Thompson Falls

SOURCE WATER PROTECTION PLAN

Thompson Falls
Public Water Supply

PWS ID #MT0000341

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by
Source Water Protection Program
Montana Department of Environmental Quality
&
Montana Rural Water Systems, Inc.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

Jeffrey Frank Herrick, a Hydrogeologist with the Montana Department of Environmental Quality (DEQ); Bill O'Connell, a Groundwater Technician with Montana Rural Water Systems, Inc.; and representatives from the City of Thompson Falls completed this Source Water Protection Plan (SWPP).

Purpose
This Source Water Protection Plan (SWPP) is intended to meet the technical requirements for completion of the delineation and assessment report and a protection plan for the public water supply (PWS) of the City of Thompson Falls, 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 (PWSs) from contamination. A major component of the Montana Source Water Protection Program is termed "delineation and assessment." Delineation is a process of mapping areas that contribute water used for drinking. Assessment involves identifying locations in the delineated areas where contaminants may be generated, stored, or transported, and then determining the relative potential for contamination of drinking water by these sources. This source water delineation and assessment is typically combined in the form of a source water delineation and assessment report (SWDAR). The primary purpose of a SWDAR is to provide information that helps the PWS owners and operators, and the residents of Thompson Falls protect their drinking water sources and provide the information needed to develop a Source Water Protection Plan (SWPP). This document is a Source Water Protection Plan that incorporates the elements of the SWDAR and additional information that allow the City of Thompson Falls to take effective steps to protect its water supply.

Limitations
This report was prepared to assess threats to the public water supply in Thompson Falls and is based on published and public information and input obtained from persons familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the PWS in Thompson Falls and not any other public or private water supply. In addition, not all of the potential or existing sources of groundwater or surface water contamination in the area are identified. Only documented or known potential sources of contamination in areas that contribute water to public water supply sources are considered.

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

CHAPTER 1
BACKGROUND

The Community

Thompson Falls is an incorporated town within the Clark Fork River valley and is situated along U.S. Highway 200. It is the seat of Sanders County (Figure 1 & Figure 2). The population of Thompson Falls was estimated at 1,500 people in the 2000 census. The main industries around Thompson Falls have historically been lumber/wood products and some mining, but has shifted toward tourism. A hydroelectric plant is located just south of town on the dam of the Clark Fork River.

The Thompson Falls PWS supplies water to the incorporated city, but residents living outside city limits get water from private wells and/or springs. Thompson Falls also has a municipal sewage treatment plant, but individual onsite septic systems treat sewage for all locations outside city limits.

Geographic setting

Thompson Falls is about 2,420 to 2,500 feet above sea level at 47.59° north latitude and -115.34° west longitude (T 21N, R 29W, Section 8). The community is located in the Clark Fork River valley, which is a north to northwest trending intermountain valley in northwestern Montana. The valley is surrounded by the Coeur d'Alene Mountains on the south and west, and the Cabinet Mountains on the north. The valley ranges from around 2,395 feet in elevation near the river to about 2,800 feet along the base of the Cabinet Mountains. The higher terrain around Thompson Falls consists of forested mountains with rocky mountain peaks that rise above 7,000 to 8,000 feet elevation. The climate of the Clark Fork River valley is consistent with that of other lower elevation basins in the northern Rocky Mountains west of the Continental Divide. The average daily high and low temperatures at the nearest weather station in Thompson Falls are 87.1°F and 49.6°F in July and 31.5°F and 20.6°F in January. Average annual precipitation falls mostly as snow in late fall and winter, and ranges from 36 inches in Thompson Falls to about 70 inches in the Cabinet Mountains.

Table 1. Climatic Data

Collected at Thompson Falls Power HO, Montana (248211)

Period of Record : 2/ 1/1956 to 12/31/2000 - Period of Record Monthly Climate Summary

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
Avg. Max. Temperature (°F)	34.5	42.4	51.5	61.8	71.0	78.0	87.1	86.7	75.8	60.5	43.1	35.0	60.6
Avg. Min. Temperature (°F)	20.6	24.0	27.6	33.2	39.7	46.2	49.6	48.8	41.7	34.3	28.3	22.9	34.7
Avg. Total Precipitation (in.)	2.72	2.02	1.83	1.65	2.07	2.12	1.08	1.25	1.30	1.80	2.69	2.75	23.28
Avg. Total Snowfall (in.)	13.7	4.5	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	12.1	36.9
Avg. Snow Depth (in.)	7	5	2	0	0	0	0	0	0	0	0	3	1

Percent of possible observations for period of record: x. Temp.: 99.8% Min. Temp.: 99.8% Precipitation: 99.8% Snowfall: 78.5% Snow Depth: 85.1%

Source: Western Regional Climate Center, wrcc@dri.edu

Public Water Supply

The Thompson Falls PWS currently uses three sources of water. The historic and future main source of water is a group of springs within the Ashley Creek watershed (located north of town in the Cabinet Mountains). The second source is two shallow production wells located near the Clark Fork River just east of town and south of the high school. These wells tap into the unconfined alluvial aquifer and are currently considered backup wells. The third source is two newer production wells (installed in 2000) located northeast of the high school. These wells tap into a confined aquifer and are currently the primary source of water for the PWS. The town has traditionally relied upon the springs to provide most of the water for the PWS, but avalanche activity within the watershed has affected the turbidity of water that had been collected into a reservoir located near the base of the mountains. To alleviate this turbidity problem, a spring collection and delivery system has been undergoing construction. The spring collection system has been installed, but the final delivery piping work is to be completed early in 2002. This work will allow the PWS to rely upon the springs as the primary source of water. The location of the wells and associated storage tanks are plotted on Figure 3. The Thompson Falls PWS is classified as a Community Non-Transient PWS because it serves over 25 year-round residents.

The shallow Thompson Falls PWS wells are identified as Well #1 and Well #2. These wells are installed in shallow alluvium that appears to lay directly on top of bedrock. It is unclear if the coarse materials encountered at the bottom of the drill holes are boulder deposits (from catastrophic fluvial action), coarse colluvial material (from landslides), or the top of bedrock. Yields reported on logs for these wells are approximately 250 to 1,500 gallons per minute. Static water levels in the area suggest that the stage of the Clark Fork River upstream of the falls (in the pool on the south side of the City of Thompson Falls) is higher than the static water level in the surrounding unconfined alluvium (2000 Production Well Construction report). This suggests that the stream in this reach is losing water into the surrounding area and recharging the groundwater in the unconfined aquifer. The two new wells, identified as Well #3 and Well #4, were drilled and constructed in 2000. Based upon the lithologic logs and aquifer testing they are appear to be installed into a locally confined aquifer and may be screened just above bedrock. It should be noted that it is not clear if the wells were installed in a way that would protect against groundwater communication or cross contamination between the unconfined and confined aquifers (per the ARM - Board of Well Contractors). A typical way to prevent cross contamination between aquifers is to grout/seal into or across the confining unit(s) separating the aquifers. These two new wells yield 350 to 1,100 gallons per minute (noted at time of drilling). The lateral extent of the confining layer above the screened interval for Wells #3 and #4 is limited by the shallow bedrock to the north, south, and east. The Thompson Falls PWS facilities are summarized in Table 2.

Table 2. PWS Relevant Information
Thompson Falls

PWS Name & Address	PWS ID	Class	Service Connections	Residents	Non-Residents	Contact Persons
Thompson Falls Public Water Supply **Attn: Jerry Lacy** **PO Box 99** **108 Fulton** **Thompson Falls, MT 59873** **406/827-3557**	**#00341**	Community	628	1,321	0 (not determined)	Jerry Lacy, Operator 406/827-3501 Dave Sund, Operator 406/827-4981 Kevin Wittenberg, Operator

Table 3. List of Sources
Thompson Falls PWS

Source # 001	Source # 002	Source # 003	Source # 004	Source # 005	Source # 006	Source # 007
Jefferson Street Storage Tank	Ashley Creek Spring Storage Tank	Well #1 (Old Well) Considered a backup well.	Well #2 (New Well)	Well #3	Well #4	Ashley Creek Infiltration Galleries

Water Quality

Water quality data were collected from Ashley Creek and three production wells. Some of these data were summarized in the Thompson Falls Wellhead Protection Plan 1995 and the Production Well Construction report 2000. The data were collected by the City of Thompson Falls in an effort to understand the source of the water present in the local aquifers (Assessment of Ground Water Development Potential, 1998)

Table 4. Water Quality Data

Sampling Date		05/07/1993	05/07/1993	05/07/1993	06/05/2000
Site	**units**	**Ashley Creek**	**Old Well Well #1**	**New Well Well #2**	**Production Well Well #3**
pH		8.6	8.13	8.09	7.91
Specific Conductance	umhos/cm	165	163	387	293
Hardness	Grains /gallon	4.1	4.2	10.9	
Hardness as $CaCO_3$	mg/l	70.8	73.1	186.7	
Calcium	mg/l	20.1	21.2	55.1	42.1
Iron	mg/l	<0.01	<0.01	0.04	<0.05
Manganese	mg/l	<0.005	<0.005	0.454	<0.01
Magnesium	mg/l	5	4.9	11.9	13.3
Sodium	mg/l	0.4	0.3	3	2.25
Alkalinity	mg/l	74	171	199	168
Sulfate	mg/l	6	<6	7	3.65
Nitrate plus Nitrite as N	mg/l	0.06	0.04	<0.01	<0.50

Note: The 1993 values above are taken from the 1995 Wellhead Protection Plan.

The above water quality data suggest that water in Well #1 and Ashley Creek have a common source and appear to be different from that of the other wells. The Old Well (Well #1) was installed before 1947. The New Well (Well #2) produced water with higher concentrations of dissolved solids. This water quality prompted the drilling and installation of Wells #3 and #4. Several large-scale landslides occurred in the Ashley Creek drainage (1996-1997) that increased the turbidity of the spring water collected into a small reservoir at the mouth of the stream. Until that point, the PWS spring water source had not required filtration. This problem was addressed by the installation of an entirely new spring collection system in 1999 and 2000. The new spring water collection system appears to consist of 5 infiltration galleries, a new collection and piping system, and a new water tank (to replace the Ashley Creek Reservoir). The infiltration galleries are positioned on the hillslopes below several springs flowing into Ashley Creek.

Water Distribution and Treatment

The following Table 5 describes treatment of the Thompson Falls PWS. See the most recent sanitary surveys in Appendix C for details about system operation.

Table 5. Water Distribution and Treatment of the Thompson Falls PWS

Public Water Supply Location (Treatment Point)	Water Distribution	Treatment
TP 002, Ashley Creek Intake / StorageTank	Collection point above the tank for lines bringing water from the spring water collection galleries farther up the canyon	Disinfection by chlorination
TP 003, Well #1	Piping near the well	Disinfection by chlorination
TP 004, Well #2	Piping near the well	Disinfection by chlorination Aqua-Mag is used to remove Mn & Fe
TP 005, Well #3 & #4	Piping near the wells at a common header	Disinfection by chlorination

Note: This information was derived from the most recent Sanitary Survey conducted on 10/16/2001.

Monitoring and Enforcement Actions

The Thompson Falls PWS sources are routinely monitored for compliance with drinking water standards. Bacteriological monitoring occurs monthly. Compliance with other drinking water standards is based on additional sampling, which is conducted on a variety of schedules or as required. No contaminants exceeded the established standards in the last 5 years. In all instances where coliform bacteria were detected, repeat samples were negative. Nitrate samples ranged from not detected to an occasional value of 0.64 mg/kg. Note that these values occurred seldom and without any distinguishable pattern. It should also be mentioned that nitrate can come from human or animal wastes, but also is naturally occurring (from wildlife). Landslides within the Ashley Creek watershed in 1997 led to an increase of turbidity in water samples collected from the spring intake. This increased turbidity led to the suspension of permission to avoid filtration of the spring-supplied water. Upon completion of the spring water collection system upgrade (to be finished by spring 2002), the sampling waiver may be appropriate and acceptable for the spring water source. There are no records of DEQ Enforcement actions taken against this PWS.

Influencing Factors

The cause of any nitrate or coliform bacterial contamination is often the result of a combination of factors. These contributing factors include: the proximity of septic tanks to wells, aquifer sensitivity, the existence of hydraulic connections between surface water and production wells, potentially poor sanitary conditions of some wells, and potentially poor construction of the wells or the distribution system. Additionally, inconsistent sampling procedures or sample handling could result in the detection of these constituents. The hydrogeology of the confined and unconfined aquifers contributes to a short residence time for groundwater (high groundwater velocity) which suggest that there is considerable mixing and dispersion of potential contaminants with local sources (Kendy and Tresch, 1996). The high velocity of groundwater is discussed in the geology/hydrogeology section of Chapter 2. The area contributing water to the production wells and to the Ashley Creek watershed is discussed in Chapter 2.

CHAPTER 2
DELINEATION

The source water protection areas for the Thompson Falls PWS sources are delineated in this chapter. The purpose of delineation is to map the source of drinking water and to define areas within which to prioritize source water protection efforts. Four types of management regions are mapped for the Thompson Falls PWS. These are the Control Zone, Inventory Region, Surface Water Buffer, and Recharge Region. The goal of management in the Control Zone (an area within a 100 foot radius circle around the well) is to protect against direct introduction of contaminants into PWS wells from immediate surrounding areas. The Inventory Region represents the effective zone of contribution to the well, which approximates a 3-year groundwater time-of-travel distance. The goal of management in the Inventory Region is to protect water quality for the present and near future. The Surface Water Buffer is an area from which water or contaminants can flow to the area of the well by means of the major surface water channels. The Recharge Region represents the entire portion of the aquifer that contributes water to the Thompson Falls area (this is essentially a portion of the watershed or the whole watershed). The goal of management in the Recharge Region is to maintain and improve water quality over long periods.

Hydrogeologic Conditions

The geology of the Clark Fork River valley is a description of the sediments and bedrock of the valley and surrounding area. This information is relevant because these rock units and sediments comprise the aquifers (the water bearing formations) into which the Thompson Falls PWS wells are installed and are materials that supply groundwater to the springs in the Ashley Creek drainage. The hydrogeology is a description of the presence and movement of groundwater in the bedrock and within the Clark Fork River valley. This discussion is relevant because it helps the reader to understand where the PWS wells are obtaining their groundwater and the vulnerability of that source of water to contamination. Most of the following information was drawn from Alt and Hyndman (1990), the Wellhead Protection Plan (1995), and the Production Well Construction report (2000).

Geology

The bedrock of the Cabinet and Coeur d'Alene Mountains is primarily Belt SubGroup sedimentary rock of Precambrian age. The Belt SubGroup rock is comprised of formations of metasediments, primarily quartzite, argillite, with some carbonate (limestone) units (Kendy and Tresch, 1996). They are not highly deformed. The region is extensively faulted with two main sets of fault zones in the area of Thompson Falls. Ancient and modern streams have exploited these fault zones and created the river channels seen today. The first set is a series of northwest trending strike-slip faults running at about 45° Northwest. The displacement along these faults is right-lateral with the eastern side of the fault moving southeast relative to the western side of the fault. The amount of displacement is not known. The northwest trending zone that is currently occupied by the Clark Fork River channel is called the Hope Fault Zone. A second set of faults are thrust faults (reverse faults) that trend north to south through the region. Thrust faults are a result of foreshortening of the continental crust in this region due to compressive tectonic forces (collisions between continental plates). Near the end of the Mesozoic Age the younger sediments that covered this area were somehow removed and displaced to the east along the north-south trending faults. This material ended up located to the east and is collectively called the overthrust belt. The uncovered older sediments (mostly Precambrian) were allowed to float upward (there was less mass above them) and some steeper angled faults cut through the reverse faults. These steep, near vertical faults are attributed to the process of unloading with the older rocks floating upward unevenly with breakage between areas of unequal buoyancy. The Clark Fork River valley was not glaciated at any point in the recent geologic past. However, it was the avenue that glacial Lake Missoula used to drain catastrophically to the west. Alt and Hyndman (1990) suggest that during the draining of the lake through this valley, the flow volume reached 8 to 10 cubic miles of water per hour. This repeated flooding scoured the valley down to the bedrock in places and left a considerable volume of coarse sediment in localized bars along the river channels. Geologic maps are presented on Figure 4 and Figure 5. An idealized schematic cross section is seen on Figure 6.

Stratigraphy in the area of Thompson Falls has never been carefully worked out. An idealized schematic cross section is represented on Figure 6. Bedrock is exposed on both flanks of the valley as rock outcrops on the Cabinet and Coeur d'Alene Mountains. Bedrock is shallow (40 to 60 feet below ground surface) on the south side of the river and is less than 25 feet below the base of the river. The deepest part of the valley (and the part containing the thickest sediments) is located north of the present-day river channel. The depth to bedrock in the center of the valley is thought to be more than 200 feet below the ground surface. Bedrock is also shallow just east of where the Thompson River drains into the Clark Fork River. The evidence for this is that the Clark Fork River valley narrows considerably at that location, suggesting that bedrock is constraining surface and subsurface flow. The valley between the falls south of Thompson Falls and where the Thompson River enters the Clark Fork River, and the area between the Cabinet Mountains and the Coeur d'Alene Mountains forms a large bedrock trough filled with sediments. At various times in the history of the basin, fine sediments accumulated in its bottom. The lithologic logs suggest the presence of laterally discontinuous silt and clay layers deposited primarily between 150 and 180 feet below ground surface. The lateral extent of these silt and clay rich layers is not known, but it is reasonable to suppose that they extend from the bedrock on one side of the deepest part of the valley to the other side and from the bottleneck near the Thompson River to the falls at Thompson Falls. These confining beds have never been mapped to confirm their lateral extent. Coarse sand, gravel, and silt were then deposited by stream action above these zones and make up the present valley floor and riverbed. The origin of the large terrace located between Thompson Falls and the mouth of Ashley Creek has never been determined and can, in fact, have several different origins. It is possibly a stream terrace related to the draining of glacial Lake Missoula; an alluvial fan for Ashley Creek; and/or colluvial material from a localized landslide.

Hydrogeology

Groundwater is a widely used source of water for the residents in and around the Clark Fork River valley. The City of Thompson Falls has a spring water collection system installed in the Ashley Creek drainage to intercept and collect groundwater before it discharges into Ashley Creek. The springs of the Ashley Creek basin have been used as a water source for more than a century, but in the past the water was collected in a surface water reservoir before being piped to the town. The primary aquifers for the Thompson Falls PWS wells are the shallow unconfined alluvial aquifer (for Wells #1 and #2) and the deeper confined aquifer (for Wells #3 and #4). The springs in the Ashley Creek Watershed receive water from a fractured bedrock aquifer that is discharging groundwater to the near surface close to the bottom of the Ashley Creek drainage. The shallow alluvial aquifer and the deeper confined aquifer in the area near Thompson Falls are bounded by the lower conductivity Precambrian bedrock that underlies and surrounds the valley. The lateral extent of both aquifers are limited by the bedrock bottleneck just east of the Clark Fork River's confluence with the Thompson River, and on the west by the bedrock high expressed as the falls of Thompson Falls. Groundwater is abundantly available from both aquifers and from the springs in the Ashley Creek Watershed. The confined aquifer is probably recharged predominately by water moving from the fractured rock into the coarser and higher conductivity materials in the bottom of the bedrock trough. Inter-aquifer movement by water has not been studied in this area and is not understood. The unconfined aquifer is clearly recharged by seepage from the bedrock and from infiltration of water from Ashley Creek. A much larger source of water for the unconfined aquifer is the Clark Fork River itself, which begins flowing into the unconfined alluvium as soon as it passes through the bedrock bottleneck east of the confluence with the Thompson River. Based upon the hydrogeologic setting (discussed in Table 6 below), the springs in Ashley Creek and the shallow aquifer are classified as having a high source water sensitivity to contamination. With the same criteria, the deeper confined aquifer is characterized as having a low source water sensitivity to contamination.

Water for the spring collection galleries originates within the fractured bedrock of the Ashley Creek watershed. The groundwater within the fractured rock in and around the Ashley Creek drainage is considered to be under unconfined or semi-confined conditions until it reaches the thin overburden that mantles the hillslopes. At that point, the groundwater is clearly moving in unconfined conditions along the bedrock-overburden interface. Since the overburden is thin (0 to 2 feet thick), the presence of a shallow water table is usually evidenced by hydrophilic/hydrophytic vegetation. Most groundwater discharged into and transported in local streams does not reach the Clark Fork River as surface flow, but will infiltrate into the coarser alluvial materials and move as groundwater. Ashley Creek is an example of this, as the surface flow disappears underground before reaching the Clark Fork River. The water table on both the north and south side of the Clark Fork River is typically between 5 to 30 feet below ground surface.

Two aquifers are present in the unconsolidated alluvial and colluvial deposits in the area of Thompson Falls. The deep aquifer appears to be confined. It is recharged by groundwater entering it directly from the surrounding bedrock. The materials that comprise this aquifer are coarse to very coarse sand, gravel, cobbles, and boulders. The Production Well Construction report (2000) suggests that the groundwater gradient is shallow (0.006 feet/foot), and the water flows at a high velocity parallel to the river (flowing to the west and northwest). It is not clear if there is much interconnection between the confined aquifer and the unconfined aquifer above it. Many wells penetrate the finer grained confining units and are poorly sealed across these units. When pumped, these boreholes can act as a conduit for upward and downward movement of groundwater between these aquifers. It can also allow contaminant movement between the aquifers. The lithologic logs indicate that if interconnected, there will be a strong downward vertical gradient between the shallow and deep confined aquifers. The lower confined aquifer is approximately 45 to 55 feet thick (the Production Well Construction report (2000) suggests an effective thickness of 34 feet). The confining layers above it are approximately 15 to 25 feet thick. It should be noted that the confining layers are comprised of numerous laterally discontinuous lenses of fine sand, silt, and clay that probably act in concert to restrict water movement between the unconfined and confined aquifers. The lateral limits of these confining layers are not known, but their extent is limited by the geometry of the bedrock trough in which they were deposited. At their greatest lateral extent, these low flow layers may extend as far east as the outfall of the Thompson River; as far west as the falls of Thompson Falls; as far south as the north shore of the Clark Fork River; and as far north as the range front of the Cabinet Mountains.

The upper alluvial aquifer is approximately 100 to 130 feet thick, depending on where it is measured and is considered semi-confined to unconfined. It is limited in lateral extent by the same constraints as is the deeper confined aquifer. The unconfined aquifer overlies the confining unit in the deepest part of the valley bedrock trough but drapes against the bedrock on all other sides. Note that the unconfined alluvial aquifer covers a bedrock bench on the south side of the Clark Fork River with a thickness that appears to be between 30 to 60 feet. No confining layers appear to be present on the south side of the river. This aquifer is comprised of unconsolidated coarse sand, gravel, and cobbles laid down more recently than the catastrophic draining of glacial Lake Missoula. The fluvial materials were deposited in meandering stream channels that interwove and successively crosscut each other in complex patterns as the river channel migrated back and forth across the river valley. Water levels range from 5 to 30 feet below ground surface in most places.

Groundwater flow direction is based upon several factors. In fractured bedrock, groundwater flows primarily downhill and eventually discharges at points where the water moving through the rock or sediment intersects with the ground surface. Generally it flows from high ground toward low ground and eventually discharges to the surface, enters the unconfined aquifer, or it enters the deeper confined aquifer. In the Production Well Construction report (2000) a groundwater gradient was calculated for the confined aquifer based on water levels in the newly installed Wells #3 and #4 and a test well. The groundwater was flowing northwest, which is relatively parallel to the Clark Fork River and the front of the Cabinet Mountains. The confined aquifer is probably being recharged primarily from the surrounding bedrock. Please refer to the cross section diagram on Figure 6. On this figure, it should be noted that the reader is looking to the west and northwest. Groundwater flow is generally toward the valley trough and it enters the confined aquifer from the sides and bottom. At that point, the water begins to move quickly in a westerly direction. The Production Well Construction report (2000) and calculations made by Jeffrey Herrick (DEQ SWPP) suggest that groundwater movement is about 60 feet per day. This is fast-moving groundwater. Groundwater flow in the unconfined aquifer is constrained to move in a northwesterly direction. Recall the boundaries on this upper alluvial aquifer include the front of the Cabinet Mountains to the north; the front of the Coeur d'Alene Mountains to the south; the falls of Thompson Falls to the west; and the bedrock bottleneck in the Clark Fork River valley just east of the confluence with the Thompson River. All groundwater and surface water in the valley must eventually discharge to the west, The area of the confluence with the Thompson River is where the initial recharge of the alluvial aquifer begins. It is recharged from the surrounding bedrock and from surface streams. It was mentioned in several of the documents (referenced in this report) that the level of water in the pool above the falls of Thompson Falls was higher than the water level in the surrounding wells. This indicates that water is leaving the river and recharging the surrounding aquifer above the falls. Therefore, groundwater flow direction near the pool and for some distance upstream is away from the river to the south and southeast. The flow in the Clark Fork River is maintained at a relatively steady level by upstream dams. The result of this is that the pool at Thompson Falls maintains a relatively steady elevation throughout the year and from year to year. Groundwater coming from the Cabinet Mountains flows predominately to the south and southwest, which is generally toward the river. Refer to the model of groundwater movement on the schematic cross section on Figure 6. The model suggests that the river is continuously discharging into the unconfined alluvial aquifer along the entire stretch of river between the Thompson River confluence and the falls. If this is the case, groundwater movement in the unconfined aquifer is parallel to that in the confined aquifer. A model of groundwater flow patterns in the area of Thompson Falls is presented on Figure 7. This model is useful to visualize the recharge and discharge areas of the river and aquifer. A published groundwater velocity was never found for the unconfined aquifer. The available data suggest that the groundwater is traveling as fast, or faster, in the unconfined alluvial aquifer than in the confined aquifer. It is noteworthy that Well #1 and #2 are both installed in the shallow alluvial aquifer. Although they are located adjacent to the pool of the falls of Thompson Falls, they appear to have different groundwater chemistry. This suggests that they draw their water from somewhat different sources. The New Well (Well #2) appears to contain greater dissolved solids. It has been suggested (but never verified) that this well draws a large portion of its water directly from water bearing fractures in the underlying bedrock. The chemistry of Well #1 is similar to water from Ashley Creek. A comparison wasn't made with water collected from the Clark Fork River.

In summary, the primary sources of water for the Thompson Falls PWS are:

- the shallow unconfined alluvial aquifer (for Wells #1 and #2),
- the deeper confined aquifer (for Wells #3 and #4), and
- the springs in the Ashley Creek Watershed which receive water from a fractured bedrock aquifer discharging groundwater to the near surface close to the bottom of the Ashley Creek drainage.

The shallow alluvial aquifer and the deeper confined aquifer in the area near Thompson Falls are bounded by the lower conductivity Precambrian bedrock that underlies and surrounds the valley. The lateral extent of both aquifers are limited by the bedrock bottleneck just east of the Clark Fork River's confluence with the Thompson River, and on the west by the bedrock high expressed as the falls of Thompson Falls. Groundwater is abundantly available from both aquifers and from the springs in the Ashley Creek Watershed. The confined aquifer is probably recharged predominately by water moving from the fractured rock into the coarser and higher conductivity materials in the bottom of the bedrock trough. Inter-aquifer movement by water is not understood. The unconfined aquifer is clearly recharged by seepage from the bedrock, infiltration of water from Ashley Creek, and the Clark Fork River. The springs in Ashley Creek and the shallow aquifer are classified as having a high source water sensitivity to contamination. With the same criteria, the deeper confined aquifer is characterized as having a low source water sensitivity to contamination.

Table 6. Source Water Sensitivity, Determination of

Source Water Sensitivity (based upon the aquifer from which the PWS draws its water)
High Source Water Sensitivity Surface Water and Groundwater Under the Direct Influence of Surface Water (GWUDISW) **Unconsolidated Alluvium (unconfined aquifer conditions)** 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 aquifer conditions)
Low Source Water Sensitivity Consolidated Sandstone Bedrock Deep Fractured or Carbonate Bedrock **Semi-consolidated Valley Fill Sediments (confined aquifer conditions)**

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. For the Thompson Falls PWS, 3 different sources of water are utilized. Spring water drains from the fractured bedrock in the Ashley Creek Watershed into subsurface spring water collection structures. The unconfined alluvial aquifer receives recharge from the surrounding bedrock and from Ashley Creek, but is supplied a majority of its water by the Clark Fork River. The river is believed to drain into the unconfined alluvium throughout the reach from the Thompson River to the falls at Thompson Falls. The effective boundaries of the unconfined aquifer are the bedrock range front of the Cabinet Mountains on the north, the Coeur d'Alene Mountains on the south, the bedrock bottleneck east of the confluence with the Thompson River, and the bedrock high of the falls at Thompson Falls. The confined aquifer occupies a bedrock trough located in the area directly beneath the unconfined aquifer and north of the current river channel. The boundaries of the confined aquifer are similar to those of the unconfined aquifer, but the area is smaller (with the Clark Fork River as the southern boundary). The confined aquifer is bounded on top by some low conductivity silt and clay units and the bottom of it rests on bedrock. Its recharge comes primarily from the bedrock. The volume of the confined aquifer does not appear large, but there is no doubt it is supplied with considerable water, which is available to the Thompson Falls PWS. Both the confined and unconfined aquifers have a considerable amount of water moving through them and both have groundwater moving from southeast to northwest, which is parallel to the Cabinet Mountains range front and the Clark Fork River.

Well Information

The PWS wells listed and summarized on Tables 2, 3, and 5 are all located east of the City of Thompson Falls (refer again to Figure 2 & Figure 3). The information on each well has been compiled from all available sources, to include: DEQ's PWS database, Montana Bureau of Mines and Geology (MBMG) GWIC database, the Montana State Library Natural Resource Information System (NRIS), and information taken from PWS Sanitary Survey. The most recent Sanitary Survey of the PWS was conducted in 2001 and a copy is found in Appendix C. The well logs for the PWS wells are found in Appendix A. Representative well logs for the other wells in the area of the Thompson Falls PWS and on both sides of the river are also found in Appendix A.

Table 7. PWS Well Information
Thompson Falls PWS

	Old Well Well #1	New Well Well #2	Well #3	Well #4
PWS ID #	00341	00341	00341	00341
PWS Source ID #	003	004	005	006
Well Location (T, R, S)	T21N R29W S9 CAAB	T21N R29W S9 CABA	T21N R29W S9 AACC	T21N R29W S9 AACC
Latitude Longitude	47.5925 -115.3246	47.5924 -115.3252	47.5970 -115.3169	47.5970 -115.3168
MBMG GWIC #	173088	76356	188077	188076
DNRC Water Right #	W133418-00	P046941-00	Unknown	Unknown
Date Well was Completed	Before 1947	06 January 1983	04 May 2000	29 May 2000
Total Depth (feet bgs)	~47	54	201	195
Screen Interval (feet bgs)	25-47	Unknown	171-191	184-194
Static Water Level (feet bgs)	18	14.6	104	105
Pumping Water Level (feet bgs)	18.21	20	105	110
Drawdown (feet)	0.21	5.4	1	5
Yield = Q (gal/min)	250	1,250	370	760
Yield = Q (ft^3/day)	48,122	240,610	71,220	146,291
Test Pumping Rate (gal/min)	250	1,250	370	1,100
Specific Capacity = Q/drawdown	1,190	368	370	152

- This PWS is considered a Community Non-Transient Public Water Supply.
- According to MT DEQ’s WQB-3 concerning PWS wells, when the water table is less than 25 feet below ground surface, disinfection is required.

Aquifer Properties

Estimates of aquifer properties including hydraulic gradient, well discharge rate, and ambient groundwater flow direction are used to determine the 3-year time-of-travel distance and to model potential "capture zones" for the PWS wells. Capture zones are the areas of the aquifer surrounding a pumping well that actively contribute groundwater to that well. This area of contribution is evidenced by the measurable cone of depression in the aquifer's potentiometric surface. The aquifer properties typically estimated are transmissivity, hydraulic conductivity, the aquifer's thickness, and effective porosity of the media. Flow test (or well pumping) data from well logs and representative published values were used to estimate hydraulic conductivity. Values for hydraulic conductivity, gradient, and velocity were published for the confined aquifer in the Production Well Construction report (2000). Unfortunately, groundwater potentiometric surface elevation maps for the confined and unconfined aquifers do not exist. The input parameters used to calculate a 3-year time-of-travel distance for groundwater movement are summarized on Table 8.

Table 8. Estimates of Input Parameters for Delineation Thompson Falls PWS

Input Parameter	Range of Values and Units	Well #1 Old Well	Well #2 New Well	Well #3	Well #4
PWS Source		003	004	005	006
Transmissivity T	ft^2/day	500,000*	118,200**	102,000**	102,000**
Screen Length L	Feet	22	Unknown	20	10
Thickness b	Feet	29	39	34	34
Hydraulic Conductivity K = T/b	Feet/day	3,000	3,000	3,000	3,000
Hydraulic Gradient	Feet/Feet	0.01	0.01	0.006	0.006
Flow Direction		Northwest	Northwest	Northwest	Northwest
Effective Porosity Ne	0.2-0.3	0.3	0.3	0.3	0.3
Pumping Rate Q	ft^3/day	48,122	240,610	71,220	146,291
1-Year TOT	Feet – Calculated	36,173	36,728	22,031	22,142
3-Year TOT	Feet - Calculated	109,583	109,763	65,851	65,984
3-Year TOT	Miles - Calculated	20.75	20.79	12.47	12.50

*This value for Transmissivity T was derived from pump test data using the Jacob's modification of the Theis Equation. Found in the Production Well Construction report (2000).

**This value for Transmissivity T is derived from the known relationship of T= Kb, with K and b known values.

Screen Length L is found in the published well logs.

Thickness b is assumed in this situation to be the saturated thickness of the aquifer rather than the screen or sand pack length. This information is found in the lithologic logs.

Hydraulic Conductivity K is a near maximum published value for the sands and gravel from Weight and Sonderegger (2000).

Hydraulic Gradient for the confined aquifer was taken from the published estimate in the Production Well Construction report (2000). The hydraulic gradient in the unconfined alluvial aquifer has never been determined. The value used above (0.01 feet/feet) is a simple educated guess.

Flow direction was taken from the Production Well Construction report (2000) and from an evaluation of site conditions. No water table contour maps have been produced for this area.

Effective porosity Ne was taken from published values found in Weight and Sonderegger (2000). The same value was used for all PWSs.
Pumping rate Q is found in the published well logs.
TOT is groundwater Time of Travel for the various wells, and was calculated using EPA's uniform flow equation. The spreadsheet used to do the calculation and the equation are found in Appendix B. One should note that this is a long travel distance reflective of high groundwater velocities through the aquifers beneath this area.

Delineation Results

Table 9 below discusses the criteria used to delineate source water protection regions around a PWS. For the Thompson Falls PWS wells, a 100 foot radius Control Zone was delineated around each well.

Table 9. Methods and Criteria for Delineation of Source Water Protection Regions

If Your Source of Water Is:	Delineate These Water Protection Regions	Method For Each Region:	Minimum Distance Values & Type of Inventory Required
Unconfined or Semi-confined Aquifers ***(this is the shallow alluvial aquifer, this applies to the shallow wells #1 & #2)***	**Control Zone**	Fixed radius	Distance - 100 feet
	Inventory Region	Time-Of-Travel Calculation	Distance - Larger of 1,000 feet up-gradient or 3-year TOT + *****half-mile buffer around hydraulically connected surface water for 10 miles upstream
	Recharge Region	Hydrogeologic mapping	Physical and Hydrologic flow boundaries
*** Ground Water that is Hydraulically Connected to Surface Water** ***(this applies to the shallow wells #1 & #2)***	**Surface Water Buffer**	Fixed Distance	One-half mile buffer extending upstream a distance corresponding to a 4-hour TOT but not to exceed ten miles or the nearest intake. Buffer will not exceed the extent of the watershed.
Confined Aquifers ***(this is the confined aquifer beneath the unconfined aquifer in the center of the valley, it could apply to wells #3 & #4 if the PWS didn't use the water from wells #1 & #2)***	**Control Zone**	Fixed radius	Distance - 100 feet
	Inventory Region	Fixed radius	Distance - Minimum of 1000 feet
	Recharge Region	Hydrogeologic Mapping	Physical and hydrologic flow boundaries
Surface Water Source ***(this does not apply to this PWS)***	**Spill Response Region**	Fixed Distance	One-half mile buffer extending upstream a distance corresponding to a 4-hour TOT but not to exceed ten miles or the nearest intake. Buffer will not exceed the extent of the watershed.

Delineating the Inventory Region for this PWS is a little more complex than usual. For the Thompson Falls PWS wells, the velocity of groundwater was calculated for the confined aquifer in the Production Well Construction report (2000) and for the unconfined and confined aquifers by Jeffrey Herrick (DEQ SWPP). The confined aquifer's groundwater velocity is believed to be around

60 feet/day. The unconfined alluvial aquifer has a velocity around 100 feet/day. The above range of velocities yielded 3-year groundwater times-of-travel of 12.5 to 20.5 miles, respectively. Although this calculated distance is only an estimate, it is reflective that groundwater moves into and through the upper alluvial and lower confined aquifers very rapidly. It is not feasible or realistic to delineate a 20-mile Inventory Region that is comprised of disconnected and unrelated aquifers. Thus, the Inventory Region delineated in this report for the Thompson Falls PWS wells only encompasses areas where contaminant sources may realistically have the potential to impact groundwater that in turn may reach the PWS wells. If a PWS uses wells that exclusively remove water from a confined aquifer, the Inventory Region for the PWS wells is a minimum 1,000-foot radius circle around the wellhead. The Thompson Falls PWS mixes water from both shallow and deep aquifers with the water from Ashley Creek springs. The mixing of water from the two different aquifers suggests that delineation based upon hydrogeologic mapping is more appropriate for this situation. This delineated Inventory Region is designed to encompass a majority of the unconfined alluvial aquifer. The delineated Inventory Region is seen on Figure 8 and Figure 9. Note that the entire delineated Inventory Region is located within a 1-year groundwater time-of-travel distance. Groundwater is estimated to travel between 4 to 6.9 miles/year in the aquifers beneath the Thompson Falls Inventory Region. This affects how hazards from inventoried potential contaminants are rated in the next chapter. For the purposes of the inventory discussed in the next chapter, the Ashley Creek Watershed is treated as an Inventory Region. The Ashley Creek Watershed has been carefully managed in conjunction with the US Forest Service by Watershed Control Plans and Management Plans since 1984. As such, the inventory reveals little new information. There are few known potential contaminant sources in the Ashley Creek Watershed that would present a hazard to this Thompson Falls PWS source. The Ashley Creek Watershed is displayed on Figure 8 and Figure 10.

Because of the rapid movement of groundwater through the unconfined alluvial aquifer and evidence that suggests that the river is discharging into the shallow unconfined aquifer, that aquifer is considered to be hydraulically connected to surface water (there is surface water – groundwater interaction). As such, a Surface Water Buffer was delineated. This Surface Water Buffer encompasses approximately 0.5 miles on either side and 10 miles upstream along the primary stream channels. The Surface Water Buffer is displayed on Figure 11.

The Recharge Region is considered the entire watershed for a stream drainage and the aquifer(s) that supply water to the PWSs. The entire Clark Fork and little Thompson River watersheds are too large to be easily manageable. The Recharge Region for this report encompasses the Clark Fork River drainage extending approximately 10 miles upstream from Plains. It also encompasses the Thompson River drainage up through the Middle Fork Thompson River to a location just north of the confluence with Big Rock Creek. The Recharge Region is depicted on Figure 12.

Limiting Factors

The reader should keep in mind that the delineation of the Inventory Region is based upon the estimated 3-year groundwater time-of-travel (TOT). The TOT estimate was in turn based upon assumptions of groundwater flow direction and velocity (which describe a probable capture zone for the wells). The estimated values are so large in this area that the authors of this report reduced the Inventory Region area to a more manageable size that encompasses a majority of the alluvial valley east and south of Thompson Falls and extends to the narrow valley walls just east of the confluence with the Thompson River. Conclusions based on the authors' interpretation of the hydrogeology are uncertain because the extent and properties of the aquifer, and the direction and rate of groundwater flow are not precisely known. This is especially true when addressing groundwater behavior beneath specific locations in the Clark Fork River valley.

CHAPTER 3
INVENTORY

An inventory of potential contaminant sources was conducted to assess the susceptibility of the Thompson Falls PWS wells to contamination and to provide a basis for source water protection planning. The inventory focuses on areas of known contamination, facilities that use, generate, transport, or store potential contaminants, and certain land uses within the Inventory Region, Surface Water Buffer, and Recharge Region delineated in the previous section. Sources of all primary drinking water contaminants and pathogens are identified, although only potential sources of contaminants that are the greatest threat to human health were selected for detailed inventory. The contaminants of greatest concern to the Thompson Falls PWS are nitrate, pathogens, fuels, solvents, and pesticides.

Inventory Method
Databases were searched to identify businesses, and land uses that are significant potential sources of regulated contaminants. The following steps were followed:

Step 1: Land use was identified from the National Land Cover Dataset compiled by the U.S. Geological Survey and the U.S. Environmental Protection Agency (USGS, 2000). Land cover types in this dataset were mapped from satellite imagery at 30 meter resolution using a variety of supporting information.

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/LUST sites), hazardous waste contaminated sites, landfills (State Superfund Sites), and abandoned mines. These include, but are not limited to, the DEQ Hazardous Waste Site Cleanup Bureau - Petroleum Release Section and State Superfund Sections databases. The DEQ SWPP/NRIS Mapper was also used to identify and locate these sites.

Step 4: A business telephone directory/database was consulted to identify businesses that generate, use, or store chemicals in the Inventory Regions. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were targeted by SIC code (Standard Industrial Classification Code).

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

Step 6: All significant potential contaminant sources were identified within the inventory regions. This includes sources of nitrate and microbial contaminants identified in the Surface

Water Buffer, and land uses and facilities that generate, store, or use large quantities of hazardous materials identified within the Recharge Region.

Potential contaminant sources are designated as significant under the Montana Source Water Protection Program if they fall into one of the following categories:

- Large quantity hazardous waste generators
- Landfills
- Hazardous waste contaminated sites
- Underground storage tanks
- Major roads or rail transportation routes
- Cultivated cropland
- Animal feeding operations
- Wastewater treatment or spray irrigation lagoons
- Septic systems
- Sewered residential areas
- Storm runoff (e.g. from logging operations)
- Floor drains, sumps, or dry wells (essentially Class V Injection Wells)

In support of this inventory, an evaluation of land use was made for the area within the Inventory Region, the Surface Water Buffer, and the Recharge Region/Watershed. Maps were developed that depict land use within these areas using the USGS 30 meter Landcover data (2000). An analysis was performed on these data that allowed for a quantified determination of primary land uses. The land use maps and the supporting analyses for these areas are found on the following pages.

Inventory Results/Control Zones

The Control Zone is the area located within 100 feet of a PWS well. Nitrate from over application of lawn chemicals (such as fertilizers) to lawns and landscape is a potential contaminant source for PWS Wells #1 and #2 which are surrounded by the high school property and draw water from the shallow unconfined aquifer. The Control Zones for the PWS wells discussed in this report (the area immediately around each wellhead) appear to be owned and controlled by the City of Thompson Falls and no obvious potential sources or activities were noted in the Sanitary Survey report for 2001. A copy of the Sanitary Survey for 2001 is found in Appendix C. A complete inventory of potential contaminant sources in and around Thompson Falls is provided in Appendix D.

Inventory Results/Inventory Regions

Ashley Creek Watershed

The entire watershed for Ashley Creek is owned by the US Forest Service / Lolo National Forest. An Ashley Creek Municipal Supply Watershed Management Plan was developed in 1984. This plan was upgraded in 1993 as the Ashley Creek Municipal Watershed Control Plan. Through these plans and with the cooperation of the US Forest Service, the entire watershed is managed as a municipal watershed. Vehicular access is extremely limited and other activities in the watershed are closely restricted and managed in order to preserve water quality. There are no anthropogenic (man made) potential sources of contamination within the boundaries of the watershed. The watershed is primarily forested and no agricultural activities are allowed. A land use map of the Ashley Creek Watershed is presented on Figure 8 and Figure 10. No pesticides, herbicides, or other chemicals are known to be used or stored in the watershed.

Inventory Region

Businesses and facilities located within the boundaries of the Inventory Region that handle, store, or generate hazardous materials are considered potential contaminant sources. They would qualify as significant potential contaminant sources if they are described by one or more of the categories listed above. Inventoried significant potential contaminant sources are addressed in the next chapter. The businesses and land uses within the Inventory Region that are considered potential sources are listed on Table 10. A complete inventory of potential contaminant sources in and around Thompson Falls is provided in Appendix D. It is important to remember that these businesses or facilities are included on the list solely because of the type of business or operation and the chemicals typically used by that type of business. This list does not imply that these businesses are actual polluters or that they mishandle the chemicals used. The locations of these businesses within the Inventory Region are shown on Figure 13. There appear to be a limited number of businesses (mostly retail gasoline stations) with underground storage tanks (USTs) currently in use, or for which records exist describing leaking underground storage tanks (LUSTs). These USTs/LUSTs are also listed on Table 10. The locations of these UST/LUST sites are plotted on Figure 13. A complete listing of both USTs and LUSTs in the Thompson Falls area is found in Appendix D. A listing of large capacity septic systems and the density of septic systems within the Inventory Regions is also provided on Table 10. A large capacity septic system is one that serves 20 or more persons per day for more than 6 months per year. Additionally, land use within the Inventory Region is described on the same table. Of significance is the small amount of commercial property (0.9%) and residential properties (0.4%). Land use within the Inventory Region is depicted on Figure 14. An analysis of land use is presented graphically on Figure 16. There is one Montana State Superfund site present within the Inventory Region and is the pool above the falls at Thompson Falls, which contains sediments impacted by mine and smelter wastes. Of significance are the large petroleum pipeline, the Thompson Falls Unloading Terminal (connecting the pipeline and railroad), the railroad line, and the highway, all of which run the length of the Inventory Region. Again, see Figure 13.

Businesses that generate, store or dispose of relatively small quantities of potential contaminants are generally not significant contaminant threats if they handle those materials properly. However, disposal of even small quantities of contaminants in sumps, floor drains, dry wells, or septic tanks that are connected directly to the aquifer via infiltration can be major threats. In addition, chemicals spilled at small businesses may be flushed to storm drains or local streams and indirectly reach the aquifer. Volatile organic compounds are the most prevalent chemicals used or stored and therefore the most likely contaminants that would reach the aquifer from areas where storm water is concentrated and directly recharges the unconfined aquifer (these are called Class V injection wells). These injection wells have not been inventoried and the locations are not known.

Accidental spills on highways and railways, the routine activities on cultivated cropland, unregistered confined animal feeding operations (CAFOs), and the presence of unsewered residential developments are other potential contaminant sources. Spills of large quantities of chemicals transported along Highway 200 or the railroad line pose a threat because they are located throughout the length of the Inventory Region. Agriculture occupies approximately 40% of the land inside the Inventory Region, which is made up of fruit trees, row crops, pasture, and small grains. The cropping practices of greatest threat to a PWS are those involving significant chemical application and irrigation. Land Use in the Inventory Region is depicted on Figure 14. The threat of groundwater contamination by wastes from residential septic systems is considered low due to the low density of these systems within the Inventory Region. Septic density within the Inventory Region is depicted on Figure 15. A summary of the septic density, which is also called Septic Hazard, is presented in Table 11.

The inventory for the Ashley Creek Watershed indicated little potential of contamination from anthropogenic (man made) sources. Land use within the Ashley Creek Watershed is primarily forest with some grassland. This land use map is found on Figure 17.

Inventory Results/Surface Water Buffer

The inventory for the Surface Water Buffer is found on Table 10. Septic drainfields at rural homes (and from unincorporated neighborhoods), agricultural land, and releases from rail or vehicular accidents are potential sources of nitrate or pathogen contaminants identified within the Surface Water Buffer. A majority of these contaminant sources appear to be located along the Clark Fork River / Highway 200 corridor with some development along the lower reaches of the Thompson River near Snider. Overall septic density is low for the entire Surface Water Buffer, but the highest septic densities are located in close proximity to surface water channels. Refer to Figure 18 and Table 10 for the inventory within the Surface Water Buffer. Land use within the Surface Water Buffer is depicted on Figure 19. An analysis of land use is presented graphically on Figure 16. The percentage of agricultural land in the Surface Water Buffer is 10.5% and poses a minimal threat. Commercial property makes up a very low percentage of the area, as does residential land. As stated above, septic density (and thus the Hazard from septic systems) within the Surface Water Buffer is low. A summary of the septic density, which is also called Septic Hazard, is presented on Table 11. This septic density is depicted on Figure 20. Unidentified (and thus unregulated) confined animal feeding operations and large scale logging operations may pose an undetermined hazard to surface water and indirectly to groundwater in the Clark Fork River valley. Mines and mine related wastes may produce contaminants that could be transported near and indirectly impact the PWS. Additionally, the metal contaminants, which are the contaminant of concern, are not actually evaluated in the Surface Water Buffer. Local mines are presented on Figure 18. A complete inventory of potential contaminant sources in and around Thompson Falls is provided in Appendix D.

Inventory Results/Recharge Region (the Watershed)

There are few potential sources of contamination within the Recharge Region that are outside of the Inventory Region and the Surface Water Buffer identified in this report. A complete inventory of potential contaminant sources in and around Thompson Falls is provided in Appendix D. The inventoried potential contaminant sources within the Recharge Region are listed on Table 10. It is noteworthy that there is a large number of historic and operating mines within the Recharge Region. Unfortunately, data on the volume or acreage of mine tailing piles was not available while writing this report. Locations of the mines within the watershed are presented on Figure 21. The population and septic density in the Recharge Region as a whole are lower than in the Surface Water Buffer and the threat posed by septic systems is considered low. The Recharge Region for this report encompasses the town of Plains, but for the sake of manageability, the inventory does not address potential contaminant sources in and around that city. An inventory of the potential contaminant sources in and around the City of Plains will be conducted as a separate report and completed in the near future. Land use within the Recharge Region is presented on Figure 22.

Inventory Update

To make this SWDAR/SWPP a useful document in the years to come, the owners or the certified water system operators for the public water supply in Thompson Falls should update the inventory for their records every year. Changes in land uses or potential contaminant sources should be noted and additions made as needed. The complete inventory should be submitted to DEQ at least every 5 years to ensure that this report/plan stays current in the public record.

Inventory Limitations

The information compiled for this inventory was drawn from a number of public sources. It is as complete as possible, but is limited by the accuracy and/or completeness of the original data sources. For example, the information that addresses inactive and active mines did not describe the volumes or acreage of their associated tailing piles. This inventory (as written) is not intended to be a substitute for the first-hand knowledge of the area that can be provided by the PWS operators and owners. As such, the initial edits and the subsequent updates provided by these persons are critical to ensuring the accuracy and usefulness of this SWDAR/SWPP.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

Hazard Determination

The susceptibility of the spring system and the production wells in the Thompson Falls PWS to contamination is assessed in this chapter. The proximity of a potential contaminant source to a spring or well, or the density of potential non-point contaminant sources determines the threat of contamination, referred to here as Hazard. Table 12 below determines Hazard within the Inventory Region as delineated in this SWPP. If the Thompson Falls PWS was not using water derived from the shallow aquifer (from Wells #1 and #2) then a more appropriate Inventory Region would be an area described by a 1,000 foot radius circle around the Wells #3 and #4, which are thought to be drawing water from a confined aquifer. If Wells #3 and #4 are the only production wells being utilized for the PWS, then the smaller Inventory Region and Table 13 below would be used to determine Hazard. This table is included for comparison purposes and to help the reader understand the vulnerability of the different sources of water.

Table 12. Hazard of Potential Contaminant Sources, Determination of For Unconfined Aquifers (for the Inventory Region as delineated in this report)

Potential Contaminant Sources	**High Hazard Rating**	**Moderate Hazard Rating**	**Low Hazard Rating**
Point Sources of All Contaminants	Within 1-year TOT	1 to 3-years TOT	Over 3-years TOT
Septic Systems (density)	More than 300 per sq. mi.	50 – 300 per sq. mi.	Less than 50 per sq. mi.
Municipal Sanitary Sewer (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region
Cropped Agricultural Land (percent land use)	More than 50 percent of region	20 to 50 percent of region	Less than 20 percent of region

Note: There is little municipal sewer system present within the Inventory Region described in this SWDAR/SWPP. TOT refers to groundwater time-of-travel (the distance that groundwater is estimated to travel in a given time).

Table 13. Hazard of Potential Contaminant Sources, Determination of For Confined Aquifers (for a delineated Inventory Region that is typically approximately a 1,000 foot radius around the wellhead)

Potential Contaminant Sources	PWS Well is not sealed through the confining layer (or records are unclear)	Other wells in the Inventory Region are not sealed through the confining layer (or records are unclear)	All wells in the Inventory Region are sealed through the confined layer (records are clear)
Point Sources of All Contaminants	High Hazard Rating	Moderate Hazard Rating	Low Hazard Rating
Septic Systems (density)	High >300 Moderate 50-300 Low <50	Moderate >300 Low <300	Low
Municipal Sanitary Sewer (percent land use)	High >300 Moderate 50-300 Low <50	Moderate >50 Low <50	Low
Cropped Agricultural Land (percent land use)	High >300 Moderate 50-300 Low <50	Moderate >50 Low <50	Low

Note: This table was not used to determine Hazard for the potential contaminant sources of the Thompson Falls PWS wells because the PWS system mixes water derived from shallow alluvial wells and water from the confined aquifer. In this situation, it is more appropriate (and conservative) to Use an Inventory Region based upon estimated groundwater time of travel (hydrogeologic information).

Susceptibility Determination

Barriers to contamination can be anything that decreases the likelihood that contaminants will reach a spring or well. Barriers can be engineered structures, management actions, or natural conditions. Examples of engineered barriers are spill catchment structures for industrial facilities and leak detection for underground storage tanks. Emergency planning and best management practices are considered management barriers. Thick clay-rich soils, a deep water table or a thick saturated zone above the well intake can be natural barriers.

Table 14. Susceptibility of Source Water based on Hazard rating and the presence of Barriers.

	High Hazard Rating	Moderate Hazard Rating	Low Hazard Rating
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

A Community Non-Transient PWS monitors for a wide range of contaminants on a varied schedule, dependant upon their history of contamination and regulatory requirements. Additional factors that are becoming useful in the determination of monitoring requirements for contaminants are:

- the presence of potential contaminant sources in proximity to the source water,
- the hazard posed by potential contaminant sources,
- the presence of barriers to those contaminants, and

- the susceptibility of the source water to the contaminants.

The significant potential contaminant sources are identified (by type of business or chemicals used) and by type and density of land use within the Inventory Region, the Ashley Creek Watershed, within the Surface Water Buffer, and within the Recharge Region. These significant potential contaminant sources are listed on Tables 15, 16, 17, and 18. These tables address:

- types of significant contaminant sources,
- how the contaminants may be released to the environment and/or reach a collection point,
- Hazard rating for those contaminants,
- any barriers that may be present, and
- provide an evaluation of the susceptibility of the source to those contaminants.

The tables also describe some management tools that can reduce the Hazard and Susceptibility to particular contaminant sources.

Inventory Region

The Thompson Falls PWS wells have a low to very high susceptibility to contaminants that may originate from several potential sources within the Inventory Region. The potential contaminant sources that produce a very high susceptibility are: the highway and railroad line, stormwater discharge from a lumber mill, lawn and landscape areas above the shallow wells, and construction businesses. These PWS wells have a moderate susceptibility to contamination from large capacity septic systems, USTs/LUSTs, the petroleum pipeline the municipal sewer system, smelter waste in the pool above the falls at Thompson Falls, an auto repair shop, and a machinery and equipment shop. These PWS wells have a low susceptibility to potential contamination from agricultural activities. As mentioned above, increasing the number of barriers between the wells and any of the potential contaminant sources can reduce the susceptibility of these PWSs to the contaminants. Many of these barriers are listed as management practices, procedures, and prevention planning on Table 15.

The results of the susceptibility assessment indicate that the major transportation routes through the area, a stormwater outfall, and lawns and landscape areas above the shallow wells are the most significant potential threats to the aquifer and the PWS wells for Thompson Falls. It should be noted that these significant potential contaminant sources are primarily threats to the shallow production wells (Wells #1 and #2). If these two wells were placed on “Standby” and physically isolated from the rest of the PWS facilities, the Inventory Region drops in size to a 1,000 foot radius around Wells #3 and #4. No Surface Water Buffer would be needed. The Ashley Creek Watershed continues to be managed as a controlled watershed. With the smaller Inventory Region surrounding Wells #3 and #4, the inventory of significant potential contaminant sources drops dramatically. With the reduced inventory, the hazard posed by potential contaminant sources would also be reduced. This would result in a reduction of the susceptibility of the wells to potential contaminant sources.

Ashley Creek Watershed

The results of the susceptibility assessment indicate that there are few threats posed by contaminants to the new infiltration galleries, transmission lines/mains, and storage tank. The hazard posed by the various naturally occurring contaminants, which may reach the system, is low. Refer to Table 16 for the susceptibility assessment. There are multiple barriers to address the low hazard posed by these contaminants, which results in a very low Susceptibility.

Surface Water Buffer
The results of the susceptibility assessment indicate that there are few threats posed to the Thompson Falls PWS wells by nitrate, nitrite, and pathogenic contaminants located in the Surface Water Buffer. The highway, railroad line, and a stormwater discharge located just upgradient from the two shallow production wells pose the greatest hazard to the PWS wells (the shallow wells). Both of these potential sources cause the Susceptibility to be ranked very high. The hazard posed by private septic systems along the Clark Fork River is low resulting in a low susceptibility of the PWS to their contaminants. Refer to Table 17 for the susceptibility assessment. No lagoons, other storm water discharges, or confined animal feeding operations were discovered during the inventory. It should be noted that these significant potential contaminant sources are primarily threats to the shallow production wells (Wells #1 and #2). If these two wells were placed on “Standby” and physically isolated from the rest of the PWS facilities, no Surface Water Buffer would be needed.

Recharge Region (and beyond)
The results of the susceptibility assessment indicate that there are few threats to the PWS within the Recharge Region. The PWS wells have a very high Susceptibility to contaminants that originate with releases from highway and railway line accidents. It should be noted that all of the contents of the petroleum pipeline are transferred at Thompson Falls Unloading Terminal to railroad cars and transported the length of the Inventory Region. The threat posed by the presence of mines within the watershed is somewhat less. The PWS wells are only moderately susceptible to these significant potential contaminant sources. The mines are located in relatively remote locations and although the erosion from the tailing piles may be significant, the volumes of material that reach the Clark Fork River and are transported to the pool of the falls at Thompson Falls would be reduced by dilution and mixing, and would accumulate over a period of years. The susceptibility assessment for the Recharge Region is found on Table 18. An inventory was not made of the significant potential contaminant sources located in and around the City of Plains. That inventory and the determination of hazard will be conducted later. Significant potential contaminant sources in the vicinity of Plains and in locations farther upstream in the Clark Fork River drainage (beyond the arbitrary Recharge Region boundary) can pose a threat to the PWS wells for Thompson Falls. Cooperative and regional planning agreements for the management of these significant potential contaminant sources and the reduction of the susceptibility to these sources should be undertaken.

PWS Monitoring Waiver Recommendation

<u>Monitoring Waivers</u>

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

Use Waivers
A Use Waiver can be allowed if through a vulnerability assessment, it is determined that specific

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

Susceptibility Waivers

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

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

<u>Susceptibility Waiver for Confined Aquifers</u>

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

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

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

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

Susceptibility Waiver for Unconfined Aquifers

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

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

The objective of the Susceptibility Waiver application is to assess the potential of organic chemical migration from the surface to the unconfined aquifer. The general procedures make use of a combination of site specific information pertaining to the location and construction of the source, monitoring history of the source, geologic characteristics of the vadose zones, and mobility and persistence characteristics of the organic chemicals. The zone of contribution of the unconfined groundwater source must be defined and plotted. Groundwater flow directions, gradients, and a 3-year time-of-travel should be described. All surface bodies within 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well and nearby wells should also be provided.

Recommendation of the Authors

Ashley Creek Watershed is a controlled and closely managed watershed. As part of the development of this Source Water Protection Plan, a delineation of the watershed was performed. The delineated area mimicked the borders of the watershed as defined by the Ashley Creek Municipal Supply

Watershed Management Plan (1984) and the Ashley Creek Municipal Watershed Control Plan (1993). An inventory was taken of potential and significant potential contaminant sources (to include land uses) within the boundaries of the watershed. Land use within the watershed is comprised of forest with a small amount of grassland. No organic chemicals are know to have been used or are currently being used within the boundaries of the watershed. The recently installed spring water collection system intercepts groundwater before it discharges to the ground surface near the bottom of the Ashley Creek drainage. The source of the spring water is from the deep fractured bedrock aquifer system of the surrounding watershed. A susceptibility analysis was performed for this area that indicates that the Ashley Creek Watershed has a very low Susceptibility to contaminants. A summary of the susceptibility analysis is presented on Table 19 below.

Table 19. Susceptibility Analysis
ASHLEY CREEK WATERSHED

Source of Contaminant	Containment	Hazard / Origin of Contaminant	Hazard Rating	Barriers to the Contamination	Susceptibility of Source Water to this Contamination
Anthropogenic (man-made) Sources	None	No realistic contamination by people other than logging high in the watershed	Low Hazard	Upward vertical gradient near springs Aquifer in the fractured bedrock is isolated from all human sources of contamination Management of Activities in Watershed (cooperative agreement with USFS and surrounding landowners) Land Use Planning	**Very Low Susceptibility**
and					
Natural Sources	Nitrate, nitrite, pathogens, metals, turbidity, and anything that may come from the aquifer host rock	Animal presence & activity above spring collection galleries High or low water table conditions Natural solution of metals and minerals into groundwater Wildland fire and subsequent erosion and mobilization of solutes	Low Hazard	Limited access by people to the tank, lines, or springs Active monitoring of facilities Maintain vegetative cover around and uphill from galleries Newly installed galleries at the springs Newly installed piping system to deliver water Newly installed water storage tank Newly installed treatment system	**Very Low Susceptibility**

The authors' recommendation is based upon the determination that the Ashley Creek Watershed has a very low Susceptibility to a wide range of contaminants and the knowledge that organic chemicals have not been used within the watershed. Thus, the watershed is not "vulnerable" to chemical contaminants that originate with human activities. No potential or significant potential contaminant sources were identified. The authors recommend that a Use Waiver be granted to the Thompson Falls PWS. This Use Waiver should grant the PWS exemption from routine monitoring for VOCs and SOCs in water derived from the spring water system in the Ashley Creek Watershed. Based upon the sampling history of the new spring water collection and delivery system, this PWS source may be eligible to avoid filtration of that water. The authors are not making a recommendation for a Use Waiver for any of the other sources of water for the Thompson Falls PWS.

CHAPTER 5
MANAGEMENT

The ultimate goal of the Source Water Protection Plan is twofold:

- to protect the source water by keeping potential polluting materials and activities out of the Control Zone, and
- to manage the Inventory Region (also called a Source Water Protection Area) to ensure that susceptibility to land use activities and potential contaminant sources is minimized.

Susceptibility Reduction

Control Zone Management

An examination of the available documentation and the 2001 Sanitary Survey for the Thompson Falls PWS suggest that the Control Zones for the 4 production wells and the area surrounding the Ashley Creek piping and storage tank are owned and/or controlled by the City of Thompson Falls. It is not clear from the documents if the wells and the associated facilities (tanks, mains, pump houses, etc.) are fenced and isolated from public access. The area surrounding Wells #1 and #2 (the Control Zone) are not used for landscape or lawns, but are surrounded by areas that are dedicated to landscape and lawns. Wells #1 and #2 are also relatively near the highway and railroad line.

It is critically important that fertilizers and pesticides be kept strictly away from the wellheads or other areas that may allow those chemicals to reach and impact the local aquifer (shallow or deep), the wells, or the PWS facilities. Steps should also be taken to secure these facilities from accidental or intentional damage/sabotage. These steps should include fencing with locked gates; locked buildings, valves, and control panels; maintaining limited key distribution; careful placement of signs (if needed); and regular patrols taking inventory of the facilities. Additionally, berming the area between Well #2 and the railroad should be done to isolate the shallow wells from potential large-scale releases of hazardous materials.

Inventory Region Management

For the purposes of planning, the Inventory Region can also be called the Source Water Protection Area. Land use within the Inventory Region is about 40% agricultural, 49.5% forest and other undeveloped land, with only a fractional percentage of commercial/transportation property. From a land use perspective, only the agricultural property poses a moderate hazard. The potential contaminant sources for which the PWS wells have a very high Susceptibility are the transportation corridors (highway and rail lines), a stormwater discharge from a nearby lumber mill, lawn and landscape areas that are in the vicinity of the shallow wells, and construction sites and shops. The latter may or may not in fact be a significant potential source of contamination, but are weighted heavily by the susceptibility analysis. The PWS wells in the shallow aquifer are moderately susceptible to several other potential contaminant sources. These sources are private septic systems, a few large capacity septic systems, the oil pipeline that runs through the Inventory Region, current and historic USTs/LUSTs, and mechanical shops. These significant potential contaminant sources within the Inventory Region are listed in the susceptibility analysis on Table 15.

The introduction of certain physical barriers and the implementation of an assortment of management strategies can reduce the impacts of these potential contaminant sources. These management strategies are listed on Table 15 of this document. The development and implementation of local hazardous materials spill response capability and the development of contingency and/or emergency response plans will go a long way to mitigating the potential harm from releases along the highway and railroad corridors. The stormwater discharge of the local lumber company is registered by DEQ, but monitoring and evaluation on a local level may go far in the reduction of the Susceptibility of the shallow aquifer to this discharge. Clear guidance and education of lawn and landscape managers in the proper handling and application of landscape-related chemicals and an awareness of the vulnerability of the shallow alluvial aquifer to those chemicals will provide some protection of that aquifer. The low density of private septic systems can be maintained by local planning and regulation. Extension of the municipal sewer lines to encompass more of the Inventory Region (extending east of town) may not be feasible because of the cost of such extensions. However, local ordinances or incentives for the construction of level II (advanced) private septic treatment systems may be very useful. These systems have proven to be effective in the reduction of septic system impacts on the shallow aquifers in various locations of Montana.

As a management strategy, it is relevant and significant to address the concept of placing the production wells #1 and #2, which are installed into the shallow aquifer, on standby. If these wells become inactive and are separated from the PWS, the delineation process restricts the Inventory Region to 1,000 foot radius circles around production wells #3 and #4. The Ashley Creek Watershed remains as previously described. This reduced Inventory Region produces a smaller inventory of significant potential contaminant sources. The smaller inventory or potential contaminant sources reduces the Susceptibility of the PWS (as a whole) dramatically. The susceptibility of the confined aquifer to local contamination is significantly reduced for the reasons discussed in the previous chapters. Wells #1 and #2 could be maintained on standby for use during emergencies when one or more of the other sources of water are unavailable. The process of activating an emergency standby well (from a regulatory standpoint) is not significant and can be done in a very short period. Wells #1 and #2 are quite suitable for this purpose. The City of Thompson Falls will examine the potential of removing the shallow production wells from active service as a management option.

Ashley Creek Watershed Management

The Ashley Creek Watershed is currently managed by the Ashley Creek Municipal Watershed Control Plan (1993). Access to the watershed and activities within it are monitored and regulated. This plan will remain in-place, and access by the public will be discouraged. In addition, the pipe main from the spring water system, the storage tank, the spring collection and access structures will all be made secure from accidental intrusion and intentional tampering by people. They will be secured by locks (and fencing as needed). The spring water collection system is relatively new (as of 2001) so revegetation efforts will continue as needed to reduce erosion in disturbed areas.

Recharge Region Management

Land use within the Recharge Region is almost 95% undeveloped forest and grassland. The percent of land occupied by agriculture or other activities is not significant. As such, their impacts on water quality is probably small. The highway and railroad lines that run the entire length of the region and closely parallel the Clark Fork River are significant potential contaminant sources. Potential releases from trucks or trains could be catastrophic and could significantly affect the Thompson Falls PWS. Large releases from any of the above could reach the river and be quickly transported in the river to the stretch of the Clark Fork River where it is draining into and recharging the shallow alluvial aquifer that supplies water to the Thompson Falls PWS. Mining activities in the Cabinet and Coeur d'Alene Mountains are significant and the long-term impacts of those mines on the sediments in the Clark Fork River are not well understood. Nevertheless, active and historic mining will have negative cumulative impacts. This is evidenced by the accumulation of mining and smelter waste in the pool of the falls of Thompson Falls.

Management of potential contaminant sources within the Recharge Region and farther upstream on the Clark Fork River is more difficult on a local level. Cooperative agreements, collective planning, and team enforcement should be established between city governments along the river (e.g., with Plains), with the county governments (Sanders and Missoula Counties), with the federal land managers, and other stakeholders within the Recharge Region and farther upstream along the Clark Fork River. Watershed management groups appear to be useful and effective in the development of plans and guidance to protect local PWSs within the watershed. Efforts will be made by the City of Thompson Falls to participate in the development of cooperative agreements and planning within the watershed.

Tools To Promote Water Quality

The following management measures will be pursued in the community to help protect groundwater within the Inventory Region/Source Water Protection Area.

<u>Conduct an Education and Outreach Campaign</u>

Public education and awareness should be a cornerstone of this SWPP because the activities of everyone in the area pose some risk to groundwater. Most homeowners and business owners will work to protect their local groundwater if they know how to minimize contamination risks. The Thompson Falls education and outreach campaign should include, but will not necessarily be limited to, the following steps:

- Letters and educational information should be sent to all residences and businesses within the Inventory Region/Source Water Protection Area. The information will address the boundaries of the Source Water Protection Area, the need to protect the aquifer, and should include materials addressing how to care for septic systems and how and where to dispose of household hazardous waste.
- Develop a media campaign to reach the public with educational information about local drinking water, and about the current source water protection effort. This can entail the following:
    - Post groundwater and drinking water facts as bullets on the local TV and radio stations.
    - Post similar bullets in the local schools' newsletters (or equivalent).
    - Incorporate source water protection into local school curricula.
    - Create informational pamphlets for businesses that use hazardous materials. These could be distributed by the local sanitarian during inspections, and to persons applying to the planning board for permits. This will require cooperation between City and County Agencies.
    - Present the idea of groundwater protection to the city and county planners. The idea is to convince them that they are stakeholders in the protection of source water.
    - Create a clearly written and assembled informational packet for distribution at both the city planning and county planning meetings. The intent is to provide the needed information to the city and county planners and involve them early in the process of groundwater protection.
    - Post signs on access points to the Inventory Region indicating that travelers are entering a Source Water Protection Area. These signs may also provide contact telephone

numbers if a contaminant release is observed.

Develop a BMP (Business Management Practices) Survey and Training Program

Many of the significant contaminant sources within the Inventory Region are petroleum and other regulated substances. Therefore, it is appropriate to develop a Best Management Practice (BMP) Survey/Inspection Program for these businesses. BMPs are guidelines for the storage and handling of hazardous materials. Many times the implementation of a BMP Survey Program is the most effective way to prevent certain types of contamination. They are effective because they are an ongoing town service that promotes awareness and can be a mutually beneficial interaction between the businesses and the town. BMP Survey Programs can be voluntary or mandatory. Voluntary programs typically do not employ town ordinances to enforce conformity. A few BMPs developed by the US EPA are included in Appendix F. As warranted, silvicultural BMPs can be developed and adopted for logging activities conducted within the Source Water Protection Area.

Post Source Water Protection Area Signs

A variation on the media campaign is the posting of signs indicating the boundaries to the Source Water Protection Area. These signs can be posted on access points around the perimeter of the area indicating that the travelers are entering a designated Drinking Water Protection Area or Source Water Protection Area. These signs may also provide contact telephone numbers if a contaminant release is observed. The signing of Source Water Protection Areas appears to be a very cost-effective step that promotes public awareness and to protect local groundwater.

Reduce the Contamination Risk from Used Motor Oil

The City of Thompson Falls in cooperation with Sanders County will work to inform the local residents how to safely dispose of their used motor oil and provide increased opportunities for motor oil colleciton.

CHAPTER 6
EMERGENCY PLANNING

This chapter identifies the principal threats to the source water, designates an emergency coordinator, and then describes a series of potential responses planned in the event that a problem arises. Another important aspect of emergency planning is an estimate of the equipment and materials that are needed in case of an emergency and a description of how a short-term replacement water supply would be handled. An evaluation of the funding available to deal with an emergency response is important, but will be undertaken later.

Identification of Possible Disruption Threats
The principal threats to the PWS have been identified as a spills, leaks, or discharges in the Control Zone, which could contaminate the source water by entering through the well bore along with contaminated shallow groundwater. These can get into the well through a compromised well casing (or a poor seal). Additionally, any releases of large quantities of contaminants anywhere within the Inventory Region can seriously impact the shallow aquifer and impair water quality. Included are spills from trucks, railway lines, USTs/LUSTs, and pipelines. In addition to the above threats to the production wells, natural events in the Ashley Creek Watershed may affect the ability of the spring water collection and delivery system to provide water. These events could include:

- dramatic changes in the amount of available water (springs running very low or dry), which may affect bacterial counts, turbidity, or other measurable factors,
- continued catastrophic landslides that may actually take out part of the collection or delivery system, or
- other unknown incidents that would affect water quality.

The following table simply describes some of the potential interruptions that can happen to the ability of the Thompson Falls PWS to deliver potable water to the public.

Table 20. Effects of Emergencies on a PWS

Emergency (cause of)	Well / Spring Contaminated	Well / Springs are out of Service	Storage Tank Damage	Broken Main	Distribution System Contamination	Power Outage
Vandalism	+	+	+	+	+	++
Earthquake	-	+	-	++	+	++
Flood	++	+	-	-	+	+
Storm Event	+	+	-	-	-	++
Extreme Temperatures	-	+	-	+	+	+
Power Outage	+	+	-	-	+	NA
Hazardous Material Release	++	++	-	-	++	-

++ indicates that the PWS is very vulnerable to this type of emergency
+ indicates that the PWS is somewhat vulnerability to this type of emergency
- indicates PWS is not very vulnerable to this type of emergency
NA indicates that this does not apply to this PWS

Designation of Emergency Coordinator

The emergency coordinator for the Thompson Falls PWS is Jerry Lacy. His contact telephone number is 406/827-3557. The backup emergency coordinator is Dave Sund at 406/827-4981.

The emergency coordinator is familiar with the county and DEQ procedures and is responsible for contacting the appropriate officials should a spill or other threat to the source water occur. The Sanders County (District 1) Department of Emergency Services (DES) coordinator is William Thomas. His landline telephone number is 406/243-4152 and his cell telephone is 406/544-4987. The State of Montana DEQ Enforcement contact number is 406/444-0379.

Equipment and material resources

The principal identified threats to wells are generally limited to spills in the control zone. The resources that may be needed to respond to a spill are heavy equipment for the construction of a berm and/or excavation work, and the use of various absorbent materials. A backhoe contractor has been identified and a preliminary agreement (contract) was established to provide the needed support on an on-call basis. Absorbent materials and media will be provided by the hazardous materials response personnel associated with the Thompson Falls Fire Department and the Sanders County Fire Department and by the backhoe contractor as needed. Should additional resources be needed due to the magnitude or chemical nature of a spill, the Thompson Falls PWS will contract with an emergency response firm properly trained and equipped. A list of possible contractors is maintained and updated by the DEQ Enforcement Division. The pone number is 406/444-0379.

Procedures to Shut Down a Well or Part of the System

Under certain conditions, it may be important to turn off a specific well to prevent that well from drawing contamination toward it or from drawing contamination into the PWS delivery system. It may also be important to isolate the spring system from the wells or visa versa. In the Thompson Falls PWS system, each well and the spring water delivery system can be shutdown and physically isolated from the rest of the system by means of valves. The valves and appropriate power shut-offs are clearly known by the PWS operators. In addition, diagrams and procedures for isolation of parts of the system and are available to other authorized persons.

Coordination Procedures

The Thompson Falls PWS Source Water Protection Plan has been made available to the Sanders County (District 1) Department of Emergency Services (DES) coordinator William Thomas. His contact telephone number is listed below.

Table 21. Emergency Contact Phone Numbers

General Emergencies, DES Contact for Sanders County	**William Thomas**	**Land Line: 406/243-4152 Cell Phone: 406/544-4987**

Table 21. Emergency Contact Phone Numbers

24 hour Spill Hotline **Montana DES**	**Duty officer**	**406/841-3911**
Agricultural chemical or fertilizer spills **Montana Department of Agriculture**	**Greg Murfitt**	**406/444-5400**

The DEQ Enforcement Division employees listed below are points of contact for citizen complaints, spills, and formal enforcement activities. For complaint or spill information, or if the contact listed below is unavailable contact the Complaint Management Section Chief, Ed Thamke by telephone at 406/444-2964.

Table 22. DEQ Enforcement Division Contact List

Comprehensive Environmental Cleanup & Responsibility (CECRA) **Underground Storage Tanks**	**Dan Kenney**	**406/444-1504**
Hazardous Waste	**Chad Anderson**	**406/444-1453**
Landfill Siting **Solid Waste Management** **Septic Disposal and Licensure** **Public Water Supply** **Water Treatment Plant Operators** **Motor Vehicle Recycling and Disposal (Junk Vehicles)**	**David Rise**	**406/444-2411**
Metal Mine Reclamation **Opencut Mining** **Strip and Underground Mine Reclamation** **Strip and Underground Mine Siting**	**Scott McCollough**	**406/444-4202**
Water Quality **Sanitation in Subdivisions**	**Ed Coleman**	**406/444-1453**

Procedures to communicate with water users

The design of the PWS should allow the source water to be isolated from the distribution system in case of a spill in the control zone or other event that threatens source water quality. If it is determined that the source water was exposed to a contaminant, the well or springs will remain off-line until sampling proves the water to be safe and an evaluation is done in cooperation with the MT DEQ, PWS Section.

In the event that a portion of the PWS is removed from service in response to a contamination problem, all of the water users should be notified. This notification serves several functions. If a chemical release has occurred or if a portion of the PWS distribution system is having problems, public notification can do the following:

- A notice can alert the public to the fact that a chemical release has occurred within the source water protection area. This involves the public in the process of source water protection and increases their understanding of its value. It is an educational tool and will benefit the PWS in its future efforts to protect the water supply.

- A notice can alert the public to the fact that a contaminant may have reached a portion of the distribution system. This allows steps to be taken to protect certain at risk individuals or groups.

The public notice can be delivered in a number of ways that will overlap to ensure that all water users are contacted. Some of the recommended ways are:

- Use the local radio and TV stations to broadcast public service announcements.
- Use the local newspaper to run public service announcements.
- City and or County Board members can contact the local hospital, nursing home, or other water users with high at-risk residents.
- In a serious emergency, police, fire, other EMS personnel, or the Montana National Guard can be utilized to conduct door-to-door or other methods of public dissemination of critical information.

Source of Emergency Water

The Thompson Falls PWS is in the enviable position of having 3 different dependable sources of water. Each of these sources is relatively isolated from the other. If any one source becomes unusable, the PWS is able to fall back on the others. The authors of this SWPP understand that the PWS intends to rely predominately upon water from the spring water collection system in Ashley Creek. Should the need arise, this water is to be supplemented with water from Wells #3 and #4 which draw from the lower confined aquifer. The PWS managers will evaluate the merit of placing Wells #1 and #2 on “standby” status and disconnecting them from the active PWS distribution system. In case of a serious shortage of available water (loss of the spring or deep aquifer wells), these shallow production wells could be reactivated without significant testing as required by DEQ’s PWS Section. It does appear that each of the 3 sources of water for the Thompson Falls PWS can easily be isolated from each other and from the distribution system.

CHAPTER 7
PLAN CERTIFICATION

This Source Water Protection Plan (SWPP) was completed by Jeffrey Frank Herrick, Bill O'Connell, and the City of Thompson Falls. The SWPP has been reviewed by Thompson Falls PWS Operators and Managers and a concurrence letter is attached in Appendix H.

The Source Water Protection Plan was submitted to DEQ for review on **XXXX(Date)XXXX**. DEQ comments were addressed and the final plan was certified by DEQ on **XXXX(Date)XXXX.** A synopsis of this plan will be included in our annual consumer confidence report.

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GLOSSARY*

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

Alkalinity. The capacity of water to neutralize acids.

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.