Town of Stanford
Public Water System
PWS ID # MT0000334

Source Water Delineation and Assessment Report

Report Date: 03/29/2004
Revised Date: 12/17/2012

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EXECUTIVE SUMMARY

Stanford is located in the central portion of Judith Basin County in Montana near State Highway 87 approximately 60 miles southeast of Great Falls and 45 miles northwest of Lewistown.

The Town of Stanford obtains its drinking water from a community public water system (PWS). Approximately 540 Stanford residents receive water through 268 service connections supplied by five groundwater wells as shown in Figure 1. Wells #9 New and #10 New are used year round. New Tower Well #1, Sundown Well #3 and Railroad Well #4 are used during the summer months to supplement the water supply. All of the wells are treated with sodium hypochlorite at the source before entering the distribution system. Water not immediately used in the distribution system is pumped to a 90,000 gallon elevated steel storage tank located near the former Artesian Well #5 and Tower Well #1

The Stanford municipal sewer district services the areas within the town limits and municipal wastewater is discharged to a sewage treatment lagoon located east of town. Stanford has a discharge permit and occasionally releases treated wastewater effluent to Skull Creek, a tributary to Wolf Creek. Residents in areas outside of the town limits utilize individual on-site septic systems for waste disposal.

Stanford is located in the Judith Basin which is generally a topographic depression in the non-glaciated central region of the state (Heath, 1984). The town of Stanford sits between Wolf Creek and the Judith River, both of which are tributaries to the Missouri River. The Judith Basin hydrologic unit covers 2,780 square miles in primarily Judith Basin and Fergus counties. It includes the Judith River and its tributaries from its origination along the mountain ranges to its confluence with the Missouri River.

The aquifer (Colorado Formation) that supplies water to the Stanford PWS wells is generally confined in the Stanford area. Based on SWPP criteria this aquifer would have a low sensitivity to potential contaminant sources. Groundwater flow direction in the vicinity of the wells is generally towards the northeast. Recharge to the wells is likely from infiltration of precipitation and stream flow in the mountainous areas surrounding the basin and in areas where the formations outcrop.

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). Source water protection areas delineated for Town of Stanford PWS include 100-foot controls zones for each well, an inventory region, and a recharge region. The most predominant potential contaminant sources in the Stanford Inventory Region are underground fuel storage tanks (USTs), leaking USTs, cultivated cropland, and transportation routes.

INTRODUCTION

This Source Water Delineation and Assessment Report (SWDAR) was prepared for the Town of Stanford Public Water Supply, PWS ID# MT0000334, located in Judith Basin County. It was originally completed by Julie Harvey with the Source Water Protection Program at the Montana Department of Environmental Quality. Carolyn DeMartino, also with the Source Water Protection Program revised this SWDAR.

Purpose

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Town of Stanford Public Water System (PWS) as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (Public Law 104-182). The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is "delineation and assessment." Delineation is a process whereby areas that contribute water to aquifers or surface water bodies that are used to supply drinking water are identified on a map. These areas are called source water protection areas. Assessment involves identifying locations in the delineated areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of this source water delineation and assessment report is to provide information that helps Town of Stanford protect its drinking water sources.

Limitations

This report was prepared to assess threats to the Town of Stanford PWS, and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the Town of Stanford public water supply and not to any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area of the Town of Stanford public water supply are identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered.

The term "contaminant" is used in this report to refer to constituents for which maximum concentration levels (MCLs) have been specified under the national primary drinking water standards, and to certain constituents that do not have MCLs but are considered to potentially represent health threats.

CHAPTER 1
BACKGROUND

The Community

Stanford is located in the central portion of Judith Basin County near State Highway 87 approximately 60 miles southeast of Great Falls and 45 miles northwest of Lewistown (Figure 1). State Highway 87 borders the town to the west and the Burlington Northern/Santa Fe Railroad boarders the town to the east. State Highway 80 runs north of town and continues through town on 3rd Street West. The U.S. Census Bureau estimates the 2010 population of Judith Basin County at 2,072 people with approximately 540 of these people residing in Stanford (http://factfinder.census.gov). The Town of Stanford obtains its drinking water from a community public water system (PWS) supplied by five groundwater wells as shown in Figure 1. The Stanford municipal sewer district services the areas within the town limits and municipal wastewater is discharged to a sewage treatment lagoon located east of town. Stanford has a discharge permit and occasionally releases treated wastewater effluent to Skull Creek, a tributary to Wolf Creek. Residents in areas outside of the town limits utilize individual on-site septic systems for waste disposal.

Geographic Setting

Stanford is located in the Judith Basin which is generally a topographic depression in the non-glaciated central region of the state (Heath, 1984). The Little Belt, Big Snowy, Judith, Moccasin, and Highwood Mountains rise to elevations of about 9,000 feet and enclose Judith Basin. Stanford's elevation of approximately 4,284 feet is typical of the valley area between the mountain ranges, which has elevations of 3,500 to 6,000 feet above sea level. The town of Stanford sits between Wolf Creek and the Judith River, both of which are tributaries to the Missouri River. The Town of Stanford is located in the Judith watershed, U.S. Geological Survey (USGS) hydrologic unit code (HUC) Number 10040103, which is located within the Lower Missouri River Watershed Management Region for Montana. The Judith Basin hydrologic unit covers 2,780 square miles in primarily Judith Basin and Fergus counties. It includes the Judith River and its tributaries from its origination along the mountain ranges to its confluence with the Missouri River.

General Description of the Source Water

The Town of Stanford water system currently uses five wells that are located throughout town (Figure 1). Wells 9 and 10, brought on line in 2005, are the primary sources of water for Stanford. Wells 1, 3, and 4 are used primarily during the summer months to supplement the water supply. Copies of the well logs are located in Appendix A. The aquifer supplying water to the Stanford PWS wells is generally confined in the Stanford area. Groundwater flow direction in the vicinity of the wells is generally towards the northeast. Recharge to the wells is likely from infiltration of precipitation and stream flow in the mountainous areas surrounding the basin and in areas where the formations outcrop. Table 1 contains a summary of well information obtained from the well logs for each well. Additional detail on the geology and hydrogeology of the area is provided in Chapter 2.

Figure 1. Vicinity Map and PWS Well Locations

Table 1. Well Information Summary

	Well #9 New	Well #10 New	New Tower Well #1	Sundown Well #3	Railroad Well #4
PWS Source Code	WL008	WL009	WL003	WL005	WL004
PWS Database Description	Well #9 New	Well #10 New	Well 1 1979 New Tower SW leg	Well 3 1981 Sundown N	Well 4 1941 Railroad S
Well Location	T16N, R12E Sec 17 DA	T16N, R12E Sec 17 DAAA	T16N, R12E Sec 17 DAAA	T16N, R12E Sec 17 ADCB	T16N, R12E Sec 16 BDBC
Latitude	47.1495	47.1487	47.1492	47.1514	47.1519
Longitude	-110.2266	-110.2250	-110.2219	-110.2269	-110.2152
MBMG GWIC #*	217357	----	28232	28228	28213
Water Right #	----	----	C023674-00	C035928-00	W141205-00
Date Completed	11/15/2004	11/12/2004	1979	1981	1941
Total Depth (feet)	130	200	210	203	193
Borehole Size (inches) / Interval (feet)	14/ 0 - 44 12/ 44 - 118 8/ 118-130	14.5/ 0 - 33 12/ 33-110 8/ 110 - 200	6 / 0 - 210	6/ 0 - 203	Unknown
Casing Diameter (inches)	8	8 6	4	4 4	12
Casing Type	Steel	Steel Steel	PVC	Steel PVC	Stee1
Casing Footage (feet)	-2 to 118 ft	+2 – 110 90 - 175	0 - 210	0-12 12-203	0 - 172
Static Water Level When drilled (feet)	40	38	5	24	84
Pumping Water Level (feet)	40	137	160	80	170
Test Pumping Rate When Drilled (gpm)	100	23	35	60	25
Geologic Formation	Not Reported	Not Reported	Colorado Formation	Not Reported (probably Telegraph Creek Fm.)	Telegraph Creek Formation
Annular Seal (feet)	Cement 0-118	Cement 0-33	Cement Grout 0-30	Rubber 0 – 0 Cement 0-70	Unknown
Screened Interval (feet)	118 - 128	175 - 195	30-40 55-210	78-203	Open hole 172-193
Notes	Used daily	Used daily	Seasonal use only	Seasonal use only	Seasonal use only

* MBMG GWIC # - Well identification number assigned by Montana Bureau of Mines and Geology Ground-Water Information Center

The Public Water Supply

Information concerning the Stanford PWS was obtained from the DEQ Public Water Supply Section files, including sanitary surveys completed on May 30, 2007 and February 2, 2010. Additional information was obtained from personal communication with the PWS operator. The sanitary surveys indicate that water system is generally well maintained and efficiently operated and no deficiencies were noted.

Stanford's PWS serves a total population of 540 people through 268 service connections (DEQ SDWIS, 2012). The PWS is currently supplied by five active wells. Wells #9 New and #10 New are used year round. New Tower Well #1, Sundown Well #3 and Railroad Well #4 are used during the summer months to supplement the water supply. All of the wells are treated with sodium hypochlorite at the source before entering the distribution system. Water not immediately used in the distribution system is pumped to a 90,000 gallon elevated steel storage tank located near the former Artesian Well #5 and Tower Well #1.

Based on the depth of the wells, the regional geology, and the confined nature of the aquifer, it is unlikely that the source water is in hydraulic connection with surface water.

The Public Sewer System

The Stanford wastewater collection system was originally installed in the early 1900's. There are 24,700 lineal feet of sewer line, of which 7,700 lineal feet were replaced as part of the 2002 upgrade (O&M Manual). The Stanford WWTF consists of a three-cell facultative lagoon system. The system replaced the existing six-acre cell in 2002. Untreated wastewater flows through a 10" line by gravity from the Stanford collection system, to the bypass control structure in the southwestern corner of Primary Pond One. Typically the wastewater flows through the three cells in series, but the first two cells can be operated in parallel. All three ponds are lined with polyvinyl chloride (PVC) liners and clay. Treated wastewater is discharged from the third pond through the lagoon multi-level draw-off structure. Effluent flow is measured via a 3" Parshall flume with float located within this structure. The effluent is discharged through a 12" pipe into an unnamed reservoir on Skull Creek, which is created by a privately-owned dam located on Skull Creek immediately northeast of the property.

The WWTF system was designed to serve 586 residents, but it currently serves approximately 540 residents. The facility is classified as a minor POTW. The facility was designed as a continuously discharging lagoon with an average design flow of 0.074 million gallons per day (mgd). However, the facility is operated in a batch mode (i.e., only periodically discharged). During the five year Period of Record (POR), discharge occurred during one or two months per year, typically in the July and August time frame. The average daily flow rate when discharging was 0.10 mgd, in excess of the average design flow.

Water Quality

PWS Water Quality Monitoring Results

Every PWS is required to perform monitoring for contamination at their water supply. The monitoring constituents include coliform and other signs of pathogenic organisms, nitrates, metals and multiple organic chemicals. The monitoring schedule depends on many factors such as the size and source water for a PWS, the number of sources (e.g. wells), and the population served. Each PWS has a specific monitoring schedule tailored to their system that follows the general protocols for operation of a PWS defined by DEQ.

Within the past five years the water system has had numerous monitoring violations for failure to monitor for: chlorine residuals, nitrate, volatile organic chemicals, and radionuclides. Within the past five years there have also been reporting violations for failure to comply with the Consumer Confidence Rule. As of December 2012, it appears that the PWS has not achieved compliance with the Groundwater Rule.

Within the past five years there have been no detections of Coliform bacteria in any of the Stanford wells. Nitrate concentrations in this timeframe have ranged from less than the method reporting level to 0.08 milligrams per liter (mg/L). These detections are well below the EPA established MCL for nitrate of 10 mg/L.

Other compounds detected in Town of Stanford's source water or distribution system monitoring include low levels of fluoride, sulfate, and trace volatile organic compounds including bromodichloromethane, bromomethane, and chloroform. Where established, detections of these compounds are all below EPA MCLs.

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to the Town of Stanford PWS is identified in this chapter. Three management areas are identified within the source water protection area. These three regions, the control zone, inventory region, and recharge region, are delineated for the wells. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around each well. The inventory region represents the zone of contribution of the well, which typically approximates a three-year groundwater time-of-travel. Analytical equations describing groundwater flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping are used to calculate groundwater time-of-travel distance. The recharge region represents the area where the source aquifer for the Town of Stanford water system wells is replenished.

General Geologic and Hydrogeologic Setting

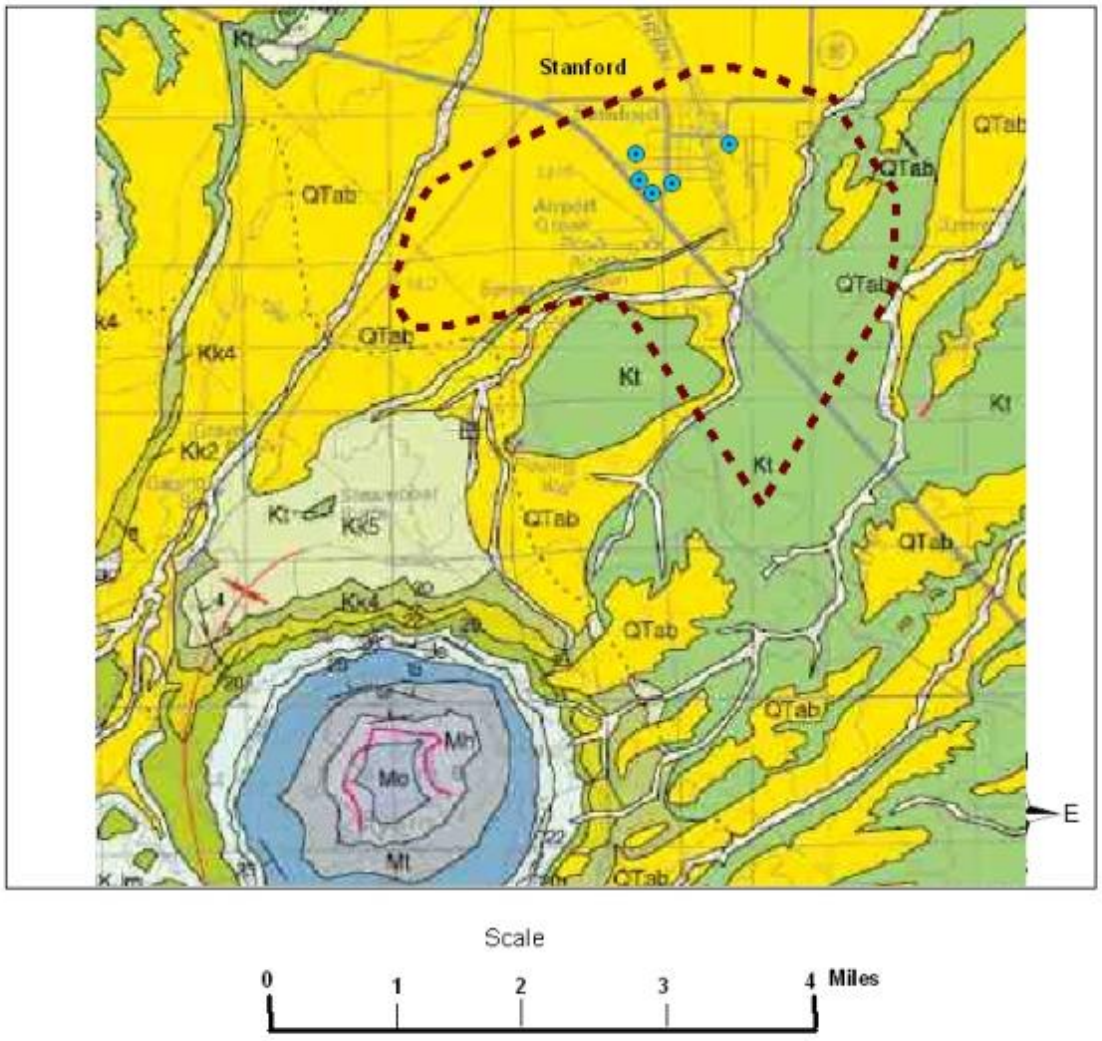
This section provides an overview of the geology and hydrology of the vicinity of Town of Stanford and is primarily based on reports regarding the geology and groundwater resources of the Judith Basin (Vine, 1956; Zimmerman, 1966; Fetis, 1980; and Vuke et.al., 1995), information provided by Town of Stanford in their PWS-6 report for the proposed wells (Entranco, 2003), the most recent sanitary survey (May 2010), and regional well logs available from the Montana Bureau of Mines and Geology (MBMG) Ground-Water Information Center (GWIC). A regional geologic map is provided in Figure 2. The geology of the area can be used to determine the locations, boundaries, and hydraulic properties of local aquifers. An understanding of hydrogeologic conditions also provides an explanation for the sensitivity of local aquifers to potential contaminant sources.

The subsurface in the Judith Basin consists of over 8,000 feet of sandstone, siltstone, shale, limestone and dolomite (Fetis, 1980). These rocks are exposed at the surface in the mountains and dip into the basin. In the Stanford area the surface geology of consists of Tertiary/Quaternary aged alluvium composed of containing gravel, sand and silt. Based on the logs for the Stanford PWS wells, the alluvium is approximately 30 to 40 feet deep. Underlying the alluvium is the lower portion of the Colorado Group Formation (primarily the Thermopolis Shale, Bootlegger Member, and Mowery Formation) which consists of dark gray marine shale with sandstone layers and thin bentonite beds. Two relatively thick water-bearing sandstone beds exist near the middle to bottom of the formation at a depth of approximately 150 to 300 feet in the Stanford area (as reported in the Entranco PWS-6 report (2003) based on a Maxim, 2000 report on Geology and Well Construction for Town of Stanford).

PWS Well Information

The Town of Stanford water is currently supplied by five active wells. Copies of the well logs showing stratigraphy and well construction information are included in Appendix A. The well information is also summarized in Table 1.

Figure 2. Regional Geology of the Stanford Area



The active wells range from 130 to 200 feet deep and are screened through the sandstone and shale layers of the Colorado Group Formation. The Colorado Group Formation aquifer is generally confined in the Stanford; however, unsealed wells or boreholes may provide a conduit for potential contaminants from the surface to migrate to the aquifer through the confining layers. Groundwater flow direction in the vicinity of the wells is generally towards the northeast based on a potentiometric map of shallow wells completed by Maxim Technologies (2000; as presented in the Entranco PWS-6 report (2003)). Recharge to the wells is likely from infiltration of precipitation and stream water in areas where the Colorado Formation is exposed at the surface upgradient (south and west) of the wells.

Conceptual Model and Assumptions

Stanford's production wells are located in the Judith Watershed (USGS Hydrologic Unit Code 10040103) which is located within the Lower Missouri River Watershed Management Region for Montana. The primary source of Town of Stanford's drinking water is the sandstone and shale layers of the Colorado Group Formation. The Colorado Formation aquifer is confined. However, unsealed wells or boreholes may provide a conduit for potential contaminants from the surface to migrate to the aquifer through the confining layers. Groundwater flow direction in the aquifer in the vicinity of the wells is northeastward. Recharge to the wells is likely from infiltration of precipitation and surface water into the Colorado Formation where this formation outcrops upgradient of the wells.

Using DEQ Source Water Protection Program criteria (1999) for ranking aquifer sensitivity (Table 2), the Town of Stanford source water is considered as having **Low Source Water Sensitivity** to contamination because the aquifer is confined. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

Table 2. Source Water (Aquifer) Sensitivity Criteria

High Source Water Sensitivity	Moderate Source Water Sensitivity	Low Source Water Sensitivity
• Surface water and GWUDISW • **Unconsolidated Alluvium (unconfined)** • Fluvial-Glacial Gravel • Terrace and Pediment Gravel • Shallow Fractured or Carbonate Bedrock	• Semi-consolidated Valley Fill sediments (semi-confined) • Unconsolidated Alluvium (semi-confined)	• Consolidated Sandstone Bedrock • Deep Fractured or Carbonate Bedrock • Semi-consolidated • **Confined Aquifers**

Delineation

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). Source water protection areas delineated for Town of Stanford PWS include controls zones for each well, an inventory region and a recharge region. The delineated management zones for the wells are depicted in Figure 3.

Control Zone - 100-foot radius control zones are delineated for Town of Stanford's wells. All sources of potential contaminants should be excluded in this region.

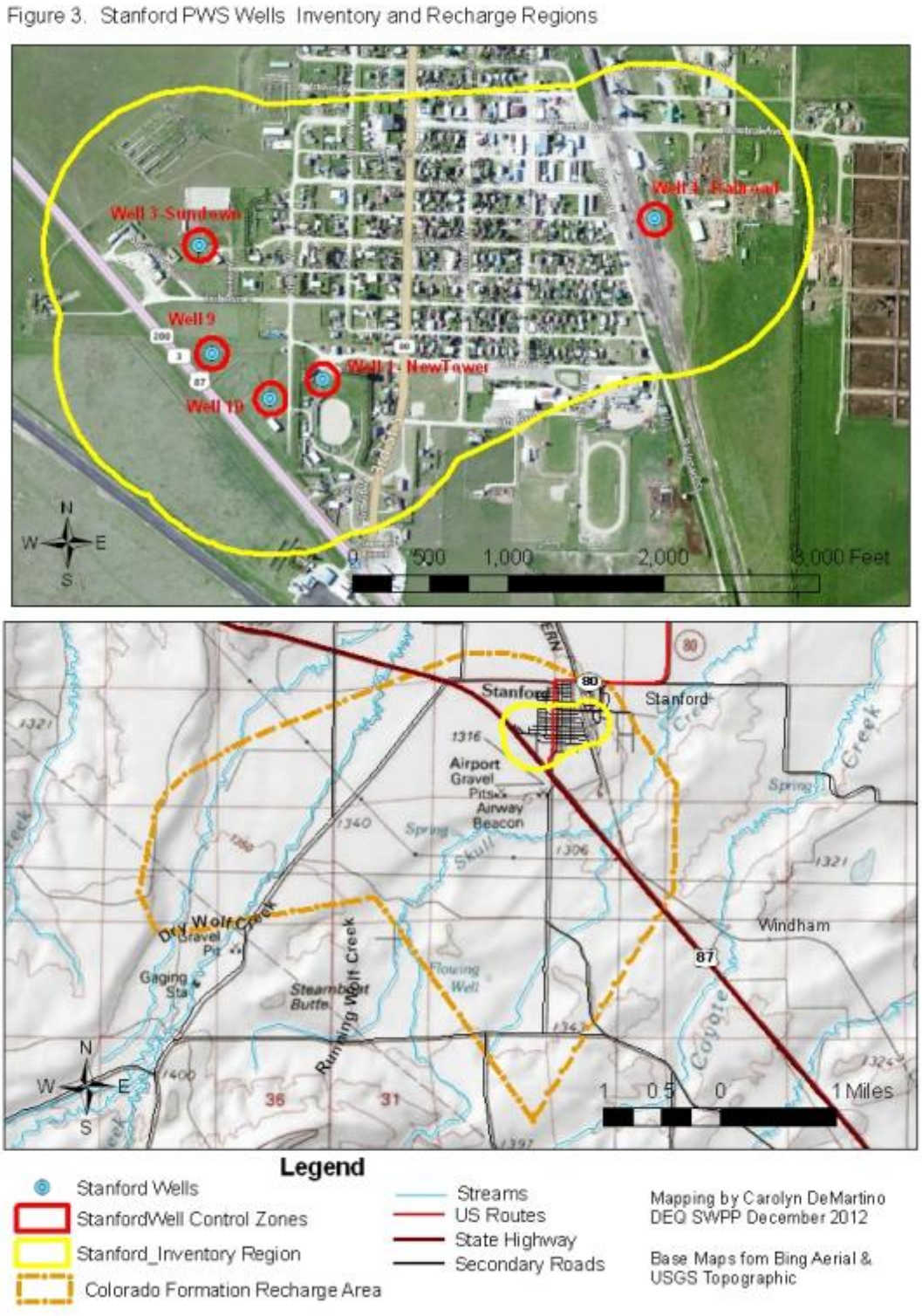
Inventory Region - The inventory zone for wells in a confined aquifer is delineated as a 1000-foot fixed radius circle around each well. Since the wells completed in the Colorado Formation are in close proximity, the fixed radius circles were combined into a single Inventory Region as shown on Figure 3. All sources of potential contaminants are inventoried in this region.

Recharge Region – On a broad scale, the aquifer receives recharge from the Colorado Formation where it outcrops southwest of the Stanford PWS wells as shown on Figures 2 and 3. Efforts to maintain and improve water quality within these land areas will benefit the Stanford PWS and other groundwater users in the area. The inventory for the recharge region focuses on general land uses and large industrial facilities. The goal of management in the recharge region is to maintain and improve the long-term quality of groundwater in the aquifer.

Limiting Factors

Delineation of the source water protection areas for the Town of Stanford PWS wells is based on published reports and the lithology indicated on the well logs. The total amount of recharge to the system from infiltration and streams is unknown and can vary seasonally.

Figure 3. Inventory and Recharge Region



CHAPTER 3
INVENTORY

Inventory Method

An inventory of significant potential contaminant sources was conducted to assess the susceptibility of Town of Stanford's wells to contamination and to provide a foundation for source water protection planning. The inventory for Town of Stanford focuses on facilities that generate, use, or store potential contaminants and certain land uses in the inventory region delineated in the previous section. Sources of all primary drinking water contaminants and pathogens are identified, although only potential sources of contaminants that are the greatest threat to human health were selected for detailed inventory.

It is important to remember that the sites and areas identified in this section are only potential sources of contamination to the drinking water. Contamination of the drinking water is not likely to occur when potential contaminants are properly used and managed. Not all of these inventoried activities pose actual high risks to your public water supply. The day-to-day operating practices and contamination awareness varies considerably from one facility or land use activity to another.

The inventory for the Town of Stanford PWS focuses on all activities in the control zones for the wells; certain types of municipal and private facilities or land uses in the inventory region; and general land uses and large facilities in the Recharge Region. Databases were searched to identify businesses and land uses that are potential sources of regulated contaminants. The process for completing the inventory included several steps, which are summarized as follows:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System (http://nris.state.mt.us/gis/datalist.html). Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from municipal wastewater utilities.

Step 2: EPA's Envirofacts System (http://www.epa.gov/enviro/) was queried to identify EPA regulated facilities located in the inventory region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) and the Permit Compliance System (PCS - for Concentrated Animal Feeding Operations with MPDES permits). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: Databases were queried to identify the following in the inventory region:

- Underground Storage Tanks (UST) (http://www.deq.state.mt.us/Rem/tsb/iss/USTDownloads.asp),
- Hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau),
- Landfills (http://nris.state.mt.us/gis/datalist.html), and
- Abandoned and active mines including gravel pits (http://nris.state.mt.us/gis/datalist.html)

Any information on past releases and present compliance status was noted.

Step 4: Major road and rail transportation routes were identified throughout the inventory region (http://nris.state.mt.us/gis/datalist.html).

Step 5: Public water system officials, or someone they designated as knowledgeable of the area, were interviewed to identify potential sources that are not listed in databases or on maps

elsewhere (such as animal feeding operations that are not required to obtain a permit) and to assist in locating potential sources listed in the state and federal databases.

Step 6: Significant potential contaminant sources were identified in the control zone and inventory region and land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region

Potential contaminant sources are designated as significant if they fall into one of the following categories:

- Large quantity hazardous waste generators.
- Landfills.
- Underground storage tanks.
- Known groundwater contamination (including open or closed hazardous waste sites, state or federal superfund sites, and UST leak sites).
- Underground injection wells.
- Major roads or rail transportation routes.
- Cultivated cropland greater than 20 % of the inventory region.
- Animal feeding operations.
- Wastewater treatment facilities, sludge handling sites, or land application areas.
- Septic systems.
- Sewer mains.
- Storm sewer outflows.
- Abandoned or active mines

Inventory Results / Control Zone

The PWS well control zones include the building housing (pump houses) and portions of streets and adjacent residential lots. The adjacent areas are connected to the city sewer system but the PWS operator indicates that sewer mains are not located within 100 feet of the wells. No potential sources of contamination were identified within the control zones.

Inventory Results / Inventory Regions

The inventory results for Stanford's source water are summarized in Table 3.
Land use within the inventory region for the Stanford PWS wells is predominantly low intensity developed land (Town of Stanford) and hay/ pasture land. Alfalfa and some small grains including winter wheat are also grown within the inventory region. U.S. Routes 80 and 87 and Montana Highway 200 are also located in the inventory region (Figure 4).

City sewer mains underlie most of the inventory region. area for both aquifers and are assigned a high hazard in accordance with the Source Water Protection guidelines. Leaks from the sewer mains can be the source of pathogens and nitrate. Storm water within the town runs off and no injection wells are known to be present.

The Burlington Northern/Santa Fe Railroad and State Highway 80 and 87 pass through the inventory region (Figure 5). There is a potential for spills along the transportation routes and for spraying of pesticides and herbicides. The hazard posed by the railroad and highway is considered as high.

Several local businesses/facilities in the area may be potential contaminant sources based on their potential to use or generate hazardous chemicals in the area. The PWS operator should verify if these businesses are within the inventory regions. The most likely potential contaminants in the inventory region from area businesses are VOCs (volatile organic compounds such as fuels and petroleum products), SOCs (synthetic organic compounds such as fertilizers, pesticides, and herbicides), microbial contaminants, and nitrate.

Table 3. Summary of Potential Contaminant Sources in the Inventory Region

Source Type	Potential Contaminants	Description/Concern
Municipal Sewer	Pathogens and nitrates	If not properly designed, installed, and maintained, sewer lines can be a point source of residential and commercial effluent in groundwater.
Agricultural Land Use	Pathogens, nitrates, pesticides and herbicides	Over-application or improper handling of pesticides or fertilizers may impact drinking water. Excessive irrigation may cause transport of contaminants or sediments to groundwater. Drip-irrigated or non-irrigated crops are considered to be a lower risk.
General Mills of Stanford (RCRA Generator – status is currently inactive)	Various Chemicals	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply.
USTs	VOCs, petroleum hydrocarbons	Spills or improper handling during tank filling or product distribution may impact the drinking water supply.
Leaking USTs	VOCs, petroleum hydrocarbons	Existing contamination from spills, leaks, or improper handling of stored materials may impact the drinking water supply.
Commercial/ Industrial Business	Various chemicals	Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage and disposal may impact the drinking water supply
Highway 80 and Highway 87	Various chemicals	Vehicle usage increases the risks for leaks or spills of fuels and other hazardous materials that may impact drinking water. Over-application or improper handling of pesticides or fertilizers may impact the drinking water supply.
Burlington Northern Santa Fe Railroad	Various chemicals	Rail transport increases the risks for leaks or spills of fuels and other hazardous materials that may impact drinking water. Over-application or improper handling of pesticides adjacent to tracks may impact the drinking water supply.

Figure 4. Generalized Land Use in the Inventory Region

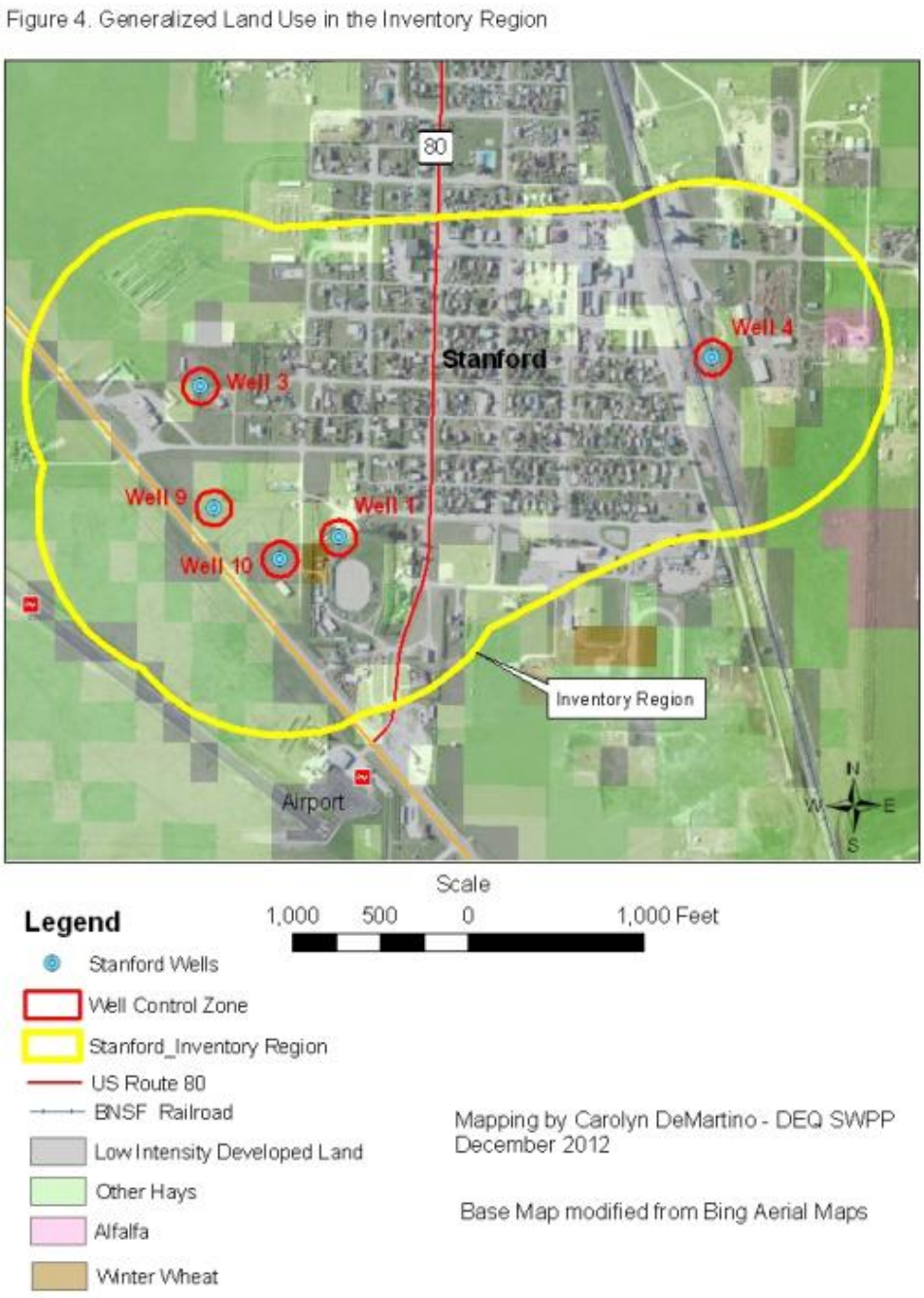
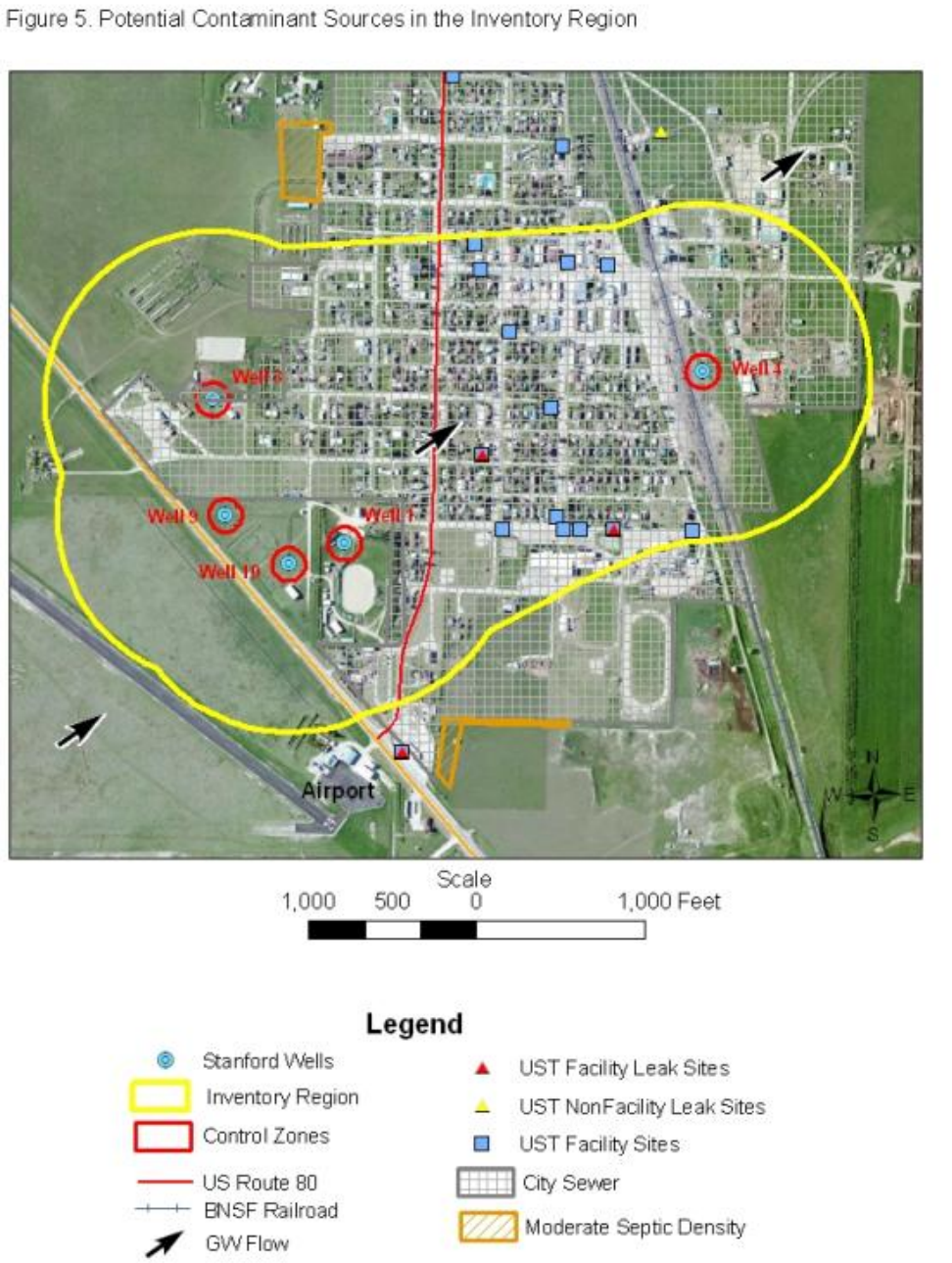


Figure 5. Potential Contaminant Sources in the Inventory Region



Multiple USTs and leaking USTs facilities were identified in Stanford. Spills or improper handling during tank filling or product distribution at these facilities may impact the drinking water supply. Based on a brief review of DEQ Remediation Division files, shallow groundwater contamination was only identified at the GW Sales Bulk Plant. The petroleum plume at the GW Sales Bulk Plant has not been fully delineated and existing contamination from spills, leaks, or improper handling of stored materials at this facility may impact the drinking water supply.

Inventory Results/ Recharge Region

Land use in the Colorado Formation recharge region is fairly evenly divided between pasture/hay (38%), small grains (28%) and grasslands/herbaceous (24%) with the remaining land being primarily commercial, residential, and transportation related (Figure 6). Over-application or improper handling of pesticides or fertilizers on agricultural lands could result in these compounds entering surface water and groundwater and impacting the drinking water supply. In pasture areas, animal wastes from concentrated livestock may impact the drinking water supply. The percentage of agricultural land in the Colorado Formation recharge region poses a moderate risk to groundwater. Septic system density within the Colorado recharge region is low and does not pose a risk to the water supply.

In addition to the above general land uses, other potential contaminant sources are located within the Colorado Formation recharge region (Figure 7).

- The Stanford Airport and the By-Way Service Station are located just outside of the inventory region within the recharge region for the Colorado Formation. The potential use, handling and storage of fuels, agricultural chemicals or other chemicals at these facilities can pose a high hazard to groundwater. The By-Way Service Station is also an inactive LUST site, the PWS should confirm that any leaks of fuels or other VOCs into the groundwater supply were properly remediated.
- The former Stanford Landfill is located in the Colorado Formation recharge area just over 1/2-mile southeast of the wells as shown on Figure 7. The landfill was closed in 1994 but may still pose a hazard to the water supply.
- The Cenex/Conoco crude oil pipelines traverse northwest to southeast through the Colorado Recharge Region. The hazard potential for spills posed by the pipeline is considered as high to moderate.

Inventory Update

To make this SWDAR a useful document for the years to come, the certified water system operator should update the inventory for his records every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ every five years to ensure the source water delineation and assessment remains current.

Inventory Limitations

The potential contaminant sources described above are identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. The use of multiple sources of information, however, should ensure that the major threats to the source water for Town of Stanford public water supply have been identified. The lack of identification of a potential contaminant source in the inventory or susceptibility assessment of this report does not mean that the potential for contamination does not exist or there is not a threat. It is highly recommended that the PWS and community “enhance” or refine the identification of the potential contaminant sources through further research and local input.

Figure 6.Land Use in the Recharge Region

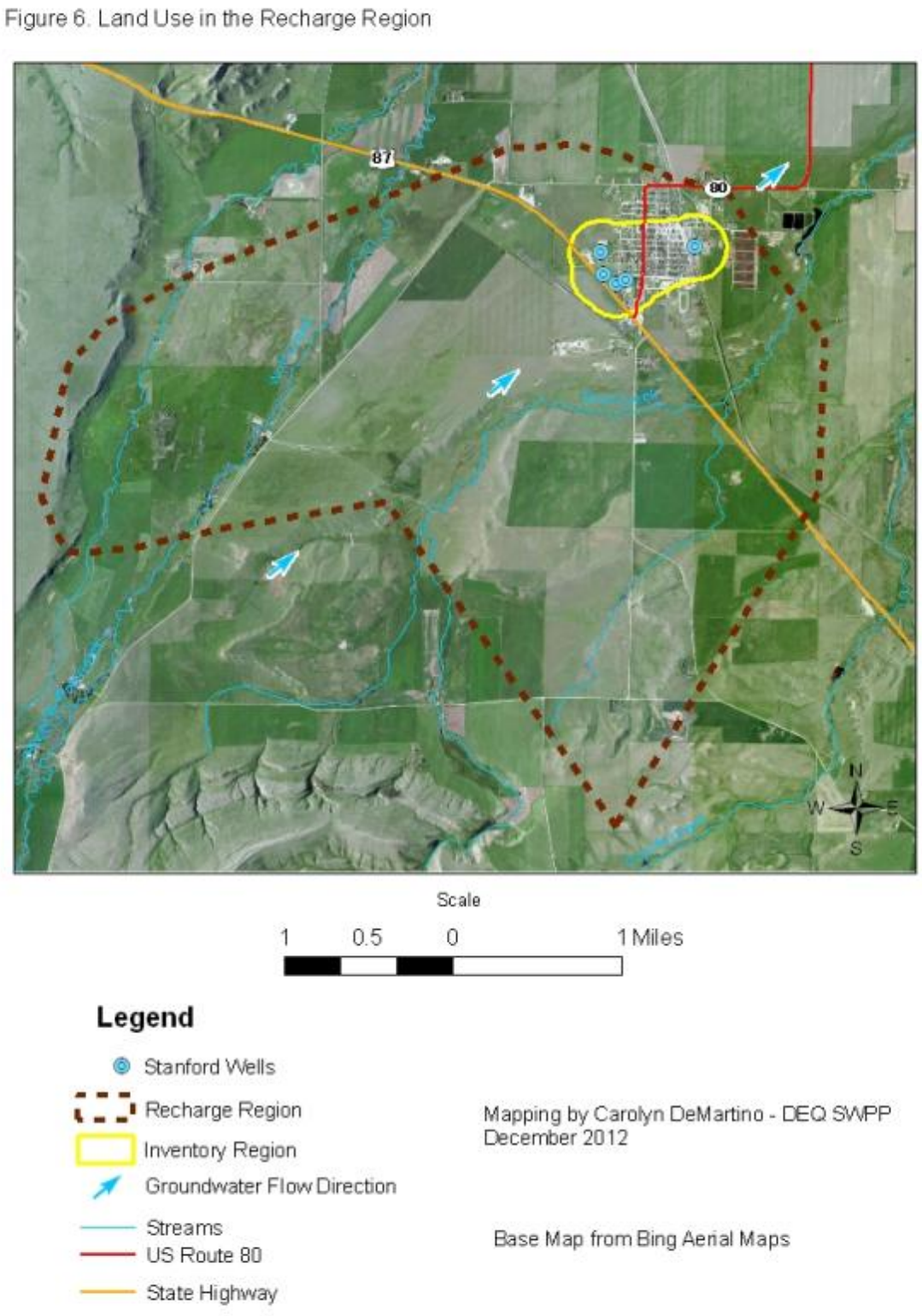
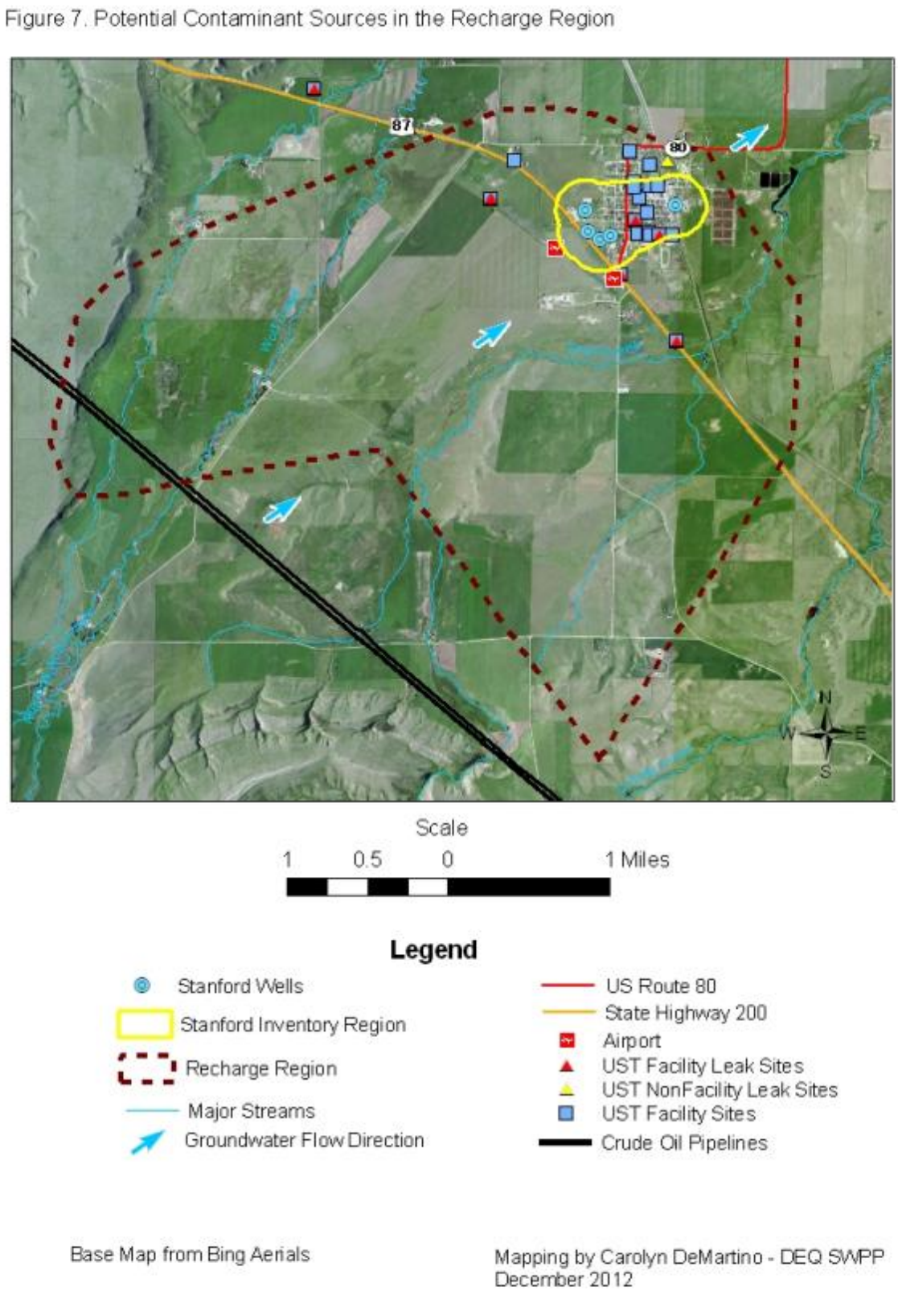


Figure 7. Potential Contaminant Sources in the Recharge Region



CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

General Discussion

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the Town of Stanford PWS managers and operators. The goal of Source Water Management is to protect the source water by 1) controlling activities in the Control Zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that major land use activities or other significant activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the PWS managers and operators to reduce susceptibility are recommended in this chapter.

Hazard Determination

The proximity of a potential contaminant source to a spring or well intake, potential contaminant migration pathways, or the density of potential non-point contaminant sources determines the threat of contamination, referred to here as hazard (Table 4). Hazard and the existence of barriers to contamination determine susceptibility, which is described in Table 6. Table 5 below describes the criteria to determine hazard within the Inventory Region as it was delineated in this SWDAR. Note that this table is specific to PWSs that draw their water from confined aquifers. The determination of hazard is somewhat different for other types of water sources.

Table 4. Hazard of Potential Contaminant Sources for Wells Drawing Water from Confined Aquifers

Potential Contaminant Sources within the Inventory Region	The PWS well is not sealed through the confining layer	Other wells in the inventory region are not sealed through the confining layer	All wells in the inventory region are sealed through the confining layer
Point Sources	**High**	Moderate	Low
Septic System Density (# per square mile)	High: > 300 Moderate: 50 to 300 **Low: < 50**	Moderate: > 300 Low: < 300	Low
Municipal or Community Sanitary Sewer (% land use)	**High >50** Moderate: 20 to 50 Low: < 20	Moderate: > 50 Low: < 50	Low
Cropland (% land use)	High: > 50 Moderate: 20 to 50 **Low: < 20**	Moderate: > 50 Low: < 50	Low

For information concerning well completion see Table 1 and Appendix A. If additional well completion information becomes available, the hazard and susceptibility ratings can be adjusted.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the Stanford PWS well intakes. First, hazard is rated by the proximity of a potential contaminant source to the well(s) and the quality of sealing through a confining unit above the well intake (from Table 5). Susceptibility ratings are then determined individually for each significant potential contaminant source and/or contaminant based on Table 6. These

susceptibility ratings are the evaluation of the vulnerability of wells to the more significant potential contaminant sources and are presented in Table 6.

Table 5. Susceptibility Based on Hazard and Barriers

Presence Of Barriers	Hazard		
	High	Moderate	Low
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

Discussion of Susceptibility

Because a contaminant source has not been identified in the inventory or susceptibility assessment of this report, it doesn't mean that the potential for contamination does not exist or is not a threat. It is highly recommended that the PWS and community "enhance" or refine the identification of the potential contamination sources through further research and local input.

Barriers to contamination can be anything that decreases the likelihood that contaminants will reach a spring or well. Barriers can be engineered structures, management actions, or natural conditions. Examples of engineered barriers are spill catchment structures for industrial facilities and leak detection for underground storage tanks. Emergency planning and best management practices (BMPs) are considered management barriers. Thick clay-rich soils, a deep water table or a thick saturated zone above the well intake can be natural barriers.

Table 7 includes the susceptibility assessment results for each significant potential contaminant source identified within the inventory region for the wells are described below. Sources located outside the Inventory region, but within the Recharge Regions may still pose a threat over time, but are not discussed in detail.

Table 6. Susceptibility Assessment of Significant Potential Contaminant Sources

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendation
Inventory Region						
Municipal Sewer	VOCs, SOCs, metals, pathogens, nitrates, others	Ongoing or catastrophic leakage of sewage into groundwater	**High:** Wells 3 and 4	Town has ongoing sewer line assessment and replacement plan	**High** for Wells 3 and 4.	Maintenance, rehabilitation, or replacement of existing sewer mains, use of sewer main liners, rapid response planning for leaks or ruptures.
Multiple businesses that may use hazardous materials	VOCs, SOCs and other chemicals	Spills and leaks impacting groundwater	**High:** Well 4 **Low:** Wells 1,3, 9 & 10	None	**Very High:** Well 4 **Moderate:** Wells 1,3, 9 & 10	Pollution prevention education; training in waste reduction, handling and recycling; regulatory oversight; promotion of good housekeeping. Schedule days for the collection of hazardous wastes from the public. Consider wellhead protection ordinance to restrict chemical use, handling and storage or to implement BMPs.
USTs	VOCs, petroleum hydrocarbons	Contaminants leaching into groundwater	**High:** Well 4 **Low:** Wells 1,3, 9 & 10	Compliance with 1998 upgrades Spill prevention Groundwater monitoring	**Moderate:** Well 4. **Very Low:** Wells 1,3, 9 & 10	Review permit status and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention, BMPs.
Leaking UST sites GW Sales Bulk Plant	VOCs, petroleum hydrocarbons	Existing contamination may impact the drinking water supply.	**High:** Well 4 **Low:** Wells 1,3, 9 & 10	None	**Very High:** 4 **Moderate:** Wells 1,3, 9 & 10	Review status and any permits or monitoring network to verify existing contamination is being properly removed or remediated.
Transportation Routes - State Highway 80 and 87 - BN/SF Railroad	Pesticides, fertilizers, VOCs, SOCs, others	Spills, routine spraying, storm water runoff, infiltration into groundwater	**High** for Wells #1, 3, 4, 9, & 10	County Emergency Response Plan, training and preparation of local response personnel	**High**: all wells	Emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry any spills away and prevent infiltration into ground, cooperation with railroad managers or MDOT to reduce herbicide use.
Former livestock handling facility	Nitrates, pathogens, VOCs, & SOCS	Historic manure placement, agricultural chemical use may impact the drinking water	**High:** Well 3 **Low:** Wells 1,3, 9 & 10	Cross-gradient groundwater flow	**High:** Well 3 **Low:** Wells 1,3, 9, & 10	Contact current landowner to determine status of former facility and what chemicals were historical used at this facility

Table 7. Susceptibility Assessment of Significant Potential Contaminant Sources (continued)

Class V Injection Wells	VOCs, SOCs, pathogens, nitrate	Infiltration of contaminants into aquifer	**Unknown**	County Emergency Response Plan, training and preparation of local response personnel	**Unknown**	- Encourage EPA to inventory the Stanford area -Support providing educational information, materials and resources to business owners and the public on proper waste disposal and recycling
Potential Contaminant Sources located in the Recharge Region						
Agricultural Land Use	SOCs, Nitrates, Pathogens	Contaminants leaching into groundwater	Moderate	Bentonite and shale layers overly the aquifers	**Not Rated –** outside the inventory region	Encourage use of best management practices (BMPs)
Transportation Routes - State Highway 80 and 87 - BN/SF Railroad	Pesticides, fertilizers, VOCs, SOCs, other	Spills, routine spraying, storm water runoff, infiltration into groundwater	High	Bentonite and shale layers overly the aquifer	**Not Rated –** outside the inventory region	Emergency planning, training of local emergency response personnel, use of levees and engineered storm drainage to carry any spills away and prevent infiltration into ground, cooperation with railroad managers or MDOT to reduce herbicide use.
Conoco/Cenex Crude Oil Pipelines	Petroleum hydrocarbons	Spills, leaks, and releases may impact groundwater	High to Moderate	- Leak detection - Emergency Response - Bentonite and shale layers overly the aquifers	**Not Rated –** outside the inventory region	Support the county's effort to maintain preparedness of local emergency personnel through active training. Encourage groundwater monitoring, spill prevention, BMPs, and ongoing remediation of soil or groundwater at leak sites.
Businesses that may use hazardous materials or have USTs: - Stanford Airport - By-Way Service	Pesticides, fertilizers, VOCs, SOCs, other	Spills and leaks impacting groundwater	High	Bentonite and shale layers overly the aquifer	**Not Rated –** outside the inventory region	Pollution prevention education; training in waste reduction, handling and recycling; regulatory oversight; promotion of good housekeeping. Schedule days for the collection of hazardous wastes from the public. Consider town wellhead protection ordinance.
Former Stanford Landfill	Various	Contaminants leaching into groundwater	Low to Moderate	-Bentonite and shale layers overly the aquifer - Cross-gradient to the wells	**Not Rated –** outside the inventory region	Review closure permit requirements and monitoring network (if any). Contact DEQ's Permitting and Compliance division program to find out if site assessment or cleanup is pending or completed.

Management Recommendations

It should be noted that even small releases of some chemicals in close proximity to a public water supply well can have significant negative impact on water quality, and therefore are a significant threat to the public water supply. Steps can be taken to reduce the likelihood of releases in the source water for the PWS or in the vicinity of the sources. Some of these management recommendations are listed below and described in detailed in the susceptibility table for the Town of Stanford PWS (Table 7). If these, and other, management recommendations are implemented; they may be considered additional barriers that will reduce the susceptibility of the intake to specific sources and contaminants.

Continue to Restrict Chemical Handling, Use and Storage in Control Zones– Stanford should restrict chemical handling, use and storage within the control zones for the production wells. Ongoing training to promote safe handling and proper storage, transport, use, and disposal of hazardous materials should be provided to the operators if these materials are used at the well houses or in the control zone.

Sewer Maintenance and leak detection – Early warning of leaks and scheduled replacement of aging sewer lines may reduce the susceptibility of the Town's PWS to contamination from municipal septic wastes.

USTs/LUSTs - Given the number of USTs and LUST sites within the inventory region, it is recommended that the PWS operator or community residents contact DEQ's Waste and Underground Tank Management Bureau (406-444-5300) to obtain further information on the cleanup status and any permits or monitoring networks to verify existing contamination is being properly assessed and remediated. The PWS can work with DEQ to encourage proper abandonment for out-of-service tanks and soil testing to evaluate potential impact from historic spills or leaks.

Education - Educational workshops provided to the general public by the city, county, or state promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designated emergency personnel would promote the efficiency and effectiveness of emergency responses to hazardous material spills. Likewise, educational workshops provided to rural homeowners will promote the proper maintenance and replacement of residential septic systems. The EPA and the State of Montana can provide educational materials on these topics.

Hazardous Materials Collection Days – Several counties in the state that have vulnerable water supplies have implemented scheduled days for the collection of hazardous wastes from the public. These vary in the inclusiveness of what materials are collected, how the materials are handled, and how they are disposed of, but they all act to reduce the amount of unauthorized or improper disposal of these wastes. Used motor oil collection station could be established and available to the public on a regular basis.

Emergency Response Plan – Several counties have compiled Emergency Response Plans that were then adopted by the local communities. The usefulness and effectiveness of a response plan are maximized if it contains a clear listing of all emergency contacts, emergency numbers, and resources available within the county to respond to an emergency situation, such as a hazardous material spill. Emergency plans are not difficult to develop or distribute, but have a significant benefit to the citizens and municipalities within the county.

REFERENCES

Feltis, R.D., 1980. Water Resources of the Judith Basin, Central Montana. Montana Bureau of Mines and Geology Hydrogeologic Map 1.

Heath, Ralph C., 1984. Ground-water Regions of the United States, U.S. Geological Survey, Water Supply Paper 2242, Washington D.C., 78p.

Montana Bureau of Mines and Geology, 2012, Groundwater Information Center, lithologic well logs. http://mbmggwic.mtech.edu/

Montana Department of Environmental Quality Public Water Supply Section, 2012. Safe Drinking Water Information System (SDWIS).

Montana Department of Environmental Quality Public Water Supply Section, May 2010. Sanitary Survey for the Town of Stanford.

Montana Department of Environmental Quality (DEQ), 1999. Montana Source Water Protection Program. http://deq.mt.gov/wqinfo/swp/default.mcpx

Montana Department of Environmental Quality Leaking Underground Storage Tank Program web-site. http://deq.mt.gov/LUST/LUSTSites.mcpx

Montana Natural Resources Information Interactive Map website. 2012. http://nris.mt.gov/wis/swap/swapquery.asp

Montana Spatial Data Infrastructure National Agricultural Imagery Program, 2009.

Personal communication with Dale Zuck, PWS Operator, January 23, 2004.

United States Census Bureau, State and County Quick Facts, 2010. http://quickfacts.census.gov/qfd/states/30000.html

United States Environmental Protection Agency "Envirofacts Data Warehouse and Applications". http://www.epa.gov/enviro/

Vine J.D., 1956. Geology of the Stanford-Hobson Area, Central Montana. US Geological Survey Bulletin 1027-J.

Vuke, Susan M., Berg, Richard B., Colton, Roger B., and O'Brian, Hugh E. 2002 (Revised 2007). Montana Bureau of Mines and Geology Open File 450, Geologic Map of the Belt 30' x 60' Quadrangle, Central Montana.

Zimmerman, E.A., 1966. Geology and Ground-Water Resources of Western and Southern Parts of Judith Basin, Montana. Montana Bureau of Mines and Geology Bulletin 50-A.

Appendix A
PWS Well Logs

Montana Bureau of Mines and Geology **Plot this site on a topographic map**
Ground-Water Information Center Site Report
TOWN OF STANFORD #1

Location Information

GWIC Id: 28232
Location (TRS): 16N 12E 17 DAAA
County (MT): JUDITH BASIN
DNRC Water Right: C023674-00
PWS Id: 00334003
Block:
Lot:
Addition:
Source of Data: LOG
Latitude (dd): 47.1492
Longitude (dd): -110.2219
Geomethod: MAP
Datum: NAD27
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 210.00
Static Water Level (ft): 5.00
Pumping Water Level (ft): 160.00
Yield (gpm): 35.00
Test Type: AIR COMP
Test Duration: 5.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:
How Drilled: FORWARD ROTARY
Driller's Name: THATCHER
Driller License: WWC305
Completion Date (m/d/y): 5/30/1979
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: 211CLRD
Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

From	To	Diameter
0.0	210.0	6.0

Casing Information[1]

From	To	Dia	Description
0.0	210.0	4.0	PVC

Annular Seal Information

From	To	Description
0.0	30.0	CEMENT GROUT

Completion Information[1]

From	To	Dia	Description
30.0	40.0	4.0	1/2 INCH HOLES
55.0	210.0	4.0	1/2 INCH HOLES

Lithology Information

From	To	Description
0.0	26.0	OVERBURDEN AND GRAVEL
26.0	42.0	GRAVEL WITH BLUE SHALE
42.0	98.0	BLUE SHALE WITH HARD LAYERS
98.0	125.0	GREY SHALE WITH BENTONITE AND SAND LAYERS
125.0	203.0	SANDSTONE WITH GREY SHALE
203.0	210.0	SAND WITH SHALE BITS

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology **Plot this site on a topographic map**
Ground-Water Information Center Site Report
CITY OF STANFORD #3

Location Information

GWIC Id: 28228
Location (TRS): 16N 12E 17 ADCB
County (MT): JUDITH BASIN
DNRC Water Right: C035928-00
PWS Id: 00334005
Block:
Lot:
Addition:
Source of Data: LOG
Latitude (dd): 47.1498
Longitude (dd): -110.2242
Geomethod: TRS-TWN
Datum: NAD27
Certificate of Survey:
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 203.00
Static Water Level (ft): 24.00
Pumping Water Level (ft): 80.00
Yield (gpm): 60.00
Test Type: AIR COMP
Test Duration: 4.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:
How Drilled: FORWARD ROTARY
Driller's Name: THATCHER
Driller License: WWC367
Completion Date (m/d/y): 8/7/1981
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: PUBLIC WATER SUPPLY

Hole Diameter Information

From	To	Diameter
0.0	203.0	6.0

Casing Information[1]

From	To	Dia	Description
0.0	12.0	4.0	STEEL
12.0	203.0	4.0	PVC

Annular Seal Information

From	To	Description
0.0	0.0	RUBBER
0.0	70.0	CEMENT

Completion Information[1]

From	To	Dia	Description
78.0	203.0	4.0	1/2 INCH HOLES

Lithology Information

From	To	Description
0.0	34.0	GRAVEL
34.0	80.0	BLUE SHALE AND BENTONITE LAYERS
80.0	189.0	SANDSTONE AND BLUE SHALE LAYERS
189.0	203.0	BLUE SHALE

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
CITY OF STANFORD #4

Plot this site on a topographic map
View Hydrograph for this Site

Location Information

GWIC Id:	28213	Source of Data:	COMBO
Location (TRS):	16N 12E 16 BDBC	Latitude (dd):	47.1514
County (MT):	JUDITH BASIN	Longitude (dd):	-110.2117
DNRC Water Right:	W141205-00	Geomethod:	UNKNOWN
PWS Id:	00334004	Datum:	NAD27
Block:		Certificate of Survey:	
Lot:		Type of Site:	WELL
Addition:			

Well Construction and Performance Data

Total Depth (ft):	193.00	How Drilled:	
Static Water Level (ft):	84.00	Driller's Name:	
Pumping Water Level (ft):	170.00	Driller License:	
Yield (gpm):	25.00	Completion Date (m/d/y):	8/23/1941
Test Type:		Special Conditions:	
Test Duration:		Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):		Geology/Aquifer:	211TPCK
Recovery Time (hrs):		Well/Water Use:	DOMESTIC INDUSTRIAL PUBLIC WATER SUPPLY
Well Notes:			

Hole Diameter Information

No Hole Diameter Records currently in GWIC.

Casing Information[1]

From	To	Dia	Description
0.0	172.3	12.0	45 LB STEEL

Annular Seal Information

No Seal Records currently in GWIC.

Completion Information[1]

From	To	Dia	Description
172.0	172.0	12.0	OPEN BOTTOM

Lithology Information

From	To	Description
0.0	37.0	CEMENTED GRAVEL
37.0	60.0	BLUE SHALE
60.0	69.0	GRAY SHALE
69.0	94.0	BLUE SHALE
94.0	103.0	GRAY SHALE
103.0	171.0	BLUE SHALE
171.0	193.0	SANDSTONE

[1] - All diameters reported are **inside** diameter of the casing.

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 on a topographic map
View scanned well log (6/16/2008 8:36:55 AM)

Site Name: TOWN OF STANFORD
GWIC Id: 217357 **Well 9** (per operator)

Section 1: Well Owner

Owner Name
TOWN OF STANFORD
Mailing Address
PO BOX 123

City	State	Zip Code
STANFORD	MT	59479

Section 2: Location

Township	Range	Section	Quarter Sections
16N	12E	17	NE¼ SE¼

County JUDITH BASIN **Geocode**

Latitude	Longitude	Geomethod	Datum
47.14948	110.22661	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

Section 5: Well Completion Date

Date well completed: Monday, November 15, 2004

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	44	14
44	118	12
118	130	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	118	8	0.322		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
118	128	8		0.020	SCREEN-CONTINUOUS-STEEL

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	118	CEMENT	
112	112	K-PACKER	

Section 7: Well Test Data

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

Pump Test *

Depth pump set for test 125 feet.
100 gpm pump rate with 61 feet of drawdown after 24 hours of pumping.
Time of recovery 2 hours.
Recovery water level 40 feet.
Pumping water level 0 feet.

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

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	44	SAND GRAVEL BROKEN ROCK
44	48	BROWN CLAY AND SHALE
48	118	GRAY SHALE
118	130	GRAY 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: CHRIS BOLAND
Company: BOLAND DRILLING
License No: WWC-482
Date Completed: 11/15/2004

Well 10 - WL009 (per Operator)

Jan JAN. 13. 2005 8:35AM T COP CONSTRUCTION 406-466-38 NO. 891 P. 2/3 p. 2

Form No. 603 R2-89

MONTANA WELL LOG REPORT

#9 WL009

Well ID# Town of Stanford

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. This form is to be completed by the driller and filed with DNRC within 60 days of completion of the work. Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.

Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

1. WELL OWNER:
Name Town of Stanford
MAILING ADDRESS
Stanford, MT

2. WELL LOCATION: List ¼ from smallest to largest
¼ ¼ ¼ ¼ Section
Township N/S Range E/W County Judith Basin
Lot Tract/Blk Subdivision Name
Well Address well # 9
GPS | |Yes |X|No
Latitude 47.148100 Longitude 110.225050
Error as reported by GPS locator (± feet)
Horizontal datum | |NAD27 | |WGS84

3. PROPOSED USE: ☐Domestic | |Stock ☐Irrigation
|X|Public Water Supply ☐Monitoring Well ☐Other:

4. TYPE OF WORK:
[X]New well | |Deepen existing well | |Abandon existing well
Method: ☐Cable [X]Rotary | |Other:

5. WELL CONSTRUCTION DETAIL:
Borehole:
Dia. 14.5 in. from 0 ft. to 33 ft.
Dia. 12 in. from 33 ft. to 110 ft.
Dia. 8 in. from 110 ft. to 200 ft.

Casing:
Steel: Wall thickness .332 ☐Threaded [X]Welded
Dia. 8 in. from +2 ft. to 110 ft.
Dia. 6 in. from 90 ft. to 175 ft.
Plastic: Pressure Rating lbs. ☐Threaded ☐Welded
Dia. in. from ft. to ft.

Perforations/Slotted Pipe:
Type of perforator used
Size of perforations/slots in. by in.
no. of perforations/slots from ft. to ft.
no. of perforations/slots from ft. to ft.

Screens: [X]Yes ☐No
Material stainless steel
Dia. 5 Slot size .050 from 175 ft. to 195 ft.
Dia. Slot size from ft. to ft.

Gravel Packed: [X]Yes | |No
Size of gravel 1/8
Gravel placed from 95 ft. to 200 ft.

Packer: ☐Yes |X|No
Type Depth(s)

Grout: Material used portland comont
Depth from 33 ft. to 0 ft. OR | |Continuous feed

6. WELL TEST DATA:
A well test is required for all wells. (See details on well log report cover.)

|X| Static water level 38 ft. below top of casing or
| | Closed-in artesian pressure psi.
How was last flow measured:
bucket/stopwatch, weir, flume, flowmeter, etc bucket/flowmeter
Yellowstone groundwater closure area only - Water Temperature °F
[ ] AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum
Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing.
Time of recovery is hours/minutes since pumping stopped

Air test*
25 gpm with drill stem set at 200 ft. for 24 hours
Time of recovery 2 hrs/min. Recovery water level 38 ft.

OR Bailer test*
gpm with ft. of drawdown after hours
Time of recovery hrs/min. Recovery water level ft.

OR Pump test*
Depth pump set for test 175 ft.
23 gpm pump rate with 137 ft. of drawdown after 6 hrs pumping
Time of recovery 24 hrs/min. Recovery water level 38 ft.

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

7. WELL LOG:

Depth, Feet From	To	Material: color/rock and type/description (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving)
27		mostly shales with intermittent shallow
	116	sandstone lenses
0	27	surface gravel
116	119	light green clay
119	126	shale
126	138	sandstone
138	154	mostly shale with imbedded sand
154	175	shales with numerous sandstone lenses
175	200	mostly shales with thin sandstone lenses

☐ADDITIONAL SHEETS ATTACHED

8. DATE WELL COMPLETED: 11/12/2004

9. REMARKS:

10. DRILLER/CONTRACTOR'S CERTIFICATION:
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.
Name, firm, or corporation (print)
AQUASOURCE LLC
Address P.O.BOX 1008
Signature
Date 11/12/2004 License no. 475

MBMG ID#

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

RECEIVED
JUN 25 2007
DEQ
PPA-TFA

RECEIVED
JUN 12 2007
MT DEQ PUBLIC WATER
& SUBDIVISIONS BUREAU