

*Town of Nashua*  
**Public Water System**

PWS ID # MT0000297

**Source Water Delineation**  
**and Assessment Report**

**Date of Report: 8/31/2010**

**Prepared by:**  
**Montana Rural Water Association, Inc., December 2002**  
**with additional information provided by**  
**Source Water Protection Program**  
**Montana Department of Environmental Quality**

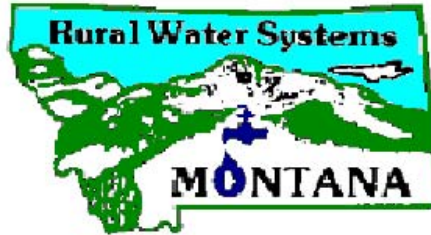
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Based on

# ***MONTANA RURAL WATER***



## *WELLHEAD/ SOURCE WATER PROTECTION PLAN*

### *NASHUA, MONTANA*



## *WELLHEAD/ SOURCE WATER PROTECTION PLAN*



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## GLOSSARY\*

**Acute Health Effect.** An adverse 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.

**Best Management Practices (BMPs).** Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from nonpoint sources.

**Coliform Bacteria.** Bacteria found in the intestinal tracts of animals. Their presence in water is an indicator of pollution and possible contamination by pathogens.

**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 that inhibits the flow of water.

**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.

**Delineation.** A process of mapping source water management areas.

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

**Hazard.** A measure of the potential of a contaminant leaked from a facility to reach a public water supply source. Proximity or density of significant potential contaminant sources determines hazard.

**Hydraulic Conductivity.** A coefficient of proportionality describing the rate at which water can move through an aquifer.

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

**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.

**Nitrate.** An important plant nutrient and type of inorganic fertilizer. In water the major sources of nitrates are 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.

**Pathogens.** A bacterial organism typically found in the intestinal tracts of mammals, capable of producing disease.

**Point-Source.** A stationary location or fixed facility from which pollutants are discharged.

**Public Water System.** A system that provides piped water for human consumption to 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.** A source water management region that is generally 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.

**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 Protection Area.** For surface water sources, the land and surface drainage network that contributes water to a stream or reservoir used by a public water supply.

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

**Susceptibility (of a PWS).** The 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.

**Transmissivity.** The ability of an aquifer to transmit water.

**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.

**Volatile Organic Compounds (VOC).** Any organic compound which evaporates readily to the atmosphere.

\* Definitions taken from EPA's Glossary of Selected Terms and Abbreviations

(<http://www.epa.gov/ceisweb1/ceishome/ceisdocs/glossary/glossary.html>)

# INTRODUCTION

This report was originally completed by Bill O'Connell, Groundwater Specialist with Montana Rural Water Systems inc. (MRWS), and Scott Gorman, the licensed operator for Nashua's Public Water System (PWS) in December 2002.

*Some additional information has been added by the Department of Environmental Quality (DEQ) to update and build upon the Wellhead Protection Plan to meet the requirements and guidance of the Federal Safe Drinking Water Act and the US Environmental Protection Agency, as well as a detailed Source Water Assessment Plan developed by a statewide citizen's advisory committee here in Montana. The Department of Environmental Quality (DEQ) is conducting these assessments for all public water systems in Montana. The sections shown in italics are provided by DEQ to update and amend the original text.*

## **Purpose**

This report uses the Source Water Assessment Program (SWAP) to meet the technical requirements for the completion of the Wellhead/Source Water Protection Plan (SWPP) for Nashua. A Source Water Assessment is required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996.

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 of mapping source water protection areas that contribute water used for drinking. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The purpose of the source water protection plan is to provide information to a PWS helping them protect their drinking water source.

## **Limitations**

This report was prepared to assess threats to Nashua'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 community's public water supply and not any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area 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 certain constituents that do not have MCLs but are considered to be significant health threats.

# CHAPTER 1 BACKGROUND

## The Community

Nashua is located in Valley County, northeast Montana, along east-west running US Highway 2, 12 miles east of Glasgow. The town has 460 residents and serves the surrounding agricultural community. The Public Water System (PWS) *serves a total of 385 people through 180 hook-ups*. See the vicinity map in [Figure 1](#).

## Geographic setting

Nashua is sited along the north bank of the Milk River approximately 15 miles above the Milk's confluence with the Missouri River. Porcupine Creek flows south around the north and east sides of Nashua. North and northwest the elevation raises over one hundred feet to a bench that separates the Milk River and Porcupine Creek drainages. The land around town is flat with a gentle 20-foot rise to Highway 2 on the north side of Nashua.

The Climate is continental types and is semi-arid in the basin. The average annual precipitation is 10 to 14 inches. The temperature in the study area is marked by extremes above 100<sup>0</sup> F and below -40<sup>0</sup> F.

## General Description of the Source Water

Nashua uses groundwater supplied by 2 wells and a backup well ([Figure 2](#)) as its' drinking water source. The production wells are between 50 and 60 feet deep and located north of the BN-SF right-of-way. The backup well (well 1) is located south of the railroad at the corner of Trumper and Front streets. The well is completed in the alluvial sediments of the Milk River.

The production wells (Wells 2 & 3) are located ½ mile north of the Milk River and 1 mile west of Porcupine Creek. This aquifer in this area is within the Milk River and Porcupine Creek alluvial deposits (MSE/HKM test wells report, 1995).

See the well location on the map in [Figure 2](#).

***Table 1. List of geologic or hydrogeologic maps available for the Nashua, Montana area.***

<b>Title or Description</b>	<b>Scale</b>	<b>Area Covered</b>	<b>Reference</b>
Topographical	1:24,000	Nashua	NRIS, map finder
Geological	Various	Montana	Taylor and Ashley
<i>Geological</i>	<i>1:100,000</i>	<i>Glasgow 30'x60' quadrangle</i>	<i>Bergantino, R.N., 1999</i>

## **The Public Water Supply**

*The town of Nashua is classified as a community public water system (PWS) since it serves at least 25 of the same people every day. The PWS has 180 hookups and serves 385 people. The Public Water Supply consists of 3 wells. Production wells 2 and 3 (DEQ Source Numbers WL003 and WL004 respectively) are located north of the BN railroad right-of-way and backup Well 1 (DEQ Source Number WL002) is near the corner of Trumper and Front streets on the west side of town. Well #1 is only used in the summer months during high demand periods. The wells pump directly into the distribution system and up to the tank.*

*The distribution system follows the layout of the town streets. Pressure is maintained by a combination of a 250,000-gallon storage tank located on a hill north of town and wells that pump directly into the system. The Well #1 pump house also has a truck loading station that is pressurized by the distribution system.*

*The water from Wells #2 and #3 is chlorinated as it passes through the common header in the pump house at well #2. A polyphosphate solution is injected at the same header to sequester iron and manganese in the drinking water. (September 3, 2001 Sanitary Survey Inspection, Appendix I).*

*A preliminary assessment of groundwater sources under the direct influence of surface water (GWUDISW) was completed for the Nashua PWS in 2001 (provided in Appendix I). The three wells passed the assessment and are classified as groundwater.*

## **Water Quality**

Nashua is routinely monitored for compliance with drinking water standards. Bacteriological monitoring occurs monthly. Compliance with other drinking water standards is based on additional sampling on a variety of schedules. The drinking water has excessive amounts of sulfate and sodium.

*Every PWS is required to perform monitoring for contamination to 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 program tailored to their system that follows the general protocols for operation of a PWS defined by DEQ. The monitoring schedule for Nashua is available at <http://nris.state.mt.us/wis/swap/swapquery.asp>. The Nashua PWS monitoring data from DEQ's PWS database for the past five years was reviewed and is summarized in this section.*

*Confirmed detections of total coliform have not been detected in the source water. The only compounds detected in Town of Nashua's source water monitoring over the past 5 years include nitrate + nitrite (0.25 to 0.83 mg/L), gross alpha (10.6 pCi/L), trichloroethylene (0.00055mg/L),*

*fluoride (0.71 mg/L), and sulfate (1050 to 1360 mg/L). These detections are all below EPA primary maximum contaminant levels (MCLs) where established. Although the detection of the volatile organic compound trichloroethylene is low and well below the MCL of 0.005 mg/L, Nashua and the community should pay close attention to future monitoring to confirm if this compound is entering the groundwater and evaluate potential sources of this man-made compound.*

*National secondary drinking water standards (SMCLs) are non-enforceable guidelines regarding contaminants that may cause cosmetic effects (such as taste, odor, or color) and are generally not a health risk. The SMCLs for sulfate of 250 mg/L was exceeded. Background monitoring conducted by Montana Bureau of Mines and Geology in 1988 on well #2 also indicates high levels of iron (0.56 mg/L which exceeds the SMCL of 0.3 mg/L), manganese (1.05 mg/L which exceeds the SMCL of 0.05 mg/L) and sodium (53.5 mg/L which is below the SMCL of 250 mg/L). The Nashua water system uses polyphosphate to treat iron and manganese in the water. Although the sodium concentrations detected do not exceed the SMCL of 250 mg/L, water systems having greater than 20 mg/L of sodium in their drinking water source are encouraged to inform their customers of the presence of this constituent so that those individuals on a physician-prescribed low-sodium diet can inform their doctors of this source of sodium in their diet.*

### **Influencing Factors**

The Source Water Protection Plan (SWAP) was started request of Judy Boyin Nashua's town clerk.

### **Source Water Protection Management**

Scott Gorman, Nashua's licensed operator will oversee implementation of the SWPP.

## **CHAPTER 2 DELINEATION**

The portion of the aquifer(s) that contributes water to Nashua's wells is identified in this chapter. Three management regions (the control zone, inventory region, and recharge region) are mapped for each well. The goal of management in the control zone is to protect against direct introduction of contaminants into the well or the immediate surrounding area.

Management in the inventory region should focus on pollution prevention activities where water is likely to flow to the wells within a relatively short time period. The goal of management in the recharge region is to maintain and improve the quality of groundwater that could reach the well over longer times or with increasing water usage.

### **Geologic Conditions and Aquifer Characteristics**

Nashua uses groundwater supplied by 3 wells to meet its' drinking water requirements. The wells are about 60 feet deep and are completed in the alluvial sediments of the Milk River and Porcupine Creek flood plain. The aquifer in this area is relatively flat.

The channel of the Milk River lies in the pre-ice-age channel of the Missouri River. The Missouri River was forced out of this channel during the Bull Lake ice-age when this region was buried under thick glacial ice. The glaciers eroded away the younger sediments and exposed the Bear Paw Shale at the surface.

The water chemistry indicates the water is a sodium-sulfate type. The water also has high total dissolved solids (TDS) at 980 ppm. The high solid content is the result of the Bear Paw Shale. The Shale was deposited in a shallow inland sea and naturally has a high salt content. As the groundwater moves through the sediments some of the salt is dissolved into the water.

*A geologic map of the area is provided in [Figure 3](#).*

## Wells

The Nashua wells are shallow at between 51 and 60 feet in total depth. The well completion depths are from 44 to 57 feet below ground surface and penetrate through clay layers. These completion depths should provide adequate protection from direct surface water influence. See the well logs in Appendix III for additional information.

**Table 2. Well information for Nashua.**

	Well #1	Well #2	Well #3
MBMG #	38972	3416	157842
Water Right #		PO71273-00	212574
Latitude / Longitude	48 8.032N 106 21.264W	48 8.020N 106 20.998W	48 7.954N 106 21.782W
Date Completed	4/2/1958	3/14/1974	8/28/1996
Depth	54 ft	51 ft	60 ft
Perforated Interval	48 to 53 ft	44 to 49 ft	46 to 57 ft
SWL Depth	31	35	35.8
PWL Depth	34.5	38.5	36.7
Drawdown	3.5	3.5	.9
Test Pumping Rate	670 gpm	545 gpm	550 gpm
Specific Capacity	191.4 gpm/ft	155.7 gpm/ft	611 gpm/ft
Pumping Rate	670 gpm	545 gpm	550 gpm
Source Type	Groundwater	Groundwater	Groundwater

## Conceptual Model and Assumptions

*The Town of Nashua's Backup Well #1 and Well # 2 are located in the Lower Milk River watershed (USGS Hydrologic Unit Code 10050012) and Well #3 is located in the Porcupine watershed (USGS Hydrologic Unit Code 10050016). Both watersheds are located within the Lower Missouri River Watershed Management Region for Montana. The source of Town of Nashua's drinking water is interpreted to be buried alluvial sand and gravel channel material that was deposited in a former channel of the Missouri River and along Porcupine Creek. The aquifer is locally semi-confined by overlying clay layers and may be unconfined in other areas of the channel. Recharge to the wells is likely from infiltration of precipitation and local surface water through the overlying alluvial materials in the valley. The aquifers are recharged from*

infiltrating surface water that drains toward the Milk River. Pumping the wells can reverse the hydraulic gradient and River water can drain into the aquifer.

Using DEQ Source Water Protection Program criteria for ranking aquifer sensitivity (Table 3), the Town of Nashua source water is considered as having **High Source Water Sensitivity** to contamination because the aquifer is semi-confined to unconfined and is an unconsolidated alluvial aquifer. Sensitivity is defined as the relative ease that contaminants can migrate to source water.

**Table 3. Source Water (Aquifer) Sensitivity Criteria**  
based on DEQ Source Water Protection Program Criteria (DEQ, 1999)

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

**Methods and Criteria**

DEQ’s Source Water Protection Program specifies methods and criteria used to delineate subregions of the source water protection areas for Nashua.

**Control Zones** - A one-hundred-foot radius control zone was delineated for each source.

**Inventory Region** - The Inventory Region was delineated using the Uniform Flow Equations. This is a 2-dimensional analytical solution to groundwater flow using information from Table 2.

$$-X = Q/2\pi Ti = -105,882 \text{ ft}^3/\text{day} / (2(3.14)(31,226 \text{ ft}^2/\text{day}).0061) = -88.5 \text{ ft (stagnation pt)}$$

$$Y = -X*\pi = (88.3 \text{ ft})(3.14) = 277.3 \text{ ft (lateral extent of capture zone)}$$

$$X = Kit/n = (2081 \text{ ft/day})(.0061)(365 \text{ days})/.3 = 15,474 \text{ ft} = 2.9 \text{ miles (up gradient)}$$

Q: pumping rate, (550 gpm)(1440 min/day)/7.48 gallons per ft<sup>3</sup>= 105,882 ft<sup>3</sup>/day

T: aquifer transmissivity, (1500)(545 gpm/7.48 gal/ft<sup>3</sup>)/3.5 ft= 31,226 ft<sup>2</sup>/day

K: hydraulic conductivity, T/aquifer thickness= 31226/15 ft= 2081 ft/day

i.: hydraulic gradient, 6 ft drop/977 ft distance= .0061 ft/ft

See areas in [Figure 4](#).

Note: The capture zones shown [Figure 4](#) are not representative of the hydrogeologic area that the wells draw from. The regional geology discussed in this section and shown on [Figure 3](#) suggests that the alluvial material extends northward to about the town boundary where the Bearpaw Shale bedrock outcrops. A majority of the groundwater for the wells is obtained from the highly permeable layers within the alluvial material and the low permeability Bearpaw shale would be a barrier to flow in the northward direction. The delineation of the inventory region should be completed by hydrologic mapping of the alluvial material in combination with an estimate of the 3-year time-of-travel distance from the wells.

Based on the hydrogeologic setting, a simple yet acceptable delineation method may be the calculated fixed radius (CFR) method which assumes no regional groundwater flow direction and that all of the water released to the well comes from storage within the aquifer proximal to the well. The CFR method determines the volume of the aquifer that is needed to supply the demand from the well over a time-of-travel period. The volume of the aquifer supplying the water is in the shape of a cylinder with the radius determined by the demand.

$$\begin{aligned} \text{The volume of the cylinder} &= \text{Discharge of the well} \\ nI(3.14)r^2 &= Q(\text{TOT}) \end{aligned}$$

$$\begin{aligned} r &= [((Q)(\text{TOT}))/nI(3.14)]^{1/2} = 2947 \text{ feet} = 2950 \text{ feet for 3-year TOT} \\ r &= [((Q)(\text{TOT}))/nI(3.14)]^{1/2} = 1701 \text{ feet} = 1700 \text{ feet for 1-year TOT} \end{aligned}$$

where  $r$  = radius of the circle for a specified TOT that represents the PWSs water supply for the next 1-year or 3-years  
 $Q$  = pumping rate = (550 gpm)(1440 min/day)/7.48 gal/ft<sup>3</sup> = 105,882 ft<sup>3</sup>/day  
 TOT = 3 years = 1095 days or 1-year = 365 days  
 $n$  = aquifer porosity = 25% based on standard values for sand and gravel  
 $I$  = open/screened interval for the well = screened interval + 1/2 of the remaining aquifer thickness = 5 feet + 1/2(23 feet) = 17 feet for Well #2

The delineation in [Figure 4](#) is revised to include more of the alluvial deposits and the revised inventory region is shown on [Figure 5](#). The delineation was modified at the contact of the Bearpaw Shale and at the Milk River boundary. All sources of potential contaminants are inventoried in this region.

**Recharge Region** – The recharge region for the Town of Nashua wells includes the alluvial channel material upgradient of the PWS wells along the Milk River and Porcupine Creek. The upgradient extent of the outwash channels mapped by Bergantino (1999) ([Figure 3](#)) is shown on [Figure 5](#) as the recharge boundary along the Milk River and the recharge boundary was extended up Porcupine Creek an arbitrary distance of 2 miles. 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 Nashua wells is based on published reports and lithology indicated on the well logs. The delineation methods have many assumptions and could be modified as additional information becomes available. The interaction of surface water with the alluvial channel deposits is not completely understood and the changes in the flow regime under seasonal conditions are not known. The delineation was completed using conservative assumptions to help ensure that the inventory zone reflects the actual area where contamination to the system may occur.*

## CHAPTER 3 INVENTORY

Potential sources of contamination were inventoried to assess the susceptibility of Nashua's drinking water sources to contamination. Potential sources of all contaminants with primary drinking water standards and cryptosporidium were identified, but a detailed inventory was conducted only for potential sources of contaminants that are the greatest threat to health. The contaminants of greatest concern to Nashua are dissolved salts and nitrates.

The inventory for Nashua focuses on all activities in the control zone, major facilities in the inventory region, and general land uses in the recharge region.

### **Inventory Method**

Databases were searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. The following steps were followed:

*Step 1:* Major road and rail transportation routes were identified throughout the inventory region.

*Step 2.* All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region and identified on the base map.

*Step3:* *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 4:* *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 5:* *Databases were queried to identify the following in the inventory region:*

- *Underground Storage Tanks (UST) (<http://www.deq.state.mt.us/UST/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 6: A business phone directory was queried to identify businesses that generate, use, or store chemicals in the inventory region. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were targeted by Standard Industrial Classification (SIC) code.*

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

- |  |   |
|--|---|
| 1. Large quantity hazardous waste generators | 2. Landfills                                |
| 3. Hazardous waste contaminated sites        | 4. Underground storage tanks                |
| 5. Major roads or rail transportation routes | 6. Cultivated cropland                      |
| 7. Animal feeding operations                 | 8. Wastewater treatment or spray irrigation |
| 9. Septic systems, Sewered residential areas | 10. Storm sewer outflows                    |

### **Inventory Results/Control Zone**

The control zone is the 100-foot radius around each well. Within the control zone for the existing wells, the main potential contaminant is:

Well 1, vehicle traffic near the wellhead.

Well 2, vehicle traffic near the wellhead.

Well 3, no activities in control zone

## **Inventory Results/Inventory Region**

The Inventory Region for Nashua's wells includes sanitary sewers, highways, city streets, railroad right-of-way and service stations. See [Figure 6](#).

*Land cover in the inventory region for the Town of Nashua PWS primarily agricultural crop lands (55%) and residential/commercial/transportation (19%) with the remaining 26% being deciduous forest, grasslands, and open water/wetlands ([Figure 7](#)). The percentage of agricultural land poses a high hazard to the water supply based on the Montana Source Water Protection Guidance Manual (1999).*

**Table 4. Results for Nashua’s inventory region**

<b>Potential Contaminant Source</b>	<b>Description/Concern</b>
Railroad	<i>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 in the right-of-way may impact the drinking water supply</i>
Roads	<i>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 in the right-of-way may impact the drinking water supply</i>
Municipal sewer and treatment plant/lagoons	<i>If not properly designed, installed, and maintained, sewer lines can impact drinking water through leaks or spills. Improper management of wastewater, treatment chemicals, or equipment maintenance materials at the treatment plant may impact drinking water supply.</i>
Agriculture	<i>Over-application or improper handling of pesticides or fertilizers may impact drinking water. Excessive irrigation may cause transport of contaminants or sediments to groundwater/surface water through runoff</i>
<i>Leaking Underground Storage Tanks (5 sites with Nashua address - see Appendix V)</i>	<i>Existing contamination from spills, leaks, or improper handling of stored materials may impact the drinking water supply.</i>
<i>Active Underground Storage Tank Sites -Farmers Union Oil -Missouri River Outpost</i>	<i>Spills, leaks, or improper handling of stored materials may impact the drinking water supply</i>
<i>Inactive Underground Storage Tank Sites (7 sites with Nashua address - see Appendix V)</i>	<i>Historic spills or leaks may impact the drinking water supply. DEQ classifies inactive USTs as temporarily out of service and requires that the product in the tank be removed. However, testing of the tanks, distribution lines or soils around the tank is not required to evaluate the potential for historic leaks or spills that may impact subsurface soils and groundwater.</i>
<i>Businesses that may use hazardous chemicals (9 sites with Nashua address - see Appendix)</i>	<i>Spills, leaks, or improper handling of chemicals and other materials during transportation, use, storage, and disposal may impact the drinking water supply</i>

*Note: For many of the facilities with a Nashua address summarized in Appendix V, the location information provided is insufficient to accurately map the facility, the PWS operator should verify if these businesses are within the inventory region.*

**Inventory Results/Recharge Region**

The Recharge Region for the wells includes more agricultural land and the Milk River which could carry contaminants rapidly from far away.

**Inventory Update**

The certified 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. A complete inventory should be submitted to DEQ every five years.

**Inventory Limitations**

The potential sources of contaminants for Nashua are determined from readily available data and reports. Unregulated activities or unreported contaminant releases may have been missed. The use of multiple sources of data, however, should ensure the major threats are inventoried.

## CHAPTER 4 SUSCEPTIBILITY ASSESSMENT

The susceptibility of Nashua’s wells to significant potential contaminant sources is assessed in this chapter to rank threats to the drinking water source. The degree of susceptibility is determined by the hazard associated with a source and the existence of barriers to contamination (Table 5). The proximity of point contaminant sources to the town’s wells or the density of non-point sources in the inventory region determines hazard (Table 6). Barriers can be anything that decreases the likelihood that contaminated water will flow to the town’s wells. 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 can be considered management barriers. Thick clayey soils, a deep water table, or a thick saturated zone above the well intake can be natural barriers.

Susceptibility ratings are presented individually for each significant potential contaminant source in the inventory region. Nashua is not considered susceptible to individual point sources in the recharge region because dispersion and dilution of contaminants should reduce concentrations of contaminants below levels associated with adverse health affects.

**Table 5. Susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.**

	<b>High Hazard</b>	<b>Moderate Hazard</b>	<b>Low Hazard</b>
<b>No Barriers</b>	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
<b>One Barrier</b>	High Susceptibility	Moderate Susceptibility	Low Susceptibility
<b>Multiple Barriers</b>	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

**Table 6. Hazard of potential contaminant sources for Nashua.**

	<b>High Hazard</b>	<b>Moderate Hazard</b>	<b>Low Hazard</b>
<b>Point Sources of All Contaminants</b>	Within one-year TOT	one to three years TOT	Over three years TOT
<b>Septic Systems</b>	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
<b>Municipal Sanitary Sewer</b> (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
<b>Cropped Agricultural Land</b> (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

The results of the susceptibility assessment for Nashua are summarized in Table 7.



**Table 7. Susceptibility Assessment for Nashua's Inventory Region.**

Source	Contaminant	Hazard	Rating	Barriers	Susceptibility	Management Recommendations
<b>Municipal sewers, treatment plant and lagoons</b>	Pathogens and nitrates VOCs, SOCs, metals, others	Ongoing Leaks or catastrophic breaks	<b>High</b>	Clay layers overlie the aquifer	<b>High</b>	routine monitoring and sewer system maintenance rapid response planning for leaks or ruptures.
<b>Agriculture</b>	pathogens, nitrates and SOCs from fertilizer, pesticides and herbicides.	Infiltration	<b>High</b> (since >50% of Inventory Region)	-Clay layers overlie the aquifer	<b>High</b>	routine monitoring Notify landowners of well and protection area locations. Encourage use of agricultural best management practices (BMPs) in the inventory and recharge region
<b>Highway &amp; city streets</b>	VOCs SOCs, petroleum products, other chemicals	Spills, routine spraying, storm water runoff, infiltration into groundwater	<b>High</b> (within 1-year TOT)	-Clay layers overlie the aquifer Wells located away from main streets. - County Emergency Response Plan, training and preparation of local response personnel	<b>Moderate</b>	routine monitoring Notify owners of well and protection area locations. 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 MDOT/County/Local road owners to reduce herbicide use.
<b>Railroad</b>	VOCs SOCs petroleum products, other Chemicals	Spills, routine spraying, storm water runoff, infiltration into groundwater	<b>High</b> (within 1-year TOT)	-Clay layers overlie the aquifer - County Emergency Response Plan, training and preparation of local response personnel	<b>Moderate</b>	Notify owners of well and protection area locations. 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 to reduce herbicide use.

**Table 7. Susceptibility Assessment for Nashua's Inventory Region (continued)**

<b>Source</b>	<b>Contaminant</b>	<b>Hazard</b>	<b>Rating</b>	<b>Barriers</b>	<b>Susceptibility</b>	<b>Management Recommendations</b>
<i>Active USTs</i> -Farmers Union Oil -Missouri River Outpost	VOCs, petroleum hydrocarbons	<i>Contaminants leaching into groundwater</i>	<b>High</b>	-Clay layers overlie the aquifer - Compliance with 1998 upgrades - Spill prevention	<b>Moderate</b>	<i>Review permit status and ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, groundwater monitoring, spill prevention, BMPs.</i>
<i>Leaking UST sites</i> -Korner One Stop -Sportsman Stop -Nashua Conoco (NFA) -Farmers Union Oil (NFA) -Fort Peck Compressor Station (NFA)	VOCs, petroleum hydrocarbons	<i>Existing contamination may impact the drinking water supply.</i>	<b>High</b>	-On-going remediation and monitoring -Clay layers overlie the aquifer	<b>Moderate</b>	<i>Review status and any permits or monitoring network to verify existing contamination is being or has been properly removed or remediated.</i>
<i>Inactive UST Sites (see Appendix V)</i>	VOCs, petroleum hydrocarbons	<i>Historic spills or leaks may impact the drinking water supply.</i>	<b>Low*</b>	- DEQ rules require product is removed from USTs.	<b>Low</b>	<i>Properly abandon and remove tanks if out-of-service, soil testing to evaluate potential impact from historic spills or leaks.</i>

<p><b>Multiple businesses that may use hazardous materials as identified by SIC Code (See Appendix V)</b></p>	<p>VOCs, SOCs and other chemicals</p>	<p>Spills and leaks impacting groundwater</p>	<p><b>High</b></p>	<p>-Clay layers overlie the aquifer - Most are handle only small volumes of potential contaminants</p>	<p><b>Moderate</b></p>	<p>Notify business owners of well and protection area locations. 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.</p>
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**Notes:** VOCs - Volatile organic compounds (i.e. solvents, fuel components)

SOCs - Synthetic Organic Compounds (i.e. pesticides, herbicides, plasticizers)

UST – Underground Storage Tank

NFA – Requires no further action at this time but project could be re-opened if warranted

\* Hazard rating varies from Table 6 due to low frequency of use or low chemical use at the facility



## **Limitations**

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. Table 7 only includes the potential contaminant sources identified in Chapter 3 that were determined to present a significant potential risk to the drinking water supply. Low risk potential sources such as grazed grasslands were not included. It is highly recommended that the PWS operator and community members familiar with the nature of businesses and land use in the area enhance the inventory through further research and local input.

## CHAPTER 5 MANAGEMENT

The goal of the Source Water Protection Program is to prevent Nashua's drinking water source from being contaminated. All land uses have been inventoried and the potential for these activities to contaminate the drinking water have been ranked. Management activities can be considered as another barrier developed to reduce the susceptibility of a specific contaminant from entering Nashua's water. *Nashua's management plan as provided in the original 2002 Wellhead Protection Plan is provided below. Additional management recommendations that could be implemented are provided by DEQ in italics. 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. Some of the DEQ management recommendations are also detailed in the susceptibility table for the Town of Nashua PWS (Table 7). If these, and other, management recommendations are implemented; they may be considered additional barriers that will reduce the susceptibility of the PWS to specific sources and contaminants.*

### **Control Zone Management**

No chemicals will be used, stored or transported within the 100-foot radius of the wells. The Control Zone is part of current PWS regulations.

***Additional DEQ Management Recommendations:** Nashua should continue to restrict chemical handling, use and storage within the control zones for the production wells (including pesticides and herbicides). Ongoing training to promote safe handling and proper storage, transport, use, and disposal of hazardous materials should be provided if these materials are used in the control zone. If sewer lines are present within the control zone, the PWS should request the lines be tested for integrity and prioritized for updating if warranted.*

### **Inventory Region Management**

Management of this region for Nashua is based on the wells' location away from most land use activities. The town's limits include all the land in this region and will control the land use near the wells. Well 3 is outside the city limits but a city may control land use within 1 ½ miles of the its' limits for public health reasons. See the city limits in [Figure 4](#).

***Additional DEQ Management Recommendations:***

***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.*

***Agricultural Best Management Practices (BMPs)** – The water system should encourage local land users in the Inventory Region and the Recharge Region to utilize BMPs that*

*address application and mixing of fertilizer and pesticides. BMPs are generally voluntary but their implementation can be encouraged through education and technical assistance.*

***Education*** – *The Town of Nashua PWS should contact the landowners identified in Table 7 and provide educational information to promote safe handling and proper storage, transport, use, and disposal of hazardous materials and information on proper maintenance and operation of wastewater systems. Ongoing training provided to designated emergency personnel would promote the efficiency and effectiveness of emergency responses to hazardous material spills. The EPA and the State of Montana can provide educational materials on these topics.*

***Inactive USTs/LUSTs*** - *It is recommended that the PWS operator or community members 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.*

### **Recharge Region Management**

The recharge region for Nashua is in the surrounding highlands north and west of the town. The land outside the Town and is agricultural. The potential surface water impact could impact Well 1, and emergencies will be monitored. Well 1 is a backup well.

### **Management Implementation**

The management strategies have been in use as part of the Public Water Systems operation. The Wellhead/ Source Water Protection Plan was started with the support of the mayor.

***Additional DEQ Management Recommendations:*** *The Nashua PWS should continue to implement the existing wellhead protection plan. At a minimum, the water system operator and other parties interested and/or knowledgeable of the area should meet annually to verify the existing conditions and update the Wellhead Protection Plan management and emergency response plan if warranted. The PWS should verify that the existing county Emergency Response Plan 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.*

## **CHAPTER 6 EMERGENCY PLAN**

Procedures for responding to emergencies are described and an emergency coordinator is designated in this chapter. The equipment and materials needed to respond to an emergency and the source of a temporary water supply are also described.

*Note: Contingency planning is not part of a typical Source Water Delineation and Assessment Report but is highly recommended as part of voluntary protection measures by each PWS. DEQ has not reviewed this chapter to confirm that the emergency plan identifies the potential threats to the drinking water supply and provides the detail necessary to implement a response to contamination or disruption of the public water system. As previously recommended, the water system operator and other parties interested and/or knowledgeable of the area should meet annually to verify the existing conditions and update this emergency plan if warranted. The PWS should verify that the existing county Emergency Response Plan 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.*

### **Possible Disruption Threats**

The main threat to the PWS has been identified as casing failure or line breaks. A failure of the casing could allow contaminated surface water or poorer quality water from a different aquifer to enter the well.

### **Emergency Coordinator**

The emergency coordinator for Nashua is Scott Gorman, Licensed operator for the Public Water System.

### **Equipment and Material Resources**

A catastrophic loss of water will require the services of an engineer and a well driller. Minor disruptions to the public water system will be handled by public works.

### **Procedures to Shut Down the Well**

The wells can be isolated from the water distribution system by using the valves at the well sites. The wells can be turned off at the respective pump house but requires a key for access. The keys are located in the town shop.

### **Well Site Security**

Wells 1 and 2 are located in the pump-houses in residential areas. The pump-houses are locked. Well 3 is located just outside the eastern city limits and the well is outside the pump-house. However the site is surrounded by an 8-foot chain link fence with a locked gate.

**Important emergency contacts and phone**

CONTACT NAME	TITLE	PHONE	RESPONSIBILITY
<i>Scott Gorman</i>	<i>Director of Public Works</i>	<i>749-3461</i>	<i>All PWS</i>
<i>DEQ Enforcement Division</i>	<i>Emergency Contractors</i>	<i>444-0379</i>	<i>Equipment and Materials</i>
<i>Mark Gruener</i>	<i>District 6 Representative</i>	<i>538-6166</i>	<i>Disasters and Emergency Services (DES)</i>
<i>Montana Spill Hotline</i>		<i>841-3911</i>	
	<i>Department of Agriculture</i>	<i>444-5400</i>	<i>Agricultural chemicals</i>

## **CHAPTER 7 ALTERNATE WATER SOURCES**

Nashua has sufficient water to meet the town's requirements during most of the year. However, during the late summer and early fall the wells and storage just meet demand with watering restrictions.

Nashua is currently working with an engineering firm to develop additional wells and upgrade the distribution system.

*Note: Evaluation of alternate water sources is not part of a typical Source Water Delineation and Assessment Report but is highly recommended as part of voluntary protection measures by each PWS. DEQ recommends that the methods used for evaluation of the susceptibility of existing sources presented in this report be considered when evaluating additional sources of water for the PWS.*

## CHAPTER 8 MONITORING WAIVERS

*Note: this chapter was added by DEQ as part of the Source Water Delineation and Assessment Report update.*

### **Waiver Recommendation**

The Town of Nashua PWS has a waiver for Phase 2 inorganics (which includes barium, cadmium, chromium, fluoride, mercury and selenium). The waiver allows Nashua to collect one sample round for these constituents every 9-year cycle (the standard is one sample round per 3-year cycle). In addition, Nashua was grandfathered under the radionuclide rule and is only required to sample once every 9-years. Based on the susceptibility assessment, the Town of Nashua PWS is not likely eligible for other waivers; however, information on susceptibility and use waivers is provided in this section to give the PWS operators an opportunity to consider if waivers may be feasible.

Before a susceptibility or use waiver is requested, the PWS Operators are encouraged to carefully review the following section on Monitoring Waiver Requirements. If after reviewing this section it is determined that an additional waivers are feasible, the PWS should submit a letter to DEQ requesting the specific monitoring waivers. If requested by DEQ, the PWS may also need to provide additional information regarding chemical use in the area within the Inventory Region.

### **Monitoring Waiver Requirements**

The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for the organic chemicals to systems that have completed an approved waiver application and review process. All PWSs in the State of Montana are eligible for consideration of monitoring waivers for several organic chemicals. The chemicals diquat, endothall, glyphosate, dioxins, ethylene dibromide (EDB), dibromochloropropane (DBCP), and polychlorinated biphenyls are excluded from monitoring requirements by statewide waivers.

### Use Waivers

A Use Waiver can be allowed if through a vulnerability assessment, it is determined that specific organic chemicals were not used, manufactured, or stored in the area of a water source (or source area). If certain organic chemicals have been used, or if the use is unknown, the system would be determined to be vulnerable to organic chemical contamination and ineligible for a Use Waiver for those particular contaminants.

## Susceptibility Waivers

If a Use Waiver is not granted, a system may still be eligible for a Susceptibility Waiver, if through a vulnerability assessment it is demonstrated that the water source would not be susceptible to contamination. Susceptibility is based on prior analytical or vulnerability assessment results, environmental persistence, and transport of the contaminants, natural protection of the source, wellhead protection program efforts, and the level of susceptibility indicators (such as nitrate and coliform bacteria). The vulnerability assessment of a surface water source must consider the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the surface water intake. PWSs developed in unconfined aquifers should use a minimum fixed radius of 1.0 mile as an area of investigation for the use of organic chemicals. Vulnerability assessment of spring water sources should use a minimum fixed radius of 1.0 mile as an area of investigation for the use of organic chemicals. Shallow groundwater sources under the direct influence of surface water (GWUDISW) should use the same area of investigation as surface water systems; that is, the watershed area above the source, or a minimum fixed radius of 1.5 miles upgradient of the point of diversion. The purpose of the vulnerability assessment procedures outlined in this section is to determine which of the organic chemical contaminants are in the area of investigation.

Given the wide range of landforms, land uses, and the diversity of groundwater and surface water sources across the state, additional information is often required during the review of a waiver application. Additional information may include well logs, pump test data, or water quality monitoring data from surrounding public water systems; delineation of zones of influence and contribution to a well; time-of-travel or attenuation studies; vulnerability mapping; and the use of computerized groundwater flow and transport models. DEQ's PWS Section and DEQ's Source Water Protection Program will conduct review of an organic chemical monitoring waiver application. Other state agencies may be asked for assistance.

## Susceptibility Waiver for Unconfined Aquifers

Unconfined aquifers are the most common source of usable groundwater. Unconfined aquifers differ from confined aquifers in that the groundwater is not regionally contained within relatively impervious geologic strata. As a result, the upper groundwater surface or water table in an unconfined aquifer is not under pressure that produces hydrostatic head common to confined aquifers.

Unconfined aquifers are usually locally recharged from surface water or precipitation. In general, groundwater flow gradients in unconfined aquifers reflect surface topography, and the residence time of water in the aquifer is comparatively shorter than for water in confined aquifers. Similar water chemistry often exists between unconfined groundwater and area surface water, and physical parameters and dissolved constituents can be an indicator of the hydraulic connection between groundwater and surface water. Consequently, unconfined aquifers can be susceptible to contamination by organic chemicals migrating from the ground surface to groundwater.

The objective of the susceptibility waiver application is to assess the potential of organic chemical migration from the surface to the unconfined aquifer. The general procedures make use

of a combination of site-specific information pertaining to the location and construction of the source development, monitoring history of the source, geologic characteristics of the unsaturated soil and vadose zones, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The zone of contribution of the unconfined groundwater source must be defined and plotted. This should describe the groundwater flow directions, gradients, and a 3-year time-of-travel. All surface bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well and those nearby should be provided as well.

#### Susceptibility Waiver for Confined Aquifers

Confined groundwater is isolated from overlying material by relatively impermeable geologic formations. A confined aquifer is subject to pressures higher than atmospheric pressure that would exist at the top of the aquifer if the aquifer were not geologically confined. A well that is drilled through the impervious layer into a confined aquifer will enable the water to rise in the borehole to a level that is proportional to the water pressure (hydrostatic head) that exists at the top of a confined aquifer.

The susceptibility of a confined aquifer relates to the probability of an introduced contaminant to travel from the source of contamination to the aquifer. Susceptibility of an aquifer to contamination will be influenced by the hydrogeologic characteristics of the soil, vadose zone (the unsaturated geologic materials between the ground surface and the aquifer), and confining layers. Important hydrogeologic controls include the thickness of the soil, the depth of the aquifer, the permeability of the soil and vadose zones, the thickness and uniformity of low permeability and confining layers between the surface and the aquifer, and hydrostatic head of the aquifer. These factors will control how readily a contaminant will infiltrate and percolate toward the groundwater.

The Susceptibility waiver has the objective of assessing the potential of contaminants reaching the groundwater used by the PWS. A groundwater source that appears to be confined from surface infiltration in the immediate area of the wellhead may eventually be affected by contaminated groundwater flow from elsewhere in the recharge area. Contaminants could also enter the confined aquifer through improper well construction or abandonment where the well provides a hydraulic connection from the surface to the confined aquifer. The extent of confinement of an aquifer is critical to limiting susceptibility to organic chemical contamination. Regional conditions that define the confinement of a groundwater source must be demonstrated by the PWS in order to be considered for a confined aquifer susceptibility waiver. Confinement of an aquifer can be demonstrated by pump test data (storage coefficient), geologic mapping, and well logs. Site-specific information is required to sufficiently represent the recharge area of the aquifer and the zone of contribution to the PWS well. The following information should be provided:

- Abandoned wells in the region (zone of contribution to the well),
- Other wells in the region (zone of contribution to the well),
- Nitrate/Coliform bacteria analytical history of the PWS well, and
- Organic chemical analytical history of the PWS well.

## REFERENCES

1. Alt, David, A., and Hyndman, Donald, W., 1992, Roadside Geology of Montana
2. Levens, Russell, L., 1999, DEQ, Source Water Protection Plan, Sage Creek Hutterite Colony
3. MSE/HKM, Nashua Test Wells Summary, 1995
4. Taylor, Robert, L., and Ashley, Joseph, M., Geologic Map of Montana and Yellowstone National Park

### *Additional References used for DEQ Update:*

Bergantino, R.N., 1999, Geologic map of the Glasgow 30' x 60' quadrangle, northeast Montana, Montana Bureau of Mines and Geology Open File Report 390, 4 page(s), scale 1:100,000.

Montana Bureau of Mines and Geology, 2004. Groundwater Information Center, lithologic well logs. <http://mbmeggwic.mtech.edu/>

Montana Department of Environmental Quality Public Water Supply Section, 2004. Safe Drinking Water Information System (SDWIS).

Montana Department of Environmental Quality (DEQ), 1999. Montana Source Water Protection Program. <http://www.deq.state.mt.us/ppa/p2/swp/index.asp>

Montana Department of Environmental Quality Underground Storage Tank Program web site. <http://www.deq.state.mt.us/Rem/tsb/iss/USTDownloads.asp>

Montana Natural Resources Information Interactive Map website. 2004. <http://nris.state.mt.us/interactive.html>

United States Census Bureau, 2000. [http://factfinder.census.gov/home/saff/main.html?\\_lang=en](http://factfinder.census.gov/home/saff/main.html?_lang=en)

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

United States Geological Survey. 1992. National Landcover Dataset, Montana. 30-meter electronic digital landcover dataset interpreted from satellite imagery. <http://nris.state.mt.us/nsdi/nris/nlcd/nlcdvector.html>

Various Authors, 1998-2004. Correspondence in DEQ's PWS files regarding the Town of Nashua Water Supply.

**Appendix I**  
**Water System Site Map *and***  
***Sanitary Survey Reports***



**Appendix II**  
**Water Chemistry**



**Appendix III**  
**Well Logs**



**Appendix IV**  
**MSE/HKM Report**



*Appendix V*  
*Listing of Potential Contaminant Sources*

## DEQ UST List

<http://www.deq.state.mt.us/UST/USTDownloads.asp>

### Notes:

Active USTs have usually been upgraded to 1998 standards (which includes leak detection and monitoring) Spills or improper handling during tank filling or product distribution at these facilities may impact the drinking water supply.

DEQ classifies inactive USTs as temporarily out of service and requires that the product in the tank be removed. However, testing of the tanks, distribution lines or soils around the tank is not required to evaluate the potential for historic leaks or spills that may impact subsurface soils and groundwater.

AltFacilityID	Facility Name	Facility_Location_Address	City	County	Active Tanks	Nonactive Tanks
53-08169	4 Mi. So West. of Nashua	Address Unknown	Nashua	Valley		1
53-05213	Adkins Ranch Inc.	N.S.R. Box 164	Nashua	Valley		2
53-12453	Bergies	410 Sargent	Nashua	Valley		3
53-10461	Farmers Union Oil Co (Nashua)	810 Main St	Nashua	Valley	4	4
53-11603	Korner One Stop	Corner of Hwy 2 & 117	Nashua	Valley		3
53-04078	Missouri River Outpost	MAHC 81	Nashua	Valley	1	2
53-02916	Nashua Conoco	Main Street PO Box 136	Nashua	Valley		4
53-01571	Nashua School Bus Barn	Address Unknown	Nashua	Valley		1

## DEQ LUST List

<http://www.deq.state.mt.us/UST/USTDownloads.asp>

City	SiteName	Location	AltEventID	Date	Confirmed Release Date	Project Officer	Active
Nashua	Farmers Union Oil	810 Main	5310461*519	20-Mar-90	20-Mar-90		No
Nashua	Fort Peck Compressor Station	S Star Route	5309382*148	10-Aug-89	10-Aug-89		No
Nashua	Korner One Stop	Corner of Hwy 2 & 117	5311603*3870	07-Dec-99	07-Dec-99	Scott Gestring	Yes
Nashua	Nashua Conoco	Main St Box 136	5302916*2208	11-May-94	11-May-94		No
Nashua	Sportsman Stop	Mahc 81 Box 245	5304078*2354	03-Oct-94	27-Sep-91	Scott Gestring	Yes

## List of Businesses Identified by SIC Code as Potential Contaminant Sources

NAME	ADDRESS	CITY	SIC1	LATITUDE	LONGITUDE	Precision
Agland CO-OP of Nashua	810 Front St	Nashua	554101	48.159180	-106.37538	4
Avon Products		Nashua	508702	48.159180	-106.37538	4
B & B Foods	719 Front St	Nashua	541105	48.159180	-106.37538	4
Burlington Northern Santa Fe	Sargent St	Nashua	401101	48.159180	-106.37538	4
Missouri River Outpost	380 Highway # 117	Nashua	541103	48.032940	-106.44630	3
Nashua Public School Dist 13	222 Mabel St	Nashua	821103	48.159180	-106.37538	4
Nashua School	222 Mabel St	Nashua	821103	48.159180	-106.37538	4
Nefzger Trucking		Nashua	421304	48.159180	-106.37538	4
Wagon Wheel Bar	401 Sargent	Nashua	541105	48.159180	-106.37538	4

Notes:

SIC- Standard Industrial Classification Code

Data Source: 1= address matched to location (most accurate), 2= located at centroid of Zip+4, 3= located at centroid of Zip+2, and 4= Zip Code Centroid (least accurate)

Reference: Select Phone Version 3.3 Phone Directory by Info USA

The U.S. Standard Industrial Classification (SIC) Codes classify categories of businesses. SIC Codes cover the entire range of business categories that exist within the economy. U.S. industries are categorized into the following divisions as represented by the first two digits of the SIC code:

- Agriculture, Forestry, and Fishing (01-09)
- Mining (10-14)
- Construction (15-19)
- Manufacturing (20-39)
- Transportation and Public Utilities (40-49)
- Wholesale Trade (50-51)
- Retail Trade (52-59)
- Finance, Insurance, and Real Estate (60-69)
- Services (70-89)
- Public Administration (90-98)
- Nonclassifiable Establishments (99)

Each SIC Code division contains a series of subcategories that cover all areas within that specific division.

Detailed descriptions of each code are provided at <http://www.census.gov/epcd/www/naicstab.htm>.