SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Harlem
Public Water System

PWSID # 00239

Report Date: May 7, 2001

Certified Operators:

Donald Coffman
Charles Wasser
Richard Mohar

Contact Person:

Richard Mohar
P.O. Box 579
Harlem, MT 59526
phone: (406) 353-2361

TABLE OF CONTENTS

INTRODUCTION

The Source Water Delineation and Assessment Report for the City of Harlem was completed by Russell L. Levens, Montana Department of Environmental Quality.

Purpose

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the City of Harlem 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 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 "delineation and assessment". Delineation is a process of mapping source water protection areas that contribute water used for drinking. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. The primary purpose of this source water delineation and assessment report is to provide information to help the City of Harlem complete a source water protection plan to protect its drinking water source.

Limitations

This report was prepared to assess threats to the City of Harlem public water system and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of Harlem's public water system and not any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area of Harlem are identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered.

The term "contaminant" is used in this report to refer to constituents for which maximum contaminant levels (MCLs) have been specified under the national primary drinking water standards, and to certain constituents that do not have MCLs but are considered to be significant health threats.

CHAPTER 1
BACKGROUND

The Community

Harlem is 42 miles east of Havre at the north edge of the Fort Belknap Indian Reservation in Blaine County (Figure 1). The population of Blaine County is 7,148 according to 1998 census estimates of which approximately 885 live in Harlem. U.S. Highway 2 and the Burlington Northern Santa Fe Railroad pass through Harlem. Most of the residents of Harlem are tribal members and derive their income from the Fort Belknap Indian Reservation. Agriculture and the highway and rail transportation corridor are the other mainstays of the local economy. Primary agricultural products are dryland grains, cattle, and hogs.

Municipal sewage disposal systems serve the City of Harlem and Fort Belknap Agency and septic systems serve outlying areas. Facilities that store, use, or produce the largest quantities of chemicals or other toxins are agricultural chemical suppliers and retail gasoline outlets.

Geographic setting

Harlem is located just south of the Canadian border at 48.5° north latitude and 108.8° west longitude and 2529 feet above sea level. The terrain around Harlem consists of plains mantled by glacial sediments. Isolated mountain ranges of igneous intrusive rocks and alluvial valleys eroded by rivers and streams interrupt the plains. The Milk River, the source of Harlem's drinking water, is the main tributary to the Missouri River in north central Montana.

The average daily high and low temperatures in Harlem are 85.6°F and 52.4°F in July and 24.7°F and 0.6°F in January. Precipitation averages 11.7 inches in town and increases to 20 inches on the Bears Paw Mountains. Precipitation comes mostly in the late spring and during infrequent intense summer storms. On the average, 26.5 inches of snow falls in Harlem with more in the nearby mountains. Snowmelt in the Bears Paw Mountains and more distant headwaters in the Sweet Grass Hills and Glacier National Park is the primary source of water in the Milk River. The Milk is the drinking water source for most of the communities along Highway 2 from Chester to Harlem. Fresno Reservoir located 35 miles upstream from Harlem is a 5,760-acre irrigation control reservoir on the Milk.

Harlem Source Water

The City of Harlem public water system serves 850 residents through 435 service connections with water from an intake in the Milk River approximately two miles south of town. The headwaters of the Milk River are on the Blackfeet Indian Reservation and in Glacier National Park 200 miles west of Harlem. Flow in the Milk is augmented by a diversion from the St. Mary River and by tributaries draining the Sweet Grass Hills and Bears Paw Mountains.

The City of Harlem pumps water out of the Milk River into two holding ponds. The holding capacity of the two ponds is approximately 5.6 million gallons. The intake pumps in the water plant pump the water through the pipes, where aluminum sulfate (alum) and polymer are injected into the water. The water then flows through the clarifier where coagulation, flocculation, and settling take place. From there, the water flows through pipes where a filter aid is injected before the filters. The water then flows through the filters into the clear well, where chlorine is added for disinfection.

Water Quality

The quality of water in the Milk River watershed varies considerably, mostly because of differences in erosion rate, riparian vegetation, and land uses. Approximately 195 miles of streams and 4000 acres of reservoir upstream from Harlem have been identified as being in need of Total Maximum Daily Load

(TMDL) development (see details in Appendix B). Selection of a stream for TMDL development is based on impairment of a specified use such as aquatic life, fisheries, agriculture, or drinking water. Fresno Reservoir, the Milk River downstream from Fresno Reservoir to Harlem, and 57 miles in the upper Sage Creek Watershed are listed because of impairment of drinking water uses.

Saline seep is a water quality problem prevalent in many areas of the Milk River watershed and is related to geologic conditions and agricultural practices. Saline seeps form when water infiltrates downward through the surface layer of glacial till and flows to low-lying discharge points along bedrock comprised of impermeable marine shale. Salts in the soil and underlying shale are leached resulting in high dissolved solids concentrations in surface waters.

Raw water from the Milk River at Harlem has seasonally high turbidity, alkalinity, and total organic carbon (Table 1). Intermittent tributaries to the Milk are major sources of dissolved solids, especially in late winter and early spring when snowmelt flushes sediment and salts that build up during times of low flow. Intense summer rains also flush poor quality water from intermittent streams.

Table 1. Raw water quality data for the Milk River as recorded by the Havre Water Treatment Plant from 1992 to 1996.

	Turbidity (NTU)	TDS (mg/L)	Hardness (mg/L)	Alkalinity (mg/L)	Temp. °F	pH	TOC (mg/L)
Minimum	1.8	190	77	88	1.4	7.4	2
Maximum	775	640	332	487	25.0	8.9	12
Average	16.0	336	175	177	11.3	8.3	7
Median	10.0	329	170	170	10.7	8.4	7

Monitoring and Enforcement Actions

The City of Harlem's water is routinely monitored for compliance with drinking water standards. Bacteriological monitoring occurs once a month. Compliance with other drinking water standards is determined on the basis of additional sampling on a variety of schedules. DEQ has taken no enforcement actions against the Harlem public water supply in the past five years. Nitrate and coliform bacteria were the only regulated contaminant detected in Harlem's water during this time. Nitrate can come from human or animal wastes but also occurs naturally. The highest nitrate level detected in Harlem's water was 0.14 mg/L, considerably below the maximum concentration level of 10 mg/L set by the U.S. Environmental Protection Agency (EPA). Coliform bacteria are not harmful but their presence can indicate the presence of pathogenic organisms.

Influencing Factors

Cooperation between the City of Harlem (or Blaine County) and Fort Belknap Indian Reservation is necessary for source water protection to be successful. The water intakes of the City of Harlem and Fort Belknap Agency, as well as their wastewater discharges, are within a short reach of the Milk River (Figure 2). Also, land on the south bank of the Milk River near Harlem is within the Fort Belknap Indian Reservation whereas Blaine County governs land on the north bank.

Figure 1. Map of the Harlem, Montana vicinity.

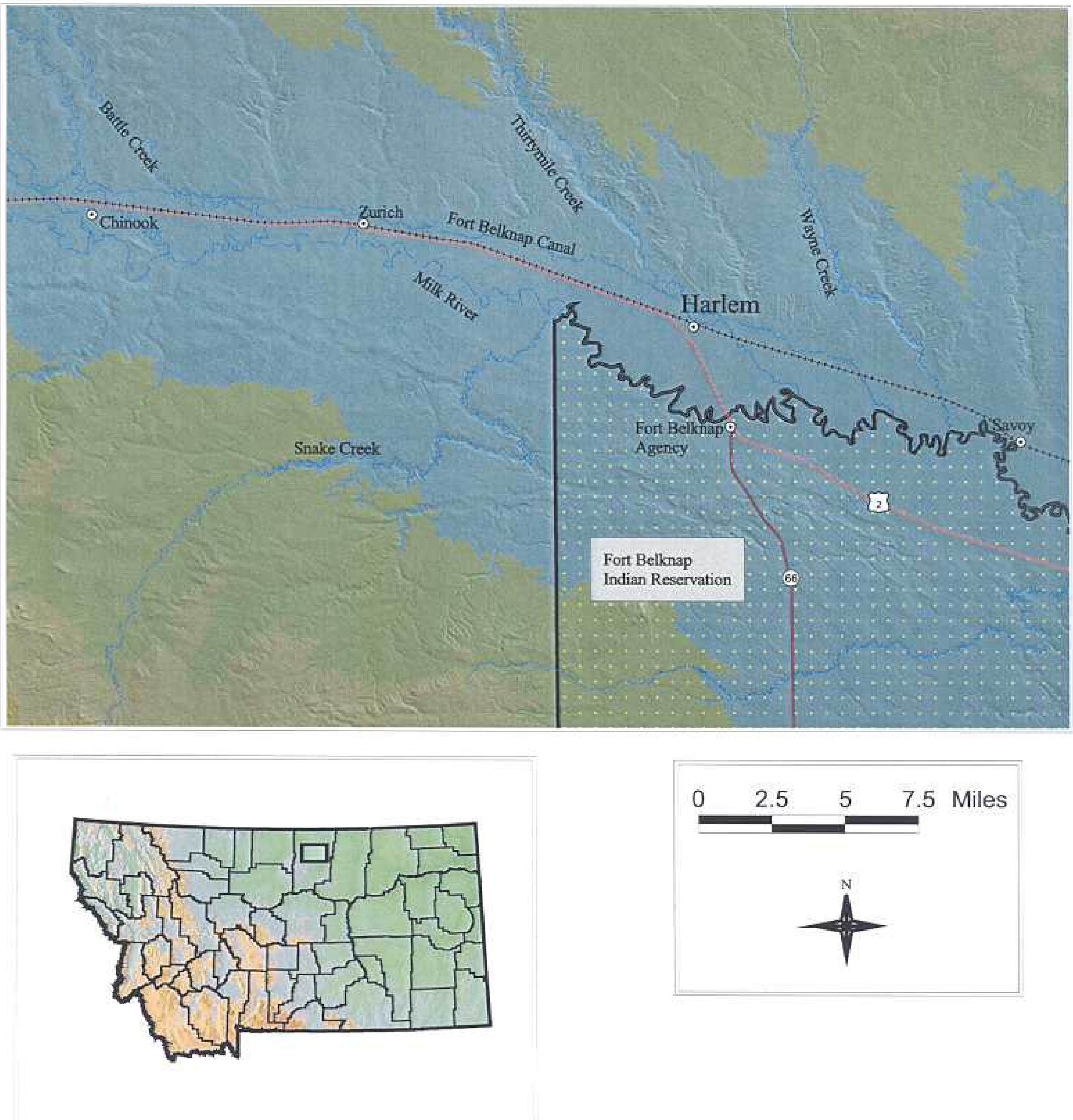
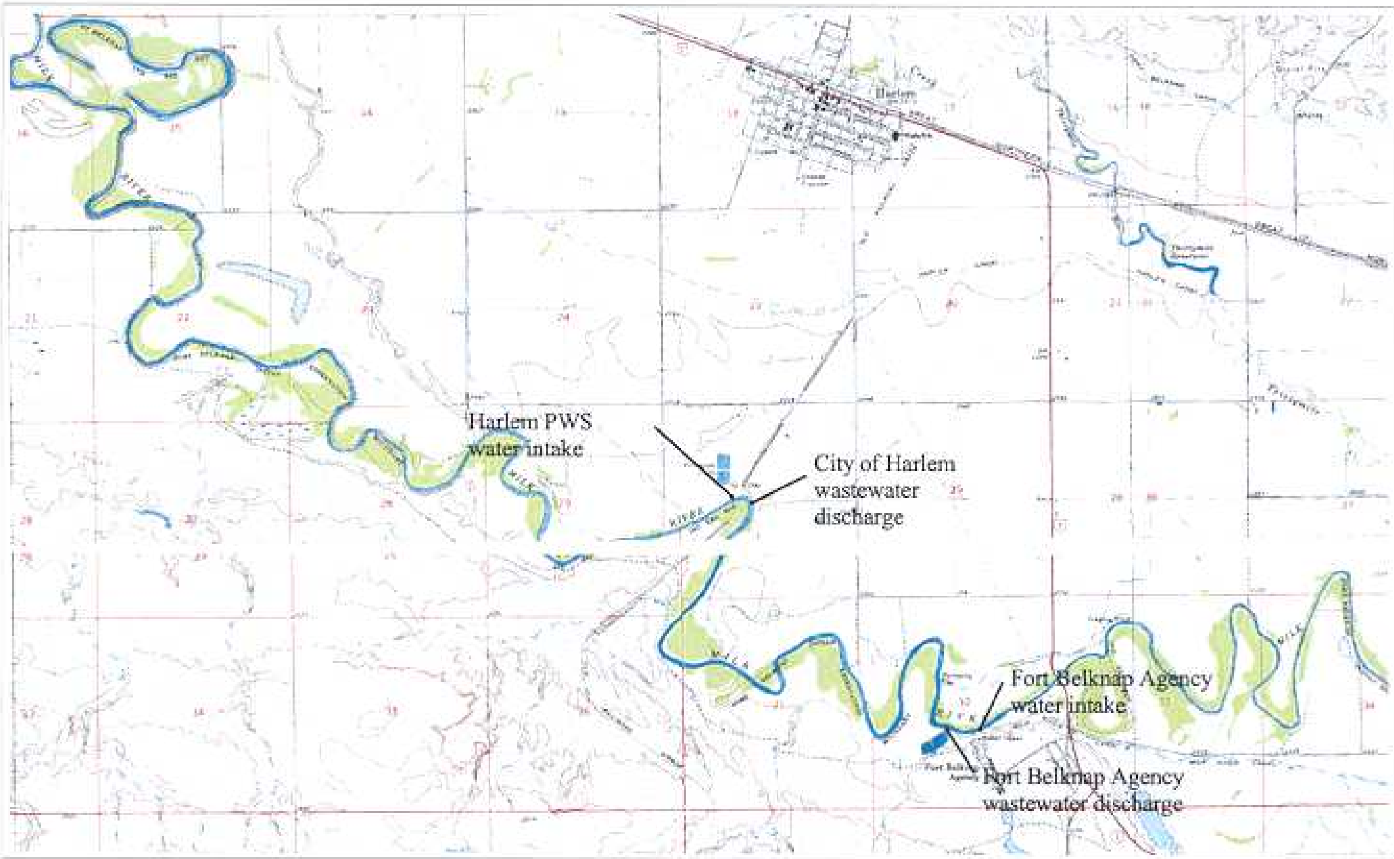
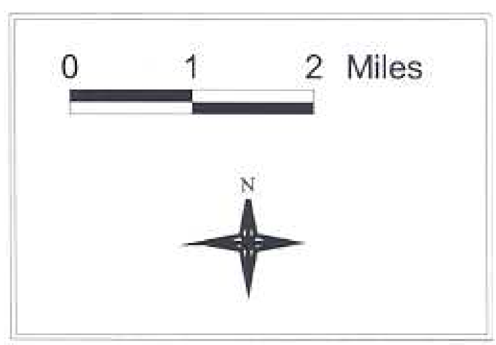


Figure 2. Locations of water intake and sewer discharges for the City of Harlem public water system and Fort Belnap Agency.





CHAPTER 2
DELINEATION

The source water protection area for the City of Harlem is delineated in this chapter. This delineated area is subdivided into spill response and watershed regions, each with separate management goals. Potential contaminant sources are identified in Chapter 3. Relative susceptibility to significant potential contaminant sources is evaluated and management solutions are recommended in Chapter 4.

Geologic and Hydrologic Conditions in the Watershed

Harlem is in the Middle Milk Watershed (HUC #10050004160) of the Lower Missouri Watershed Management Region. The headwaters of the Milk River are on the Blackfeet Indian Reservation and in Glacier National Park approximately 200 miles west of Harlem. The Milk flows into Alberta Canada near its headwaters and then east until reentering Montana approximately 100 miles upstream from Harlem. Flow in the Milk is augmented by a diversion from the St. Mary River and tributaries flowing from the Sweet Grass Hills and the Bears Paw Mountains. In total, the Milk River drains approximately 9,822 square miles upstream from Harlem.

The average flow of the Milk River at Harlem is 387 cubic feet per second (cfs), with a median flow of 256 cfs. Flow is highly variable, however. Peak annual flows ranged from 578 to 13,900 cfs between 1952 and 1997 while flows less than 10 cfs were recorded several times during that period. Flow is affected by annual and seasonal variations in runoff and water storage for irrigation. Most of the flow in the Milk River at Harlem comes from snowmelt in its headwaters, the St. Mary Diversion, and tributaries that flow north from the Sweet Grass Hills (Table 1). Big Sandy, Beaver, Little Box Elder, and Clear creeks are important tributaries to the Milk between Fresno Reservoir and Harlem. They flow primarily in response to brief storms in late spring and early summer and to runoff from snowmelt from the Sweet Grass Hills and Bears Paw Mountains.

Table 2 Stream flow for streams in the Milk River Watershed (USGS gaging stations).

Gaging Station (# of years)	Area (mi^2)	Average (cfs)	Maximum (cfs)	Minimum (cfs)
Milk near Del Bonita (4)	325	83.4	5,780	0
North Milk River (Glacier Co.) (73)	60	24.7	1,320	1.7
Milk at Crossing into Montana (81)	2,506	470.8	7,450	0
Big Sandy near Havre (15)	1,805	19.9	5,100	0
Sage Creek near Kremlin (6)	914	1.9	692	0
Beaver Creek near Havre (4)	87	11.3	498	0
Milk at Havre (62)	5,785	377.4	16,000	0
Little Box Elder Ck. at Havre (3)	96	11.1	900	0
Bullhook Creek near Havre (16)	40	----	700	----
Clear Creek near Lohman (6)	135	12.7	3,050	0
Lodge Creek (3)	1,175	55.8	3,000	0
Battle Creek (15)	1,623	34.4	12,000	0
Milk at Harlem (17)	9,822	386.6	12,900	0

Bedrock is variable in the Milk River Watershed (Figure 3). Sedimentary rocks found in Glacier National Park were faulted and stacked in response to continent-wide forces. The Sweet Grass Hills and Bears Paw Mountains were formed when masses of liquid rock rose thousands of feet along faults through layers of sedimentary rocks. These masses cooled and solidified below the surface and later were exposed when the overlying sedimentary rock was stripped away by erosion. Sedimentary formations dip gently east from the flanks of the Sweet Grass Hills. Glacial till and outwash deposits mantle the bedrock surface over much of the plains portion of the watershed. Fluvial deposits are found along streams that have eroded into glacial sediments.

Harlem is built on glacial deposits of clay, silt, and sand overlying an alluvial valley eroded into bedrock; this valley is believed to be the pre-glacial channel of the Missouri River (Alden, 1932). The buried channel follows Big Sandy Creek from the vicinity of Virgelle to the Havre area and then follows the Milk River downstream through Harlem. The Milk River has eroded an alluvial channel into the glacial sediments.

Conceptual Model

The Milk River and its tributaries immediately upstream from Harlem are of greatest concern for source water protection. Contaminants that spill into these streams or accumulate in flood plains can reach Harlem before water plant operators can close the intake. Also, contaminants in groundwater can enter the Milk River where it is hydraulically connected to underlying glacial sediments. Activities in the remainder of the watershed contribute most of the dissolved solids transported by the Milk River, however they are less of a threat to Harlem water users because mixing and residence time in Fresno Reservoir reduces the concentrations of contaminants to less harmful levels.

Source Intake

The City of Harlem pumps water out of the Milk River at a location approximately two miles south of town, and into two holding ponds. According to a technical assistance report on the City of Harlem water treatment plant (see Appendix D), two 10 hp, 300-gpm centrifugal pumps draw water from the two holding ponds into the treatment plant. They do not pump from the river during spring runoff when turbidity is high. See Appendix A for a diagram of the Harlem distribution system.

Delineation Results

Spill Response Region – The Montana Source Water Protection specifies that the spill response region include all surface waters and land within one-half mile on either side of a surface water source and its tributaries for ten miles or a four-hour time-of-travel upstream from a water intake. The mean velocity of the Milk River was 1.72 miles-per-hour and only exceeded 2.5 miles-per-hour once between July 1995 and November 1998 (data from USGS gaging station at Havre). Accordingly, to ensure a four-hour time-of-travel under the majority of flow conditions the upstream extent of the spill response region for Harlem is 10 miles from the water intake (Figure 4).

Watershed Region - All land and water within the drainage basin upstream from Harlem are included in the watershed region. The watershed region for Harlem lies in the Lower-Missouri Watershed Region; it straddles the Canadian Border and includes parts of the Blackfeet and the Rocky's Boy Indian reservations and Glacier National Park.

Limiting Factors

The spill response region extends one-half mile on either side of the center of the Milk River. During flooding, the buffer adjacent to the river will be less than one-half mile. However, a sufficient buffer should be maintained to protect against most spills.

Figure 3. Geologic map of the Harlem, Montana vicinity.

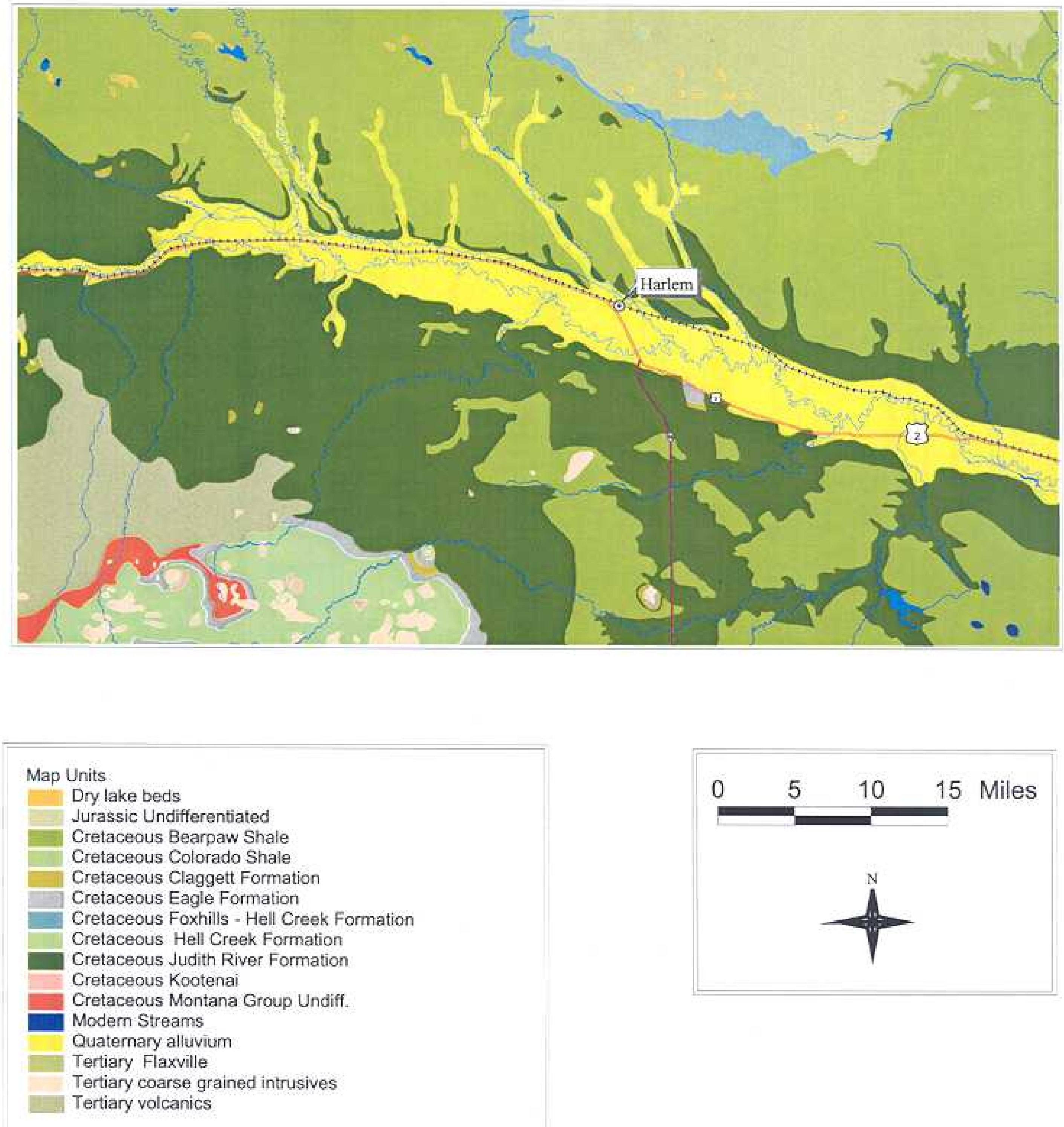
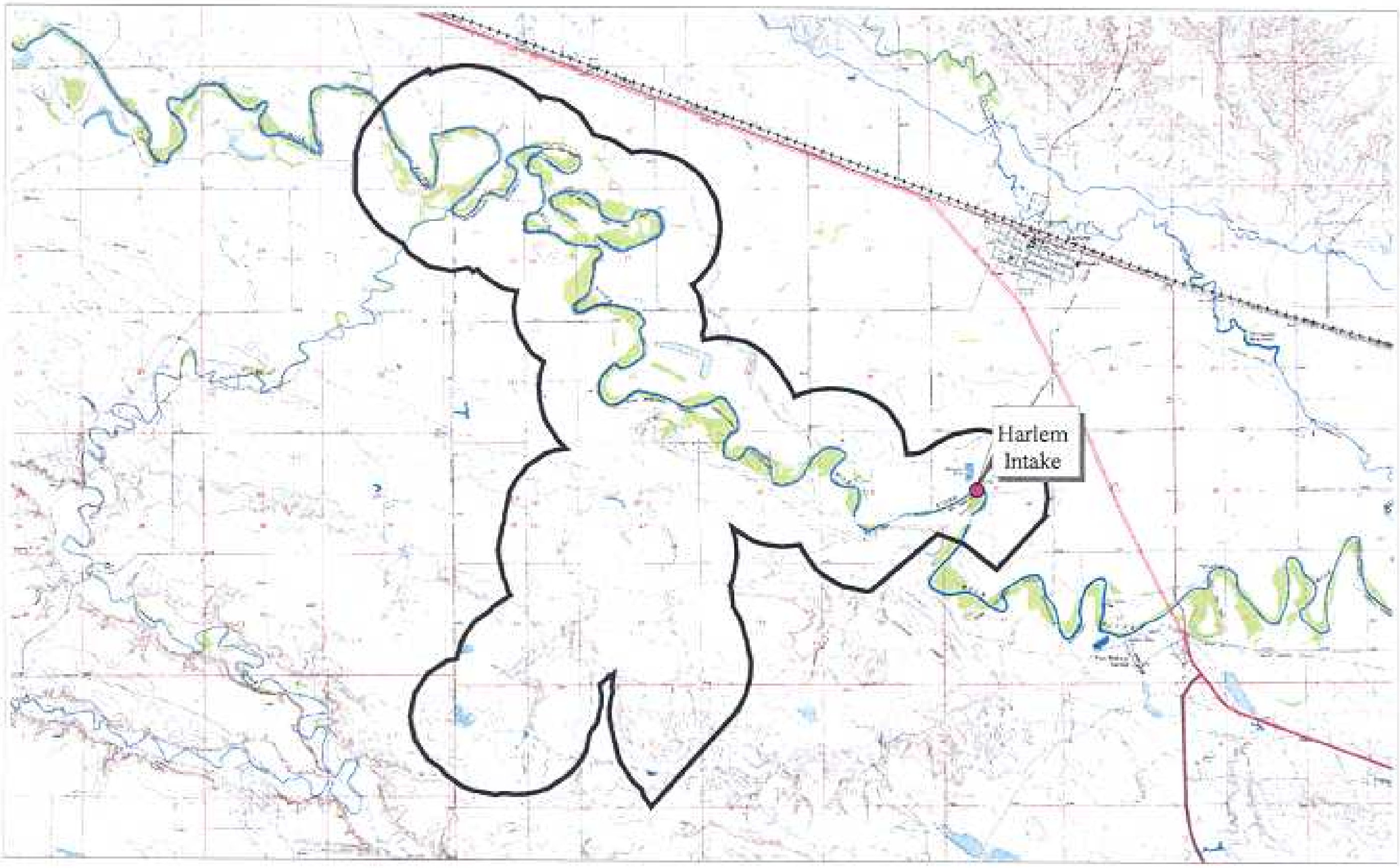
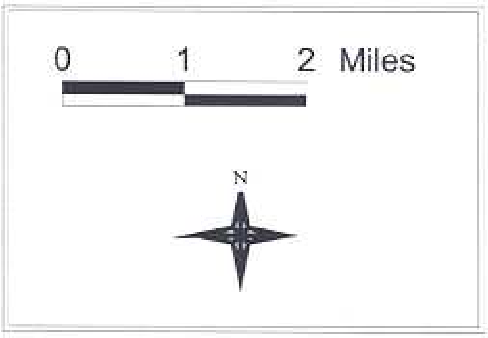


Figure 4. Spill response region for the City of Harlem public water system.





CHAPTER 3
INVENTORY

An inventory of potential contaminant sources was conducted to assess the susceptibility of Harlem's drinking water source to contamination. Sources of all primary drinking water contaminants and cryptosporidium were identified, however only potential sources of contaminants that are the greatest threat to human health were selected for detailed inventory. The contaminants of greatest concern to Harlem are nitrate, microbial contaminants, solvents, and pesticides.

The inventory for Harlem focuses on facilities that generate, use, or store potential contaminants and certain land uses in the spill response region. General land uses, permitted discharges, and large spill threats are identified in the remainder of the Milk River watershed.

Inventory Method

Available databases were searched to identify businesses and land uses that are significant potential sources of contaminants. The following steps were followed:

Step 1: Percentage of agricultural land use was estimated from a preliminary land cover GIS coverage released by the U.S. Geological Survey (U.S. Geological Survey, 2000).

Step 2: EPA's Envirofacts System was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), Permit Compliance System (PCS), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS).

Step 3: DEQ databases were queried to identify Underground Storage Tanks (UST)s, sites contaminated with hazardous wastes (DEQ hazardous waste site cleanup bureau), landfills, and abandoned mines in the inventory region. Any information on past releases and present compliance status was noted.

Step 4: A business phone directory was queried to identify businesses that generate, use, or store chemicals in the inventory region. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were identified as potential contaminant sources.

Step 5: Major road and rail transportation routes were identified throughout the inventory region.

Step 6. All land uses and facilities that generate, store, or use large quantities of potential contaminants were identified within the recharge region and identified on the base map.

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

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

Inventory Results/Spill Response Region
Land uses in the spill response region are primarily agricultural (see Figure 5). Fifty-four percent of the land is grass and shrub rangeland and thirty-nine percent is cropland or pasture. Fort Belknap Indian Reservation owned land south of the Milk River is primarily rangeland whereas the northern part of the spill response region is small grains and pasture. The average population density in the spill response region is 1.4 persons per square mile.

Three facilities with Montana Pollutant Discharge Elimination (MPDES) discharge permits are located in Harlem's spill response region. These facilities include Harlem's water treatment and wastewater treatment plants and a feedlot. Filter backwash water is discharged from Harlem's water treatment plant to the holding ponds. Treated sewage from the wastewater treatment plant is discharged immediately downstream from the intake. The feedlot, located approximately eight miles upstream from Harlem's intake, is designed to store twice the rainfall from a 10 year-24 hour storm event.

No businesses that use or store hazardous chemicals were identified in the spill response region. Septic systems at farmsteads scattered throughout the spill response region are potential sources of nitrate and pathogens. Stormwater runoff from residential areas and farms can carry spilled pesticides or fuels, or improperly discarded waste chemicals. Fuels or other chemicals could be spilled if a vehicle accident were to occur at the bridge approximately three miles upstream from Harlem's intake. Cropland is a potential source of nitrate, pesticides, and pathogens that can reach the Milk River through irrigation return flow. Significant potential contaminant sources for Harlem are listed in Table 3.

Table 3. Significant potential contaminant sources in the City of Harlem spill response region.

	Significant Potential Contaminant Source	Description of Hazard
1	Water Treatment Plant	Discharge of filter backwash water near water intake
2	Wastewater Treatment Plant	Sewage discharge during flooding
3	Feedlot	Discharge of animal wastes during storms
4	Cultivated Cropland	Runoff and ground water contaminated by pesticides, nitrate, and pathogens
5	Stormwater Runoff	Runoff contaminated by spilled and improperly discarded chemicals from residents and farmsteads
6	Septic Systems	Groundwater contaminated by septic system effluent

Inventory Results/Watershed Region
Agricultural land use in the Milk River Watershed upstream from Harlem is concentrated in the Sage Creek and Upper Milk River sub-basins and the lower elevations of the Big Sandy Creek, Beaver Creek, and Milk Headwaters sub-basins. Rangeland is concentrated along stream bottoms in agricultural areas and in the foothills of the Sweet Grass Hills, Bears Paw Mountains, and Glacier Park. Forested land is limited to the higher elevations of the Bears Paw Mountains and Glacier Park. Urban development is limited to Havre and a few small communities. Past mining in the Milk River Watershed includes base and precious metals mining in the Sweet Grass Hills and Bears Paw Mountains, coal mining east of Big Sandy, and sand and gravel mining throughout the watershed. Oil exploration and production has occurred throughout the watershed most heavily on the north slopes of the Sweet Grass Hills.

Cropping practices can impact water quality by increasing saline seep and soil erosion. Nutrients and pesticides can be transported by irrigation return flows. Livestock grazing and logging in riparian areas can increase turbidity by increasing erosion. Improper livestock grazing also can contribute pathogens and organic carbon. Urban land uses may contribute contaminants to surface water through stormwater runoff.

Wastewater treatment plants and stream crossings by roads, railways, and pipelines are the potential contaminant sources of greatest concern in the watershed region (see Figure 6 and Table 4). Nitrate and pathogens are the potential contaminants from wastewater treatment plants and VOCs are the potential contaminants from spills at stream crossings. Waste rock and mill tailings at abandoned mines and oil-well brine pits are other potential contaminant sources in the watershed region.

Inventory Update

The certified water operator will update the inventory for his or her records 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.

Inventory Limitations

The potential sources of contaminants for Harlem's public water supply are identified from data and reports that are readily available. Consequently, unregulated activities or unreported contaminant releases may have been missed. The use of multiple sources of data, however, should ensure that the sources identified represent the major threats to the source water for Harlem. The water system operator also reviewed this report to check for errors and omissions.

Table 4. Potential point sources of contaminants in the watershed region for Harlem.

Facility	Type of Facility	Description
30 RCRA Facilities	Hazardous Waste Handlers	See Appendix C for List
6 SSTS Facilities	Pesticide Handlers	See Appendix C for List
2 CERCLA Sites	Groundwater Contamination	See Appendix C for List
9 Landfills	Groundwater Contamination	See Appendix C for List
Road, Rail, and Pipeline Crossings	Crude Oil Pipeline	Spills
City of Chinook	Sewage Treatment Plant	Milk River Discharge
City of Havre	Sewage Treatment Plant	Milk River Discharge
Rocky Boy's Agency	Sewage Treatment Plant	Box Elder Creek Discharge
Chippewa-Cree Tribe	Sewage Treatment Plant	Box Elder Creek Discharge
City of Big Sandy	Sewage Treatment Plant	Big Sandy Creek Discharge

Figure 5. Inventory region for the City of Harlem public water system.

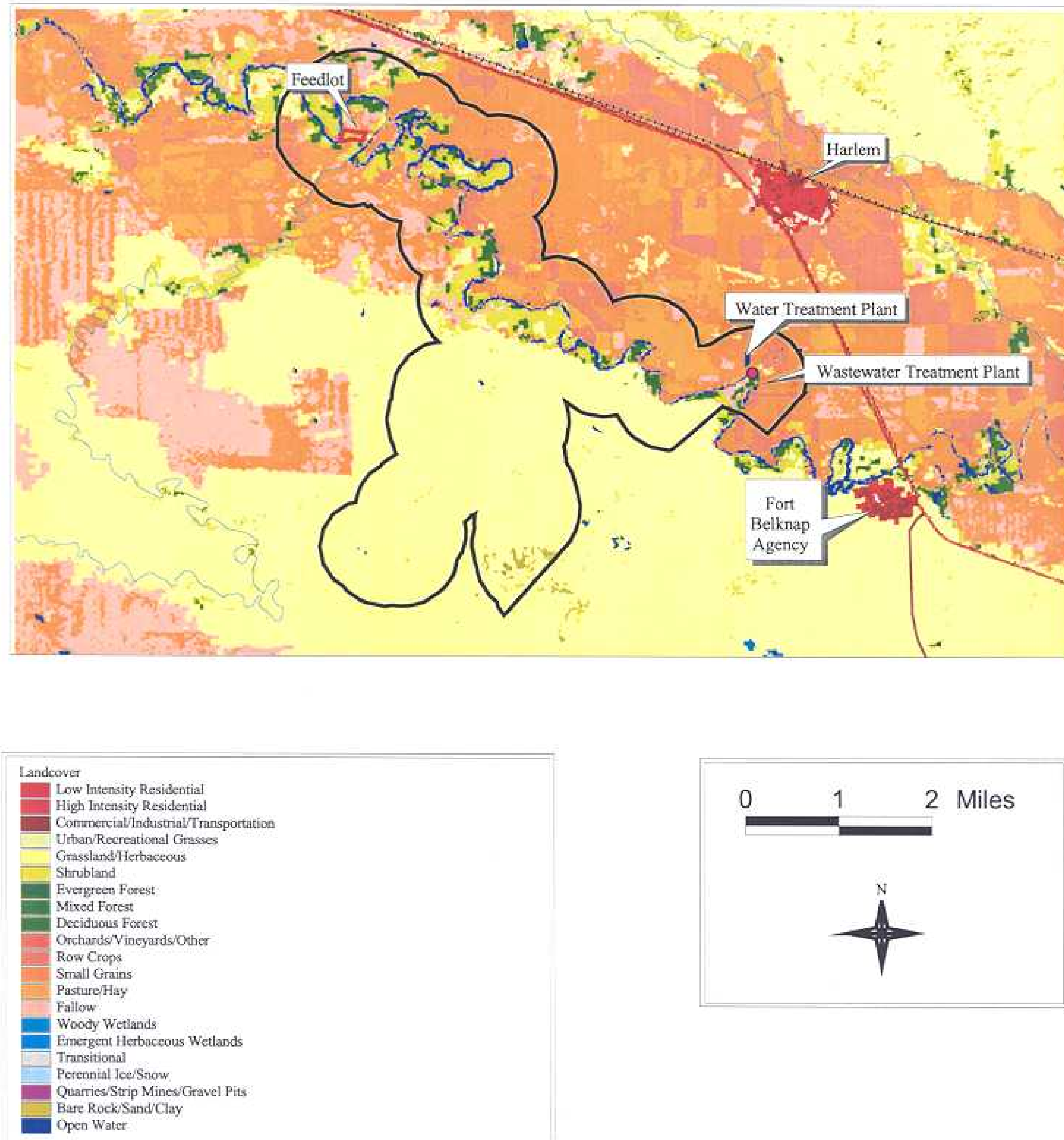
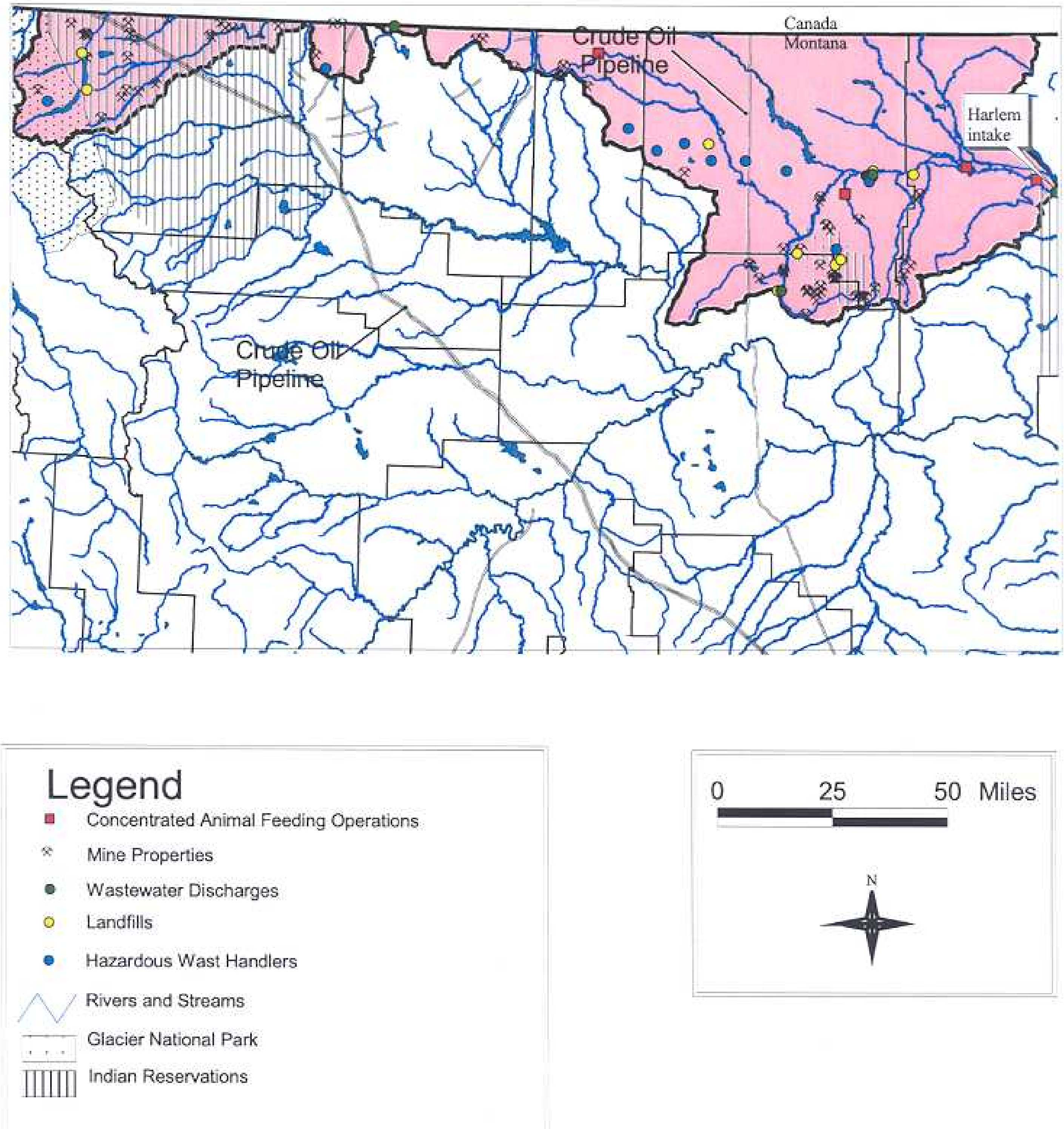


Figure 6. Large potential contaminant sources in the watershed region for Harlem, Montana.



CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

Susceptibility of Harlem's source water is determined by two factors: the potential of a contaminant reaching the intake and the resulting health hazard. The purpose of assessing susceptibility is to prioritize significant potential contaminant sources for Harlem to manage in order to minimize threats to their drinking water source.

Susceptibility is assessed in Harlem's spill response region. Susceptibility to individual point sources in the watershed region is considered to be low because dispersion and dilution of contaminants should reduce concentrations of contaminants below levels associated with adverse health affects. Non-point contaminant sources in the watershed region do impact Harlem's water quality; however, managing these sources is beyond local control. Instead, efforts intended to reduce impacts in the watershed need to be implemented through existing conservation and restoration programs, primarily the TMDL program.

Susceptibility is determined under the Montana Source Water Protection Program by the hazard associated with a source and the existence of barriers to contamination. The hazard presented by point sources of contaminants in Harlem's spill response region depends on whether contaminants can discharge directly to the Milk River or one of its tributaries and whether contaminants are associated with acute health effects (Table 5). Barriers can be engineered physical structures, management actions, or natural conditions. Barriers lower susceptibility by decreasing the likelihood that contaminated water will flow to Harlem's intake (Table 6). Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant.

Table 5. Hazard of potential contaminant sources for the City of Harlem.

	High Hazard	Moderate Hazard	Low Hazard
Point Sources of Nitrate or Microbes	Potential for direct discharge to source water	Potential for discharge to groundwater hydraulically connected to source water	Potential contaminant sources in the watershed region
Point Sources of VOCs, SOCs, or Metals	Potential for direct discharge of large quantities from roads, rails, or pipelines	Potential for direct discharge of small quantities to source water	Potential for discharge to groundwater hydraulically connected to source water
Septic Systems	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Cropped Agricultural Land (% land use)	More than 50 percent of spill response region	20 to 50 percent of spill response region	Less than 20 percent of spill response region

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

	High Hazard	Moderate Hazard	Low Hazard
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

The results of the susceptibility assessment for Harlem are summarized in Table 7. Dilution is considered a natural barrier if the concentration of a contaminant that may discharge directly to surface water is reduced to non-significant levels. Dilution is not considered a barrier to sources of microbial contaminants. A permit process that restricts activities at a potential contaminant source can be considered a management barrier. For example, MPDES permits include provisions that effectively reduce the susceptibility of a downstream water intake. The following are brief descriptions of the susceptibility assessments for each significant potential contaminant source included in Table 3.

Feedlot – Hazard is rated high because nitrate and pathogens can discharge directly to the Milk River during extreme storm events. Susceptibility is rated high instead of very high because provisions of the feedlots MPDES permit limit the likelihood of a release.

Water Treatment Plant – Hazard is rated high because pathogens in filter backwash can be drawn into Harlem's intake. Susceptibility is rated high instead of very high because provisions of the MPDES permit limit concentrations of contaminants in backwash water.

Wastwater Treatment Plant – Hazard is rated high because nitrate and pathogens in sewage effluent can flow to Harlem's water intake during extreme flooding events. Susceptibility is rated high instead of very high because effluent is treated to meet standards specified in the plants MPDES permit.

Septic Systems - Hazard is rated low because unsewered development in the spill response region is limited to widely scattered residents or farmsteads. Susceptibility is rated low because clay rich soils act as a barrier.

Stormwater Runoff - Hazard is rated moderate because VOCs and SOCs can discharge directly to the Milk River but should not cause acute health effects at the concentrations expected to occur. Susceptibility is moderate because dilution is a barrier.

Cropland or Pasture - Hazard is rated moderate because 39 percent of the spill response region is cropland or pasture. Susceptibility is rated moderate because clay rich soils act as a barrier.

Table 7. Susceptibility assessment for significant potential contaminant sources in the spill response region.

Source	Contaminant	Contaminant Origin	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Feedlot	Pathogens and Nitrate	Discharge during storms	High	MPDES permit requirements	High	Facility inspections
Wastewater Treatment Plant	Pathogens and Nitrate	Dicharge during floods	High	MPDES permit requirements	High	Emergency Planning
Water Treatment Plant	Pathogens and Nitrate	Discharge near water intake	High	MPDES permit requirements, Dilution	Moderate	Modify backwash water discharge
Cropland or Pasture	Pathogens, Nitrate, and SOCs	Irrigation return flow	Moderate	Clay rich soils	Moderate	Grazing and chemical application BMPs
Stormwater Runoff	Fuels, Solvents, and Pesticides	Direct discharge	Moderate	Dilution	Moderate	Runoff control and waste chemical collection program
Septic Systems	Nitrate and Pathogens	Ground water seepage	Low	Clay rich soils	Low	Growth management

REFERENCES

Alden, W.C., 1932, Physiography and Glacial Geology of Eastern Montana and Adjacent Areas, U.S. Geological Survey Professional Paper 174, 133 p.

Cary, L.E. and C. Parrett, 1995, Synthesis of natural flows at selected sites in and near the Milk River Basin, Montana, 1928-89: U.S. Geological Survey Water-Resources Investigations Report 95-4022, 42 p.

Clark, D.W., 1990, Pesticides in soils and ground water in selected irrigated agricultural areas near Havre, Ronan, and Huntley, Montana. U.S. Geological Survey Water Resources Investigations Report 90-4023, 34 p.

DEQ, 1999, Montana source water protection program.

Thompson, R.E. Jr., 1986, Natural flow and water consumption in the Milk River Basin, Montana and Alberta, Canada: U.S. Geological Survey Water-Resources Investigations Report 86-4006, 40 p.

Tuck, L.K., 1993, Reconnaissance of geology and water resources along the north flank of the Sweet Grass Hills, North-Central Montana, 1988 -1992, 68 p.

U.S. Bureau of Reclamation, 1991, Summarizing the Milk River Water Supply Study.

Missouri River Basin Commission, 1981, Level B Study Report and Environmental Impact Statement.

U. S. Geological Survey, 1998, Natural Flow and Water Consumption in the Milk River Basin, Montana and Alberta, Canada: Rocky Boy's / North Central Montana Regional Water System Final Engineering Report.

Montana Department of Health and Environmental Sciences, 1974, Water Quality Inventory and Management Plan, 119 p.

GLOSSARY*

Acute Health Effect. An adverse health effect in which symptoms develop rapidly.

Alkalinity. The capacity of water to neutralize acids.

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

Coagulation. A treatment process where chemical coagulants are used to clump together very fine particles into larger particles. Clumping particles together makes it easier to separate solids from water by settling, skimming, draining, or filtering.

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

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

Delineation. A process of mapping source water management areas.

Filtration. A process for removing particulate matter from water by passage through porous media.

Flocculation. A treatment process where biological or chemical action is used to aggregate and remove clumps of solids in water.

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

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

Nitrate. An important plant nutrient and type of inorganic fertilizer. In water the major sources of nitrates are septic tanks, feed lots and fertilizers.

Nonpoint-Source Pollution. Pollution sources that are diffuse and do not have a single point of origin or are not introduced into a receiving stream from a specific outlet.

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

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

Public Water System. A system that provides piped water for human consumption to at least 15 service connections or regularly serves 25 individuals.

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

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

Sedimentation. A water treatment process where solid particles are settled out of water in a large clarifier or sedimentation basin.

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

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

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

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

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

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

Volatile Organic Compounds (VOC). Any organic compound which evaporates readily to the atmosphere (e.g. fuels and solvents).

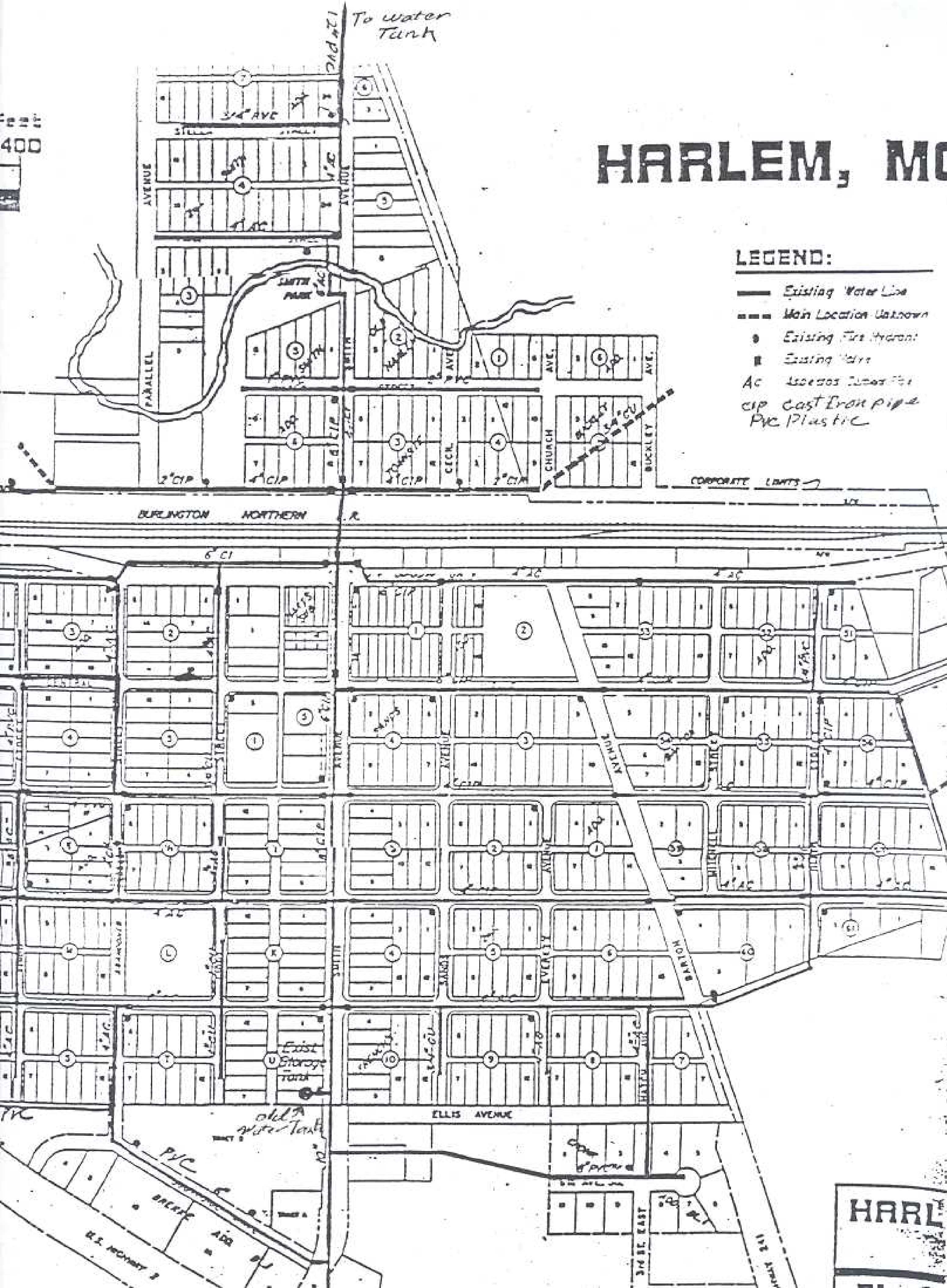
Watershed. The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

* Definitions taken from EPA's Glossary of Selected Terms and Abbreviations
(http://www.epa.gov/ceisweb1/ceishome/ceisdocs/glossary/glossary.html)

APPENDICES

APPENDIX A

Public Water System Site Plan



HARLEM, MO
LEGEND:
Existing Water Line
Main Location Unknown
Existing Fire Hydrant
Existing Valve
Ac Asbestos Cement Pipe
CIP Cast Iron pipe
PVC Plastic
To water Tank
BURLINGTON NORTHERN R.R.
CORPORATE LIMITS
SMITH PARK
PARALLEL
CECIL
CHURCH
BUCKLEY
BARTON
ELLIS AVENUE
Exist Storage Tank
old Water Tank
PVC
400

APPENDIX B

Streams in Need of TMDL Development

Milk Headwaters Watershed
USGS HUC 10050001

ID	Assess-ment Date (yr/mo)	Waterbody Name	Est. Lgth (miles)	TMDL Development Priority	Probable Impaired Uses	Probable Use Support (miles)			(Causes and sources of impairment are not linked)	
						Threat-ened	Partial Support	Non-Support-ing	Probable Cause	Probable Source
1	8910	Milk R	37	LOW	Cold Water Fishery - Trout Aquatic Life Support		37.2 37.2		Nutrients Salinity/TDS/chlorides Siltation	AGRICULTURE Irrigated Crop Production Nonirrigated Crop Production Pasture Land

Sage Watershed
USGS HUC 10050006

ID	Assess-ment Date (yr/mo)	Waterbody Name	Est. Lgth (miles)	TMDL Development Priority	Probable Impaired Uses	Probable Use Support (miles)			(Causes and sources of impairment are not linked)	
						Threat-ened	Partial Support	Non-Support-ing	Probable Cause	Probable Source
1		Sage Cr	57	LOW	Cold Water Fishery - Trout				Nutrients	AGRICULTURE
					Agriculture		57.2	57.2	Salinity/TDS/chlorides	Irrigated Crop Production
					Aquatic Life Support			57.2	Thermal modifications	Nonirrigated Crop Production
					Warm Water Fishery		57.2			
					Drinking Water Supply			57.2		

Big Sandy Watershed
USGS HUC 10050005

ID	Assess-ment Date (yr/mo)	Waterbody Name	Est. Lgth (miles)	TMDL Development Priority	Probable Impaired Uses	Probable Use Support (miles)			(Causes and sources of Impairment are not linked)	
						Threat-ened	Partial Support	Non-Support-Ing	Probable Cause	Probable Source
1	8910	Big Sandy Cr	35	LOW	Aquatic Life Support Agriculture Warm Water Fishery		34.6 34.6 34.6		Salinity/TDS/chlorides Siltation Thermal modifications	AGRICULTURE Irrigated Crop Production Nonirrigated Crop Production Streambank Modification/Destabilization

Middle Milk Watershed
USGS HUC 10050004

Map ID	Waterbody Number	Waterbody Name	Est. Lgth (miles)	TMDL Develop-ment Priority	Probable Impaired Uses	Probable Use Support (miles)			(Causes and sources of impairment are not linked)	
						Threat-ened	Partial Support	Non-Support-ing	Probable Cause	Probable Source
1	MT40J0011	Milk R	177	LOW	Aquatic Life Support Drinking Water Supply Warm Water Fishery Agriculture		176.9 176.9 176.9 176.9		Flow alteration Nutrients Other habitat alterations Other inorganics Salinity/TDS/chlorides Suspended solids	AGRICULTURE Irrigated Crop Production MUNICIPAL POINT SOURCES Nonirrigated Crop Production Range Land Streambank Modification/Destabilization
2	MT40J0021	Beaver Cr	15	LOW	Cold Water Fishery - Trout Aquatic Life Support		15 15		Flow alteration Nutrients Siltation Thermal modifications	AGRICULTURE Irrigated Crop Production Range Land Streambank Modification/Destabilization
3	MT40J0022	Bullhook Cr	15	LOW	Cold Water Fishery - Trout Aquatic Life Support		14.5 14.5		Nutrients Siltation Thermal modifications	AGRICULTURE Irrigated Crop Production Range Land Streambank Modification/Destabilization
4	MT40J0023	Little Boxelder Cr	30	LOW	Aquatic Life Support Cold Water Fishery - Trout		30.2 30.2		Nutrients Siltation Thermal modifications	AGRICULTURE Irrigated Crop Production Range Land Streambank Modification/Destabilization
	MT40J0061	Nelson Reservoir	3902 acres	LOW	Aquatic Life Support Cold Water Fishery - Trout		3902 3902		Flow alteration Noxious aquatic plants Nutrients	AGRICULTURE Irrigated Crop Production Onsite Wastewater Systems (Septic Tanks) Range Land

Upper Milk Watershed
USGS HUC 10050002

ID	Assess-ment Date (yr/mo)	Waterbody Name	Est. Lgth (miles)	TMDL Development Priority	Probable Impaired Uses	Probable Use Support (miles)			(Causes and sources of impairment are not linked)	
						Threat-ened	Partial Support	Non-Support-Ing	Probable Cause	Probable Source
1	8910	Milk R	22	LOW	Aquatic Life Support Warm Water Fishery		21.7 21.7		Flow alteration Nutrients Other habitat alterations Salinity/TDS/chlorides Siltation	AGRICULTURE Irrigated Crop Production Nonirrigated Crop Production Pasture Land
2	9403	Fresno Reservoir	3996 acres	LOW	Warm Water Fishery Swimmable Drinking Water Supply Agriculture Aquatic Life Support	 3996 	3996 3996 3996 3996		Metals Nutrients Other inorganics Pathogens Salinity/TDS/chlorides Suspended solids Thermal modifications	AGRICULTURE Irrigated Crop Production Nonirrigated Crop Production

APPENDIX C

Hazard and Barrier Worksheets

Natural Barriers – Significant Potential Contaminant Sources

Worksheet 3b.
PWSID 00239
Source 002

ID#	Facility Name	Barrier Type	Description

Wells or Groundwater Seepage to Surface Water

Surface Water (Direct Discharges)

A – Continuous Clay Layer; B – Depth to Water > 100 ft.;
C – Upward Hydraulic Gradient
D – Dilution; E – Forested Riparian Zone > 50 ft.

Significant Point Sources Including Underground Storage Tanks

ID#	Facility Name	Barrier Type	Description
E1	City of Harlem water plant	D	dilution

Ground Water Remediation Sites

Animal Feeding Operations

Wastewater Treatment, Spray Irrigation, Lagoons

Spill Threat: Highway, Pipeline, or Railway

MPDES Wastewater Discharges

Injection Wells

Sanitary Sewer Main

Stormwater Runoff or Irrigation Return Flow

ID#	Facility Name	Barrier Type	Description
I1	Stormwater Runoff	D	dilution

Septic Systems

ID#	Facility Name	Barrier Type	Description
J	Scattered Farmsteads	A	clay soils

Cropped Agricultural Land

ID#	Facility Name	Barrier Type	Description
K	Cropland & pasture	A	clay soils

Hazard Determination – Significant Potential Contaminant Sources for Surface Water

PWSID 00239
Source 002

Hazard	High	Medium	Low
A. Animal Feeding Operations (Direct Discharge)			
A1. Feedlot - Charles Schwenke Feedlot	X		
A2.	X		
B. Animal Feeding Operations (Groundwater Discharge)			
B1.		X	
B2.		X	
C. MPDES Wastewater Discharges			
C1. City of Harlem Wastewater	X		
C2.	X		
D. Spill Threat: Highway, Railway, and Pipeline Crossings			
D1.	X		
D2.	X		
E. Other Significant Point Sources of Nitrate and Pathogens (Direct Discharge)			
E1. City of Harlem Water Plant	X		
E2.	X		
F. Other Significant Point Sources of Nitrate and Microbes (Groundwater Seepage)			
F1.		X	
F2.		X	
G. Other Significant Point Sources of VOCs, SOCs, & Metals (Direct Discharge)			
G1.		X	
G2.		X	
H. Other Significant Point Sources of VOCs, SOCs, & Metals (Groundwater Seepage)			
H1.			X
H2.			X
I. Storm Water Runoff (Direct Discharge)			
I1. Storm water runoff		X	
I2.		X	
# Septics / Sq. Mile:	>300	50-300	<50
J. Septic Systems (unsewered)			X
Percent:	>50	20-50	<20
K. Cropped Agricultural Land		X	

Engineered and Management Barriers – Significant Potential Contaminant Sources

PWSID 00239
Source 002

ID#	Facility Description	Barrier Type	Barrier Description
Significant Point Sources			
A – Spill Prevention, B – Spill Catchment, C – Leak Detection			
E1	City of Harlem water plant	AB	MPDES requirements
Known Groundwater Contamination Sites			
A – Hydraulic Control; B – Source Removal; C - Treatment			
Animal Feeding Operations			
A – BMPs (Manure Storage & Disposal, Runoff Diversion); B - Other			
A1	Charles Schwenke Feedlot	A	MPDES requirements
Wastewater Treatment, Spray Irrigation, Lagoons			
A – BMPs (Land Application Limited to Agronomic Rates), B – Lined Lagoons, C - Other			
C1	City of Harlem wastewater	A	MPDES requirement
Spill Threat: Highway, Pipeline, or Railway			
A – Emergency Preparedness; B – Transport Restrictions			
MPDES Wastewater Discharges			
A – Residential Waste Chemical Collection Program			
Class V Injection Wells			
A – Inventory & Closure Plan; B – Waste Segregation; C – Restrictions on Commercial Development in Unsewered Areas			
Sanitary Sewer Mains			
A – Sewer Main Replacement Program			
Stormwater Runoff or Irrigation Return Flow			
A – Waste Chemical Collection Program; B – Storm Water Control; C – BMPs (surface water non-point sources)			
Septic Systems (unsewered)			
A – Growth Management Plan; B – Enhanced Treatment Requirements			
Cropped Agricultural Land			
A – Chemical Spill Prevention; B – BMPs (Chemical Application and Mixing); C – Chemical Use Prohibition			

APPENDIX D

Sanitary Survey

FILES

C X N ___ P ___
PWSID # 00239

Bact ___
Correspondence X
Chlorine/Turbidity ___
Lead & Copper ___
Phase II & V ___
GWUDISW ___
Initials E.P.

South Hills Environmental Management Consultants, L.L.P.
505 South Roberts
Helena, Mt. 59601

System Name: Harlem
PWSID: 00239
Date of Visit: July 20, 2000
Persons Contacted: Don Coffman, Operator
South Hills Personnel: Shelley Nolan
Reason for Visit: Requested by John Camden to check status of Backwash recycling line and pre-sed holding pond piping.

Main Visit:

On Thursday July 20, I met with Don Coffman, the operator of the Harlem Water Treatment Plant. Don gave me a tour of the facilities from the river intake through the plant processes. The plant was originally constructed in the 1950's as a direct filtration plant. It has been upgraded through the years by adding the clarifier, an additional filter, high service pump, new raw water intake pump house and structure, etc.

The water flows into a wet well on the Milk River and is pumped into the South Cell, that holds 2,673,567 gallons of raw water. There is a pipe between the South cell and the North cell. The valve is opened between the two cells and the North cell, that holds 2,970,112 gallons, fills at the same time. They pump on average once a week during the winter months and twice a week during the summer months. During spring runoff where the turbidity and color increases on the Milk River they do not pump from the river at all. The water is pumped into the plant using two 10 hp. 300gpm. alternating vacuum primed centrifugal raw water pumps. The plant has the capability of bypassing the clarifier and direct filtering. The raw water pumps, chemical feed and storage, and sludge blanket clarifier are all located in the same room. The equipment is poorly maintained and the room is very dirty.

Currently, dry aluminum sulfate blended with water is being fed at 72 ppm with a raw water turbidity of 22-23 ntu's. A poly-blend unit is being used to mix and feed a coagulant aid that is NS 3125 but will change to NS 3150. This is being fed at 0.6 ppm. A Poly EZ 692 filter aid is also being batched mixed at a .25% solution and being fed pre-filter. There is no rapid mixing of the coagulants or in-line mixer. Chemicals are simply being fed into the raw water line ahead of the clarifier. Occasionally, activated carbon is fed for taste and odor. The set up for feeding carbon is not adequate. They are batch mixing and pumping with a diaphragm pump that clogs up all the time. The carbon is not isolated and no explosion proof equipment is installed.

The Infilco reactor clarifier is utilized as a flocculation chamber and clarifier. The raw water flows into the northeast side of the clarifier. The water is pulled under the hood and mixed in the lower primary mixing zone by a large rotor impeller. The water flows upward into the secondary mixing and reaction zone and into the draft tubes. Some of the water is reintroduced into the primary zone and the clarified water flows into a ring collection weir at the top of the basin. The clarifier holds 20.000 gallons and is rated at 350 gpm flow capacity. Currently there is a sludge blanket approximately 2 feet from the top of the water level. There is a strong organic odor in the plant from the sludge blanket. The operator said he opens the valve daily and removes sludge from the clarifier.

This is a very operator intensive treatment plant, that is sensitive to small changes in temperature, chemical feed rates, and flow rates. The water flows into two filters by a header pipe that splits ahead of the filter influent piping. Filter #1 is 10'6" in diameter while filter #2 is 12' in diameter. If my memory is correct the filter influent piping is the same for each filter. The filter flow into the filters is very turbulent and should have some type of a plate to disperse it more equally. There is a build up of floc opposite the filter intake that doesn't appear to be cleaning up on backwash. This is due to the short circuiting and uneven flow onto the filter area.

The filters are of a mixed media type with anthracite coal, intermediate sand, and high-density garnet. Filter #1 is filtering at 140gpm or 1.6 gpm/ft/sq and filter #2 filters at 230-240 gpm or 2.12 gpm/ft/sq. The filter runs are around 49 plus hours and are backwashed by reverse flow with a backwash pump from the clear well. The pump backwash rate is 1000 gpm or 8.8 – 11.3 gpm/sq/ft. There is also rotary surface wash to break up the surface mat. The filters have filter-to waste capacity that is half the size of the filter effluent piping. The operator backwashes manually, according to turbidity when it increases to .13-.14 ntu. The filter effluent lines have Hach turbidity meters that are currently reading 0.098 ntu (#1) and .115 ntu (# 2) filters. The operator had backwashed on the 14th and again on the 19th. I assume the filters are in the ripening stage following a backwash on the previous day. Backwash water flows back to the raw water wet well at the river pump station and is pumped into the south cell holding pond. The backwash water is not permitted into the river by a one-way check valve. The backwash line into the south cell is approximately 50 feet upstream of the plants intake piping.

The MDEQ is concerned that the piping is too close and will pull backwash water into the plant head works or recycle backwash water. The second concern is the south pond is always utilized and the north pond sits stagnant with the current piping scheme. It would make more sense to pipe the backwash water to the north pond along with the raw water. The water would then flow to the south pond and into the plant. This would double the detention time of the holding pond and allow the backwash water to settle in the north pond. The third concern or problem is the line from the south pond to the plant becomes clogged due to a drop in the piping and possibly a couple of 90degree angles. No one knows the current piping lay out but they do know it quits flowing because of silt buildup. The operator has had to set up a portable pump and temporary piping into the plant in the past to continue treating water. Algae control is practiced in the south cell but not in the north cell. This will create taste and odor problems if it is not corrected in the future.

Disinfection is achieved by gas chlorination utilizing 150# cylinders scale mounted with automatic switch over units. The rotameters are located in the filter gallery. Chlorine residual is measured on-line as it enters the clear well with a FX 1000 Foxcroft analyzer. It is currently reading 1.40 ppm.

Water flows into a baffled clear well where it is pumped to the distribution system with 2 -75hp pumps with an 800 gpm capacity. The pumps are set up on a rotating system. The on-off status of the pumps is controlled by storage tank level and clear well level. There is a Singer surge relief valve installed on the discharge line to prevent pressure surges. A new telemetry system had been installed with radio, power supply, transducer, and computer, by Bear Paw Communications recently to control pumps.

Recommendations:

1. Install an adequate carbon feed system to handle taste and odor problems.
2. Practice algae control measures on the north cell in the early spring.
3. Monitor turbidities, pH, suspended solids, etc. before and after backwash in south cell to determine if backwash water is short circuiting to the raw water intake line. Operator could change backwash procedure to shut plant down following a backwash to allow water to settle out temporarily.
4. Discharge more sludge regularly from clarifier to keep bottom from becoming septic and causing taste and odor problems in process.
5. Install a baffle in filters to disperse water more evenly and quietly.
6. General housekeeping duties, in the chemical feed room, and on the equipment, is in order.
7. Add coal to filters to bring level up to 2" below surface wash arms.
8. Optimize chemical feed. Seems to be feeding a large amount of alum that will reduce pH and cause other problems.
9. Run jar tests instead of using the jar testing equipment as a paperweight. This would help keep chemical costs down, optimize chemical feed, and increase filter runs.
10. Seriously consider changing the backwash line and raw water line from the river to the south cell.

APPENDIX F

Concurrence Letter

RECEIVED
APR 2 6 2001
D.E.Q.

Source Water Protection Section
Department of Environmental Quality
POB 200901
Helena, MT 59602-0901

RE: SWDAR

To whom it may concern:

The City of Harlem public water system has reviewed the source water delineation and assessment report dated March 13, 2001. We concur that the delineation component appears to describe current conditions at the water system based on reasonably available information and that the susceptibility assessment identifies the origins of regulated contaminants to the extent practical.

We understand that the City of Harlem PWS SWDAR will be made available to the public by DEQ as described in the Montana Source Water Protection Program. Also, we will make a copy of the report available for the public to view during our normal office hours and describe the results in subsequent releases of our consumer confidence report.

Signed,

Richard Mohan
Public Works Director 3/15/2001
←Title Date

Donald Coffman
Water Plant Supervisor 4/23/01
←Title Date