

Morgan Border Station Source Water Delineation and Assessment Report

Public Water Supply: **Morgan Border Station
(PWSID #MT0002764)**

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Introduction

This delineation and assessment report is intended to meet the technical requirements of the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). Joe Meek, supervisor, with the Montana Department of Environmental Quality (DEQ) prepared the final report with assistance from intern Melissa Stupfel. Information on land use and potential contaminant sources comes from a variety of sources including a preliminary land cover data layer produced by the United States Geological Survey (USGS), DEQ Public Water Supply files (including sanitary surveys), and other public sources of information. A web-based GIS application was also used to query and generate maps to support writing this report. This application is called the Source Water Protection Program Query System and is available at the following web address or URL: <http://nris.state.mt.us/wis/swap/swapquery.asp>. The application was developed by the Natural Resource Information System at the Montana State Library and DEQ Source Water Protection Program (SWPP) in order to provide access to data from the U.S. EPA, DEQ, Montana Bureau of Mines and Geology (MBMG) and other sources.

Purpose

The purpose of this delineation and assessment report is to assess threats to the Morgan Border Station water supply using information obtained from personnel managing the site, published reports, and the most recent sanitary survey of the area, which was completed in July of 2002 by Joe Steiner of The Cadmus Group, Inc. (available from DEQ upon request). Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water are identified on a map. These areas are referred to as source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Public Water Supply Information

The Morgan Border Station is located in Phillips County, about sixteen miles north of Loring, on Highway 191 at the Canadian border ([Figure 1](#)). The PWS system serves the

border station office, and two residences. The resident population is 3 people and the transient population is about 15 to 25 people per day in the summer and 5 people per day in the winter. Because the water supply does not regularly serve the same 25 persons for at least six months a year, it is classified as a transient, non-community public water supply. Water demand is approximately 80-280 gallons per day, depending on the season, assuming water use is 10 gallons per person, per day (EPA, 1991).

A well log is available for a well on the Morgan Border Station site and information was available from the previous sanitary surveys done on the well. According to the most recent sanitary survey, there are two abandoned wells and one active well on the site. The active well is located approximately 200 feet to the west of and behind the port office (Appendix B). This well was drilled in 1952. The 4 inch steel casing extends at least 18 inches above the outside ground level. The well cap has a hydrant protruding from the top and is not vented. The well is 325 feet deep and the static water level is 50 feet. The survey states that this well has a 2-horse power submersible pump and one captive air pressure tank. Water from this well is not treated.

Review of the well log for the active well on the Morgan Border Station site provided useful information of the lithology near the Border Station. The well, GWIC # 48000, is in agreement with the sanitary survey on the date, depth, and static water level of the well (Appendix A). The lithology of the area describes a 3-foot sandy topsoil layer followed by five feet of hardpan, and 130 feet of clay. Subsequent layers of gravel, sandstone, shale and coal follow the clay layer. The clay layer and the high static water level indicate some pressure and suggest that this water source is confined. Due to the confinement this aquifer is assigned a low sensitivity rating to potential contaminant sources in the area, in accordance with the Source Water Protection Program document (MT DEQ, 1999). If additional accurate information becomes available for this well in the future, it may be necessary to amend the sensitivity and susceptibility ratings in the table following this report.

The aquifer appears to be in the Judith River Formation. This formation has a fair amount of local variation, hence hydrogeologic parameters are poorly known (MBMG 99).

The sanitary survey for Morgan Border Station listed three recommendations that might be helpful in the future. It recommends that the seals of the well should be gasketed to provide a tight seal and prevent entry of dust, insects and other contaminants. The seals should also be vented with a downward facing screened vent to allow air to move freely in and out of the casing as the water level changes with pumping. The hydrant currently installed on the well cap is not acceptable due to potential back siphonage and well contamination. This hydrant will need to be removed and an acceptable sanitary seal installed. It is also suggested that the discontinued well on site be properly abandoned. The survey notes that the routine monitoring for this PWS is inadequate and that the border station is in violation of nitrate sampling. If the system is tested for nitrate the border station will be allowed to discontinue the public notice of non-compliance.

Morgan Border Station is required to test for microbiological contaminants and nitrate. The PWS must complete monthly bacteriological samples, as well as an annual nitrate sample. The monitoring data for the site notes that there have been no coliform bacteria hits in the past five years. The highest level of nitrate detected in the well in the last five years is 6.63 mg/L in 1998, which is below the maximum concentration level (MCL) of 10 mg/L set by the U.S. Environmental Protection Agency (EPA).

Delineation

Two source water protection zones are delineated for the Morgan Border Station. They include a 100-foot radius control zone and a one-mile radius inventory region ([Figure 1](#)). The control zone is the most critical area from which direct introduction of contaminants into the well or immediate area can occur. The inventory region encompasses the area from which water or contaminants can flow into the border station's water supply over a period of months to years.

Inventory

The Montana Source Water Protection Program (Montana DEQ, 1999) requires that land uses and all potential sources of nitrate and microbial pathogens within the control zone and inventory region be identified. The control zone has a radius of 100 feet from the well where spills, leaks, or discharges could migrate quickly to the wellhead. For a TNCWS, a simple fixed radius approach is typically used to delineate inventory region and all significant potential contaminant sources within that region are assigned a high hazard.

The sanitary survey for the Morgan Border Station provides little information about the control zone other than that of the abandoned wells and residences. There was no information on the discontinued wells other than that there are plans to have them properly abandoned according to DEQ regulations. The abandoned wells are located to the north and south of the border station office, slightly to the west. The two residences are in line directly south of the border station.

The Morgan Border Station has its own large capacity septic system, (serves in excess of 20 persons per day) which is a high hazard land use. The exact location of the septic system serving the facility is unknown.

Analysis of the area surrounding the Morgan Border Station complex reveals that the predominant land covers include grassland (46%), cultivated cropland (6%), and woodland (1%). There is less than 1% residential/commercial land use within the inventory region. See [Figure 2](#) for a pie chart summarization of this data. Also, 46% of the inventory region land use is unknown because it is within the Canadian border and no information was available for the Canadian portion of the inventory region. A minimal amount of surrounding area is used for agriculture, which might also be assumed for the unknown portion of the inventory region. In this case the percentage of the inventory region used in agriculture would actually be higher than 6%. In order to maintain a conservative approach, hazard will be assigned assuming that less than 20% of the inventory region is used for

agriculture. Knowing this, the minimal amount of cultivated cropland (<20%) present in this region poses a low hazard to the border station's water supply.

Susceptibility Assessment

Susceptibility to significant potential contaminant sources is assessed for a public water supply well. The susceptibility assessment is based on the hazard of identified significant potential contaminant sources and the presence or absence of natural or man-made barriers to contaminant migration. The well log of GWIC # 48000 contains lithology information, which indicates that there is a 130-foot clay layer. It appears that the aquifer is confined. Well log information helps verify that the well is constructed properly and helps identify the aquifer the well is completed in. When constructed properly, shallow ground water that is more vulnerable to contaminant sources at the land surface is prevented from entering the well bore hole and co-mingling with water from the deeper aquifer.

Under some circumstances, the well bore could act as a conduit for contaminants entering the deeper aquifer. There is no annular seal information recorded for the active well serving the border station.

Management conditions, engineered structures, or management actions can be considered as barriers that would lower the susceptibility to contamination within the inventory region. There is one identifiable barrier to contamination for this water system, which is the consistent thick clay layer depicted in the well logs.

The Morgan Border Station water system has high susceptibility to nitrate and bacterial contaminants from the presumed large capacity septic system, the surrounding cultivated cropland surrounding the station (Table 1).

The Border Station's own large capacity septic system poses the greatest threat to the well and is considered to represent a high hazard (Montana DEQ, 2000, Table 6b). The station's drain field is located about 100 feet from the building to the west. Since there is one barrier identified that could slow or prevent nitrates and pathogens from entering the aquifer, the susceptibility to the high capacity septic system is classified as high (Montana DEQ, 2000, Table 7).

As mentioned previously, less than 20% of the land cover surrounding the border station is used for cultivated cropland. This percentage of agricultural land present in the inventory region is considered to represent a low hazard. Because one barrier has been identified, the susceptibility to the agricultural land is rated as low (Montana DEQ, 2000, Table 7).

Management Options

Possible management options for potential contamination from individual septic systems include promoting the maintenance of septic tanks and distribution lines. Options for managing contamination by agricultural land surrounding the well include encouraging and supporting efforts to provide educational information, materials, and resources to land

owners on the proper application and storage of pesticides and fertilizers and implementing agricultural BMPs. The hazard and susceptibility ratings for each potential contaminant source as well as management options are summarized in the table below.

Table 1: Significant Potential Contaminant Sources

Source	Contaminant	Hazard Rating	Barriers	Susceptibility	Management
Large capacity septic system	Pathogens, nitrate	High	1. Thick clay layer	High	Encourage and support efforts to promote maintenance of septic tanks and distribution lines.
Cultivated Croplands	Fertilizers, pesticides, pathogens, nitrate	Low	1. Thick clay layer	Low	Encourage and support efforts to provide educational information, materials and resources to land owners on the proper application and storage of pesticide and fertilizers; implement agricultural BMPs

References:

- DEQ Permitting and Compliance Division, 2001. Sanitary Survey for Morgan Border Station PWS- PWS ID: #MT0002764.
- Montana Bureau of Mines and Geology, 1982. Occurrence and Characteristics of Ground Water In Montana, Volume 1, pp 68-73.
- Montana DEQ, 1999. Montana Source Water Protection Program, Approved by EPA in November 1999.
- Montana DEQ, 2000. Montana Source Water Protection Program, Template for Transient Public Water Supplies, Revised 2002.
- Montana State Library - Natural Resources Information System (NRIS) 2000 map base of the USGS Topographical coverage at 1:24,000 scale in MrSID format.
- U.S. EPA, Office of Water, 1991. Manual of Small Public Water Supply Systems, EPA 570/9-91-003, 211 p.
- U.S. Geological Survey, 2000. National Land Cover Dataset, Montana. 30-meter electronic digital land cover/land use dataset interpreted from satellite imagery.

Appendix A: Well log for the Morgan Border Station Well

Montana Bureau of Mines and Geology
 Ground-Water Information Center Site Report
 MORGAN BORDER STATION

[Plot this site on a topographic map](#)

Location Information

GWIC Id: 48000	Source of Data: COMBO
Location (TRS): 37N 30E 06 BABB	Latitude (dd): 48.9996
County (MT): PHILLIPS	Longitude (dd): -107.8331
DNRC Water Right: W189792-00	Geomethod: MAP
PWS Id: 02764002	Datum: 1927
Block:	Certificate of Survey:
Lot:	Type of Site: WELL
Addition:	
Site Notes: TRACT LOCATION BASED ON LAT\LONG FROM DEQ.	

Well Construction and Performance Data

Total Depth (ft): 325.00	How Drilled:
Static Water Level (ft): 50.00	Driller's Name:
Pumping Water Level (ft):	Driller License:
Yield (gpm):	Completion Date (m/d/y): 11/13/1952
Test Type:	Special Conditions:
Test Duration:	Is Well Flowing?:
Drill Stem Setting (ft):	Shut-In Pressure:
Recovery Water Level (ft):	Geology/Aquifer: 211JDRV
Recovery Time (hrs):	Well/Water Use: PUBLIC WATER SUPPLY
Well Notes:	

Hole Diameter Information

From	To	Diameter
0.0	325.0	6.0

Annular Seal Information

No Seal Records currently in GWIC.

Casing Information¹

From	To	Dia	Description
0.0	325.0	4.0	11 LB STEEL

Completion Information¹

From	To	Dia	Description
0.0	0.0	4.0	1/8 X 6 PERFS

Lithology Information

From	To	Description
0.0	3.0	SANDY TOP SOIL
3.0	8.0	HARD PAN
8.0	80.0	SANDY BROWN CLAY
80.0	98.0	SANDY BLUE CLAY
98.0	138.0	YELLOW CLAY
138.0	139.0	GRAVEL
139.0	140.0	HARD SANDSTONE
140.0	190.0	YELLOW SANDSTONE
190.0	193.0	SOFT YELLOW SHALE
193.0	195.0	LIGNITE COAL
195.0	210.0	SOFT YELLOW SHALE
210.0	265.0	SHALE

265.0	273.0	SANDSTONE
273.0	283.0	SANDSTONE AND SHALE
283.0	284.0	HARD SANDSTONE
284.0	308.0	WATER BEARING SANDSTONE
308.0	313.0	SHALE
313.0	315.0	LIGNITE COAL
315.0	325.0	WATER BEARING SANDSTONE

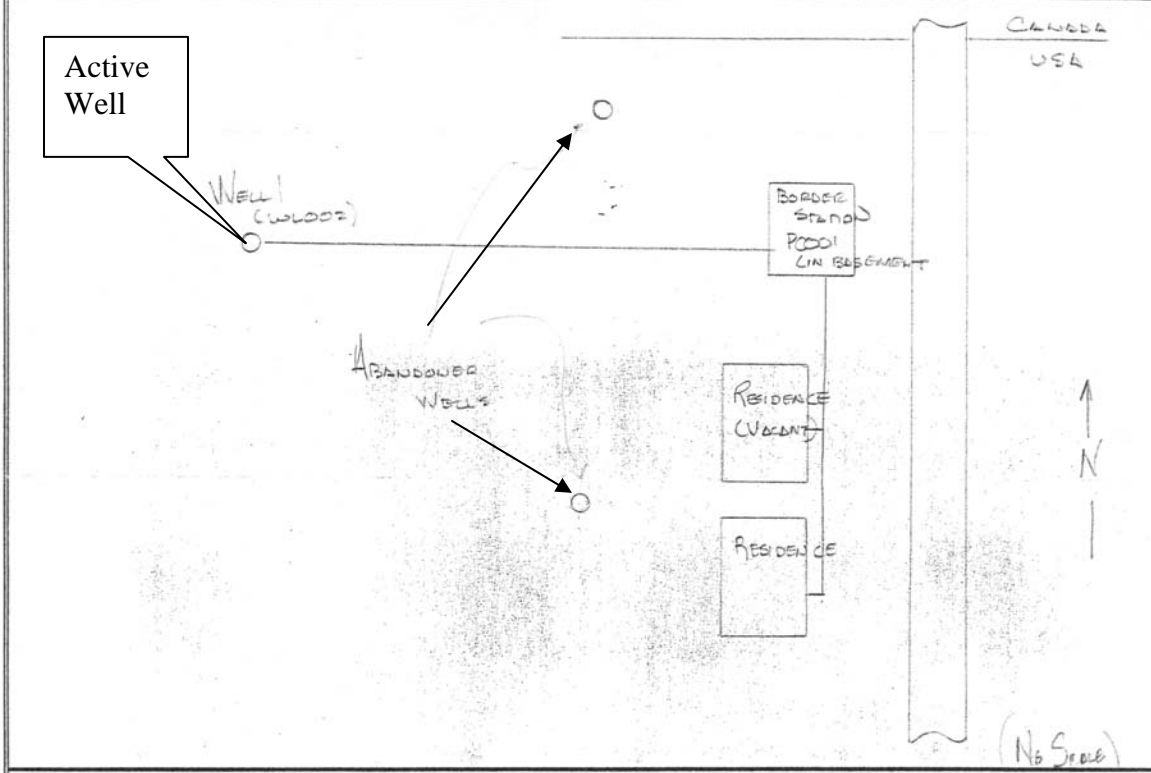
¹ - All diameters reported are **inside** diameter of the casing.

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted. Note: non-reported casing, completion, and lithologic records may exist in paper files at GWIC.

Appendix B: Site Plan

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Draw brief site plan showing location of well(s), springs(s), water storage, distribution system, pumphouse(s), entry point(s), treatment, etc. and label with appropriate facility designation. (See example on instruction sheet)



Draw brief schematic of pumphouse facilities (pressure control assemblies, treatment(s) valves, filters, meters, electrical controls, etc.)

