Blue Sky Heights Water Users Association – PWS ID # MT0000030

SOURCE WATER DELINEATION

AND

ASSESSMENT REPORT

Date of Report: November 27, 2000

Will Mavis, Certified Operator
5 Whitetail Lane
Clancy, MT 59634
(406) 933-5735

And

Forest Park Water Users Association – PWS ID# 00591

Public Water Systems
Larry Wycoff, MT Associates, Inc. (MTA)
Certified Operator
MTA, 4528 Hwy 12 West, Helena, MT 59601
MTA, 449-3918

And

Prepared By:

Lowell C. Hanson, PE, PLS

Jerry Paddock, PE

Northland Engineering and Surveying

2969 Airport Road

Helena, Montana 59601

(406)-442-8108

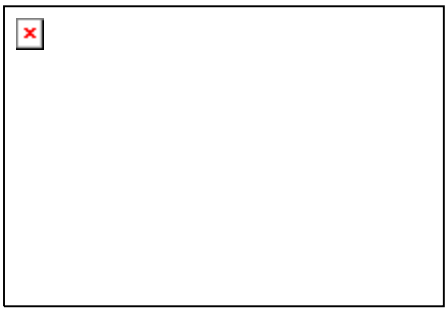

Table of Contents

ACKNOWLEDGMENTS

This Delineation and Assessment Report was completed by:

Will Mavis

Principal Operator

Blue Sky Heights Water Users Association

PWS ID# 000030

Jefferson County, MT

5 Whitetail Lane

Clancy, MT 59634

(406) 933-5735

Larry Wycoff

Principal Operator

Forest Park Water Users Association

PWS ID# 000591

Jefferson County, MT

MT Associates, Inc.

4528 Hwy 12 West

Helena, MT 59601

MTA, 449-3918

And

Lowell C. Hanson, PE, PLS

And

Jerry Paddock, PE

Northland Engineering and Surveying

2969 Airport Road

Helena, Montana 59601

(406)-442-8108

INTRODUCTION

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for Blue Sky Heights Water Users Association and Forest Park Water Users Association as required by the Montana Source Water Protection Program and the Federal Safe Drinking Water Act (SDWA).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for Blue Sky Heights and Forest Park Estates Water Users Associations.

Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation of source water protection plans, the mechanism that the Water Users Association can use to protect their drinking water source. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the Water Users Association operators and the community to complete a source water protection plan that meets their specific needs.

CHAPTER 1

BACKGROUND

The Communities

The Blue Sky Heights and Forest Park Estates Subdivisions have been in place since the mid-1970s. Lot sizes vary from 1 to 20 acres. The population is a mixture of retired people and working families. The estimated population of Blue Sky Heights is 300 people. Forest Park Estates population is in the range of 375 to 400 people. Water is pumped from wells to storage tanks, where it is then distributed to individual homes. Septic systems on each lot consist of a septic tank and absorption drainfield, which treat and dispose of domestic sewage. Industrial activities and business activities are not permitted in the subdivisions. See Appendix 1E and 2E for the general location of the subdivisions.

Geographic Setting

The subdivisions are geographically located adjacent to each other, both approximately two miles north of the small Town of Clancy. The climate is semi-arid, with 12 to 13 inches of precipitation per year. The area is covered with trees. No agriculture or industry is present and business activity is not permitted in the subdivisions. It is approximately 46.5 degrees latitude and 4,000 feet above sea level.

General Description of the Source Water

Blue Sky Heights and Forest Park Estates subdivisions rely on ground water for their water supply. Blue Sky Heights is supplied by two wells near Prickly Pear Creek that are 146 and 300 feet deep. The wells are completed in the Boulder Batholith, an igneous intrusive rock that is present throughout this region. Forest Park is served by three wells that are also completed in the Boulder Batholith. The Forest Park wells range in depth between 125 to 300 feet. Both subdivisions have pumps set between 100 and 300 feet below the land surface.

The Public Water Supply

Blue Sky Heights: There are 98 service connections that serve 98 individual homes and approximately 300 people. There are two wells, ranging from 146 to 300 feet below the land surface that produce a total of 160 gallons per minute. The distribution system is mostly four-inch with some three-inch PVC pipe. There are two 50,000-gallon storage tanks. The system is only treated when work or repair to the system is done. See Appendix 1B, public water system site plan, for location of mains, valves, storage tanks, and wells. The well logs are included in Appendix 1G (Figure 7 & Figure 8). The well logs describe construction details of the wells.

Forest Park Estates: This subdivision contains an estimated population of 375-400 with 126 residential water service connections. Water is provided by three wells, which fill an 8,500-gallon mid-station tank for gravity fed water to lower elevation homes. Well depth varies from 125 feet to 300 feet. A booster pump at the mid-station tank pumps water to a 100,000-gallon reservoir, which gravity

feeds mid elevation homes. Additionally, homes above the upper reservoirs are supplied with water by a two-inch pressurized line powered by two pumps located in the power building at the reservoir. See Appendix 2B, public water system site plan, for location of mains, valves, storage tanks, and wells. The well logs are included in Appendix 2G (Figure 12, Figure 13, & Figure 14). The well logs describe construction details of the wells.

Water Quality

The Blue Sky Heights: Well water 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 as specified in the Public Drinking Water Supply Rules. Among regulated contaminants, nitrate and coliform bacteria were detected in the last five years. Nitrate can come from fertilizer, or human or animal wastes, but also is naturally occurring. Nitrate was detected at levels of 0.39 mg/L (1980) and 0.34 mg/L (1999), well below the maximum contaminant level of 10 mg/L set by the U.S. Environmental Protection Agency (EPA). Coliform bacteria were detected on five occasions in the past five years, but follow-up sampling indicated the water was not contaminated and, therefore, no violation was issued.

Forest Park Estates: These wells are also 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 as specified in the Public Drinking Water Supply Rules. Among regulated contaminants, nitrate and coliform bacteria were detected in the last five years. Nitrate was detected at levels ranging from 0.08 mg/L to 2.36 mg/L. These levels are below the maximum contaminant level of 10 mg/L, set by the U.S. Environmental Protection Agency (EPA). Coliform bacteria were detected on five occasions in the past five years with health advisories resulting from two instances when a repeat sample also contained coliform bacteria. On November 28, 1999, the DEQ recommended that Forest Park Estate implement full-time disinfection. According to a letter in DEQ files dated February 4, 2000, DEQ granted a conditional approval of delay of full-time disinfection under the following conditions:

- Total coliform (T/C) samples be collected weekly for a one-year period. After one year of no confirmed detections, monthly samples may be resumed.

- Any detection of T/C contamination will require five sites to be sampled within 24 hours of notification of detection for confirmation purposes.

- Any confirmed contamination will void this delay approval and Forest Park Estates WUA must submit plans within 90 days to the Public Water Supply

Section by a Professional Engineer for a chlorination/disinfection system (ref: Eric Minetti, MT DEQ, 28 Nov 99 Letter to Forest Park Estates WUA).

- Manual chlorination/disinfection will be resumed in the event of any confirmed contamination and a "Health Advisory Notice" will be distributed to residents and published.

On October 10, 2000, Forest Park Estates published a Health Advisory resulting from positive detection of total coliform bacteria for an initial sample (09-28-2000) and a repeat sample (10-02-2000).

CHAPTER 2

DELINEATION

The source water protection area, the land area that contributes water to the Blue Sky Heights and Forest Park Water Users Association, is identified in this chapter. The subdivision's wells are completed in the Boulder Batholith, a body of fractured igneous rock, characterized as granite or quartz monzonite. A complex network of fractures in the bedrock provides pathways for ground water flow. As a result, the Boulder Batholith is clearly not a homogenous and isotropic aquifer that transmits ground water in a way that can be modeled with the uniform flow equations (EPA 1980). As an alternative, four delineation zones are identified and include a 100 foot fixed radius Control Zone; a 1-mile fixed radius Inventory Region combined with a Watershed Region, Recharge Region; and a half mile wide Buffer Zone on both sides of Prickly Pear Creek, extending 10 miles upstream from the wells. The Control Zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The goal of management in the control zone is to protect against direct introduction of contaminants into the wells, or the immediate surrounding areas. The Inventory Region and surface water buffer should be managed to prevent release of contaminants that could flow to the wells before being removed by natural processes. The goal of management in the recharge region is to maintain and improve water quality over long periods of time or increased usage.

Hydrogeologic Conditions

Blue Sky Heights / Forest Park Estates

The Boulder Batholith is the aquifer supplying water to Forest Park and Blue Sky Heights. The Batholith is exposed at the surface over a wide area in western Montana and is overlain in some places by a thin cover of stream deposits (Quaternary Alluvium) or glacial deposits. As a result, the Boulder Batholith is classified as an unconfined, shallow fractured bedrock aquifer and is given a high sensitivity ranking to potential sources of contamination sources.

An assessment to determine if the Blue Sky Heights groundwater source is under the direct influence of surface water was conducted in 1998 by the Department of Environmental Quality, in conjunction with the Montana Bureau of Mines and Geology (MBMG). A letter from the Permitting and Compliance Division, dated December 11, 1998, states, "It has been determined that the source is not under the direct influence of surface water; therefore the sources are classified as groundwater." A copy of this letter is included in Appendix 1H. Forest Park Estates was not included in the assessment.

Table 1. List of geologic or hydrogeologic investigations near the Blue Sky Heights and Forest Park Estates Water Users Association areas.

Title of Project	Period of Project	Area Covered	Project Purpose
Boulder Batholith and Adjacent Area, Montana - Knopf		Central Montana	Geologic Map
Geologic Map Of Montana - USGS	1955	State of Montana	Geologic Map

Table 2. List of geologic or hydrogeologic maps available for the area of Blue Sky Heights and Forest Park Estates Water Users Associations.

Title or Description	Date	Area Covered	Reference
Boulder Batholith and Adjacent Area, Montana - Knopf		Central Montana	
Geologic Map of Montana	1955	State of Montana	Montana Bureau of Mines & Geology

See the Geologic Maps in Appendix 1C and 2C (Figure 3) of the area discussed in this report.

Conceptual Model and Assumptions

In general, ground water in this area flows from upland areas toward stream tributaries and the Prickly Pear Creek flood plain. As mentioned previously, a complex network of fractures in the rock provides pathways for ground water flow. The fractures are associated with fault lines and joint patterns. Drainages and valleys are often associated with the fractures. At depth, fractures are present, but difficult, if not impossible to predict. Due to the complex nature of the fracture system, the Boulder Batholith cannot be considered a homogenous and isotropic aquifer and, therefore, the uniform flow equations (EPA 1980) cannot be used for Time of Travel (TOT) calculations. In addition, it seems very likely that fractures in the area provide hydraulic connection between the aquifer and Prickly Pear Creek. In summary, source water comes

from ground water within the local watershed surrounding the sudivisions on both sides of Prickly Pear Creek and from the Prickly Pear Creek drainage upstream (south) from the wells.

Methods and Criteria

Source water protection regions are delineated based on hydrogeologic mapping and fixed radius criteria presented in the Source Water Protection Document and Public Water Supply Rules. As mentioned above, TOT calculations were not used because the Boulder Batholith is not a homogenous and isotropic aquifer.

Well Information

Table 3. Source well information for Blue Sky Heights Water Users Association *

Information	Well #1	Well #2
PWS Source Code	002	003
Well Location (T,R, Sect or lat, long)	T9N, R3W, NENE Sect. 34	T9N, R3W, SWNE Sect. 34
MBMG#	5493	58847
Water Right #	3740-G-41I	2575-G-41I
Date Well was Completed	7/14/74	3/31/86
Total Depth	146	249
Perforated Interval	Unknown	Unknown

Static Water Level	10 feet	106 Feet
Pumping Water Level	80 Feet	Unknown
Draw Down	70 Feet	Unknown
Test Pumping Rate	98 gpm	29-45 gpm
Specific Capacity	1.4 gpm/foot	Unknown

Table 3. Source well information for Forest Park Estates Water Users Association *

Information	Well #1	Well #2	Well #3
PWS Source Code	002	003	004
Well Location (T,R,Sec or lat, long)	NESWNE Sect. 34, T9N, R3W	NWSWNE Sect. 34, T9N, R3W	SWSWNE Sect. 34, T9N, R3W
MBMG#		121010	58860
Water Right #	65152-64I	65152-64I	65152-64I
Date Well was Completed	8/24/77	7/5/90	10/31/89
Total Depth	125 Feet	200 Feet	300 Feet

Perforated Interval	Unknown	124 – 139 Feet	100-120, 140-160, 180-200, 280-300
Static Water Level	9 Feet	15 Feet	4 Feet
Pumping Water Level	95 Feet	Unknown	Unknown
Draw Down	86 Feet	Unknown	Unknown
Test Pumping Rate	80 – 103 gpm	125 gpm	25 gpm
Specific Capacity	1.06 gpm/ foot (avg.)		

* Data taken from Well Log Report

Model Input

Not Applicable, see Conceptual Model and Assumptions section above.

Delineation Results

DEQ's Source Water Protection Program (DEQ, 1999) specifies methods and criteria used to delineate sub-regions of the source water protection area. Following this guidance, the Control Zone and Expanded Inventory Region were delineated on USGS maps using a 100-foot and one-mile radius, respectively. The Recharge Region is shown on a Forest Service map (which also shows land ownership). The 10-mile Buffer Zone is not shown on the maps but is discussed in the text and is included in the potential significant contaminant inventory. The areas delineated on the maps are located topographically above the well locations. These maps are located in Appendix 1D and 2D (Figure 4).

It is important to note the inventory is expanded beyond the one-mile fixed radius to include a local watershed surrounding the subdivisions on both sides of Prickly Pear Creek. This was done to conduct a more comprehensive inventory of regulated contaminants. This is necessary because the fracture network providing flow paths for ground water in this area may extend beyond a one-mile fixed radius. As a result, conducting the inventory only within a one-mile fixed radius of the wells could exclude some sources that, because of the fracture network, pose a threat to the source water.

Potential sources of regulated contamination within the delineated regions for the Blue Sky Heights and Forest Park Estates WUA wells include nitrate, microbial, volatile organic compounds (VOC), synthetic organic compounds (SOC), and metals. Underground Storage Tanks (UST) includes VOC. Sources include leaking fuels from service and gas stations. The septic systems that exist above the subdivisions may release nitrates and pathogens that could affect the WUA's wells. The existing and abandoned mines could generate wastewater that may contain metals, which could also contaminate the wells. Uncontained spills along Interstate 15 could generate various chemical or other materials that could contaminate the well water. Hazardous waste from the post manufacture process could contaminate the well water should a large spill or leak occur. Additionally, discharges (permitted and non-permitted) from industry and other businesses located upstream of the WUA's can generate discharge that could contaminate the wells.

These potential sources of contamination have been listed in Table 4.

Table 4. Potential Contaminant Sources

Source	Contaminants
UST	Fuels
Septic Systems	Pathogens and Nitrates
Sewage Treatment and Permitted Stream Discharge	Pathogens and Nitrates
Wood Treatment	Hazardous waste-chromium compounds

Active and Abandoned Mines	Mine waste drainage
Interstate I5	Various chemicals and materials
Permitted-Discharge	De-watering well discharge to stream

Delineation Maps are included in Appendix 1D and 2D (Figure 4) of this report. These maps depict sources noted on the USGS Quadrangle and found on the Natural Resource Information System (SWP Query System or "Mapper" State of Montana – Helena).

Limiting Factors

As mentioned previously, the fractures and fracture networks that provide pathways for water to the source wells are often not visible from the surface and cannot be located precisely. In addition, they may extend beyond the one-mile fixed radius Inventory Region used in this delineation. As a result, potential contamination sources outside the one-mile fixed radius Inventory Region could impact the water source. With this in mind, the Inventory Region was expanded as mentioned previously.

CHAPTER 3

INVENTORY

An inventory of potential sources of contamination was conducted for Blue Sky Heights and the Forest Park Estates Water Users Association within the Control and Inventory Regions and 10-mile Buffer Zone. Potential sources of all primary drinking water contaminants and cryptosporidium were identified, however, only significant potential contaminant sources were selected for detailed inventory, as specified in the Source Water Protection Document. The only significant potential contaminants found in the Expanded Inventory Region are nitrates, microbial, volatile organic compounds

(VOC), synthetic organic compounds (SOC), and metals. In addition, the watershed and surface water buffer zone was inventoried for nitrate and microbial sources.

The inventory for the Blue Sky Heights and the Forest Park Estates Water Users Associations focuses on all activities in the Control Zone, municipal and private facilities in the Inventory Region, and general land uses and large facilities in the Recharge Region.

Inventory Method

The inventory was completed with the help of Will Mavis, a long-time resident in the subdivision and the principal operator of the Blue Sky Heights public water system for more than 25 years. He has monitored the area closely during this time. The inventory was completed mostly by driving through the area and through familiarity of the area. The area is not densely populated. Some of the mine locations are from the USGS maps and some are from visual observations.

Available databases were searched to identify businesses and land uses that are potential sources of regulated contaminants in the Inventory Region. In addition to the Natural Resources Information System Website (SWP Query System or "Mapper"), the following steps were followed:

All land uses and facilities that generate, store, or use large quantities of hazardous materials were visually identified within the Recharge Region and identified on the base map (1D and 2D).

Potential sources of contamination include nitrate, microbial, volatile organic compounds (VOC), synthetic organic compounds (SOC), and metals. The potential sources of contamination for the Blue Sky Heights and Forest Park Estates WUA have been listed in Table 4A.

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) Underground storage tanks.

4) Known groundwater contamination (including open or closed hazardous waste sites,

state or federal superfund sites, and UST leak sites).

5) Underground injection wells.

6) Major roads or rail transportation routes.

7) Cultivated cropland greater than 20 % of the Inventory Region.

8) Animal feeding operations.

9) Wastewater treatment facilities, sludge handling sites, or land application areas.

10) Septic systems.

11) Sewer mains.

12) Storm sewer outflows.

13) Abandoned or active mines.

Inventory Results/Control Zone

The Control Zone includes the area within a 100-foot radius of the wells.

Blue Sky Heights WUA: The nearest septic system to Well #1 is approximately 310 feet (to the north and down gradient). The nearest septic system to Well #2 is approximately 520 feet (to the north and no gradient). The subdivision road lies within the Control Zone of Well #1.

Forest Park Estates WUA: The nearest septic system is approximately 300 feet from Well #1 (to the northwest and no gradient), approximately 180 feet to Well #2 (to the south and up gradient), and approximately 470 feet to Well #3 (to the northwest and no gradient). A portion of the subdivision road lies within the Control Zone of Well #2, and as mentioned before, Prickly Pear Creek is located within the Control Zone of Wells #1 and #3.

Inventory Results - Expanded Inventory Region

Two mine sites were found within the Inventory Region on the State Natural Resources Information System (NRIS), both mines are small and only one has a slag or waste pile associated with it. These small mines are active sites but due to their size, probably do not constitute a threat to the wells for either subdivision. One abandoned mine site at Alhambra is shown to have a waste or slag pile, but is located more than 3.4 miles from the subdivision wells.

Interstate Highway 15 runs north and south through the valley. The highway is approximately 450 feet east of the nearest well; however, Prickly Pear Creek is

located between the highway and the wells. Spills along I-15 could pose a threat to the wells if they are not reported and responded to promptly. Spills of concern would be those occurring upstream from the well sites. The relative threat to the wells would depend on the type of material and volume of the spill, and the magnitude of flow in Prickly Pear Creek. During high flow periods, Prickly Pear Creek may dilute and transport contaminants away from the well sites before the wells could be impacted.

Land Use within the Inventory Region is predominately forest (69.3%), rangeland (29.6%) and urban (1.1%) (NRIS).

Table 5A summarizes the inventory results for the Inventory Region and Stream Buffer Zone upstream of the wells for approximately 1-mile.

Table 5A. Potential Contaminant Sources and Description

Inventory Region and Stream Buffer Zone

Source	Contaminants	Description
Septic Systems	Pathogens and Nitrates	Unsewered areas near wells (within the subdivisions) and within stream buffer zone. The density is rated as high (1 system per acre or more)
Active and Abandoned Mines	Mine waste drainage	There are 2 active mines in the Inventory Region – 1 mile
Interstate 15	Various chemicals and materials	Interstate extends throughout the 10 mile Stream Buffer Zone and to the limits of the watershed

Inventory Results - Recharge Region and Stream Buffer Zone

Approximately ninety-seven percent of the Recharge Region is privately owned land. The Forest Service and the Bureau of Land Management own the remainder of the land (2.2 and 0.7 percent respectively (NRIS)). Land in the Blue Sky Heights and Forest Park Estates recharge area is moderately forested, sparsely populated with residential homes generally located on 1 ½ to 20-acre lots. The biggest potential contamination source in the Recharge Region and Stream Buffer Zone is the septic systems of these homes, but a spill on Interstate 15 or effluent from the mine waste (active or abandoned) could also occur. The majority of the homes were constructed at least 20 years ago. Nitrate test results taken in 1980 were 0.39 ppm and 0.34 ppm in 1999. This 20-year track record seems to indicate the nitrate contaminate source from drainfields is of little consequence to the wells. No space is available for more homes within the subdivision within Blue Sky Heights and only a few undeveloped lots are remaining in the Forest Park Estates Subdivision.

No land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the Recharge Region.

The Clancy Store, which is approximately 2.4 miles above the subdivisions, includes gasoline pumps and underground storage tanks, therefore the store has potential contaminant sources. The potential of contaminating is low based on distance from the wells.

Should a spill of a contaminated substance occur on Interstate 15, the rapid moving water of Prickly Pear Creek, which is between Interstate 15 and the wells, should provide a natural barrier.

The Table 5B summarizes the inventory results for the Recharge Region and Stream Buffer Zone upstream of the wells 1 to 10 miles.

Table 5B. Potential Contaminant Sources and Description

Recharge Region and Stream Buffer Zone

Source	Contaminants	Description
UST	Fuels	Clancy Store - 2.4 miles upstream in Buffer Zone
Sewage Treatment and Permitted Stream Discharge	Pathogens and Nitrates	Evergreen Nursing Home – 3.4 miles upstream in Buffer Zone
Wood Treatment	Hazardous waste-chromium compounds	Marks-Miller Post and Pole Inc. – 1.5 miles upstream in Stream Buffer Zone
Active and Abandoned Mines	Mine waste drainage	There are 50 active and numerous abandoned mines in the Recharge Region and Stream Buffer Zone
Interstate 15	Various chemicals and materials	Interstate extends throughout the 10 mile Stream Buffer and to the limits of the watershed
Permitted-Discharge	De-watering well discharge to stream	Montana Tunnels – Approximately 10 miles upstream in Recharge Region

Inventory Update

The certified operator will update the inventory every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

The potential sources of contaminants for Blue Sky Heights, Forest Park Estates and the surrounding area are identified from information that is readily available. None of the data sources represent comprehensive listing of regulated activities or hazardous materials. In addition, unregulated activities or unreported contaminant releases may result in some sources being overlooked. While considerable effort is made to inventory all potential sources and significant potential source of contamination, this inventory should be considered a starting point. Ideally, the water users association, local community and local government would continue this effort to create a more complete and comprehensive inventory. The current inventory should be sufficient to ensure that the sources that are identified represent the major threats to the water supply sources. Also, the water system operators reviewed this report to check for errors and omissions.

CHAPTER 4

SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case Blue Sky Heights or Forest Park Estates Water Users Association.

The goal of Source Water Management is to protect the source water by 1) controlling activities in the control zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that land use activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility.

Alternative management approaches that could be pursued by the Blue Sky Heights or Forest Park Water Users Associations to reduce susceptibility are recommended.Susceptibility is determined by considering the hazard rating for

each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to the Water User Association

wells (Table 5A and 5B). Hazard is rated by the proximity of a potential contaminant source to the wells. Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 6). The susceptibility of each well to each potential contaminant source is assessed separately.

Table 6. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

Presence of Barriers	High Hazard	Moderate Hazard	Low Hazard
No Barriers	Very High	High	Moderate
One Barrier	High	Moderate	Low
Multiple Barriers	Moderate	Low	Very Low

Table 7. Susceptibility Assessment for Significant Potential Contaminant Sources.

Recharge Region and the Surface Water Buffer Region						
Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Septic Systems	Nitrates and Pathogens	Nitrates and Pathogens	Moderate to High	Prickly Pear Creek	Moderate to High	DEQ regulates subdivision development and continued monitoring

Sewage Treatment Facility - Evergreen Rest Home	Nitrates and Pathogens	Nitrates and Pathogens	Moderate	Approx. 3.5 miles from wells and monitored, and in compliance with State Regulation	Low	Monitored and in Compliance with State Regulation
MDT Jefferson City Rest Areas	Nitrates and Pathogens	Nitrates and Pathogens	Low	Approximately 7 miles from well heads	Low to Moderate	Monitored and in Compliance with State Regulations
Other Sources Within the Recharge Region						
Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Wood Treatment Marks-Miller Post and Pole Inc.	Hazardous waste-chromium compounds	Spill	Moderate	Approx. 1.6 miles	Moderate to Low	Monitored and in Compliance with State Regulations
UST - Clancy Store	Fuel	Leak	Low	Approx. 2.4 miles from wells, and in compliance with State Regulations	Low	Monitored and in compliance with State Regulations
Abandoned and Active Mine Sites	Mine waste drainage	Waste drainage	Low	Small or closed sites	Low	Monitor new mining activities in the watershed, and participate in public meetings
Expanded Inventory Region						
Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management

US Interstate 15	Various Chemicals	Spill	Very High to High	Prickly Pear Creek	High	Develop Emergency Response Plan
Wood Treatment Marks-Miller Post and Pole Inc.	Hazardous waste-chromium compounds	Spill	Moderate	Approx. 1.6 miles	Moderate to Low	Monitored and in Compliance with State Regulations
Sewage Treatment Facility - Evergreen Rest Home	Nitrates and Pathogens	Nitrates and Pathogens	Moderate	Approx. 3.5 miles from wells and monitored, and in compliance with State Regulations	Low	Monitored and in Compliance with State Regulations
Abandoned and Active Mine Sites	Mine waste drainage	Waste drainage	Low	Small or closed sites	Low	Monitor new mining activities in the watershed, and participate in public meetings
UST - Clancy Store	Fuel	Leak	Low	Approx. 2.5 miles from wells, and in compliance with State Regulations	Low	Monitored and in compliance with State Regulations
Septic Systems	Nitrates and Pathogens	Nitrates and Pathogens	Moderate to High	Prickly Pear Creek, distance upstream, and dilution	Moderate	DEQ regulates subdivisions & monitoring water quality.

SELECTED REFERENCES

- DEQ Water Quality Circular 1, Water Quality Standards For Water And Wastewater Systems.

- DEQ Source Water Protection Program Guideline Document, 1999.

- Klepper, M. R., 1971, Geology and mineral deposits, east flank of the Elkhorn Mountains, Broadwater County, Montana: USGS Professional Paper 665, p. 66.

- Knopf, Adolf, 1913, Ore deposits of the Helena mining region, Montana, USGS Bulletin 527, p. 143.

- Ross, C. P. et all, Geologic Map of Montana: Montana School of Mines and Geology (MBMG), 1955

- Knopf, Adolf, 1963, Geology of the northern part of the Boulder batholith and adjacent area, Montana: USGS Miscellaneous Geologic Investigations MapI-381, scale 1:48,000

- Rupple, E. T. et al, 1958, Geology of part of the Townsend Valley, Broadwater and Jefferson counties, Montana: USGS Bulletin 1042-N, pp. 481-556.

- Smedes, H. W., 1966, Geology and igneous petrology of the northern Elkhorn Mountains, Jefferson and Broadwater Counties, Montana: USGS Professional Paper 510, p. 116.

- Tilling, R. I. et al, 1988, Preliminary map of plutonic units of the Boulder batholith, southwestern Montana: USGS Open-file Report 88-283.

- Tyson, N. S. et al, 1965, Aeromagnetic map of the Boulder Batholith area, Southwestern Montana: USGS Geophysical Investigation Map GP-538.

APPENDIX 1 BLUE SKY HEIGHTS WUA