City of Kalispell
Public Water System

PWSID # MT0000259

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

02/06/03

Date of Report: 02/06/03

Jim Hansz
Director of Public Works
P.O. Box 1997
312 1st Avenue East
Kalispell, MT 59903

phone**:** (406) 758-7720

Table of Contents

INTRODUCTION

This Delineation and Assessment Report was completed by HDR Engineering, Missoula, MT, with assistance from Land and Water Consulting, Kalispell, MT for:

The City of Kalispell, Kalispell Public Works Department
PWSID MT0000259
Jim Hansz, Public Works Director, P.O. Box 1997, Kalispell, MT 59903-1997

PURPOSE

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Kalispell Public Works Water system 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 protect public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is "delineation and assessment." Delineation is a process of mapping source water protection areas, 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 assessing 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 that helps the Kalispell Public Works Department protect its drinking water source.

Limitations

This report was prepared to assess threats to the Kalispell Public Works public water supply (PWS), and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the Kalispell Public Works PWS 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 the Kalispell Water System are identified. Only potential sources of contamination in areas estimated to contribute water to its drinking water source are considered.

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

CHAPTER 1
BACKGROUND

The Community

The Kalispell water system serves approximately 15,000 persons within or adjacent to the City of Kalispell, which is located in northwest Montana. The water system lies within the planning area that is designated in ***Water, Sewer and Storm Drainage Systems Facility Plan 2000,*** a document that was recently adopted by the City of Kalispell. This study area will be used to evaluate the water supply system characteristics and is shown on the map in Appendix A. The study area is bounded by the Flathead River on the east, the north border of Sections 26, 27, 28, 29, and 30 of Township 29 North, Range 21 West and Sections 25, 26, and 27 of Township 29 North, Range 22 West on the north, West Valley Drive on the west, Lower Valley Road and Foys Lake on the south.

Kalispell serves as the population and commercial center of Flathead County and portions of four surrounding counties. Kalispell is the Flathead County seat. Major industrial, health care and government facilities are also located in the Kalispell area. The economic base of the Kalispell area and Flathead County is diverse. The county's leading industries are wood products manufacturing, microelectronics manufacturing, metals refining, railroad, agriculture, tourism, and the federal government. The area is also attractive to retired individuals and the local retirement income represents a substantial and growing portion of the local economy. The area's proximity to Glacier National Park and Big Mountain, a destination ski resort, makes it a year-round center for the tourist trade.

The Kalispell area is a growth area and in recent decades, growth rates in the City–County planning jurisdiction have fluctuated in a cyclical pattern between moderate and boom levels. The average annual growth rate of the planning jurisdiction population was 1.7 percent in the 1960's, 3.7 percent in the 1970's, and 1.8 percent in the 1980's [1]. The 1990 census data was adjusted using recent tax information to estimate the current year (2000) population. The overall population growth in the study area between 1990 and 2000 was approximately 17 percent. Population and employment data for the study area is summarized in Table 1-1.

Table 1-1. Existing Population and Employment

Category	1990		2000	
	Population	Employment	Population	Employment
Study Area [1]	26,672	15,246	32,007	22,753

1 Population data for all analysis zones combined

The study area is currently served by City of Kalispell water and sewer utilities, which serve the

[1] Growth rates as stated in the Resources and Analysis Section, Kalispell City County Master Plan, Flathead Regional Development Office, November 1997.

area inside the Kalispell city limits, the Evergreen Water and Sewer District, which is located northeast of the City of Kalispell and the Village Sewer District, located north of Kalispell. The City of Kalispell provides water and sewer service to the majority of the population in the study area. The Evergreen Water and Sewer District discharges sewage to the City of Kalispell and provides water to a portion of the City. The Village Sewer District receives sewer service from the City of Kalispell and water service from the Evergreen Water and Sewer District. Table 1-2 is a summary of population and employment currently served by these utilities.

Table 1-2. Existing Population and Employment Served By Utilities

Category	2000	
	Population	Employment
Kalispell Sewer	**14,639**	**15,573**
Kalispell Water	**14,639**	**15,573**
Evergreen Sewer District	5,072	2,740
Evergreen Water District	7,372	3,289
Village Sewer District	813	119

Water services outside the City of Kalispell and the Evergreen and Village service areas consist of a variety of small public and private water systems utilizing groundwater as their source. Wastewater treatment for the areas outside the sewer service areas described above, is accomplished with on-site septic systems.

The major transportation corridors include Montana State Highway 93 which is the primary north-south corridor connecting Kalispell with Whitefish to the north and Polson and Missoula to the south. Montana State Highway 2 is the major east west corridor connecting Kalispell to Libby on the west and Columbia Falls to the northeast. The Burlington Northern/Santa Fe Railroad also passes through the City of Kalispell.

Geographic Setting

The Kalispell Public Works PWS is located within the City of Kalispell in the heart of the Flathead Valley. The Flathead valley is a south to northwest trending intermountain valley in western Montana. The valley is surrounded by the Flathead and Mission mountains in the east and the Cabinet and Salish Mountains to the west and north. Glacier National Park is north and east of the valley. The eastern half of the study area encompasses the confluence of the Flathead, Whitefish, and Stillwater Rivers. This area is characterized as a large complex of swales, streams, wetlands, and alluvial terraces comprised of a significant amount of floodplain and hydric soils. The Evergreen alluvial aquifer located generally along the Flathead River floodplain, is a highly permeable sand and gravel aquifer controlled by the flows of the river. These hydrogeologic features were a factor driving the construction of a public sewer system for Evergreen.

The western half of the study area is characterized by agricultural land with foothills in the Southwest. Ashley Creek is the main drainage. Foys Lake is located in the southwestern foothills area. The maps in the Appendices to this report graphically depict the characteristics of the study area.

The climate of the Flathead Valley is consistent with that of other lower elevation basins in the northern Rocky Mountains, west of the Continental Divide. The elevation at Kalispell is 2,970 feet. The average high and low temperatures at the weather station in Kalispell are 81 and 48 degrees F in July and 28 and 13 degrees F in January. Average annual precipitation falls mostly as winter snow and totals an average of 16.6 inches.

General Description of the Source Water

The majority of drinking water in the Kalispell area comes from a deep artesian aquifer that spans the region. This groundwater aquifer generally flows from northwest to southeast across the area, toward Flathead Lake. Because of the depth and semi-confined or confined nature of the aquifer, contamination from septic systems or other sources is unlikely. Flathead Lake, one of the cleanest lakes of its size in the world, is fed by waters from the Flathead, Stillwater, and Whitefish Rivers as well as Ashley Creek, all of which flow through the study area.

Flathead Lake, the Whitefish River, and Ashley Creek are all on the State of Montana Section 303(d) list of water quality impaired water bodies for nutrients. Concerns over declining water quality in Flathead Lake have led to development of a TMDL (Total Maximum Daily Load) and voluntary nutrient reduction strategy for Flathead Lake. Although nutrients significantly impact surface water quality, the impact to the drinking water taken from the groundwater sources in the area is negligible.

The City of Kalispell is served by a potable water system consisting of groundwater wells and a spring with a distribution pipe network, an elevated storage tank and ground level storage tanks; a sanitary sewer collection system consisting of a network of gravity sewers and lift stations leading to a wastewater treatment plant; and a storm sewer collection system consisting of a network of gravity piping as well as several above grade detention basins. Demands on these facilities are increasing as Kalispell grows and more stringent water quality standards are implemented.

A public sewer system was installed in Evergreen in 1993 due to concerns about pollution of Flathead Lake from septic systems within the alluvial aquifer located generally along the Flathead River floodplain.

The wastewater that is generated in the area is either treated at the Kalispell Advanced Wastewater Treatment Facility, or in individual septic systems located in un-sewered areas outside the City.

The Public Water Supply

The City of Kalispell's potable water system consists of seven wells, one spring, two partially buried storage tanks, one elevated storage tank, two booster pump stations and the pumps, pipes and appurtenances to deliver the water to the customers. Currently four of the wells and the spring are actively used. The active wells are Armory, Depot, Buffalo Hills and Grandview #1. Grandview #2 is not used due to problems with sand and iron bacteria. The Section 36 (DNRC) well, located at the northwest corner of the intersection of Highway 93 and Four-Mile Drive, is used for irrigation only and the Grandview test well is used for testing only and is not connected to the system. The water is chlorinated at each source prior to entering the distribution system. The water system is divided into two separate and distinct pressure zones. Figures in Appendix B depict the existing water system. The lower pressure zone is supplied by three wells (Armory, Depot Park, and Buffalo Hills), the Noffsinger Spring (Lawrence Park), and two partially buried ground-level storage tanks. The upper zone is supplied by two wells (Grandview Wells #1 and #2) and an elevated storage tank. Water is transferred from the lower zone to the upper zone via two booster pumping stations. Booster Pumping Station # 1 is only used as a back-up. There is an irrigation well located in Section 36 (DNRC) at the northwest corner of the intersection of Highway 93 and Four-Mile Drive. This well has the potential of being connected into the potable water system.

The water distribution system is characterized by cast iron piping that was installed in the 1920's and 1930's, asbestos cement, and cast iron pipe that was installed in the 1960's and 1970's, and unprotected ductile iron and PVC pipe that was installed in the 1980's and 1990's. There are areas of moderately corrosive soils combined with unprotected cast iron pipe that was installed 70 to 80 years ago. Those conditions have led to water main breaks and the need for pipe replacement.

A tabulation of water production capacity data is found in Table 1-3.

Table 1-3. Water Source Capacity Data

Water Source	Capacity (gpm)	No. of Pumps	Horsepower	Static Water Level (FT)	Aux. Power	Aux Power Capacity (KW)	Well Depth (FT)	Casing Depth (FT)	Casing Diameter (IN)
Armory	1,700	1	150	19	No	NA	390	382	16
Depot Park	1,250	1	100	48	No	NA	298	278	12
Buffalo Hills	2,000	1	200	159	Yes	275	540	275	16
Grandview #1	1,100	1	125	83	Yes	400	457	391	12
Grandview #2	800[1]	1	100	85	No	NA	482	397	12
Noffsinger Spring	4,200[2]	3	150/75/100	NA	No	NA	NA	NA	NA
Section 36 (DNRC)	2,000[3]	1	125	105	No	NA	463	463	10
Grandview Test Well	1,000[4]	None	NA	83	No	NA	450	450	8

[1] Not currently in active use. Sand and iron Bacteria problems.
[2] Noffsinger Spring may be limited by permit to a maximum output capacity of 2,100 gpm and the period of use may be limited to July through September in the future.
[3] Irrigation use only. Not currently available for use in the potable water system. May be used in the future.
[4] Test well only. Not currently available for use in the potable water system. May be used in the future.

It is important to note that the Noffsinger Spring has been classified by the State of Montana Department of Environmental Quality (DEQ) as groundwater under the direct influence of surface water. A management plan has recently been implemented and improvements made to address the under-the-influence classification. These improvements included chlorination of the source as well as reservoir baffling improvements to provide disinfection. The Grandview #2 well is not used due to iron bacteria and unacceptable levels of sand. Deficiencies in the Noffsinger Spring and the Grandview #2 sources have made it difficult for the system to produce enough water to meet current peak summer demand. Chlorination is provided at each well and at Noffsinger Spring. Emergency generators are available for standby power at the Buffalo Hills Well, and the Grandview #1 Well and are sized adequately for the well to provide its full capacity. Table 1-4 tabulates storage capacity for the Kalispell system.

Table 1-4. Water Storage Data

Reservoir	Volume (GAL)	Depth (FT)	High Water Elevation	Footprint	Pressure Zone	Vintage (Year)	Construction
Reservoir 1	1,700,000	22	3,077.14	150 FT diameter	Lower	1914	Buried Concrete With Wood Roof
Reservoir 2	2,700,000	22	3,077.14	150X75 FT[1]	Lower	1952	Buried Concrete With Wood Roof
Elevated Reservoir	100,000	25.4	3,212.20	30 FT Diameter	Upper	1957	Elevated Steel

[1] Tank is 150 feet by 75 feet with each end on half of a 150-foot diameter circle.

All storage reservoirs were inspected in July of 1998 and were in good condition with only

minor maintenance recommended[2]. The 100,000-gallon upper zone reservoir was found to be in good condition with the only recommendation being the installation of OSHA approved safety-climbing rail on all exterior ladders. The report recommended that the roofs of Reservoir 1 and 2 be repaired to eliminate leakage and avoid damage to the wood structure. New roof membranes were installed during the summer of 2000 as well as inlet/outlet modifications and reservoir baffling to enhance chlorine contact.

Two booster pumping stations are available for transferring water from the lower zone reservoirs to the upper zone reservoir. Booster Pumping Station No. 1 was constructed in 1957 and is used only as a backup to Booster Pumping Station #2. An emergency generator is available for standby power at Booster Pumping Station #2, however, it is only sized to run a single pump.

Table 1-5 tabulates water booster pumping station data.

Table 1-5 Water Booster Station Data

Booster Pump Station	No. of Pumps	Capacity (gpm)	Head (FT)	Horsepower	Auxiliary Power	Aux. Power Capacity (KW)	Floor Elevation
No. 1	1	700	160	50	No	---	---
No. 2	1 of 3	1,100	160	100	Yes	150[1]	3,067.90
	1 of 3	1,200	160	100	No	---	---
	1 of 3	900	160	50	No	---	- - -

[1] Capacity sufficient for single pump operation.

Water Quality

The deep aquifer that is utilized for the supply of drinking water for the Kalispell area has a low susceptibility to surface contamination and no major sources of contamination are apparent in the area. Selected water quality data for several wells in the nearby area are presented in Appendix J in addition to a recent water quality report published by the City of Kalispell. The levels of contaminants in the water are substantially lower than the drinking water standards in all cases. Possible sources of contamination and their potential to impact the water quality will be evaluated in the subsequent chapters of this report.

[2]Inspection Report for City of Kalispell, 100K Elevated Tank, 2.7 Million Gallon Concrete Reservoir,
1.7 Million Gallon Reservoir, Extech, LLC, July 1998

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to the Kalispell PWS, is identified in this chapter. Three management areas are identified within the source water protection area: the control zone, inventory region, and recharge region. The control zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The inventory region represents the zone of contribution of the well, which approximates a three-year groundwater time-of-travel. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping are used to calculate groundwater time-of-travel distance. The recharge region represents the entire portion of the aquifer which contributes water to the Kalispell PWS.

Hydrogeologic Conditions

Kalispell is located within the center of the Flathead Valley in northwestern Montana. The Flathead Valley is a northwest trending intermontane basin forming the southern extension of the Rocky Mountain Trench. The valley is bounded on the east by the Swan-Whitefish fault, located along the base of the Swan Range, and on the west by the Kalispell fault at the base of the Salish Mountains. The mountains rise abruptly 4,500 feet above the valley floor. Gravity data indicate the Cenozoic basin-fill in the central part of the valley may be as much as 4,000 feet thick (Noble and others, 1982). Although Tertiary rocks are not exposed, it is believed that Miocene and Oligocene sediments rest unconformably on Precambrian bedrock. Pleistocene continental and mountain glaciation advanced southward through the Trench in the vicinity of Kalispell depositing a layer of glacial till. As the glaciers receded, meltwater lakes pooled in areas where drainage was impeded, leaving lakebed deposits. In contrast, fluvial outwash deposits accumulated where discharge flowed unrestricted. It is estimated that 600 to 1,000 feet of Wisconsin-age Pleistocene glacial deposits overlie the Tertiary sediments. Surficial geology of the area is shown on the geologic map in Appendix C.

The two primary aquifers recognized in the Kalispell area are the shallow alluvial aquifer and the deep artesian aquifer (Konizeski and others, 1968; MBMG, 20000). The shallow alluvial aquifer is composed of unconsolidated fluvial sediments (i.e., sand and gravel) deposited along the floodplain of the Flathead, Whitefish, and Stillwater Rivers. The aquifer thickness ranges from 20 to 100 feet. Low permeability glacial till and lakebed deposits of various thicknesses separate the shallow aquifer from the deep artesian aquifer. The low permeability deposits are nearly laterally continuous in the area and generally separates surface water and shallow groundwater from the deep artesian aquifer.

The deep artesian aquifer consists of a series of intercalated sand and gravel layers with fine-grained interbeds. These deposits probably represent the paleo-channel of the Flathead River. Recent work in the central and eastern portions of the valley indicate this package of sediments is hydraulically interconnected and responds as a single aquifer demonstrating anisotropic characteristics (Shapley, 1992; and Noble, 1998). The thickness of the deep artesian aquifer is unknown but a well located in Section 18 of Township 29 North, Range 21 West was drilled to a

depth of more than 800 feet and had not penetrated the base of the aquifer. In the western portion of the Flathead Valley the confining unit overlying the deep artesian aquifer consists of glacial till composed of clayey and silty gravel. Northwest of Kalispell, the till is overlain by glacial outwash deposits.

The Kalispell PWS wells derive groundwater from the deep artesian aquifer. The depth to the deep artesian aquifer and thickness of the overlying confining layer is approximately 200 feet in the vicinity of the PWS wells. Groundwater flow directions in the deep artesian aquifer are generally from north to south in the center of the valley (see groundwater flow map in Appendix D). Near the edges of the valley, groundwater flows toward the center of the valley. In the vicinity of the Kalispell PWS, groundwater flow directions are northwest to southeast. Because the aquifer is an extensive confined artesian system, seasonal fluctuations in groundwater levels and flow directions likely are small. Long-term declines in water levels may occur in response to prolonged drought.

Noffsinger Spring derives water primarily from the deep artesian aquifer but may derive a small amount of water from the shallow alluvial aquifer along the Stillwater River. Groundwater flow directions in the alluvial aquifer likely parallel the Stillwater River.

Based on hydrogeologic conditions, the **Kalispell PWS Wells are classified as having a Low Source Water Sensitivity**, according to the following table. The deep artesian aquifer is a deep confined groundwater system. **Noffsinger Spring is classified as having a High Source Water Sensitivity** because of potential contributions of shallow alluvial groundwater to the spring. The shallow alluvial aquifer is unconsolidated alluvium.

Source Water Sensitivity
High Source Water Sensitivity
Surface water and GWUDISW
Unconsolidated Alluvium (unconfined)
Fluvial-Glacial Gravel
Terrace and Pediment Gravel
Shallow Fractured or Carbonate Bedrock
Moderate Source Water Sensitivity
Semi-consolidated Valley Fill sediments
Unconsolidated Alluvium (semi-confined)
Low Source Water Sensitivity
Consolidated Sandstone Bedrock
Deep Fractured or Carbonate Bedrock
Semi-consolidated Valley Fill Sediments (confined)

A summary of the published and unpublished sources of information used in this assessment are presented in Tables 2-1 and 2-2.

Table 2-1. List of geologic or hydrogeologic investigations near the Kalispell PWS area

Title of Project	Period of Project	Area Covered	Project Purpose
Montana Groundwater Assessment Atlas for the Flathead Lake Area. MBMG, (2000)	Compilation of data and interpretations from approximately 1968 to 2000	Flathead Valley north of Flathead Lake	Groundwater Characterization
Occurrence and Characteristics of Ground Water in Montana: Montana Bureau of Mines and Geology Open-File Report 99, vol. 2, 132 p. Noble and Others (1982)	Compilation of data and interpretations prior to 1982	Montana	Groundwater Characterization
Geology and Ground Water Resources of the Kalispell Valley, Northwestern Montana: Montana Bureau of Mines and Geology Bulletin 68, 42 p. Konizeski and Others (1968)	Compilation of data and interpretations prior to 1968	Flathead Valley north of Flathead Lake	Groundwater Characterization
Analysis of Evans Farm's Aquifer Test, East Flathead Valley, unpublished report on MDNRC Provisional Permit Application No. 066522 Shapley (1990)	1990	Eastern Flathead valley	Characterization of Aquifer
Groundwater Resources of the Upper Flathead Basin, Interpreting the Landscape Through Science Symposium, Flathead Valley Community College, pp 11-14. Noble (1998)	Compilation of data and interpretations prior to 1998	Upper Flathead Valley	Characterization of Aquifer
Hydrogeology Investigation Kalispell North Side Water Project (Spratt & Associates, 1994)	Summary of available information.	Deep artesian aquifer	Characterization of Aquifer
Hydrogeological Report for the Flathead County Solid Waste District Phase IV (Morrison-Maierle, 1994)	1993-1994	Area in vicinity of landfill and deep artesian aquifer	Characterization of Aquifer
Groundwater Monitoring in the Meadow Lake Golf course Area, Columbia Falls, Montana (Corbett, 1994)	1993-1994	Area in vicinity of golf course and deep artesian aquifer	Characterization of Aquifer
A Hydrogeological Investigation of the Ponderosa Subdivision Community Wells Flathead county (Spratt, 1983)	1983	Area in vicinity of Ponderosa Subdivision and deep artesian aquifer.	Characterization of Aquifer
Hydrogeologic Assessment of Noffsinger Spring (Land & Water, 1999)	1999	Area in vicinity of spring, shallow and deep artesian aquifer.	Characterization of aquifers, identify source waters for spring.
Source Water Delineation and Assessment Report – Noffsinger Spring (Land and	2001	Noffsinger Spring Area	Characterization of aquifers, identify source waters for spring.

Water Consulting, Inc.; 2001)			

Table 2-2. List of geologic or hydrogeologic maps available for the Kalispell PWS area.

Title or Description	Date	Area Covered	Reference
Montana Groundwater Assessment Atlas for the Flathead Lake Area	2000	Flathead Valley north of Flathead Lake	(MBMG, 2000)
Geologic and Structure Maps of the Kalispell 1 x2 Quadrangle, Montana, and Alberta and British Columbia. USGS Miscellaneous Investigation Series	1992	Northwest Montana, Southern Alberta and British Columbia	(Harrison and Others, 1992)

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. The conceptual hydrogeologic model for the Kalispell PWS area is shown in Appendix D. Groundwater derived from the PWS wells occurs in a permeable, moderately sorted, confined artesian, sand and gravel aquifer that is overlain and confined by poorly sorted, low permeability, glacial till. The low permeability glacial till likely impedes or limits direct surface infiltration of rain or snowmelt to the aquifer. The lateral extent of the aquifer is limited by Flathead Lake to the south, and mountains of the Whitefish Range, Swan Range, and Salish Range to the north, east and west, respectively. Groundwater flow direction is from northwest to southeast. Recharge to the aquifer likely comes from surface infiltration of rain and snowmelt particularly around the valley margins in the foothills of the mountains and groundwater interflow from bedrock in the surrounding mountains. Water flows from the recharge areas vertically downwards to the aquifer, then horizontally towards the central part of the Flathead Valley and Flathead Lake. Groundwater discharge occurs by discharge to Flathead Lake and by groundwater withdrawal from wells. Given the hydrogeologic setting it is unlikely that water table elevations or groundwater flow directions vary appreciably from season to season.

The conceptual hydrogeologic model for Noffsinger Spring is shown in Appendix D. As for the PWS wells, groundwater primarily derived from Noffsinger Spring occurs in a permeable, moderately sorted, confined artesian, sand and gravel aquifer that is overlain and confined by poorly sorted, low permeability, glacial till. A very small portion of the water derived from Noffsinger Spring may come from the shallow alluvial aquifer, which receives some recharge from the Stillwater River. Groundwater flow direction in the shallow aquifer likely parallels the Stillwater River. Groundwater discharge occurs by discharge to the Stillwater River and withdrawal by wells. Water table elevations likely vary seasonally in response to stream flows and stage in the Stillwater River.

Well and Spring Information

The Kalispell PWS derives water from one spring and six water supply wells. Two additional wells may be included in the Kalispell PWS in the future and are also described in this Section. Well logs for all PWS wells are included in Appendix H and individual well descriptions are given in Table 2-3 and the following paragraphs.

Noffsinger Spring is located within the confines of Lawrence Park on the north side of Kalispell (see Appendix F, Figures F1 and F1b) and is the oldest water source in the Kalispell PWS, having been brought into service on May 1, 1916. The springhouse and pump building are located at the base of a bluff with Buffalo Hills Golf Course at the top of the bluff forming the western Park boundary. The Stillwater River forms the northern and eastern margins of Lawrence Park. At the closest point, the river is within approximately 300 feet of the springhouse. The MDEQ has classified the water derived from Noffsinger Spring as Groundwater Under the Direct Influence of Surface Water (GUDISW). As a result of this classification a hydrogeologic assessment of the spring was conducted (Land & Water, 1999) to develop a more thorough understanding of the groundwater flow system. The results of the investigation indicated that the water produced from Noffsinger Spring is derived from two sources, primarily the deep artesian aquifer and to a very small extent, the shallow alluvial aquifer. Based on the hydrogeologic assessment, a Source Water Delineation and Assessment Report (Land and Water, 2001) was completed for the spring. The source water delineation for the spring in this report is largely based on the approved 2001 SWDAR, the results of which are described in this report.

The Depot Well was drilled in 1954 to a total depth of 330 feet bgs and cased with 16-inch steel casing to 260 feet and 10-inch steel casing from 22 to 290 feet. The well is screened from 290 to 330 feet. Static water level in the well is 34 feet bgs. The pumping water level was 109 feet after 43 hours of pumping at 1,200 gallons per minute. No annular seal information is available for the well.

The Armory Well was drilled in 1964 with a 20-inch bit to 276 feet bgs and cased with 16-inch steel casing. Well diameter below 276 feet is not stated on the driller's log but the well is cased with 10-inch steel casing from 230 to 370 feet bgs and presumably the hole diameter was reduced as well. The well is screened from 295 to 335 feet and 370 to 380 feet bgs. Static water level in the well is 10 feet bgs. The pumping water level was 57 feet after approximately 30 hours of pumping at 1,585 gallons per minute. Pressure grout was installed around the 16-inch casing in uppermost 276 feet of the well to form a sanitary seal.

The Buffalo Hill Well was drilled in June 1978 and completed sometime later in early 1979. Completion log for this well is not available and MBMG and DEQ information is somewhat contradictory. The following description is based on information from DEQ and City of Kalispell records. The well was drilled to 540 feet bgs according to the driller's formation log. DEQ records (sanitary survey) indicate the well is cased with 16-inch casing from surface to 275 feet and is screened over an unknown interval. For purposes of calculating aquifer characteristics, this well is assumed to have 40 feet of screen. City of Kalispell pumping test records indicate static water level in the well is 157 feet bgs and the pumping water level was 186 feet after 10 hours of pumping at approximately 1,940 gallons per minute. No annular seal information is available for the well.

Grandview Well #1 was drilled in 1997 to 459 feet bgs and cased with 12-inch steel casing to393 feet bgs and 10-inch steel casing to 459 feet bgs. The well is screened with 0.07 to 0.13 inch slots from 394 to 410 feet and 0.09 to 0.11 inch slots from 422 to 448 feet feet bgs. Static water

level in the well is 86 feet bgs. The pumping water level was 103 feet after 24.5 hours of pumping at 1650 gallons per minute. The uppermost 35 feet of the well was drilled with a 16-inch bit and the annulus around the steel casing was filled with cement grout to form a sanitary seal.

Grandview Well #2 was drilled in 1997 to 486 feet bgs and cased with 12-inch steel casing to395 feet bgs and 10-inch steel casing to 459 feet bgs. The well is screened with 0.06 to 0.1 inch slots from 400 to 424 feet and 0.09 to 0.055 inch slots from 436 to 452 feet feet bgs. Static water level in the well is 98 feet bgs. The pumping water level was 359 feet after 24.5 hours of pumping at 1550 gallons per minute. The uppermost 38 feet of the well was drilled with a 16-inch bit and the annulus around the steel casing was filled with cement grout to form a sanitary seal.

The Grandview Test Well is not currently in the Kalispell PWS but may be added to the PWS in the future. The Grandview Test Well was drilled in 1995 at the Flathead Valley Community College as a test well to evaluate the potential of the area to support production wells. Favorable results in the test well led to the subsequent construction of Grandview Wells #1 and #2. Although not initially intended as a production well, the well yields a significant amount of clean water and could be used to augment Kalispell's existing water supply. Grandview Test Well was drilled and cased to 544 feet bgs with 8-inch steel. The well is perforated with ¼ by 1-inch perforations over four intervals: 452 to 470, 479 to 489, 492 to 506, and 517 to 539 feet bgs. Static water level in the well is 100 feet bgs. The pumping water level was 109 feet after 26 hours of pumping at 642 gallons per minute. The uppermost 50 feet of the well was drilled with a 13 3/8-inch bit and the annulus around the steel casing was filled with cement grout to form a sanitary seal.

The Section 36 (DNRC) Well is not currently in the Kalispell PWS but may be added to the PWS in the future. The Section 36 (DNRC) Well was drilled in 1998 for use as an irrigation well. The well yields a significant amount of clean water and could be used to augment Kalispell's existing water supply. Section 36 (DNRC) Well was drilled to 463 feet bgs and cased to 460 feet bgs with 10-inch steel. The well is perforated with 3/8 by 3-inch perforations over four intervals. Static water level in the well is 105 feet bgs. The pumping water level was 115 feet after 22.5 hours of pumping at 1,475 gallons per minute. The uppermost 21 feet of the well was drilled with a 15-inch bit and the annulus around the steel casing was filled with cement grout to form a sanitary seal.

Table 2-3. Source water information for Kalispell PWS

Information	Armory Well	Noffsinger Spring	Depot Well	Buffalo Hill Well	Grandview Well #1	Grandview Well #2	Section 36 (DNRC) Well	Grandview Test Well
PWS Source Code	WL002	WL003	WL004	WL005	WL006	WL007	NA	NA
Well Location (T, R, Sec or lat, long)	48 10' 48" N 114 18' 16" W	48 12' 57" N 114 18' 43" W	48 11' 58" N 114 18' 41" W	48 12' 47" N 114 19' 16" W	48.2263 N 114.3263 W	48.2263 N 114.3263 W	48.2310 N 114.3379 W	48.2263 N 114.3277 W
MBMG #	82448	173086	82104	702836??	186754	173084	169198	169098
Water Right #	W045077	W045075	W045076	P010756 P023590	P097295	P097295	NA	NA
Date Well was Completed	April 1964	January 1915	April 1954	Early 1979	April 1997	April 1997	June 1998	September 1995
Total Depth	390 feet	NA	330 feet	540 feet	459 feet	486 feet	463 feet	544 feet
Perforated Interval	295 to 335 370 to 380 feet	NA	290 to 330 feet	Unknown	394 to 410 422 to 448 feet bgs	400 to 424 436 to 452 feet bgs	320 to 336 345 to 360 377 to 442 458 to 460 feet bgs	452 to 470, 479 to 489, 492 to 506, and 517 to 539 feet bgs
Static Water Level	10 feet bgs	NA	34 feet bgs	157 feet bgs	86 feet bgs	98 feet bgs	105 feet bgs	100feet bgs
Pumping Water Level	57 feet	NA	109 feet	186 feet bgs	103 feet bgs	359 feet bgs	115 feet bgs	109 feet bgs
Drawdown	47 feet	NA	75 feet	39 feet	17 feet	261 feet	10 feet	9 feet
Test Pumping Rate	1585 gpm	NA	1200 gpm	1940 gpm	1650 gpm	1550 gpm	1475 gpm	642 gpm
Specific Capacity	34 gpm/ft	NA	16 gpm/ft	50 gpm/ft	97 gpm/ft	6 gpm/ft	148 gpm/ft	72 gpm/ft

Methods and Criteria

Source water protection areas are divided into zones or regions according to the amount of time water takes to reach the water supply intake. Intakes for the Kalispell PWS are the water supply wells and Noffsinger Spring. Source water protection areas for groundwater-based systems, in order of increasing size and time of travel to intakes, are the control zone, inventory region, and recharge region. The methods and criteria used to delineate the source water protection zones for the Kalispell PWS are specified in the DEQ's SWPP (DEQ, 1999). For the Kalispell system, the criteria for confined systems were followed for all wells. The control zone is based on a fixed distance of 100 feet radius from each well. The inventory region is based on a fixed distance of 1,000 feet from each PWS well and the recharge region is based on geologic mapping and locations of hydrologic boundaries. For Noffsinger Spring, the inventory region is based on a combination of a fixed distance and hydrogeologic mapping, and the control zone and recharge region were defined as for the wells. The analytical method used to calculate groundwater time-of-travel is the Uniform Groundwater Flow Equation described in Appendix H of the SWPP (DEQ, 1999). Copies of the uniform flow equation time-of-travel calculations are in Appendix E and are summarized in Table 2-4.

Aquifer Properties for Estimation of Groundwater Time-of-Travel

Aquifer properties used to estimate groundwater time-of-travel (TOT) are based on site-specific information derived from well drilling logs, hydrogeologic maps, pumping tests and other physical measurements made on the PWS wells and spring. A summary of the hydrogeologic characteristics for the PWS wells is presented in Table 2-4.

Thickness of the aquifer for each well was estimated based on driller's logs and assumed to be equal to the length of the perforated section of the well casing. The perforated interval was also used to calculate the hydraulic conductivity from the transmissivity value.

Transmissivity values for the PWS wells (Table 2-4) were calculated based on the drawdown observed during short-term, single well, pumping tests (described above) using the following equations:

Modified Jacob Equation (Appendix 16.D in Groundwater and Wells, 2nd. Ed.; Driscoll, 1986)

Transmissivity (ft2/day) = [2000 x Pumping Rate (gpm)/Drawdown (ft)]/7.48 (gallon/ft3)

Empirical Equation of Razack and Huntley (in Applied Hydrogeology, 3rd Ed., Fetter, 1994)

Transmissivity (ft2/day) = 33.6[Pumping Rate (ft3/day)/Drawdown (ft)]$^{0.67}$

In addition, some transmissivity and storativity values are available from more sophisticated pumping tests (i.e., longer tests and/or test that included observation wells) on wells in the vicinity of PWS wells:

- A transmissivity of 49,846 ft2/day was estimated based on the Grandview Test Well aquifer test conducted by Thomas, Dean, & Hoskins (TDH) in 1995. This 26-hour test

included four observation wells. Storativity was estimated to be 0.0001.

- A transmissivity of 10,844 ft2/day was estimated based on the Buffalo Hill Test Well aquifer test conducted by Thomas, Dean, & Hoskins (TDH) in 1977. Storativity was not estimated.
- Transmissivity estimates of 42,000 to 117,000 ft2/day were made based on pumping tests of Noffsinger Spring (Land & Water, 1999). This 12-day pumping test used four observation wells.

Transmissivity and storativity values are also available from literature reports on the deep artesian aquifer. These literature values are not necessarily representative of aquifer conditions in the vicinity of the Kalispell PWS wells, but they do provide an indication of the range of aquifer characteristics in the deep aquifer. Literature values include:

- Corbett (1994) estimated transmissivities of 30,719 ft2/day and 21,165 ft2/day based on aquifer tests of the Columbia Falls 94 well and Columbia Falls L-P well, respectively. Storativity was not estimated.
- Morrison-Maierle (1994) estimated transmissivity of 1,417 ft2/day based on an aquifer test of a monitoring well at the Flathead County Landfill. Storativity was not estimated.
- Spratt (1983) estimated transmissivity of 1,893 ft2/day based on an aquifer test of a well #2 at Ponderosa Subdivision. Storativity was estimated to be 0.00001.
- Shapley (1990) estimated transmissivity values ranging from 5,030 to 17,800 ft2/day based on an aquifer test of a large irrigation well approximately five miles east of Kalispell. Storativity was estimated to range from 0.0013 to 0.0019.

The range of transmissivity values calculated for the PWS wells by the Modified Jacob and Razack and Huntley equations compare favorably with literature values and values derived from pumping tests of test wells. Therefore, the transmissivity and hydraulic conductivity values selected for the TOT calculations are the average values for each well calculated by the Modified Jacob and Razack and Huntley equations. For the Noffsinger Spring, transmissivity value is based on results of the 12-day aquifer test (Land and Water, 1999).

Effective porosity values were estimated based on literature values (Freeze and Cherry, 1979) for sand and gravel. Hydraulic gradient was estimated from the MBMG potentiometric map (MBMG, 2000; see Appendix D) to be 25 feet in three miles, or 0.0015 ft/ft. Groundwater flow direction is determined to be northwest to southeast based on the MBMG potentiometric map.

Water usage and pumping rates for the Kalispell PWS are from the sanitary survey conducted on the system in 1998. The Grandview Test Well and Section 36 (DNRC) Well are not currently in the Kalispell PWS system. Pumping rates of 66 percent of tested capacity were assumed for these wells.

Table 2-4. Estimates of input parameters used to delineate the source water protection area

Input Parameter	Armory Well	Noffsinger Spring	Depot Well	Buffalo Hill Well	Grandview Well #1	Grandview Well #2	Section 36 (DNRC) Well	Grandview Test Well
PWS Source Code	WL002	WL003	WL004	WL005	WL006	WL007	NA	NA
Transmissivity (ft2/day)	10529	42,000	5792	14461	25200	2674	35900	19482
Thickness (feet)	50	51	40	40	42	40	98	54
Hydraulic Conductivity (ft/day)	211	840	145	362	600	67	366	361
Hydraulic Gradient (ft/ft)	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
Flow Direction	NW to SE	NW to SE	NW to SE	NW to SE	NW to SE	NW to SE	NW to SE	NW to SE
Effective Porosity	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Pumping Rate (gpm)	840	3,125	625	1390	520	800	975	425
1-Year TOT*	1550	3700	1400	2325	2070	1435	1540	1430
3-Year TOT*	3135	8325	2725	4810	5020	2620	3510	3325

*Time of Travel

Delineation Results

The results of the delineation of source water protection areas are shown in Appendix F. For the Kalispell system, the criteria for confined systems were followed for all wells.

- The control zone is based on a fixed distance of 100 feet radius from each well.
- The inventory region is based on a fixed distance of 1,000 feet from each PWS well.
- The recharge region for the PWS wells is based on geologic mapping, groundwater flow directions, and locations of hydrologic boundaries, principally the divide along the Salish Mountains to the west of Kalispell.

For Noffsinger Spring, protection areas identified in the approved SWDAR (Land and Water, 2001) were assumed:

- The control zone is based on a fixed radius of 100 feet from the spring.

- The inventory region is a fixed radius of 1,000 feet upgradient in the deep artesian aquifer and approximately 8,000 feet upgradient in the shallow alluvial aquifer (this approximates a three year TOT and coincides with the extent of the aquifer).
- The recharge region for the PWS wells is based on geologic mapping, groundwater flow directions, and locations of hydrologic boundaries, principally the divide along the Salish Mountains to the west of Kalispell.

Limiting Factors

The groundwater flow rate calculations use values that are considered representative of actual conditions. This approach reflects the uncertainties in the data used in the modeling process, with estimates reflecting conservative conditions. While the inventory regions are delineated using criteria for confined aquifers, groundwater flow rates were estimated to demonstrate the general properties of the groundwater flow system for assessments on a more regional scale. The assumed groundwater flow direction and gradients in the area are based on regional data, actual local gradients, and flow directions may vary. Limitations also result from the use of the Uniform Flow Equation for analysis of flow rates, which does not account for pumping from multiple wells, and the density and frequency of pumping from wells installed at various locations across the study area. An additional limitation on this assessment reflects the nature of the fluvially-deposited aquifer, where deposit types reflect variable shapes, and can exhibit rapid changes in hydraulic properties, hydraulic gradients and flow directions over very short distances.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted for the Kalispell Water System within the control and inventory regions. Potential sources of all primary drinking water contaminants and Cryptosporidium were identified, however, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the Kalispell inventory region are nitrate, pathogens and fuels.

The inventory for Kalispell PWS focuses on all activities in the control zone for each well, certain sites or land use activities in the inventory region, and general land uses and large facilities in the recharge region.

Inventory Method

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

Step 1: Urban and agricultural land uses were identified from data collected by the Montana Department of Natural Resources (1982) and the City of Kalispell Land Use Report (2003).

Step 2*:* EPA's Envirofacts System was queried to identify EPA regulated facilities. This system accesses 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). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility is a significant potential contaminant source.

Step 3: DEQ databases were queried to identify Underground Storage Tanks (UST), hazardous waste contaminated sites, landfills, and abandoned mines. Jeffrey Frank Herrick, a Water Quality Specialist in the Pollution Prevention Bureau of the DEQ, provided this data.

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

Step 5: Major road and rail transportation routes were identified.

Step 6: All significant potential contaminant sources were identified in the inventory region. 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 lagoons or spray irrigation
9) Septic systems
10) Sewered residential areas
11) Storm sewer outflows
12) Floor drains, sumps, or dry wells
13) Abandoned or active mines

Step 7: Land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region. A land use map is provided in Appendix F, Figure F-2. A listing of facilities that generate store or use large quantities of hazardous materials is provided in Appendix J.

Step 8: All wells located within the inventory region were identified and well logs were obtained when available.

Step 9: A site visit was made and the control zone and inventory region were visually inspected for potential contaminant sources.

Inventory Results/Control Zone

- Armory Well
  The Armory Well is located along Highway 93 on the southern edge of the City. The armory itself is an active military installation where several military vehicles are stored. A standby generator was observed within the control zone of this well. The fuel and lubricants associated with the generator may represent a potential source of contamination within the control zone.
- Depot Well
  The Depot Well is located in the center of the City near the Chamber of Commerce building and Depot Park. The railroad tracks pass within a few hundred feet of the well. No apparent sources of contaminants were identified within the control zone for this well.
- Buffalo Hill Well
  The Buffalo Hill Well is located in an area of mixed uses that includes residential housing, a golf course and hospital and medical facilities. The well itself is located within a fenced area that also houses two storage tanks and pumping facilities. Fuels for vehicles and standby generator equipment may represent potential contaminant sources within the control zone for this well.
- Grandview Wells #1 and #2 and Grandview Test Well
  The Grandview Wells are located near the northern edge of the City in an area of mixed uses that includes residential housing, a community College and vacant land. No apparent sources of contamination were identified within the control zone for these wells.

- SECTION 36 (DNRC) Well
  The SECTION 36 (DNRC) Well is located along Highway 93 near the northern edge of the City. It is adjacent to an athletic complex and is surrounded by a mixture of residential and vacant land. No apparent sources of contamination were identified within the control zone for this well.
- Noffsinger Spring
  The spring is located at the base of a bluff in Lawrence Park adjacent to the Stillwater River. The golf course is located on top of the bluff, forming the western boundary of Lawrence Park and the Stillwater River forms the eastern boundary of the park. No apparent sources of contamination were identified in the control zone for this source.

Inventory Results/Inventory Region

The land uses in the inventory regions for the Kalispell wells are varied. One significant potential contaminant source within the inventory regions that impacts all of the sources is the raw or inadequately treated sewage that may be leaking from sewer piping and/or septic systems that are used for wastewater management. The locations of sewer pipes are shown on the maps in Appendix B. Although the exact locations of all septic systems in the inventory regions were not determined, it is likely that several systems are located within the control zones or inventory regions of the wells.

- Armory Well
  The Armory Well is located along Highway 93 on the southern edge of the City. There is a small airport, several service stations, and military vehicles that are stored and possibly maintained at the Armory, all located within the inventory region. The fuels associated with all of these facilities and uses represent potential sources of contaminants for this well.
- Depot Well
  The Depot Well is located in the center of the City near the Chamber of Commerce building and Depot Park. The railroad tracks pass within a few hundred feet of the well. A fuel depot with several above ground fuel storage tanks is located near the western edge of the inventory region for this well. There is also a printing shop located adjacent to the fuel depot. Several service stations are also located within or very close to the inventory region for this well. The fuels and solvents associated with these facilities represent potential contaminants within the inventory region for this well.
- Buffalo Hill Well
  The Buffalo Hill Well is located in an area of mixed uses that includes residential housing, a golf course and hospital and medical facilities. The well itself is located within a fenced area that also houses two storage reservoirs and pumping facilities. There is an underground fuel storage tank associated with the hospital that is within the inventory region for this well. In addition, the chemical fertilizers, herbicides and pesticides that are used to maintain the golf course represent a potential contaminant source within the inventory region of this well.
- Grandview Wells #1 and #2 and Grandview Test Well
  The Grandview wells are located near the northern edge of the City in an area of mixed uses that includes residential housing, Flathead Valley Community College and vacant land. A nursery is located across Highway 93 to the west. It is near the edge of the

inventory region for the Grandview test well, which is located furthest to the west of the three wells. The chemical fertilizers, herbicides and pesticides that are stored and sold at the nursery are potential sources of contamination.

- SECTION 36 (DNRC) Well
  The SECTION 36 (DNRC) well is located along Highway 93 near the northern edge of the City. It is adjacent to an athletic complex and is surrounded by a mixture of residential and vacant land. The only source of contaminants identified for this well are those associated with the proximity of Highway 93, which passes through the inventory region for this well.
- Noffsinger Spring
  The spring is located at the base of a bluff in Lawrence Park adjacent to the Stillwater River. A golf course, located on top of the bluff, forms the western boundary of Lawrence Park and the Stillwater River forms the eastern boundary. The chemical fertilizers, herbicides and pesticides that are used to maintain the golf course represent potential contaminant sources within the inventory region of this well. Also, because of the influence of surface water on the spring, the inventory region includes a surface water buffer along the Stillwater River that encompasses an area for several miles upstream. As an untreated surface water, the Stillwater River itself is a potential source of contamination from various sources including biological contaminants such as giardia and cryptosporidium. The Stillwater River buffer area, which is included in the inventory region, is characterized by several different land uses and commercial activities. A truck and auto repair shop and the Bill's Scales company, advertising sandblasting services, are both located just outside the 1,000 foot radius of the spring on the east side of the river.

Table 3-1. Significant potential contaminant sources for Kalispell

Water Source	Contaminant Source	Contaminants	Description
All Sources	Septic tanks/sewer lines	Nitrates and Pathogens	Possible leakage of inadequately treated wastewater from the septic systems and sewer lines in the area.
Armory Well	Standby generator/military vehicles	Gasoline and lubricants	Leakage or spillage of fuel or lubricants associated with the standby generator or military vehicles stored in the area.
Armory Well	Airport	Aircraft fuels and solvents	Leakage or spillage of fuel or lubricants associated with the aircraft fuelling, operation and maintenance.
Armory Well	Service Stations	Gasoline and diesel fuel	Leakage or spillage of fuel or lubricants associated with fuelling operations or USTs at the service stations.
Depot Well	Service Stations	Gasoline and diesel fuel	Leakage or spillage of fuel or lubricants associated with fuelling operations or USTs at the service stations.
Depot Well	Fuel depot with multiple above-ground storage tanks	Gasoline and other VOCs	Leakage or spillage of fuel or fuel additives stored at the fuel depot.
Depot Well	Print Shop	VOCs	Leakage, spillage or improper disposal of solvents and inks used in the printing processes.
Buffalo Hill Well	Underground fuel storage tank at Hospital	VOCs	Leakage or spillage of fuel associated with hospital UST.
Buffalo Hill Well and Noffsinger Spring	Golf Course and residential lawn care	Chemical fertilizers, herbicides and pesticides	Leaching of lawn care chemicals into the area groundwater.
Grandview Wells	Nursery	Chemical fertilizers, herbicides and pesticides	Leakage or spillage of lawn care chemicals stored and sold at the nursery.
Noffsinger Spring	Automotive repair shop	Gasoline and other VOCs	Leakage or spillage of gasoline or solvents associated with vehicle repair.
Noffsinger Spring	Sandblasting facility	Heavy metals, paint and solvents	Leaching of heavy metals, paint and solvents associated with the wastes generated in the sandblasting process.
Noffsinger Spring	Stillwater River	Microbial contaminants	This untreated surface water may contain contaminants including Giardia and Cryptosporidium.

Inventory Results/Recharge Region

The recharge region for the Kalispell Water System includes Kalispell and the entire Flathead Valley floor to the northwest and extends to the divides of the surrounding mountains. This large area encompasses a multitude of activities and potential contaminant sources. The area is shown in Appendix H. Large and/or significant potential contaminant sources and general land uses are

shown on the map in Appendix H and the lists in Appendix J.

Inventory Update

To make this SWDAR a useful document in the years to come, the certified operator of the system should update the inventory every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete updated inventory should be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

The information in this inventory was derived from a number of public and private sources. It is as complete as possible, but is limited by the accuracy and completeness of the original data sources. This inventory was ground-checked by a site visit to the well head. It was not possible to inventory all properties in the inventory region due to access limitations. First hand knowledge of the water system can be provided by the PWS operator(s) and owners. This report will be submitted to those individuals and the edits and updates they provide will be critical to ensuring the accuracy and usefulness of this SWDAR.

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 the Kalispell PWS.

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 Kalispell PWS 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 Kalispell PWS wells and Noffsinger Spring (Table 4-1). The deep artesian aquifer that is the source water for the Kalispell PWS wells is a confined aquifer. In accordance with the MDEQ SWPP (1999), hazard for confined aquifers is considered to be low if all wells in the inventory region are constructed to current state standards. Hazard is high if the PWS well is not sealed into the confining layer and moderate if only other wells are not properly constructed.

As described in Chapter 2, the Kalispell PWS draws water from five wells and may draw water from two additional wells in the future. Records of adequate sealing in accordance with the current DEQ requirements are available for all wells in the Kalispell PWS except the Depot and Buffalo Hill wells. Although no annular seal information is available these wells are likely to be properly sealed because they were constructed with driven casing and because of the high clay content and thickness of the confining layer in the area. Compliance with Montana Water Well regulations only requires the feeding of bentonite along the casing as it is driven in order to form an effective seal. This requirement is likely to have been met for the wells. For purposes of the susceptibility assessment, the Kalispell PWS wells are considered likely to be properly constructed with adequate seals.

A query of the MBMG-GWIC database indicates approximately 13 other wells installed within the inventory zones for the Kalispell wells. Well logs for these wells are in Appendix G.

Hazard is low for all sources within the inventory region of Section 36 (DNRC) Well as there are no other wells within the inventory region and the PWS well is documented to have an adequate seal.

Hazard is low for all sources within the inventory region of the Armory Well as there are no other wells within the inventory region that penetrate the confining layer. The four other wells in the inventory region are all less than 25 feet deep.

Hazard is moderate for contaminant sources within the inventory region of Grandview Wells #1 and #2 and Grandview Test Well because there are three other wells within the inventory regions and most of the wells are lacking information regarding sanitary seals. It is possible, perhaps likely, that the confining layer forms an adequate sanitary seal for these other wells. To be conservative given the uncertainty about the adequacy of well seals, hazard for all sources within the inventory region of the Grandview Wells #1 and #2 and Grandview Test Well is deemed to be moderate. This rating reflects the assumption that most wells likely have adequate seals while some wells may not.

Hazard is moderate for contaminant sources within the inventory region of the Depot Well. There is one other well within the inventory region and the well is also lacking information regarding sanitary seals. As for the Depot Well, it is possible, perhaps likely, that the confining layer forms an adequate sanitary seal for these other wells. To be conservative given the uncertainty about the adequacy of well seals, hazard for all sources within the inventory region of the Depot Well is deemed to be moderate.

Hazard is moderate for contaminant sources within the inventory region of the Buffalo Hill Well. There is one other well within the inventory region and the well is also lacking information regarding sanitary seals. It is possible, perhaps likely, that the confining layer forms an adequate sanitary seal for these other wells. To be conservative given the uncertainty about the adequacy of well seals, hazard for all sources within the inventory region of the Buffalo Hill Well is deemed to be moderate.

Noffsinger Spring may derive a portion of its source water from the unconfined shallow alluvial aquifer along the Stillwater River. For unconfined groundwater systems, hazard is rated by the proximity of a potential contaminant source to the PWS source water:

- Contaminant sources within an estimated 1-year groundwater time-of-travel distance of the PWS intake are considered to be a high hazard;
- Contaminant sources within an estimated 1 to 3-year groundwater time-of-travel distance of the PWS intake are considered to be a moderate hazard;
- Contaminant sources greater than an estimated 3-year time-of-travel are considered to be a low hazard;

Hazard ranges from low to high for contaminant sources within the inventory region of Noffsinger Spring. Hazard posed to Noffsinger Spring by specific contaminant sources is detailed in Table 4-2.

All potential contaminant sources located in the recharge region, and outside of the inventory region, are assigned a relative hazard of low due to their distance from the PWS wells.

Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 4-2). The susceptibility of each Kalispell PWS well and Noffsinger Spring to each potential contaminant source is assessed separately.

It should be noted that potential sources of contaminants that are located within the 100-foot perimeter around the wellhead, which constitutes the control zone, are of special concern. The hazard associated with contaminants located this area is much higher than the surrounding area because of the possibility of contaminants entering directly into the well. The natural barriers described in the next paragraph would not attenuate spills or leaks of contaminants in this area. **Whenever possible, all potential contaminant sources should be excluded from the control zone.**

For wells that derive groundwater from the confined deep artesian aquifer, such as the Kalispell PWS wells, natural barriers to all sources of contamination include:

- The confining layer, which is an extensive, thick, low permeability till that overlies the aquifer and limits or precludes vertical movement of contaminants to the aquifer.
- Upward groundwater flow direction. Because the aquifer is artesian, vertical hydraulic gradients in the aquifer favor upward flow.
- Natural Attenuation. The thick unsaturated zone above the artesian aquifer provides abundant soil mass for chemical transformation, biological degradation, adsorption or other chemical or physical processes to reduce water quality impacts to nonsignificant levels.

For the Kalispell PWS wells, an engineered barrier to all sources of contamination is the well intake depth, which is greater than 50 feet below the pumping water level elevation. Engineered barriers to specific sources are listed in Table 4-2.

For Noffsinger Spring, which may derive a portion of its water from the shallow alluvial aquifer, natural barriers to sources of contamination include dilution and mixing (except for microbial contaminants). The majority of the source water to the spring comes from the deep artesian aquifer that has a low sensitivity and is unlikely to become contaminated. This deep artesian water has the ability to dilute any contaminants present in the shallow aquifer water. Stillwater River flows may also dilute contaminants in the river or the shallow aquifer. Engineered barriers to specific sources are listed in Table 4.2.

Table 4.1 Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers

Presence Of Barriers	Hazard		
	High	**Moderate**	**Low**
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

Table 4.2 Susceptibility assessments for significant potential contaminant sources in the Control Zone and Inventory Region

Water Source	Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
All Sources	Septic tanks/sewer lines	Pathogens	Leaks and leaching of contaminants into the groundwater	Moderate for all wells except Armory and Section 36(DNRC) which are Low, High for Noffsinger Spring	Chlorine Disinfection Reservoir baffling to improve disinfection Thick unsaturated zone and deep intake (all except Noffsinger)	Moderate for Noffsinger Low for all others	Frequent monitoring of groundwater quality Septic system inspection program Wastewater collection system inspection and repair program. Maintenance of adequate Chlorine residual in distribution system.
All Sources	Septic tanks/sewer lines	Nitrates	Leaks and leaching of nitrates into the groundwater	Moderate for all wells except Armory and Section 36(DNRC) which are Low, High for Noffsinger Spring	Thick unsaturated zone and deep intake (all except Noffsinger) Wastewater collection system inspection and repair program	Very High for Noffsinger Low for all wells except Armory and Section 36(DNRC) which are Very Low	Frequent monitoring of groundwater quality Septic system inspection program
Armory Well	Standby generator/military vehicles	Gasoline and lubricants	Spills or leaks	Low	Thick unsaturated zone and deep intake	Low	Spill and leak control program
Armory Well	Airport	Aircraft fuels and solvents	Spills or leaks	Low	Thick unsaturated zone and deep intake	Low	Spill and leak control program
Armory Well	Service Stations	Gasoline and Diesel fuel	Spills or leaks	Low	Thick unsaturated zone and deep intake	Low	Spill and leak control program

Water Source	Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Depot Well	Service Stations	Gasoline and Diesel fuel	Spills or leaks	Low	Thick unsaturated zone and deep intake	Low	Spill and leak control program
Depot Well	Fuel depot with multiple above-ground storage tanks	Gasoline and other VOCs	Spills or leaks	Moderate	Physical containment basin Thick unsaturated zone and deep intake	Low	Spill and leak control program
Depot Well	Print Shop	VOCs (Solvents and inks used in the printing process)	Spills, leaks or improper disposal	Moderate	Thick unsaturated zone and deep intake	Low	Spill and leak control program Hazardous Materials disposal outside the inventory region.
Buffalo Hill Well	Underground fuel storage tank at Hospital	VOCs	Spills or Leaks	Moderate	Thick unsaturated zone and deep intake	Low	Tank inspection program Monitoring wells
Buffalo Hill Well and Noffsinger Spring	Golf course and residential lawn care	Chemical fertilizers, herbicides and pesticides	Chemical leaching into groundwater	Moderate for Buffalo Hill Well High for Noffsinger Spring	Thick unsaturated zone and deep intake for Buffalo Hill None for Noffsinger	Moderate for Buffalo Hill Well Very High for Noffsinger	Limit the amount of water used from Noffsinger. Apply lawn chemicals at the proper rates and restrict all application in the control zones of wells.
Grandview Wells	Nursery	Chemical fertilizers, herbicides and pesticides	Chemical leaching into groundwater	Moderate	Thick unsaturated zone and deep intake	Low	Inspection and awareness programs at the Nursery.

Water Source	Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
Noffsinger Spring	Automotive repair shop	Gasoline and other VOCs	Spills or leaks including those entering the Stillwater River	High	None	Very High	Limit the amount of water used from this source.
Noffsinger Spring	Sandblasting facility	Heavy metals, paint and solvents	Spills, leaks or improper disposal causing leaching of metals from contaminants stored on site, including those entering the Stillwater River	High	None	Very High	Limit the amount of water used from this source.
Noffsinger Spring	Stillwater River	Microbial contaminants including Giardia and Cryptosporidium	Surface water contamination from various sources including wildlife and livestock	High	Chlorine disinfection Reservoir baffling to improve disinfection	High	Limit the amount of water used from this source. Install filtration facilities.

REFERENCES

Freeze, R. Allan and Cherry, John A., Groundwater, 1979 Prentice-Hall, Inc.

Internet source of graphical and tabular information provided by Montana State Library - Natural Resource Information Service: http://nris.state.mt.us/mapper/

Internet source of tabular well information at the Montana Bureau of Mines and Geology Information Service: http://mbmgsun.mtech.edu/ & http://mbmggwic.mtech.edu/

Kendy, E., and R.E. Tresch, 1996, Geographic, Geologic, and Hydrologic Summaries of Intermontane Basins of the Northern Rocky Mountains, Montana: U.S. Geological Survey Water Resources Investigations Report 96-4025, 233 p.

Montana Department of Environmental Quality, 1999. Montana Source Water Protection Program, Approved by EPA in November 1999, inclusive of personal communications with Joe Meek & Jeffrey F. Herrick.

Montana Department of Environmental Quality, Permitting & Compliance Division and the Drinking Water Assistance Program - Montana Water Center: Ground Water Manual for Small Water Systems, January 1999

Montana State Library - Natural Resources Information System (NRIS) map base of the USGS Topographical coverage at 1:24,000 scale in MrSID format.

Raines, G.L. and B.R. Johnson, 1996. Digital Representation of the Montana State Geologic Map: A Contribution to the Interior Columbia River Basin Ecosystem Management Project: U.S. Geological Survey Open File Report 95-691, 19 p.

United States Environmental Protection Agency (US EPA), Manual of Small Public Water Supply Systems, US EPA Office of Water (WH-550), EPA 570/9-91-003, May 1991

U.S. Geological Survey, 2000. National Landcover Dataset, Montana. 30-meter electronic digital landcover dataset interpreted from satellite imagery.

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.

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

Confined Aquifer. A fully saturated aquifer overlain by a confining unit such as a clay layer. The static water level in a well in a confined aquifer is at an elevation that is equal to or higher than the base of the overlying confining unit.

Confining Unit. A geologic formation that inhibits the flow of water.

Delineation. A process of mapping source water management areas.

Effective Porosity. The percent of soil, sediment, or rock through which fluids, such as air or water, can pass. Effective porosity is always less than total porosity because fluids can not pass through all openings.

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

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

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

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

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 or virus 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.

Porosity. The percent of soil, sediment, or rock filled by air, water, or other fluid.

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

SIC Code. The U.S. Standard Industrial Classification (SIC) Codes classify categories of businesses. SIC Codes cover the entire range of business categories that exist within the economy.

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. 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.

Transmissivity. The ability of an aquifer to transmit water.

Unconfined Aquifer. An aquifer containing water that is not under pressure. The water table is the top surface of an unconfined aquifer.

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

Recharge Region / 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 and other sources

APPENDICES

APPENDIX A

APPENDIX A VICINITY MAP

APPENDIX B

PWS SITE PLAN

Insert File MT0000259-B-1.jpg
Insert File MT0000259-B-2.jpg

APPENDIX C

APPENDIX C GEOLOGIC MAP

APPENDIX D

GROUND WATER DIRECTION FLOW MAPS

APPENDIX E

TIME-OF-TRAVEL EQUATIONS

Kalispell Public Water Supply
Summary of Time of Travel Calculations
Noffsinger Spring

Property		Units	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	840
Hyd Grad	I	ft/ft	0.0015
Pumping Rate	Q	gpm	3125
		ft3/day	601593.75
Aquifer Thickness	b	feet	51
Distance Upgradient to Null Point			
Null Distance	Xl	feet	1490
		miles	0.28
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	4681
		miles	0.89

Note: Add values in this section, to do calculations below. The pumping rate will automatically convert from gpm to cubic feet per day, which is used in the calculations

Change values for the distance traveled at the bottom of the time of travel calculation section to obtain values for a one year and three year time of travel

Time of Travel Calculations

Distance Traveled		Time of Travel	
feet	miles	days	years
1000	0.19	46.60	0.13
100	0.02	0.64	0.00
500	0.09	13.66	0.04
1000	0.19	46.60	0.13
2500	0.47	204.83	0.56
5000	0.95	557.04	1.53
6070	1.15	724.23	1.98
7500	1.42	956.74	2.62
10000	1.89	1380.24	3.78
10560	2.00	1477.28	4.04
15000	2.84	2265.49	6.20
15840	3.00	2417.47	6.62
19100	3.62	3013.34	8.25
21120	4.00	3386.47	9.27
25000	4.73	4109.49	11.25
31680	6.00	5368.40	14.70
40000	7.58	6953.03	19.04
3700	0.70	365.19	1.00
8325	1.58	1094.48	3.00
7035	1.33	880.18	2.41
12000	2.27	1729.62	4.74

Kalispell Public Water Supply
Summary of Time of Travel Calculations
Grandview Test Well

Property		Units	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	361
Hyd Grad	I	ft/ft	0.0015
Pumping Rate	Q	gpm	425
		ft3/day	81816.75
Aquifer Thickness	b	feet	54
Distance Upgradient to Null Point			
Null Distance	Xl	feet	445
		miles	0.08
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	1399
		miles	0.26

Note: Add values in this section, to do calculations below. The pumping rate will automatically convert from gpm to cubic feet per day, which is used in the calculations

Change values for the distance traveled at the bottom of the time of travel calculation section to obtain values for a one year and three year time of travel

Time of Travel Calculations

Distance Traveled		Time of Travel	
feet	miles	days	years
1000	0.19	219.63	0.60
100	0.02	4.52	0.01
500	0.09	76.08	0.21
1000	0.19	219.63	0.60
2500	0.47	765.80	2.10
5000	0.95	1793.65	4.91
6070	1.15	2250.77	6.16
7500	1.42	2870.17	7.86
10000	1.89	3968.13	10.86
10560	2.00	4215.93	11.54
15000	2.84	6196.11	16.96
15840	3.00	6573.04	18.00
19100	3.62	8040.60	22.01
21120	4.00	8952.97	24.51
25000	4.73	10710.28	29.32
31680	6.00	13746.38	37.64
40000	7.58	17540.21	48.02
1430	0.27	364.61	1.00
3325	0.63	1095.91	3.00
7035	1.33	2667.89	7.30
12000	2.27	4855.47	13.29

Kalispell Public Water Supply
Summary of Time of Travel Calculations
Grandview #2 Well

Property		Units	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	67
Hyd Grad	I	ft/ft	0.0015
Pumping Rate	Q	gpm	100
		ft3/day	19251
Aquifer Thickness	b	feet	40
Distance Upgradient to Null Point			
Null Distance	Xl	feet	762
		miles	0.14
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	2394
		miles	0.45

Note: Add values in this section, to do calculations below. The pumping rate will automatically convert from gpm to cubic feet per day, which is used in the calculations

Change values for the distance traveled at the bottom of the time of travel calculation section to obtain values for a one year and three year time of travel

Time of Travel Calculations

Distance Traveled		Time of Travel	
feet	miles	days	years
1000	0.19	898.52	2.46
100	0.02	15.02	0.04
500	0.09	287.43	0.79
1000	0.19	898.52	2.46
2500	0.47	3462.26	9.48
5000	0.95	8602.53	23.55
6070	1.15	10941.29	29.96
7500	1.42	14138.19	38.71
10000	1.89	19855.91	54.36
10560	2.00	21152.77	57.91
15000	2.84	31570.28	86.43
15840	3.00	33561.39	91.89
19100	3.62	41330.94	113.16
21120	4.00	46172.18	126.41
25000	4.73	55514.44	151.99
31680	6.00	71694.25	196.29
40000	7.58	91957.94	251.77
575	0.11	364.56	1.00
1135	0.21	1094.38	3.00
7035	1.33	13091.30	35.84
12000	2.27	24507.87	67.10

Kalispell Public Water Supply
Summary of Time of Travel Calculations
Grandview #1 Well

Property		Units	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	600
Hyd Grad	I	ft/ft	0.0015
Pumping Rate	Q	gpm	520
		ft3/day	100105.2
Aquifer Thickness	b	feet	42
Distance Upgradient to Null Point			
Null Distance	Xl	feet	421
		miles	0.08
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	1324
		miles	0.25

Note: Add values in this section, to do calculations below. The pumping rate will automatically convert from gpm to cubic feet per day, which is used in the calculations

Change values for the distance traveled at the bottom of the time of travel calculation section to obtain values for a one year and three year time of travel

Time of Travel Calculations

Distance Traveled		Time of Travel	
feet	miles	days	years
1000	0.19	135.45	0.37
100	0.02	2.85	0.01
500	0.09	47.31	0.13
1000	0.19	135.45	0.37
2500	0.47	467.77	1.28
5000	0.95	1089.83	2.98
6070	1.15	1365.96	3.74
7500	1.42	1739.87	4.76
10000	1.89	2402.20	6.58
10560	2.00	2551.63	6.99
15000	2.84	3745.21	10.25
15840	3.00	3972.33	10.88
19100	3.62	4856.50	13.30
21120	4.00	5406.08	14.80
25000	4.73	6464.47	17.70
31680	6.00	8292.71	22.70
40000	7.58	10576.84	28.96
2070	0.39	366.97	1.00
5020	0.95	1094.95	3.00
7035	1.33	1617.79	4.43
12000	2.27	2937.21	8.04

Kalispell Public Water Supply
Summary of Time of Travel Calculations
Buffalo Hill Well

Property		Units	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	362
Hyd Grad	I	ft/ft	0.0015
Pumping Rate	Q	gpm	1390
		ft3/day	267588.9
Aquifer Thickness	b	feet	40
Distance Upgradient to Null Point			
Null Distance	Xl	feet	1961
		miles	0.37
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	6160
		miles	1.17

Note: Add values in this section, to do calculations below. The pumping rate will automatically convert from gpm to cubic feet per day, which is used in the calculations

Change values for the distance traveled at the bottom of the time of travel calculation section to obtain values for a one year and three year time of travel

Time of Travel Calculations

Distance Traveled		Time of Travel	
feet	miles	days	years
1000	0.19	88.37	0.24
100	0.02	1.14	0.00
500	0.09	25.15	0.07
1000	0.19	88.37	0.24
2500	0.47	408.97	1.12
5000	0.95	1158.28	3.17
6070	1.15	1521.83	4.17
7500	1.42	2032.28	5.56
10000	1.89	2971.61	8.14
10560	2.00	3188.13	8.73
15000	2.84	4958.33	13.58
15840	3.00	5301.44	14.51
19100	3.62	6650.54	18.21
21120	4.00	7497.88	20.53
25000	4.73	9143.98	25.03
31680	6.00	12019.65	32.91
40000	7.58	15650.72	42.85
2325	0.44	364.53	1.00
4810	0.91	1095.79	3.00
7035	1.33	1863.68	5.10
12000	2.27	3752.84	10.27

Kalispell Public Water Supply
Summary of Time of Travel Calculations
Armory Well

Property		Units	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	211
Hyd Grad	I	ft/ft	0.0015
Pumping Rate	Q	gpm	840
		ft3/day	161708.4
Aquifer Thickness	b	feet	50
Distance Upgradient to Null Point			
Null Distance	Xl	feet	1626
		miles	0.31
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	5109
		miles	0.97

Note: Add values in this section, to do calculations below. The pumping rate will automatically convert from gpm to cubic feet per day, which is used in the calculations

Change values for the distance traveled at the bottom of the time of travel calculation section to obtain values for a one year and three year time of travel

Time of Travel Calculations

Distance Traveled		Time of Travel	
feet	miles	days	years
1000	0.19	174.22	0.48
100	0.02	2.33	0.01
500	0.09	50.57	0.14
1000	0.19	174.22	0.48
2500	0.47	778.66	2.13
5000	0.95	2144.91	5.87
6070	1.15	2797.79	7.66
7500	1.42	3708.41	10.15
10000	1.89	5372.11	14.71
10560	2.00	5754.02	15.75
15000	2.84	8862.03	24.26
15840	3.00	9462.22	25.91
19100	3.62	11817.42	32.35
21120	4.00	13293.53	36.40
25000	4.73	16155.98	44.23
31680	6.00	21144.88	57.89
40000	7.58	27430.31	75.10
1550	0.29	364.40	1.00
3135	0.59	1096.36	3.00
7035	1.33	3408.29	9.33
12000	2.27	6747.98	18.47

Kalispell Public Water Supply
Summary of Time of Travel Calculations
Depot Well

Property		Units	
porosity	n	percent	0.25
Hyd Cond	K	ft/day	145
Hyd Grad	I	ft/ft	0.0015
Pumping Rate	Q	gpm	625
		ft3/day	120318.75
Aquifer Thickness	b	feet	40
Distance Upgradient to Null Point			
Null Distance	Xl	feet	2201
		miles	0.42
Lateral limits of Zone of Contribution			
Boundary Limits	Y	feet	6915
		miles	1.31

Note: Add values in this section, to do calculations below. The pumping rate will automatically convert from gpm to cubic feet per day, which is used in the calculations

Change values for the distance traveled at the bottom of the time of travel calculation section to obtain values for a one year and three year time of travel

Time of Travel Calculations

Distance Traveled		Time of Travel	
feet	miles	days	years
1000	0.19	201.85	0.55
100	0.02	2.53	0.01
500	0.09	56.82	0.16
1000	0.19	201.85	0.55
2500	0.47	953.71	2.61
5000	0.95	2748.39	7.52
6070	1.15	3627.79	9.93
7500	1.42	4868.01	13.33
10000	1.89	7161.48	19.61
10560	2.00	7691.63	21.06
15000	2.84	12039.70	32.96
15840	3.00	12884.59	35.28
19100	3.62	16211.47	44.38
21120	4.00	18304.09	50.11
25000	4.73	22374.50	61.26
31680	6.00	29497.08	80.76
40000	7.58	38504.75	105.42
1400	0.27	363.73	1.00
2725	0.52	1094.05	3.00
7035	1.33	4457.80	12.20
12000	2.27	9076.30	24.85

APPENDIX F

DELINEATION AND INVENTORY RESULTS

APPENDIX F2F LAND USE – BUFFALO HILL WELL

APPENDIX F2G LAND USE – DEPOT WELL

APPENDIX F2H LAND USE – ARMORY WELL

APPENDIX G

WELL LOG(s)

Insert copies of available well logs

APPENDIX H

APPENDIX H RECHARGE REGION

APPENDIX I

SANITARY SURVEY

Insert copy of Sanitary Survey

APPENDIX J

SUPPORTING INFORMATION

Water Quality of Selected Wells

Sample Id: 1984Q0846
Sample Date: 08/21/1984
Site Name: MBMG RESEARCH WELL
Location (TRS): 28N 21W 20 BBCB
Site Type: WELL

The code **---** means there is currently no standard for this constituent.

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	**82.40 mg/L**	---	---	---
Magnesium (Mg)	**29.60 mg/L**	---	2,000 mg/L	---
Sodium (Na)	**45.00 mg/L**	250 mg/L [smcl]	2,000 mg/L	See SAR
Potassium (K)	**2.20 mg/L**	---	---	---
Iron (Fe)	**0.01 mg/L**	0.3 mg/L [smcl]	---	---
Manganese (Mn)	**0.24 mg/L**	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO2)	**16.90 mg/L**	---	---	---
Bicarbonate (HCO3)	**477.00 mg/L**	---	---	---
Carbonate (CO3)	**0.00 mg/L**	---	---	---
Chloride (Cl)	**4.20 mg/L**	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO4)	**38.80 mg/L**	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO3 as N)	**0.47 mg/L**	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	**0.20 mg/L**	4 mg/L [mcl]	2 mg/L	---
Phosphate (as P)	**0.02 mg/L**	500 mg/L [smcl]	5,000 mg/L	2,000 mg/L [c]
Aluminum (Al)	**<30. ug/L**	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	**NR ug/L**	6 ug/L [mcl]	---	---
Arsenic (As)	**NR ug/L**	50 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	**NR ug/L**	2,000 ug/L [mcl]	---	---
Boron (B)	**<20. ug/L**	---	---	---
Cadmium (Cd)	**<2. ug/L**	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	**<2. ug/L**	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	**NR ug/L**	---	1,000 ug/L	50 ug/L
Copper (Cu)	**2.00 ug/L**	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	**NR ug/L**	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	**7.00 ug/L**	---	---	2,500 ug/L
Molybdenum (Mo)	**<20. ug/L**	---	---	5 ug/L
Nickel (Ni)	**<10. ug/L**	---	---	200 ug/L
Phosphate (P)	**0.02 ug/L**	---	---	---
Selenium (Se)	**NR ug/L**	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	**<2. ug/L**	100 ug/L [smcl]	---	---
Strontium (Sr)	**124.00 ug/L**	---	---	---
Titanium (Ti)	**12.00 ug/L**	---	---	---

Vanadium (V)	**<1. ug/L**	---	---	---
Zinc (Zn)	**<3. ug/L**	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	**<4. ug/L**	---	---	---

Key:

NR No Reading in GWIC

mg/L milligrams per liter or parts per million

ug/L micrograms per liter or parts per billion

--- There is currently no standard for this constituent.

[b] High concentrations of sulfate may restrict calcium uptake by crops.

[c] Varies with crop; generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm).

[d] Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR)

[mcl] U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999.

[smcl] U.S. Environmental Protection Agency secondary contaminant level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

Sample Id: 1997Q0048
Sample Date: 07/15/1996
Site Name: MCADAMS RICHARD
Location (TRS): 29N 22W 32 DADB
Site Type: WELL

The code **---** means there is currently no standard for this constituent.

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	**22.00 mg/L**	---	---	---
Magnesium (Mg)	**18.00 mg/L**	---	2,000 mg/L	---
Sodium (Na)	**19.00 mg/L**	250 mg/L [smcl]	2,000 mg/L	See SAR
Potassium (K)	**0.53 mg/L**	---	---	---
Iron (Fe)	**<.003 mg/L**	0.3 mg/L [smcl]	---	---
Manganese (Mn)	**<.002 mg/L**	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO2)	**32.80 mg/L**	---	---	---
Bicarbonate (HCO3)	**183.20 mg/L**	---	---	---
Carbonate (CO3)	**0.00 mg/L**	---	---	---
Chloride (Cl)	**2.70 mg/L**	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO4)	**16.00 mg/L**	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO3 as N)	**.18 P mg/L**	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	**<1. mg/L**	4 mg/L [mcl]	2 mg/L	---
Phosphate (as P)	**NR mg/L**	500 mg/L [smcl]	5,000 mg/L	2,000 mg/L [c]
Aluminum (Al)	**<30. ug/L**	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	**<2. ug/L**	6 ug/L [mcl]	---	---
Arsenic (As)	**<1. ug/L**	50 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	**<2. ug/L**	2,000 ug/L [mcl]	---	---
Boron (B)	**<30. ug/L**	---	---	---
Cadmium (Cd)	**<2. ug/L**	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	**4.40 ug/L**	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	**<2. ug/L**	---	1,000 ug/L	50 ug/L
Copper (Cu)	**<2. ug/L**	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	**<2. ug/L**	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	**<6. ug/L**	---	---	2,500 ug/L
Molybdenum (Mo)	**<10. ug/L**	---	---	5 ug/L
Nickel (Ni)	**<2. ug/L**	---	---	200 ug/L
Phosphate (P)	**NR ug/L**	---	---	---
Selenium (Se)	**<1. ug/L**	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	**<1. ug/L**	100 ug/L [smcl]	---	---
Strontium (Sr)	**130.00 ug/L**	---	---	---
Titanium (Ti)	**<10. ug/L**	---	---	---
Vanadium (V)	**<5. ug/L**	---	---	---
Zinc (Zn)	**104.20 ug/L**	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	**<20. ug/L**	---	---	---

Key:

NR No Reading in GWIC

mg/L milligrams per liter or parts per million

ug/L micrograms per liter or parts per billion

--- There is currently no standard for this constituent.

[b] High concentrations of sulfate may restrict calcium uptake by crops.

[c] Varies with crop; generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm).

[d] Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR)

[mcl] U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999.

[smcl] U.S. Environmental Protection Agency secondary contaminant level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

Appendix J

LIST OF EPA-REGULATED FACILITIES IN ENVIROFACTS

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
A & B NORGE LAUNDRY & CLEANING VILLAGE 702 E IDAHO KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
A AND J TRAILER MANUFACTURING 4039 US HIGHWAY 93 SOUTH KALISPELL, MT 599018602	NO	NO	**YES**	NO	NO	NO
A-1 PAVING DBA A-1 CONCRETE 1993 MCNEILUS READY MIX PORTABLE, MT 59901	NO	NO	NO	NO	**YES**	NO
A-1 PAVING, INC. 3131 HIGHWAY 2 EAST KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
A-1 PAVING, INC. NW1/4 SEC. 22 T29N R21W FLATHD PORTABLE, MT 59901	NO	NO	NO	NO	**YES**	NO
A4S TECHNOLOGIES 3977 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
AUTOMOTION INC 1257 N MERIDAN KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
AUXIER CUSTOM TEXTILES 4009 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
BATCO OF KALISPELL INC 1023 E IDAHO KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
BAUSKA FIREARMS 1ST ST W KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
BEARINGS INCORPORATED	NO	NO	**YES**	NO	NO	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
2547 US HIGHWAY 2 EAST KALISPELL, MT 599012399						
BIG MOUNTAIN TOYOTA 1331 US HIGHWAY 2 EAST KALISPELL, MT 599013296	NO	NO	**YES**	NO	NO	NO
BIOFORCE OF MONTANA 2211 HWY 2 E KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
BMC WEST TRUSS PLANT KALISPELL FACILITY KALISPELL, MT 59901	**YES**	NO	NO	NO	NO	NO
BN KALISPELL POLE AND TIMBER 330 FLATHEAD DRIVE KALISPELL, MT 59901	NO	NO	**YES**	**YES**	NO	**YES**
BUSY BEE DRY CLEANERS 305 2ND AVE W KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
CABLE TECHNOLOGY INC 3985 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
CENEX FARMERS UNION EXCHANGE 55 4TH AVENUE EAST NORTH KALISPELL, MT 599014197	NO	NO	**YES**	NO	NO	NO
CITY SERVICE TRUCK STOP 990 DEMERSVILLE ROAD KALISPELL, MT 599017936	NO	NO	**YES**	NO	NO	NO
CLASSIC CLEANERS 710 W IDAHO KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
COLUMBIA PAINT & COATINGS CO KALISPELL 645 W IDAHO KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
COSTCO WHOLESALE NUMBER 109 3850 US HIGHWAY 2 EAST KALISPELL, MT 599016511	NO	NO	**YES**	NO	NO	NO
CRESTON POST CO INC 1220 HATCHERY RD KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
DELTA AIR LINES - KALISPELL	NO	NO	**YES**	NO	NO	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
GLACIER PARK INTL AIRPORT KALISPELL, MT 59901						
DIAMOND AIRE 1893 AIRPORT ROAD KALISPELL, MT 599017501	NO	NO	**YES**	NO	NO	NO
DISASTER AND EMERGENCY SERVICES 1249 WILLOW GLEN DRIVE KALISPELL, MT 599017541	NO	NO	**YES**	NO	NO	NO
DOUG MILLER SHOPS SE CRN OF HWY 93 S & FOREST KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
DRUG ENFORCEMENT ADMINISTRATION 17 SHADY LANE NUMBER 8 KALISPELL, MT 599012956	NO	NO	**YES**	NO	NO	NO
EISINGER MOTORS 1000 W IDAHO KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
EQUITY SUPPLY COMPANY 150 1ST AVE NW KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
FEDERAL EXPRESS CORPORATION 2033 US HIGHWAY 2 EAST KALISPELL, MT 599012944	NO	NO	**YES**	NO	NO	NO
FERRON & SONS HOME 231 W RESERVE KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
FERRON & SONS BODY SHOP INC 2540 HWY 2 E KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
FLATHEAD CO SHERIFF STORAGE FFA RD KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
FLATHEAD COUNTY ROAD DEPARTMENT 800 SOUTH MAIN KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
FLATHEAD COUNTY ROAD DEPT. - ASPHALT 5 MILES EAST OF KALISPELL	NO	NO	NO	NO	**YES**	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
KALISPELL, MT 59901						
FLATHEAD COUNTY SOLID WASTE DISTRICT NE1/4 NE1/4 SEC 1, T29N, R22W KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
FLATHEAD ELECTRIC COOPERATIVE INCORPORATED 2510 US HIGHWAY 2 EAST KALISPELL, MT 599012397	NO	NO	**YES**	NO	NO	NO
FLATHEAD PROPERTIES MINING PROJECT T 25 N R 23 W KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
FRONTIER TRANSPORTATION 2422 US HIGHWAY 2 WEST KALISPELL, MT 599017303	NO	NO	**YES**	NO	NO	NO
GLACIER FUR DRESSING 2185 3RD AVE E KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
GOOSE BAY EQUIPMENT, INC. 1995 THIRD AVENUE EAST KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
GRIZZLY LOGGINE AND LUMBER LLC 100 SHERMAN ROAD KALISPELL, MT 599018123	NO	NO	NO	NO	**YES**	NO
HEDSTROM DAIRY E 1/2 NW 1/4 OF SEC 9 T29N KALISPELL, MT 59901	**YES**	NO	NO	NO	NO	NO
ICEAN CORPORATION 3975 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
IMPERIAL DRY CLEANERS INCORAPORATED 151 3RD AVENUE EAST NORTH KALISPELL, MT 599014109	NO	NO	**YES**	NO	NO	NO
INDUSTRIAL PACIFIC MACHINE WORKS 640 W MONTANA KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
KALISPELL CITY OF	NO	NO	**YES**	NO	NO	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
1400 1ST AVE W KALISPELL, MT 59901						
KALISPELL REGIONAL HOSPITAL 310 SUNNYVIEW LN KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
KALISPELL WRECKING COMPANY 57 5TH AVENUE EAST N KALISPELL, MT 599014115	**YES**	NO	NO	NO	NO	NO
KLINGLER LUMBER 350 FLATHEAD DRIVE KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
LASALLE SAND AND GRAVEL LLP 1107 ROSE CROSSING KALISPELL, MT 599016634	NO	NO	NO	NO	**YES**	NO
LHC INC 615 W MONTANA KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
LONG MACHINERY 3500 US HIGHWAY 93 SOUTH KALISPELL, MT 599018637	NO	NO	**YES**	NO	NO	NO
MAJOR AEROCRAFTSMAN INCORPORATED 1845 AIRPORT ROAD KALISPELL, MT 599017501	NO	NO	**YES**	NO	NO	NO
MAJOR AEROCRAFTSMAN INCORPORATED 4475 US HIGHWAY 2 EAST KALISPELL, MT 599016517	NO	NO	**YES**	NO	NO	NO
MAKING TRACKS 3981 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
MC ELROY & WILKEN, INC. 86 KHD HMBLT WEDAG B #4620128 KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
MC ELROY AND WILKEN 801 WHITEFISH STAGE KALISPELL, MT 599013771	NO	NO	**YES**	NO	**YES**	NO
MEADOW GOLD DAIRY INCORPORATED 1300 TWO MILE DRIVE KALISPELL, MT 59901	**YES**	NO	NO	NO	NO	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
MENNONITE ROAD MENMILE RD KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
MONTANA DEPARTMENT OF TRANSPORTATION 85 5TH AVENUE EAST NORTH KALISPELL, MT 599014115	NO	NO	**YES**	NO	NO	NO
MONTANA GOLD BULLET 350 18TH ST E KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
MOUNTAIN VIEW PET CREMATORY 3249 US HIGHWAY 93 SOUTH KALISPELL, MT 599017904	NO	NO	NO	NO	**YES**	NO
MSE ENVIRONMENTAL INC KALISPELL 1840 HWY 93 S KALISPELL, MT 599015721	NO	NO	**YES**	NO	NO	NO
MT ARNG OMS 1 1800 HWY 93 S 1800 HWY 93 S KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
MT ARNG OMS 1 2987 HWY 93 N 2987 HWY 93 N KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
MT DOT KALISPELL HUTTON PIT 2359 HWY 93 N KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	**YES**
NORTHWEST PIPE 1780 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
NORTHWESTERN TELEPHONE SYSTEMS 290 N MAIN KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
NUPAC 2355 HWY 93 N KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
OMNI PLASTICS 4005 MONTANA HIGHWAY 35 KALISPELL, MT 599018806	NO	NO	**YES**	NO	NO	NO
PACIFIC POWER AND LIGHT 448 MAIN STREET	NO	NO	**YES**	NO	NO	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
KALISPELL, MT 599014849						
PACK & COMPANY 2355 HWY 93N KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
PALMER BROTHERS AUTO SUPPLY 111 W IDAHO KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
PENSKE AUTO CENTER KALISPELL 245 LASALLE RD KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
PLUM CREEK MANUFACTURING L P EVERGREEN PLYWOOD DIVISION 75 SUNSET DRIVE KALISPELL, MT 599012347	NO	**YES**	**YES**	NO	**YES**	NO
PONDEROSA MOTORS 1177 HIGHWAY 2 EAST KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
PREFERRED PAVING INC 1978 BARBER-GRN DRUM MX-AS PLT PORTABLE, MT 59901	NO	NO	NO	NO	**YES**	NO
PREFERRED PAVING, INC. 1960'S BARBER-GREENE BATCH MIX PORTABLE ASPHALT PLANT, MT 59901	NO	NO	NO	NO	**YES**	NO
R LAZY M ENT., DBA CRESTON SAND & GRAVEL 5915 MONTANA HIGHWAY 35 KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO
RELIANCE REFINING COMPANY 100 1ST AVE E KALISPELL, MT 59901	NO	NO	**YES**	**YES**	NO	NO
RENT-A-WRECK 2425 US HIGHWAY 2 EAST KALISPELL, MT 599012309	NO	NO	**YES**	NO	NO	NO
ROBINSON FOREST PRODUCTS 3182 MONTANA HIGHWAY 35 KALISPELL, MT 599017722	NO	NO	**YES**	NO	NO	NO
ROBINSON POST & POLE 519 EZY DR	NO	NO	**YES**	NO	NO	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
KALISPELL, MT 59901						
RUSSELL OLSEN CONSTRUCTION/TRUCKING 2820 HELENA FLATS ROAD KALISPELL, MT 599016535	NO	NO	**YES**	NO	NO	NO
RYGG FORD 820 E IDAHO KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
SCARFF AUTO CENTER INC. 1212 S MAIN KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
SEMI THERM 4051 HWY 53 S KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
SEMITOOL INCORPORATED RESERVE DR 655 W RESERVE DR KALISPELL, MT 599010000	NO	NO	**YES**	NO	NO	**YES**
SEMITOOL, INCORPORATED 4051 US HIGHWAY 93 SOUTH KALISPELL, MT 599018602	NO	NO	**YES**	NO	NO	NO
SMALLS FARMS INC 305 SMALLS LN KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
SMITHS PHOTO 172 195 3RD AVE KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
SONJUS AUTO BODY SHOP 2902 US HIGHWAY 93 NORTH KALISPELL, MT 599016859	NO	NO	**YES**	NO	NO	NO
STAMPEDE PACKING COMPANY KALISPELL, MT 59901	**YES**	NO	NO	NO	NO	NO
STAMPEDE PACKING COMPANY 2095 AIRPORT ROAD KALISPELL, MT 599017503	**YES**	NO	NO	NO	NO	NO
STEVENS AERO WORKS 2436 US HIGHWAY 93 SOUTH KALISPELL, MT 599017532	NO	NO	**YES**	NO	NO	NO
STILLWATER FOREST PRODUCTS 955 WHITEFISH STAGE	NO	NO	**YES**	NO	**YES**	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
KALISPELL, MT 599013773						
STREICH SEED POTOTOES 1328 TRUMBLE CREEK ROAD KALISPELL, MT 599016741	NO	NO	**YES**	NO	NO	NO
SURE SEAL DUST CONTROL WEST VALLEY DR KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
SUTHERLAND CLOTHES CLINIC 130 2ND ST E KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
THORNTON OIL 2ND AVE EAST N & RAILROAD KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
TOW MASTER 2211 US HIGHWAY 2 EAST KALISPELL, MT 599012815	NO	NO	**YES**	NO	NO	NO
TREASURE STATE FOUNDRY 4063 US HIGHWAY 93 SOUTH KALISPELL, MT 599018602	NO	NO	**YES**	NO	NO	NO
TREE IMAGE 3979 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
TRI CITY WRECKING 3900 US HIGHWAY 2 EAST KALISPELL, MT 599016512	NO	NO	**YES**	NO	NO	NO
UPS KALISPELL CENTER 1151 N MERIDIAN KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
USDOE BPA KALISPELL SUBSTATION 2540 MONTANA HWY 35 KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
USDOE BONNEVILLE POWER ADMINISTRATION(BPA)/KALISPELL MAINTANCE HEADQUATERS 2520 US HIGHWAY 2 EAST KALISPELL, MT 599012312	NO	NO	**YES**	NO	NO	NO
VALLEY EXCAVATING & WEST SHORE GRAVEL 4644 HIGHWAY 93 SOUTH KALISPELL, MT 59901	NO	NO	NO	NO	**YES**	NO

FACILITY NAME/ADDRESS	Permitted Discharges to Water?	Toxic Releases Reported?	Hazardous Waste Handler?	Active or Archived Superfund Report?	Air Releases Reported?	BRS Reporter?
VALLEY MOTOR SUPPLY COMPANY 140 W CENTER ST KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
WAL MART STORE # 2259 KALISPELL 1150 IDAHO ST KALISPELL, MT 59901	NO	NO	**YES**	NO	NO	NO
WASTEWATER TREATMENT PLANT 2001 AIRPORT ROAD KALISPELL, MT 599017503	**YES**	NO	NO	NO	NO	NO
WISHER'S AUTO RECYCLING 2190 AIRPORT ROAD KALISPELL, MT 599017540	**YES**	NO	NO	NO	NO	NO
WOODRING'S CONSTRUCTION 43 CEDAR RAPIDS JAW & ROLL CRS PORTABLE, MT 59901	NO	NO	NO	NO	**YES**	NO