New Castle Court
SOURCE WATER DELINEATION AND ASSESSMENT REPORT

New Castle Court
Public Water System

PWSID # MT0004322

Date of Report: 5/31/2006

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ACKNOWLEDGMENTS

This Delineation and Assessment Report for the New Castle Court PWS (source #004322) was completed by Michelle Hutchins, Travis Ross, and Jon Harvala, Environmental Health Specialists with the Missoula Valley Water Quality District. West Riverside is located in Missoula County. The system can be contacted through Bob Greil (406) 258-6273.

GLOSSARY*

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

Alkalinity The capacity of water to neutralize acids.

Aquifer A water-bearing layer of rock or sediment that will yield water in usable quantity to a well or spring.

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.

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

Delineation A process of mapping source water management areas.

Hardness Characteristic of water caused by presence of various chemical compounds. 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.

HazMat Hazardous Materials Response Team.

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 the area expected to contribute water to a public water supply within a fixed distance or a specified groundwater travel time.

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.

MGWPCS Montana Ground Water Pollution Control System.

MPDES Montana Pollution Discharge Elimination System.

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

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

NPL National Priority List (Superfund).

Pathogens Bacterial organisms typically found in the intestinal tracts of mammals, capable of producing disease.

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

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

Pumping Water Level Water level elevation in a well when the pump is operating.

Recharge Region Source water management region that is generally the entire area that could contribute water to an aquifer used by a public water system. Includes areas that could contribute water over long time-periods or under different water usage patterns.

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

SDWA Safe Drinking Water Act.

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.

Static Water Level (SWL) Water level elevation in a well when the pump is not operating.

Susceptibility (of a PWS) The potential for a public water system to draw water with contamination 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) Manmade organic chemical compounds such as herbicides and pesticides.

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

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 that evaporates readily to the atmosphere.

MWQA Montana Water Quality Act.

WQD Missoula Valley Water Quality District.

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

INTRODUCTION

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for New Castle Court PWS as required by the Montana Source Water Protection Program and the federal Safe Drinking Water Act (SDWA).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for New Castle Court PWS. Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources. New Castle Court can use this information to protect their drinking water source. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the New Castle Court PWS operator and the community to complete a source water protection plan that meets their specific needs.

CHAPTER 1
BACKGROUND

The Community

West Riverside is located on the Clark Fork River, approximately 2-3 miles upstream from the City of Missoula. The population of the West Riverside/Bonner area is 1693 (U.S. Census 2000). The population of Missoula County in 2000 was 95,802 with 57,053 people living in the city of Missoula (Census 2000). Interstate 90 runs along the northern edge of Missoula and along the southern edge of West Riverside (Figure 1). Much of the West Riverside population works in Missoula. Major Missoula area employers include the University of Montana, and the two local hospitals, each employing more than 1000 people. Stimson Lumber operates a plywood mill in the West Riverside area, and employs 450 people. Other economic contributors include Smurfit-Stone Container, several transportation companies, as well as tourism, small businesses and outlying agriculture and timber operations. West Riverside residences and businesses currently rely upon onsite septic systems for sewage treatment. Drinking water is supplied by private and small public supply wells.

Geographic setting

West Riverside is located in the Hellgate Valley, upstream of Missoula, Montana, on the Clark Fork River. Milltown Dam and Milltown Reservoir are located approximately ½ to 1 mile upstream from West Riverside, at the confluence of the Clark Fork and Blackfoot Rivers. West Riverside is approximately 3300 feet above sea level. The Hellgate Valley is bordered on the south by the Sapphire Range, on the northwest by the Rattlesnake Range, and on the northeast by the Garnet Range. The annual average precipitation is approximately 13.5 inches (45 inches of snow); the annual average temperature is 44°F with average maximum temperatures occurring in July (83°F) and average minimum temperatures occurring in January (15°F).

General description of the Source Water

The New Castle Court PWS is a community water system that obtains water from two wells finished in the Hellgate Valley aquifer. The aquifer consists of unconsolidated alluvial sand, gravel and cobbles with a few lenses of clay (Woessner, 1984) and is recharged mainly by underflow from the Blackfoot and Clark Fork Valleys and leakage from the Blackfoot and Clark Fork Rivers (Gestring, 1994). The Milltown Reservoir sediments and Upper Clark Fork has been designated a “Superfund” site under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), due to contamination with arsenic and other metals. Analytical results from 2005 (MDEQ) show elevated arsenic levels in water from New Castle Court wells. One sample in August 2005 was above the new drinking water standard of 0.01mg/L, which went into effect In January 2006, and other samples were just below the new standard.

The Public Water Supply

The New Castle Court PWS obtains water from two wells finished in the Hellgate Valley aquifer. The wells are located off of Juniper Drive in the West Riverside area, Missoula County, and draws from an approximate depth of 102 feet below the ground surface. The New Castle Court PWS currently serves an estimated population of 50 with 24 active service connections. The location of the well is shown in Figure 2. The wells link to eight pressure tanks, located in the pump house, prior to distribution. There is currently no treatment system for this PWS. A general plan showing the layout of the distribution system is presented in Appendix A, with copies of the sanitary survey and the driller's well logs.

Water Quality

Every PWS is required to perform monitoring for contamination to their water supply. Water is typically monitored for total coliform and fecal coliform bacteria, nitrates and metals. The monitoring schedule depends on the population served, the number of wells and the source water for the PWS. DEQ defines monitoring programs and protocols that are specific to each PWS. There are no violations of drinking water standards reported in the DEQ's database for this PWS.

Table 1 lists typical chemical constituents of the Hellgate Aquifer. It is important to note that part of the Hellgate Aquifer has been contaminated from Milltown Dam and Reservoir sediments. The Milltown Reservoir has been collecting sediments from mine tailings upstream for decades and harbors several million tons of toxic mine sediments that contain high levels of arsenic and copper. The EPA has issued a Record of Decision requiring the responsible parties to remove the Milltown Dam and the most contaminated sediment behind the dam. A Consent Decree has been signed by the involved parties, and preliminary work has begun. The reservoir is being drawn down in stages to allow dam and sediment removal. There is currently a plume of arsenic-contaminated groundwater, with arsenic levels exceeding Safe Drinking Water Act MCLs, in the Milltown /West Riverside area. This groundwater contamination rendered several wells in the area unusable, and required development of a replacement water source for many residents. The New Castle Court wells are right along the edge of this plume, and past samples from the wells have exceeded 10 µg/L – the new drinking water standard.

Portions of the Clark Fork River downstream could be impacted, temporarily, as sediment from the reservoir is released during removal activities, as it has been in the past during events such as floods, and ice jams, which have occurred periodically. Dam failure is also possible, and this would inundate downstream areas with toxic sediments; dam removal will eliminate the threat of dam failure, and greatly reduce the threat from future sediment releases. Data from a past ice jam event indicate that copper, which is highly toxic to fish but less toxic to humans, rather than arsenic, was the contaminant of concern after this event. The Milltown Reservoir issue is further discussed in the *Inventory* section of this report.

Table 1. Sample water quality data for the Hellgate Valley Aquifer, West Riverside Area (Juday and Keller, 1979; Missoula Water Quality District, 1995- 2002)

Sample date	Well #/ Location	pH	Ca Mg/L	Mg Mg/L	Na Mg/L	SiO_2 Mg/L	$S0_4$ Mg/L	NO_3 Mg/L	PO_4 Mg/L	Cl Mg/L	HCO_3 Mg/L	TDS Mg/L	Fe Mg/L	K Mg/L	As Mg/L
1977 – 1978 (Ave.)	#163 T13N, R18W, 16	7.5	33.9	15.8	5.8	13.9	6.9	.01	0.001	5.0	183.6	268.5	1.0	2.6	--
1995-2002 (Ave.)	WQD 23 T13N, R18W, 18	7.4	38.5	11.7	4.94	--	10.5	0.33	--	2.43	138.8	--	0.024	1.3	.0012

Table 2. Water quality data for New Castle Court (MDEQ, PWS analytical results, 2003-2006)

Sample Date	Well #/ Location	pH	T D S (Mg/L)	NO_3 (Mg/L)	As (Mg/L)	Ba (Mg/L)	Fl^- (Mg/L)	Organic Chemicals	Gross Alpha (PiC/L.)
2003-2005 (Ave.)	PWS #4322	7.3	240	0.11	0.009	0.22	0.11	None Detected	2.0

CHAPTER 2
DELINEATION

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

Hydrogeologic Conditions

Geologic and hydrogeologic studies of the Hellgate Valley are listed in Table 3, with a summary of maps listed in Table 4. The following description is derived from these reports.

Faulting and folding along the Lewis and Clark Lineament has shaped the Hellgate Valley's complex geologic structure. Precambrian metasedimentary rocks of the Belt Supergroup, intruded by several diabase sills and dikes (Woessner and Popoff, 1982), surround the valley, with peaks of 5000 to 6000 feet elevation. This relatively impermeable and deeply eroded landscape was partially filled with Tertiary and Quaternary alluvium. Most of the Tertiary sediments were scoured from the valley during the repeated draining of Glacial Lake Missoula approximately 12,000 to 15,000 years ago, during the Wisconsin glacial stage, and were replaced with layers of coarse-grained sand, gravel and cobbles, deposited during these catastrophic events. Isolated lenses of silt and clay residue from the glacial lakebed remain, and may partially confine some units.

The Hellgate Valley Aquifer is predominantly unconfined and composed of unconsolidated Quaternary alluvium; it has high hydraulic conductivity and yields large volumes of water. Depth to the water table ranges from approximately 20 feet to 70 feet below land surface, with a saturated thickness of less than 10 feet near the Milltown Reservoir increasing to almost 140 feet in the Bandmann Flats area (Gestring, 1994). The seasonal fluctuation of the groundwater table is approximately 9 feet (Gestring, 1994). The lateral extent of the aquifer varies from less than a quarter mile wide at the mouth of Hellgate Canyon, to approximately one mile wide in the Bandmann Flats and West Riverside areas. The aquifer has high source water sensitivity because it is unconfined and comprised of relatively coarse-grained material. Groundwater flows generally west northwestward through West Riverside, roughly paralleling the flow of the Clark Fork River, and joins the Missoula Valley Aquifer near the mouth of Hellgate Canyon, just downstream from East Missoula (Gestring, 1994). The Missoula Valley Aquifer has been designated a "Sole Source Aquifer" by the U.S. EPA. A geologic map of the West Riverside area is presented in Figure 3. Figure 4 represents a generalized ground water flow map. Geologic cross sections are shown in Figure 5.

Table 3. List of geologic or hydrogeologic investigations near West Riverside area.

Title of Project	Reference	Area Covered	Project Purpose.
Preliminary Groundwater Modeling To Estimate Effects of Dam and Sediment Removal on the Alluvial Aquifer in Milltown, Montana	Chris Brick, 2003	Milltown area	To model projected water level decline associated with removal of Milltown Dam
Hydrogeology and water resources of the Missoula Basin, Montana	A.L. Geldon, 1980	Missoula Basin	To determine the storage potential of the basin
The Interaction of the Clark Fork River and the Hellgate Valley Aquifer Near Milltown, Montana.	S.L. Gestring, 1994	Hellgate Canyon, Missoula, Montana	To quantify the interaction between the Clark Fork River and the Hellgate Valley Aquifer
Geographic, Geologic, and Hydrologic Summaries of Intermontane Basins of the Northern Rocky Mountains, Montana	Kendy and Tresch, 1996.	Intermontane basins of the northern Rocky Mountains	Summarize the geographic, geologic and hydrologic characteristics of the Rocky Mountain region in western Montana.
Geology and Ground-water Resources of the Missoula Basin,MT	McMurtrey, et. al, 1965	Missoula Basin	Summary of geology and hydrogeology
Hydrology and Water Chemistry of Shallow Aquifers Along the Upper Clark Fork, Western Montana	D.A. Nimick, 1993	Upper Clark Fork region	Analyze hydrology of bedrock and unconsolidated Tertiary and Quaternary deposits
A Depth to Bedrock Model of the Hellgate Canyon and Bandmann Flats area, Western Montana using Constrained Inversion of Gravity Data	D.L. Nyquest, 2001	Hellgate Canyon/Bandmann Flats	Characterize subsurface topography of bedrock underlying aquifer
Missoula Valley Aquifer Study: Hydrogeology of the eastern portion of the Missoula Aquifer, Missoula County, Montana	W.W. Woessner, 1988	Eastern portion of the Missoula Aquifer	To assess existing and future anthropogenic effects on the aquifer
Hydrogeologic Survey of Milltown	Woessner & Popoff, 1982	Milltown Area	Survey of hydrogeologic system to identify possible sources of As and alternate drinking water supplies.

Table 4. List of geologic or hydrogeologic maps available for West Riverside area.

Title or Description	Date	Area Covered	Reference
Distribution of hydraulic conductivity in the calibrated model	2003	Hellgate Canyon	Brick, Christine, 2003. Preliminary Groundwater Modeling To Estimate Effects of Dam and Sediment Removal on the Alluvial Aquifer in Milltown, MT
Model Calibrated Hydraulic Conductivity	1994	Hellgate Canyon, Missoula County	Gestring, S.L., 1994. The Interaction of the Clark Fork River and the Hellgate Valley on the Aquifer Near Milltown, MT
Geologic Map of Milltown Area	1994	Hellgate Canyon, Missoula County	Gestring, S.L., 1994 (after Nelson and Dobell, 1961). The Interaction of the Clark Fork River and the Hellgate Valley on the Aquifer Near Milltown, MT
Potentiometric Map, March 1993 and June 1993	1994	Hellgate Canyon, Missoula County	Gestring, S.L., 1994. The Interaction of the Clark Fork River and the Hellgate Valley on the Aquifer Near Milltown, MT
Generalized geologic map of the Butte 1 X 2 degree quadrangle, Montana	1987	Approximately 100 X 70 mi. area of Missoula, Powell, Lewis & Clark and Deer Lodge Counties	Wallace, C.A., USGS Miscellaneous Field Studies Map MF-1925
Geology of the Bonner Quadrangle Montana	1961	Missoula to east of Bonner Montana	Nelson, W.H., and Dobell, J.P., 1961. Geologic Map and Sections of the Bonner Quadrangle, MT. USGS Bulletin 1111 - F

Conceptual Model and Assumptions

A conceptual hydrogeologic model is a simplified representation of the hydrogeologic system. This section describes the conceptual model used for this report.

The ground water in the Hellgate Valley is predominantly unconfined and occurs in unconsolidated sand and gravel units beneath the valley floor, which are laterally and basally bounded by the relatively impermeable bedrock. Recharge is derived mainly from the Clark Fork and Blackfoot Rivers, and underflow from the Clark Fork and Blackfoot Valleys, with minor recharge from tributary drainages and excess irrigation and precipitation. The lower reaches of the Blackfoot River are losing water to the aquifer; the Clark Fork is a losing river along most of its path through the Hellgate Valley, with a short gaining stretch, just below the Milltown Dam. Ground water flows generally west northwestward through the West Riverside area, flowing the same overall direction as the Clark Fork River (Figure 5). The direction of ground water flow shifts slightly westward during periods of low flow. In the area of New Castle Court, ground water is currently derived mainly from the Milltown Reservoir. Milltown Reservoir water from the Clark Fork River is driven into the aquifer by the hydraulic head of the reservoir. Blackfoot River water is hydraulically constrained away from this immediate area by the flow coming out of the reservoir. After the dam and reservoir are removed over the next few years, recharge to these wells will likely shift more from the Blackfoot, as the reservoir hydraulic head is removed. The first stage of the permanent drawdown of the reservoir is scheduled to occur this Spring or early summer. Consequently, we have limited the upstream extent of the Clark Fork aquifer included in the inventory region, and included the part of the Blackfoot alluvial aquifer that will likely contribute water in the future. We have truncated the Blackfoot portion of the Inventory Region at a point about 2.5 miles upstream from the confluence where the alluvium diminishes to a thin mantle over a bedrock ridge across the valley.

Methods and Criteria

The Montana Department of Environmental Quality specifies the methods and criteria used for source water protection zone delineation for The New Castle Court PWS (DEQ, 1999). Because the Hellgate Aquifer is in direct contact with the Clark Fork River and communicates with tributary streams in the area, Surface Water Buffer Zones were applied to the drainage system. Buffer zones were applied to both the Clark Fork River and the Blackfoot River for this PWS because the Blackfoot River contributes significantly to recharge in this area. The surface water buffer zones were delineated based on standard distance criteria of 10 miles upstream from the ground water inventory zone and encompassed ½ mile width of land area on each side of the drainages.

Time-of-travel calculations were completed for the ground water system using the uniform flow equation (U.S.E.P.A. 1991). Using published reports, estimates of the aquifer properties were made and are discussed in the following section. The recharge area is defined as the area where the aquifer is present upgradient from the well(s).

Well(s) Information

The well is located on the property off of Juniper Drive in the West Riverside area in Missoula County. Table 5 is a summary of the well information and Appendix B contains copies of the driller's well logs.

Table 5. Source well information for New Castle Court PWS.

Information	Well #1	Well #2
PWS Source Code	**4322 -002**	**4322-003**
Well Location (T, R, Sec or lat, long)	**Lat: 46° 52.612' Long: -113° 53.879'**	**Lat: 46° 52.617' Long: -113° 53.888'**
MBMG#	**181473**	**181472**
Water Right #	**--**	**--**
Date Well was Completed	**2/9/2000**	**2/11/2000**
Total Depth	**102 ft.**	**102 ft**
Perforated Interval	**--**	**--**
Static Water Level	**56 ft.**	**56 ft.**
Pumping Water Level	**Unknown**	**Unknown**
Drawdown	**Unknown**	**Unknown**
Test Pumpi ng Rate	**100 gpm**	**100 gpm**
Specific Capacity	**Unknown**	**Unknown**

Model Input

Time-of-travel calculation values are based on conservative assumptions made to identify areas that potentially impact source water for the New Castle Court PWS. The criteria for selection of each value used for this delineation are summarized as follows:

Thickness: The value for the thickness of the aquifer is estimated at 64 ft (Nyquest, 2001; Gestring, 1994; Schombel (unpublished map)).

Hydraulic Conductivity: The estimated hydraulic conductivity is 3,750 ft/day, based on average hydraulic conductivities upgradient from New Castle Court PWS (Gestring, 1994; Brick, 2003).

Transmissivity: The estimated value for transmissivity in this area is 240,000 ft^2/day (T = Kb, where K = hydraulic conductivity = 3,750 ft/day, b = aquifer thickness = 64 ft).

Hydraulic Gradient: The average hydraulic gradient is estimated to be 0.0046 (Gestring, 1994).

Flow Direction: The flow direction is generally WNW in the area of the New Castle Court PWS and immediately upgradient (Gestring, 1994).

Porosity: The value for effective porosity is estimated at 25%. The estimated value is considered representative of poorly sorted, unconsolidated sand and gravel, and is between two published estimates of 20% (Clark, 1986) and 40% (McMurtrey et. al, 1965).

Pumping Rate: The combined pumping rate of the well is based on 100 gallons per day, estimated use per capita (Solley, et al., 1998; Salvato, 1992).

Time-of-Travel Calculation

Travel distances for 100 days, one year and three years are calculated based on the input values discussed below. The one-year time-of-travel distance is used in Chapter 4 to rate the hazards of potential contaminant sources.

Estimates including aquifer flow properties, well discharge rate, ambient groundwater flow direction, and groundwater gradient are used to calculate the distance corresponding to 100 day, one- and three-year times-of-travel (Table 6). Aquifer flow properties estimated are hydraulic conductivity, aquifer thickness, transmissivity, and effective porosity. For the purpose of this report, we estimated hydraulic conductivity (K) at 3750 ft/day (Gestring, 1994; Brick, 2003), aquifer thickness 64 ft (Schombel, personal communication) and transmissivity of 240,000 $ft.^2$/day. Effective porosity (the ratio of: sediment or rock volume occupied by interconnected voids, to the total sediment or rock volume) was estimated at 25%.

Groundwater flow direction and gradient were estimated from published static water level data and potentiometric surface maps (Gestring, 1994). The effective gradient used in this report is 0.0046. Flow direction was estimated by averaging upgradient flow directions from potentiometric surface maps (Gestring, 1994).

Finally, the pumping rate of the well is based on 100 gallons per day, estimated use per capita (Salvato, 1992) for 50 residents.

Table 6. Estimates of input parameters used to delineate the New Castle Court PWS source water protection area.

Input Parameter	Range of Values	Values Used
PWS Source Code		**4322-002, 003**
Transmissivity	**11,550 – 750,000 ft^2/day**	**240,000ft^2/ day**
Thickness	**30 - 100 ft.**	**64 ft.**
Hydraulic Conductivity	**2000 - 7500 ft/day**	**3750 ft/day**
Hydraulic Gradient	**.0025-.0079**	**0.0046**
Flow Direction	**0-275 deg.**	**292.5 deg.**
Effective Porosity	**0.20 – 0.40**	**0.25**
Pumping Rate	**2.6 – 4.3 gpm**	**3.5 gpm**
100-day TOT	**137 ft. – 29,100 ft.**	**6,950 ft 1.3 miles**
1-Year TOT*	**485 ft. – 105,600 ft.**	**25,000 ft 4.73 miles**
3-Year TOT*	**1448 ft. – 318,500 ft.**	**75,500 ft 14.3 miles**

*Time-of-travel

Delineation Results

The results of the calculations indicate an estimated average distance of 6,950 feet (1.3 miles) for a 100-day time-of-travel (TOT), an average distance of 25,000 feet (4.73 miles) for a one-year TOT and an average distance of 75,500 feet (14.3miles) for a three-year TOT. The inventory zones were modified to reflect hydrologic boundaries, as described in the "Conceptual Model and Assumptions" section, above. The delineated inventory zones are depicted in Figure 6 for the New Castle Court PWS. The surface water buffer zones for the Clark Fork River and Blackfoot River are shown in Figure 7. The recharge region for the aquifer comprises the aquifer upgradient from the supply well, delineated in the inventory zone. A 45-degree range of groundwater flow direction was used to define the lateral boundaries of the inventory region (Figure 5).

Limiting Factors

This delineation is based on estimated aquifer properties, pumping conditions and groundwater flow conditions, and assumes uniform flow in a homogeneous aquifer. Conclusions based on this interpretation are uncertain because the extent and properties of the aquifer, and the direction and rate of groundwater flow are not known precisely, and the actual transient flow and heterogeneous stratigraphy can only be roughly approximated by the above assumptions. Time-of-travel distances are estimates based on available data. We have chosen input parameter values that will give us conservative but reasonable estimates of capture zones. This should provide a protective margin for inaccuracy inherent in calculations of this nature.

CHAPTER 3
INVENTORY

An inventory of potential sources of contamination was conducted for New Castle Court within the control and inventory regions. Potential sources of all primary drinking water contaminants and Cryptosporidium were identified, however, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the New Castle Court inventory region are nitrate, pathogens, fuels, solvents, and metals. The inventory for New Castle Court focuses on all activities in the control zone, municipal and private facilities in the inventory region, and general land uses and large facilities in the recharge region.

Inventory Method

Available databases were searched to identify businesses and land uses that are potential sources of regulated contaminants in the inventory region. A "windshield survey" was conducted to obtain additional information for this assessment. The following steps were followed:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System. Sewered and unsewered residential land use was identified from boundaries of sewer coverage obtained from municipal wastewater utilities. Septic system density outside of the sewered area was evaluated using the Montana Department of Revenue Computer Assisted Mass Appraisal (CAMA) database.

Step 2: EPA's Envirofacts System was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), 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 should be classified as a significant potential contaminant source.

Step 3: The Permit Compliance System (PCS) was queried using Envirofacts to identify Concentrated Animal Feeding Operations with MPDES permits. The water system operator or other local official familiar with the area included in the inventory region identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following in the inventory region: Underground Storage Tanks (USTs), hazardous waste contaminated sites (DEQ CECRA and WQA sites), landfills, abandoned mines and active mines including gravel pits. Any information on past releases and present compliance status was noted.

Step 5: County records were queried to identify businesses that generate, use, or store chemicals in the inventory region. The facilities include equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers.

Step 6: A "windshield survey" was undertaken to identify additional potential contaminant sources not listed in the databases. These are listed in Table 8.

Step 7: Major road and rail transportation routes were identified throughout the inventory region.

Step 8. All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the recharge region and identified on the base map.

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

1) Large quantity hazardous waste generators.
2) Landfills.
3) Underground storage tanks.
4) Known groundwater contamination (including open or closed hazardous waste sites, state or federal superfund sites, and UST leak sites).
5) Underground injection wells.
6) Major roads or rail transportation routes.
7) Cultivated cropland greater than 20 % of the inventory region.
8) Animal feeding operations.
9) Wastewater treatment facilities, sludge handling sites, or land application areas.
10) Septic systems.
11) Sewer mains.
12) Storm sewer outflows.
13) Abandoned or active mines.

Inventory Results/Control Zone

The control zone represents the most critical point to protecting the integrity of the wellhead for ground water sources. The land within the control zone for well #1 (source 002) and is primarily residential land use.

Inventory Results/Inventory Region

Land use within the 3 year TOT inventory zone is approximately 53% evergreen forest/grassland and approximately 47 % residential/commercial. Three major transportation routes run near West Riverside: Interstate 90 is located south of West Riverside and runs east-west; Highway 200 connects with Highway 90 near Milltown Reservoir; Highway 10 also joins Interstate 90 and runs south of West Riverside. In addition, one railroad line runs parallel to Interstate 90. A petroleum pipeline passes within ¾ mile from the wellheads, and represents a significant potential source of contamination. Locations are shown on Figure 9a, Figure 9b, and Figure 9c. Septic system density is approximately 340/mile^2. There is one active class III landfill, operated by Stimson Lumber, in the area. Arsenic-contaminated groundwater from the Milltown Reservoir Superfund site is impacting the New Castle Court wells. After removal of the Milltown Dam and contaminated reservoir sediments, this impact should recede. The significant potential contaminant sources within the inventory zone are listed in Table 7. The general locations of these sources are shown in Figure 10.

Inventory Results/Surface Water Buffer Zones

Significant potential contaminant sources for the surface water buffer zone are pathogens and nitrates from high-density septic system drain fields, cesspools and seepage pits, potential spills of toxic materials along major transportation routes, which pass about 750 feet from New Castle Court, toxic chemicals from potential release sites, including Stimson Lumber, approximately 4/5 miles away, and agricultural land use, which may also contribute pesticides and herbicides to surface waters. The Missoula Valley Water Quality District identified the West Riverside area as a priority for future extension of municipal sewer, due to the density of on-site septic systems, which include a relatively large number of antiquated cesspools and seepage pits (MVWQD, 1996). Future extension of City Sewer to upgradient areas would significantly reduce the threat of contamination from nitrates and pathogens. The petroleum pipeline that passes through the area is a potential threat to surface water in the Clark Fork River. Contamination from this source would probably not impact groundwater quality at New Castle Court, because groundwater is flowing mainly from the Blackfoot Valley. Septic system density in the Surface Water Buffer Zone is 15.5 per mile^2 in the Blackfoot corridor, and 44 per mile^2 in the Clark Fork corridor. There are no permitted confined animal feeding units, class V injection wells or municipal sanitary sewers in the West Riverside area. Two wastewater treatment facilities exist in the inventory region, and are listed in Table 7. Toxic elements from mine tailings are a significant threat to the Clark Fork River above Milltown Dam. The groundwater from the reservoir area flows south of New Castle Court T.C. During certain periodic events (ice jams, flooding) toxic sediments are released below the dam, potentially threatening ground water. However, data suggests that the primary concern associated with these events is toxicity to aquatic life from increased levels of copper in surface water. Surface water flows within about 500 feet of New Castle Court.

Inventory Results/Recharge Region

The land use in the recharge area is primarily private, federal and state evergreen forest. Potential hazards and general land use for the area are depicted in Figure 8

Table 7. Significant Potential Contaminant Sources for PWS #4322 Inventory Region

Facility ID #	Map ID #	Facility Name	Address/Location	Type of Facility	Potential Contaminants	WQD Permit?
MTD98071756	1	Milltown Reservoir Sediments	SE side of town Milltown	NPL	Arsenic, metals	No
MT000025 001A, 002A, 003A [1]; MTD058858721(Handler ID) 32-04262 [2] --4161[3] (DEQ)	2	Stimson Lumber Corporation	9630 HWY 200 E., Bonner	MPES Wastewater Discharge	Pathogens, nitrates,[1] use hazardous chemicals [2] oil release [3]	Yes
32-10972	5	Two Rivers Market	Hwy 200 E. Milltown	UST	Fuel	Yes
32-13629	6	Town Pump	7985 Hwy 200	UST/LUST (active)	Fuel	Yes
	7	Triple Tree Inc.	6205 Pinegrove	AST	Fuel	Yes
32-03961	8	A&T Auto Recycling	6705 Pinegrove	AST/LUST (Inactive)	Fuel	Yes
32-05765	9	Dave's Country Station (former)	HWY 200 E.	LUST (tanks removed)	Fuel	No
32-02084	10	Hillco (former)	9th/ W. Riverside	LUST (tanks removed)	Fuel	No
356 (DEQ)	15	Stimson Log Yard Waste	W. Riverside/1st	Class III Landfill	Wood waste breakdown products	No
	Labeled	Montana Rail Link		Rail line	Fuel/potential derailments (chemical releases)	No
	Labeled	Interstate 90		Freeway	Potential fuel, chemical releases	No
	Labeled	Yellowstone Pipeline		Petroleum products pipeline	Potential fuel releases	No
300630031	Symbol	Bonner Quarry	T13 R18W Sect. 15 C	Inactive Rock Quarry	NA	No

Table 8. Other Minor Potential Contaminant Sources.

Facility ID # (When applicable)	Facility Type	Facility Name	Address	Land Use	Potential Contaminants
10000000092	LEPC	Brian Motor Company	7000 Hwy 200 East	Former auto repair location	Antifreeze, gas, oil, flammable liquids, solvent
1000000279	LEPC	Curley's Transmission	8080 Starr Dr.	Transmission repair	Transmission fluid; oil; anti-freeze
		G & S Reconditioned Auto Sales	8270 Zaugg Dr.	Auto service and sales	Fuel, oil, anti-freeze and solvents
		Interstate Truck & Auto Recycling	7620 W. Riverside	Auto salvage	Waste fuel, oil, antifreeze and other fluids; battery acid
MTD051637098	Handler ID	Matson Audiovisual Microscopic	7620 Zaugg, East Missoula	Hazardous Waste Handler	
MTD981545106	Handler ID	Matsons Laboratory	5410 Flagler, Milltown	Hazardous Waste Handler	
1000000456	LEPC	Milltown Garage	7450 Hwy 200 East	Auto repair	Oil, antifreeze, brake cleaner, lube, carburetor cleaner
		Montana Truck Parts	1250 Tremper	Auto salvage	Waste fuel, oil, anti-freeze and other fluids; battery acid
	Handler	NW Energy – Milltown Dam Project		Hazardous Waste Handler	
		Unidentified shop	8045 Starr Dr.	Truck repair	Gasoline, diesel, oil, antifreeze
		Unidentified shop	8480 Zaugg	Trucking and Hvy Equip.	Gasoline, diesel, oil, antifreeze
		Walker logging truck shop	945 1st, W. Riverside	Diesel truck shop	Fuel, waste oil

Inventory Update

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

Inventory Limitations

The accuracy of the inventory is limited by the accuracy of information provided by state and federal databases. The windshield survey provides a level of quality assurance that the information presented reflects actual conditions. The inventory is also limited by the accuracy of the delineation, which is discussed above.

CHAPTER 4
SUSCEPTIBILITY ASSESSMENT

The susceptibility of the New Castle Court PWS to significant potential contaminant sources is assessed in this chapter. Susceptibility is the potential for a well to be contaminated by one of the sources inventoried in the previous chapter. Hazard ratings and the presence of barriers determine susceptibility (Table 9). Hazard ratings are determined by the proximity of a potential point-source contaminant or the density of a non-point source potential contaminants to the well. For the New Castle Court PWS, contaminant sources within the one-year TOT were given a high hazard rating and all other sources within the inventory region were given moderate hazard rating. The susceptibility is then determined based upon the hazard and any barriers that mitigate the hazard. Barriers can be engineered structures, management actions and/or natural conditions. Spill catchment structures for fueling facilities and leak detection for underground storage tanks are examples of engineered barriers. Emergency planning and availability of trained hazardous materials response team, and best management practices are examples of management barriers. Clay soils, deep wells and a thick layer of substrate above an aquifer can be considered natural barriers.

Table 9. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

Presence Of Barriers	Hazard		
	High	**Moderate**	**Low**
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

For point sources, the relative hazard of the significant potential contaminant sources listed in Table 7 reflects the location of the sites relative to the PWS well and how long ground water would take to travel from that site to the well. For sites located within a time of travel distance of less than one year, the relative hazard is assigned as high. For the remaining sites located in the inventory region, the relative hazard assigned is moderate.

For non-point sources, the relative hazard is assigned based on the following table:

Table 10. Non-point source relative hazard ratings.

Source Type	High Hazard	Moderate Hazard	Low Hazard
Septic Systems	>300 per sq. mi.	50-300 per sq. mi	<50 per sq. mi.
Municipal Sanitary Sewer (% Land Use)	>50% of region	20%-50% of region	<20% of region
Cropped Agricultural Land (% Land Use)	>50% of region	20%-50% of region	<20% of region

Table 11. Susceptibility assessment for significant potential contaminant sources in the Control Zone and Inventory Region.

Map ID#	Facility Name	Contaminant	Hazard	Barriers	Susceptibility	Management
	Septic Systems: Density = 340/mi^2	Pathogens, nitrates	High		Very High	Extension of municipal sewer to areas upstream.
1	Milltown Reservoir Sediments	Arsenic, metals	High		Very High	Removal of contaminated sediment and dam will minimize this potential source.
Labeled	Yellowstone Pipeline	Potential fuel releases	High	HazMat	High	
Labeled	Montana Rail Link	Potential fuel, chemical spills	High	HazMat	High	
Labeled	Interstate 90	Potential fuel, chemical spills	High	HazMat	High	
2, 15 [1]	Stimson Lumber Corporation	Oil release; hazardous chemical handler (NaOH, diesel, new oil, cyclohexamine, PCBs, formaldehyde, Ca hypochlorate, gasoline); Class III Landfill [1]	High	Pollution prevention permit; HazMat	High	Remediation of oil release site; continued program of spill prevention; timely turnover of log yard waste piles [1].
2	Stimson Lumber Wastewater Treatment Facilities	Pathogens/nitrates	High	Trickling filter, activated sludge, chlorination	Moderate	Maintenance of adequate treatment systems.
5	Two Rivers Market	Fuel	High	Pollution prevention permit; HazMat	Moderate	

Map ID#	Facility Name	Contaminant	Hazard	Barriers	Susceptibility	Management
6	Town Pump	Fuel	High	Pollution prevention permit; HazMat	Moderate	
7	Triple Tree	Fuel	High	Pollution prevention permit; HazMat	Moderate	
8	A&T Auto Recycling	Fuel	High	Pollution prevention permit; HazMat	Moderate	
9	Dave's Country Station (former)	Fuel	High	Tanks removed; site remediation; site not being used	Low	
10	Hillco (former)	Fuel	High	Tanks removed; site remediation	Moderate	
Symbol	Bonner Quarry	NA (Inactive rock quarry)	High	Inactive; no chemical processing used	Moderate	

The results of the susceptibility assessment indicate that septic systems, Milltown Reservoir, and transportation routes pose the most significant threats to the source water for New Castle Court public water supply system. A trained HazMat team helps to control the susceptibility from transportation accidental releases. The extension of municipal sewer to this area, and eventually areas upstream, would help control the potential pathogen and nitrate contamination from high-density septic systems.

REFERENCES

Brick, C., 2003. Preliminary Groundwater Modeling To Estimate Effects of Dam and Sediment Removal on the Alluvial Aquifer in Milltown, Montana. Clark Fork Coalition, 24 p.

Canonie, 1993. MRSSS Remedial Investigation Report, Sections 5, 6, and 9. Prepared for Atlantic Richfield Company. Prepared bt Canonie Environmental Services, Englewood, CO.

CH2M Hill, 1984. Milltown Superfund Site Supplemental Data Interpretation of Geochemical Release Mechanisms and Arsenic Fate and Transport, Appendix 6-C, 83p.

Clark, K.W., 1986. Interactions between the Clark Fork River and Missoula Aquifer, Missoula, Montana. University of Montana, M.S. thesis, 150 p.

Driscoll, F.G., 1986. Groundwater and Wells, 2nd Edition. Johnson Division, St. Paul, Minnesota.

Fetter, C.W., Jr., 1980. Applied Hydrogeology. Charles E. Merrill, Columbus, Ohio, 488 p..

Freeze, R.A., and Cherry, J.A., 1979. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, NJ, 604 p.

Geldon, A. L., 1980. Hydrogeology and Water Resources of the Missoula Basin, Montana. University of Montana, M.S. thesis, 114 p.

Gestring, S.L., 1994. The Interaction of the Clark Fork River and the Hellgate Valley Aquifer Near Milltown, Montana. University of Montana, M.S. thesis, 273 p.

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

Land and Water Consulting, 1994. Quantitative Groundwater Flow Model For the Hellgate Valley. Prepared for ARCO, Anaconda, Montana.

Missoula Valley Water Quality District, 1996. Evaluation of Unsewered Areas in Missoula, Montana.

Montana Department of Environmental Quality (DEQ), 1999. Montana Source Water Protection Program.

Nelson, W.H., and Dobell, J.P., 1961. Geology of the Bonner Quadrangle Montana. U.S. Geological Survey Bulletin 1111 – F, 235 p.

Nimick, D.A., 1993. Hydrology and Water Chemistry of Shallow Aquifers Along the Upper Clark Fork, Western Montana. U.S. Geological Survey Water-Resources Investigations Report 93-4052, 63 p.

Nyquest, D. L., 2001. A Depth to Bedrock Model of the Hellgate Canyon and Bandmann Flats Area, Western Montana, Using Constrained Inversion of Gravity Data. University of Montana M.S. Thesis, 186 p.

Salvato, J.A., 1992. Environmental Engineering and Sanitation. John Wiley & Sons, Inc. pp. 285-294.

Solley, W.B., Pierce, R.R. and Perlman, H.A., 1998. Estimated Use of Water in the United States in 1995. U.S.G.S. Circular 1200, pp. 24 – 27.

U.S. Environmental Protection Agency, 1997. Water on Tap: A Consumer's Guide to the Nation's Drinking Water.

Woessner, W.W., 1988. Missoula Valley Aquifer Study: Hydrogeology of the Eastern Portion of the Missoula Aquifer, Missoula County, Montana. University of Montana Department of Geology, 127 p.

Woessner, W.W., and Popoff, Marin A., 1982. Hydrogeologic Survey of Milltown, Montana and Vicinity, University of Montana Department of Geology.

APPENDIX A

PWS System Layout and Sanitary Survey

APPENDIX B

Well Logs for PWS

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
LIERG INC * EAST WELL (#1)

Location Information

GWIC Id:	181473	Source of Data:	LOG
Location (TRS):	13N 18W 20 AB	Latitude (dd):	46.8763
County (MT):	MISSOULA	Longitude (dd):	-113.8985
DNRC Water Right:		Geomethod:	TRS-SEC
PWS Id:		Datum:	NAD27
Block:		Altitude (feet):	
Lot:		Certificate of Survey:	
Addition:	NEW CASTLE COURT	Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	102.00	How Drilled:	ROTARY
Static Water Level (ft):	56.00	Driller's Name:	BLACKFOOT
Pumping Water Level (ft):		Driller License:	WWC578
Yield (gpm):	100.00	Completion Date (m/d/y):	2/9/2000
Test Type:	AIR LIFT	Special Conditions:	
Test Duration:	2.00	Is Well Flowing?:	
Drill Stem Setting (ft):	96.00	Shut-In Pressure:	
Recovery Water Level (ft):	56.00	Geology/Aquifer:	112ALVM
Recovery Time (hrs):	0.25	Well/Water Use:	PUBLIC WATER SUPPLY
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	102.0	6.0

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	98.5	6.0	0.250		WELDED	STEEL

Annular Seal Information

From	To	Description
0.0	0.0	BENTONITE

Completion Information[1]

No Completion Records currently in GWIC.

Lithology Information

From	To	Description
0.0	1.5	TOPSOILS
1.5	16.0	GRAVELS, COBBLES, SMALL BOULDERS
16.0	19.5	SAND, DARK GRAY TO BLACK
19.5	28.0	GRAVELS, SMALL TO MEDIUM SIZED
28.0	29.0	SAND
29.0	31.0	GRAVELS, SMALL TO MEDIUM SIZED
31.0	31.8	SAND
31.8	54.0	GRAVELS, SMALL TO MEDIUM SIZE, SANDS.
54.0	55.5	SAND
55.5	74.0	GRAVELS, SMALL TO MEDIUM SIZED, SANDS. DAMP AT 54 FT, PUMPS SILTY WATER AT 62 FT AND BEYOND. SILTS BEDDED IN FORMATION PREVENT YIELD BEYOND 15 GPM.
74.0	76.0	SAND AND SILT, FINE, PREVENTS WATER YIELD.
76.0	102.0	GRAVELS & COURSE SAND, WATER, 100+ GPM AT 100 FT. PUMPS CLEAR AFTER TWO HOURS OF DEVELOPMENT.

[1] - All diameters reported are **inside** diameter of the casing.

Montana Bureau of Mines and Geology
Ground-Water Information Center Site Report
LIERG INC * WEST WELL (#2)

Location Information

GWIC Id:	181472	Source of Data:	LOG
Location (TRS):	13N 18W 20 AB	Latitude (dd):	46.8763
County (MT):	MISSOULA	Longitude (dd):	-113.8985
DNRC Water Right:		Geomethod:	TRS-SEC
PWS Id:		Datum:	NAD27
Block:		Altitude (feet):	
Lot:		Certificate of Survey:	
Addition:	NEW CASTLE COURT	Type of Site:	WELL

Well Construction and Performance Data

Total Depth (ft):	102.00	How Drilled:	ROTARY
Static Water Level (ft):	56.00	Driller's Name:	BLACKFOOT
Pumping Water Level (ft):		Driller License:	WWC578
Yield (gpm):	100.00	Completion Date (m/d/y):	2/11/2000
Test Type:	AIR LIFT	Special Conditions:	
Test Duration:	2.00	Is Well Flowing?:	
Drill Stem Setting (ft):	96.00	Shut-In Pressure:	
Recovery Water Level (ft):	56.00	Geology/Aquifer:	112ALVM
Recovery Time (hrs):	0.25	Well/Water Use:	PUBLIC WATER SUPPLY
Well Notes:			

Hole Diameter Information

From	To	Diameter
0.0	102.0	6.0

Casing Information[1]

From	To	Dia	Wall Thickness	Pressure Rating	Joint	Type
-1.5	98.5	6.0	0.250		WELDED	STEEL

Annular Seal Information

From	To	Description
0.0	0.0	BENTONITE

Completion Information[1]

No Completion Records currently in GWIC.

Lithology Information

From	To	Description
0.0	1.8	TOPSOIL
1.8	18.0	GRAVEL, COBBLES, SMALL BOULDERS
18.0	21.5	SAND, DARK GRAY TO BLACK
21.5	56.0	GRAVELS WITH SMALL AMOUNTS OF SAND AND SILT, DAMP @ 54 FT.
56.0	59.5	SAND, WATER, WATER YIELD IS SUBSTANTIALLY RESTRICTED DUE TO COMPACTION AND SMALL SIZE OF FORMATION.
59.5	64.0	GRAVELS WITH SANDS AND SILTS, DAMP, RESTRICTED WATER FLOW
64.0	70.0	GRAVELS, SMALL TO MEDIUM SIZED, SANDS. PUMPS SILTY WATER AT 64 FT AND BEYOND. SILTS BEDDED IN FORMATION PREVENT YIELD BEYOND 15 GPM.
70.0	102.0	GRAVELS AND COURSE SANDS, WATER, 100+ GPM AT 100 FT. PUMPS CLEAR AFTER TWO HOURS OF DEVELOPMENT.

[1] - All diameters reported are **inside** diameter of the casing.

APPENDIX C

MBMG-GWIC Well Logs for Area

Appendix C

Ground Water Information Center
Wells Report

The following data were returned from the GWIC databases for the area you requested. For a more detailed description of the data view the GWIC Metadata report. If you notice data entry errors or have questions please let us know by clicking here to send us an E-mail. If you wish to view a one page report for a particular site, click the hyperlinked Gwic Id for that well. Scroll to the right of your screen to view all the data.

Retrieval Statistics *				
Field	Max	Min	Count	Avg
Total Depth	380.00	58.00	36	95.39
Pumping Water Level	98.00	27.00	21	58.10
Static Water Level	211.00	16.00	30	48.47
Yield (gpm)	800.00	7.00	28	87.61

* These statistics do not take any geographic, topographic, or geologic factors into consideration. Negative swl values are reported for water levels that are above land surface.

Gwic Id	DNRC WR	Site Name	Location	Ver?	Type	Td	Pwl	Swl	Yield	Date	Use
68134		ANUE PETE	13N18W21	NO	WELL	82.00	54.00	56.00	16.00	4/12/1961	PUBLIC WATER SUPPLY
68128		COMMUNITY WELL ASSC	13N18W21	NO	WELL	75.00		28.00		1/1/1950	DOMESTIC
68129		CYR GEORGE A & HELEN M	13N18W21	NO	WELL				10.00	1/1/1930	DOMESTIC
68126		DEFRESNE LUCIEN	13N18W21	NO	WELL	74.00		35.00		1/1/1890	DOMESTIC
68135		GONSIOR LEO J.	13N18W21	NO	WELL	58.00		30.00		1/1/1954	DOMESTIC
68137	10616	HILL JAMES	13N18W21	NO	WELL	80.00	65.00	55.00	35.00	11/1/1976	DOMESTIC
68127		JESZENKA WINNIFRED E	13N18W21	NO	WELL				4.00	1/1/1913	DOMESTIC
68133		KARKAINEN PETER A	13N18W21	NO	WELL	66.00		16.00	40.00	1/1/1938	DOMESTIC
68132		KOCGURE ANTON	13N18W21	NO	WELL	66.00	46.00	46.00	15.00	4/17/1963	DOMESTIC
68131		MARCEAU LEE & ROY	13N18W21	NO	WELL	96.00	81.00	81.00	15.00	2/23/1961	DOMESTIC
178267		MILLTOWN COMMUNITY WELL	13N18W21	NO	WELL	85.00		48.00	50.00	6/11/1941	DOMESTIC
68136		VIKTORA CHARLES W	13N18W21	NO	WELL	71.00		30.00	40.00	4/1/1952	DOMESTIC
68130		WILCOX GEORGE E &	13N18W21	NO	WELL	100.00			8.00	1/1/1926	DOMESTIC

		ANNE J									
68139	3849	1ST STREET COMMUNITY WELL	13N18W21AC	NO	WEL L	80.00	65.00	32.00	95.00	9/4/1974	DOMESTIC
68138	57721	MILLTOWN WATER USERS ASSOCIATION - WELL 1	13N18W21ACBC	NO	WEL L	160.00	50.00	35.00	530.00	10/22/1984	PUBLIC WATER SUPPLY
69013	P005772-00	STIMSON LUMBER COMPANY	13N18W21ACBD	YES	WEL L	160.00	35.00	29.00	800.00	10/16/1975	PUBLIC WATER SUPPLY
68156	W116474	STIMSON LUMBER COMPANY - PLYWOOD MILL	13N18W21ADCD	NO	WEL L	110.00	62.00	47.00	100.00	6/28/1973	INDUSTRIAL PUBLIC WATER SUPPLY
68141		CHAMPION INTERNATIONAL CORP	13N18W21B	NO	WEL L	101.00	95.00	58.00	75.00	5/14/1981	UNKNOWN
68140		ZAVARELLI FRANK	13N18W21B	NO	WEL L	80.00		40.00		1/1/1955	DOMESTIC
68142		BLACKFOOT FOREST PROTECTION ASSOCIATION	13N18W21BA	NO	WEL L			68.00	10.00	5/1/1946	DOMESTIC FIRE PROTECTION
68143		ZAVARELLI FRANK	13N18W21BB	NO	WEL L	80.00		40.00		1/1/1956	DOMESTIC
68144		M.P.C.	13N18W21BC	NO	WEL L	78.00	54.00	49.00	35.00	3/29/1973	PUBLIC WATER SUPPLY
68147	P096056	TOWN PUMP #8500 - WELL 1	13N18W21BCAA	NO	WEL L	109.00	80.00	38.00	75.00	9/15/1978	PUBLIC WATER SUPPLY
68145		AUNE PETER O.	13N18W21BD	NO	WEL L	90.00		60.00	25.00	1/1/1923	DOMESTIC
164416		BROWN JIM	13N18W21BD	NO	WEL L	60.00	37.00	33.00	25.00	10/20/1997	DOMESTIC
68148		HARDING LAWSON ASSOC	13N18W21BD	NO	WEL L	99.50				5/5/1986	MONITORING
68149		HARDING LAWSON ASSOC	13N18W21BD	NO	WEL L	87.00				5/12/1986	MONITORING
68146		LOEWEN VICTOR	13N18W21BD	NO	WEL L	65.00	55.00	39.00	60.00	4/10/1962	DOMESTIC
68150	5917	NYQUIST CHARLES T	13N18W21BDB	NO	WEL L	71.00	35.00	29.00	40.00	5/21/1975	DOMESTIC
68151		HAKALA GEORGE	13N18W21BDD	NO	WEL L	72.00				1/1/1914	DOMESTIC
68152		MONTANA POWER CO	13N18W21C	NO	WEL L	62.00	58.00	38.00	30.00	5/2/1980	UNKNOWN
157497		STARR ROBERT	13N18W21CC	NO	WEL L	380.00		211.00	7.00	7/11/1996	DOMESTIC
68154		MILLTOWN WELL	13N18W21D	NO	WEL L	95.00	65.00	64.00	17.00	4/6/1967	DOMESTIC
68157	34519	OUR SAVIORS	13N18W21DA	NO	WEL	100.0	62.0	50.00	40.00	6/15/1981	PUBLIC

		LUTHERAN CHURCH	CD		L	0	0				WATER SUPPLY
68155	W114352	BONNER SCHOOL DISTRICT #14 - WELL 1	13N18W21DADB	NO	WELL	126.00			30.00	9/7/1956	PUBLIC WATER SUPPLY
68153	147767	ST ANN'S CATHOLIC CHURCH	13N18W21DADC	NO	WELL	98.50	98.00	56.00	75.00	11/5/1985	PUBLIC WATER SUPPLY
68159		BUSH RICHARD	13N18W21DD	NO	WELL	75.00	44.00	39.00	60.00	5/7/1970	DOMESTIC
68158		KINONAN O.A.	13N18W21DD	NO	WELL	82.00	52.00	42.00	75.00	5/19/1971	DOMESTIC
171485		MISSOULA COUNTY SHERRIF'S POSSE	13N18W21DD	NO	WELL	60.00	27.00		40.00	3/12/1998	DOMESTIC

End of Report. **39** record(s) listed.

This report is restricted to site types of **WELL**, **BOREHOLE**, **SPRING**, and **COAL BED METHANE WELL**.

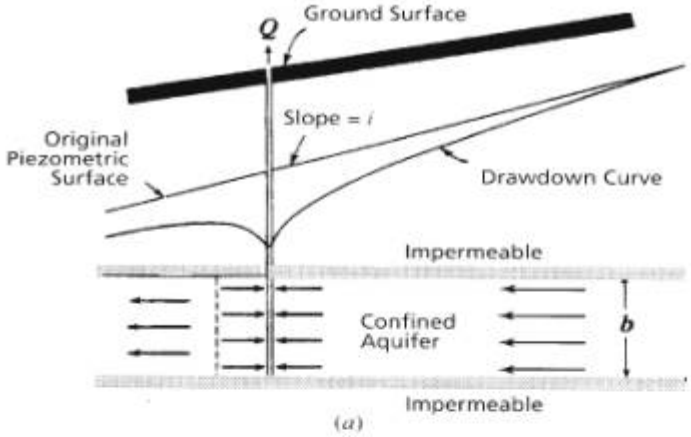
Explanation of Columns: **Td** = **T**otal **d**epth of well in feet below ground
Pwl = **P**umping **w**ater **l**evel in feet below ground
Swl = **S**tatic **w**ater **l**evel in feet above/below ground - Negative values are reported for water levels that are above land surface.
Yield = Yield in gallons per minute
Date = Completion date of well/borehole
Use = Reported use of water
Ver? = Was location verified?

APPENDIX D

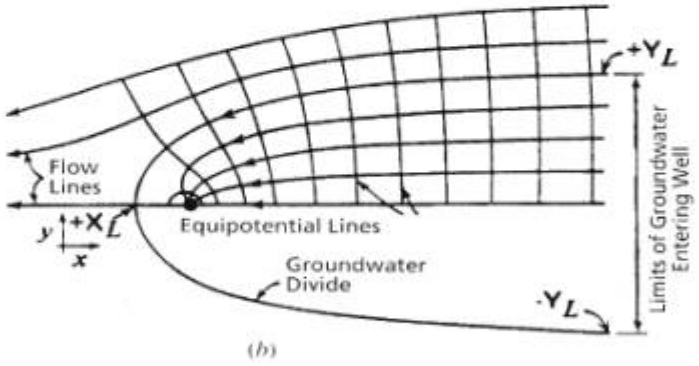
Time of Travel Calculations

UNIFORM GROUNDWATER FLOW EQUATION

Flow to a well penetrating a confined aquifer having a sloping plane piezometric surface - vertical section and plan view (Todd, 1980).



(a)



(b)

$$-\frac{Y}{X} = \tan\left(\frac{2\pi Kbi}{Q}Y\right)$$

Uniform-Flow Equation

$$X_L = -\frac{Q}{2\pi Kbi}$$

Distance to Down-Gradient Null Point

$$Y_L = \pm\frac{Q}{2Kbi}$$

Boundary Limit

Legend:

- Pumping Well

Where:

Q = Well Pumping Rate
K = Hydraulic Conductivity
b = Saturated Thickness
i = Hydraulic Gradient
π = 3.1416

TIME-OF-TRAVEL CALCULATION METHOD

The time of travel for water to move along a line parallel to the hydraulic gradient, from a point to a pumping well (EPA 1991).

$$T_x = \frac{n}{Ki}\left[X_L - \frac{Q}{2\pi Kbi}\ln\left(1 + \frac{2\pi Kbi}{Q}X_L\right)\right]$$

T_X	=	travel time from point x to a pumping well
n	=	porosity
X_L	=	distance from pumping well over which groundwater travels in T_X
Q	=	discharge
K	=	hydraulic conductivity
b	=	aquifer thickness
i	=	hydraulic gradient

APPENDIX E

Inventory Sheet

APPENDIX F

Checklist

Department of Environmental Quality
Source Water Protection Program

CERTIFICATION CHECKLIST

Source Water Delineation and Assessment Reports (SWDAR)
For Community and non-community non-transient PWSs

The following items represent the minimum requirements for certification of a completed SWDAR for Community and non-community non-transient PWSs. The SWDAR represents the technical component of the SWPP, and mush be completed per the 1996 amendments to the Federal Safe Drinking Water Act. This checklist should be used in conjunction with the information and general format provided in the template for preparing SWDAR documents. While the format of the template may be modified as needed, all requested information should be included for certification.

For any items that are not applicable or information is not available, note in checklist column and provide and explanation. Attach additional sheets for explanation, if necessary.

Name of System:		**New Castle Court**
PWS #:		**4322**
Date Submitted:		**May 31, 2006**
Operator Name:		**Mary/Tom Greil**
SWPP Contact:		Bob Greil 6205 Pine Grove Ln. 1 Missoula, MT 59802 (406) 258-6213
Person Preparing	Name:	Michelle Hutchins, Environmental Health Specialist
Plan Contact:	Address:	Missoula City County Health Department 301 W. Alder Missoula, MT 59802
	Phone:	(406) 258-4890

The following summary checklist is derived from the Source Water Delineation and Assessment Report template document. The completed plan should include summary discussions, when appropriate, for each listed item. Indicate the page and/or section number where this information is, or indicate not applicable (n/a) when appropriate. For items indicated as not applicable, the text should indicate why.

Introduction

	Page
Person who prepared document	iv
Name of system and county located in	iv
PWS Identification Number	iv
PWS contact person, with address and phone number	cover

Chapter 1 – Background

This section provides background information on the community served by the PWS.

	Page
1. The Community:	1
• Population	1
• Economic base	1
• Major water users	1
• Major waste generators	1
• Domestic sewage treatment and disposal	1
2. Geographic Setting	1
• Geographic setting, including surrounding area	1
• Physiographic features	1
• Streams and lakes	1
• Climate information (including annual precipitation and temperatures)	1
• A vicinity map at appropriate scale	Fig. 1

For surface water sources, or ground water systems influenced by surface water

• 8 and 11 digit USGS Hydrologic Units	n/a
• Montana Watershed Management Region	n/a
3. General Description of Source Water	1

Description of PWS system, including:

- Source of water (number of wells, depths, etc.) 2
- Well lithology and construction logs (in appendix) Appx B
- Distribution system 1, Appx A
- Number of connections and users 2
- PWS Treatment System 2

- Copy of latest Sanitary Survey (in appendix) Appx A

- A map indicating the general layout of the PWS. Appx A

4. Water Quality:

- Summarize enforcement actions in the past 5 years 2
- Describe background/regional water quality 2
- Table summarizing background water quality 3

For surface water sources, or ground water systems influenced by surface water

- Use classification n/a
- Threatened or impaired streams in watershed n/a
- TMDL development prioritization and status n/a

Chapter 2 – Delineation

This section provides information on the hydrogeology of the water supply for the PWS. Background information on the hydrogeologic setting should be assembled into a ***Hydrogeologic Conceptual Model*** that summarizes the ground water system in a simplified manner. The background information should support the process to delineate management areas.

		Page
1.	Hydrogeologic Conditions	4
•	Identification of references for hydrogeologic information	4
•	Summary tables of hydrogeologic studies and maps for area	5-6
•	Summary of wells in area from GWIC database	Appx C
•	Geologic map(s) included (if not, valid justification for omission)	Fig. 3
•	Geologic cross section(s) included	Fig. 5

For ground water systems:

• Identify aquifer	4
• Geologic setting of aquifer	4
• Aquifer properties (lithology, boundaries, etc.)	4
• Aquifer type (confined, unconfined, semi-confined)	4
• Connection with surface water	4
• Classify sensitivity of hydrogeologic setting of source water	4

For surface water sources, or ground water systems influenced by surface water

• Hydrogeologic setting of PWS watershed	n/a
• Identification of references for hydrogeologic information	n/a
• Stream flow characteristics	n/a

2.	Conceptual Model and Assumptions	6
•	Seasonal trends in system	4
•	Assumptions made to simplify model	9

For ground water systems:

• Aquifer boundaries	4
• Aquifer recharge areas	6
• Ground water flow direction	6
• Communication with surface water	6

For surface water sources, or ground water systems influenced by surface water

• Relationships of surface water with ground water system	n/a

3. Well (or source) Information

For ground water systems:

- Well depths, construction details 7
- Well locations described 7
- Summary table of source information 7
  [Source information to include: PWS Source Code, Well Location, MBMG (GWID) No., MT Water Right No., Date Well completed, total depth, perorated interval, static water level, pumping water level, drawdown, test pumping rate, and specific capacity]

For surface water sources, or ground water systems influenced by surface water

- Description of source water intake system n/a
- Streamflow data, if available n/a

4. Delineation Methods and Criteria

- Overview of approach used for delineation 6

5. Model Input

For ground water systems:

- Identify analytical method used, with source reference 6
- Values of hydraulic parameters identified, with ranges 9
- Identify hydrogeologic parameter values used, with rationale 8-9
- Summary table of input values for model 9
- Reference and justification for assumed values 7-8
- Time of travel equations or model specifications 7-8

For surface water sources, or ground water systems influenced by surface water

- Time of travel calculations for surface water body n/a
- Summary of ranges for streamflow parameter values n/a
- Identify streamflow parameter values used with rationale n/a
- Summary table of input values for model n/a

6. Delineation Results

- Travel time calculation results, or computer model calibration criteria 9
- Management zones identified on map(s) Figs. 6 & 7
- Delineated areas reflect seasonal variations in hydrologic systems 9

7. Limiting factors

- Identify uncertainties in delineation approach based on assumptions 9
- Identify how uncertainties may effect delineated areas 9

Chapter 3 – Inventory

This section identifies all known and potential contaminant sources which may affect the PWS.

1. Inventory methods identified 10-11
2. Appropriate databases searched, with potential sources identified 10-11

For ground water systems:

- Control zone 11

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

- Inventory Region 11

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map Fig. 10

- Surface Water Buffer 12

Description of land uses
Description of potential contaminant sources for pathogens (acute health hazards)

- Recharge Region 12

Description of land uses
Description of large potential contaminant sources
Large potential sources and land use shown on a map

For surface water sources, or ground water systems influenced by surface water

- Spill Response Region n/a

Description of land uses
Description of potential contaminant sources
Worksheets completed for significant potential sources
Potential contaminant sources summarized in a table
Potential contaminant sources located on a base map

- ***Watershed Region*** n/a

Description of land uses
Description of large potential contaminant sources
Map of watershed region showing significant potential contaminant sources
(e.g. MPDES permitted discharges, to the extent practical with existing databases)

For all systems

- Inventory update – procedures to update every five years 14

Chapter 4 – Susceptibility Assessment

This section evaluates the potential for the PWS water supply to be contaminated by the significant potential sources of contamination identified in Chapter 3. This information can be used by local officials to prioritize management actions for the delineation control and inventory zones. Worksheets to be considered when completing each task are listed with each topic.
Attach completed worksheets as Appendices to final document

1. Hazard of potential contaminant sources identified 15-17

2. Barriers for each potential contaminant sources identified and evaluated 15-17
3.

4. Supporting information for identification of features as barriers 15-17
   -

5. Threats from significant potential contaminant sources ranked 15-17
6.

References

All technical references are listed in the appropriate format 18

Appendices

All necessary supporting information is included in Appendices yes

List any Deficiencies:

none

APPENDIX G

Letter of Concurrence

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

RE: Source Water Delineation & Assessment Report

To Whom It May Concern:

The New Castle Court Trailer Court public water system has reviewed the source water delineation and assessment report (SWDAR) dated May 2006. We concur that the delineation component appears to describe current conditions at the water system based on reasonably available information and that the susceptibility assessment identifies the origins of regulated contaminants to the extent practical.

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

Signed,

_____

Signature Title and Date

Figures

Filename: 3F1E9B34.htm
Directory: C:\Documents and Settings\CB1196\Local Settings\Temporary Internet Files\Content.MSO
Template: C:\Documents and Settings\CB1196\Application Data\Microsoft\Templates\Normal.dotm
Title: Montana DEQ - Source Water Assessment New Castle Court, Missoula
Subject:
Author: Hutchinsm
Keywords:
Comments:
Creation Date: 12/11/2006 8:35:00 AM
Change Number: 4
Last Saved On: 8/26/2010 1:04:00 PM
Last Saved By: Wittenberg, Joyce
Total Editing Time: 2,684 Minutes
Last Printed On: 8/26/2010 1:27:00 PM
As of Last Complete Printing
Number of Pages: 53
Number of Words: 11,287 (approx.)
Number of Characters: 62,982 (approx.)