmium		0.255	mg/L	0.0010	102	85	115			
Chromium		0.505	mg/L	0.0050	101	85	115			
Manganese		2.52	mg/L	0.0010	101	85	115			
Nickel		0.521	mg/L	0.010	104	85	115			
Selenium		0.484	mg/L	0.0010	97	85	115			
Thallium		0.484	mg/L	0.00050	97	85	115			
Lab ID: B16040522-001CMS3	10 Sample Matrix Spike					Run: ICPMS202-B_160411A			04/11/16 16:52	
Antimony		0.561	mg/L	0.0010	112	70	130			
Arsenic		0.521	mg/L	0.0010	104	70	130			
Barium		0.597	mg/L	0.050	118	70	130			
Beryllium		0.233	mg/L	0.0010	93	70	130			
Cadmium		0.261	mg/L	0.0010	104	70	130			
Chromium		0.511	mg/L	0.0050	102	70	130			
Manganese		2.52	mg/L	0.0010	101	70	130			
Nickel		0.535	mg/L	0.010	107	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: 98289
Lab ID: B16040522-001CMS3	10	Sample Matrix Spike				Run: ICPMS202-B_160411A				04/11/16 16:52
Selenium		0.495	mg/L	0.0010	99	70	130			
Thallium		0.505	mg/L	0.00050	101	70	130			
Lab ID: B16040522-001CMSD	10	Sample Matrix Spike Duplicate				Run: ICPMS202-B_160411A				04/11/16 17:02
Antimony		0.532	mg/L	0.0010	106	70	130	5.4	20	
Arsenic		0.490	mg/L	0.0010	98	70	130	6.0	20	
Barium		0.559	mg/L	0.050	110	70	130	6.6	20	
Beryllium		0.223	mg/L	0.0010	89	70	130	4.6	20	
Cadmium		0.252	mg/L	0.0010	101	70	130	3.5	20	
Chromium		0.496	mg/L	0.0050	99	70	130	2.9	20	
Manganese		2.41	mg/L	0.0010	96	70	130	4.5	20	
Nickel		0.515	mg/L	0.010	103	70	130	3.8	20	
Selenium		0.469	mg/L	0.0010	94	70	130	5.6	20	
Thallium		0.475	mg/L	0.00050	95	70	130	6.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E245.1									Analytical Run: HGCV202-B_160411A	
Lab ID: ICV		Initial Calibration Verification Standard							04/11/16 13:46	
Mercury		0.00207	mg/L	0.00010	104	90	110			
Method: E245.1									Batch: 98308	
Lab ID: MB-98308		Method Blank				Run: HGCV202-B_160411A			04/11/16 15:36	
Mercury		ND	mg/L	4E-06						
Lab ID: LCS-98308		Laboratory Control Sample				Run: HGCV202-B_160411A			04/11/16 15:38	
Mercury		0.00210	mg/L	0.00010	105	85	115			
Lab ID: B16040522-001CMS		Sample Matrix Spike				Run: HGCV202-B_160411A			04/11/16 15:42	
Mercury		0.00201	mg/L	0.00010	100	70	130			
Lab ID: B16040522-001CMSD		Sample Matrix Spike Duplicate				Run: HGCV202-B_160411A			04/11/16 15:44	
Mercury		0.00206	mg/L	0.00010	103	70	130	2.3	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Work Order Receipt Checklist

DOWL

B16040522

Login completed by: Brittaney R. Garza
Reviewed by: BL2000\lcadreau
Reviewed Date: 4/11/2016

Date Received: 4/7/2016
Received by: dlf
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	1.1°C On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	Not Applicable ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Standard Reporting Procedures:

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

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

Contact and Corrective Action Comments:

Sample for Dissolved Metals was subsampled, filtered and preserved to pH <2 with 2mL of nitric acid per 250mL in the laboratory. According to 40CFR136, samples for Dissolved Metals should be filtered and preserved within 15 minutes of collection.

Total Coliform Bacteria was logged in Work Order B16040521.

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT (Provide as much information as possible.)

Company Name: Dowl

Report Mail Address (Required): 2096 Stadium Drive, Bozeman MT 59715

No Hard Copy Email: jpotts@dowl.com

Invoice Address (Required): SAME As Above, Attention Bill Dreyer

No Hard Copy Email: bdreyer@dowl.com

Special Report/Formats:
- ☑ DW
- ☐ POTW/WWTP
- ☐ State: ____
- ☐ Other: ____
- ☐ EDD/EDT (Electronic Data) Format: ____
- ☐ LEVEL IV
- ☐ NELAC

Project Name, PWS, Permit, Etc.: Hysham Rest Stop

Contact Name: Jim Potts Phone/Fax: 539-9565 586-8834 Cell:

Invoice Contact & Phone: Bill Dreyer 586-8834

Sample Origin: State: MT

EPA/State Compliance: Yes ☐ No ☐

Sampler: (Please Print): Jim Potts

Purchase Order:

Quote/Bottle Order:

Shipped by: Hand

Cooler ID(s):

Receipt Temp 1.1 °C

On Ice: (Y) N

Custody Seal: On Bottle Y N; On Cooler Y N; Intact Y N; Signature Match Y N

Contact ELI prior to RUSH sample submittal for charges and scheduling – See Instruction Page

RUSH

Standard Turnaround (TAT)

Comments: Bill to 40522

	SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Number of Containers (Sample Type: A W S V B O DW; Air Water Soils/Solids Vegetation Bioassay Other DW - Drinking Water)	Per Bottle Order 99607 (Attached)	SEE ATTACHED
1	New Eastbound Hysham Rest Stop	4-7-16	7:30	DW	3	X	X
2							
3							
4							
5							
6							
7							
8							
9							
10							

LABORATORY USE ONLY 001

Custody Record MUST be Signed

Relinquished by (print): Jim Potts Date/Time: 4-7-16 11:45 Signature:

Relinquished by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by (print): Date/Time: Signature:

Received by Laboratory: 4/7/16 1148

Sample Disposal: Return to Client: ____ Lab Disposal: ____

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.

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BOTTLE ORDER 99607

SHIPPED TO: DOWL HKM

Contact: Bill Dreyer
2090 Stadium Drive
Bozeman MT 59715
Phone: (406) 586-8834
Project:

Order Created by: Debbie Fosjord
Shipped From: Billings, MT
Ship Date: 2/18/2016
VIA: Ground

Bottle Size/Type	Bottles Per Samp	Method	Tests	Critical Hold Time	Preservative	Notes	Num of Samp
DW (2 Sets)							
1 Liter Plastic	1	A2320 B	Alkalinity			Cl, SO4 & F by E300.0	1
		A2510 B	Conductivity				
		E300.0	Anions by Ion Chromatography				
		E353.2	Nitrogen, Nitrite	48 hrs			
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Dissolved			Will be Filtered and Preserved in lab for Ca, Mg, K & Na	1
		A2340 B	Hardness as CaCO3				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Drinking Water		■ HNO3	Sb, As, Ba, Be, Cd, Cr, Fe, Mn, Hg, Ni, Se, Tl	1
250 mL Plastic	1	E353.2	Nitrogen, Nitrate + Nitrite		☐ H2SO4		1
		Calculation	Nitrogen, Nitrate				
100 mL Plastic Sterile	1	A9223	Bacteria, Private Water Supply	48 hrs			1
WW (2 Sets)							
1 Liter Plastic	1	A5210 B	Biochemical Oxygen Demand, 5 Day	48 hrs			1

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ANALYTICAL SUMMARY REPORT

April 13, 2016

DOWL
2090 Stadium Dr
Bozeman, MT 59715-0616

Work Order: B16040522

Project Name: Hysham Rest Stop

Energy Laboratories Inc Billings MT received the following 1 sample for DOWL on 4/7/2016 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
B16040522-001	New Eastbound Hysham PWS	04/07/16 7:30	04/07/16	Drinking Water	Metals by ICP/ICPMS, Dissolved Metals by ICP/ICPMS, Drinking Water Alkalinity Conductivity Mercury, Drinking Water Hardness as CaCO3 Anions by Ion Chromatography Nitrogen, Nitrite Nitrogen, Nitrate + Nitrite Nitrogen, Nitrate pH Drinking Water Metals Digestion by EPA 200.2 Preparation, Dissolved Filtration Digestion, Mercury by CVAA Preparation for TDS Solids, Total Dissolved

The analyses presented in this report were performed by Energy Laboratories, Inc., 1120 S 27th St., Billings, MT 59101, unless otherwise noted. Any exceptions or problems with the analyses are noted in the Laboratory Analytical Report, the QA/QC Summary Report, or the Case Narrative.

The results as reported relate only to the item(s) submitted for testing.

If you have any questions regarding these test results, please call.

Report Approved By: Supervisor, Wet Chemistry

Digitally signed by
Keri Conter
Date: 2016.04.13 16:44:29 -06:00

LABORATORY ANALYTICAL REPORT

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop
Lab ID: B16040522-001
Client Sample ID: New Eastbound Hysham PWS

Report Date: 04/13/16
Collection Date: 04/07/16 07:30
DateReceived: 04/07/16
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.7	s.u.	H	0.1		A4500-H B	04/07/16 15:05 / pjw
Conductivity @ 25 C	2300	umhos/cm		5		A2510 B	04/07/16 15:05 / pjw
Solids, Total Dissolved TDS @ 180 C	1510	mg/L	D	20		A2540 C	04/11/16 10:16 / cnm
INORGANICS							
Alkalinity, Total as CaCO3	508	mg/L		4		A2320 B	04/07/16 22:15 / cnm
Chloride	9	mg/L		1		E300.0	04/08/16 16:23 / cmb
Sulfate	684	mg/L	D	4		E300.0	04/08/16 16:23 / cmb
Fluoride	0.7	mg/L	D	0.4		E300.0	04/08/16 16:23 / cmb
Hardness as CaCO3	11	mg/L		1		A2340 B	04/08/16 16:48 / jbm
NUTRIENTS							
Nitrogen, Nitrite as N	ND	mg/L		0.01		E353.2	04/07/16 15:12 / ajm
Nitrogen, Nitrate as N	ND	mg/L		0.01		Calculation	04/08/16 13:15 / jbm
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	10	E353.2	04/08/16 11:03 / ajm
METALS, DISSOLVED							
Calcium	3	mg/L		1		E200.7	04/08/16 11:51 / rlh
Magnesium	ND	mg/L		1		E200.7	04/08/16 11:51 / rlh
Potassium	1	mg/L		1		E200.7	04/08/16 11:51 / rlh
Sodium	561	mg/L	D	2		E200.7	04/08/16 11:51 / rlh
METALS, TOTAL							
Antimony	ND	mg/L		0.001	0.006	E200.8	04/11/16 16:47 / mas
Arsenic	ND	mg/L		0.001	0.01	E200.8	04/11/16 16:47 / mas
Barium	ND	mg/L		0.05	2	E200.8	04/11/16 16:47 / mas
Beryllium	ND	mg/L		0.001	0.004	E200.8	04/11/16 16:47 / mas
Cadmium	ND	mg/L		0.001	0.005	E200.8	04/11/16 16:47 / mas
Chromium	ND	mg/L		0.005	0.1	E200.8	04/11/16 16:47 / mas
Iron	0.03	mg/L		0.02		E200.7	04/12/16 02:02 / rlh
Manganese	0.009	mg/L		0.001		E200.8	04/11/16 16:47 / mas
Mercury	ND	mg/L		0.0001	0.002	E245.1	04/11/16 15:40 / ser
Nickel	ND	mg/L		0.01		E200.8	04/11/16 16:47 / mas
Selenium	ND	mg/L		0.001	0.05	E200.8	04/11/16 16:47 / mas
Thallium	ND	mg/L		0.0005	0.002	E200.8	04/11/16 16:47 / mas

Report Definitions:
RL - Analyte reporting limit.
QCL - Quality control limit.
D - RL increased due to sample matrix.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2320 B										Batch: R259211
Lab ID: MBLK		Method Blank				Run: MAN-TECH_160407A				04/07/16 20:00
Alkalinity, Total as CaCO3		2	mg/L	2						
Lab ID: LCS		Laboratory Control Sample				Run: MAN-TECH_160407A				04/07/16 20:08
Alkalinity, Total as CaCO3		97.3	mg/L	4.0	95	90	110			
Lab ID: B16040374-001ADUP		Sample Duplicate				Run: MAN-TECH_160407A				04/07/16 20:21
Alkalinity, Total as CaCO3		58.1	mg/L	4.0				0.8	10	
Lab ID: B16040374-002AMS		Sample Matrix Spike				Run: MAN-TECH_160407A				04/07/16 20:36
Alkalinity, Total as CaCO3		404	mg/L	4.0	94	80	120			
Lab ID: B16040431-002ADUP		Sample Duplicate				Run: MAN-TECH_160407A				04/07/16 22:01
Alkalinity, Total as CaCO3		244	mg/L	4.0				0.2	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2510 B										Batch: R259151
Lab ID: SC 2nd 1413	Laboratory Control Sample					Run: PHSC _101-B_160407A				04/07/16 08:16
Conductivity @ 25 C		1410	umhos/cm	5.0	100	90	110			
Lab ID: MBLK	Method Blank					Run: PHSC _101-B_160407A				04/07/16 14:34
Conductivity @ 25 C		2	umhos/cm							
Lab ID: B16040470-001ADUP	Sample Duplicate					Run: PHSC _101-B_160407A				04/07/16 14:40
Conductivity @ 25 C		2810	umhos/cm	5.0				0.2	10	
Lab ID: B16040522-001ADUP	Sample Duplicate					Run: PHSC _101-B_160407A				04/07/16 15:08
Conductivity @ 25 C		2290	umhos/cm	5.0				0.3	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Report Date: 04/13/16
Project: Hysham Rest Stop
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A2540 C										Batch: 98334
Lab ID: MB-98334		Method Blank				Run: BAL #SD-15_160411A			04/11/16 10:12	
Solids, Total Dissolved TDS @ 180 C		ND	mg/L	5						
Lab ID: LCS-98334		Laboratory Control Sample				Run: BAL #SD-15_160411A			04/11/16 10:13	
Solids, Total Dissolved TDS @ 180 C		1060	mg/L	10	106	90	110			
Lab ID: B16040582-006A DUP		Sample Duplicate				Run: BAL #SD-15_160411A			04/11/16 10:13	
Solids, Total Dissolved TDS @ 180 C		3890	mg/L	38				0.3	5	D
Lab ID: B16040714-016A DUP		Sample Duplicate				Run: BAL #SD-15_160411A			04/11/16 10:15	
Solids, Total Dissolved TDS @ 180 C		1520	mg/L	10				0.1	5	

Qualifiers:

RL - Analyte reporting limit.
ND - Not detected at the reporting limit.
D - RL increased due to sample matrix.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: A4500-H B									Analytical Run: PHSC _101-B_160407A	
Lab ID: pH 8	Initial Calibration Verification Standard								04/07/16 08:06	
pH		7.98	s.u.	0.10	100	98	102			
Method: A4500-H B									Batch: R259151	
Lab ID: B16040470-001ADUP	Sample Duplicate					Run: PHSC _101-B_160407A			04/07/16 14:40	
pH		7.02	s.u.	0.10				0.0	3	
Lab ID: B16040522-001ADUP	Sample Duplicate					Run: PHSC _101-B_160407A			04/07/16 15:08	
pH		8.72	s.u.	0.10				0.0	3	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E300.0										Analytical Run: IC METROHM 2_160408A
Lab ID: ICV	3	Initial Calibration Verification Standard								04/08/16 09:39
Chloride		2.13	mg/L	1.0	95	90	110			
Sulfate		8.89	mg/L	1.0	99	90	110			
Fluoride		1.13	mg/L	0.20	100	90	110			
Method: E300.0										Batch: R259254
Lab ID: ICB	3	Method Blank				Run: IC METROHM 2_160408A				04/08/16 09:53
Chloride		ND	mg/L	0.02						
Sulfate		ND	mg/L	0.2						
Fluoride		ND	mg/L	0.006						
Lab ID: LFB	3	Laboratory Fortified Blank				Run: IC METROHM 2_160408A				04/08/16 10:06
Chloride		10.1	mg/L	1.0	101	90	110			
Sulfate		30.2	mg/L	1.0	101	90	110			
Fluoride		3.07	mg/L	0.20	102	90	110			
Lab ID: B16040526-001AMS	3	Sample Matrix Spike				Run: IC METROHM 2_160408A				04/08/16 16:50
Chloride		547	mg/L	3.0	105	90	110			
Sulfate		4140	mg/L	9.1	100	90	110			
Fluoride		157	mg/L	0.91	104	90	110			
Lab ID: B16040526-001AMSD	3	Sample Matrix Spike Duplicate				Run: IC METROHM 2_160408A				04/08/16 17:04
Chloride		548	mg/L	3.0	105	90	110	0.1	20	
Sulfate		4150	mg/L	9.1	100	90	110	0.2	20	
Fluoride		158	mg/L	0.91	104	90	110	0.0	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E353.2									Analytical Run: FIA203-B_160407B	
Lab ID: ICV		Initial Calibration Verification Standard							04/07/16 15:05	
Nitrogen, Nitrite as N		0.509	mg/L	0.010	102	90	110			
Method: E353.2									Batch: R259192	
Lab ID: MBLK		Method Blank				Run: FIA203-B_160407B			04/07/16 15:06	
Nitrogen, Nitrite as N		ND	mg/L	0.002						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA203-B_160407B			04/07/16 15:07	
Nitrogen, Nitrite as N		0.491	mg/L	0.010	98	90	110			
Lab ID: B16040423-001BMS		Sample Matrix Spike				Run: FIA203-B_160407B			04/07/16 15:09	
Nitrogen, Nitrite as N		0.514	mg/L	0.010	103	90	110			
Lab ID: B16040423-001BMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_160407B			04/07/16 15:11	
Nitrogen, Nitrite as N		0.515	mg/L	0.010	103	90	110	0.2	10	
Method: E353.2									Analytical Run: FIA203-B_160408A	
Lab ID: ICV		Initial Calibration Verification Standard							04/08/16 10:34	
Nitrogen, Nitrate+Nitrite as N		0.540	mg/L	0.010	96	90	110			
Method: E353.2									Batch: R259224	
Lab ID: MBLK		Method Blank				Run: FIA203-B_160408A			04/08/16 10:35	
Nitrogen, Nitrate+Nitrite as N		ND	mg/L	0.005						
Lab ID: LFB		Laboratory Fortified Blank				Run: FIA203-B_160408A			04/08/16 10:36	
Nitrogen, Nitrate+Nitrite as N		0.988	mg/L	0.010	99	90	110			
Lab ID: B16040495-002BMS		Sample Matrix Spike				Run: FIA203-B_160408A			04/08/16 11:00	
Nitrogen, Nitrate+Nitrite as N		1.32	mg/L	0.010	100	90	110			
Lab ID: B16040495-002BMSD		Sample Matrix Spike Duplicate				Run: FIA203-B_160408A			04/08/16 11:01	
Nitrogen, Nitrate+Nitrite as N		1.31	mg/L	0.010	100	90	110	0.1	10	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7										Analytical Run: ICP203-B_160408A
Lab ID: ICV	4	Continuing Calibration Verification Standard								04/08/16 08:51
Calcium		25.3	mg/L	1.0	101	95	105			
Magnesium		25.4	mg/L	1.0	102	95	105			
Potassium		25.2	mg/L	1.0	101	95	105			
Sodium		25.2	mg/L	1.0	101	95	105			
Method: E200.7										Batch: R259216
Lab ID: MB-6500DIS160408A	4	Method Blank				Run: ICP203-B_160408A				04/08/16 08:57
Calcium		ND	mg/L	0.02						
Magnesium		ND	mg/L	0.003						
Potassium		ND	mg/L	0.09						
Sodium		ND	mg/L	0.03						
Lab ID: LFB-6500DIS160408A	4	Laboratory Fortified Blank				Run: ICP203-B_160408A				04/08/16 09:05
Calcium		50.3	mg/L	1.0	101	85	115			
Magnesium		50.8	mg/L	1.0	102	85	115			
Potassium		50.0	mg/L	1.0	100	85	115			
Sodium		50.2	mg/L	1.0	100	85	115			
Lab ID: B16040421-001CMS2	4	Sample Matrix Spike				Run: ICP203-B_160408A				04/08/16 11:16
Calcium		370	mg/L	1.0	98	70	130			
Magnesium		306	mg/L	1.0	99	70	130			
Potassium		268	mg/L	1.0	100	70	130			
Sodium		927	mg/L	2.0	89	70	130			
Lab ID: B16040421-001CMSD	4	Sample Matrix Spike Duplicate				Run: ICP203-B_160408A				04/08/16 11:19
Calcium		369	mg/L	1.0	97	70	130	0.1	20	
Magnesium		306	mg/L	1.0	99	70	130	0.1	20	
Potassium		270	mg/L	1.0	100	70	130	0.6	20	
Sodium		940	mg/L	2.0	94	70	130	1.4	20	
Lab ID: MB-98244	4	Method Blank				Run: ICP203-B_160408A				04/08/16 11:37
Calcium		0.04	mg/L	0.02						
Magnesium		ND	mg/L	0.003						
Potassium		0.2	mg/L	0.09						
Sodium		ND	mg/L	0.03						

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.7									Analytical Run: ICP203-B_160411A	
Lab ID: ICV	Continuing Calibration Verification Standard								04/11/16 09:15	
Iron		2.54	mg/L	0.020	102	95	105			
Method: E200.7									Batch: 98289	
Lab ID: MB-98289	Method Blank					Run: ICP203-B_160411A			04/12/16 01:55	
Iron		0.005	mg/L	0.002						
Lab ID: LCS-98289	Laboratory Control Sample					Run: ICP203-B_160411A			04/12/16 01:58	
Iron		2.58	mg/L	0.020	103	85	115			
Lab ID: B16040522-001CMS3	Sample Matrix Spike					Run: ICP203-B_160411A			04/12/16 02:13	
Iron		2.69	mg/L	0.020	107	70	130			
Lab ID: B16040522-001CMSD	Sample Matrix Spike Duplicate					Run: ICP203-B_160411A			04/12/16 02:16	
Iron		2.50	mg/L	0.020	99	70	130	7.4	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8									Analytical Run: ICPMS202-B_160411A	
Lab ID: QCS	10	Initial Calibration Verification Standard								04/11/16 16:16
Antimony		0.0476	mg/L	0.050	95	90	110			
Arsenic		0.0491	mg/L	0.0050	98	90	110			
Barium		0.0486	mg/L	0.10	97	90	110			
Beryllium		0.0246	mg/L	0.0010	98	90	110			
Cadmium		0.0246	mg/L	0.0010	98	90	110			
Chromium		0.0505	mg/L	0.010	101	90	110			
Manganese		0.241	mg/L	0.010	96	90	110			
Nickel		0.0504	mg/L	0.010	101	90	110			
Selenium		0.0484	mg/L	0.0050	97	90	110			
Thallium		0.0491	mg/L	0.10	98	90	110			
Method: E200.8										Batch: 98289
Lab ID: MB-98289	10	Method Blank				Run: ICPMS202-B_160411A				04/11/16 16:44
Antimony		6E-05	mg/L	4E-05						
Arsenic		ND	mg/L	9E-05						
Barium		ND	mg/L	0.0003						
Beryllium		ND	mg/L	5E-05						
Cadmium		ND	mg/L	9E-06						
Chromium		0.0003	mg/L	8E-05						
Manganese		ND	mg/L	6E-05						
Nickel		ND	mg/L	9E-05						
Selenium		ND	mg/L	0.0002						
Thallium		ND	mg/L	1E-05						
Lab ID: LCS-98289	10	Laboratory Control Sample				Run: ICPMS202-B_160411A				04/11/16 16:49
Antimony		0.528	mg/L	0.0010	105	85	115			
Arsenic		0.497	mg/L	0.0010	99	85	115			
Barium		0.550	mg/L	0.050	110	85	115			
Beryllium		0.237	mg/L	0.0010	95	85	115			
Cadmium		0.255	mg/L	0.0010	102	85	115			
Chromium		0.505	mg/L	0.0050	101	85	115			
Manganese		2.52	mg/L	0.0010	101	85	115			
Nickel		0.521	mg/L	0.010	104	85	115			
Selenium		0.484	mg/L	0.0010	97	85	115			
Thallium		0.484	mg/L	0.00050	97	85	115			
Lab ID: B16040522-001CMS3	10	Sample Matrix Spike				Run: ICPMS202-B_160411A				04/11/16 16:52
Antimony		0.561	mg/L	0.0010	112	70	130			
Arsenic		0.521	mg/L	0.0010	104	70	130			
Barium		0.597	mg/L	0.050	118	70	130			
Beryllium		0.233	mg/L	0.0010	93	70	130			
Cadmium		0.261	mg/L	0.0010	104	70	130			
Chromium		0.511	mg/L	0.0050	102	70	130			
Manganese		2.52	mg/L	0.0010	101	70	130			
Nickel		0.535	mg/L	0.010	107	70	130			

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E200.8										Batch: 98289
Lab ID: B16040522-001CMS3	10	Sample Matrix Spike				Run: ICPMS202-B_160411A				04/11/16 16:52
Selenium		0.495	mg/L	0.0010	99	70	130			
Thallium		0.505	mg/L	0.00050	101	70	130			
Lab ID: B16040522-001CMSD	10	Sample Matrix Spike Duplicate				Run: ICPMS202-B_160411A				04/11/16 17:02
Antimony		0.532	mg/L	0.0010	106	70	130	5.4	20	
Arsenic		0.490	mg/L	0.0010	98	70	130	6.0	20	
Barium		0.559	mg/L	0.050	110	70	130	6.6	20	
Beryllium		0.223	mg/L	0.0010	89	70	130	4.6	20	
Cadmium		0.252	mg/L	0.0010	101	70	130	3.5	20	
Chromium		0.496	mg/L	0.0050	99	70	130	2.9	20	
Manganese		2.41	mg/L	0.0010	96	70	130	4.5	20	
Nickel		0.515	mg/L	0.010	103	70	130	3.8	20	
Selenium		0.469	mg/L	0.0010	94	70	130	5.6	20	
Thallium		0.475	mg/L	0.00050	95	70	130	6.1	20	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

QA/QC Summary Report

Prepared by Billings, MT Branch

Client: DOWL
Project: Hysham Rest Stop

Report Date: 04/13/16
Work Order: B16040522

Analyte	Count	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
Method: E245.1									Analytical Run: HGCV202-B_160411A	
Lab ID: ICV		Initial Calibration Verification Standard							04/11/16 13:46	
Mercury		0.00207	mg/L	0.00010	104	90	110			
Method: E245.1									Batch: 98308	
Lab ID: MB-98308		Method Blank				Run: HGCV202-B_160411A			04/11/16 15:36	
Mercury		ND	mg/L	4E-06						
Lab ID: LCS-98308		Laboratory Control Sample				Run: HGCV202-B_160411A			04/11/16 15:38	
Mercury		0.00210	mg/L	0.00010	105	85	115			
Lab ID: B16040522-001CMS		Sample Matrix Spike				Run: HGCV202-B_160411A			04/11/16 15:42	
Mercury		0.00201	mg/L	0.00010	100	70	130			
Lab ID: B16040522-001CMSD		Sample Matrix Spike Duplicate				Run: HGCV202-B_160411A			04/11/16 15:44	
Mercury		0.00206	mg/L	0.00010	103	70	130	2.3	30	

Qualifiers:

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

Work Order Receipt Checklist

DOWL

B16040522

Login completed by: Brittaney R. Garza
Reviewed by: BL2000\lcadreau
Reviewed Date: 4/11/2016

Date Received: 4/7/2016
Received by: dlf
Carrier name: Hand Del

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on all sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes ☑	No ☐	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes ☑	No ☐	Not Applicable ☐
Container/Temp Blank temperature:	1.1°C On Ice		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	Not Applicable ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☑	Not Applicable ☐

Standard Reporting Procedures:

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

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

Contact and Corrective Action Comments:

Sample for Dissolved Metals was subsampled, filtered and preserved to pH <2 with 2mL of nitric acid per 250mL in the laboratory. According to 40CFR136, samples for Dissolved Metals should be filtered and preserved within 15 minutes of collection.

Total Coliform Bacteria was logged in Work Order B16040521.

Chain of Custody and Analytical Request Record

Page 1 of 1

PLEASE PRINT (Provide as much information as possible.)

Company Name: DOWL	Project Name, PWS, Permit, Etc.: Hysham Rest Stop	Sample Origin State: MT	EPA/State Compliance: Yes ☐ No ☐
Report Mail Address (Required): 2096 Stadium Drive, Bozeman MT 59715	Contact Name: Jim Potts Phone/Fax: 539-9565 586-8834	Cell:	Sampler: (Please Print) Jim Potts
No Hard Copy Email: jpotts@dowl.com	Invoice Contact & Phone: Bill Dreyer 586-8834	Purchase Order:	Quote/Bottle Order:
Invoice Address (Required): SAME As Above, Attention Bill Dreyer			
No Hard Copy Email: bdreyer@dowl.com			

Special Report/Formats:
- ☑ DW
- ☐ POTW/WWTP
- ☐ State: _____
- ☐ Other: _____
- ☐ EDD/EDT (Electronic Data) Format: _____
- ☐ LEVEL IV
- ☐ NELAC

Number of Containers
Sample Type: A W S V B O DW
Air Water Soils/Solids Vegetation Bioassay Other DW - Drinking Water

ANALYSIS REQUESTED

SAMPLE IDENTIFICATION (Name, Location, Interval, etc.)	Collection Date	Collection Time	MATRIX	Per Bottle Order	99607 (Attached)	SEE ATTACHED	Standard Turnaround (TAT)	RUSH	Comments:
1 Mon Eastbound Hysham Rest Stop	4-7-16	7:30	5 DW	X		X			B160405 22 001
2									
3									
4									
5									
6									
7									
8									
9									
10									

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Shipped by: Hand
Cooler ID(s):
Receipt Temp 1.1 °C TB
On Ice: Y N
Custody Seal: On Bottle Y N, On Cooler Y N
Intact Y N
Signature Match Y N

LABORATORY USE ONLY

Custody Record MUST be Signed

Relinquished by (print): Jim Potts	Date/Time: 4-7-16 11:45	Signature:	Received by (print):
Relinquished by (print):	Date/Time:	Signature:	Received by (print): Date/Time: Signature:
Sample Disposal: Return to Client: _____ Lab Disposal: _____			Received by Laboratory: 4/7/16 1148 Signature:

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested.

ENERGY LAB
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College Station, TX 888.690.2218 • Gillette, WY 866.686.7175 • Helena, MT 877.472.0711

BOTTLE ORDER 99607

SHIPPED TO: DOWL HKM

Contact: Bill Dreyer
2090 Stadium Drive
Bozeman MT 59715
Phone: (406) 586-8834
Project:

Order Created by: Debbie Fosjord
Shipped From: Billings, MT
Ship Date: 2/18/2016
VIA: Ground

Bottle Size/Type	Bottles Per Samp	Method	Tests	Critical Hold Time	Preservative	Notes	Num of Samp
DW (2 Sets)							
1 Liter Plastic	1	A2320 B	Alkalinity			Cl, SO4 & F by E300.0	1
		A2510 B	Conductivity				
		E300.0	Anions by Ion Chromatography				
		E353.2	Nitrogen, Nitrite	48 hrs			
		A4500-H B	pH	0.24 hrs			
		A2540 C	Solids, Total Dissolved				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Dissolved			Will be Filtered and Preserved in lab for Ca, Mg, K & Na	1
		A2340 B	Hardness as CaCO3				
250 mL Plastic	1	E200.7_8	Metals by ICP/ICPMS, Drinking Water		■ HNO3	Sb, As, Ba, Be, Cd, Cr, Fe, Mn, Hg, Ni, Se, Tl	1
250 mL Plastic	1	E353.2	Nitrogen, Nitrate + Nitrite		☐ H2SO4		1
		Calculation	Nitrogen, Nitrate				
100 mL Plastic Sterile	1	A9223	Bacteria, Private Water Supply	48 hrs			1
WW (2 Sets)							
1 Liter Plastic	1	A5210 B	Biochemical Oxygen Demand, 5 Day	48 hrs			1

DNRC/DEQ Form 633 Revised 04/2008

AQUIFER TEST DATA

Shaded Cells Require User Input

Water-Right Applicant	MDT Hysham East Bound Replacement Well			DNRC Applic.#		DEQ Applic. #	
Address:	Department of Transportation Real Estate Service Section			County:	Treasure		
Test Site Location:	Hysham Rest Stop	Section:	5	Twnshp (N/S):	5N	Range (E/W):	36E
Date Test Conducted:	4/6/2016	Person and Company Conducting Test:		Jim Potts DOWL			
Type of Test:	Constant Rate according to DEQ-3						
Pumping Well ID:	East Bound Replacement			Pumping Rates (gpm):	40		
Pumping Well GWIC ID #:	286246	Depth (feet):	250	Diameter (inches):	4.5	Perf. Zone(s):	170 to 250
Pumping Well GPS Coordinates:	Select Datum of NAD 27 or 83:	NAD 83		Latitude:	46.2176	Longitude:	107.25008
Author of Technical Report	Jim Potts DOWL						

Observation Well ID(s)	GWIC ID#	GPS Coordinates Latitude	GPS Coordinates Longitude	Depth (feet)	Diameter (inches)	Perforated Zone(s) (feet)	Distance from Test Well (feet)	Bearing from Test Well (degrees)
1) none								
2)								
3)								
4)								
5)								
6)								

Specify Water-Level Monitoring Equipment: Slope Indicator Water Level Indicator

Production Well Water-Level Data

Static Water Level (swl) to 0.01 ft:	66.53
Date/Time Measured:	4/6/2016 9:35
How swl Measured:	E-Tape
Measuring Point ID:	Top Casing
Measuring Point Elevation (mp) (feet):	1.75
How mp Measured:	Tape Measure

Time Data

Pump On:	Date	4/6/2016
	Time	13:35:55
Pump Off:	Date	4/7/2016
	Time	7:33:20
Recovery End:	Date	4/7/2016
	Time	9:39:14

Aquifer-Test Duration:

Pumping (hrs):	18
Recovery (hrs):	2

Discharge Data

Discharge to be measured several times per hour during the first 3 hours of pumping and thereafter several times per hour if discharge fluctuates and requires and requires little or no adjustment; Otherwise, hourly measurements if discharge remains constant and requires little or no adjustment.

Discharge must be reported in gallons per minute (gpm) if using flow meter; in cumulative gallons if using totalizing meter; or 0.01 foot if using flume/weir.

Specify Discharge Measurement Equipment:

Blue White Meter

Background Water Levels

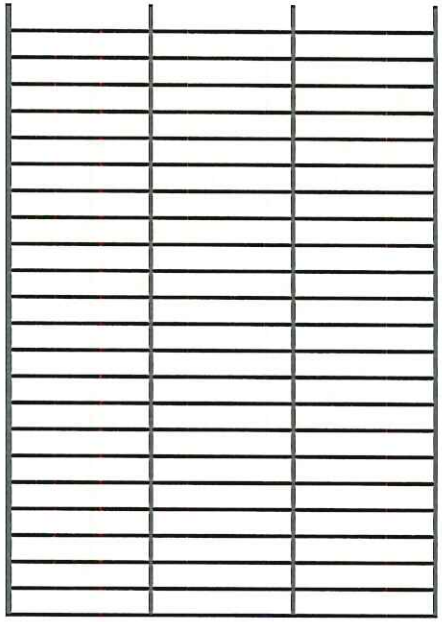
Production Well		
Date	Clock Time	Depth to Water from m.p. (to 0.01 foot)
4/6/16	12:31:20	66.524
4/6/16	12:32:00	66.524
4/6/16	12:33:00	66.666
4/6/16	12:34:00	66.666
4/6/16	12:35:00	66.666
4/6/16	12:36:00	66.63
4/6/16	12:37:00	66.666
4/6/16	12:38:00	66.63
4/6/16	12:39:00	66.63
4/6/16	12:40:00	66.63
4/6/16	12:41:00	66.63
4/6/16	12:42:00	66.63
4/6/16	12:43:00	66.524
4/6/16	12:44:00	66.63
4/6/16	12:50:10	66.666
4/6/16	12:51:10	66.63
4/6/16	12:52:10	66.63
4/6/16	12:53:10	66.666
4/6/16	12:54:10	66.63
4/6/16	12:55:10	66.63
4/6/16	12:56:10	66.63
4/6/16	12:57:10	66.63
4/6/16	12:58:10	66.63
4/6/16	12:59:10	66.63
4/6/16	13:00:10	66.63
4/6/16	13:01:10	66.63
4/6/16	13:02:10	66.63
4/6/16	13:03:10	66.63
4/6/16	13:04:10	66.63
4/6/16	13:05:10	66.666
4/6/16	13:06:10	66.63
4/6/16	13:07:10	66.63
4/6/16	13:08:10	66.63
4/6/16	13:09:10	66.63
4/6/16	13:10:10	66.63
4/6/16	13:11:10	66.63
4/6/16	13:12:10	66.63
4/6/16	13:13:10	66.63
4/6/16	13:14:10	66.63
4/6/16	13:15:10	66.63

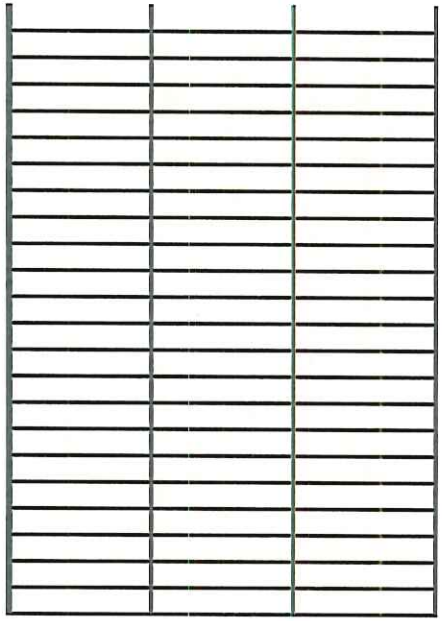
Observation Well 1		
Date	Clock Time	Depth to Water from m.p. (to 0.01 foot)
Not Applicabe		

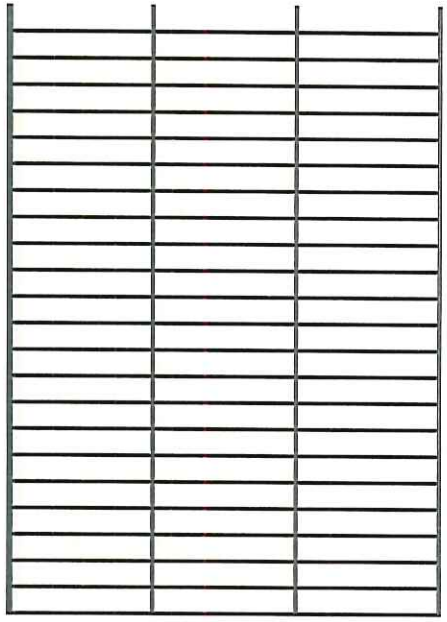
Observation Well 2		
Date	Clock Time	Depth to Water from m.p. (to 0.01 foot)
Not Applicabe		

Observation Well 3		
Date	Clock Time	Depth to Water from m.p. (to 0.01 foot)
Not Applicabe		

4/6/16	13:16:10	66.63
4/6/16	13:17:10	66.63
4/6/16	13:18:10	66.63
4/6/16	13:19:10	66.63
4/6/16	13:20:10	66.595
4/6/16	13:21:10	66.63
4/6/16	13:22:10	66.63
4/6/16	13:23:10	66.666
4/6/16	13:24:10	66.63
4/6/16	13:25:10	66.63
4/6/16	13:26:10	66.63
4/6/16	13:27:10	66.63
4/6/16	13:28:10	66.63
4/6/16	13:29:10	66.63
4/6/16	13:30:10	66.63
4/6/16	13:31:10	66.63
4/6/16	13:32:10	66.63
4/6/16	13:33:10	66.63
4/6/16	13:34:10	66.63
4/6/16	13:35:10	66.63
4/6/16	13:36:10	66.63
4/6/16	13:37:10	66.63







Measured Discharge

Date	Clock Time	Elapsed Time (minutes)	Measured Discharge (gallons per minute)	Comments
4/6/2016	13:36:26	1	40	
4/6/2016	13:40:58	5	40	
4/6/2016	13:45:57	10	40	
4/6/2016	13:50:59	15	40	
4/6/2016	13:55:58	20	40	
4/6/2016	14:05:55	30	40	
4/6/2016	14:36:05	60	40	
4/6/2016	15:05:24	89	40	
4/6/2016	15:38:10	122	40	
4/6/2016	16:43:47	188	40	
4/6/2016	17:23:47	228	39	
4/6/2016	17:33:47	238	40	
4/6/2016	18:43:47	308	40	
4/6/2016	19:33:47	358	40	
4/6/2016	20:33:47	418	40	
4/6/2016	21:33:47	478	40	
4/6/2016	22:33:47	538	40	
4/6/2016	23:33:47	598	40	
4/7/2016	1:43:47	728	40	
4/7/2016	3:33:47	838	40	
4/7/2016	5:33:47	958	40	
4/7/2016	7:23:47	1068	40	

Drawdown Phase of Aquifer Test

Drawdown Data for Production Well

Note: Drawdown is the difference between the pumping water level at a specified time after pumping starts and the static water level observed at time = 0. Drawdown values are reported as positive numbers unless the pumping water level rises above the initial static water level.

Date	Clock Time	Time since Pump Started (minutes)	Depth to Water from m.p. (to 0.01 foot)	Drawdown (to 0.01 foot)	Discharge Measurement (when applicable)	Test Comments
4/6/2016	13:35:55	0	66.53			
4/6/2016	13:36:26	0.50	66.636	0.106	40	
4/6/2016	13:36:27	0.53	66.707	0.177		
4/6/2016	13:36:29	0.56	67.132	0.602		
4/6/2016	13:36:31	0.59	70.322	3.792		
4/6/2016	13:36:33	0.63	72.094	5.564		
4/6/2016	13:36:35	0.66	74.328	7.798		
4/6/2016	13:36:37	0.70	76.525	9.995		
4/6/2016	13:36:40	0.74	78.759	12.229		
4/6/2016	13:36:42	0.78	81.028	14.498		
4/6/2016	13:36:45	0.82	83.297	16.767		
4/6/2016	13:36:48	0.87	85.531	19.001		
4/6/2016	13:36:51	0.92	87.8	21.27		
4/6/2016	13:36:54	0.97	90.034	23.504		
4/6/2016	13:36:57	1.03	92.269	25.739		
4/6/2016	13:37:01	1.09	94.432	27.902		
4/6/2016	13:37:04	1.15	96.595	30.065		
4/6/2016	13:37:08	1.22	98.688	32.158		
4/6/2016	13:37:13	1.29	100.781	34.251		
4/6/2016	13:37:17	1.36	102.838	36.308		
4/6/2016	13:37:22	1.44	104.825	38.295		
4/6/2016	13:37:27	1.52	106.741	40.211		
4/6/2016	13:37:32	1.61	108.692	42.162		
4/6/2016	13:37:38	1.71	110.537	44.007		
4/6/2016	13:37:44	1.81	112.276	45.746		
4/6/2016	13:37:50	1.91	113.872	47.342		
4/6/2016	13:37:57	2.02	115.434	48.904		
4/6/2016	13:38:04	2.14	116.96	50.43		
4/6/2016	13:38:11	2.27	118.379	51.849		
4/6/2016	13:38:19	2.40	119.799	53.269		
4/6/2016	13:38:28	2.54	121.076	54.546		
4/6/2016	13:38:37	2.69	122.283	55.753		
4/6/2016	13:38:46	2.85	123.419	56.889		
4/6/2016	13:38:56	3.01	124.519	57.989		
4/6/2016	13:39:07	3.19	125.548	59.018		
4/6/2016	13:39:18	3.38	126.471	59.941		
4/6/2016	13:39:30	3.58	127.323	60.793		
4/6/2016	13:39:43	3.79	128.14	61.61		
4/6/2016	13:39:56	4.01	128.92	62.39		
4/6/2016	13:40:10	4.24	129.666	63.136		
4/6/2016	13:40:25	4.49	130.376	63.846		
4/6/2016	13:40:41	4.76	131.015	64.485		
4/6/2016	13:40:58	5.04	131.689	65.159	40	
4/6/2016	13:41:16	5.34	132.293	65.763		
4/6/2016	13:41:34	5.65	132.79	66.26		
4/6/2016	13:41:54	5.98	133.358	66.828		
4/6/2016	13:42:16	6.34	133.855	67.325		
4/6/2016	13:42:38	6.71	134.388	67.858		
4/6/2016	13:43:02	7.11	134.849	68.319		
4/6/2016	13:43:27	7.53	135.346	68.816		
4/6/2016	13:43:54	7.97	135.772	69.242		
4/6/2016	13:44:22	8.44	136.269	69.739		
4/6/2016	13:44:52	8.94	136.66	70.13		
4/6/2016	13:45:23	9.47	137.086	70.556		

Date	Clock Time	Time since Pump Started **(minutes)**	Depth to Water from m.p. (to **0.01 foot**)	Drawdown (to **0.01 foot**)	Discharge Measurement (when applicable)	Test Comments
4/6/2016	13:45:57	10.03	137.2	70.67	40	
4/6/2016	13:45:57	10.03	137.235	70.705		
4/6/2016	13:45:58	10.04	137.235	70.705		
4/6/2016	13:45:58	10.04	137.164	70.634		
4/6/2016	13:45:59	10.06	137.271	70.741		
4/6/2016	13:46:00	10.08	137.306	70.776		
4/6/2016	13:46:00	10.08	137.306	70.776		
4/6/2016	13:46:01	10.09	137.271	70.741		
4/6/2016	13:46:02	10.11	137.306	70.776		
4/6/2016	13:46:02	10.11	137.129	70.599		
4/6/2016	13:46:03	10.13	137.306	70.776		
4/6/2016	13:46:04	10.14	137.306	70.776		
4/6/2016	13:46:04	10.14	137.342	70.812		
4/6/2016	13:46:05	10.16	137.306	70.776		
4/6/2016	13:46:06	10.18	137.306	70.776		
4/6/2016	13:46:06	10.18	137.342	70.812		
4/6/2016	13:46:07	10.19	137.306	70.776		
4/6/2016	13:46:08	10.21	137.413	70.883		
4/6/2016	13:46:08	10.21	137.413	70.883		
4/6/2016	13:46:09	10.23	137.271	70.741		
4/6/2016	13:46:10	10.24	137.342	70.812		
4/6/2016	13:46:10	10.24	137.413	70.883		
4/6/2016	13:46:11	10.26	137.306	70.776		
4/6/2016	13:46:12	10.28	137.413	70.883		
4/6/2016	13:46:13	10.29	137.377	70.847		
4/6/2016	13:46:13	10.29	137.413	70.883		
4/6/2016	13:46:14	10.31	137.377	70.847		
4/6/2016	13:46:15	10.33	137.413	70.883		

Recovery Phase of Aquifer Test

Note: Residual drawdown is the difference between the recovering water level at a specified time after pumping stopped and the static water level prior to pumping at time = 0. Residual drawdown values are reported as positive numbers.

Recovery Data for Production Well

Date	Clock Time	Time (t) since Pump Started (minutes)	Time (t') since Pump Stopped (minutes)	t/t'	Depth to Water from m.p. (to 0.01 foot)	Residual Drawdown (to 0.01 foot)	Test Comments
4/7/2016	7:33:20	1078	0.00		164.215		
4/7/2016	7:33:20	1078.011	0.01	98001.00	164.251	97.72	
4/7/2016	7:33:21	1078.022	0.02	49001.00	164.215	97.69	
4/7/2016	7:33:21	1078.033	0.03	32667.67	164.251	97.72	
4/7/2016	7:33:22	1078.044	0.04	24501.00	164.215	97.69	
4/7/2016	7:33:23	1078.055	0.06	19601.00	164.286	97.76	
4/7/2016	7:33:23	1078.066	0.07	16334.33	164.215	97.69	
4/7/2016	7:33:24	1078.077	0.08	14001.00	164.251	97.72	
4/7/2016	7:33:25	1078.088	0.09	12251.00	164.215	97.69	
4/7/2016	7:33:25	1078.099	0.10	10889.89	164.109	97.58	
4/7/2016	7:33:26	1078.11	0.11	9801.00	164.073	97.54	
4/7/2016	7:33:27	1078.121	0.12	8910.09	164.038	97.51	
4/7/2016	7:33:27	1078.132	0.13	8167.67	164.038	97.51	
4/7/2016	7:33:28	1078.143	0.14	7539.46	164.109	97.58	
4/7/2016	7:33:29	1078.154	0.15	7001.00	164.215	97.69	
4/7/2016	7:33:29	1078.165	0.17	6534.33	164.357	97.83	
4/7/2016	7:33:30	1078.176	0.18	6126.00	164.215	97.69	
4/7/2016	7:33:31	1078.187	0.19	5765.71	164.215	97.69	
4/7/2016	7:33:31	1078.198	0.20	5445.44	164.18	97.65	
4/7/2016	7:33:32	1078.209	0.21	5158.89	164.215	97.69	
4/7/2016	7:33:33	1078.22	0.22	4901.00	164.038	97.51	
4/7/2016	7:33:33	1078.231	0.23	4667.67	164.286	97.76	
4/7/2016	7:33:34	1078.2427	0.24	4442.70	164.215	97.69	
4/7/2016	7:33:35	1078.2552	0.26	4225.14	164.109	97.58	
4/7/2016	7:33:36	1078.2683	0.27	4018.89	164.144	97.61	
4/7/2016	7:33:36	1078.2823	0.28	3819.63	164.109	97.58	
4/7/2016	7:33:37	1078.2972	0.30	3628.19	164.286	97.76	
4/7/2016	7:33:38	1078.3128	0.31	3447.29	164.286	97.76	
4/7/2016	7:33:39	1078.3295	0.33	3272.62	164.144	97.61	
4/7/2016	7:33:40	1078.3472	0.35	3105.84	164.073	97.54	
4/7/2016	7:33:41	1078.3658	0.37	2947.97	164.215	97.69	
4/7/2016	7:33:43	1078.3857	0.39	2795.92	164.251	97.72	
4/7/2016	7:33:44	1078.4067	0.41	2651.60	164.003	97.47	
4/7/2016	7:33:45	1078.4288	0.43	2514.99	164.038	97.51	
4/7/2016	7:33:47	1078.4523	0.45	2384.37	164.144	97.61	
4/7/2016	7:33:48	1078.4772	0.48	2260.01	164.109	97.58	
4/7/2016	7:33:50	1078.5035	0.50	2142.01	164.251	97.72	
4/7/2016	7:33:51	1078.5315	0.53	2029.22	164.109	97.58	
4/7/2016	7:33:53	1078.5612	0.56	1921.88	164.038	97.51	
4/7/2016	7:33:55	1078.5925	0.59	1820.41	163.613	97.08	
4/7/2016	7:33:57	1078.6257	0.63	1723.87	160.423	93.89	
4/7/2016	7:33:59	1078.6608	0.66	1632.36	158.651	92.12	
4/7/2016	7:34:01	1078.6982	0.70	1544.97	156.417	89.89	
4/7/2016	7:34:04	1078.7377	0.74	1462.30	154.22	87.69	
4/7/2016	7:34:06	1078.7795	0.78	1383.94	151.986	85.46	
4/7/2016	7:34:09	1078.8238	0.82	1309.57	149.717	83.19	
4/7/2016	7:34:12	1078.8708	0.87	1238.94	147.448	80.92	
4/7/2016	7:34:15	1078.9207	0.92	1171.85	145.214	78.68	
4/7/2016	7:34:18	1078.9733	0.97	1108.57	142.945	76.42	
4/7/2016	7:34:21	1079.0292	1.03	1048.42	140.711	74.18	
4/7/2016	7:34:25	1079.0883	1.09	991.54	138.476	71.95	
4/7/2016	7:34:29	1079.151	1.15	937.58	136.313	69.78	
4/7/2016	7:34:33	1079.2173	1.22	886.57	134.15	67.62	
4/7/2016	7:34:37	1079.2877	1.29	838.15	132.057	65.53	
4/7/2016	7:34:41	1079.3622	1.36	792.37	129.964	63.43	
4/7/2016	7:34:46	1079.4412	1.44	748.99	127.907	61.38	
4/7/2016	7:34:51	1079.5248	1.52	707.98	125.92	59.39	

Date	Clock Time	Time (t) since Pump Started (minutes)	Time (t') since Pump Stopped (minutes)	t/t'	Depth to Water from m.p. (to 0.01 foot)	Residual Drawdown (to 0.01 foot)	Test Comments
4/7/2016	7:34:56	1079.6133	1.61	669.20	124.004	57.47	
4/7/2016	7:35:02	1079.7072	1.71	632.44	122.053	55.52	
4/7/2016	7:35:08	1079.8065	1.81	597.73	120.208	53.68	
4/7/2016	7:35:14	1079.9118	1.91	564.87	118.469	51.94	
4/7/2016	7:35:21	1080.0233	2.02	533.79	116.873	50.34	
4/7/2016	7:35:28	1080.1415	2.14	504.39	115.311	48.78	
4/7/2016	7:35:36	1080.2667	2.27	476.58	113.785	47.26	
4/7/2016	7:35:43	1080.3992	2.40	450.32	112.366	45.84	
4/7/2016	7:35:52	1080.5397	2.54	425.46	110.946	44.42	
4/7/2016	7:36:01	1080.6885	2.69	401.97	109.669	43.14	
4/7/2016	7:36:10	1080.846	2.85	379.78	108.462	41.93	
4/7/2016	7:36:20	1081.0128	3.01	358.81	107.326	40.80	
4/7/2016	7:36:31	1081.1897	3.19	338.96	106.226	39.70	
4/7/2016	7:36:42	1081.377	3.38	320.22	105.197	38.67	
4/7/2016	7:36:54	1081.5753	3.58	302.51	104.274	37.74	
4/7/2016	7:37:07	1081.7855	3.79	285.77	103.422	36.89	
4/7/2016	7:37:20	1082.0082	4.01	269.95	102.605	36.08	
4/7/2016	7:37:34	1082.244	4.24	255.01	101.825	35.30	
4/7/2016	7:37:49	1082.4938	4.49	240.89	101.079	34.55	
4/7/2016	7:38:05	1082.7585	4.76	227.54	100.369	33.84	
4/7/2016	7:38:22	1083.0388	5.04	214.94	99.73	33.20	
4/7/2016	7:38:40	1083.3357	5.34	203.04	99.056	32.53	
4/7/2016	7:38:59	1083.6502	5.65	191.79	98.452	31.92	
4/7/2016	7:39:19	1083.9833	5.98	181.17	97.955	31.43	

MONTANA WELL LOG REPORT

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

Other Options

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps

Site Name: HYSHAM EAST BOUND REPLACEMENT WELL
GWIC Id: 286246

Section 1: Well Owner(s)

1) DEPARTMENT OF TRANSPORTATION REAL ESTATE SERVICE SECTION (MAIL)
P.O. BOX 201001
HELENA MT. 59620 [02/26/2016]

Section 2: Location

Township	Range	Section	Quarter Sections
05N	36E	5	NE¼ NW¼

County: TREASURE
Geocode:

Latitude	Longitude	Geomethod	Datum
46.2176	107.25008	NAV-GPS	NAD83

Ground Surface Altitude: Method: Datum: Date:

Addition: Block: Lot:

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, February 26, 2016

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	30	11
30	250	7.9

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	38	8	0.25		WELDED	A53B STEEL
10	250	4.5			SPLINE	PVC-SDR 17

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
170	230	4.5		.050	FACTORY SLOTTED
230	250	4.5		.025	FACTORY SLOTTED
250	250	4.5			BOTTOM CAP

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	30	BENTONITE	

Section 7: Well Test Data

Total Depth: 250
Static Water Level: 66
Water Temperature:

Bailer Test *

15 gpm with 60 feet of drawdown after 1 hours.
Time of recovery 0.5 hours.
Recovery water level 66 feet.
Pumping water level _ feet.

Pump Test *

Depth pump set for test 231 feet.
50 gpm pump rate with 150 feet of drawdown after 1.5 hours of pumping.
Time of recovery 1 hours.
Recovery water level 66 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

GPS ELEVATION 2890.

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	5	SANDY CLAY, LT BROWN, SL MOIST
5	10	SILT, LT BROWN, SL MOIST
10	16	SILT W/SAND, LT BROWN, SL MOIST
16	20	SP W/GRAVEL, YELLOWISH BROWN, MOIST
20	37	GRAVEL, POORLY GRADED, SUBROUNDED (7IN MINUS) WET AT 25FT.
37	39	SHALE, BLUISH GRAY TO GRAYISH BROWN - COLOR LIGHT & DARK LAYERED, COMPLETELY WEATHERED, WEAK
39	50	THINLY INTERBEDDED SILT & SAND, GRAY
50	54	THINLY INTERBEDDED SILT & SAND, GRAYISH BROWN,(IRON STAINING - OXIDATION)
54	72	POORLY GRADED SAND, FINE TO COARSE GRAINED, GRAY, WET
72	77	POORLY GRADED SAND,MED GRAINED, GRAYISH BROWN, (10 TO 15 GPM, TDS 1254 PPM)
77	91	SHALE, BLUEISH GRAY
91	103	THINLY INTERBEDDED SANDSTONE
103	105	

16	160	BENTONITE	
160	230	6/12 SILICA SAND	
230	250	10/20 SILICA SAND	

		SANDSTONE, HARD DRILLING, COMPLETELY WEATHERED, WEAK, (15 TO 20 GPM TDS 1260 PPM)
105	115	SHALE, BLUEISH GRAY, WEATHERED, WEAK
115	130	W/SAND

Driller Certification

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

Name: DOUG ASKIN
Company: ASKIN DRILLING
License No: WWC-525
Date Completed: 2/26/2016

Site Name: HYSHAM EAST BOUND REPLACEMENT WELL
GWIC Id: 286246
Additional Lithology Records

From	To	Description
130	135	POORLY GRADED SAND, LAYER THINLY INTERBEDDED SANDSTONE, CEMENTED FRAG. V. WEAK
135	140	THINLY INTERBEDDED SILTSTONE
140	152	POORLY GRADED SAND, FINE TO MED. GRAINED, GRAY (30 GPM TDS 1440 PPM)
152	162	SHALE, BLUEISH GRAY
162	180	POORLY GRADED SAND, FINE GRAINED, CEMENTED FRAGMENTS.
180	200	SILTSTONE LAYER - THINLY INTERBEDDED, (80 GPM TDS 1580PPM)
200	240	BROWN CEMENTED FRAGMENTS
240	250	BEARPAW SHALE, BLUISH GRAY, SL WEATHERED, MED. STRONG

APPENDIX J:

ISA Form

MONTANA DEPARTMENT OF TRANSPORTATION

INITIAL SITE ASSESSMENT

FOR HAZARDOUS MATERIALS/SUBSTANCES, TRAFFIC NOISE & AIR QUALITY

PROJECT INFORMATION

Project Name: Hysham Rest Area **Start Date:** 4/23/2014

Project #: IM 94-2(36)65 **UPN (CN):** 8200000

County: Treasure County

Description of Project (ie, Reconstruct Rural/Urban, bridge replacement/rehab): Rest Area Reconstruction

New R/W?	☐ Yes	☒ No	comment:	All improvements will remain within existing R/W
▪ Horizontal alignment shift?	☒ Yes	☐ No	comment:	Possible realignment of entry and exit ramps may result from Phase II design
▪ Vertical alignment shift?	☒ Yes	☐ No	comment:	Possible realignment of entry and exit ramps may result from Phase II design
Utility or RR Involvement?	☒ Yes	☐ No	comment:	Limited involvement; visual inspection of above-ground utilities has been performed; no RR adjacent to site
▪ Water line replacement ?	☒ Yes	☐ No	comment:	Water supply treatment upgrades
▪ Storm sewer replacement?	☒ Yes	☐ No	comment:	Anticipated replacement of stormwater pipes
▪ Sanitary sewer replacement?	☒ Yes	☐ No	comment:	Advanced wastewater treatment & replacement of septic tanks/drainfields

DOCUMENT/FIELD REVIEWS (Activity 702)

Records review (DEQ, NRIS, etc.): DEQ (May 27, 2014); NRIS (May 27, 2014), including review of Underground Storage Tanks, Petroleum Leak Sites, Petroleum Tank Release Compensation Board Sites, Abandoned Mine Sites, Landfills, MBMG and DEQ Abandoned/Inactive Mines, Crude Oil Pipelines, and EPA Toxic Release Inventory Sites.

Field review: June 2, 2014

Personal communications: Conversations with DEQ regarding existing water/wastewater systems in April 2014

AIR QUALITY (Activity 742)

Is project in or adjacent to a non-attainment area for PM-10, PM-2.5 or CO? ☐ Yes ☒ No Comment: The closest non-attainment area is for CO non-attainment in Billings, more than 60 miles away.

Is project exempt from the requirements that a conformity determination be made? (Is the project on the list of exempt projects in Table 2, 40 CFR 93.126?) ☒ Yes ☐ No Comment:

CO or PM Hot-Spot Analysis:
If project is not listed in Table 2 of 40 CFR 93.126), and is in a CO non-attainment area, then a quantitative hot-spot analysis for CO may be necessary. Consult the regulations (93.123) and follow required consultation procedures (Montana Air Quality SIP).

This project requires a CO Hot-Spot Analysis: ☐ Yes ☒ No Comment: This project involves reconstruction of an existing rest area, which is included in the list of exempt projects in Table 2, 40 CFR 93.126.

*If project is not listed in Table 2 of 40 CFR 93.126 and is in a PM-10 or PM2.5 area, but is not a "project of localized air quality concern," then no PM-10/PM-2.5 hot-spot analysis is needed. Projects of localized air quality concern are those projects that will significantly increase diesel emissions (truck bypasses, bus and rail terminals), or projects in areas identified in the SIP as sites of existing or potential violation. Currently, such sites are not identified in Montana's SIP. (Quantitative particular matter hot-spot analyses are not yet required for projects of air quality concern because EPA has not yet issued modeling guidance, but qualitative analysis is required.)

This project requires a PM-10 or PM-2.5 qualitative analysis ☐ Yes ☒ No Comment: This project involves reconstruction of an existing rest area, which is included in the list of exempt projects in Table 2, 40 CFR 93.126.

Mobile Source Air Toxics (MSATs): No analysis or discussion of MSATs is needed for projects that are categorically excluded under 23CFR771.117(c), or are exempt under the Clean Air Act (Transportation Conformity, 40CFR93.126). All other projects, whether located in a non-attainment area or not, require some level of discussion for MSATs. Refer to FHWA guidance document HEPN-10, dated Feb 3, 2006.

This project requires a discussion of MSATs: ☐ Yes ☒ No Comment: This project involves reconstruction of an existing rest area, which is included in the list of exempt projects in Table 2, 40 CFR 93.126 and is categorically excluded under 23 CFR 771.117(c)12. Therefore, this project is exempt from analysis for MSATs.

TRAFFIC NOISE (Activity 704): Is the project a Type I project as defined in 23 CFR 772? ☒ Yes ☐ No Comment: Although this project could be considered a Type I Project per 23 CFR 772, a detailed Traffic Noise Study is not required because there are no noise-sensitive receptors within 500 feet of the rest area.

If project is not a Type I then it meets the criteria for a Type III project, as established in 23 CFR 772. Therefore, the project requires no analysis for highway traffic noise impacts. Type III projects do not involve added cpapacity, construction of new through lanes or auxiliary lanes, changes in the horizontal or vertical alighment of the roadway or exposure of noise sensitive land uses to a new or existing highway noise source. MDT acknowledges that a noise analysis is required if changes to the proposed project result in reclassification to a Type I Project.

CONCLUSIONS

Are there any potential issues concerning hazardous substances, groundwater quality, solid waste, air quality or traffic noise on or adjacent to this proposed project? ☐ Yes ☒ No Comment:

If yes, explain problems and further evaluation needed for TRAFFIC NOISE, AIR QUALITY OR HAZARDOUS MATERIALS:

Further evaluation of the issues will include completion of the following additional environmental activities:

Detailed Noise Analysis (Activity 705):	☐ Yes	☒ No
Further Air Quality Analysis (Activity 742):	☐ Yes	☒ No
Phase II – Hazardous Materials/Substances (Activity 746):	☐ Yes	☒ No
Special Provisions are anticipated (Activity 716) :	☐ Yes	☒ No

If there are no* potential issues, *let this serve as a statement of "No Impact" for the environmental document (activities 702, 704, and 742 are now completed). Comment:

Name of Reviewer: Will Trimbath Title: Environmental Specialist

Signature: Willis W. Trimbath Finish Date: 7/17/2014

Copy:

APPENDIX K:

Group (c) Action Letter

Environmental Services
MONTANA DEPARTMENT OF TRANSPORTATION
Helena, Montana 59620

Memorandum

To: Lisa Hurley
Fiscal Programming Section Supervisor

From: Heidy Bruner, P.E.
Engineering Section Supervisor

Date: November 12, 2014

Subject: Categorical Exclusion Group (c) – for Improvements to an Existing Rest Area
Project Name: Hysham Rest Area
Project Number: IM 94-2(36)65
Control Number: UPN 8200000

Environmental Services Bureau has reviewed the proposed project and concluded that it will not involve unusual circumstances as described under 23 CFR 771.117(b). As a result, the project qualifies as a Categorical Exclusion under the provisions of 23 CFR 771.117(c), part (12), which describes improvements to existing rest areas. The proposed action also qualifies as a Categorical Exclusion under the provisions of ARM 18.2.261 (Sections 75-1-103 and 75-1-201, MCA).

In accordance with the Federal Highway Administration (FHWA) letter of March 29, 1999, please notify FHWA that the proposed action is being processed in accordance with 23 CFR 771.117(c).

electronic copies:

Stefan Streeter, P.E.	Billings District Administrator
Gary Neville	Engineering Services Supervisor
Jake Goettle, P.E.	Design Build Engineer
Kevin Malone, P.E.	Consultant Project Engineer
Robert Stapley	Right-of-Way Bureau Chief
Suzy Price	Contract Plans Bureau Chief
Tom Martin, P.E.	Environmental Services Bureau Chief
Heidy Bruner, P.E.	Environmental Services Engineering Section Supervisor
Doug Lieb, E.I	Environmental Services Project Development Engineer
Tom Erving	Fiscal Programming Section
Alan Woodmansey	FHWA Operations Engineer
Montana Legislative Branch Environmental Quality Council	

copies:

File	Environmental Services Bureau

APPENDIX L:

Conceptual Site Layout

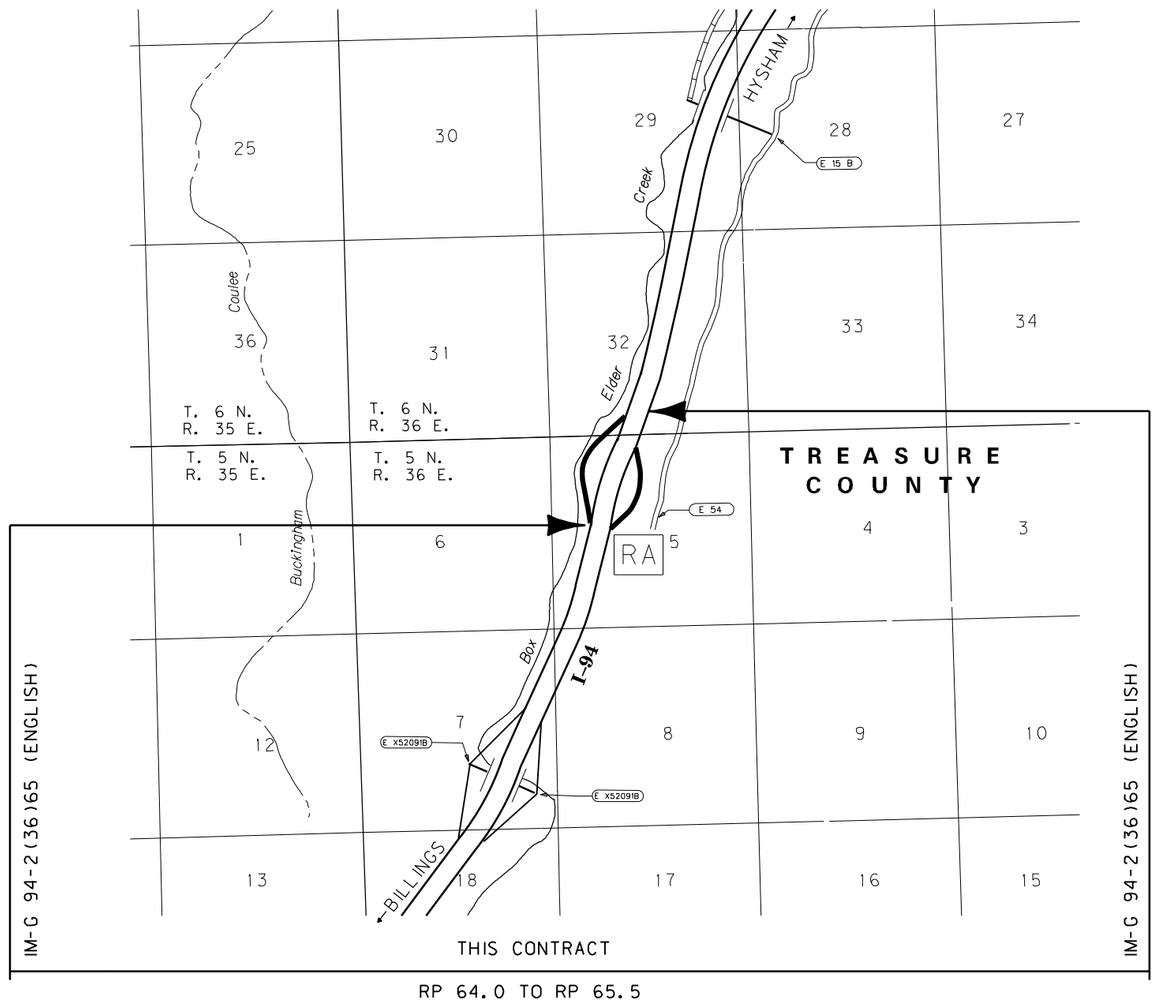
MONTANA DEPARTMENT OF TRANSPORTATION

PRESENT	2014	A.D.T. = 4,940
LETTING	2016	A.D.T. = 5,140
DESIGN	2036	A.D.T. = 7,650
		D.H.V. = 880
		TRUCKS = 27.3%
		V. = 70 MPH
		18 KIP ESAL'S = 827
		GROWTH RATE = 2.0%

FEDERAL AID PROJECT IM-G 94-2(36)65
PHASE 1 CONCEPTUAL SITE LAYOUT
HYSHAM REST AREA - MONTANA
TREASURE COUNTY

CSF=0.9993521809

LENGTH N/A MILES



RP 64.0 TO RP 65.5

PLANS PREPARED BY

DOWL

2090 STADIUM DRIVE
BOZEMAN, MONTANA 59715
(406) 586-8834

ASSOCIATED PROJECT AGREEMENT NUMBERS	
R/W & I.C.	
P.E.	IM-G 94-2(36)65

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDTTLZ30.dgn	DESIGNED BY	D FISCHER	7/22/2016	PH. 1 CONCEPTUAL SITE LAYOUT
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016	
		11:38:50 AM dofischer	CHECKED BY	T CORMIER	7/22/2016	UPN 8200000

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EXISTING SITE PLANS	SHEET NO.
TITLE SHEET	1
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NOTES	2
CONTROL DIAGRAM	3
DESIGN ASSUMPTIONS	4
MDEQ SETBACK REQUIREMENTS	5
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EXISTING OVERALL SITE LAYOUT	
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CONCEPTUAL SITE PLAN DETAIL - EASTBOUND	
CONCEPTUAL SITE PLAN DETAIL - WESTBOUND	
PLAN & PROFILE	10
SANITARY SEWER SYSTEM	

LINEAR AND LEVEL DATA

BEARING SOURCE

GRID -- MONTANA COORDINATE SYSTEM NAD83-2011

LEVEL DATUM SOURCE

NAVD88 (GNSS DERIVED ELEVATIONS USING GEOID 12A AND HOLDING NGS MARK A555)

NOTES

UTILITIES

CALL THE UTILITIES UNDERGROUND LOCATION CENTER (811) OR OTHER NOTIFICATION SYSTEM FOR THE MARKING AND LOCATION OF ALL LINES AND SERVICE BEFORE EXCAVATING. ALL CLEARANCES OR DEPTHS PROVIDED FOR UTILITIES ARE FROM EXISTING GROUND LINE.

WETLANDS

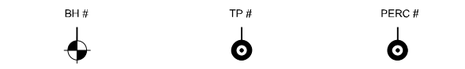
WETLANDS MAY EXIST ADJACENT TO THE ROADWAY AND BEYOND THE PROJECT LIMITS. A WETLAND DELINEATION HAS NOT BEEN COMPLETED FOR THIS PROJECT. IMPACTS TO WETLAND AREAS ARE NOT ANTICIPATED IN ASSOCIATION WITH THE PROPOSED WORK. NO PERMITS HAVE BEEN OBTAINED. ANY ACTION IMPACTING WETLAND AREAS WITHOUT THE APPROPRIATE PERMITTING IS THE RESPONSIBILITY OF THE CONTRACTOR.

SOILS INFORMATION

SOILS INFORMATION ON THE PLAN AND PROFILE SHEETS IS A BRIEF SUMMARY OF THE SOILS CLASSES. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.

GEOTECHNICAL BORING / SOIL SURVEY LEGEND

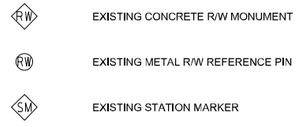
- MATERIAL IS LABELED AT THE BOTTOM OF THE LAYER
- A MINUS (-) OFFSET INDICATES A DIRECTION LEFT OF PROJECT CENTERLINE
- THE GEOTECHNICAL TEST PITS WERE CONDUCTED FOR WASTEWATER DESIGN PURPOSES



COMBINATION SCALE FACTOR

ALL COORDINATES ARE STATE PLANE (SEE CONTROL DIAGRAM).
CSF IS 0.9993521809.

R/W SURVEY LEGEND



CONTROL DIAGRAM

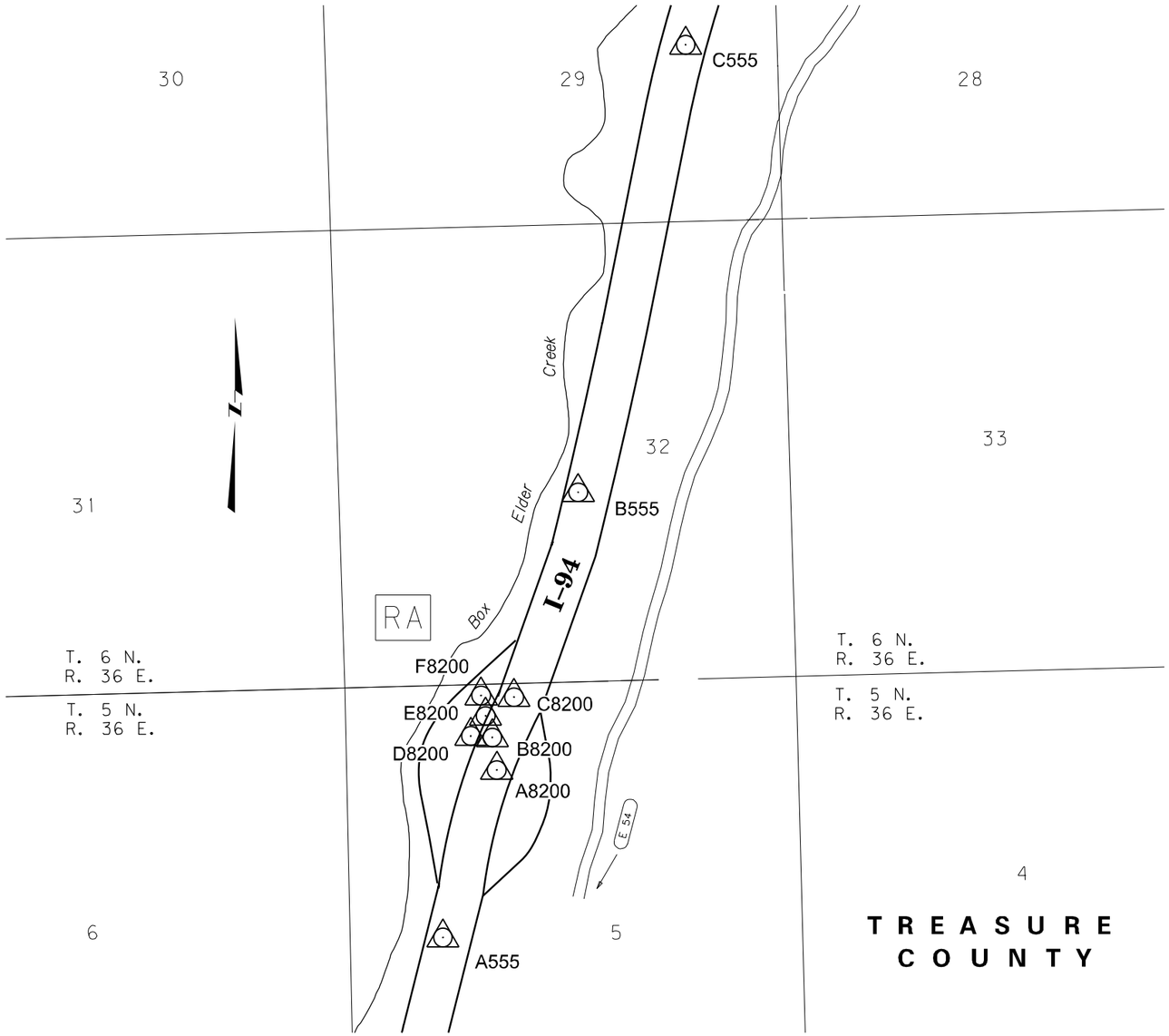
SCALE: N/A

NOTE:
THIS PROJECT IS ON THE MONTANA COORDINATE SYSTEM NAD83-2011.
NORTHING AND EASTING COORDINATES ARE EXPRESSED IN UNITS OF INTERNATIONAL FEET AND ELEVATIONS ARE IN UNITS OF U.S. SURVEY FEET.

DIMENSIONS SHOWN ON THE PLANS ARE GRID. ALL SURVEY AND STAKING REQUIRE THE USE OF A COMBINATION SCALE FACTOR (CSF) TO CONVERT GRID DIMENSIONS TO GROUND DIMENSIONS (GRID DISTANCE % CSF = GROUND DISTANCE).
THE CSF FOR THIS PROJECT IS 0.9993521809.

CONTROL ABSTRACT

POINT NAME/NUMBER	N OR Y COORDINATE	E OR X COORDINATE	POINT ELEVATION	LOCATION AND DESCRIPTION
A8200	725,426.577	2,537,663.876	2,901.27	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "A8200 2014", for the east bound I-94 rest area, on a small bench south of the maintained grass area, 90 ft. E-SE of the east edge of pavement, 76 ft. se of a metal sign post(no camping) . Set a metal witness post and MDT sticker 3 ft. north of the cap.
B8200	725,804.962	2,537,612.307	2,890.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "B8200 2014", for the east bound I-94 rest area, near the center (N-S) of the rest area, 1 ft. west of the top back of curb for the tractor trailer parking area, in the grass area, on top of a small hill between the east bound I-94 guard rail and the tr/tr parking area, 45 ft. north of an angle point in along the west edge of the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
C8200	726,275.214	2,537,865.555	2,893.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "C8200 2014", for the east bound I-94 rest area, 380 ft. north of the north most picnic table, on a small hill above where the exit ramp for the rest area meets the east bound lane of I-94, 28 ft. west of the N-S r/w fence. Set a metal witness post and MDT sticker 3 ft. north of the cap.
D8200	725,822.290	2,537,361.381	2,881.85	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "D8200 2014", for the west bound I-94 rest area, near the south most end of the rest area, 7 ft. west of the edge of pavement, 35 ft. northwest of the south most nose of the curbing between the car and truck lanes leaving the rest area, west bound onto I-94. Set a metal witness post and MDT sticker 3 ft north of the cap.
E8200	726,056.134	2,537,534.645	2,879.45	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "E8200 2014", for the west bound I-94 rest area, near the center (N-S) of the tractor/trailer parking area, on the grass slope between the west bound edge of pavement and the tr/tr parking lot, 10 ft. west of the I-94 edge of pavement, 26 ft. east of the eop for the tr/tr parking lot. Set a metal witness post and MDT sticker 3 ft. north of the cap.
F8200	726,293.950	2,537,481.604	2,876.41	A #5 X 30 in. rebar with A 2 in. MDT aluminum cap, set flush with the ground, marked "F8200 2014", for the west bound I-94 rest area, near the north end of the rest area, 1 ft. north of the edge of pavement, 33 ft. north of the north most end of the concrete sidewalk next to the handicap parking stall. Set a metal witness post and MDT sticker 3 ft. east of the cap.
A555	723,475.593	2,537,037.718	2,929.16	A ngs stainless steel rod in a monument box with a lid marked "A555 1981", on the east bound side of I-94, near milepost 64.4, 100 ft. southeast of the centerline of the east bound lane, 1.2 ft. west-northwest of an ngs witness post, 1.6 ft. west-northwest of the r/w fence.
B555	728,660.461	2,538,613.291	2,869.74	A ngs stainless steel rod in a monument box with a lid marked "B555 1981", on the east bound side of I-94, near milepost 65.35, 113 ft. E-SE of the centerline of the east bound lane, 1.6 ft. west-northwest of the r/w fence
C555	733,871.091	2,539,864.383	2,814.30	A ngs stainless steel rod in a monument box with a lid marked "C555 1981", on the east bound side of I-94, near milepost 66.4, 93 ft. E-SE of the centerline of the east bound lane, 1.75 ft. west-northwest of the r/w fence.



EASTBOUND REST AREA SITE DESIGN ASSUMPTIONS

DESIGN	REMARKS
PROPOSED PARKING	PROPOSED PARKING: ONLY CARS CAN GENERALLY MEET CALCULATED PARKING DEMAND AS IDENTIFIED IN THE PRELIMINARY TRAFFIC REPORT DATED JUNE 4, 2014. TRUCK PARKING IS LOWER DUE TO SITE RESTRICTIONS.
	CARS / TRUCKS
	EXISTING PARKING: 15 / 4
	CALCULATED PARKING DEMAND: 9 / 31
	PROPOSED PARKING: 16 / 19
	(CAR PARKING INCLUDES HANDICAP STALLS).
OFF-RAMP	THE EXISTING OFF-RAMP IS 650-FT AND MEETS THE MINIMUM DECELERATION DISTANCE OF 590-FT FOR PASSENGER CARS, ASSUMING Vi = 70MPH, Vf=15MPH. THE OFF-RAMP MEETS THE MINIMUM DECELERATION DISTANCE OF 640-FT FOR TRUCKS, ASSUMING Vi = 55MPH, Vf=15MPH.
ON-RAMP	THE EXISTING ON-RAMP IS 540-FT. THE RAMP LENGTH REQUIREMENTS ARE 1,560-FT (PASSENGER CARS) AND 2,795-FT (TRUCKS), ASSUMING Vi=15MPH, Vf=70MPH. THE EXISTING RAMP LENGTH MEETS MINIMUM REQUIREMENTS OF 490-FT FOR PASSENGER CARS, ASSUMING Vi=15MPH, Vf=45MPH. THE EXISTING RAMP LENGTH DOES NOT MEET THE LOWEST MINIMUM REQUIREMENTS OF 625-FT FOR TRUCKS, ASSUMING Vi=15MPH, Vf=55MPH.
CLEARZONE	38-FT CLEAR AT 5:1 SLOPES, 70MPH MINIMUM FROM THE EDGE OF INTERSTATE TRAVELED LANE. EXISTING GUARDRAIL SEPARATES EASTBOUND TRAVEL LANES FROM REST AREA.
GRADING	SITE APPEARS TO MEET ADA WITH 5% GRADES WITHOUT SPECIAL GRADING NEEDS.
ENVIRONMENTAL	IMPROVEMENTS ARE EXPECTED TO BE LOCATED OUTSIDE WETLANDS. WELLS ARE CURRENTLY LOCATED OUTSIDE PARKING AREAS AND MEET SETBACK REQUIREMENTS.
DRAINAGE	ON-SITE AND OFF-SITE DRAINAGE WILL BE PERPETUATED UTILIZING EXISTING CULVERTS AND INLETS.
REST ROOM UNITS	THE EXISTING NUMBER OF REST ROOM UNITS IS 4 WOMEN'S TOILET STALLS AND 2 MEN'S URINALS + 2 MEN'S TOILET STALLS. PROPOSED NUMBER OF REST ROOM UNITS IS 4 WOMEN'S BATHROOMS AND 3 MEN'S BATHROOMS (MEN'S BATHROOM INCLUDES URINAL AND TOILET).
REST AREA BUILDING	CONCEPTUAL REST AREA BUILDING FOOTPRINT SIZE DETERMINED BY MDT.

WESTBOUND REST AREA SITE DESIGN ASSUMPTIONS

DESIGN	REMARKS
PROPOSED PARKING	PROPOSED PARKING: ONLY CARS CAN GENERALLY MEET CALCULATED PARKING DEMAND AS IDENTIFIED IN THE PRELIMINARY TRAFFIC REPORT DATED JUNE 4, 2014. TRUCK PARKING IS LOWER DUE TO SITE RESTRICTIONS.
	CARS / TRUCKS
	EXISTING PARKING: 16 / 4
	CALCULATED PARKING DEMAND: 9 / 27
	PROPOSED PARKING: 17 / 20
	(CAR PARKING INCLUDES HANDICAP STALLS).
OFF-RAMP	THE EXISTING OFF-RAMP IS 640-FT AND MEETS THE MINIMUM DECELERATION DISTANCE OF 590-FT FOR PASSENGER CARS, ASSUMING Vi = 70MPH, Vf=15MPH. THE OFF-RAMP MEETS THE MINIMUM DECELERATION DISTANCE OF 640-FT FOR TRUCKS, ASSUMING Vi = 55MPH, Vf=15MPH.
ON-RAMP	THE EXISTING ON-RAMP IS 310-FT. THE RAMP LENGTH REQUIREMENTS ARE 1,560-FT (PASSENGER CARS) AND 2,795-FT (TRUCKS), ASSUMING Vi=15MPH, Vf=70MPH. THE EXISTING RAMP LENGTH MEETS MINIMUM REQUIREMENTS OF 300-FT FOR PASSENGER CARS, ASSUMING Vi=15MPH, Vf=40MPH. THE EXISTING RAMP LENGTH DOES NOT MEET THE LOWEST MINIMUM REQUIREMENTS OF 625-FT FOR TRUCKS, ASSUMING Vi=15MPH, Vf=55MPH.
CLEARZONE	38-FT CLEAR AT 5:1 SLOPES, 70MPH MINIMUM FROM THE EDGE OF INTERSTATE TRAVELED LANE.
GRADING	SITE APPEARS TO MEET ADA WITH 5% GRADES WITHOUT SPECIAL GRADING NEEDS.
ENVIRONMENTAL	IMPROVEMENTS ARE EXPECTED TO BE LOCATED OUTSIDE WETLANDS. WELLS ARE CURRENTLY LOCATED OUTSIDE PARKING AREAS AND MEET SETBACK REQUIREMENTS.
DRAINAGE	ON-SITE AND OFF-SITE DRAINAGE WILL BE PERPETUATED UTILIZING EXISTING CULVERTS AND INLETS.
REST ROOM UNITS	THE EXISTING NUMBER OF REST ROOM UNITS IS 4 WOMEN'S TOILET STALLS AND 2 MEN'S URINALS + 2 MEN'S TOILET STALLS. PROPOSED NUMBER OF REST ROOM UNITS IS 4 WOMEN'S BATHROOMS AND 3 MEN'S BATHROOMS (MEN'S BATHROOM INCLUDES URINAL AND TOILET).
REST AREA BUILDING	CONCEPTUAL REST AREA BUILDING FOOTPRINT SIZE DETERMINED BY MDT.

NOTE:

REST AREA USAGE CALCULATIONS IDENTIFIED IN THE PRELIMINARY TRAFFIC REPORT DATED JUNE 4, 2014 WERE DEVELOPED IN ACCORDANCE WITH GUIDELINES FROM THE MONTANA REST AREA PLAN UPDATE, USING A MODIFIED VERSION OF THE METHODOLOGY OUTLINED IN THE WESTERN TRANSPORTATION INSTITUTE REPORT TITLED *REST AREA USE: DATA ACQUISITION AND USAGE ESTIMATION REPORT* (2011). THE MODIFIED VERSION SUBSTITUTES SITE -SPECIFIC DOOR COUNT DATA IN PLACE OF WTI-RECOMMENDED DEFAULT VALUES TO IDENTIFY PEAK-HOUR VISITATION AT THE EASTBOUND AND WESTBOUND REST AREAS.

DESIGN ASSUMPTIONS

EASTBOUND AND WESTBOUND

DOWL

3
2
MDT MONTANA DEPARTMENT OF TRANSPORTATION

...\8200000\RD\8200000RDDETZ3(1).DGN
7/22/2016
11:42:00 AM doflscher

DESIGNED BY	D FISCHER	7/22/2016
REVIEWED BY	B DREYER	7/22/2016
CHECKED BY	T CORMIER	7/22/2016

PH. 1 CONCEPTUAL SITE LAYOUT
TREASURE COUNTY

HYSHAM REST AREA - MONTANA
CSF=0.9993521809 | UPN 8200000
IM-C 94-2(36)65
SHEET 4 OF 10

PUBLIC WELL AND WASTEWATER SETBACKS

FROM	TO PUBLIC WATER SUPPLY WELLS (FEET)	TO SEALED COMPONENTS (1) AND OTHER COMPONENTS (2) (FEET)	TO DRAINFIELDS/SOIL ABSORPTION SYSTEMS (3) (FEET)
PUBLIC OR MULTIUSER WELLS/SPRINGS	---	100 (4)	100
INDIVIDUAL & SHARED DRINKING WELLS	---	50 (4)	100
OTHER WELLS (5)	---	50 (4)	100 (4)
SUCTION LINES	---	50	100
CISTERNS	---	25	50
ROADCUTS, ESCARPMENT	---	10 (6)	25
SLOPES > 35% (7)	---	10 (6)	25
PROPERTY BOUNDARIES	10 (8)	10 (8)	10 (8)
SUBSURFACE DRAINS	---	10	10
WATER MAINS	---	10 (9)	10
DRAINFIELDS/ SOIL ABSORPTION SYSTEMS	100	10	---
FOUNDATION WALLS	---	10	10
SURFACE WATER (10), SPRINGS	100 (4) (11) (12)	50 (4) (11)	100 (4) (11) (13)
FLOODPLAINS	10 (11)	SEALED --- (1) OTHER 100 (2)(4)(11)	100 (11) (14)
MIXING ZONES	100 (4)	---	---
STORM WATER PONDS AND DITCHES (15)	100 (16)	10	25

(1) SEALED COMPONENTS INCLUDE HOLDING TANKS, SEALED PIT PRIVIES, AND THE COMPONENTS ADDRESSED IN DEPT. CIRCULAR DEQ-4, CHAPTERS 4 & 5. SEALED COMPONENTS MUST MEET REQUIREMENTS OF ARM 17.36.322(4).
(2) OTHER COMPONENTS INCLUDE THE COMPONENTS ADDRESSED IN DEPT. CIRCULAR DEQ-4, CHAPTER 7.
(3) ABSORPTION SYSTEMS INCLUDE THE SYSTEMS ADDRESSED IN DEPT. CIRCULAR DEQ-4, CHAPTERS 6 & 8, SUBJECT TO THE LIMITATIONS IN ARM 17.36.321.
(4) A WAIVER OF THIS REQUIREMENT MAY BE GRANTED BY THE DEPARTMENT OF ENVIRONMENTAL QUALITY PURSUANT TO ARM 17.36.601.
(5) OTHER WELLS INCLUDE, BUT ARE NOT LIMITED TO, IRRIGATION AND STOCK WATERING, BUT DO NOT INCLUDE OBSERVATION WELLS AS ADDRESSED IN DEPT. CIRCULAR DEQ-4.
(6) SEWER LINES AND SEWER MAINS MAY BE LOCATED IN ROADWAYS AND ON STEEP SLOPES IF THE LINES AND MAINS ARE SAFEGUARDED AGAINST DAMAGE.
(7) DOWN-GRADIENT OF THE SEALED COMPONENT, OTHER COMPONENT, OR DRAINFIELD/SOIL ABSORPTION SYSTEM.
(8) EASEMENTS MAY BE USED TO SATISFY THE SETBACK TO PROPERTY BOUNDARIES.
(9) UNLESS A WAIVER IS GRANTED BY THE DEPARTMENT PURSUANT TO ARM 17.36.601, SEWER MAINS THAT CROSS WATER MAINS MUST BE LAID WITH A MINIMUM VERTICAL SEPARATION DISTANCE OF 18 INCHES BETWEEN THE MAINS.
(10) FOR PURPOSES OF THIS RULE, "SURFACE WATER" DOES NOT INCLUDE INTERMITTENT STORM WATER.
(11) THE DEPARTMENT MAY REQUIRE MORE SEPARATION FROM THE FLOODPLAIN OR FROM SURFACE WATER OR SPRINGS IF IT DETERMINES THAT SITE CONDITIONS OR WATER QUALITY REQUIREMENTS INDICATE A NEED FOR THE GREATER DISTANCE.
(12) PURSUANT TO ARM 17.36.331, THE REVIEWING AUTHORITY MAY REQUIRE GREATER THAN A 100-FOOT HORIZONTAL SEPARATION BETWEEN A WELL AND SURFACE WATER IF THERE IS A POTENTIAL THAT THE WELL MAY BE INFLUENCED BY CONTAMINANTS IN THE SURFACE WATER.
(13) A WAIVER MAY BE GRANTED BY THE DEPARTMENT, PURSUANT TO ARM 17.36.601, IF THE APPLICANT DEMONSTRATES THAT GROUND WATER FLOW AT THE DRAINFIELD SITE CANNOT FLOW INTO THE SURFACE WATER OR SPRING. THE SETBACK BETWEEN DRAINFIELDS OR SOIL ABSORPTION SYSTEMS TO IRRIGATION DITCHES DOES NOT APPLY IF THE DITCH IS LINED WITH A FULL CULVERT.
(14) AFTER CONSULTATION WITH THE LOCAL HEALTH DEPARTMENT, A WAIVER MAY BE GRANTED BY THE DEPARTMENT, PURSUANT TO ARM 17.36.601, IF THE APPLICANT DEMONSTRATES THAT THE SURFACE WATER OR SPRING SEASONALLY HIGH WATER LEVEL IS AT LEAST A 100-FOOT HORIZONTAL DISTANCE FROM THE DRAINFIELD AND THE BOTTOM OF THE DRAINFIELD WILL BE AT LEAST TWO FEET ABOVE THE MAXIMUM 100-YEAR FLOOD ELEVATION.
(15) STORM WATER PONDS AND DITCHES ARE THOSE STRUCTURES THAT TEMPORARILY HOLD OR CONVEY WATER AS PART OF STORM WATER MANAGEMENT.
(16) THE SETBACK IS 100 FEET FOR PUBLIC WELLS, UNLESS A DEVIATION IS GRANTED UNDER ARM TITLE 17, CHAPTER 38, SUBCHAPTER 1.
(17) SLOPE SURFACE AWAY FROM WELL HEADS WITH 3:1 SLOPE.

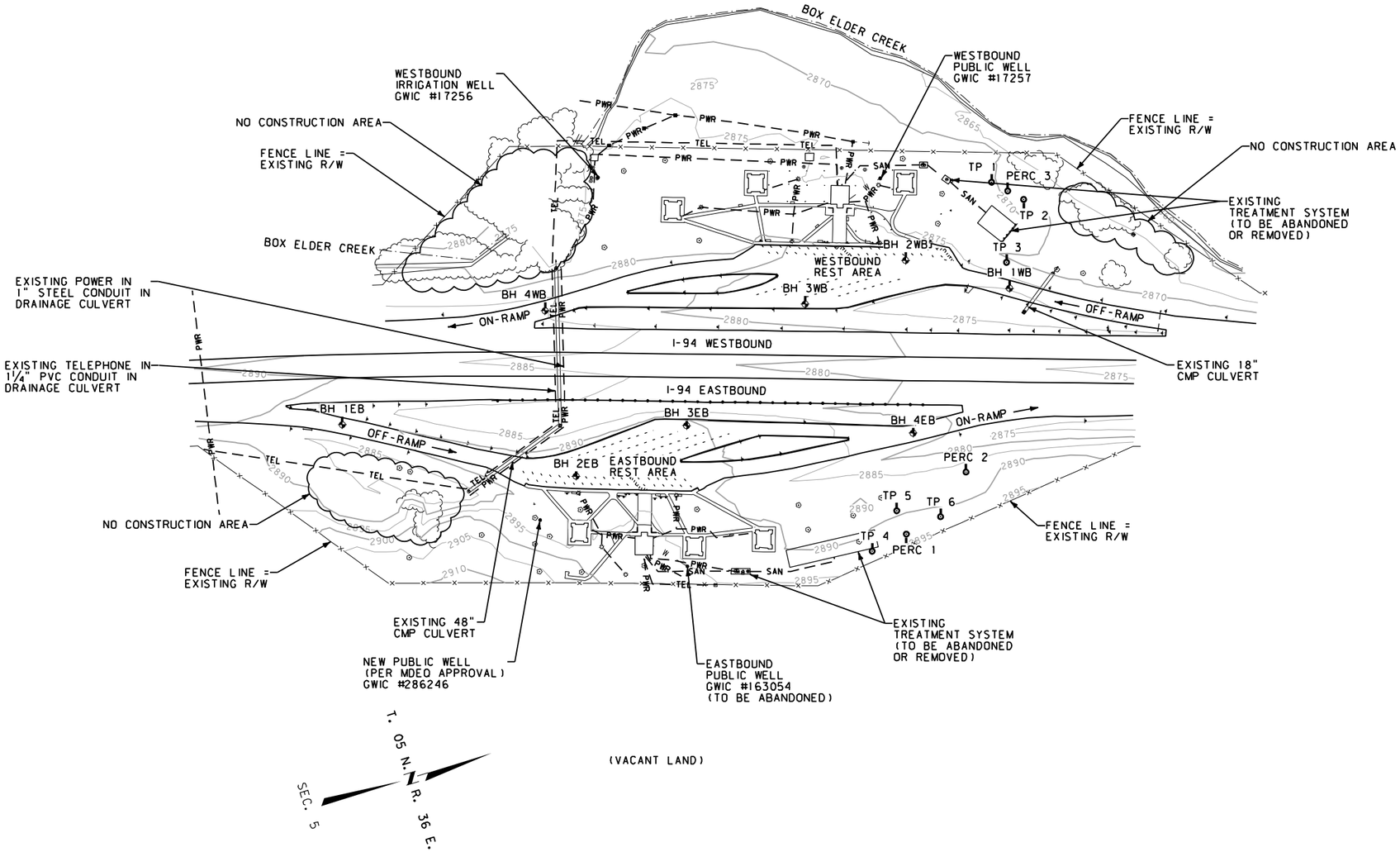
DESIGN ASSUMPTIONS

MDEQ SETBACK REQUIREMENTS

NOTES:

TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.

DOWL



NOTES:

1. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
2. EXISTING UNDERGROUND UTILITIES ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE DRAWN BASED ON THE SURVEY AND AS-BUILT DRAWINGS PROVIDED BY MDT.

EXISTING OVERALL SITE LAYOUT

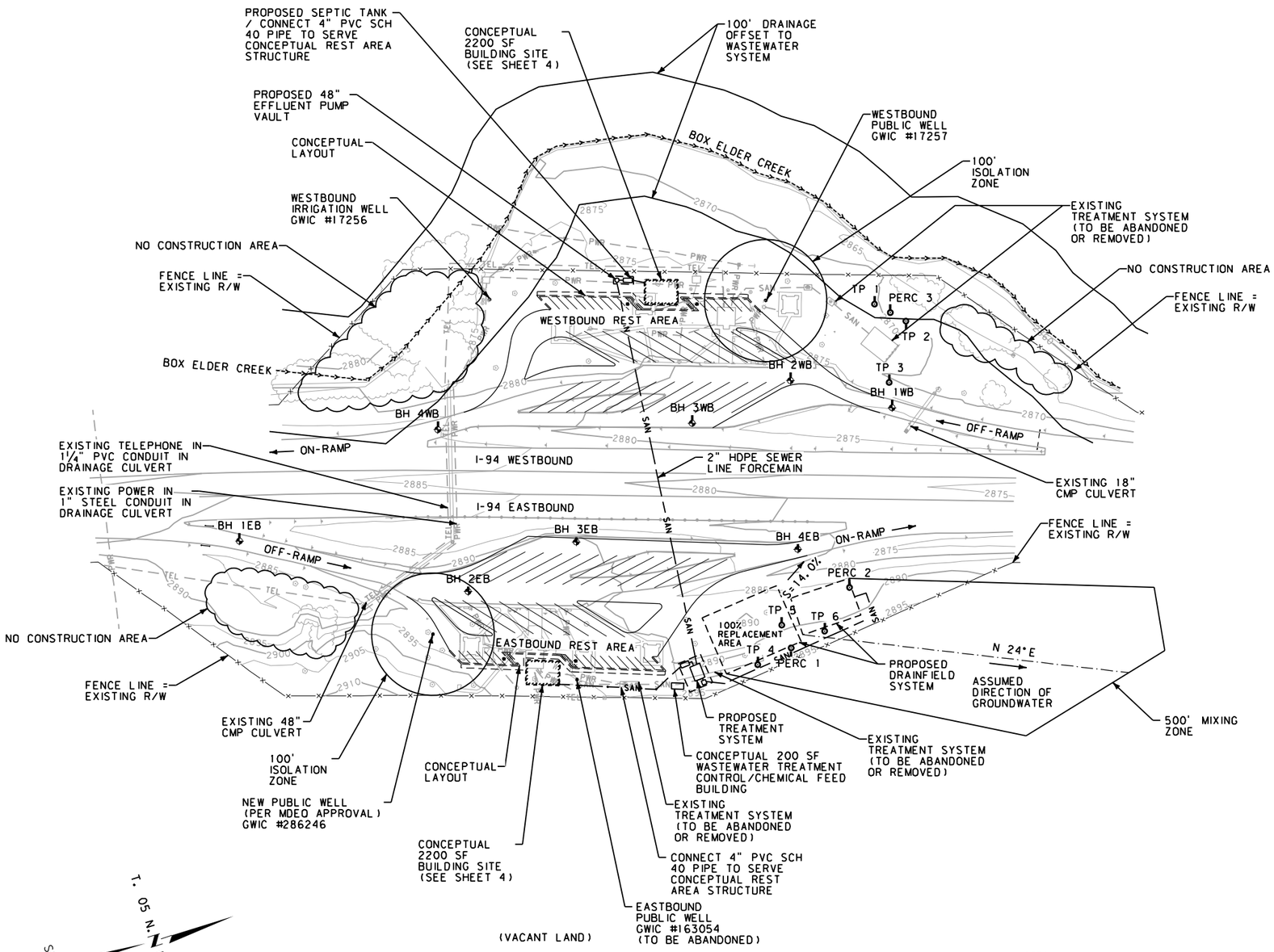
EASTBOUND AND WESTBOUND

SCALE 1"=100'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDDETZ3	DESIGNED BY	D FISCHER	7/22/2016	PH. 1 CONCEPTUAL SITE LAYOUT	HYSHAM REST AREA - MONTANA	IM-C 94-2(36)65
		7/22/2016	REVIEWED BY	B DREYER	7/22/2016			
1		11:42:02 AM doflscher	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000	SHEET 6 OF 10

(VACANT LAND)

NO WELLS OR SURFACE WATER WITHIN
MIXING ZONE OR 100 FEET OF DRAINFIELD



• = PROPOSED HANDICAP STALL

NOTES:

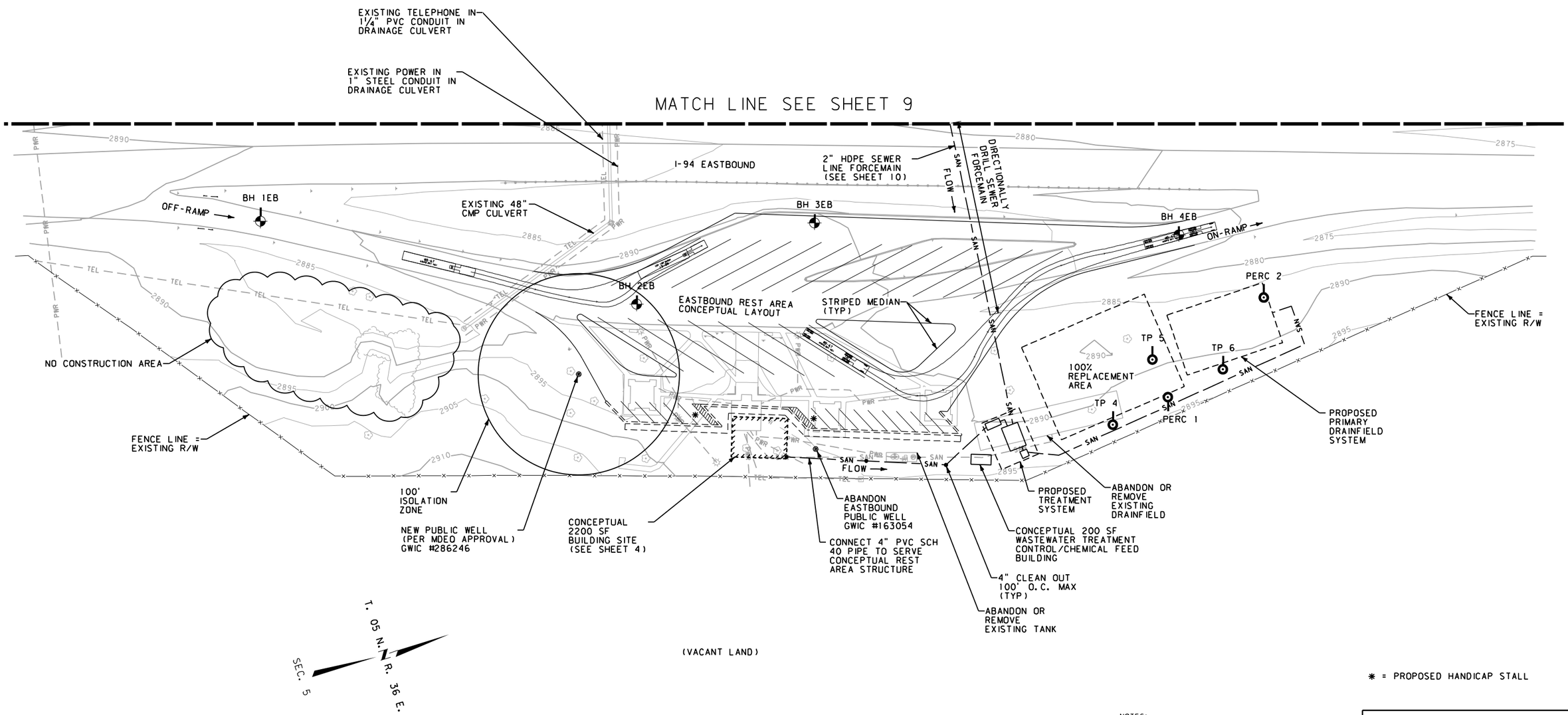
1. TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.
2. FINAL LOCATION OF STRUCTURES WILL BE DETERMINED IN PHASE II OF THIS PROJECT.
3. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
4. CONCEPTUAL FACILITIES ARE APPROXIMATE.
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

CONCEPTUAL OVERALL SITE PLAN

EASTBOUND AND WESTBOUND

SCALE 1"=100'

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDDETZ31.DGN	DESIGNED BY	D FISCHER	7/22/2016	PH. 1 CONCEPTUAL SITE LAYOUT	HYSHAM REST AREA - MONTANA	IM-C 94-2(36)65
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000	SHEET 7 OF 10
		11:43:02 AM doflscher	CHECKED BY	T CORMIER	7/22/2016			



NOTES:

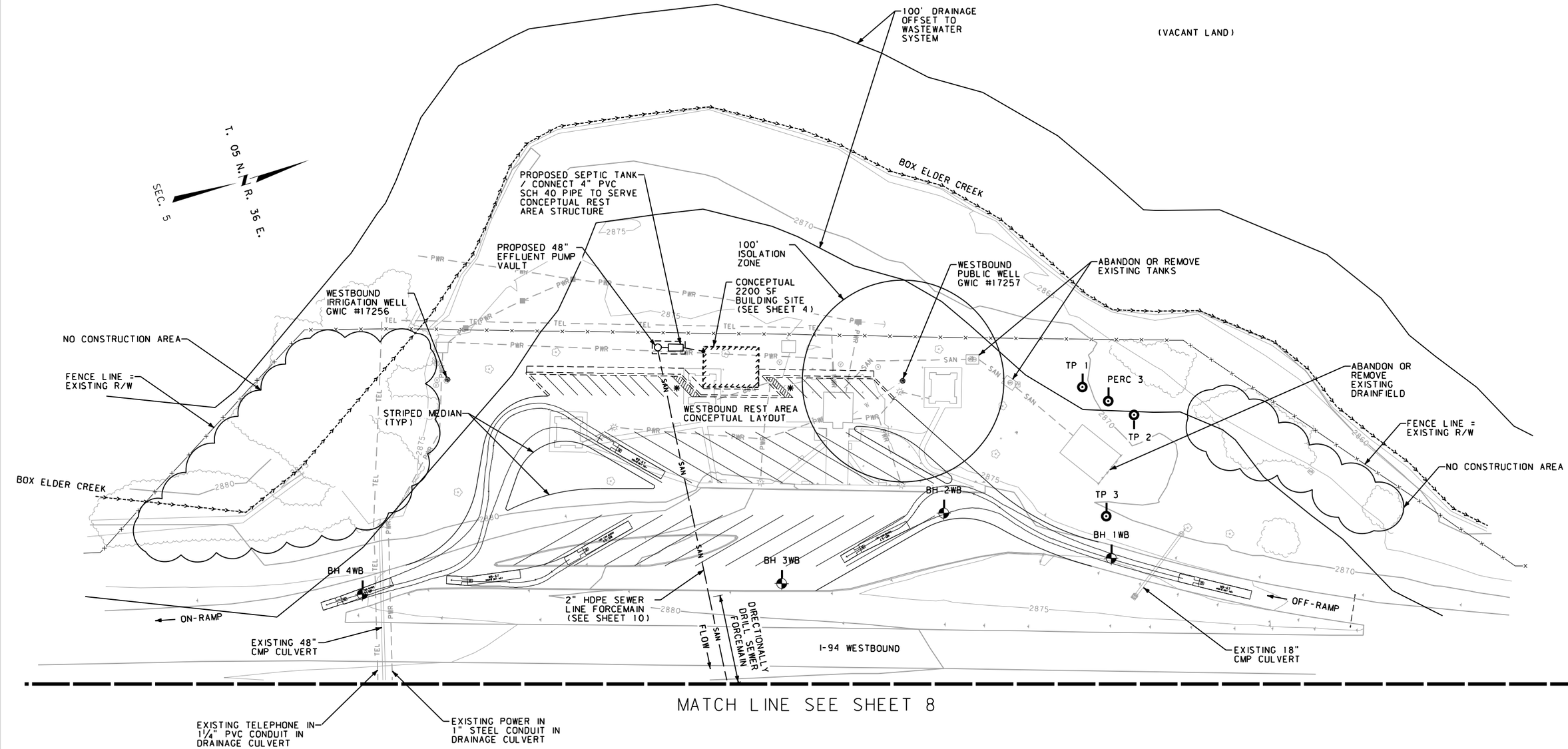
1. TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.
2. FINAL LOCATION OF STRUCTURES WILL BE DETERMINED IN PHASE II OF THIS PROJECT.
3. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
4. CONCEPTUAL FACILITIES ARE APPROXIMATE.
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

CONCEPTUAL SITE PLAN DETAIL

EASTBOUND SITE

SCALE 1"=50'

3 / 1	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDDETZ31.dgn	DESIGNED BY	D FISCHER	7/22/2016	PH. 1 CONCEPTUAL SITE LAYOUT	HYSHAM REST AREA - MONTANA	IM-C 94-2(36)65
		7/22/2016	REVIEWED BY	B DREYER	7/22/2016			
		11:43:03 AM dolfischer	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000	SHEET 8 OF 10



MATCH LINE SEE SHEET 8

* = PROPOSED HANDICAP STALL

NOTES:

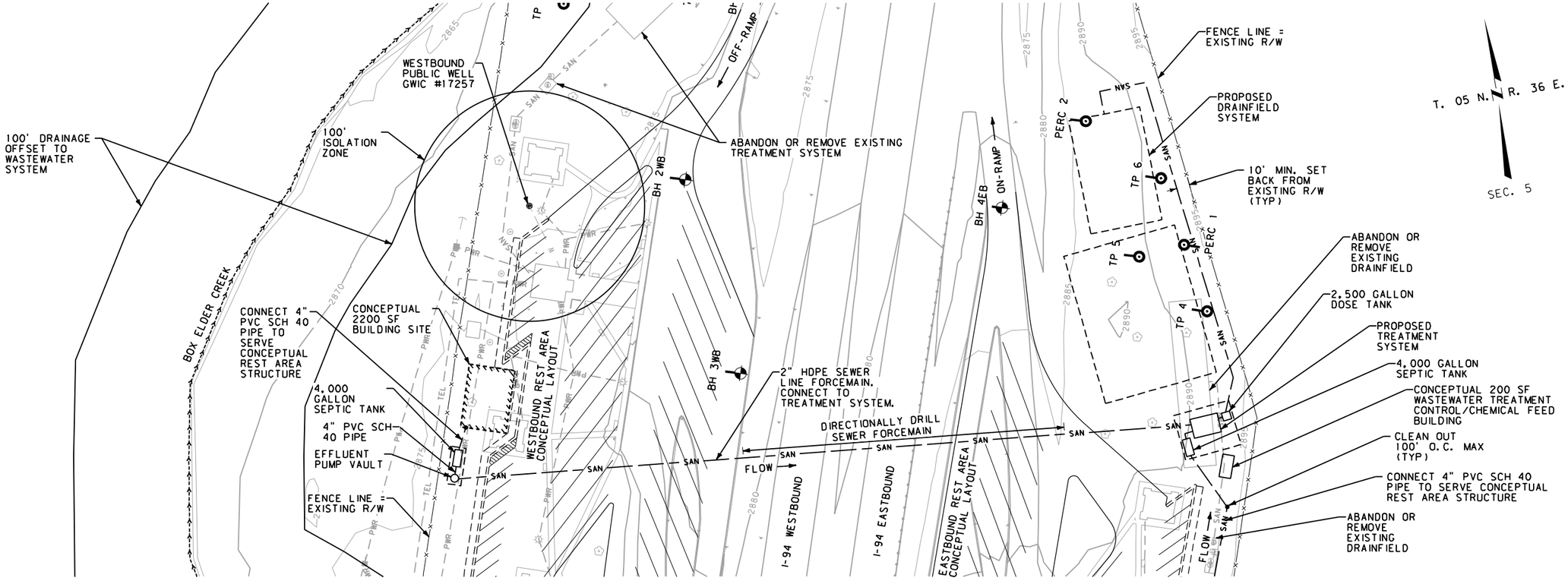
1. TREATMENT AREA CAN BE RELOCATED TO ACCOMMODATE FINAL REST AREA LAYOUT. ALL STATE AND COUNTY OFFSETS MUST BE MET.
2. FINAL LOCATION OF STRUCTURES WILL BE DETERMINED IN PHASE II OF THIS PROJECT.
3. EXISTING UNDERGROUND SANITARY SEWER LINES AND ASSOCIATED TANKS AND DRAINFIELDS ARE SHOWN FOR INFORMATION ONLY. UNDERGROUND FACILITIES WERE NOT SURVEYED.
4. CONCEPTUAL FACILITIES ARE APPROXIMATE.
5. GRAVITY TRANSPORT OF WASTEWATER PREFERRED.
6. FINAL GRADING MUST DIVERT SURFACE WATER AWAY FROM WELLS.

CONCEPTUAL SITE PLAN DETAIL

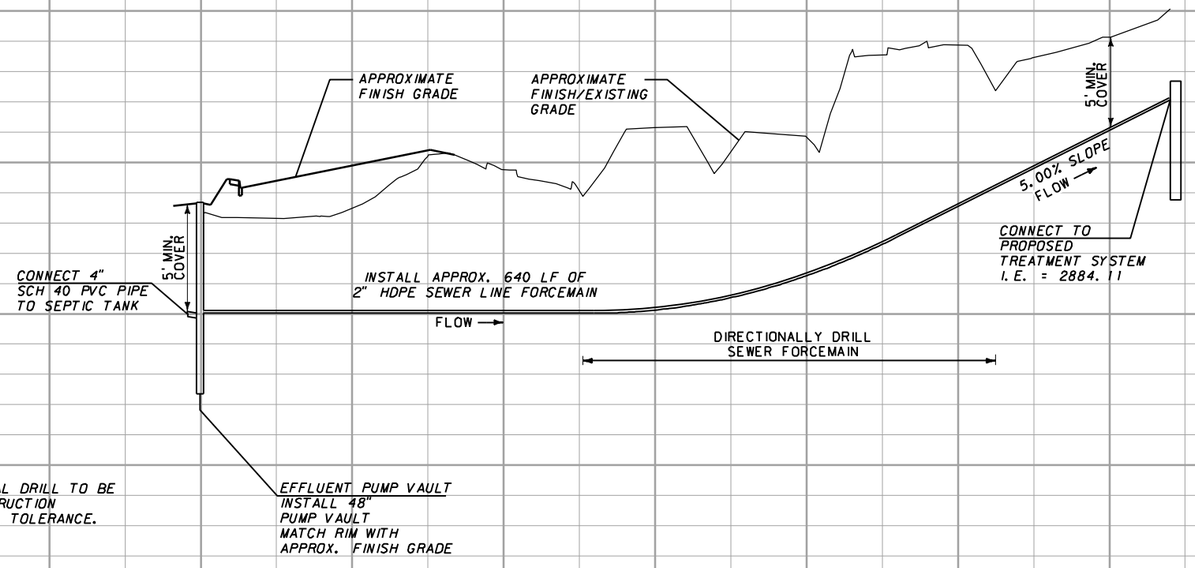
WESTBOUND SITE

SCALE 1"=50'

2	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDDETZ31.dgn	DESIGNED BY	D FISCHER	7/22/2016	PH. 1 CONCEPTUAL SITE LAYOUT	HYSHAM REST AREA - MONTANA / IM-C 94-2(36)65
1		7/22/2016	REVIEWED BY	B DREYER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 / UPN 8200000 / SHEET 9 OF 10
		11:43:04 AM dofischer	CHECKED BY	T CORMIER	7/22/2016		



DIRECTIONALLY DRILLED 2" SEWER FORCEMAIN



LENGTH OF DIRECTIONAL DRILL TO BE DETERMINED BY CONSTRUCTION TECHNIQUE & MATERIAL TOLERANCE.

EFFLUENT PUMP VAULT
INSTALL 48" PUMP VAULT
MATCH RIM WITH APPROX. FINISH GRADE

3	MDT MONTANA DEPARTMENT OF TRANSPORTATION	...\8200000\RD\8200000RDPLPZ01.dgn	DESIGNED BY	D FISCHER	7/22/2016	PH. 1 CONCEPTUAL SITE LAYOUT	HYSHAM REST AREA - MONTANA	IM-C 94-2(36)65
2		7/22/2016	REVIEWED BY	B DREYER	7/22/2016			
		11:44:18 AM dofischer	CHECKED BY	T CORMIER	7/22/2016	TREASURE COUNTY	CSF=0.9993521809 UPN 8200000	SHEET 10 OF 10

APPENDIX M:

DNRC Water Rights

Billings Water Resources Regional Office
Airport Business Park
1371 Rimtop Drive, Billings, MT 59105

Phone: 406-247-4415
Fax: 406-247-4416
Web: http://dnrc.mt.gov

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

STATE OF MONTANA

STEVE BULLOCK, GOVERNOR

February 1, 2016

Bill Dreyer, PE
DOWL
2090 Stadium Drive
Bozeman, MT 59715

Re: Hysham Rest Area (Eastbound) Replacement Well – Treasure County

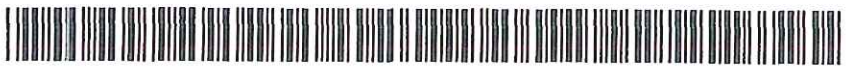
Dear Mr. Dreyer:

The DNRC Billings Regional Office received a copy of the DEQ approval of the plans and specifications for the Hysham Rest Area (Eastbound) replacement well. The letter from DEQ states the anticipated capacity of the replacement well is 35 GPM. The Montana Department of Transportation (MDOT) has a water right (42KJ 163867-00) for the Hysham Rest Area for 28 GPM and 5 Acre-feet per year (AF) for institutional use. The water right does not specify which side of the highway the rest area is on. The map in the file appears to indicate the eastbound side. I am writing to let you know that MDOT needs to file either a Replacement Well Notice (form 634) or a Notice of Completion of Groundwater Development (form 602) with DNRC after the well is completed and water is put to a beneficial use. The 634 can be filed if the new and old well are in the same aquifer, the flow rate for the new well is the same or less than the old well, it's for the same purpose and the old well is properly abandoned. If the new well does not meet all of the above requirements the DOT may file a 602. If the new well will use more than 35 GPM or 10 AF, the DOT will need to apply for and receive a Beneficial Water Use Permit (form 600) prior to putting the water to beneficial use. Please feel free to contact me if you have any questions.

Cordially,

Christine Schweigert
Water Resources Specialist
Billings Regional Office
CSchweiget@mt.gov
406-247-4419

FILE



STATEMENTOF CLAIM

42KJ

163868

00

Box Bar Code _____

File Bar Code _____

Date/Initials _____

Form No. 76-O R2/80

RECEIVED
APR 30 1982
DEPT. OF NATURAL RESOURCES AND CONSERVATION

163868

STATEMENT OF CLAIM FOR EXISTING WATER RIGHTS
OTHER USES

42KJ

For the Water Courts of the State of Montana

TR-Y

NWT #5850
40.00

1. Owner of Water Right: MONTANA, STATE OF / DEPT OF HIGHWAYS / 2701 PROSPECT / HELENA MT 59620

Co-Owner or Other Interest Owner: _____ / _____ / _____ (Last / First / Middle Initial)

Address _____

City _____ State _____ Zip Code _____

Home Phone No. _____ Business Phone No. _____

2. Person completing form: Hutchison / William / D. (Last / First / Middle Initial)

Address 2701 Prospect Avenue

City Helena State Montana Zip Code 59620

Home Phone No. _____ Business Phone No. 449-2584

3. Use: (Check Only One)

FR ☐ Fish Raceways	GE ☐ Geothermal	MN ☐ Mining
FW ☐ Fish & Wildlife	NV ☐ Navigation	PG ☐ Power Generation
CM ☐ Commercial	FP ☐ Fire Protection	RC ☐ Recreation
IN ☐ Industrial	AS ☐ Agricultural Spraying	OT ☒ Other
MC ☐ Municipal	OF ☐ Oil Well Flooding	Explain MDOH Rest Area

4. Source of Water: (Check Only One)

☐ Spring Name _____

☒ Well Name Hysham Rest Area - Eastbound

☐ Stream Name _____ Tributary of _____

☐ Lake Name _____ Stream _____

Tributary of _____

☐ Reservoir Name _____ Stream _____

Tributary of _____

5. Point of Diversion: County Treasure

SE ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W

Lot _____, Block _____, Subdivision _____

6. Means of Diversion:

☐ Well
☒ Pump Capacity 16 gpm
☐ Headgate with ditch or pipeline
☐ Instream use
☐ Other Explain _____

7. Means of Conveyance:

☐ Ditch ☐ Instream
☒ Pipeline ☐ Other: _____

8. **Place of Use:** County Treasure

☐ Instream ☐ City or Town ☒ Other: Explain MDOH Rest Area

Lot, Block, SE ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Lot, Block, ¼ ¼ ¼, Section, T N/S, R E/W

Subdivision

9. **Flow rate claimed:** 16
☐ cubic feet per second
☒ gallons per minute
☐ miner's inches

10. **Volume claimed:** 2 acre-feet per year

11. **Period(s) of use:** 3 (Month) / 1 (Day) to 11 (Month) / 30 (Day)

DNRC

(12.) **Check one:**
☐ Decreed Water Right
☐ Filed Appropriation Right
☒ Use Water Right

Priority date or date of first use
Hour / 2 (Month) / 9 ~~14~~ (Day) / 1966 (Year)

13. **Attach** copies of the Decree, Record of Filing or Proof of Use Right.

14. **Attach** copies of aerial photographs, U.S. Geological Survey maps or such other documents necessary to show point of diversion, place of use, place of storage, and conveyance facilities.

15. **Notarized Statement signed by claimant.**

STATE OF MONTANA)
:ss.
County of Lewis and Clark)

I, W. D. Hutchison, having been duly sworn, depose and say that I, being of legal age and being the claimant of this claim of existing water right, and the person whose name is signed to it as the claimant, know the contents of this claim and the matters and things stated there are true and correct.

W D Hutchison

Subscribed and sworn before me, this 30th day of April 19 82.

Kathleen a Ellis
Notary Public for the State of Montana

Residing at Helena, MT

My Commission expires 12/16/83

Approved Stock Form—State Publishing Co., Helena, Montana—42329

File No. 163868

T. 5 N. R. 26 E.

QUADRUPLICATE

County Treasure

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

LOG

Casing Setback = 10'
Top of Ground
(Elev. above sea level 3899.29 ft.)

Tan to grey sandy silt, with some clay.

10.0'

Grey sandy cracked shale, with some gravel.

Owner Montana Bureau of Conservation Address Helena, Montana

Driller Montana Bureau of Mines Address Helena, Montana

Date of Notice of appropriation of groundwater February 6, 1968

Date well started January 29, 1968 Date completed February 3, 1968

Type of well drilled Equipment used Churn drill
(Dug, Driven, bored or drilled) (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐
Industrial ☐ Drainage ☐ Other ☐

Root Area Here 40' 17

Indicate on the log and the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
8"	6" ID Steel 19.00 lbs. per ft.	0.0'	61.5'	NONE		

90.0'

Grey clay.

80.0'

61.5' Bottom of casing above.

Grey sandy shale.

Soft grey sandstone.

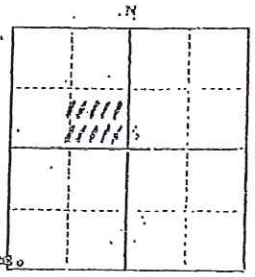
Est. Sec. 6 T. 5 R. 26 E.

70.0

Grey sandy gravel.

75.0 Bottomed hole in grey sandy gravel.

Show exact depth of bottom.



NW ¼ Sec. 6 T. 5 N R. 26 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 24.0 feet.

Shut-in Pressure for Flowing Well

Pumping Water Level 30.0 feet at 16 gal. per minute.

Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 6 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e. Lot, Block and Addition).

WATER ANALYSES

pH	7.9	
SO_4	52	p.p.m.
Calcium + Magnesium Hardness as $CaCO_3$	382	p.p.m.
Sodium Hazard	42	p.p.m.

Water is Clear

Form to be prepared by driller, and three copies to be filed by the owner with the County Clerk and Recorder in the county in which the well is located, tissue copy to be retained by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

None required
Driller's License Number

Lehman G. Fox
Driller's Signature Helena, Montana

FORM S. D. 25--2M TRIP.--P-54--McKEE Log No. 40 205' Rt. Std. 073+00, Project I-94-7(10)69

(Elev. above sea level 2893.2 ft.)

Top of Ground

Tanto grey sandy silt with some clay.

10.0'

Grey, sandy, reworked shale, with some gravel.

34.0'

Grey clay.

60.0'

Grey sandy shale.

61.5' Bottom of casing shoe.

Soft grey sandstone.

70.0'

Grey sandy gravel.

75.0 Bottomed hole in grey sandy gravel.

Show exact depth of bottom. F/c

163868

MONTANA STATE BOARD OF HEALTH

Division of Environmental Sanitation

Helena, Montana

WELL DRILLER'S REPORT

Driller's Registration No. None Req'd.

Driller Montana Highway Dept. Address Helena, Montana

Owner of Well Montana Highway Commission

Exact Location of Well SE 1/4 NW 1/4, Sec. 5, T.5 N., R.36 E.

Nearest Post Office Hysham County Treasure

Water to be Used for Rest Area Water Supply

Drilling Begun January 28, 1966 Well Finished February 3, 1966

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Casing Record

Size of Pipe	Kind and Weight of Material Used	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6" ID	Steal 19.00 lbs. per ft.	0.0'	61.5'	NONE		

WATER ANALYSIS

pH	7.5	
CO_2	52	p.p.m.
Calcium & Magnesium Bicarbonates	352	p.p.m.
Sodium Bicarbonates	42	p.p.m.
Water is basic		

Describe the type of joints in casing Electric Weld

Describe any screens used None

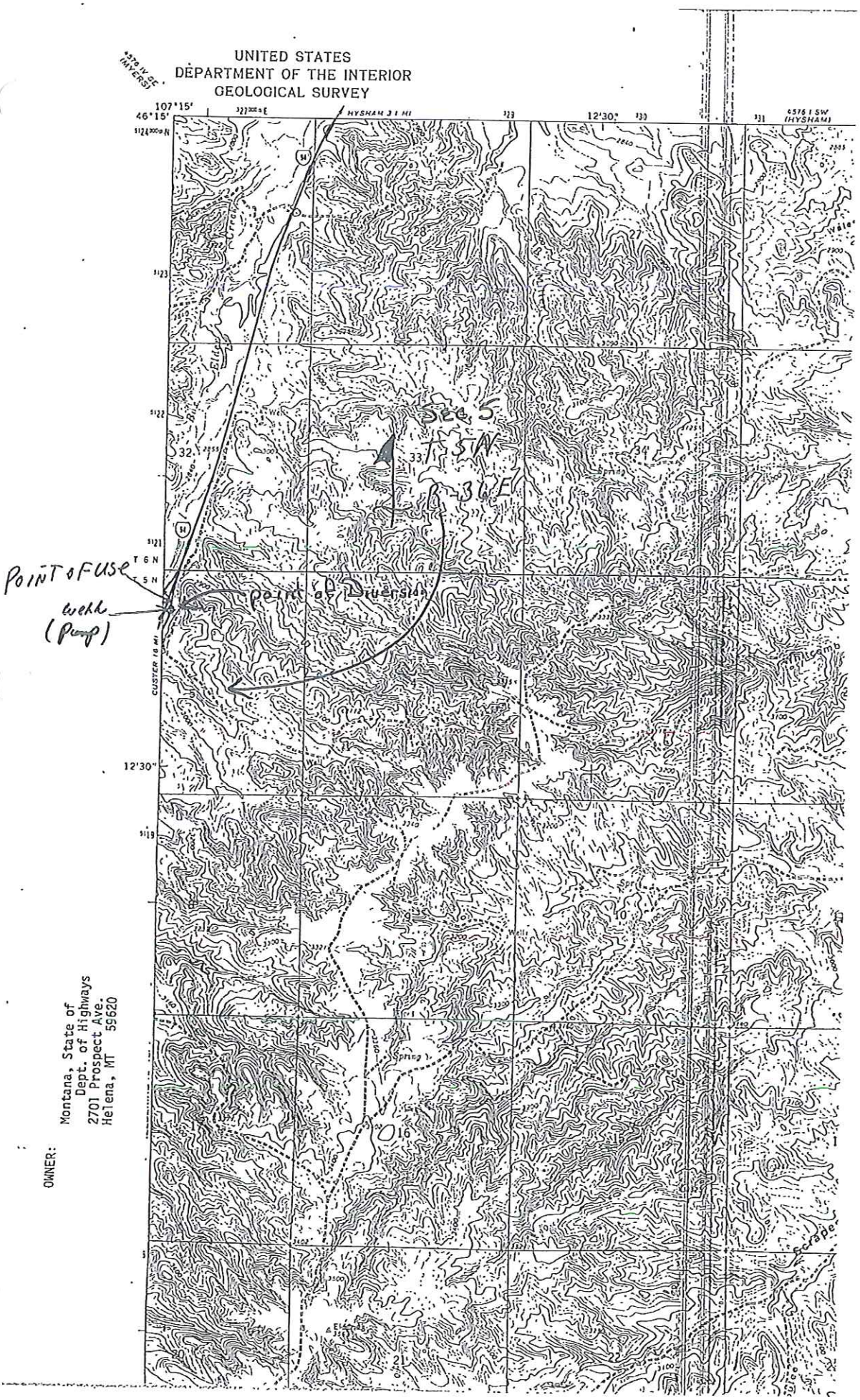
Capacity of Well 16 gallons per minute (In Gallons or Barrels)

How Determined Pumped (Pump, Bailer, Weir, Etc)

Signed Watts, Engr.

Date February 10, 1966

THIS TO BE RETURNED BY DRILLER


UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
107°15'
46°15'
12'30"
HYSHAM 31 MI
4576 I SW (HYSHAM)
CUSTER 19 MI
T 6 N
T 5 N
Sec 5
T5N
R34E
POINT OF USE
well (Pump)
Point of Diversion
Scrape
OWNER:
Montana, State of
Dept. of Highways
2701 Prospect Ave.
Helena, MT 59620

RW 158

163868

WATER WELL REPORT

Location:

County Treasure

Town Hysham East Reat Area

Subdivision SE¼ NW¼

Addition

Section 5

Block

Township 5N

Lot

Range 36 E

Highway Project No.

Right/~~Left~~ Station 285 Ft. Sta. 673+00

Purpose:

Maintenance Section Headquarters:

☐ Irrigation ☐ Potable

Depth of Well 75.0 ft. (feet)

Capacity of Well 16 gallons per minute (gal. per min.)

Rest Area:

☒ Irrigation ☒ Potable

Notice of Completion of Appropriation Filed With County Clerk and Recorder

February 14,1966 (date)

Beautification:

☐ Irrigation ☐ Potable

Well Drillers Report Filed With State Department of Health

February 14,1966 (date)

Remarks:

FORM E. S. 26--2M TRIP.--9.64--McKEE Log No. 40 205' Rt. Sta. 673+00, Project I-94-2(10)88 East Bound

(Elev. above sea level 2899.2 ....)
Top of Ground

MONTANA STATE BOARD OF HEALTH

Division of Environmental Sanitation Hysham Rest Area

Helena, Montana

163868

WELL DRILLER'S REPORT

Driller's Registration No. None Req'd.

Driller Montana Highway Dept. Address Helena, Montana

Owner of Well Montana Highway Commission

Exact Location of Well SE 1/4 NW 1/4, Sec. 6, T.5 N., R.36 E.

Nearest Post Office Hysham County Treasure

Water to be Used for Rest Area Water Supply

Drilling Begun January 28, 1966 Well Finished February 3, 1966

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Tanto grey sandy silt with some clay.

10.0' Grey, sandy, reworked shale, with some gravel.

34.0' Grey clay.

60.0' Grey sandy shale.

61.5' Bottom of casing shoe.

Soft grey sandstone.

70.0' Grey sandy gravel.

75.0 Bottomed hole in grey sandy gravel.

Casing Record

Size of Pipe	Kind and Weight of Material Used	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6" ID	Steel 19.00 lbs. per ft.	0.0'	61.5'	NONE		
		WATER ANALYSIS				
pH				7.5		
CO_2				52 p.p.m.		
Calcium & Magnesium Bicarbonates				352 p.p.m.		
Sodium Bicarbonates				42 p.p.m.		
Water is basic						

Describe the type of joints in casing Electric Weld

Describe any screens used None

Capacity of Well 18 gallons per minute
(In Gallons or Barrels)

How Determined Pumped
(Pump, Baller, Weir, Etc)

Signed Merle. Engr.

Date February 10, 1966

TO BE RETAINED BY DRILLER

Show exact depth of bottom. F/c

Form W-109
New 2-81

163868

REMARK RECORD STATEMENT OF CLAIM CODING FORM

codes	headings	codes	headings
OW	owner information	FR	flow rate remark
PU	purpose clarification	VM	volume remark
SN	source name remark	PE	period of use remark
CL	clarification of land descr.	SB	subdivision name
DM	diversion means	RM	general remark
PR	priority date		

	ACTION	GEN CODE	GEN #	BASIN	ID CODE	ID NUMBER	EXT ID
0 6	A	N	0 0	4 2 K J	W		0 0

REMARKS: PU01

DOH HIGHWAY REST AREA

REMARKS:

REMARKS:

REMARKS

REMARKS:

STATEMENT OF CLAIM CHECKLIST

FORM TYPE: I S D ©

OK	NOT OK		
____	____	Received	
____	____	Basin	
____	____	County	163868
____	____	Division	
____	____	Transmittal	
____	____	Fee	
____	____	____	
____	____	____	

FORM ITEMS

	OK	NOT OK	
1	____	____	____
2	____	____	____
3	____	____	____
4	____	____	____
5	____	____	____
6	____	____	____
7	____	____	____
8	____	____	____
9	____	____	____
10	____	____	____
11	____	____	____
12	____	____	____
13	____	____	____
14	____	____	____
15	____	____	____
16	____	____	____

Checked by D. RICHARD / 6-8-82
Date

DEFICIENT:

____Phoned _____ / _____
Number Date

____Sent Letter _____ / _____
To Date

Correction Deadline: _____
Date

____Form Corrected _____
Date

____Incomplete Form & Correspondence Sent To Helena

☐ See notes on reverse side

NEW 10 90 :

WATER RIGHT DATA BASE CODING FORM
REMARK RECORD

DNRC
Supplemental Document
Claim # 42KJ W163868-00

EFERENCE JUMBER	REMARK CODE & NUMBER	SPECIFIC DATA
P565	PU01	Highway Rest Area
A5	AM01	Period of Use 09/16/99

Form #76-A 5-91

AMENDMENT

TO STATEMENT OF CLAIM

RECEIVED
SEP 16 1999
DEPT. OF NATURAL RESOURCES AND CONSERVATION
BILLINGS OFFICE

Claim number(s): 42KJ W163868-00

Owner(s): Montana, State of Dept of Transportation

I make the following amendment(s) to the above statement of claim(s):

(Complete only those sections that require amendment.)

1. Owner of Water Right: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Co-owner or Other Interest Owner: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Address _____

   City _____ State _____ Zip Code _____

   Home Phone No. ( ) _____ Business Phone No. ( ) _____

2. Purpose (use): _____

   a. If irrigation, method of irrigation use ☐ Sprinkler ☐ Flood ☐ Waterspreading ☐ Subirrigation ☐ Natural Overflow

   b. If domestic, number of households served _____

   c. If stock, total number and type of livestock served _____

3. Source of Water: _____ Tributary of _____

4. Point of Diversion: County _____

   _____ ¼, _____ ¼, _____ ¼, Section _____, T_____N/S, R_____E/W

   Lot_____, Block _____, Subdivision _____

   ☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

   Please attach a map showing all points of diversion for this water right.

5. Means of Diversion: ☐ Well ☐ Instream Use ☐ Dam ☐ Headgate ☐ Pump: Capacity _____ gpm ☐ Other _____

6. Means of Conveyance: ☐ Ditch ☐ Pipeline ☐ Instream Use ☐ Other _____

AMENDMENT

7. Place of Use: County _____

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____Total Acres. Subdivision _____

☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

Please attach map showing entire place of use for this water right.

8. Flow Rate Claimed: _____ ☐ cubic feet per second ☐ gallons per minute ☐ miner's inches

9. Volume Claimed: _____ acre-feet per year

10. Period(s) of Use: Jan. (Month) / 1 (Day) to Dec. (Month) / 31 (Day)

11. Priority Date *(date of first use)*: _____ (Hour) / 2 (Month) / 14 (Day) / 66 (Year)

12. Type of Historical Right: ☐ Decreed Right ☐ Filed Appropriation Right ☐ Use Right

Please attach proof of priority date or type of right.

13. Reasons for Amendment: _____

_____

14. Comments: _____

_____

15. Notarized Statement Signed by Owner:

I, having been duly sworn, depose and say that I, being of legal age and being the owner of this claim of existing water right know the contents of this amendment and that the matters and things stated there are true and correct. *(Only one current owner of the right as listed in the DNRC centralized record system is required to sign, but all owners are encouraged to sign.)*

Signature: James C. James Date: 9/15/99

Signature _____ Date _____

Subscribed and sworn before me this 15 day of SEPTEMBER, 1999

Brent D. McCann

(notary seal)

Residing at Billings, Mt.

My commission expires July 28, 2003

47148

tice of Completion
of groundwater Appropriation
by means of well:
Montana Highway Comission
Sec 5 Twp 5 Range 36 E

STATE OF MONTANA, } ss.
County of Treasure
OFFICE OF RECORDER OF DEEDS.

I hereby certify that the within instrument was filed for record in this office on the 14 day of Feb 1966, at 9 o'clock A.M.

Marion Gaukler
County Clerk and Recorder of Treasure County

By _____ Deputy.

DNRC
Supplemental Document
CLAIM #42KJ W163868-00

07/11/94 D.N.R.C. 42KJ-W-163868-00

EXAMINATION WORKSHEET

* *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
PO BOX 201001
HELENA MT 59620-1001

✓ ok ___amended ___rule 2.II. ___DNRC error ___issue
comments: _____

___|*|PURPOSE: Institutional

___ok ___amended ✓ rule 5.II. ___DNRC error ___issue
comments: _____

____| |SOURCE: WELL

✓ ok ___amended ___rule 2.VI. ___DNRC error ___issue
data source: USGS topo map Scraper Coulee
WR survey _____ others _____
comments: _____

____ SOURCE TYPE: GROUNDWATER
✓ ok ___not ok comments: _____

| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
____	WL01		SENENW	05	05N	36E	TR

✓ ok ___amended ___rule 2.III. ___DNRC error ___issue
___additional PODS: see attached code sheets/amendment form
✓ depth 75 static wtr lvl 24 yield rate 16 csng diam 6.00
comments: _____

____ basin code: 42KJ
✓ ok ___not ok interbasin transfer with basin _____
comments: _____

✓ |*|PRIORITY DATE: FEB ~~09~~ 14 1966

___ok ___amended ___rule 2.VIII. ✓ DNRC error ___issue
comments: _____

✓ |*|TYPE OF RIGHT: ~~USE~~ Filed

___ok ___amended ✓ rule 2.VIII. ___DNRC error ___issue
comments: _____

07/11/94 DNRC EXAMINATION WORKSHEET CONT. 42KJ-W-163868-00

\ | FLOW RATE: 16.00 GPM (1.42 MI)

/ ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

_____

____ | VOLUME: 2.00 acre-feet per year
(feasible vol. = 19.44 AF)
(comparison stat.= 2.46 hrs/day)

/ ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

_____

/ |* PERIOD OF USE: ~~MAR 1 TO NOV 30~~ Jan 1 Dec 31 (computer array: 001999999970)

✓ ok / amended ___rule 5.V. ___DNRC error ___issue
comments: _____

_____

____ | PLACE OF USE FOR : 01

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SENENW	05	05N	36E	TR

/ ok ___amended ___rule 5.III. ___DNRC error ___issue
___additional pou parcels: see attached code sheets/amendment form

data source: _____
comments: _____

_____

SUPPLEMENTAL: ___yes / no comments: _____

MULTIPLE USE: ___yes (add MU remark) / no

/ EXISTING REMARKS IN DATABASE: ___ok / not ok

~~PU01 MDOH HIGHWAY REST AREA~~

____ fee paid: $40.00 / ok ___not ok
____ claim received: 4/30/82 / ok ___not ok

* * * *

11/23/99 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

____| |PURPOSE (USE):

PU01 INSTITUTIONAL

PU03 HIGHWAY REST AREA

____| |SOURCE: WELL
SOURCE TYPE: GROUNDWATER

✓ ____|*|PRIORITY DATE: FEBRUARY ~~09~~ 14, 1966
✓ ____| | TYPE OF HISTORICAL RIGHT: ~~USE~~ Filed

____| |FLOW RATE: 16.00 GPM

____| |VOLUME: 2.00 AF

✓ ____| |PERIOD OF USE: ~~MARCH~~ Jan 01 TO ~~NOVEMBER 30~~ Dec 31

____| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

____| |PLACE OF USE FOR :

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SENENW	05	05N	36E	TR

____ GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

____ UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* *
* POTENTIAL ERROR/WARNING MESSAGES *
* invalid purpose code (B02) *
* more than one purpose: (B03) *
* *
* *

11/23/99 DNRC REVIEW ABSTRACT (CONT.) 42KJ-W-163868-00

REVIEWED BY: _____ DATE _____
ADDENDUMS: ___ YES ___ NO (NOS: ___DVRS ___RSRV ___POU ___RMRK ___OWNR)

CODED BY: _____ DATE _____

01/05/00 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

✓ | |PURPOSE (USE): ~~IRRIGATION~~ Institutional "IS" code
~~TYPE OF IRRIGATION SYSTEM: OTHER~~

~~PU01 INSTITUTIONAL~~

PU03 ✓ HIGHWAY REST AREA

____| |SOURCE: WELL
SOURCE TYPE: GROUNDWATER

____|*|PRIORITY DATE: FEBRUARY 14, 1966
____| | TYPE OF HISTORICAL RIGHT: FILED

____| |FLOW RATE: 16.00 GPM (OK)
*** NO ACRES

____| |VOLUME: 2.00 AF
CLIMATIC AREA: 5

____| |PERIOD OF USE: JANUARY 01 TO DECEMBER 31

____| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

✓ ____| |PLACE OF USE FOR IRRIGATION:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
			SE NE NW	05	~~36E~~ 05N	36E.	TR

____ GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

____ UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* *
* POTENTIAL ERROR/WARNING MESSAGES *
* volume value - not water spreading, reservoir, or decreed right (F09) *
* maximum claimed acres = zero (G02) *
* year round irrigation (H03) *
* missing entire place of use (M09) *

01/05/00 DNRC REVIEW ABSTRACT (CONT.) 42KJ-W-163868-00

* * * *

02/09/00 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

____| |PURPOSE (USE): INSTITUTIONAL

~~PU01 INSTITUTIONAL~~

PU03 HIGHWAY REST AREA

____| |SOURCE: WELL
SOURCE TYPE: GROUNDWATER

____|*|PRIORITY DATE: FEBRUARY 14, 1966
____| | TYPE OF HISTORICAL RIGHT: FILED

____| |FLOW RATE: 16.00 GPM

____| |VOLUME: 2.00 AF

____| |PERIOD OF USE: JANUARY 01 TO DECEMBER 31

____| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

____| |PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SENENW	05	05N	36E	TR

____ GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

____ UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* * * * * * * * * * * * * * * *

02/09/00 DNRC REVIEW ABSTRACT (CONT.) 42KJ-W-163868-00

REVIEWED BY: OSR DATE 2/15/00

ADDENDUMS: ___ YES ___ NO (NOS: ___DVRS ___RSRV ___POU ___RMRK ___OWNR)

CODED BY: _____ DATE _____

02/23/00 42KJ-W-163868-00

D.N.R.C.

* * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163868-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
2701 PROSPECT AVE
PO BOX 201001
HELENA MT 59620-1001

____| |PURPOSE (USE): INSTITUTIONAL

PU01 HIGHWAY REST AREA

____| |SOURCE: WELL
SOURCE TYPE: GROUNDWATER

____|X|PRIORITY DATE: FEBRUARY 14, 1966
____| | TYPE OF HISTORICAL RIGHT: FILED

____| |FLOW RATE: 16.00 GPM

____| |VOLUME: 2.00 AF

____| |PERIOD OF USE: JANUARY 01 TO DECEMBER 31

____| |POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SENENW	05	05N	36E	TR

WELL DATA: DEPTH 75 SWL 24 YLD 16 CSN 6.00

____| |PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SENENW	05	05N	36E	TR

____ GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

____ UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* * * * * * * * * * * * * * * *

TEMPORARY PRELIMINARY DECREE
YELLOWSTONE RIVER BETWEEN BIGHORN AND TONGUE RIVERS
BASIN 42KJ
ABSTRACT OF WATER RIGHT CLAIM

WATER RIGHT NUMBER 42KJ-W-163868-00

IMPORTANT NOTICE

YOUR WATER RIGHT AS SHOWN ON THIS ABSTRACT MAY HAVE CHANGES FROM YOUR WATER RIGHT AS CLAIMED OR AMENDED. AN ASTERISK (*) HAS BEEN PLACED NEXT TO EACH ITEM CHANGED BY THE DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION (DNRC) DURING THE EXAMINATION PROCESS. THESE CHANGES ARE AUTHORIZED BY THE MONTANA WATER COURT OR THE WATER RIGHT CLAIM EXAMINATION RULES AS ADOPTED BY THE MONTANA SUPREME COURT.

OBJECTIONS MAY BE FILED ACCORDING TO THE PROCEDURES OUTLINED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
ENVIRONMENTAL SERVICES
PO BOX 201001
HELENA MT 59620-1001

PURPOSE (USE): INSTITUTIONAL

HIGHWAY REST AREA

SOURCE: WELL
SOURCE TYPE: GROUNDWATER

PRIORITY DATE: FEBRUARY 14, 1966
TYPE OF HISTORICAL RIGHT: FILED

FLOW RATE: 16.00 GPM (.04 CFS)

VOLUME: 2.00 AF

PERIOD OF USE: JANUARY 01 TO DECEMBER 31

POINT OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
01			SENENW	05	05N	36E	TREASURE

PLACE OF USE FOR INSTITUTIONAL:

	ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
001				SENENW	05	05N	36E	TREASURE

REMARKS:

THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

****
* THE DNRC EXAMINATION OF THIS CLAIM FOUND NO SIGNIFICANT FACTS, *
* DATA, OR ISSUES TO REPORT TO THE WATER COURT. *
****

FILMED

WATER RIGHT NUMBER 42KJ-W-163868-00 (CONTINUED)

A BETTER UNDERSTANDING OF YOUR CLAIMED WATER RIGHT CAN BE OBTAINED BY COMPARING YOUR RIGHT WITH OTHER CLAIMS IN THE BASIN. FOR EXAMPLE, COMPARE PRIORITY DATES, FLOW RATES, VOLUMES, OR ACRES IRRIGATED. ALSO, YOUR WATER RIGHT MAY BE SUBJECT TO WATER RIGHTS IN ADJOINING BASINS OR SUBBASINS AS WELL AS BEING SUBJECT TO OTHER RIGHTS ON YOUR SOURCE OF SUPPLY. FINALLY, YOUR WATER RIGHT MAY BE SUBJECT TO INDIAN RESERVED AND FEDERAL RESERVED WATER RIGHTS.

COMPLETE DETAILS REGARDING THE DNRC EXAMINATION RESULTS AND RELATED MATERIALS CAN BE REVIEWED AT THE OFFICE LOCATIONS IDENTIFIED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

SEE GENERAL FINDINGS OF FACT AND CONCLUSIONS OF LAW FOR FURTHER EXPLANATION OF YOUR CLAIMED WATER RIGHT. THESE FINDINGS CAN BE FOUND AS INDICATED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY." IF YOU NEED OBJECTION FORMS, OR HAVE QUESTIONS ABOUT WATER COURT PROCEDURES OR CHANGES TO YOUR RIGHT, YOU CAN CONTACT THE WATER COURT BY CALLING 1-800-624-3270 (WITHIN MONTANA ONLY) OR 1-406-586-4364, OR BY WRITING TO P.O. BOX 1389, BOZEMAN MT 59771-1389.

FILMED

FILE

STATEMENT OF CLAIM

42KJ

163867

00

Box Bar Code _____

File Bar Code _____

Date/Initials _____

Form No. 76-O R2/80

163867

TR-Y

42KJ

STATEMENT OF CLAIM FOR EXISTING WATER RIGHTS

OTHER USES

RECEIVED
APR 30 1982
DEPT. OF NATURAL RESOURCES AND CONSERVATION

For the Water Courts of the State of Montana

NWT 45850
40.00

1. Owner of Water Right

Co-Owner or Other Interest Owner: MONTANA, STATE OF
DEPT OF HIGHWAYS
2701 PROSPECT
HELENA MT 59620

Address _____ / _____ Middle Initial

City _____ / _____ Middle Initial

Zip Code _____

Home Phone No. _____ Business Phone No. _____

2. Person completing form Hutchison (Last) / William (First) / D. (Middle Initial)

Address 2701 Prospect Avenue

City Helena State Montana Zip Code 59620

Home Phone No. _____ Business Phone No. 449-2584

3. Use: (Check Only One)

- FR ☐ Fish Raceways
- FW ☐ Fish & Wildlife
- CM ☐ Commercial
- IN ☐ Industrial
- MC ☐ Municipal
- GE ☐ Geothermal
- NV ☐ Navigation
- FP ☐ Fire Protection
- AS ☐ Agricultural Spraying
- OF ☐ Oil Well Flooding
- MN ☐ Mining
- PG ☐ Power Generation
- RC ☐ Recreation
- OT ☒ Other

Explain MDOH Rest Area

4. Source of Water: (Check Only One)

- ☐ Spring — Name _____
- ☒ Well — Name Hysham Rest Area - Westbound
- ☐ Stream — Name _____ Tributary of _____
- ☐ Lake — Name _____ Stream _____ Tributary of _____
- ☐ Reservoir — Name _____ Stream _____ Tributary of _____

5. Point of Diversion: County Treasure

NW ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W

Lot _____, Block _____, Subdivision _____

6. Means of Diversion:

- ☐ Well
- ☒ Pump Capacity 28 gpm
- ☐ Headgate with ditch or pipeline
- ☐ Instream use
- ☐ Other Explain _____

7. Means of Conveyance:

- ☐ Ditch
- ☒ Pipeline
- ☐ Instream
- ☐ Other: _____

8. **Place of Use:** County Treasure

☐ Instream ☐ City or Town ☒ Other: Explain MDOH Rest Area

____ Lot, ____ Block, NW ¼ NE ¼ NW ¼, Section 5, T 5 N N/S, R 36 E E/W

____ Lot, ____ Block, ____ ¼ ____ ¼ ____ ¼, Section ____, T ____ N/S, R ____ E/W

____ Lot, ____ Block, ____ ¼ ____ ¼ ____ ¼, Section ____, T ____ N/S, R ____ E/W

____ Lot, ____ Block, ____ ¼ ____ ¼ ____ ¼, Section ____, T ____ N/S, R ____ E/W

____ Lot, ____ Block, ____ ¼ ____ ¼ ____ ¼, Section ____, T ____ N/S, R ____ E/W

Subdivision ____

9. **Flow rate claimed:** 28
☐ cubic feet per second
☒ gallons per minute
☐ miner's inches

10. **Volume claimed:** 5 acre-feet per year

11. **Period(s) of use:** 3 / 1 (Month / Day) to 11 / 30 (Month / Day)

DNRC

12. **Check one:**
☐ Decreed Water Right
☐ Filed Appropriation Right
☒ Use Water Right

Priority date or date of first use: ____ / ____ / ~~2~~ 28 / ~~14~~ / 1966 (Hour / Month / Day / Year)

13. **Attach** copies of the Decree, Record of Filing or Proof of Use Right.

14. **Attach** copies of aerial photographs, U.S. Geological Survey maps or such other documents necessary to show point of diversion, place of use, place of storage, and conveyance facilities.

15. **Notarized Statement signed by claimant.**

STATE OF MONTANA)
:ss.
County of Lewis and Clark)

I, W. D. Hutchison, having been duly sworn, depose and say that I, being of legal age and being the claimant of this claim of existing water right, and the person whose name is signed to it as the claimant, know the contents of this claim and the matters and things stated there are true and correct.

W D Hutchison

Subscribed and sworn before me, this 30th day of April 19 82

Kathleen A. Ellis
Notary Public for the State of Montana

Residing at Helena, M.T

My Commission expires 12/16/83

Approved Stock Form—State Publishing Co., Helena, Montana—42129

File No. 163867

T. 5 N. R. 33 E.

QUADRUPLICATE

County Treasure

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Owner [illegible] Address Colstrip, Montana

Driller [illegible] Address Helena, Montana

Date of Notice of appropriation of groundwater January 31, 1966

Date well started January 24, 1966 Date completed January 28, 1966

Type of well Churn drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐
Industrial ☐ Drainage ☐ Other ☐

Test Area [illegible]

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

LOG

Top of Ground

Greyish tan sandy silt. (Elev. above sea level 2871.00 ft.)

← 5.0' Change to grey sandy clay.

← 15.0' Traces of gravel.

← 20.0' Grey sandy clay; some surface water

← 25.0' Grey shale.

← 35.0' Bluish grey clay.

← 55.0' Some traces gravel. Increasing amounts of sand to coarse rock

@ 62.0 ft.

← 63.0' Bottom of casing.

← 63.0 Bottomed hole in gravel & dark grey sand.

Show exact depth of bottom.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6"	5" 18 Steel 19.49 lbs. pipe ft.	0.0'	63.0'	NONE		

N / W / E / S

SE 1/4 NW 1/4 Sec. 5 T. 2 N R. 39 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 19.0 feet.

Shut-in Pressure for Flowing Well [illegible]

Pumping Water Level 43 feet, at 28 gal. per minute.

Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

(Continue on reverse side)

USE—If used for irrigation, industrial, drainage or other. Explain, state number of acres and location or other data (i.e. Lot, Block and Addition).

WATER ANALYSIS

pH	7.0
SO4	5.4 p.p.m.
Calcium & Magnesium Bicarbonates	280 p.p.m.
Sodium Sulphate	93 p.p.m.
Water is Basic	

None required

Driller's License Number

Driller's Signature [illegible]

Form to be prepared by driller, and three copies to be filed by the owner with the Clerk and Recorder in the county in which the well is located, tissue copy to be kept by driller.

Please answer all questions. If not applicable, so state, otherwise the form will be returned.

POOR COPY

FORM E. S. 20--2529 THIP ... Log No. 3[illegible] 340' Lt. of Sta. 675+92, Project F-39-(10)61

(Elev. -5 ... 2871.63) Ft.

MONTANA STATE BOARD OF HEALTH

163867

Division of Environmental Sanitation

Helena, Montana

WELL DRILLER'S REPORT

Driller's Registration No. None req'd.

Driller Montana Highway Department Address Helena, Montana

Owner of Well Montana Highway Commission

Exact Location of Well NE 1/4 NW 1/4, Sec. 7, T. 5 N., R. 36 E.

Nearest Post Office Hysham County Treasure

Water to be Used for Rest Area Water Supply

Drilling Begun January 24, 1966 Well Finished January 28, 1966

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Top ...

Greyish tan silt.

5.0' To gray sandy clay.

15.0' Traces of gravel.

20.0' Grey sandy clay, with some surface water.

35.0 Bluish grey clay.

55.0' Some traces of gravel; increasing amounts of sand to coarse rock at 63'

63.0' Bottom of casing.

65.0' Bottomed hole in gravel and dark gray sand.

Casing Record

Size of Pipe	Kind and Weight of Material Used	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6" ID	Steel 19.00 lbs. per ft.	0.0'	63.0'	NONE		

WATER ANALYSIS

pH	7.5	
CO_2	5.4	p.p.m.
Calcium & Magnesium Bicarbonates	280	p.p.m.
Sodium Bicarbonate	90	p.p.m.
Water is basic		

Describe the type of joints in casing Electric weld

Describe any screens used None

Capacity of Well 28 gallons per minute
(In Gallons or Barrels)

How Determined Pumped
(Pump, Bailer, Weir, Etc)

Signed ... Asst. Engr.

Date February 10, 1966

DUPLICATE—TO BE RETAINED BY DRILLER

f./c

POOR COPY

Log No. 39 340' Lt. of Sta. 675+92, Project I-94-2(10)63

REC'D FEB 16 1966

GW 2

Approved Stock Form—State Publishing Co., Helena, Montana—42329

File No. 163867 W B Hyshom Rest Area

T. 5 N. R. 30 E.

ADRUPLICATE

County Treasure

LOG

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Notice of Completion of Groundwater Appropriation by Means of Well

DEVELOPED AFTER JANUARY 1, 1962

(Under Chapter 237, Montana Session Laws, 1961)

Top of Ground

Greyish tan sandy silt.
(Elev. above sea level 2371.68) ft.

← 5.0' Change to grey sandy clay.

← 15.0' Traces of gravel.

← 20.0' Grey sandy clay; some surface water

← 25.0' Grey shale.

← 35.0' Bluish grey clay.

← 55.0' Some traces gravel. Increasing amounts of sand to coarse rock @ 63.0 ft.

Perf. Casing

← 63.0' Bottom of casing.

← 65.0 Bottomed hole in gravel & dark grey sand.

Owner Montana Highway Comission Address Nolena, Montana

Driller Montana Highway Department Address Helena, Montana

Date of Notice of appropriation of groundwater January 31, 1966

Date well started January 24, 1966 Date completed January 29, 1966

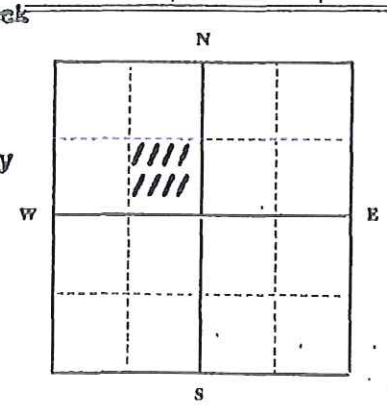
Type of well Churn drilled (Dug, Driven, bored or drilled) Equipment used Churn drill (Churn drill, rotary or other)

Water use: Domestic ☐ Municipal ☐ Stock ☐ Irrigation ☐ Industrial ☐ Drainage ☐ Other ☐

Rest Area Water Supply.

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

Size of Drilled Hole	Size and Weight of Casing	From (Feet)	To (Feet)	PERFORATIONS Kind Size	From (Feet)	To (Feet)
6"	6" ID Steel 19.00 lbs. per ft.	0.0'	63.0'	NONE		



SE 1/4 NW 1/4 Sec. 5 T. 5 N. R. 30 E.

Indicate location of well and place of use, if possible. Each small square represents 40 acres.

Static Water Level for non-flowing well 10.0 feet.

Shut-in Pressure for Flowing Well

Pumping Water Level 43 feet at 20 gal. per minute.

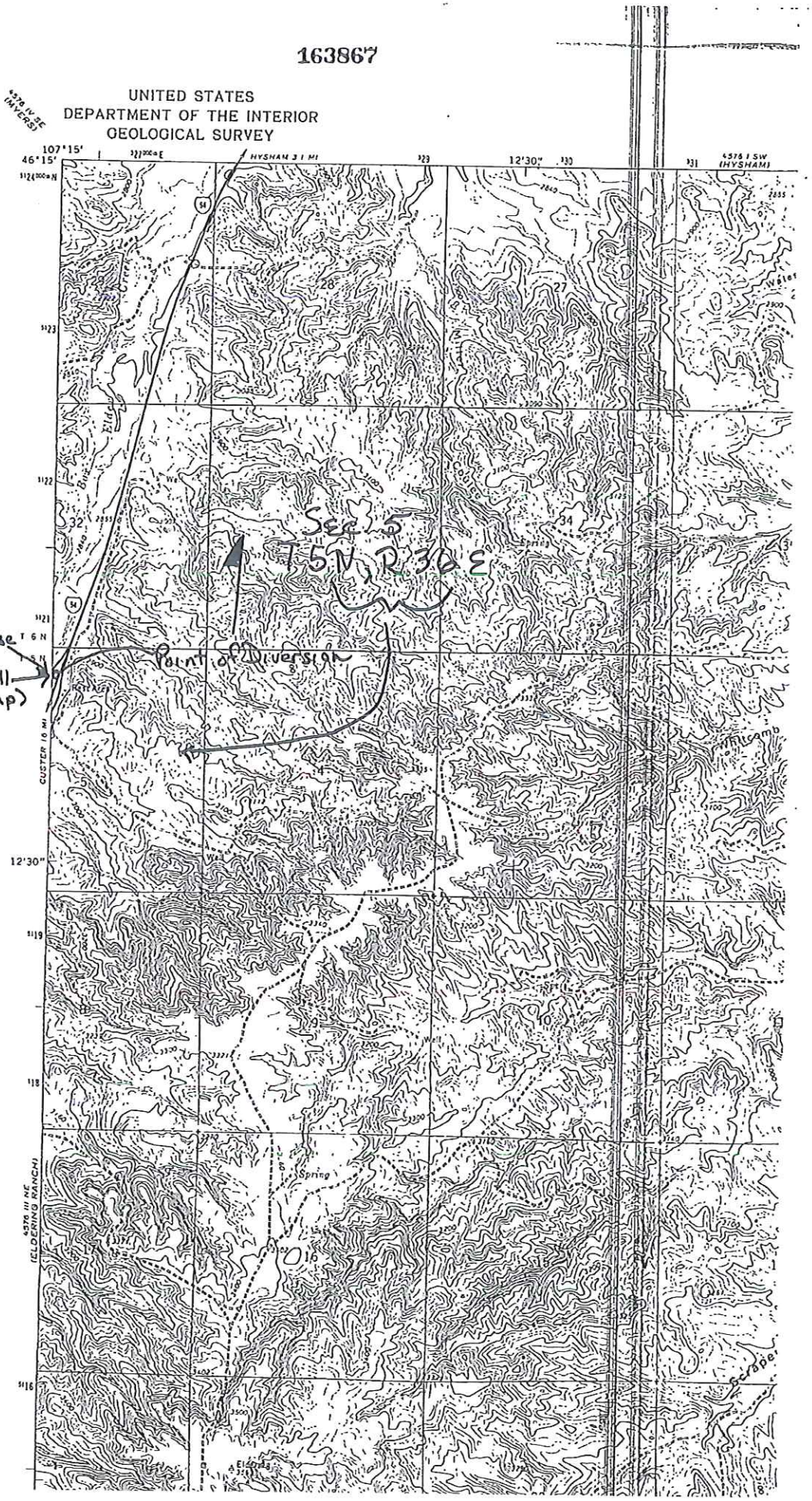
Discharge in gal. per min. of flowing well

How Tested Pumped

Length of Test 4 hours

Remarks: (Gravel packing, cementing, packers, type of shutoff) None

163867



OWNER:
Montana, State of
Dept. of Highways
2701 Prospect Ave.
Helena, MT 59620

RW 158

163867

WATER WELL REPORT

Location:

County Treasure

Town Hysham East Rest Area

Subdivision SE¼ NW¼

Addition

Section 5

Block

Township 5N

Lot

Range 36E

Highway Project No. I-94-2(10)63

~~Right~~/Left Station 340' Sta. 675+92

Purpose:

Maintenance Section Headquarters:

☐ Irrigation ☐ Potable

Rest Area:

☒ Irrigation ☒ Potable

Beautification:

☐ Irrigation ☐ Potable

Depth of Well 65.0 ft. (feet)

Capacity of Well 28 gallons per minute (gal. per min.)

Notice of Completion of Appropriation Filed With County Clerk and Recorder

February 14,1966 (date)

Well Drillers Report Filed With State Department of Health

February 10,1966 (date)

Remarks:

Form WR09
Nov 2-81

163867

REMARK RECORD STATEMENT OF CLAIM CODING FORM

codes	headings	codes	headings
OW	owner information	FR	flow rate remark
PU	purpose clarification	VM	volume remark
SN	source name remark	PE	period of use remark
CL	clarification of land descr.	SB	subdivision name
DM	diversion means	RM	general remark
PR	priority date		

	ACTION	GEN CODE	GEN #	BASIN	ID CODE	ID NUMBER	EXT ID
06	A	N	00	42KJ	W		00

REMARKS. PU01
DØH HIGHWAY REST AREA

REMARKS:

REMARKS:

REMARKS

REMARKS.

STATEMENT OF CLAIM CHECKLIST

FORM TYPE: I S D (O)

OK	NOT OK		
____	____	Received	
____	____	Basin	
____	____	County	
____	____	Division	163867
____	____	Transmittal	
____	____	Fee	
____	____	____	
____	____	____	

FORM ITEMS

	OK	NOT OK	
1	____	____	____
2	____	____	____
3	____	____	____
4	____	____	____
5	____	____	____
6	____	____	____
7	____	____	____
8	____	____	____
9	____	____	____
10	____	____	____
11	____	____	____
12	____	____	____
13	____	____	____
14	____	____	____
15	____	____	____
16	____	____	____

Checked by D. RICHARD / 6-8-82
Date

DEFICIENT:

____Phoned _____ / _____
Number Date

____Sent Letter _____ / _____
To Date

Correction Deadline: _____
Date

____Form Corrected _____
Date

____Incomplete Form & Correspondence Sent To Helena

☐ See notes on reverse side

NEW 10-90

WATER RIGHT DATA BASE CODING FORM
REMARK RECORD

DNRC
Supplemental Document
Claim #42KJ W163867-00

REFERENCE NUMBER	REMARK CODE & NUMBER	SPECIFIC DATA
P565	PU01	Highway Rest Area
A5	AM01	Period of Use 09/16/99

07/11/94 D.N.R.C. 42KJ-W-163867-00

EXAMINATION WORKSHEET

* *

coding

WATER RIGHT NUMBER 42KJ-W-163867-00

____| |OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
PO BOX 201001
HELENA MT 59620-1001

✓ ok ___amended ___rule 2.II. ___DNRC error ___issue
comments: _____

___/|*|PURPOSE: Institutional

___ok ___amended ✓ rule 5.II. ___DNRC error ___issue
comments: _____

____| |SOURCE: WELL

✓ ok ___amended ___rule 20VI. ___DNRC error ___issue
data source: USGS topo map Scraper Coulee
WR survey _____ others _____
comments: _____

____ SOURCE TYPE: GROUNDWATER
✓ ok ___not ok comments: _____

|*|POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
✓ WL01			~~NW~~SW NENW	05	05N	36E	TR

___ok ___amended ✓ rule 2.III. ___DNRC error ___issue
___additional PODS: see attached code sheets/amendment form
✓ depth 165 static wtr lvl 14 yield rate 28 csng diam 6.000
comments: _____

____ basin code: 42KJ
✓ ok ___not ok interbasin transfer with basin _____
comments: _____

✓ |*|PRIORITY DATE: ~~JAN 28~~ Feb 14, 1966

___ok ___amended ___rule 2.VIII. ✓ DNRC error ___issue
comments: _____

___/|*|TYPE OF RIGHT: ~~USE~~ Filed

___ok ___amended ✓ rule 2.VIII. ___DNRC error ___issue
comments: _____

07/11/94 DNRC EXAMINATION WORKSHEET CONT. 42KJ-W-163867-00

__| |FLOW RATE: 28.00 GPM (2.49 MI)

__ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

____| |VOLUME: 5.00 acre-feet per year
(feasible vol. = 34.03 AF)
(comparison stat.= 3.52 hrs/day)

__ok ___amended ___rule 5.IV. ___DNRC error ___issue
comments: _____

__/__|X|PERIOD OF USE: ~~MAR 1~~ Jan 1 TO ~~NOV 30~~ Dec 31 (computer array: 001999999970)

__ok __amended ___rule 5.V. ___DNRC error ___issue
comments: _____

__/__|X|PLACE OF USE FOR : 01

	ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001				~~NW~~NENW ~~SW~~	05	05N	36E	TR

___ok ___amended __rule 5.III. ___DNRC error ___issue
___additional pou parcels: see attached code sheets/amendment form

data source: _____
comments: _____

SUPPLEMENTAL: ___yes __no comments: _____

MULTIPLE USE: ___yes (add MU remark) __no

__ EXISTING REMARKS IN DATABASE: ___ok ___not ok

~~PU01 MDOH HIGHWAY REST AREA~~

____ fee paid: $40.00 __ok ___not ok
____ claim received: 4/30/82 __ok ___not ok

* * * *

47147

Notice of Completion of
Groundwater Appropriation
By Means of Wells

Montana Highway Commission

Sec 5 Twp 9 R 36E

STATE OF MONTANA,
Treasure } ss.

RECORDER OF DEEDS

I hereby certify that the within instrument was filed for record in this office on the 12 day of Feb 1966 at 9 o'clock A M

Clerk and Recorder of Treasure County

By _____ Deputy.

DNRC
Supplemental Document
CLAIM # 42KJ W163867-00

Form #76-A 5-91

AMENDMENT

TO STATEMENT OF CLAIM

RECEIVED
SEP 16 1999
DEPT. OF NATURAL RESOURCES AND CONSERVATION
BILLINGS OFFICE

Claim number(s): 42KJ W163867-00

Owner(s): Montana, State of Dept of Transportation

I make the following amendment(s) to the above statement of claim(s):

(Complete only those sections that require amendment.)

1. Owner of Water Right: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Co-owner or Other Interest Owner: _____ (Last) / _____ (First) / _____ (Middle Initial)

   Address _____

   City _____ State _____ Zip Code _____

   Home Phone No. ( ) _____ Business Phone No. ( ) _____

2. Purpose (use): _____

   a. If irrigation, method of irrigation use ☐ Sprinkler ☐ Flood ☐ Waterspreading ☐ Subirrigation ☐ Natural Overflow

   b. If domestic, number of households served _____

   c. If stock, total number and type of livestock served _____

3. Source of Water: _____ Tributary of _____

4. Point of Diversion: County _____

   _____ ¼, _____ ¼, _____ ¼, Section _____, T_____N/S, R_____E/W

   Lot_____, Block _____, Subdivision _____

   ☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

   Please attach a map showing all points of diversion for this water right.

5. Means of Diversion: ☐ Well ☐ Instream Use ☐ Dam ☐ Headgate ☐ Pump: Capacity _____ gpm ☐ Other _____

6. Means of Conveyance: ☐ Ditch ☐ Pipeline ☐ Instream Use ☐ Other _____

AMENDMENT

7. Place of Use: County _____

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____acres, ____Lot, ____Block, _____1/4, _____1/4, _____1/4, Section _____, T_____N/S, R_____E/W

_____Total Acres. Subdivision _____

☐ Replaces claimed information ☐ Supplements claimed information ☐ Addendum included

Please attach map showing entire place of use for this water right.

8. Flow Rate Claimed: _____ ☐ cubic feet per second ☐ gallons per minute ☐ miner's inches

9. Volume Claimed: _____ acre-feet per year

10. Period(s) of Use: Jan. (Month) / 1 (Day) to Dec. (Month) / 31 (Day)

11. Priority Date *(date of filing use)*: _____ (Hour) / 2 (Month) / 14 (Day) / 66 (Year)

12. Type of Historical Right: ☐ Decreed Right ☐ Filed Appropriation Right ☐ Use Right

Please attach proof of priority date or type of right.

13. Reasons for Amendment: _____

14. Comments: _____

15. Notarized Statement Signed by Owner:

I, having been duly sworn, depose and say that I, being of legal age and being the owner of this claim of existing water right know the contents of this amendment and that the matters and things stated there are true and correct. *(Only one current owner of the right as listed in the DNRC centralized record system is required to sign, but all owners are encouraged to sign.)*

K. Lawrence Sauer — Signature — 9/15/99 — Date

_____ — Signature — Date

Subscribed and sworn before me this 15 day of SEPTEMBER, 1999.

Brent A. M. Gann

(notary seal)

Residing at Billings, MT.

My commission expires July 28, 2003

/11/01 42KJ-W-163867-00

D.N.R.C.

* * * * * * * * * * * * * * * * * REVIEW ABSTRACT * * * * * * * * * * * * * * * * *

coding

WATER RIGHT NUMBER 42KJ-W-163867-00

OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
ENVIRONMENTAL SERVICES
PO BOX 201001
HELENA MT 59620-1001

*|PURPOSE (USE): INSTITUTIONAL

PU03 HIGHWAY REST AREA

SOURCE: WELL
SOURCE TYPE: GROUNDWATER

*|PRIORITY DATE: FEBRUARY 14, 1966
TYPE OF HISTORICAL RIGHT: FILED

FLOW RATE: 28.00 GPM

VOLUME: 5.00 AF

*|PERIOD OF USE: JANUARY 01 TO DECEMBER 31

*|POINTS OF DIVERSION AND MEANS OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
WL01			SWNENW	05	05N	36E	TR

WELL DATA: DEPTH 65 SWL 14 YLD 28 CSN 6.00

*|PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	CNTY
001			SWNENW	05	05N	36E	TR

GENERAL EXAMINATION REMARKS:

AM01 THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

UNPUBLISHED INFORMATION:
FEE RECEIVED $40.00
DATE RECEIVED APR 30, 1982

* * * * * * * * * * * * * * * * *

TEMPORARY PRELIMINARY DECREE
YELLOWSTONE RIVER BETWEEN BIGHORN AND TONGUE RIVERS
BASIN 42KJ
ABSTRACT OF WATER RIGHT CLAIM

WATER RIGHT NUMBER 42KJ-W-163867-00

IMPORTANT NOTICE

YOUR WATER RIGHT AS SHOWN ON THIS ABSTRACT MAY HAVE CHANGES FROM YOUR WATER RIGHT AS CLAIMED OR AMENDED. AN ASTERISK (*) HAS BEEN PLACED NEXT TO EACH ITEM CHANGED BY THE DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION (DNRC) DURING THE EXAMINATION PROCESS. THESE CHANGES ARE AUTHORIZED BY THE MONTANA WATER COURT OR THE WATER RIGHT CLAIM EXAMINATION RULES AS ADOPTED BY THE MONTANA SUPREME COURT.

OBJECTIONS MAY BE FILED ACCORDING TO THE PROCEDURES OUTLINED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

OWNERS: MONTANA, STATE OF DEPT OF TRANSPORTATION
ENVIRONMENTAL SERVICES
PO BOX 201001
HELENA MT 59620-1001

* PURPOSE (USE): INSTITUTIONAL

HIGHWAY REST AREA

SOURCE: WELL
SOURCE TYPE: GROUNDWATER

* PRIORITY DATE: FEBRUARY 14, 1966
TYPE OF HISTORICAL RIGHT: FILED

FLOW RATE: 28.00 GPM (.06 CFS)

VOLUME: 5.00 AF

* PERIOD OF USE: JANUARY 01 TO DECEMBER 31

* POINT OF DIVERSION:

	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
01			SWNENW	05	05N	36E	TREASURE

* PLACE OF USE FOR INSTITUTIONAL:

ACRES	LOT	BLK	QTR SEC	SEC	TWP	RGE	COUNTY
001			SWNENW	05	05N	36E	TREASURE

REMARKS:

THE PERIOD OF USE WAS AMENDED BY THE CLAIMANT ON 09/16/99.

****
* THE DNRC EXAMINATION OF THIS CLAIM FOUND NO SIGNIFICANT FACTS, *
* DATA, OR ISSUES TO REPORT TO THE WATER COURT. *
****

FILMED

TEMPORARY PRELIMINARY DECREE
YELLOWSTONE RIVER BETWEEN BIGHORN AND TONGUE RIVERS
BASIN 42KJ
ABSTRACT OF WATER RIGHT CLAIM

WATER RIGHT NUMBER 42KJ-W-163867-00 (CONTINUED)

A BETTER UNDERSTANDING OF YOUR CLAIMED WATER RIGHT CAN BE OBTAINED BY COMPARING YOUR RIGHT WITH OTHER CLAIMS IN THE BASIN. FOR EXAMPLE, COMPARE PRIORITY DATES, FLOW RATES, VOLUMES, OR ACRES IRRIGATED. ALSO, YOUR WATER RIGHT MAY BE SUBJECT TO WATER RIGHTS IN ADJOINING BASINS OR SUBBASINS AS WELL AS BEING SUBJECT TO OTHER RIGHTS ON YOUR SOURCE OF SUPPLY. FINALLY, YOUR WATER RIGHT MAY BE SUBJECT TO INDIAN RESERVED AND FEDERAL RESERVED WATER RIGHTS.

COMPLETE DETAILS REGARDING THE DNRC EXAMINATION RESULTS AND RELATED MATERIALS CAN BE REVIEWED AT THE OFFICE LOCATIONS IDENTIFIED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY."

SEE GENERAL FINDINGS OF FACT AND CONCLUSIONS OF LAW FOR FURTHER EXPLANATION OF YOUR CLAIMED WATER RIGHT. THESE FINDINGS CAN BE FOUND AS INDICATED IN THE DOCUMENT ENTITLED "NOTICE OF ENTRY OF TEMPORARY PRELIMINARY DECREE AND NOTICE OF AVAILABILITY." IF YOU NEED OBJECTION FORMS, OR HAVE QUESTIONS ABOUT WATER COURT PROCEDURES OR CHANGES TO YOUR RIGHT, YOU CAN CONTACT THE WATER COURT BY CALLING 1-800-624-3270 (WITHIN MONTANA ONLY) OR 1-406-586-4364, OR BY WRITING TO P.O. BOX 1389, BOZEMAN MT 59771-1389.

FILMED

DNRC Water Right Query System

Water Right	A	WR Type	Status	Purpose	Priority Date yyyymmdd (hhmm)	Src	Src Name	Means of Diversion	Owner	Flow Rate	Volume	Acres	Doc Image	Div Count & map	Use Count & map	Irr Count & map	Res Count & map	Issue Remarks
42KJ 163867 00	A	STATEMENT OF CLAIM	ACTV	INSTITUTIONAL	19660214	G	GROUNDWATER	WELL	MONTANA, STATE OF DEPT OF TRANSPORTATION	28.00 GPM	5.00		View	1	1			
42KJ 163868 00	A	STATEMENT OF CLAIM	ACTV	INSTITUTIONAL	19660214	G	GROUNDWATER	WELL	MONTANA, STATE OF DEPT OF TRANSPORTATION	16.00 GPM	2.00		View	1	1			
42KJ 41852 00	A	STATEMENT OF CLAIM	ACTV	STOCK	19811030	G	GROUNDWATER	WELL	NIX RANCH INC	5.00 GPM			View	1	1			
42KJ 67212 00	A	PROVISIONAL PERMIT	ACTV	IRRIGATION	19880331912	S	BOX ELDER CREEK	PUMP	MONTANA, STATE OF DEPT OF TRANSPORTATION	40.00 GPM	1.00	6	View	1	2	2		

APPENDIX N:

DNRC Sage Grouse Approval

RECEIVED
JUN 10 2016
ENVIRONMENTAL

MONTANA SAGE GROUSE HABITAT CONSERVATION PROGRAM

STEVE BULLOCK, GOVERNOR
1625 ELEVENTH AVENUE
STATE OF MONTANA
PHONE: (406) 444-0554
FAX: (406) 444-6721
PO BOX 201601
HELENA, MONTANA 59620-1601

Project No. 1464032072204
Governor's Executive Orders 12-2015 and 21-2015
Hysham Rest Area

Susan Lenard
2701 Prospect Avenue
P. O. Box 200701
Helena, MT 59620

June 7, 2016

Dear Ms. Lenard,

The Montana Sage Grouse Habitat Conservation Program received a request for consultation and review of your project or proposed activity on May 23, 2016 with spatial data received on June 2, 2016. Based on the information provided, all or a portion of this project is located within General Habitat for sage grouse.

Executive Orders 12-2015 and 21-2015 set forth Montana's Sage Grouse Conservation Strategy. Montana's goal is to maintain viable sage grouse populations and conserve habitat so that Montana maintains flexibility to manage our own lands, our wildlife, and our economy and a listing under the federal Endangered Species Act is not warranted in the future.

The program has completed its review, including:

Project Description:

Project Type: Building
Project Disturbance: 13.6 Acres
Time Frame: Summer 2016

Project Location:

Legal: Township 5 North, Range 36 East, Section 5
County: Treasure
Ownership: Private

Executive Orders 12-2015 and 21-2015 Consistency:

The project proposes to reconstruct the existing eastbound and westbound Hysham rest areas on Interstate Highway 94 in designated General Habitat for sage grouse. The construction will occur within existing easements.

Based on the information you provided, your project is not within two miles of an active sage grouse lek.

Recommendations:

Weed management is required within General Habitat for sage grouse. Reclamation of disturbed areas must include control of noxious weeds and invasive plant species, including cheatgrass (*Bromus tectorum*) and Japanese brome (*Bromus japonicas*).

Your activities are consistent with the Montana Sage Grouse Conservation Strategy. Your proposed project or activity may need to obtain additional permits or authorization from other Montana state agencies or possibly federal agencies. They are very likely to request a copy of this consultation letter, so please retain it for your records.

Please be aware that if the location or boundaries of your proposed project or activity change in the future, or if new activities are proposed within one of the designated sage grouse habitat areas, please visit https://sagegrouse.mt.gov/projects/ and submit the new information.

Thanks for your interest in sage grouse and your commitment to taking the steps necessary to ensure Montana's Sage Grouse Conservation Strategy is successful.

Sincerely,

Carolyn Sime

Carolyn Sime
Montana Sage Grouse Habitat Conservation Program Manager