

Midway Colony Public Water System

PWS ID # MT0004628

Source Water Delineation and Assessment Report

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Executive Summary

Midway Colony is located in north central Montana, in Pondera County; approximately 8 miles southwest of Conrad. Drinking water for the Midway Colony Public Water System (PWS) is supplied by two groundwater wells; Well #1 (north) and Well #2 (south). Their Source Water Identification numbers are Source ID WL002 and Source ID WL003, respectively. The wells are located approximately one-half mile southwest of the Midway Colony.

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for the completion of the delineation and assessment for the Midway Colony 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 (P.L. 104-182).

The purpose of this report is to provide information that helps the water system operator(s) to better understand the water system for which they are responsible. The information will include delineation of source water protection areas (i.e. the control zone and inventory region), an inventory of potential contaminant sources within these areas, and an assessment of the relative threat that potential contaminant sources pose to the water system.

Based on information provided in the well logs and on the geologic map, it appears that the aquifer providing water to the Midway Colony PWS well is comprised of Quaternary-Tertiary-aged gravel. In accordance with the Montana Source Water Protection Program criteria (1999), groundwater within this type of aquifer is considered to have a high sensitivity to potential contaminant sources. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials. Regional groundwater flow direction appears to be southeasterly. Groundwater recharge in the vicinity of the Midway Colony is most likely from precipitation and area springs located west of the PWS wells.

Three source water protection areas mapped for the Midway Colony PWS as part of this assessment. They are the control zone, inventory region, and the recharge region. Each source water protection area is discussed in greater detail in Chapter 2.

No potential contaminant sources were identified in the Well 1 and Well 2 control zone. Potential contaminant sources identified within the inventory region include: cultivated cropland, livestock production, and an active gravel pit.

Susceptibility is the potential for a PWS to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers. Barriers decrease the likelihood that contaminated water will flow to PWS wells. Midway Colony PWS wells have a very high susceptibility to cultivated cropland, livestock production, a gravel pit. Low risk potential contaminant sources are not discussed in detail in the assessment. The susceptibility analysis provides the colony with information on where the greatest risk occurs; and where to focus resources for protection of their drinking water.

Introduction

This Source Water Delineation and Assessment Report (SWDAR) was prepared for the Midway Colony PWS, (PWS ID# MT000), located in Cascade County. The initial report was completed by Bill O'Connell, with Montana Rural Water Systems, Inc. with review and assistance from the Montana DEQ Source Water Protection Program. February 2013, Carolyn DeMartino, a Water Quality Specialist with the DEQ Source Water Protection Program updated and revised the SWDAR.

Purpose

The primary purpose of this source water delineation and assessment report is to provide information that helps Midway Colony protect its drinking water sources. This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Midway Colony 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.

Limitations

This report was prepared to assess threats to Midway Colony's public water supply, 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 Midway Colony 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 Midway Colony public water supply may have been 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

The Midway Hutterite Colony is located in north central Montana, in Pondera County; approximately 8 miles southwest of Conrad and 52 miles northwest of Great Falls (Figure 1). The economy of the colony relies on the production of a variety of crops, livestock, and the operation of a gravel pit.

The Colony complex is comprised of residential buildings, a kitchen building, several barns and several other facilities that support the agricultural activities at the colony. The population of Midway Colony is approximately 75 people. The Midway Colony PWS is classified as a Community PWS because it serves greater than 25 of the same individuals daily for more than six months annually. Drinking water is supplied to the Colony by two groundwater wells (Figure 1).

Wastewater Treatment and Disposal

Sanitary wastewater from the colony residences and other buildings is collected and transported via sewer mains; and then discharged into a two cell wastewater treatment lagoon. Animal wastes are treated in a separate wastewater treatment lagoon that utilizes a biogas collection cover. Both wastewater treatment lagoons are located on the northeast- east side of the colony complex. Some wastewater and manure are eventually applied to cropland at agronomic rates.

Geographic Setting

Midway Colony is located in north central Montana in sections 28 and 29 of Township 27 North and Range 3 West. Wells 1 and 2 are located on elevated gravel terrace west of the colony (Figure 1). Aldrich Coulee forms a shallow ravine around this terrace; and may contain flowing water during precipitation events. Midway Colony is located approximately 35 miles east of the Rocky Mountain Front.

Source Water Description

Based on the well logs and the Valier 30' x 60' United States Geological Survey (USGS) geologic map both Wells 1 and 2 appear to be completed in Quaternary-Tertiary-aged, stream deposited gravel (Figure 2). This area is located within the Lower Missouri River Watershed Management Region for Montana and in the Kropp Coulee sub-basin (USGS Hydrologic Unit Code 100302050803).

Figure 1. Midway Colony Vicinity Map

Figure 1. Midway Colony PWS (MT0004628) Vicinity Map

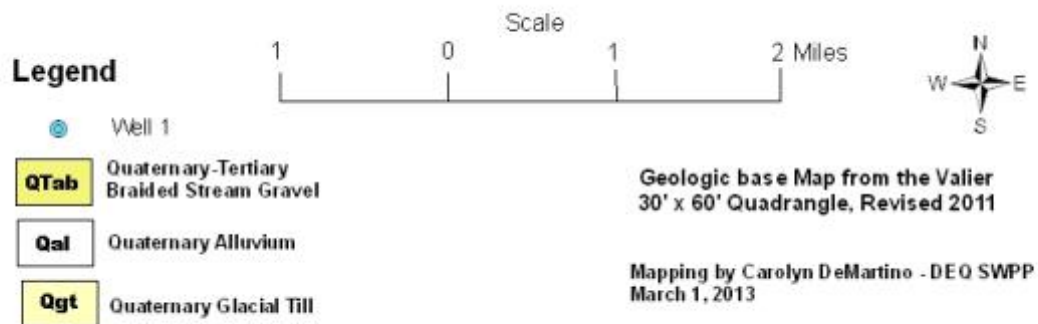
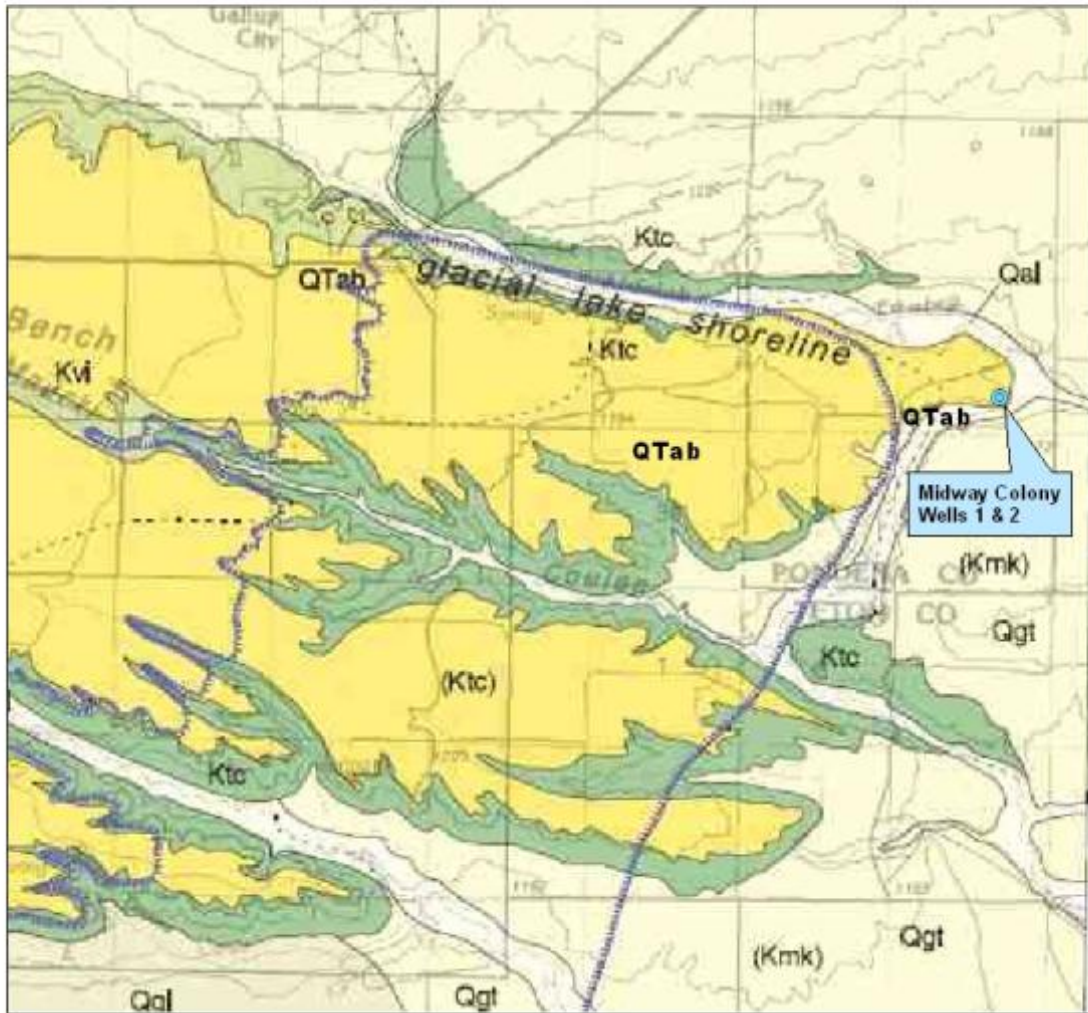


State Base Map from MSDI- MT NAIP, 2009
Base Map Modified from Bing Aerial Maps

Mapping by Carolyn DeMartino - DEQ SWPP
February 2013

Figure 2. Midway Colony PWS Area Geology

Figure 2. Midway Colony Area Geology



The Public Water Supply

Water flows from Midway Colony PWS wells Well 1 and 2 to a common header and through a transmission main to supply water to approximately 75 people through 10 service connections. According to the August 31, 2011 sanitary survey:

“WL002 Well 1 N (GWIC #218332) is located on a small landform rise ~4400 feet Southwest of the main colony site near the other well (WL003). There is <50 feet between Well 1 and Well 2. The immediate head isolation area is secured by a perimeter wire fence, and the immediate area appears to have adequate drainage. The well is terminated above ground and features a sanitary seal, sealed conduit entrance, and screened vent, and a concrete apron around the well head.”

“WL003 Well 2 S (GWIC #218333) is located on a small landform rise ~4400 feet Southwest of the main colony site near the other well (WL003). There is <50 feet between Well 1 and Well 2. The immediate head isolation area is secured by a perimeter wire fence, and the immediate area appears to have adequate drainage. The well is terminated above ground and features a sanitary seal, sealed conduit entrance, screened vent.”

The Midway Colony PWS utilizes the following two treatment points:

“TP001 consists of hypochlorite disinfection located in the plumbing shop upstream to ST001 storage and all subsequent distribution. In its current configuration, it is unknown if 4-log virus inactivation is achieved through ST001 and distribution. TP001 appears to have a history of adequate function without defect.”

“TP002 consists of water softening located in the plumbing shop downstream to ST001 storage. TP002 softens water for a separate 3-inch distribution line leading to each colony building (unsoftened water is distributed in a 2-inch distribution line leading to each colony building). TP002 appears to have a history of adequate function without defect.”

The Midway Colony PWS also has a finished water storage tank

“The storage tank consists of one horizontal steel structure (~53 ft x ~12 ft diameter) with a capacity of 40,000 gallons (46,000 gal maximum). The tank is located inside the plumbing shop on a concrete slab. The tank features an air gapped inlet in the top of the tank and a separate bottom outlet on the opposite end. Tank cleaning and structural inspections are conducted at more than 5 year intervals. ST001 storage appears to have a history of adequate function and appears to be in good condition.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. The monitoring constituents include coliform bacteria 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 program tailored to their system that follows the general protocols for operation of a PWS defined by DEQ.

Within the past five years, no Coliform bacteria have been detected in this drinking water supply. Nitrate plus nitrite as nitrogen (nitrate), has been detected in the drinking water (Table 1).

Table 1. Nitrate Concentrations in the Midway Colony PWS

Date Collected	Result (milligrams/Liter – mg/L)
05/02/2012	4.32
04/19/2011	3.00
11/22/2010	3.88
08/31/2010	4.36
05/26/2010	3.97
02/10/2010	3.03
10/29/2009	3.74
08/17/2009	3.33
06/01/2009	7.87
09/15/2008	8.46

While elevated, the nitrate concentrations are below the EPA’s maximum contaminant level (MCL) of 10 mg/L.

In addition to nitrate; fluoride, total trihalomethanes (a disinfection by-product), and radionuclides were detected in the water. These constituents were well below their MCLs.

Chapter 2 Delineation

The source water protection area, the land area that contributes water to the Midway Colony is identified in this chapter. Three source water protection areas are delineated for Midway Colony Wells 1 and 2. They are the control zone, the inventory region, and the recharge region.

The control zone (Figure 3), also known as the exclusion zone, is delineated as a 100-foot radius circle around each well. For the purposes of this report because the two wells are less than 50 feet apart one control zone was designated for both wells. All potential contaminant sources should be excluded from the Control Zone. The management goal in the control zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. No significant potential contaminant sources were identified within the Well 1 and 2 control zone.

The inventory region (Figure 3) represents the zone of contribution to the well; and includes the area of land overlying the aquifer that supplies drinking water to the wells. The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The inventory region for an unconfined aquifer is typically based on analytical equations (using pumping and aquifer characteristics) to calculate an approximate a three-year groundwater time-of-travel. For the purposes of this assessment, the inventory region is identified using a 1-mile fixed radius inventory because the land use and potential contaminant sources would not vary by delineating a larger inventory region. The most significant potential contaminant sources identified within the inventory region are: cultivated cropland, livestock, and a gravel pit.

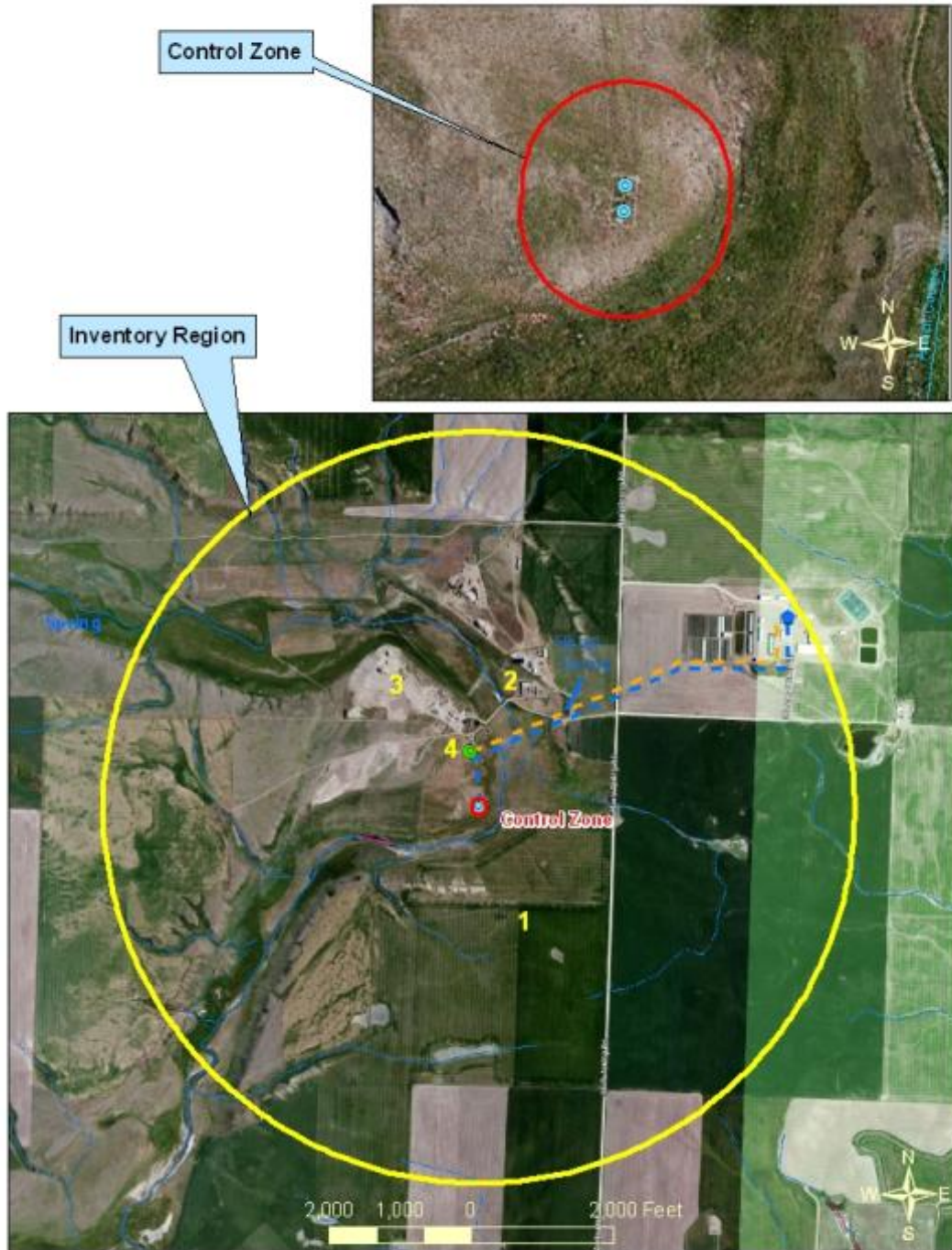
The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage. Recharge to the aquifer supplying water to the wells is most likely from infiltration of precipitation, snowmelt, and springs located west and east of the colony. No additional potential contaminant sources were identified within the recharge region in addition to those previously identified in the inventory region.

Hydrogeologic Setting

As previously stated, there are no published reports on groundwater hydrogeology in the vicinity of the Midway Colony. Both Wells 1 and 2 appear to be completed in Quaternary-Tertiary-aged, unconfined terrace gravel. Recharge to the aquifer is most likely from precipitation, snow melt, and area springs.

Figure 3. Midway Colony Control Zone and Inventory Region

Figure 3. Midway Colony PWS Control Zone, Inventory Region, and Potential Contaminant Sources



Base Map modified from Bing Aerial Maps

Mapping by Carolyn DeMartino - DEQ SWPP
February 2013

Based on the well logs for Wells 1 and 2, the sub-surface geologic material providing water to the wells is from stream deposited gravels.

PWS Well Information

Table 2 contains a summary of the well information for both Midway Colony Well 1 and Well 2 summarizes Midway Colony PWS well information.

Table 2. Midway Colony PWS Well Information Summary

Well Information	Well 1	Well2
DEQ Well Name	Well 1 North	Well 2 South
Source ID Code	WL002	WL003
GWIC ID	218332	218333
DNRC Water Right	None	None
Legal Location (T., R., Sec.)	27 N., 03 W., Section 29 SE1/4NW1/4SE1/4	27 N., 03 W., Section 29 SE1/4NW1/4SE1/4
Latitude	48.0614	48.0613
Longitude	-112.013	-112.013
Well Elevation (feet)	~4400	~4400
Date Completed	4/13/2005	4/12/2005
Total Depth (feet bgs)	40	40
Well Casing (feet)	-2 to 40	-2 to 40
Casing Type	Welded steel	Welded steel
Casing Diameter (inches)	6	6
Well Screen (feet)	10; from 30-40	10; from 30-40
Screen Type	Steel	Steel
Screen Diameter (inches)	6	6
Grout type & footage	Portland Cement 0 to 25	Portland Cement 0 to 25
Static Water Level (SWL) in feet	22	21
Pumping Water Level (PWL) in feet	0.20	0.17

Conceptual Model and Assumptions

The Midway Colony PWS wells are located on the east end of a bench that is covered with gravel that was derived from the mountains to the west and eventually deposited on the bench by braided streams from melting glaciers. The gravel aquifer is unconfined. Recharge to the aquifer is primarily from infiltration of precipitation, snowmelt, and area springs. Regional groundwater flow direction most likely follows the topography and is towards the east and northeast.

Using DEQ Source Water Protection Program criteria for ranking aquifer sensitivity (Table 3); the gravel aquifer setting for Midway Colony Wells 1 and 2 is considered to have **High Source Water Sensitivity** to potential contaminant sources. Sensitivity is defined as the relative ease that contaminants can migrate to source water.

Table 3. Source Water Sensitivity Criteria (DEQ, 1999)

Source Water Sensitivity
<p>High Source Water Sensitivity Surface water and GWUDISW Unconsolidated Alluvium (unconfined) Fluvial-Glacial Gravel Terrace and Pediment Gravel Shallow Fractured or Carbonate Bedrock</p>
<p>Moderate Source Water Sensitivity</p> <ul style="list-style-type: none"> ▪ Semi-consolidated Valley Fill sediments ▪ Unconsolidated Alluvium (semi-confined)
<p>Low Source Water Sensitivity</p> <ul style="list-style-type: none"> ▪ Consolidated Sandstone Bedrock ▪ Deep Fractured or Carbonate Bedrock

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 the Midway Colony’s PWS include a control zone, an inventory region and a recharge region.

Control Zone – A 100-foot radius control zone is delineated around Well 1 and Well 2 (Figure 3).

Inventory Region - For the purposes of this assessment report, a 1-mile fixed radius inventory region was delineated for the Midway Colony wells (Figure3). The basis for this inventory region is data that shows the most significant potential contaminant sources are captured; and a larger inventory region is unnecessary.

Recharge Region –The recharge region for the Midway Colony well is based on the boundaries of the Kropp Coulee sub-basin (Figure 4). 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. Additional cultivated cropland and the colony site, including the wastewater sewer mains and lagoons, are located in the recharge region. Groundwater flow direction appears to be east to northeasterly.

Limitations

Delineation of the source water protection areas for the Midway Colony PWS wells is based on the aquifer type, groundwater data located in the most recent sanitary survey, published reports, and the lithology indicated on other area well logs. The total amount of recharge to the system from precipitation, snow melt, and area springs is unknown. Recharge to the groundwater system from precipitation and springs can vary seasonally.

Chapter 3 Inventory

Inventory Method

An inventory of significant potential contaminant sources was conducted to assess the susceptibility of Midway Colony's PWS Wells 1 and 2 to contamination; and to help the colony better understand where to focus resources to protect their drinking water. The inventory for Midway Colony 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 significant potential contaminant sources were selected for detailed inventory. It is important to remember that the sites and areas identified in this section are only potential contaminant sources.

The inventory for the Midway Colony PWS focuses on all activities in the control zone for the wells, certain types of facilities or land uses in the inventory region, and general land uses and large facilities in the recharge region. Various databases, including DEQ's SWPP Query Database, were used to identify facilities and land uses that are potential sources of regulated contaminants.

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

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

Inventory Results/ Control Zone

No significant potential contaminant sources were identified in the control zone around Wells 1 and 2. The land that the wells are installed in is completely owned by Midway Colony.

Inventory Results/ Inventory Region

Potential contaminant sources were identified within the inventory region including: cultivated cropland, livestock barn and corral, and a gravel pit. These potential contaminant sources pose a very high susceptibility to the Midway Colony PWS wells. Land use within the inventory region is predominantly cultivated cropland and pasture land. Table 4 provides a summary of the potential contaminant sources in the inventory region.

Table 4. Summary of Significant Potential Contaminant Sources in the Midway Colony Inventory Region

Potential Contaminant	Potential Contaminants	Hazard
1. Cultivated Cropland	Pathogens, nitrate, VOCs, SOCs	Over-application or improper handling of pesticides or fertilizers may impact drinking water. Excessive irrigation may cause transport of contaminants or sediments to groundwater
2. Livestock Barn and corral	Pathogens and nitrate	Surface water runoff coming into contact with manure and allowing pathogens and nitrate to migrate into area groundwater
3. Gravel pit	Pathogens, nitrate, VOCs, SOCs	Surface water runoff coming into contact with nitrate, VOCs, and SOCs and transporting it into the gravel pit and exposed groundwater
4. Agricultural Wells	Pathogens, nitrate, VOCs, SOCs	If improperly constructed these wells could allow contaminants to migrate into the aquifer

Inventory Results/ Recharge Region

In addition to the potential contaminant sources already identified in the inventory region there are the Colony’s wastewater treatment lagoons, additional cultivated cropland acres, and individual septic systems in the recharge region. Overall, septic system density within the recharge region is low. Land use in the recharge region is predominantly cultivated cropland (Figure 4).

Inventory Update

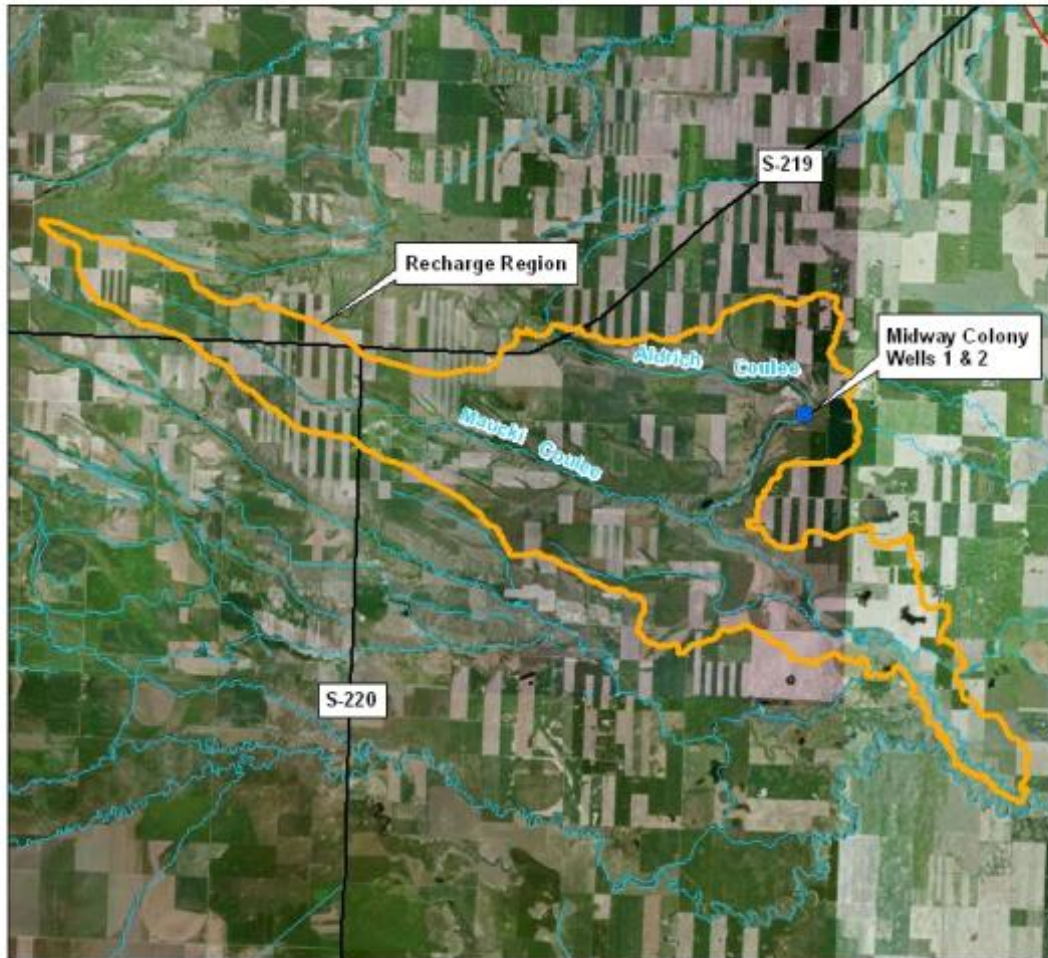
To make this SWDAR a useful document for the years to come, the certified water system operator should update the inventory for his records every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ 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 Midway Colony’s public water supply have been identified.

Figure 4. Recharge Region for the Midway Colony PWS

Figure 4. Recharge Region for the Midway Colony PWS



Legend

-  Wells 1 & 2
-  Recharge Region
-  Secondary Roads
-  Streams

Base Map Modified from Bing Aerial Maps

Mapping by Carolyn DeMartino - DEQ SWPP
February 2013

Chapter 4 Susceptibility Assessment

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose a concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by the Midway Colony 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 5). 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 for an unconfined aquifer.

Table 5. Hazard of Potential Contaminant Sources for Wells Drawing Water from Unconfined Aquifers

Type of Potential Contaminant	High Hazard	Moderate Hazard	Low Hazard
Septic System Density (# per square mile)	More than 300 septic systems per sq. mile	Between 50 and 300 septic systems per sq. mile	Less than 50 septic systems per sq. mile
Municipal or Community Sanitary Sewer (% land use)	More than 50 percent of the inventory region	Between 20 and 50 percent of the inventory region	Less than 20 percent of the inventory region
Agricultural (% land use)	More than 50 percent of the inventory region	Between 20 and 50 % of the inventory region	Less than 20 percent of the inventory region
Point sources of all contaminants	Within 1-year TOT	Between 1 to 3 years TOT	Over 3 years TOT

Susceptibility Discussion

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 Midway Colony proposed wells (Table 6).

Table 6. 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

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 are considered management barriers. Thick clay-rich soils, a deep water table or a thick unsaturated zone above the well intake can be natural barriers.

A summary of the susceptibility assessment for the Midway Colony PWS Well is located in Table 7.

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. Management recommendations for protecting the Midway Colony’s drinking water supply are also indicated in table Table 7. If these, and other, management recommendations are implemented; they may be considered additional barriers that will reduce the susceptibility of the wells to specific potential contaminant sources and their associated contaminants.

Table 7. Midway Colony PWS Wells Inventory Region Significant Potential Contaminant Source Susceptibility Assessment

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
1. Cultivated Cropland	Pathogens, nitrate, VOCs and SOCs from pesticides and herbicides	Contaminants leaching into groundwater used for drinking water	High	Groundwater flow direction	High	Prohibit land application within inventory region. Use agricultural best management practices (BMPs) and apply all chemicals according to label instructions.
2. Livestock Barn and corral	Pathogens and nitrate	Contaminants leaching into groundwater used for drinking water	High	Groundwater flow direction	High	Use BMPs to prohibit agricultural storm water runoff from barns and corrals from migrating into shallow groundwater.
3. Gravel pit	Pathogens, nitrate, VOCs and SOCs from pesticides and herbicides	Contaminants leaching into groundwater used for drinking water	High	Groundwater flow direction	High	Use BMPs to prohibit agricultural storm water runoff from barns and corrals from migrating into shallow groundwater.
4. Agricultural Wells	Pathogens, nitrate, VOCs and SOCs from pesticides and herbicides	Improperly constructed wells could allow contaminants to migrate into groundwater used for drinking water	High	Groundwater flow direction	High	Properly abandoned wells if not in use. If in use inspect the wells to determine if they are properly constructed.

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Glossary*

Acute Health Effect. A negative health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

Aquifer. A water-bearing layer of rock or sediment that will yield water in usable quantity to a well or spring.

Barrier. A physical feature or management plan that reduces the likelihood of contamination of a water source from a potential contaminant source

Best Management Practices (BMPs). Methods for various activities that have been determined to be the most effective, practical means of preventing or reducing non-point source pollution.

Biennial Reporting System (BRS). An EPA database that contains information on hazardous waste sites. The data can be accessed through the EPA Envirofacts website.

Chronic Health Effect. A negative health effect in which symptoms develop over an extended period of time.

Class V Injection Well. Any pit or conduit into the subsurface for disposal of waste waters. The receiving unit for an injection well typically represents the aquifer, or water-bearing interval.

Coliform Bacteria. A general type of bacteria found in the intestinal tracts of animals and humans, and also in soils, vegetation and water. Their presence in water is used as an indicator of pollution and possible contamination by pathogens.

Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Passed in 1989 by the Montana State Legislature, CECRA provides the mechanism and responsibility to clean up hazardous waste sites in Montana.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Enacted in 1980. CERCLA provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment. Through the Act, EPA was given power to seek out those parties responsible for any release and assure their cooperation in the cleanup.

Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS). A database that provides information about specific sites through the EPA Envirofacts website.

Confined Animal Feeding Operation (CAFO). Any agricultural operation that feeds animals within specific areas, not on rangeland. Certain CAFOs require permits for operation.

Confined Aquifer. A fully saturated aquifer overlain by a confining unit such as a clay layer. The static water level in a well in a confined aquifer is at an elevation that is equal to or higher than the base of the overlying confining unit.

Confining Unit. A geologic formation present above a confined aquifer that inhibits the flow of water and maintains the pressure of the groundwater in the aquifer. The physical properties of a confining unit may range from a five-foot thick clay layer to shale that is hundreds of feet thick.

Delineation. The process of determining and mapping source water protection areas.

Glacial. Of or relating to the presence and activities of ice or glaciers. Also, pertaining to distinctive features and materials produced by or derived from glaciers.

Geographic Information Systems (GIS). A computerized database management and mapping system that allows for analysis and presentation of geographic data.

Hardness. Characteristic of water caused by presence of various calcium and magnesium salts. Hard water may interfere with some industrial processes and prevent soap from lathering.

Hazard. A relative measure of the potential of a contaminant from a facility or associated with a land use to reach the water source for a public water supply. The location, quantity and toxicity of significant potential contaminant sources determine hazard.

Hydraulic Conductivity. A constant number or coefficient of proportionality that describes the rate water can move through an aquifer material.

Hydrology. The study of water and how it flows in the ground and on the surface.

Hydrogeology. The study of geologic formations and how they affect groundwater flow systems.

Inventory Region. A source water management area for groundwater systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified three year groundwater travel time.

Lacustrine. Pertaining to, produced by, or formed in a lake or lakes.

Large Capacity Septic System. Defined by Underground Injection Control regulations as an on-site septic system serving 20 or more persons.

Leaking Underground Storage Tank (LUST). A release from a UST and/or associated piping into the subsurface.

Maximum Contaminant Level (MCL). Maximum concentration of a substance in water that is permitted to be delivered to the users of a public water supply. Set by EPA under authority of the Safe Drinking Water Act to establish concentrations of contaminants in drinking water that are protective of human health.

Montana Bureau of Mines and Geology – Groundwater Information Center (MBMG/GWIC). The database of information on all well drilled in Montana, including stratigraphic data and well construction data, when available.

Montana Pollutant Discharge Elimination System (MPDES). A permitting system that utilizes a database to track entities that discharge wastewater of any type into waters of the State of Montana.

National Pollutant Discharge Elimination System (NPDES). A national permitting system that utilizes a database to track entities that discharge wastewater into waters of the United States.

Nitrate. An important plant nutrient and type of inorganic fertilizer that can be a potential contaminant in water at high concentrations. In water the major sources of nitrates are wastewater treatment effluent, septic tanks, feed lots and fertilizers.

Nonpoint-Source Pollution. Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet. Examples of nonpoint- source pollution include agriculture, forestry, and run-off from city streets. Nonpoint sources of pollution, such as the use of herbicides, can concentrate low levels of these chemicals into surface and/or groundwaters at increased levels that may exceed MCLs.

Pathogens. A microorganism typically found in the intestinal tracts of mammals, capable of producing disease.

Phase II (and IIB) Rules. EPA updated or created legal limits on 38 contaminants. The rules became effective July 30, 1992 and January 1, 1993. Some of these contaminants are frequently-applied agricultural chemicals such as nitrate and others are industrial solvents.

Phase V Rule. EPA set standards for 23 contaminants in addition to those addressed by the Phase II Rules. The Phase V Rule became effective January 17, 1994. Some of these contaminants include inorganic chemicals such as cyanide and other Phase V contaminants are pesticides that enter water supplies through run-off from fields where farmers have applied them or by leaching through the soil into groundwater. Six are probable cancer-causing agents. Others can cause liver and kidney damage, or problems of the nervous system and brain.

Point Source. A stationary location or a fixed facility from which pollutants are discharged. This includes any single identifiable source of pollution, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fracture, container, rolling stock (tanker truck), or vessel or other floating craft, from which pollutants are or may be discharged.

Pollutant. Generally, any substance introduced into the environment that adversely affects the usefulness of a resource (e.g. groundwater used for drinking water).

Permit Compliance System (PCS). An EPA database that provides information on the status of required permits for specific activities for specific facilities. The data can be accessed through the EPA Envirofacts website.

Public Water System (PWS). A system that provides water for human consumption through at least 15 service connections or regularly serves 25 individuals.

Pumping Water Level. Water level elevation in a well when the pump is operating.

Recharge Region. An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers. As a source water management region, the term generally describes the entire area that could contribute water to an aquifer used by a public water supply. Includes areas that could contribute water over long time periods or under different water usage patterns.

Resource Conservation and Recovery Act (RCRA). Enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner.

Resource Conservation and Recovery Information System (RCRIS). Is a database that provides information about specific sites through the EPA Envirofacts website.

Secondary Maximum Contaminant Levels (SMCL). The maximum concentration of a substance in water that is recommended to be delivered to users of a public water supply based on aesthetic qualities. SMCLs are non-enforceable guidelines for public water supplies, set by EPA under authority of the Safe Drinking Water Act. Compounds with SMCLs may occur naturally in certain areas, limiting the ability of the public water supply to treat for them.

Section Seven Tracking System (SSTS). SSTS is an automated system EPA uses to track pesticide producing establishments and the amount of pesticides they produce.

Source Water. Any surface water, spring, or groundwater source that provides water to a public water supply.

Source Water Delineation and Assessment Report (SWDAR). A report for a public water supply that delineates source water protection areas, provides an inventory of potential contaminant sources within the delineated areas, and evaluates the relative susceptibility of the source water to contamination from the potential contaminant sources under "worst-case" conditions.

Source Water Protection Areas. For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply. For groundwater sources, the area within a fixed radius or three-year travel time from a well, and the land area where the aquifer is recharged.

Spill Response Region. A source water management area for surface water systems that encompasses the area expected to contribute water to a public water supply within a fixed distance or a specified four-hour water travel time in a stream or river.

Standard Industrial Classification (SIC) Code. A method of grouping industries with similar products or services and assigning codes to these groups.

Static Water Level (SWL). Water level elevation in a well when the pump is not operating.

Susceptibility (of a PWS). The relative potential for a PWS to draw water contaminated at concentrations that would pose concern. Susceptibility is evaluated at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the distribution system.

Synthetic Organic Compounds (SOC). Man made organic chemical compounds (e.g. herbicides and pesticides).

Total Dissolved Solids (TDS). The dissolved solids collected after a sample of a known volume of water is passed through a very fine mesh filter.

Total Maximum Daily Load (TMDL). The total pollutant load to a surface water body from point, nonpoint, and natural sources. The TMDL program was established by section 303(d) of the Clean Water Act to help states implement water quality standards.

Toxicity. The quality or degree of being poisonous or harmful to plants, animals, or humans.

Toxicity Characteristic Leachate Procedure. A test designed to determine whether a waste is hazardous or requires treatment to become less hazardous.

Toxic Release Inventory (TRI). An EPA database that compiles information about permitted industrial releases of chemicals to air and water. Information about specific sites can be obtained through the EPA Envirofacts website.

Transmissivity. A number that describes the ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity time the aquifer thickness.

Turbidity. The cloudy appearance of water caused by the presence of suspended matter.

Unconfined Aquifer. An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.

Underground Storage Tanks (UST). A tank located at least partially underground and designed to hold gasoline or other petroleum products or chemicals, and the associated plumbing system.

Volatile Organic Compounds (VOC). Chemicals such as petroleum hydrocarbons and solvents or other organic chemicals that evaporate readily to the atmosphere.

Watershed. The region drained by, or contributing water to, a stream, lake, or other water body of water.

* With the exception of the definitions for Lacustrine, Phase II and Phase V Rules, and Standard Industrial Classification Code, definitions were adapted from EPA's Term References System (formerly known as Glossary of Selected Terms and Abbreviations) which can be found at: <http://www.epa.gov/trs/index.htm> . The

definitions of glacial and lacustrine were taken from the Glossary of Geology by Robert L. Bates and Julia A. Jackson.

The definitions for Phase II and Phase V Rules were adapted from:

<http://www.epa.gov/OGWDW/source/therule.html#PhaseII>

<http://www.epa.gov/OGWDW/source/therule.html#PhaseV>

The definition for Standard Industrial Classification Code was adapted from:

EPA/Office of Enforcement and Compliance Assurance: [Guide to Environmental Issues: Glossary of Terms & Acronyms](#) *Term Detail*

Appendix A PWS Well Logs

