

# MUSSELSHELL WATER SYSTEM PUBLIC WATER SYSTEM

PWS ID No. MT0000296

## DRAFT SOURCE WATER DELINEATION & ASSESSMENT REPORT

PREPARED BY:

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SOURCE WATER PROTECTION PROGRAM

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## EXECUTIVE SUMMARY

This Source Water Delineation and Assessment Report (SWDAR) was prepared under 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 completing these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the inventory region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

Musselshell's drinking water is supplied by two wells at the south and east ends of town. In accordance with the Montana Source Water Protection Program criteria (1999), the aquifer (source water) is considered to have a low sensitivity to potential contaminant sources since the wells are completed in consolidated sandstone bedrock. Sensitivity is defined as the relative ease that contaminants can migrate to source water through the natural materials.

As part of this assessment, three types of source water protection management areas were mapped for the Musselshell public water system. They are: the control zone, the inventory region, and the recharge region. Potential sources of contamination were identified within each of these three regions and the results are as follows:

- No potential sources of contamination were identified within the control zone. The goal of management in the control zone is to avoid introducing contaminants directly into the water supply's well or immediate surrounding areas. The control zone is delineated as a 100-foot radius around the wellheads. All sources of potential contaminants should be excluded from the control zones.
- No significant potential contaminant sources were identified within the inventory region. Two underground storage tank locations are located in town, but their physical locations could not be determined.

The inventory region should be managed to prevent contaminants from reaching the well before natural processes reduce their concentrations. The inventory region includes the area upgradient of the well that is expected to supply groundwater recharge to the well over the next three years.

- Potential contaminant sources identified within the recharge region are limited to minor agricultural lands. Few point sources of potential contaminants were identified in this sparsely developed region; these are not inventoried.

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 is primarily from infiltration of precipitation and surface water into the Fort Union Formation in Hawk Creek drainage.

Low risk potential sources and potential sources located outside the inventory region, but within the recharge region may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for Musselshell. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource.

The costs associated with contaminated drinking water are high, and prevention is preferable to treatment. Public awareness is a powerful tool for protecting drinking water. The information in this report will help increase public awareness about the relationship between land use activities and drinking water quality.

## TABLE OF CONTENTS

Executive Summary .....	i
1.0 Introduction .....	1
2.0 Background .....	1
2.1 Physical Setting.....	1
2.1.1 Geography and Geology .....	1
2.1.2 Climate.....	1
2.2 The Public Water Supply .....	2
2.2.1 Water Supply System.....	2
2.2.2 Supply Well Information .....	2
2.2.3 Source Water.....	3
2.3 Water Quality .....	3
2.3.1 Public Water Supply Monitoring Results .....	3
2.3.2 Background Water Quality Monitoring Results .....	3
3.0 Management Area Delineation.....	4
3.1 Conceptual Model .....	4
3.2 Delineation .....	4
4.0 Inventory .....	4
4.1 Inventory Method.....	4
4.2 Inventory Results .....	5
4.2.1 Control Zone Inventory Results.....	5
4.2.2 Inventory Region Results.....	6
4.2.3 Recharge Region Inventory Results.....	6
4.3 Inventory Update.....	6
5.0 Susceptibility Assessment .....	6
5.1 Introduction To Susceptibility.....	6
5.2 Determination of Susceptibility .....	6
5.3 Results of Susceptibility Assessment.....	7
6.0 Limitations .....	9
7.0 Conclusions .....	10
8.0 References .....	12
9.0 Glossary.....	13

## FIGURES

- [Figure 1](#) – Public Water Supply Location  
[Figure 2](#) – Regional Geology of the Public Water Supply  
[Figure 3](#) – Source Water Inventory Recharge Regions

## APPENDICES

- Appendix A - PWS Sanitary Survey, Well Logs and Hydrogeologic Assessment  
Appendix B - Water Quality Analytical Results and Chemical Information  
Appendix C - Underground Storage Tank (UST) Database Reports  
Appendix D - Source Water Monitoring Waivers  
Appendix E - Concurrence Letter

## 1.0 INTRODUCTION

Eric Sivers, a hydrogeologist with the Montana Department of Environmental Quality (DEQ) Source Water Protection Section, completed the Musselshell (PWS ID No. 00296) Source Water Delineation and Assessment Report (SWDAR).

The primary purpose of this source water delineation and assessment report is to provide information that helps Musselshell protect its drinking water source. The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protect public drinking water supplies from contamination. Two major components of the Montana Source Water Protection Program are *delineation* and *assessment*. Delineation is the process of mapping source water protection areas, which 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.

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for the completion of the delineation and assessment for the Musselshell 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).

## 2.0 BACKGROUND

Musselshell is located in Musselshell County in central Montana ([Figure 1](#)), approximately 20 miles east of Roundup. According to the Census Bureau, the population of Musselshell County in 2000 was 4,497, with 60 individuals residing in Musselshell.

### 2.1 PHYSICAL SETTING

#### 2.1.1 Geography and Geology

Musselshell is located at the confluence of Hawk Creek and the Musselshell River, on the northeastern edge of the Bull Mountains. Musselshell lies at an elevation of approximately 3,000 feet above mean sea level.

Bedrock exposed in the Musselshell area is largely comprised of the Tongue River Member of the Fort Union Formation. The Fort Union Formation is a fluvial-deltaic deposit of Tertiary age, conformably overlying the Cretaceous Hell Creek Formation, which is exposed in outcrops north of the Town. The Tongue River Member is largely fine-grained sandstone, with lesser amounts of shale and coal, and minor beds of fresh-water limestone. The geology of the Musselshell area is shown on [Figure 2](#).

Musselshell is located in the Central Non-Glaciated Plains groundwater region of North America (Heath, 1984). The community is in the Middle Musselshell Watershed, in the Lower Missouri River drainage of Montana.

#### 2.1.2 Climate

Information on Musselshell's climate was provided by the National Oceanic and Atmospheric Administration (NOAA) climate station in Roundup, approximately 25 miles west of Musselshell. Climate in the area is semi-arid and typical of central Montana. Annual total precipitation is 12.3 inches. Rainfall occurs April through September with May and June

being the wettest months. The area receives an annual average of 24.3 inches of snow, mainly November to April. Climate data is provided by the Western Regional Climate Center, operated by the Desert Research Institute of Reno, Nevada. See Table 1 for additional climate information.

**Table 1. Monthly Climate Summary: Roundup Climate Station (247214)**

Period of Record: 06/04/1914 to 06/30/2004

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Ave. Max. Temp (F)	35.9	41.1	48.4	60.3	70.3	78.8	88.6	87.4	75.8	63.7	47.8	38.4	61.4
Ave. Min. Temp. (F)	11.7	15.7	21.8	31.8	41.0	49.3	55.1	52.6	43.0	33.7	22.8	14.9	32.8
Ave Tot. Precip. (in.)	0.41	0.34	0.56	1.05	2.08	2.54	1.42	1.07	1.09	0.90	0.41	0.43	12.30
Ave. Tot. Snowfall (in.)	5.7	3.7	4.3	1.3	0.2	0.0	0.0	0.0	0.1	1.1	3.0	4.8	24.3
Ave Snow Depth (in.)	1	1	0	0	0	0	0	0	0	0	0	1	0

## 2.2 THE PUBLIC WATER SUPPLY

### 2.2.1 Water Supply System

The Musselshell PWS serves approximately 80 people through 45 service connections, at a pumping rate of approximately 10,000 to 15,000 gallons per day. The Musselshell PWS is classified as a community public water system since it serves at least 25 of the same people every day. Information on the water system was obtained from correspondence in the DEQ Public Water Supply Section files including the most recent sanitary survey, completed in 2002 (attached as Appendix A). Groundwater is provided by two wells completed in consolidated sandstone bedrock. Water from the wells is pumped to a 1,000-gallon storage tank outside town.

### 2.2.2 Supply Well Information

The PWS draws from two wells. The Musselshell supply wells are located at the southeast end of town, and were completed in the mid-1970s. The wells are 340 and 360 feet deep, and each well is rated to yield 35 gallons per minute. Well summary information is provided in Table 2, and the well logs are attached as Appendix A.

**Table 2. Supply Well Summary**

DEQ Well Name/ Source Code	Well 1	Well 2
GWIC ID	22650	22649
DNRC Water Right	C012616-00	C012615
Well Location	46.5162 / -108.0895	46.5162 / -108.0896
Well Elevation	3,000	3,000
Date Completed	09/06/1974	03/28/1977
Total Depth (fbgs)	360.0	340.0
Well Completion: Casing	8" steel to 39'; 6" PVC to 360'	6" PVC to 340'
Well Completion: Screen	6" PVC with $\frac{1}{8}$ " slots from 220'-340'	6" PVC with $\frac{1}{8}$ " slots from 55'-80' and 200'-320'
Well Completion: Annular Seal	No information	No information
Static Water Level (fbgs)	28.0	35.0

### 2.2.3 Source Water

The Musselshell PWS wells are completed in consolidated sandstone bedrock of the Fort Union Formation. This aquifer is recharged by infiltration of precipitation and surface water in Hawk Creek drainage of the Bull Mountains south of Musselshell, as shown on [Figure 3](#).

Based on the results of a groundwater under the direct influence of surface water (GWUDISW) study completed in 2002, the source water is classified as groundwater.

According to the Source Water Protection Program (DEQ, 1999) the source water aquifer is considered to have low sensitivity to potential contamination.

## 2.3 WATER QUALITY

Each PWS is required to perform regular sampling of their water supply to detect contamination. The analytical parameters include: coliform bacteria and other pathogenic organisms, nitrates, metals, petroleum hydrocarbons, and other organic chemicals. The monitoring schedule depends on factors such as the size and source water of a PWS, the number of supplies (e.g. wells), and the population served. Monitoring programs are tailored to each system, following the general protocols defined by DEQ. Monitoring schedules are available at: <http://nris.state.mt.us/wis/swap/swapquery.asp>. The Musselshell PWS monitoring data from DEQ's database for the past five years was reviewed and is summarized in this section. Analytical results are compared to quality standards established by the US EPA. Maximum Contaminant Levels (MCLs) are enforceable standards that limit the highest level of a contaminant allowed in drinking water. National Secondary Drinking Water Standards (known as SMCLs) are non-enforceable guidelines regarding contaminants that may cause aesthetic (color, odor, taste) or cosmetic (staining, skin/tooth discoloration) issues.

### 2.3.1 Public Water Supply Monitoring Results

Health-based violations are issued when the amount of contaminant exceeds the MCL. A health-based violation for total coliform (TCR) was issued in June 2004. Coliform bacteria were detected repeatedly in May, June and July 2004. Compliance was achieved, and bacteria have not been detected in subsequent analyses.

Nitrate + nitrite has not been detected above the method detection level. Di(2-ethylhexyl)phthalate (DEHP) was detected at concentrations of 2.7 µg/L (microgram per liter, or parts per billion) in April 2002 and 5.8 µg/L (December 2001). These concentrations are below the MCL of 6 µg/L. The water quality results are attached as Appendix B.

Information regarding the organic chemical DEHP is included with Appendix B. This information was obtained from the Agency for Toxic Substances and Disease Registry (ATSDR). This agency is operated by the Centers For Disease Control and is a good source of information regarding chemicals or other substances of public concern.

### 2.3.2 Background Water Quality Monitoring Results

Background water quality sampling typically includes general water quality parameters: major dissolved ions (calcium, magnesium, sodium, potassium, iron, manganese, silica, bicarbonate, carbonate, chloride, sulfate, nitrate, fluoride and orthophosphate), trace elements, and metals. No background water quality data was identified for the Musselshell wells.

### 3.0 MANAGEMENT AREA DELINEATION

This report delineates three source water management areas. The goal of source water management is protection of 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.

#### 3.1 CONCEPTUAL MODEL

Musselshell is located in the Middle Musselshell River watershed (USGS Hydrologic Unit Code 10040202), which is located within Montana's Lower Missouri River watershed. As detailed above, Musselshell's drinking water source is interpreted to originate as rainfall and runoff in the Hawk Creek drainage of the Bull Mountains.

The wells are completed in consolidated sandstone bedrock, and according to the DEQ Source Water Protection Program criteria (DEQ, 1999), the wells are considered to have low source water sensitivity to contamination.

#### 3.2 DELINEATION

Methods and criteria for delineating source water protection areas are specified in the Montana Source Water Protection Program (DEQ, 1999). The delineated management zones for the wells are shown on [Figure 3](#).

*Control Zone* – A 100-foot radius control zone is delineated for the wells. All sources of potential contaminants should be excluded in this region.

*Inventory Region* – The inventory region is the area that is expected to contribute to the water supply within no less than three years. All significant sources of potential contaminants are inventoried in this region. According to the DEQ's Source Water Protection Program criteria for a consolidated sandstone bedrock aquifer (DEQ, 1999), the inventory zone for the wellheads was delineated based on a 1,000-foot fixed radius around the wellheads, as shown in [Figure 3A](#).

*Recharge Region* – The recharge region for the Musselshell source water is essentially the Hawk Creek watershed, as shown on [Figure 3B](#). 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

### 4.0 INVENTORY

Significant potential contaminant sources in the source water management areas were inventoried to assess the susceptibility of Musselshell's source water to contamination, and to provide a foundation for source water protection planning. The inventory for Musselshell focuses on facilities or features that generate, use, store, or transport potential contaminants, as well as certain land uses in the inventory and recharge regions. It is important to remember that the sites and areas identified in this section are only potential sources of contamination to the drinking water. Contamination of drinking water sources is less likely when potential contaminants are properly used and managed.

#### 4.1 INVENTORY METHOD

The inventory focus is slightly different in each of the delineated management areas. The inventory for the Musselshell focuses on all activities in the control zones; certain types of facilities and land

uses in the inventory region; and general land uses and large facilities in the Recharge Region. Information on facilities and land uses that are potential sources of regulated contaminants was obtained from a number of databases, described below. The process for completing the inventory included several steps, which are summarized as follows:

- Step 1: Land uses were identified from the U.S. Geological Survey's (USGS) Geographic Information Retrieval and Analysis System <<http://nris.state.mt.us/gis/datalist.html>>. Sewered and unsewered residential land uses were identified from boundaries of sewer coverage obtained from municipal wastewater utilities.
- Step 2: The US Environmental Protection Agency's (EPA) Envirofacts System <<http://www.epa.gov/enviro/>> was queried to identify EPA-regulated facilities located in the management areas. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory System (TRIS), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) and the Permit Compliance System (PCS - for Concentrated Animal Feeding Operations with MPDES permits). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.
- Step 3: Montana DEQ databases were queried to identify any of the following in the management areas:
  - Underground storage tanks (USTs) <<http://www.deq.state.mt.us/UST/USTDownloads.asp>>
  - Hazardous waste contaminated sites, above ground storage tanks (ASTs), landfills, and abandoned and active mines, including gravel pits <<http://nris.state.mt.us/gis/bundler/>>
 Any information on past releases and present compliance status was noted.
- Step 4: Major road and rail transportation routes were identified throughout the inventory region: <<http://nris.state.mt.us/gis/gisdata/lib/gisDataList.aspx>>.

Potential contaminant sources are considered significant if they fall into one or more of the following categories:

- |   |   |
|---|---|
| 1. Large quantity hazardous waste generators.   | 7. Cultivated cropland exceeding 20% of the inventory region.                         |
| 2. Landfills.   | 8. Animal feeding operations.   |
| 3. Underground storage tanks.   | 9. Wastewater treatment facilities, sludge handling sites, or land application areas. |
| 4. Known groundwater contamination (including open or closed hazardous waste sites, state or federal Superfund sites, and leaking UST sites). | 10. Septic systems.   |
| 5. Underground injection well.  | 11. Sewer mains.  |
| 6. Major roads or rail transportation routes.   | 12. Storm sewer outflows.   |
|   | 13. Abandoned or active mines   |

## 4.2 INVENTORY RESULTS

### 4.2.1 Control Zone Inventory Results

The 100-foot control zones around the wellheads include the wellheads. No potential sources of contamination were identified within the control zone. The PWS should confirm this and

be vigilant to ensure that potential sources of contamination are excluded from the control zone and that positive drainage away from the wellheads is maintained.

#### 4.2.2 Inventory Region Results

The inventory results for Musselshell's source water are summarized in Table 2, and are shown on [Figure 3](#).

Two UST facilities plotted within the inventory region based on available information, but it could not be determined whether the physical locations of these two tanks were actually within the inventory region. The database report of UST facilities in the Musselshell area is attached as Appendix C for the operator's review and general reference.

The land cover types identified within the inventory region are: mixed urban land, evergreen forest and grassland. The inventory region contains areas of low, medium and high septic system density. The high and medium density areas are within the town, and are located downgradient of the supply wells.

#### 4.2.3 Recharge Region Inventory Results

According to the 1992 National Land Cover dataset, the primary land cover in the recharge region is grassland and evergreen forest, with some agricultural (crop-fallow small grain) land use along Hawk Creek. Septic system density within the watershed/recharge region is low. The septic system density is not considered a hazard to the PWS drinking water.

### 4.3 INVENTORY UPDATE

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

## 5.0 SUSCEPTIBILITY ASSESSMENT

### 5.1 INTRODUCTION TO SUSCEPTIBILITY

*Susceptibility* is the degree of likelihood for a public water supply to be impacted by contaminant sources at concentrations that would pose a concern. Susceptibility is assessed to prioritize potential pollutant sources for the Musselshell PWS managers and operators.

### 5.2 DETERMINATION OF SUSCEPTIBILITY

According to the DEQ Source Water Protection Program (DEQ, 1999) Susceptibility is determined by considering the *hazard* rating for each potential contaminant source relative to any contaminant *barriers*. Proximity or density of significant potential contaminant sources and nature of contaminants determines hazard.

Barriers to contamination are anything that decreases the likelihood of contaminants reaching a spring or well. Barriers may be engineered structures, management actions, or natural conditions. Examples of engineered barriers include spill catchment structures and leak detection for underground storage tanks. Emergency planning and best management practices (BMPs) are considered management barriers. Thick clay-rich soils, a deep water table or a thick unsaturated zone above the well intake are examples of natural barriers. Where credited, barriers are noted in Table 2.

### 5.3 RESULTS OF SUSCEPTIBILITY ASSESSMENT

A summary of the susceptibility assessment for the Musselshell wells is provided in Table 2. This table only includes the potential contaminant sources (identified in the inventory) that were determined to present a significant potential risk to the drinking water supply. Therefore, this list is not exhaustive, and 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.

**Table 2. Susceptibility Assessment of Significant Potential Contaminant Sources**

Potential Contaminant Source	Potential Contaminants	Hazard	Hazard	Barriers	Susceptibility	Management Recommendations
<i>Inventory Region</i>						
Septic Systems	Pathogens, nitrate (NO <sub>3</sub> )	System failure could result in discharge of untreated effluent	Moderate	Downgradient from wells; depth to well intakes	Very Low	Encourage septic system owners to periodically inspect their septic systems.
USTs and LUSTs	VOCs, petroleum hydrocarbons	Release of petroleum hydrocarbons to soil and groundwater	Moderate	1998-compliant upgrades; site cleanup; groundwater monitoring	Low	Review permit status; ensure proper operation and maintenance, emergency planning, training of local emergency response personnel, spill prevention, and BMPs. Properly abandon and remove tanks if out-of-service. Encourage soil testing to evaluate potential impact from historic spills or leaks.
Agricultural Land: Cropland and grazing lands	NO <sub>3</sub> and SOC from fertilizer, pesticides and herbicides. Pathogens from pastures.	Contaminants leaching into groundwater	Low	Distance from wells and gallery	Low	Encourage BMPs.
Transportation Routes: Roads and Railroads	Pesticides, fertilizers, VOCs, SOCs, other	Spills, routine spraying, storm water runoff, infiltration into groundwater	Low	Emergency spill response	Low	Encourage and support emergency planning, training of local emergency response personnel, and cooperation with MDOT to reduce herbicide use.
Class V Injection Wells	VOCs, SOCs, metals	Infiltration into groundwater	Unknown at this time	None	Unknown at this time	Work with EPA to identify locations and appropriate response.
<i>Recharge Region</i>						
Agricultural Crop Land	NO <sub>3</sub> and SOCs from fertilizer, pesticides and herbicides. Pathogens (if grazing occurs)	Contaminants leaching into groundwater	Not assessed	None	Not assessed outside inventory region	Encourage use of BMPs in the recharge region.

## 6.0 LIMITATIONS

This Source Water Delineation and Assessment Report is intended to meet the technical requirements for delineation and assessment of the Musselshell 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 following limitations should be noted:

- This report was prepared to assess the susceptibility of the Musselshell PWS to significant potential contaminant sources, and is based on published information and correspondence within DEQ files. The terms “drinking water supply” or “drinking water source” refer specifically to the source of the Musselshell public water supply and not any other public or private water supply. Also, not every potential or existing source of groundwater contamination in the Musselshell area has been identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered
- Delineation of the source water protection areas for the Musselshell wells is based on map and aerial photograph interpretation. In the absence of extensive field investigations to accurately characterize aquifer characteristics, the assumptions are necessarily conservative. The use of such conservative assumptions was to ensure that the inventory zone reflects the actual area where contamination to the system may occur.
- The potential contaminant sources described in the inventory are identified from readily available information. Consequently, unregulated activities or unreported contaminant releases may have been overlooked. The use of multiple sources of information increases the likelihood that the major threats to the source water for Musselshell’s public water supply have been identified. The inventory is not exhaustive. If a type of potential contaminant source is not identified in the inventory or susceptibility assessment of this report, it does not necessarily follow that the potential for contamination does not exist, or there is not a threat. It is highly recommended that the PWS and community enhance or refine the identification of potential contamination sources through further research and local input.

## 7.0 CONCLUSIONS

This Source Water Delineation and Assessment Report (SWDAR) was prepared under 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 completing these assessments for all public water systems in Montana. The purpose is to provide information so that the public water system staff/operator, consumers, and community citizens can begin developing strategies to protect your source of drinking water. The information that is provided includes the identification of the area most critical to maintaining safe drinking water, i.e., the inventory region, an inventory of potential sources of contamination within this area, and an assessment of the relative threat that these potential sources pose to the water system.

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- Potential contaminant sources identified within the recharge region are limited to minor agricultural lands. Few point sources of potential contaminants were identified in this sparsely developed region.

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 is primarily from infiltration of precipitation and surface water into the Fort Union Formation in Hawk Creek drainage.

Low risk potential sources and potential sources located outside the inventory region, but within the recharge region may still pose a threat over time, but are not discussed in detail in this assessment. This provides a quick look at the existing potential sources of contamination that could, if improperly managed or released, impact the source water for Musselshell. The susceptibility analysis provides the community and the public water system with information on where the greatest risk occurs and where to focus resources for protection of this valuable drinking water resource.

The costs associated with contaminated drinking water are high, and prevention is preferable to treatment. Public awareness is a powerful tool for protecting drinking water. The information in this

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## 8.0 REFERENCES

- Agency for Toxic Substances and Disease Registry (ATSDR). Public Health Statement for Di(2-ethylhexyl)phthalate (DEHP). <http://www.atsdr.cdc.gov/toxprofiles/phs9.html>
- Heath, Ralph C., 1984. Ground-water Regions of the United States, U.S. Geological Survey, Water Supply Paper 2242, Washington D.C., 78p.
- Montana Bureau of Mines and Geology, 2004. Groundwater Information Center, lithologic well logs. <http://mbmgwic.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>
- Raines, G.L., and Johnson, B.R., 1995, Digital representation of the Montana state geologic map in ARC/INFO export format.: U.S. Geological Survey Open-File Report 95-0691.
- 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, 1999-2004. Correspondence in DEQ’s PWS files regarding the Musselshell Water Supply.
- Western Regional Climate Center Montana Climate Summaries. [wrc@dr.edu](mailto:wrc@dr.edu)
- Wilde, E.M., Porter, K.W., 2000, Geologic map of the Roundup 30' X 60' quadrangle, central Montana, Montana Bureau of Mines and Geology Open File Report 404, scale 1:100,000.

## 9.0 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, including drywells, storm drains and floor drains. 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. Hardness is often expressed in units of milligrams per liter (mg/L) or parts per million (ppm) of CaCO<sub>3</sub> (calcium carbonate). Waters with a total hardness in

the range of 0 to 60 mg/L are termed soft; from 60 to 120 mg/L moderately hard; from 120 to 180 mg/L hard; and above 180 mg/L very hard.

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 effect 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 CapaTown 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 wells 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 Town 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 to regulate hazardous materials 'from the cradle to the grave.' 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). A database that provides information about specific RCRA 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.

Sensitivity. The relative ease with which contaminants can migrate to source water through the natural materials

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.

Syncline. A geologic structure consisting of a down-arched fold with an axial plan dividing it in half.

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.

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

ToxiTown Characteristic Leachate Procedure (TCLP). A test designed to determine whether a waste is hazardous or requires treatment to become less hazardous.

Toxic Release Inventory System (TRIS). 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. The ability of an aquifer to transmit water. The transmissivity is determined by multiplying the hydraulic conductivity by the aquifer thickness.

Turbidity. The cloudy appearance of water caused by the presence of suspended matter. Turbidity is measured in nephelometric turbidity units (NTUs).

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.

## **FIGURES**



**APPENDIX A**

**PWS SANITARY SURVEY, GROUNDWATER ASSESSMENT, AND WELL LOGS**



Montana Bureau of Mines and Geology  
Ground-Water Information Center Site Report  
TOWN OF MUSSELSHELL

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

Location Information

GWIC Id: 132785  
Location (TRS): 31N 27E 30 DAD  
County (MT): PHILLIPS  
DNRC Water Right: G030254-00  
PWS Id: 00203003  
Block:  
Lot:  
Addition:

Source of Data: LOG  
Latitude (dd): 48.4129  
Longitude (dd): -108.2613  
Geomethod: TRS-TWN  
Datum: NAD27  
Altitude (feet):  
Certificate of Survey:  
Type of Site: WELL

Well Construction and Performance Data

Total Depth (ft): 105.00  
Static Water Level (ft): 19.50  
Pumping Water Level (ft): 23.90  
Yield (gpm): 150.00  
Test Type: AIR  
Test Duration: 1.50  
Drill Stem Setting (ft):  
Recovery Water Level (ft):  
Recovery Time (hrs):

How Drilled: FORWARD ROTARY  
Driller's Name: HICKEL & TOOKE  
Driller License: WWC196  
Completion Date (m/d/y): 10/17/1985  
Special Conditions:  
Is Well Flowing?:  
Shut-In Pressure:  
Geology/Aquifer: Not Reported  
Well/Water Use: PUBLIC WATER SUPPLY

Well Notes:

Hole Diameter Information

From	To	Diameter
0.0	105.0	12.0

Annular Seal Information

From	To	Description
6.0	8.0	K PACK NEOPREM
10.0	20.0	CEMENT & WATER

Lithology Information

From	To	Description
0.0	2.0	SURFACE
2.0	7.0	CLAY
7.0	11.0	SAND
11.0	15.0	CLAY
15.0	16.0	GRAVEL
16.0	19.0	SAND
19.0	21.0	GRAVEL
21.0	36.0	CLAY
36.0	38.0	GRAVEL
38.0	43.0	SANDY CLAY
43.0	54.0	SAND AND FINE GRAVEL
54.0	82.0	GRAVEL
82.0	94.0	SAND AND CLAY
94.0	102.0	GRAVEL
102.0	103.0	SAND
103.0	105.0	SHALE

Casing Information<sup>1</sup>

From	To	Dia	Wall Thickness	Pressure Rating	Joint Type
-1.5	105.0	8.0			STEEL

Completion Information<sup>1</sup>

From	To	Dia	# of Openings	Size of Openings	Description
61.0	65.0	6.0			BLACK
65.0	82.0	6.0			100 SLOT
82.0	95.0	6.0			BLACK
95.0	102.0	6.0			80 SLOT

<sup>1</sup> - All diameters reported are **inside** diameter of the casing.

**Montana Bureau of Mines and Geology  
Ground-Water Information Center Site Report  
TOWN OF MUSSELSHELL**

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

**Location Information**

GWIC Id:	42647	Source of Data:	LOG
Location (TRS):	31N 27E 30 ADAD	Latitude (dd):	48.4179
County (MT):	PHILLIPS	Longitude (dd):	-108.2592
DNRC Water Right:	W030255-00	Geomethod:	MAP
PWS Id:	00203002	Datum:	NAD27
Block:		Altitude (feet):	2311.00
Lot:		Certificate of Survey:	
Addition:		Type of Site:	WELL

**Well Construction and Performance Data**

Total Depth (ft):	30.00	How Drilled:	HAND DUG
Static Water Level (ft):	25.00	Driller's Name:	
Pumping Water Level (ft):	20.00	Driller License:	
Yield (gpm):	250.00	Completion Date (m/d/y):	1/1/1916
Test Type:	PUMP	Special Conditions:	
Test Duration:	1.00	Is Well Flowing?:	
Drill Stem Setting (ft):		Shut-In Pressure:	
Recovery Water Level (ft):		Geology/Aquifer:	110ALVM
Recovery Time (hrs):		Well/Water Use:	PUBLIC WATER SUPPLY

Well Notes:

**Hole Diameter Information**

From	To	Diameter
0.0	30.0	16.0

**Casing Information<sup>1</sup>**

From	To	Dia	Wall Thickness	Pressure Rating	Joint Type
0.0	20.0	16.0			16 X 16 FT SQ
20.0	30.0	12.0			10 X 10 FT SQ

**Annular Seal Information**

No Seal Records currently in GWIC.

**Completion Information<sup>1</sup>**

From	To	Dia	# of Openings	Size of Openings	Description
20.0	30.0	10.0			STEEL GRATING AND CONCRETE

**Lithology Information**

From	To	Description
0.0	25.0	SANDY LOAM
25.0	30.0	GRAVEL

<sup>1</sup> - 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**

**WATER QUALITY ANALYTICAL REPORTS AND CHEMICAL INFORMATION**



**APPENDIX C**

**UNDERGROUND STORAGE TANK (UST) DATABASE REPORT**



**Underground Storage Tank Facility Summary Report**  
Data last retrieved from DEQ on 1/2/2005 12:03:26 AM  
**Facility ID: 33-07498**  
**Musselshell Garage**

**I. Ownership of Tank(s)**

**System ID:** 5910 **State Owner ID:** 5910  
**Name:** Musselshell Garage  
**Address:** Main St Box 195 Musselshell, MT 59059  
**Phone:** (406) 947-2301 **Fax:**  
**Contact:** **Comments:**

**Type of Notification: Closure**

**SystemID:** 3307498 **State Facility ID:** 33-07498  
**Date Received:** 5/8/1986 **Re-Notification:**  
**Facility Operator:**

**II. Facility (Location of Tanks)**

**Name:** Musselshell Garage  
**Location:** Main St Box 195 Musselshell, MT 59059, Musselshell County  
**Latitude:** 46.5194 **Longitude:** -108.0913  
**Phone:** **Comments:**

**Facility Compliance**

**Operating Permit Renewal Date:**  
**Last Operating Permit Issued:**

**III. Type of Owner**

Private

**IV. Indian Lands**

Tanks are not located on land with an Indian Reservation or on other trust lands  
Tanks are not owned by a native American nation or tribe

**V. Type of Facility**

**Type of Facility:** Automotive repair, services, and parking  
**Comments:**

**VI. Contact Persons in Charge of Tanks**

**Name:** Lavern Carpenter **Address:** Address Unknown ZipCode Unknown, XX 99999  
**Phone:** (406) 947-2301 **Fax:**  
**Contact Type:**

**VII. Financial Responsibility**

**Facility does not meet financial responsibility requirements.**

**Financial Responsibility methods:**

**Comments:**

**VIII. Certification**

**Name:** John Lavern L. Carpenter **Title:** **Date:** 4/1/1986

**IX, X, and XI. Underground Storage Tanks**



## VII. Financial Responsibility

Facility does not meet financial responsibility requirements.

Financial Responsibility methods:

Comments:

## VIII. Certification

**Name:** Elmer Quanbeck

**Title:** President

**Date:** 2/13/1990

## IX, X, and XI. Underground Storage Tanks

Tank ID (Click Link for Details)						
Status	Installed	Substance	Capacity	Date Closed	Closure Status	
<a href="#">1</a>	Permanently Out of Use	2/14/1980	Gasoline	1000	3/10/1990	Tank removed from ground



**APPENDIX D**

**SOURCE WATER MONITORING WAIVERS**



# MONITORING WAIVERS

## Waiver Recommendation

The Musselshell PWS has a waiver for Phase 2 inorganics. Under the waiver, the PWS samples for these parameters every nine years rather than every three years. The PWS was grandfathered under the radionuclide rule and is only required to sample once every nine years for these parameters.

Before a susceptibility or use waiver is requested, the PWS Operators are encouraged to carefully review the Monitoring Waiver Requirements, described below. If after reviewing this section it is determined that an additional waiver is feasible, the PWS should submit a letter to DEQ requesting the specific monitoring waivers. The PWS must be in compliance with monitoring requirements to be considered. If requested by DEQ, the PWS may also need to provide additional information regarding chemical use in the area within the Inventory Region. The table below shows how identified potential contaminant sources affect the eligibility for monitoring waivers.

## Susceptibility Assessment as it relates to Waiver Eligibility

Source	Contaminant	Susceptibility	Waiver Eligibility
<b>Transportation Corridors</b>	VOCs, SOCs, petroleum products and other chemicals		Chemical use in right-of-way may preclude waivers for some chemicals. PWS should confirm chemical use history along the right-of-way. Waivers might be rescinded if a spill occurred.
<b>Sewer System/ Wastewater Treatment</b>	Nitrates, pathogens		Waivers are not available for pathogens and nitrate.
<b>Agricultural Cropped Areas</b>	Nitrates and SOCs		Chemical use may preclude waivers for some chemicals. The PWS should confirm chemical use/storage history by land parcel.

## 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 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 (PCBs) 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. 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. 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 one 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 one mile as an area of investigation for the use of organic chemicals. Surface water and shallow groundwater sources under the direct influence of surface water (GWUDISW) should assess the watershed area above the source, or a minimum fixed radius of one and one-half miles upgradient.

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, 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 are not contained within impervious geologic strata. As a result, the upper groundwater surface, or water table, in an unconfined aquifer is not under the 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 generally 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.

Properly assessing a susceptibility waiver application for an unconfined source aquifer requires: 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 water 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 units. A confined aquifer is generally subject to pressures greater than atmospheric pressure. A well that is screened in a confined aquifer will have a static water level that determined by the pressure (hydrostatic head) at the top of the 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. Important hydrogeologic controls include 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.

A confined aquifer may eventually be affected by contaminated groundwater from elsewhere in the recharge area. Improper well construction or abandonment can act as a hydraulic connection to the confined aquifer. The extent of confinement of an aquifer is critical to limiting susceptibility to organic chemical contamination. The extent of confinement must be demonstrated by the PWS in order to be considered for a confined aquifer susceptibility waiver. Typical information includes: pump test data (storage coefficient), geologic mapping, well logs, water quality history, and available information related to any other wells, active or abandoned, in the recharge region.

**APPENDIX E**

**CONCURRENCE LETTER**