Power Teton County Water District
Public Water Supply System

PWSID #MT0000311

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Report Date: 12/12/02

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FINAL DOCUMENT

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INTRODUCTION

This Delineation and Assessment Report was prepared by Carolyn DeMartino, a Water Quality Specialist with the Source Water Protection Program of the Montana Department of Environmental Quality (DEQ) and Aubrey Smartt, a DEQ intern. The Power Teton County Water District public water supply (PWS) is located in Power approximately 13 miles north of Vaughn in Teton County, Montana. In addition to the operator listed on the title page of this report, Carol Walker (Certified Operator # 5942) and President Mark Lehnerz assist in the operation of the Power Teton County Water District PWS.

Purpose

This report is intended to meet the technical requirements for the completion of the source water delineation and assessment report for the Power Teton County Water District PWS as required by the Montana Source Water Protection Program (DEQ, 1999) and the federal Safe Drinking Water Act (SDWA) Amendments of 1996 (P.L. 104-182). The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to the protection of public drinking water supplies from contamination. The primary purpose of this source water delineation and assessment report is to provide information to assist the Power Teton County Water District PWS operator in the identification of potential contaminant sources near the Muddy Creek intake and in providing information that helps Power in the completion of a source water protection plan to protect its drinking water sources.

Delineation and assessment constitute major components of the Montana Source Water Protection Program. Delineation entails mapping the boundaries of source water protection areas, which encompass ground water and/or surface waters contributing to public water supply sources. Assessment involves identifying locations or regions within source water protection areas where contaminants may be generated, stored, transported, or disposed, and determining the relative susceptibility of drinking water to contamination from these sources.

Limitations

This report was prepared to assess threats to the Power Teton County Water District public water supply, and is based on published data and information obtained from local residents familiar with the community. The terms “drinking water supply” and “drinking water source” refer specifically to the sources of the public water supplies, and not any other public or private water supply. Also, not all potential or existing sources of groundwater or surface-water contamination in the area of the Power Teton County Water District are identified. Only potential sources of contamination in areas that contribute water to the identified drinking water sources are considered.

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

CHAPTER 1
BACKGROUND

The Community

Power, Montana is located approximately 25 miles northwest of Great Falls in eastern Teton County. The Power Teton County Water District supplies water to the Town of Power via a surface water intake located in Muddy Creek (Figure 1). The town of Power is situated on the eastern side of Muddy Creek. The U.S. Census Bureau estimates the 2000 population of Teton County at 6,445 people, 188 of whom reside in the city limits of Power. Power's population has remained relatively constant over the last 10 years. The main line of the Great Northern Railroad runs north-south through town. Interstate 15 connects Power with Vaughn to the south and Dutton to the north. In recent years, the economic mainstays of small grain and local retail development have augmented the local economy.

Within the Power city limits, residents obtain their drinking water from the county water district PWS. There is no municipal sewer district or wastewater treatment facility for Power to service residents within city limits and as such, most rely on private on-site septic systems. Residents in areas outlying city limits utilize private wells for water and on-site septic systems for waste disposal.

Climate

The climate in the vicinity of Power is considered semi-arid. Based on Western Regional Climatic Center data for the period of record, annual precipitation averages 11.66 inches. Monthly average precipitation ranges from 0.39 inches in February to 2.15 inches in May. Summer thunderstorms and winter snows provide a majority of the precipitation in the area. The annual mean snowfall in Power is 50.4 inches. Periodic drought cycles (as defined by moving annual precipitation averages less than 10 inches) occur in the region at approximately 3 to 4 year intervals. A summary of the available climatic data for the Power area is presented in Table 1 below.

Table 1. Climatic Summary
Power, Montana (246700)
Period of Record Monthly Climate Summary
Period of Record : 2/13/1953 to 12/31/2001

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	Insufficient Data												
Average Min. Temperature (F)	Insufficient Data												
Average Total Precipitation (in.)	0.46	0.39	0.58	0.95	2.15	2.06	1.28	1.34	0.99	0.6	0.45	0.4	11.66
Average Total Snow Fall (in.)	7.6	6	8.6	7.9	2.1	0.2	0	0.2	1.6	3.4	6.3	6.6	50.4
Average Snow Depth (in.)	3	3	2	1	0	0	0	0	0	0	1	2	1

Percent of possible observations for period of record.
Max. Temp.: 0% Min. Temp.: 0% Precipitation: 99.4% Snowfall: 98.7%% Snow Depth: 98.7%%
Source: Western Regional Climate Center, wrcc@dri.edu

Geographic Setting

Power is located in the Missouri Plateau section of the Great Plains physiographic province. The Missouri Plateau section contains both glaciated and unglaciated features, with plateaus and terraces being the predominant physical features. The Greenfields Bench, located immediately west of Power, is comprised of three gravel terraces. Numerous springs and seeps flow through this area. Generally, the land is underlain by relatively flat-lying sandstone, siltstone, and shale that have been dissected by major drainages, mainly the Missouri and Sun Rivers (Figure 2). Muddy Creek enters the Power vicinity from the north and flows to the south into the Sun River. The Sun River then flows east and into the Missouri River, which continues in an eastward direction. Numerous irrigation ditches and canals withdraw are located in the Power/ Greenfields Bench area and withdraw water from these streams.

The Rocky Mountains are further west of Power and the Greenfields Bench area. Open plains are to the east of Power. Area lakes include Benton Lake, to the east of Muddy Creek, and Freezeout Lake to the west.

General Description of the Source Water

Power obtains its water from the Power Teton County Water District via one surface water intake on Muddy Creek (Figure3). Muddy Creek is located in the Sun watershed. The U.S. Geological Survey hydrologic unit code for this watershed is 10030104 and the area covered by the watershed is 1,983.68 square miles (Figure 4).

Muddy Creek is a perennial stream. Stream flow data was obtained from U.S.G.S. gauging station 06088000, located on Muddy Creek, near the surface water intake for Power Teton County Water District. Based on stream gauging data collected from 1935 to 1983, the mean monthly discharge at this station varies from 3.80 cubic feet per second (ft^3/s) in February to 70.1 ft^3/s in August (U.S.G.S.).

The Public Water Supply

The Power Teton County Water District PWS is classified as a community system under the Federal Safe Drinking Water Act, because the system serves at least 25 year-round residents through at least 15 service connections. The PWS services 163 residents via 84 active service connections.

The Power Teton County Water District source water intake is located directly west of the treatment plant. The treatment facility is a Microfloc Water Boy 82 package plant with a mixing basin, 5.0 MG pre-sedimentation basin with laminar tube settlers, and mixed media filtration. The design capacity of the plant is 70 gallons per minute (gpm) and is currently running at 60 gpm with a filtration rate of 5 gpm/ft^2. A clearwell with finish water pumps transports the water to a 40,000 gallon cistern. The distribution system has dead-end mains that are equipped with 2-inch blowoffs.

The Power Teton County Water District treatment facility utilizes alum mixed from a dry alum and Nalco 8105 that is diluted to a 0.27% solution. The current feed rate for Nalco 8105 is around 0.5 parts per million. The alum pump puts out 60 gpd and is set at a 70% output. Calcium hypo-chlorite is also used to disinfect the source water.

The distribution system consists of a pumping station that contains three pumps. There are 2 identical aurora pumps with the North pump as the pressure-sustaining pump that runs constantly. The South

pump is set on a timer and runs from 6 a.m. to 10 p.m. Water is pumped from the 40,000 gallon cement storage tank through the pumping station and into the community. Table 2 gives a detailed description of the treatment components and process. See Appendix A for a diagram of the site layout.

Table 2. List of Sources & Facilities
Power Teton County Water District PWS

Facility	PWS Facility ID	Location	Description	Notes
Intake from Muddy Creek	IN002		Surface Water Intake (Active)	Pumped into holding pond
Holding Pond		along Muddy Creek shoreline	6 million gallon pond	Holds raw water from intake before treatment
Backwash Pond		just west of Muddy Creek	small pond that flows back into Muddy Creek	Carries backwash and overflow back to Muddy Creek
Water Treatment Plant	TP001	just east of intake	Microfloc Water Boy 82 package plant	
Clear Well	CW001	at the treatment plant	12,000 container that holds filtered water	water is transferred to Storage Tank
Storage Tank	ST001	in town	40,000 gallon, underground cement tank for finished water	Pumped into distribution
Distribution System	DS001	throughout city limits	distribution of water via PVC pipe	
Pumping Station	PF001	just north of storage tank	pumps water for distribution	
Pressure Control Assemblies		at pumping station	pumps water to community	pressure is 30 lbs. for pressure sustaining pump and 50-60 lbs. for high service pump

Power obtains its drinking water from a surface water supply. As a result, the source water is classified as highly sensitive to contamination, in accordance with Montana Source Water Protection Program aquifer/source water sensitivity criteria (1999). These criteria are discussed in the next chapter.

Water Quality

Public water systems must conduct routine monitoring for contaminants in accordance with Federal Safe Drinking Water Act requirements. Parameters such as coliform bacteria, lead, copper, nitrate, nitrite, volatile organic chemicals (including hydrocarbons and chlorinated solvents), inorganic chemicals (including metals), synthetic organic chemicals (including pesticides), and radiological contaminants must be sampled in community PWSs in accordance with schedules specified in the Administrative Rules of Montana. All contaminant concentrations detected in required samples must comply with numeric maximum contaminant levels (MCLs) specified in the Federal Safe Drinking Water Act.

Background Muddy Creek Water Quality

In addition to routine sampling by the Power Teton County Water District PWS of their treated (finished) water, some water quality data have been collected to characterize background water quality of Muddy Creek by U.S.G.S. The data provided by the USGS is found in Table 3.

Table 3
Water Quality Data
Muddy Creek, west of Power

USGS Station ID	Date	Time	Inst. Discharge (cfs) (00061)	Barometric Pressure (mm of Hg) (00025)	Diss. Oxygen (mg/L) (00300)	Field pH (Standard units) (00400)	Specific Conductance (us/cm) (00095)	Air Temperature (Deg C) (00020)	Water Temperature (Deg C) (00010)	Diss. Calcium (mg/L as Ca) (00915)	Diss. Magnesium (mg/L as Mg) (00925)	Diss. Potassium (mg/L as K) (00935)	Diss. Sodium (mg/L as Na) (00930)	Diss. Chloride (mg/L as Cl) (00940)	Diss. Fluoride (mg/L as F) (00950)	Diss. Silica (mg/L as SiO2) (00955)
6088000	07/01/82	1630	161				936	23.0	18.5							
6088000	08/10/82	0943	100				614	22.5	16.0							
6088000	09/23/82	1330	73				604	23.0	12.5							
6088000	10/21/82	1615	31				840	16.0	7.0							
6088000	03/31/83	1515	17				2280	6.5	7.0							
6088000	05/13/83	1000	52				8490	4.0	0.0							
6088000	06/20/83	1145	68				843	17.0	10.5							
6088000	08/05/83	1100	93				749	29.0	17.0							
6088000	09/23/83	1230	39				882	21.0	10.5							
6088000	06/14/91	1415	25	668	8.7	8.6	970	18.0	14.5	51.0	65.0	2.00	74.0	8.9	0.6	6.1
6088000	09/10/91	1400	81	667	10.0	8.7	600	20.5	14.5	41.0	45.0	1.80	23.0	6.7	0.6	6.7
6088000	04/03/92	1440	20	660	12.5	8.9	980	19.0	11.5	42.0	81.0	1.70	57.0	11.0	1.0	3.9

USGS Station ID	Date	Time	Diss. Sulfate (mg/L as SO4) (00945)	Diss. NO2 + NO3 (mg/L as N) (00631)	Diss. Nitrogen, Nitrite (mg/L as N) (00613)	Diss. Ortho Phosphorus (mg/L as P) (00671)	Total Arsenic (ug/L as As) (01002)	Total Recoverable Boron (ug/L as B) (01022)	Total Cadmium (ug/L as Cd) (01027)	Total Recoverable Chromium (ug/L as Cr) (01034)	Total Recoverable Copper (ug/L as Cu) (01042)	Total Recoverable Nickel (ug/L as Ni) (01067)	Total Selenium (ug/L as Se) (01147)	Total Recoverable Zinc (ug/L as Zn) (01092)	Specific Conductance Lab (US/CM) (90095)	ANC Unfiltered TIT 4.5 Lab (mg/L as CaCO3) (90410)
6088000	07/01/82	1630														
6088000	08/10/82	0943														
6088000	09/23/82	1330														
6088000	10/21/82	1615														
6088000	03/31/83	1515														
6088000	05/13/83	1000														
6088000	06/20/83	1145														
6088000	08/05/83	1100														
6088000	09/23/83	1230														
6088000	06/14/91	1415	280	2.00	0.020	0.010	1	110	<1.00	1	6.0	10	3.0	<10	968	243
6088000	09/10/91	1400	83	2.00	0.010	<0.010	1	120	<1.00	1	3.0	4	2.0	<10	603	252
6088000	04/03/92	1440	240	3.50	0.040	<0.010	1	160	<1.00	1	6.0	4	5.0	20	981	295

The State of Montana classifies Muddy Creek as I surface water. The goal of the state of Montana is to eventually have I surface waters fully support the following uses drinking , culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply. This surface water classification is pursuant to the Administrative Rules of Montana 17.30.600-.625.

The entire segment of Muddy Creek that runs south toward the Sun River appears on the Montana 2000 303(d) list of impaired streams as only partially supporting agriculture and drinking water supply, as well as not supporting aquatic life support, cold water fishery (trout), and recreation. The probable cause and source of the impairment is not known at this time. Future studies will be performed to determine the factors preventing or limiting attainment of these uses.

Power Teton County Water District PWS Water Quality

According to the DEQ PWS Database, there has been no detection of coliform or fecal coliform bacteria in the drinking water within the past five years. Within the past five years, the range of nitrate plus nitrite detected in the drinking water has ranged from 0.02 mg/L to 1.67 mg/L, well below the MCL of 10 mg/L (SIDWIS). See Appendix B for a detailed description of this data.

CHAPTER 2
DELINEATION

The source water protection area, the land area that contributes water to the Power Teton County Water District public water supply surface water intake, is delineated in this chapter. The purpose of delineation is to map the source of Power's drinking water and to define areas within which to prioritize source water protection efforts.

Source water protection areas for surface water sources are subdivided into Spill Response and Watershed Regions, each with separate management goals. The Spill Response Region encompasses an area upstream of the Power Teton County Water District PWS in which contaminants can be drawn into the intake with little lag time. The Watershed Region encompasses the entire area of the watershed upstream of the Power PWS.

Hydrogeologic Conditions

This section provides an overview of the hydrogeologic conditions in the vicinity of the Power Teton County Water District PWS intake in Muddy Creek. Muddy Creek is a tributary to the Sun River, which enters the Missouri River at Great Falls. Hydrogeologic conditions of the area can be used to determine the locations, boundaries, and hydraulic properties of local aquifers, and provides an explanation for the sensitivity of local aquifers to potential contamination sources. Most of the hydrogeologic information described in this section was obtained from a report published by Edwin Maughan (1961) and presented in the Muddy Creek Special Water Quality Project (1979).

Cretaceous-aged sedimentary rocks are exposed throughout the basin, predominantly on steep slopes of dissected terrain and on the upland surface east of Muddy Creek. Terrace gravel forms the upland surface west of Muddy Creek; and lake deposits occur mainly within the Sun River and Muddy Creek valleys. The most dominant structure of the region is the Sweetgrass Arch. The Muddy Creek drainage covers the southern part of this arch. This area is called South Arch. The northern part of the arch was removed by pre-Pleistocene erosion, which left a nearly level plain with very low relief. Bedrock in the Muddy Creek area is comprised of four members of the Blackleaf Formation which are approximately the lower 790 feet of the Colorado shale group. The formation consists mainly of dark gray shale with many sandstone beds.

Most of the present landforms in the Muddy Creek area were formed during the Pleistocene, a period of extensive glacial activity. Dissection of the nearly level plain mentioned previously occurred in the late Tertiary time. Periods of downcutting followed by periods of terrace gravel deposition continued into the late Pleistocene time when the present Sun River and Muddy Creek Valleys were excavated.

Surficial deposits consist of Quaternary age unconsolidated sediments including, from oldest to youngest, terrace gravels, glacial and glacial lake depostis, and Recent age deposits. The Greenfields Bench area located west of Muddy Creek are underlain by 15 to 20 feet of gravel deposited successively at lower levels of the Sun River. The contact of the gravel with the underlying bedrock commonly is marked by springs or seeps and is the principal mechanism for

discharge of sub-surface irrigation returns to surface drainages. Numerous irrigation ditches and canals are located in this area. The underlying bedrock generally parallels the terrace gravels causing the geologic basin to closely resemble the surface drainage basin.

Glacial and glacial lake deposits are the direct result of continental glaciation and are mainly lake deposits from Glacial Lake Great Falls, which covered most of the area now drained by Muddy Creek. Other glacial deposits including end moraine, kame-delta, deltaic and slope-wash, and terrace deposits are found with the glacial lake deposits. A deltaic deposit at Power was formed in Glacial Lake Great Falls to an elevation of 3,715 feet. The delta consists mainly of unconsolidated silt, some clay, and fine-grained sand derived from outwash transported from the glacier lying to the north. The delta merges northward into a glacial outwash channel and originally filled the pre-glacial valley of Muddy Creek. A new channel along this part of Muddy Creek was excavated (some through bedrock) after Glacial Lake Great Falls waters drained from this area and probably was completed by the end of the glacial period.

More recent deposits along Muddy Creek and the Sun River and their tributaries consist of alluvial silt and clay not more than 10 feet thick. Deposits of silt, clay, and small amounts of sand and gravel have accumulated throughout the area as a thin veneer that may be 10 feet thick in coulee bottoms. Landslide deposits consisting of slumped shale along steep slopes are found in many of the area coulees, but are small. Active land sliding of surficial deposits is occuring along Muddy Creek.

Soils along Muddy Creek are mainly composed of alluvial clay and silty clay. Saline seeps containing toxic concentrations of salts are frequently associated with this clayey soil that is difficult to drain. Along Muddy Creek, adsorbed sodium has caused a dense impervious layer a few inches to several feet below the land surface.

Recharge in the form of snowmelt, direct precipitation, surface runoff, leaky irrigation canals, and lateral inflow from alluvial and bedrock aquifers contribute to flow in Muddy Creek and the Sun River.

Using DEQ Source Water Protection Program criteria for ranking aquifer/source water sensitivity (Table 4), the Power Teton County Water District PWS source water is considered highly sensitive to contamination. The sensitivity ranking is a result of the surface water source for the Power PWS.

Table 4. Source water sensitivity criteria (DEQ, 1999).

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

Conceptual Model and Assumptions

Contaminants spilled or discharged directly into Muddy Creek or into one of its immediate tributaries upstream of the Power PWS source intake may reach the surface water intake before plant operators can close/isolate it. Contaminants derived from sources farther removed from the river throughout the watershed may be flushed into tributaries and the main stream channel during spring snowmelt or storm events, or may infiltrate into aquifers which discharge to the creek via hydraulic connections. Contaminants in groundwater can also enter Muddy Creek in areas where it is hydraulically connected to sub-surface sediments.

Delineation Results

Spill Response Region

The Spill Response Region for the Power Teton County Water District PWS extends 1/2 mile downstream and encloses the upstream portion of the Power Teton County Water District surface water intake (Figure 3). There are no major tributaries of Muddy Creek that are a significant source of contamination. The width of the region extends 1/2 mile surrounding either side of Muddy Creek.

Watershed Region

The Watershed Region for the Power Teton County Water District PWS intake encompasses the entire Muddy Creek watershed upstream of the intake (Figure 4). The region extends approximately 2 miles west of Power.

Limiting Factors

The delineations for the Power PWS Spill Response Region and Watershed Region are based on fixed-distance and watershed mapping. The Spill Response Region represents an approximation of the distance required for contaminants released upstream to reach the surface water intake with little lag time. Numerous assumptions are associated with these Source Water Protection Program (SWPP) criteria for Spill Response Region delineations. Contaminant transport rates and concentrations will vary depending on stream/river flow conditions, ground water flux into the river, contributions from overland flow, soil types, slope, characteristics of riparian vegetation, the extent of riparian vegetation buffer zones, the extent and duration of contamination, contaminant solution density, adsorption, mechanical dispersion, biological transformation, dilution, molecular diffusion, adsorption, precipitation, oxidation, complexation, and volatilization. As a result, some areas within the Spill Response Region may be more conducive to contaminant transport than others, and should be designated as higher priority areas for source water protection efforts.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted to assess the susceptibility of Power Teton County Water District PWS to contamination, and to identify priorities for source water protection planning. Inventories were conducted within the delineated Spill Response and Watershed Regions. The inventory focuses on facilities that generate, use, store, transport, or dispose potential contaminants, and on land types on which potential contaminants are generated, used, stored, transported, or disposed. Additionally, the inventory identifies potential sources of all primary drinking water contaminants and pathogens. Only significant potential contaminant sources were selected for detailed inventory. The most significant contaminants posing potential threats to the Power PWS include nitrate, pathogens, herbicides, pesticides, fuels and metals. The inventory for the Power PWS also focuses on all activities in the Spill Response Region, as well as general land uses and large potential contaminant sources in the Watershed Region.

Inventory Method

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

Step 1: Land cover is identified from the National Land Cover Dataset compiled by the U.S. Geological Survey and U.S. Environmental Protection Agency (U.S.G.S., 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), hazardous waste contaminated sites, landfills, and abandoned mines.

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

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

Step 6. All significant potential contaminant sources were identified in the inventory region and land uses and facilities that generate, store, transport, or dispose large quantities of hazardous materials were identified within the recharge region.

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

1) Large quantity hazardous waste generators
2) Landfills
3) Hazardous waste contaminated sites
4) Underground storage tanks
5) Major roads or rail transportation routes
6) Cultivated cropland
7) Animal feeding operations
8) Wastewater lagoons or spray irrigation
9) Septic systems
10) Sewered residential areas
11) Storm sewer outflows
12) Floor drains, sumps, or dry wells
13) Abandoned or active mines

Inventory Results/Spill Response Region

Figure 5 identifies the locations of potential contaminant sources (point sources) in the Spill Response Region. It should be noted that the only major source of contamination apparent on Figure 5 is the Great Northern Railroad. Spills of fertilizers, pesticides, volatile organic compounds (VOCs), and synthetic organic compounds (SOCs) could occur along the railroad tracks within the Spill Response Region (Figure 6). A full listing of businesses in and around Power (based on SIC codes and their potential to be contaminant sources) and other types of facilities was compiled and is present in Appendix C.

The principal land covers in the Spill Response Region are grassland (53%), agricultural land (24%), fallow (23%), with little deciduous forest and commercial or transportation uses (Figure 6). Activities on agricultural land pose a moderate potential threat to the Power Teton County PWS because cultivated cropland occupies 23.6 percent of the Spill Response Region.

Low septic densities occur over the entire Spill Response Region (100% overall). The area is not sewered which means that area residences are utilizing private septic systems. No large capacity septic systems were found in the surrounding residences, therefore the overall risk of contamination is reduced. Even though the individual septic systems themselves may be small, they still pose a risk to the Power surface water intake. Septic density in Power contains areas of both moderate and high risk but it should be noted that Power is located just outside of the spill response region. No concentrated animal feeding operations are located in the Spill Response Region, however, it was noted in an August 2000 letter to Gene and Carol Walker from the South Hills Management Consultants, L.L.P. that cattle were eroding the bank of the creek near the intake area. Septic Density within the Spill Response Region is presented on Figure 7.

Table 5. Potential contaminant sources in the Spill Response Region Power Teton County Water District PWS

Potential Source	Potential Contaminants	Hazard
Cultivated Cropland	Fertilizers, pesticides, pathogens, nitrate	Spills, over application, surface runoff
Great Northern Railway	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
Area Streets and Roads	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
Grazing Cattle	Pesticides, fertilizers	Erosion of creek banks increasing the risk of pesticide/fertilizer runoff
On-site residential septic systems	Nitrate, pathogens	Leaks in septic tanks, leaks in collection lines, system failure, infiltration of untreated effluent into shallow ground water, which may in turn reach surface water

From the above list of potential contaminant sources, some are considered significant based upon the volume of potential releases, the volume of hazardous materials typically handled, the potential of the released materials to impact nearby surface water or groundwater, and the proximity of the sources to the PWS surface water intake.

Table 6. Significant potential contaminant sources in the Spill Response Region Power Teton County Water District PWS.

Source	Potential Contaminants	Hazard
Great Northern Railway	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
Area Streets and Roads	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
Cultivated Cropland	Fertilizers, pesticides, pathogens, nitrate	Spills, over application, surface runoff

Inventory Results/Watershed Region

The Watershed Region for the Power Teton County Water District PWSs includes only the area upstream of Muddy Creek (Figure 4). Most of the potential contaminant sources are located west of the surface water intake in the vicinity of Fairfield and Freezeout Lake (Figure 8). Spills of fertilizers, pesticides, volatile organic compounds (VOCs), and synthetic organic compounds (SOCs) could occur along U.S. Highway s 89 and 287 and the Great Northern railroad tracks within the Watershed Region. Fairfield has several facilities that can potentially contribute contaminants to Muddy Creek either through direct introduction to the stream or via contaminated groundwater entering the stream, such as underground storgage tanks (USTs), storm water discharges, municipal sewer mains, a landfill, and a lagoon. There are also a few mine prospects in the area. The Watershed Region does not encompass Power and as such, it is not a significant hazard. A full listing of businesses in Fairfield (based on SIC codes) was compiled and is present in Appendix D. Predominant land covers in the Watershed Region include agricultural land (48%), grasslands/ herbaceous (36%), fallow (13%), open water (3%), as well as commercial transportation areas (Figure 4). Activities on agricultural land pose a moderate potential threat to the Power Teton County Water District PWS because cultivated cropland occupies 47.9 percent of the Watershed Region.

Low septic densities occur over the entire Watershed Region (99.41% overall). However, there are areas of both high (0.06%) and medium (0.40%) septic density west of the PWS's surface water intake. The Fairfield municipal sewer system is located entirely inside the Watershed Region and comprises approximately 0.13% of the total area. This area is small, but sewer main breaks or leaking connections in the system could pose a threat to the PWS. Table 7 below summarizes septic density in the Spill Response Region and within the Watershed Region.

No concentrated animal feeding operations are located in the Watershed Region (Figure 8). Figure 9 is a detailed tabular and graphical summary of all land use within the Spill Response Region and within the Watershed Region. Table 8 on the following page lists the potential contaminant sources identified in the Watershed Region.

Table 7. Septic Density Analysis for Inventoried Areas of the Power PWS

Spill Response Region		
Hazard Ranking	**Acres**	**% Total in Spill Response Region**
Municipal Sewer	0	0.00%
High	0	0.00%
Moderate	0	0.00%
Low	20,920,181.12	100.00%
Totals	20,920,181.12	100.00%
Watershed Region		
Hazard Ranking	**Acres**	**% Total in Watershed Region**
Municipal Sewer	1,657.81	0.13% (more than)
High	731.41	0.06% (less than)
Moderate	5,122.28	0.40% (more than)
Low	1,262,063.53	99.41% (less than)
Totals	1,269,575.03	100.00%

Table 8. Potential contaminant sources in the Power Teton County Water District PWS Watershed Region

Potential Source	Potential Contaminants	Hazard
Cultivated Cropland	Fertilizers, pesticides, pathogens, nitrate	Spills, over application, surface runoff
Great Northern Railway	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
Highways and Roads	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
On-site residential septic systems	Nitrate, pathogens	Leaks in septic tanks, leaks in collection lines, system failure, infiltration of untreated effluent into shallow ground water, which may in turn reach surface water
Municipal Sewer	Nitrate, pathogens	Leaks in mains/lines, system failure, infiltration of untreated effluent into shallow ground water, which may in turn reach surface water
USTs/LUSTs	VOCs, petroleum hydrocarbons	Spills, leaks impacting groundwater and or reaching surface water
Mining operations	Metals	Erosion and mobilization of metals in sediment and/or leached into surface water and groundwater
Assorted businesses in Fairfield	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Releases or spills, mishandling of chemicals, improper disposal of chemicals anywhere near the lake
Landfill	VOCs, nitrates, pathogens, metals	Contaminated groundwater discharging to surface water
Class V Injection Wells (existence and locations are not known) where storm and/or waste water is concentrated and recharges groundwater.	VOCs, SOCs, petroleum hydrocarbons, metals, pathogens, nitrate	Leaks, spills, improper handling and disposal/discharge of chemicals used by various businesses and are released to systems that allow infiltration of contaminants to the subsurface or to the storm water system
Storm Water / Wastewater Discharges	VOCs, SOCs, pathogens, nitrate, TDS	Leaks, spills, improper handling and disposal/discharge of chemicals used by various businesses and are released to systems that allow discharge of contaminants with wastewater to surface water

From the above list of potential contaminant sources, some are considered significant (Table 9) based upon the volume of potential releases, the volume of hazardous materials typically handled, the potential of the released materials to impact nearby surface water or groundwater, and the proximity of the sources to the PWS surface water intake.

Table 9. Significant potential contaminant sources in the Power Teton County Water District PWS Watershed Region

Source	Potential Contaminants	Hazard
Great Northern Railway	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
Highways and Roads	Pesticides, fertilizers, VOCs, other	Spills, storm water runoff, infiltration into ground water
On-site residential septic systems	Nitrate, pathogens	Leaks in septic tanks, leaks in collection lines, system failure, infiltration of untreated effluent into shallow ground water, which may in turn reach surface water
Municipal Sewer	Nitrate, pathogens	Leaks in mains/lines, system failure, infiltration of untreated effluent into shallow ground water, which may in turn reach surface water
Cultivated Cropland	Fertilizers, pesticides, pathogens, nitrate	Spills, over application, surface runoff
Landfill	VOCs, nitrates, pathogens, metals	Contaminated groundwater discharging to surface water
USTs/LUSTs	VOCs, petroleum hydrocarbons	Spills, leaks impacting groundwater and or reaching surface water
Storm Water / Wastewater Discharges	VOCs, SOCs, pathogens, nitrate, TDS	Leaks, spills, improper handling and disposal/discharge of chemicals used by various businesses and are released to systems that allow discharge of contaminants with wastewater to surface water

Inventory Update

To make this SWDAR a useful document in the years to come, the owners, manager, or the certified water system operator(s) for the public water supply for the Power Teton County Water District 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 extent of the potential contaminant source inventory is limited in several respects. The inventory is based on data readily available through state documents, published reports, and GIS data. Documentation may not be readily available on some potential sources. As a result, all potential contaminant sources may not have been identified. In some instances, inadequate location information precluded the inclusion of potential sources in the inventory.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

Susceptibility of the Power Teton County Water District PWS's source water is determined by two factors: the potential of a contaminant reaching the intake and the resulting health hazard. Susceptibility is assessed in order to prioritize potential pollutant sources in the Spill Response Region in order to guide management actions undertaken by local entities, in this Power Teton County Water District and Teton County.

The goal of source water management is to protect the source water, manage significant potential contaminant sources in the Spill Response Region, and ensure that land use activities in the Watershed Region pose minimal threats to the source water. Management priorities in the Spill Response Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the Power Teton County Water District PWS owner and operators to reduce susceptibility are also included in this section of the report.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will reach the PWS intake. Barriers can be anything that decreases the likelihood that contaminated water will reach Power's surface water intake. 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 10. 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

The hazard presented by point sources of contaminants Power Teton County Water District’s Spill Response Region depends on whether contaminants can discharge directly to Muddy Creek. Point source hazard is also dependent on the health affects associated with potential contaminants (Table 11).

Table 11. Hazard of Potential Contaminant Sources, Determination for Surface Water Sources

Potential Contaminant Sources	High Hazard Rating	Moderate Hazard Rating	Low Hazard Rating
Point Sources of Nitrates or Pathogens	Potential for direct discharge to surface water	Potential for discharge to groundwater hydraulically connected to surface water	potential contaminant sources in the watershed region
Point Sources of VOCs, SOCs, or Metals	Potential for direct discharge of large quantities from roads, rails, or pipelines	Potential for direct discharge of small quantities to surface water	Potential for discharge to groundwater hydraulically connected to surface water
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

Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant (Table 12).

Table 12. Susceptibility Assessment Results

Significant Potential Contaminant Sources in the Spill Response and Watershed Regions

Power Teton County Water District PWS surface water intake

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management Recommendations
Great Northern Railway	Pesticides, fertilizers, VOCs	Spills, storm water runoff, infiltration into ground water	**High**	None	**Very High**	Maintain preparedness of local emergency personnel through active training, runoff diversion, continued remediation of former release sites
Cropped Agricultural Land	Nitrates and pathogens	Contaminants in surface water runoff or irrigation return flows	**Moderate**	None	**High**	Use best management practices
Highways and Roads	Pesticides, fertilizers, VOCs	Spills, storm water runoff, infiltration into ground water	**Moderate**	Distance from intake	**Moderate**	Maintain preparedness of local emergency personnel through active training, storm water diversion
Stormwater Discharges	VOCs, SOCs, pathogens, nitrate, TDS	Storm events that may wash contaminants into surface water near the intake	**Low**	None	**Low**	Public education to reduce improper disposal, spill catchment, stormwater filtration/diversion, wetland development
Landfill	Pathogens, nitrates, VOCs, metals	Contaminants discharging to surface water via groundwater	**Low**	Distance from intake	**Very Low**	Ensure proper maintenance and operation of systems; monitor site
On-site residential septic systems (septic density)	Pathogens, nitrate	Leaks in septic tanks, leaks in collection lines, system failure, infiltration of untreated effluent into shallow ground water	**Low**	Distance from intake	**Very Low**	Educate public on proper maintenance and replacement of on-site systems; promote advanced treatment systems; annex into City sewer district
Municipal Sewer System	Pathogens, nitrate	Leaks in sewer mains to groundwater, which may reach surface water	**Low**	Distance from intake	**Very Low**	Ongoing testing and maintenance of lines and system, replacement of old lines, compliance with current regulations for discharges
Mines	Metals	Contaminants spreading to surface water	**Low**	Distance from intake	**Very Low**	Monitor to ensure proper site management
USTs/LUSTs	VOCs, petroleum hydrocarbons	leaks, spills that reach groundwater, which may reach surface water	**Low**	Spill monitoring, ongoing remediation of spill sites	**Very Low**	Spill response planning, tank and groundwater monitoring, spill catchment, active and ongoing remediation of spill sites

Table 12, above, displays the susceptibility assessment results for the Power Teton County Water District PWS surface water intake. The town's intake on Muddy Creek is susceptible to a number of different contaminants, including pathogens, nitrates, fertilizers, pesticides, VOCs, petroleum hydrocarbons, and total dissolved solids. The above assessment addresses both the Spill Response Region and the Watershed Region for the Power PWS.

The susceptibility assessment results for each significant potential contaminant source identified is described below:

Great Northern railway – The potential hazard imposed by pesticides, fertilizers, VOCs and SOCs originating from the Great Northern railway is high. The railway and former spills along the railway pose a high threat. This is because there is potential for a spill originating on or near the tracks to directly discharge into Muddy Creek upstream from the Power's surface water intake. Contamination from former spills could reach surface water indirectly. The susceptibility of the Power Teton County Water District PWS to contaminants originating from this source is considered to be very high, as there appear to be no barriers to contamination.

Cropped Agricultural land – The potential hazard imposed by pathogens and nitrate originating from agricultural land is moderate. The percent of agricultural land in the spill response region is 24% and in the watershed region is 48% classifying the hazard as moderate. The susceptibility of the intake to nitrate and pathogens originating from this source is high, as there are no barriers identified between this source and the town's intake.

Highway 89, Highway 287 and other roads near the creek – The potential hazard imposed by pesticides, fertilizers, VOCs, and SOCs originating from releases along these roads is moderate. This is because there is potential for a spill originating on or near the roadways to discharge into Muddy Creek near or upstream from the Power Teton County Water District's surface water intake overtime. The susceptibility of the Power Teton County Water District PWS to contaminants originating from this source is considered to be moderate. A barrier identified for this source is the distance from the intake for the two highways.

The Power Teton County Water District PWS has a low to very low susceptibility to the remaining significant sources listed in Table 12 above. The hazard they pose is low due to the presence of barriers that reduce the susceptibility, the most significant being the distance from the intake. It should be noted that even small releases of some chemicals in close proximity to a surface water intake can have significant negative impact on water quality, and is therefore a significant threat to the public water supply. Steps can be take to reduce the likelihood of releases in the source water for the PWS or in the vicinity of the intake. Some of these steps (considered management recommendations) are listed below.

Management Recommendations

Management recommendations are included in the susceptibility table for the Power PWS (Table 12). If these management recommendations are implemented, they may be considered additional barriers that will reduce the susceptibility of Power Teton County Water District's intake to specific sources and contaminants.

Management recommendations fall into the following categories:

- Sewer maintenance and leak detection
- Municipal sewer extension
- Agricultural best management practices
- Stormwater management
- Proper disposal and monitoring of oil and gas production wastewater
- Education
- Emergency Response Planning

Sewer Maintenance and leak detection – Early warning of leaks and scheduled replacement of aging sewer lines will reduce the susceptibility of Power's intake to contamination from municipal septic wastes.

Sewer Extension – Installation of advanced septic treatment systems such as sand filters can limit contamination from new rural residential development, however, annexation and extension of sewers is the only way to reduce contamination from existing unsewered developments.

Agricultural and silvicultural best management practices (BMPs) – BMPs that address application and mixing of fertilizer and pesticides are a viable alternative to prohibition of their use. BMPs may also be utilized to minimize surface runoff and soil erosion on cultivated fields. Erosion control, selective logging, and other silvicultural practices (essentially BMPs) should be considered on a county-wide basis. BMPs are generally voluntary but their implementation can be encouraged through education and technical assistance. County planning can help promote the implementation of BMP on lands that are outside city limits but indirectly affect the city PWS.

Stormwater management – Stormwater planning should address source and drainage control. Source control can be accomplished through educational programs focussing on residential and commercial chemical use, disposal, and recycling. Drainage control and pollutant removal can be accomplished through the use of vegetated detention basins at outfall locations. The construction of storm runoff wetlands can go a long way to reducing the amount of non-point pollutants that could potentially reach the lake.

Education - Educational workshops provided to the general public by the city, county, or state promote safe handling and proper storage, transport, use, and disposal of hazardous materials. Ongoing training provided to designated emergency personnel will promote the efficiency and effectiveness of emergency responses to hazardous material spills. Likewise, educational workshops provided to rural homeowners will promote the proper maintenance and replacement of residential septic systems. The EPA and the State of Montana can provide educational materials on these topics.

Hazardous Materials Collection Days – Several counties in the state that have vulnerable water supplies have implemented scheduled days for the collection of hazardous wastes from the public. These vary in the inclusiveness of what materials are collected, how the materials are handled, and how they are disposed of, but they all act to reduce the amount of unauthorized or improper disposal of these wastes. Used motor oil collection station could be established and available to the public on a regular basis.

Emergency Response Plan – Several counties have compiled Emergency Response Plans that were then adopted by the local communities. The usefulness and effectiveness of a response plan are maximized if it contains a clear listing of all emergency contacts, emergency numbers, and resources available within the county to respond to an emergency situation, such as a hazardous material spill. Emergency plans are not difficult to develop or distribute, but have a significant benefit to the citizens and municipalities within the county.

These management recommendations should be considered by the Power Teton County Water District PWS operator, the city administration, and the Teton County administration. Should contamination reach the town's intake, the City and County will likely need to work cooperatively to address remediation or relocation of the Power PWS source.

Monitoring Waivers

Monitoring Waiver Requirements

The 1986 Amendments to the Safe Drinking Water Act require that community and non-community PWSs sample drinking water sources for the presence of volatile organic chemicals (VOCs) and synthetic organic chemicals (SOCs). The US EPA has authorized states to issue monitoring waivers for 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.

Susceptibility Waiver for Confined Aquifers
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 where the well provides 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 contained within 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 usually locally recharged from surface water or precipitation. In general, groundwater flow gradients in unconfined aquifers reflect surface topography, and the residence time of water in the aquifer is comparatively shorter than for water in confined aquifers. Similar water chemistry often exists between unconfined groundwater and area surface water, also physical parameters and dissolved constituents can be an indicator of the hydraulic connection between groundwater and surface water. Consequently, unconfined aquifers can be susceptible to contamination by organic chemicals migrating from the ground surface to groundwater.

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 development, monitoring history of the source, geologic characteristics of the unsaturated soil and vadose zones, and chemical characteristics of the organic chemicals pertaining to their mobility and persistence in the environment. The zone of contribution of the unconfined groundwater source must be defined and plotted. This should describe the groundwater flow directions, gradients, and a 3-year time-of-travel. All surface bodies within a 1,000 feet of the PWS well(s) must be plotted. Analytical monitoring history of the PWS well and those nearby should be provided as well.

<u>Waiver Recommendation</u>

Currently, the Power Teton County Water District does have some waivers. According to DEQ records, the Power Teton County Water District PWS has both a Phase II Inorganic Chemicals waiver and a Phase V Inorganic Chemicals waiver. For further monitoring waiver consideration, Power Teton County Water District PWS should submit a letter to DEQ requesting additional monitoring waivers. The PWS also needs to provide additional information to DEQ regarding chemical use within the Spill Response Region.

REFERENCES

Alt, David, and Hyndman, Donald W., 1990, Roadside Geology of Montana, Mountain Press Publishing Company, Missoula.

Alt, David, and Hyndman, Donald W., 1998, Northwest Exposures, A Geologic Story of the Northwest, Mountain Press Publishing Company, Missoula.

Board of Water Well Contractors, Administrative Rules of Montana, 01/30/2001. 36.21.656-.660

Community Services Bureau of the Department of Environmental Quality, 1999. Inorganic Chemical Monitoring Waiver for Power Teton County Water District, PWSID #00311.

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

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

Heath, Ralph C., 1984. Ground-water Regions of the United States, U.S. Geological Survey, Water Supply Paper 2242, Washington D.C., 78p.

Maughan, Edwin R. Geology of the Vaughn Quadrangle. 1961. United States Geological Survey.

Midwest Assistance Program, 2000. Correspondance for Power Teton County Water District PWS – PWS #00311.

Montana Bureau of Mines and Geology tabular well information, 2000: http://mbmgsun.mtech.edu/ & http://mbmggwic.mtech.edu/

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

Montana State Library - Natural Resource Information Service, 2000. Graphical and tabular information: http://nris.state.mt.us/mapper/

Montana State Library - Natural Resources Information System (NRIS) 2000 map base of the USGS Topographical coverage at 1:24,000 scale in MrSID format.

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

South Hills Environmental Management Consultants, L.L.P., 2000. Correspondence for Power Teton County Water District PWS - PWS # 00311.

Systems Technology, Inc. November 1979. Muddy Creek Special Water Quality Project. Helena, Montana.

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

U.S. Geological Survey, 2000. National Landcover Dataset, Montana. 30-meter electronic digital landcover / land use data set interpreted from satellite imagery.

GLOSSARY*

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

Alkalinity. The capacity of water to neutralize acids.

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

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

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

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

Delineation. A process of mapping source water management areas.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Transmissivity. The ability of an aquifer to transmit water.

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

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

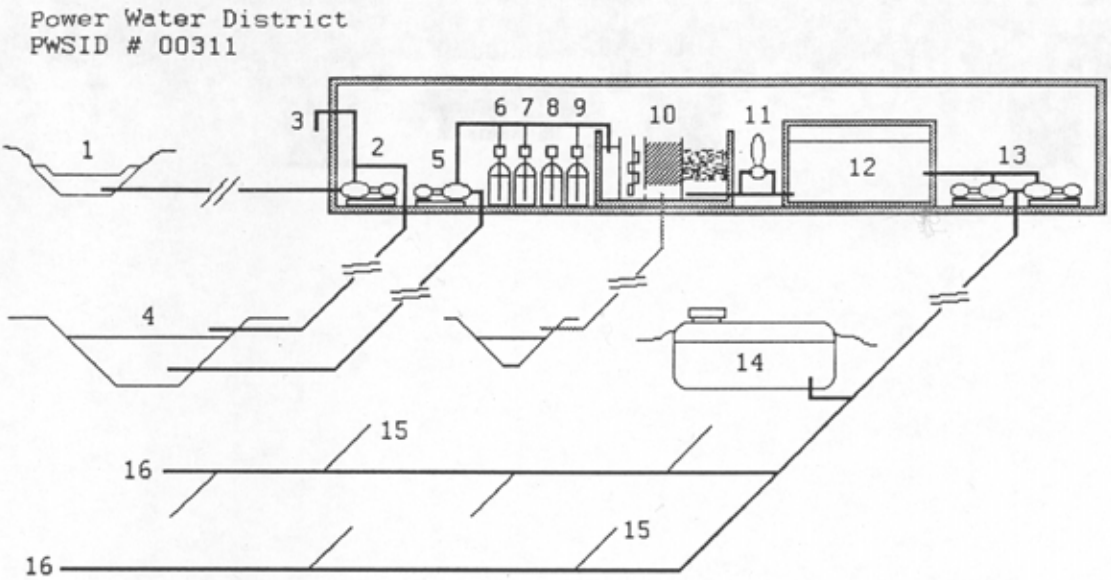
Recharge Region / Watershed. The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common delivery point.

* Definitions taken from EPA's Glossary of Selected Terms and Abbreviations and other sources.

APPENDICES

APPENDIX A

Site Layout



1.Muddy Creek intake
2.Pre-Sedimentation pump
3.Fire truck load line
4.Pre-Sed. pond - 5.0 MG
5.Raw water pump
6.Coagulant equip.
7.Polymer equip.
8.Potassium Permang. equip. (not in use)
9.Calcium Hypo. equip.
10.60 gpm Microfloc package plant
11.Backwash pump
12.Clearwell tank
13.Finish water pumps
14.Cistern storage tank - 40K gals.
15.Service lines w/meters
16.Deadend main w/ 2 inch blowoff.

This drawing is not to scale nor exact. It is meant to demonstrate system components only.

FACILITY CONFIGURATION: Power Teton Co. Water District
A surface water system consisting of an intake structure on the Muddy Creek, a 5.0 MG pre-sedimentation basin, a 0.70 MG Microfloc single train package plant, and a clearwell with finish water pumps that supply a 40K cistern. The distribution system has dead-end mains which are equipped with 2-inch blowoffs. All service lines are metered.

APPENDIX B

DEQ PWS's Database Output

Chemical	1st Collection	2nd Collection	3rd Collection	4th Collection	5th Collection
Trichloroethane	08/27/2001 **0 mg/L**	11/10/1999 **0 mg/L**	10/05/1998 **0 mg/L**	08/05/1997 **0 mg/L**	07/23/1996 **0 mg/L**
Antimony	10/05/1998 **0 mg/L**	08/05/1997 **0 mg/L**	07/23/1996 **0 mg/L**	__ __ __ __*	__ __ __ __*
Arsenic	08/27/2001 **0 mg/L**	11/10/1999 **0.002 mg/L**	10/05/1998 **0 mg/L**	__ __ __ __*	__ __ __ __*
Barium	06/16/1995 **0.035 mg/L**	12/23/1994 **0.046 mg/L**	07/16/1993 **0.027 mg/L**	04/26/1991 **0.076 mg/L**	08/10/1988 **0.04 mg/L**
Beryllium	10/05/1998 **0 mg/L**	08/05/1997 **0 mg/L**	07/23/1996 **0 mg/L**	__ __ __ __*	__ __ __ __*
Cadmium	06/16/1995 **0 mg/L**	12/23/1994 **0 mg/L**	07/16/1993 **0 mg/L**	04/26/1991 **0 mg/L**	08/10/1988 **0 mg/L**
Chromium	06/16/1995 **0 mg/L**	12/23/1994 **0 mg/L**	07/16/1993 **0 mg/L**	04/26/1991 **0 mg/L**	08/10/1988 **0 mg/L**
Dinoseb	08/27/2001 **0 mg/L**	07/23/1996 **0 mg/L**	07/16/1993 **0 mg/L**	__ __ __ __*	__ __ __ __*
Fluoride	08/28/2000 **0.74 mg/L**	06/16/1995 **0.72 mg/L**	12/23/1994 **0.83 mg/L**	07/16/1993 **0.7 mg/L**	04/26/1991 **1.02 mg/L**
Mercury	06/16/1995 **0 mg/L**	12/23/1994 **0 mg/L**	07/16/1993 **0 mg/L**	04/26/1991 **0 mg/L**	08/10/1988 **0 mg/L**
Nickel	10/05/1998 **0 mg/L**	08/05/1997 **0 mg/L**	07/23/1996 **0 mg/L**	__ __ __ __*	__ __ __ __*
Nitrate + Nitrite (as N)	08/28/2000 **0.35 mg/L**	11/10/1999 **1.67 mg/L**	10/05/1998 **0.28 mg/L**	08/05/1997 **0.02 mg/L**	05/24/1996 **0.47 mg/L**
Oxamyl	08/27/2001 **0 mg/L**	07/23/1996 **0 mg/L**	07/16/1993 **0 mg/L**	__ __ __ __*	__ __ __ __*
Polychlorinated Biphenyls	08/27/2001 **0 mg/L**	07/23/1996 **0 mg/L**	07/16/1993 **0 mg/L**	__ __ __ __*	__ __ __ __*
Selenium	06/16/1995 **0.002 mg/L**	12/23/1994 **0.001 mg/L**	07/16/1993 **0 mg/L**	04/26/1991 **0.003 mg/L**	08/10/1988 **0.003 mg/L**
Simazine	08/27/2001 **0 mg/L**	07/23/1996 **0 mg/L**	07/16/1993 **0 mg/L**	__ __ __ __*	__ __ __ __*
Thallium	10/05/1998 **0 mg/L**	08/05/1997 **0 mg/L**	07/23/1996 **0 mg/L**	__ __ __ __*	__ __ __ __*

* No samples were collected

APPENDIX C

Listing of Potential Contaminant Sources by SIC Code & Other Sources for Power (Teton County)

Name	Address	City	State	Zip	Phone	SIC 1	SIC 2	SIC 3	SIC 4	Latitude	Longitude
Flaman Equipment Rental	1010 2nd Rd. NE	Power	MT	59468	467-2901	769942				47.640420	-111.76950
Lattin Trucking & Construction	1010 2nd Rd. NE	Power	MT	59468	467-2901	421203	179403	152103	519114	47.640420	-111.76950
Mountain View Co-Op	307 Cascade Ave	Power	MT	59468	463-2281	422101	517210	515301		47.715540	-111.68340
Power Fire Dept		Power	MT	59468	463-2231	922404				47.683620	-111.52830
Power Merc Butchering	310 Central Ave	Power	MT	59468	463-2306	201104				47.715000	-111.68640
Power School District 30	402 Teton Ave	Power	MT	59468	463-2251	821103				47.715780	-111.68772

APPENDIX D

Listing of Potential Contaminant Sources by SIC Code & Other Sources for Fairfield (Teton County)

Name	Address	City	State	Zip	Phone	SIC 1	SIC 2	SIC 3	SIC 4	Latitude	Longitude
A M Construction Llc	2144 US Highway 89	Fairfield	MT	59436	467-3470	152103				47.663640	-112.00728
A W Trucking	291 8th Ln Sw	Fairfield	MT	59436	467-2231	421304				47.581080	-112.15680
Ag Mont Custom Air Flow	412 4th Ln Ne	Fairfield	MT	59436	467-2087	287301	519114			47.658420	-111.90210
Allen's Feedlot	631 Rust Allen	Fairfield	MT	59436	467-2695	515403				47.663040	-111.92346
Allen's Market	419 Central Ave	Fairfield	MT	59436	467-2323	541105	201104			47.614920	-111.98124
B & D Construction	636 1st Rd Ne	Fairfield	MT	59436	467-2258	152103				47.625360	-111.83562
Baer's Construction	35 W Division	Fairfield	MT	59436	467-2394	152103				47.611560	-111.99258
Batson Photography		Fairfield	MT	59436	467-2217	722101				47.663040	-111.92346
Bob Murray Constr Mobile		Fairfield	MT	59436	467-2750	152103				47.663040	-111.92346
Busch Agricultural Resources	223223 W Main St	Fairfield	MT	59436	467-2440	422101	422105			47.663040	-111.92346
Cummings Custom Cutting	224 County Line Rd	Fairfield	MT	59436	467-2388	201104				47.611020	-111.87882
Dirkes Chevrolet Pontiac Olds	503 Central Ave	Fairfield	MT	59436	467-2321	551102				47.614920	-111.98016
Eagle Iga Grocery	401 Central Ave	Fairfield	MT	59436	467-2424	541105	542107			47.614920	-111.98130
Ervin A Baeth Construction	671 1st Rd Ne	Fairfield	MT	59436	467-2029	179403				47.625420	-111.83562
Fairfield Airport		Fairfield	MT	59436	467-2650	458106				47.663040	-111.92346
Fairfield Boots & Leather	216 3rd Ave N	Fairfield	MT	59436	467-3344	725102	769928			47.617800	-111.98412
Fairfield Elementary School	109 7th Ln Ne	Fairfield	MT	59436	467-2425	821103				47.703780	-111.83634
Fairfield Fire Dept		Fairfield	MT	59436	467-3473	922404				47.663040	-111.92346
Fairfield School	13 7th Ln Sw	Fairfield	MT	59436	467-2528	821103				47.588820	-112.13598
Fairfield School District 21	13 7th Ln Sw	Fairfield	MT	59436	467-2103	821103				47.588820	-112.13598
Golden Ridge School Dist 45	1130 3rd Rd Sw	Fairfield	MT	59436	467-2010	821103				47.556600	-112.26246
Greenfield School District 75	590 2nd Rd Ne	Fairfield	MT	59436	467-2433	821103				47.639820	-111.86100
Harvest Hills Golf Course	PO Box 204	Fairfield	MT	59436	467-2052	799201				47.663040	-111.92346
Kind Irrigation Co	331 13th Ln Sw	Fairfield	MT	59436	467-2090	508305				47.566320	-112.26360
L A Auction Co	86 S Division	Fairfield	MT	59436	467-3333	738901				47.639460	-111.96570
Meyer Ditcher Mfg	90 W Division	Fairfield	MT	59436	467-2506	508310				47.611500	-111.99864
Meyer Ditcher Mfg	10 1st Rd Nw	Fairfield	MT	59436	467-2223	508310	508305			47.639460	-111.96570
Mills Motor Co	302 Central Ave	Fairfield	MT	59436	467-2511	551102	754901	751401		47.614920	-111.98280
Mountain View Canvas Products	850 3rd Rd Sw	Fairfield	MT	59436	467-2601	239406	594109	594113	519948	47.582760	-112.13568
Mountain View Soil Svc Ctr	PO Box 271	Fairfield	MT	59436	467-2563	519114				47.663040	-111.92346
Mountian View Co-Op	Main St	Fairfield	MT	59436	467-2516	517206	519114			47.663040	-111.92346
Oakley Brothers Trucking	4 W Division	Fairfield	MT	59436	467-2116	421304				47.611560	-111.98910
Store	306 Central St	Fairfield	MT	59436	467-3232	541103	592102			47.614920	-111.98280
Swimming Pool		Fairfield	MT	59436	467-2244	799969				47.663040	-111.92346
Teton County Road Dept		Fairfield	MT	59436	467-2106	161103				47.663040	-111.92346
Teton Irrigation Svc	280 1st Ln Ne	Fairfield	MT	59436	467-2619	508305	352310			47.652300	-111.96594
Treasure State Seed Co	6 1st St Sw	Fairfield	MT	59436	467-2557	072301	516916	519105	018101	47.639460	-111.96570

SIC Codes

SIC	#	Description
02**	4	Agricultural production- livestock
07**	41	Agricultural services
1521		General contractors - single family houses
1541		Industrial buildings & warehouses
1611		Highway and street contstruction (not elevated)
1711		Plumbing, heating and air conditioning
1794		Excavation work
2011	0	Meat Packing Plants
2015	0	Poultry Slaughtering and Processing
2491	0	Wood Preserving
27**	26	Printing and publishing
3089		Plastics products, NEC
3295	0	Minerals and Earths, Ground or Otherwise Treated
33**	0	Primary metal industries
3599		Industrial and commercial machinery & equipment, NEC
3732	0	Boat Building and Repairing
3861	0	Photographic Film, Paper, Plates and Chemicals
3911	1	Jewelry, Precious Metal
3914	1	Silverware, Plated Ware, and Stainless Steel Ware
4011	3	Railroads, Line-haul Operating
4142		Bus charter service, except local
4212		Local trucking without storage
4213	19	Trucking, Except Local
4214	2	Local Trucking with Storage
4221	0	Farm Product Warehousing and Storage
4225	16	General Warehousing and Storage
4226	0	Special Warehousing and Storage, NEC
4231	0	Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation
4581	3	Airports, Flying Fields, and Airport Terminal Services
4789	1	Transportation Services, NEC
49**	3	Electric, gas, and sanitary services
5012		Automobiles and other motor vehicles
5013		Motor vehicle supplies and new parts
5015		Motor vehicle parts, used
5043	0	Photographic Equipment and Supplies
5052	0	Coal and Other Minerals and Ores
5063		Electrical apparatus and equipment, wiring supplies & construction materials
5082		Construction and mining (except petroleum) machinery and equipment
5083		Farm & garden machinery and equipment
5084		Industrial machinery and equipment
5085		Industrial supplies
5087		Service establishment equipment
5093	3	Scrap and Waste Materials

SIC	#	Description
5154	1	Livestock
5169		Chemicals and allied products, NEC
5171	0	Petroleum Bulk Stations and Terminals
5172	6	Petroleum and Petroleum Products Wholesalers, Except Bulk Stations and Terminals
5191	4	Farm Supplies
5198	0	Paint, Varnishes, and Supplies
5261	9	Retail Nurseries, Lawn and Garden Supply Stores
5411		Grocery stores
5511		Motor vehicle dealers (new and used)
5521		Motor vehicle dealers (used only)
5531		Auto and home supply stores
5541	9	Gasoline Service Stations
5551		Boat dealers
5941		Sporting goods and bicylce shops
5983	0	Fuel Oil Dealers
5989	0	Fuel Dealers, NEC
5999		Miscellaneous retail stores, NEC
7216	0	Drycleaning Plants, Except Rug Cleaning
7221	6	Photographic Studios, Portrait
7261	3	Funeral Services and Crematories
7335	3	Commercial Photography
7342	1	Disinfecting and Pest Control Services
7384	4	Photofinishing Laboratories
7389		Business services, NEC
75**	31	General Automotive Repair Shops
7692	5	Welding Repair
7694		Armature rewinding shops
7699	20	Repair Shops and Related Services, NEC
7992	2	Public Golf Courses
7999		Amusement and recreation, NEC
8062	2	General Medical and Surgical Hospitals
8071	3	Medical Laboratories
8072	2	Dental Laboratories
8211		Elementary and secondary schools
8734	2	Testing Laboratories
9111		Executive offices
9224		Fire protection

APPENDIX E

Correspondence

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

FILES
C X N ___ P ___
PWSID # 00311
Bacti ___
Correspondence X
Chlorine/Turbidity ___
Lead & Copper ___
Phase II & V ___
GWUDISW ___
Initials C.P.

System Name: Power Teton County Water District
PWSID: 00311
Date of Visit: August 18, 2000
Persons Contacted: Gene Walker and Carol Walker
Reason for Visit: Continuous Technical Assistance
South Hills Personnel: Shelley Nolan

Main Visit:

I met with Carol Walker at 8:20 a.m. on Friday the 18 of August. Carol explained that Gene is a National Guardsman and had to move fire crews to Three Forks and had not returned. Carol took me out to the plant and I toured the treatment facility, raw water intake, the pre-sed holding pond, and the backwash pond. I took photos of all the ponds and treatment plant.

The raw water intake is from Muddy Creek just directly west of the treatment plant. At the time I drove up there were cattle down on the bank, eroding the bank away where the water is dammed up and the intake pipe for the holding pond is located. It is not a good situation. I mentioned to Carol and later to Gene that they should try to alleviate this problem of cattle át their intake for a couple of reasons. The land is owned by the state and is leased out for grazing. I informed them of the source water protection program and that they should have a buffer zone along the creek and keep cattle away from the intake. They only fill the holding pond a couple of times a year but the cattle are ruining the stream bank. The holding pond is a six million gallon pond that shows eutrophication from high organic loading and no algae control. I discussed this with Gene on the need to have algae control considering the problems they are having with taste and odor at this time. It would not be a good time to shock it now with the amount of plants growing in the pond. This would give him more problems with taste and odor. He said the plants would die off this winter so I told him to disperse copper sulfate in the pond in the early spring when they are filling the pond.

The backwash water goes into a small pond that is full of alum sludge currently. The overflow for the clear well, also flows into this if the plant were to keep running and the tank overflows. This water makes it's way back to muddy creek directly and indirectly. The pond is located just west of the Muddy Creek approximately 50 feet and there is a direct stream that flows into the creek through cattails.

The treatment plant is a Microfloc Water Boy 82 package plant with a mixing basin, sedimentation basin with laminar tube settlers, and mixed media filtration. The design capacity of the plant is 70 gpm. The plant is currently operating at 60 gpm with a filtration rate of 5 gpm/sq/ft. The total plant detention time is approximately 38 minutes. The plant utilizes alum mixed from a dry and Nalco 8105 that is diluted to a .27 %

solution. The current feed rate on 8105 is around .5 ppm. Alum is mixed in a 50gallon tub using 3 pounds of dry to every 5 gallons of water. This works out to be 72 mg/ml of alum solution. Normally, the alum is mixed at 1 pound to every 10 gallons of water. The alum pump puts out 60 gpd and is currently set at 70% output. Alum is pumped directly into the raw water line as it enters the treatment plant. The chlorine solution is mixed using 65 % calcium hypo-chlorite and mixing 1 pound to 10 gallons of water. When I visited the solution was mixed at 2 pounds to 5 gallons of water. The pump will pump 2.5 gph and was set at 25% output. There is potassium permanganate that is not being fed at this time. The solution is mixed at 4.5 pounds to every 50 gallons of water. This was recommended for taste and odor control by the MDEQ. Apparently, when they started feeding it the water was coming out brown.

There is one raw water pump that sounds as if the bearings are going out. There is no backup pump on hand and no provisions made if the pump goes out. There are two high service pumps but only one is working. The water flows from the filter to the clear well where it is pumped to a storage tank in town. The clear well capacity is 12,000 gallons and is 7'6" to the overflow. There is a man way on the north west corner that has a cover on it. The probes for the plant and high service pumps are located in the clear well through the man way. The opening is only 18" and there is only 2-3 feet of clearance overhead. There are no permanent ladders attached to get up to the filter area on the treatment train or the clear well. The 40,000 gallon, underground cement storage tank is located in town with a two foot lip above ground. The tank is 32'x32'x8' with water to the 7' level. There is a steel constructed cover that is in excellent shape. To the north of the storage tank is a pump station that contains 3 pumps. There are 2 identical aurora pumps with the North pump as the pressure sustaining pump that runs constantly. The South pump is set on a timer and runs from 6 a.m. to 10 p.m.

Most of the lines in town are PVC and are 2" to 4" with the pumps both 4" line to a 6" line leaving the pump station. Normal line pressure is 30 pounds with the pressure sustaining pump running and 50-60pounds with the high service pump running. The current pressure is 55 pounds. There are 163 people living in Power with 84 hookups. The town is on restrictions with odd and even watering from 6a.m.-12p.m. and 6p.m.-12 midnight. There is no watering on the 31st of each month to keep watering days equal for everyone. The town is metered with a cost of 20.00 for the first 20,000 gallons used. It then cost 10 cents per 100 gallons or $1.00/1,000 gallons. There is no distinction on rates, everyone pays the same whether they are a business or residence.

Problems Encountered

During the visit I checked the on-line turbidimeter to see if it was reading correctly. The meter was reading .65 ntu down to .55 ntu while I was there. My meter read 2.5 ntu and 3.0 ntu when the plant was put back on line. The turbidity was visible in the sample and looked like alum floc precipitation. I asked Gene how he calibrates the turbidimeter because we couldn't find a calibration cylinder earlier. He has an old bench top meter that he checks with a .5ntu standard. He then takes a sample from the filter and reads it on the bench top and changes the on-line reading to what the bench top reading is. We checked his standard against my meter. Gene had some new standard that we used and eventually it was determined his standard was too old. I explained to him that he needs to

use a primary standard and calibrate his turbidity meter at least quarterly and it was o.k. to check it with a secondary standard in between. I also explained that the instrument had to be zeroed with distilled water and a 20 ntu formazin standard entered to read linear. That the way he was doing it will not work since there is nothing for the instrument to compare with on a 4-20ma signal. The plant was having electrical problems prior to my visit and apparently the on–line chlorine analyzer was affected. I trouble shot the meter for fuses, water flow, etc. but could not get the board to read anything but 888. Nothing could be reset and it was recommended that they call Hach and get a new circuit board if that was the problem. I decided to check the chlorine residual and it was over what my meter could read with a max of 5.0ppm. Carol said there had been complaints on odor so they mixed the chlorine stock solution at a higher dose and were trying to mask the pond smell in the water. The plant had a wastewater smell to it when I initially entered it. I called John Camden to confer with him on the turbidity problem and the chlorine problem since they were out of compliance on two regulations. John said they would issue a treatment technique violation for not calibrating the turbidimeter properly. I checked the turbidities going through the treatment process with a raw of 10 ntu, a turbidity of 14.5 after the alum addition, 12.8 ntu in the mixing chamber, 11.8 in the tube settlers onto the filter. There was a snowflake floc with a variation in large size to small size particles. The finished water ntu readings were 2.17, 3.07, and 2.44 with the plant on line. I had Gene go through the back wash cycle to check the timing and look at the condition of the filter. The actual backwash cycle took only 3-5 minutes and goes into a second cycle to fill the sedimentation basin back up. The filter is extremely dirty and loaded with mud balls. I had Gene backwash again and to extend the backwash to 10 minutes. Again it was not long enough and it is not a high enough flow to lift the large mud balls out of the filter bed. We discussed how to clean out the mud balls and they were going to work on it this weekend using a screen to sift out the mud balls while back washing the filter. I tried to work on getting the right chemical dose but it is a guessing game without the proper jar testing equipment to know where you are at. We did get the settled water turbidity down to 7.5 ntu by increasing the detention time and water level. The water level is below the top of the tube settlers and the filter effluent valve is open too much. When the filter opens it looks like a toilet flushing as the water level drops so quickly. I suggested that they dam up the settling basin a couple of inches to raise the water level. We built a temporary dam with wood and it kept the large floc particles from being pulled through the tube settlers onto the filter bed. The filter has been overloaded for an extremely long time. The filter runs are only 5-6 hours with four backwashes per day. The head loss gauge is set to run up to 4 and then it backwashes. According to the manual on the filter there is 8 feet of head loss since the water is all on top of the filter. This can be improved by lessening the turbidity loading of the filter.

Recommendations:

1. Calibration Equipment for On-line turbidity meter. Monthly calibration of on-line turbidity meter and quarterly calibration of bench top meter. Clean and flush.
2. Contact Hach and get chlorine analyzer working properly. Order calibration kit for turbidimeter.
3. Clean filter media for now and order replacement media ASAP.

4. Run jar tests to determine proper chemical dosing. Alum is being mixed 3 times stronger in the summer.and hypochlorite solution is being mixed 4 times as strong. Chlorine demand will increase but shouldn't increase this much. Alum dosing should not change drastically with a pre-sed holding pond. There appears to be high color in the raw from lack of algae control.
5. Algae control of pre-sed holding pond in the early spring when filling the pond.
6. Order back up pump for raw water. Scheduled pump maintenance.
7. Repair second high service pump or replace if not operating.
8. Keep clear well man hole cover in place.
9. Clean alum sludge from backwash receiving pond.
10. Work on getting cattle away from the source water intake.
11. General overall plant maintenance could be improved.
12. Need a second part-time Montana certified water treatment operator to fill in when Gene is on Montana National Guard duty.

Summary

The plant is very run down and in need of repairs. The plant was currently out of compliance on finished water turbidity and chlorine residual parameters. John Camden, Rick Cottingham, and myself will follow up with a technical visit to get plant into compliance and stress the need for a good maintenance program along with closer monitoring of the treatment plant.

Power Teton Co. Water Dist.

MIDWEST ASSISTANCE PROGRAM
O&M TA System Evaluation Report

System Source		
Groundwater	NA	
GWUDISW	NA	
Surface Water	X	Muddy Creek.
System Components		
Intake(s)	X	Weir structure w/ culvert intake.
Well(s)	NA	
Plant(s)	X	Microfloc single train Package plant, 0.7 MGD.
Booster Pump	NA	
Reservoir(s)	X	Plant clearwell and 40K gal. cistern.
PRV(s)	NA	
Hydrants	X	2-inch blowoffs attached to all dead-end mains.
Meters	X	Finish water meter w/totalizer.
O&M Manuals		
Pumps	X	Appear complete - filed at plant and in office.
Motors	X	Appear complete - filed at plant and in office.
Valves	X	Appear complete - filed at plant and in office.
Meters	X	Appear complete - filed at plant and in office.
Hydrants	X	Appear complete - filed at plant and in office.
Lab Inst.	X	Appear complete - filed at plant and in office.
Process Instruments	X	Appear complete - filed at plant and in office.
Chemical Feeders	X	Appear complete - filed at plant and in office.
O&M Records		
Pumps	X	Informal documentation. Discussed & provided materials for formal documentation.
Motors	X	Informal documentation. Discussed & provided materials for formal documentation.
Valves	X	Informal documentation. Discussed & provided materials for formal documentation.
Meters	X	Informal documentation. Discussed & provided materials for formal documentation.
Hydrants	X	Informal documentation. Discussed & provided materials for formal documentation.
Lab Instruments	X	Informal documentation. Discussed & provided materials for formal documentation.
Process Instruments	X	Informal documentation. Discussed & provided materials for formal documentation.
Chemical Feeders	X	Informal documentation. Discussed & provided materials for formal documentation.
Maintenance Schedule	X	Performed as needed. Discussed creation of schedule, provided materials.
Monitoring& Report.		
Monthly BacT	X	Hagen Lab. No recent violations.
Cl2 Res. Groundwater	NA	
F1	X	Utilizes MTDEQ forms. Appear complete.
F2	X	Utilizes MTDEQ forms. Appear complete.
F3	X	Utilizes MTDEQ forms. Appear complete.
F4	X	Utilizes MTDEQ forms. Appear complete.
Lead & Copper	X	State Lab. No violations
Phase 2 & 5	X	State Lab. No violations.
Radiological	X	Energy Lab. No violations.
Nitrite/Nitrate	X	State Lab. No violations.
Sample Site Map	X	Posted and on file with MDEQ.
Consumer Confidence	X	Completed.
Fluoride	NA	
Other	NA	
System Practices		
Inst. Op./Calibration	X	Monthly, as required by Manufacturer.
Cross Connection	X	No formal plan. Discussed and provided materials.
Disinfection	X	Full-time, calcium hypochlorite.
Main Disinfection	X	No formal plan. Discussed and provided materials.
Water Conservation	X	Irrigation season; Alternate watering.
System Metering	X	100 % service line meters.
Source Water Protection	X	No formal plan. Discussed and provided materials.
Capacity Development	X	Seeking Grants for Plant/distribution upgrades. Have reserve operating fund.
Safety	X	Utilizes chemical safety equipment.