# TOWN OF STEVENSVILLE

## Water System Improvements

## *Preliminary Engineering Report*

*November 2009 UPDATE*

HISTORIC STEVENSVILLE Where Montana Began


prepared by:

PCI

Professional Consultants Inc.
Unmatched Experience. Uncompromising Standards.

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# *PRELIMINARY ENGINEERING REPORT*
# *TOWN OF STEVENSVILLE WATER SYSTEM IMPROVEMENTS*

## TABLE OF CONTENTS

# APPENDICES:

## Section I: EXECUTIVE SUMMARY

The Town of Stevensville contracted with Professional Consultants, Inc. (PCI) in June, 2004, to inventory and study the Town's water supply, treatment and distribution systems and prepare a Preliminary Engineering Report (PER) in conformance with the "*Uniform Application for Montana Public Facility Projects*". This PER is to provide background and support documentation for applications to State and federal funding agencies for grant and loan funds to accomplish the identified improvements. This is an update to the *Town of Stevensville, Water System Improvements, Preliminary Engineering Report, as Amended September 2007.*

The Town of Stevensville's current water system is in drastic need of upgrades. In addition to significant sanitary deficiencies, non-conformance to Circular DEQ-1, and possible non-compliance with EPA surface water treatment rules; the system is currently losing excessive amounts of finished water to leaks in the distribution system. Based on 2008 production and wastewater treatment plant flows these leaks are estimated from 60,000 to 390,000 gallons per day during winter months, and may be higher during peak summertime use. The combination of these deficiencies is making the system more expensive and difficult to operate, while only providing marginal quantity and quality water to the Stevensville water system users. In addition, the system is currently unable to meet required ISO fire flows. Based on the water model all but 6 junctions failed to deliver adequate fire flow during peak day demands.

This report focuses on the Town's water system and provides documentation of the needed improvements. Alternative improvements for water supply, treatment, storage, transmission, distribution system, and metering are addressed in this report. Alternatives and their associated costs will be evaluated to address the following issues with the Town's water system:

- Reduce risks to public health and safety.
- Install meters on all sources and services to encourage water conservation & account for lost water.
- Correct deficiencies in the transmission and distribution system to minimize lost water and provide adequate capacity for fire and peak day flows.
- Meet requirements of DEQ Circular 1, including:
    - Source Capacity
    - Water Quality
    - Backup Power
    - Storage Capacity
- Meet current EPA water treatment requirements

The following alternatives for each element of the water system are explored in this PER update:

**A. Water Supply & Treatment**
- No action
- Other water supply systems
- Rehabilitation of existing wells, infiltration gallery, and treatment plant
- Identify new well site/sites
- New or alternative surface water source and treatment plant

**B. Water Storage**
- No action
- Tank replacement in existing location
- New storage tank with removal of existing tank
- New storage tank keeping existing tank

**C. Water Transmission**
- No Action
- Rehabilitate 8" water main in Middle Burnt Fork Road in place
- Replace 8" water main in Middle Burnt Fork Road in existing location
- New transmission main along alternate route

**D. Distribution Improvements**
- No action
- Full distribution replacement
- Main upsizing and looping of dead end mains
- Add additional pressure zone

**E. Metering**
- No action
- Install meters on all service connections and supplies, upgrade existing meters with radio-read heads.

**F. Recommended Improvements**

The preparation of this PER was complicated since the Town of Stevensville is not completely metered. The lack of accurate production and use data made differentiating between excessive use and system losses difficult. Historic use records from other systems and estimations from Stevensville's metered data were used to project expected demands on the system now and as leaks are repaired. However, due to the unknown leaks in the system, some improvements, such as storage, are better left alone at this time until more accurate information is available to properly size the improvements, as considerable cost savings may be realized by reductions in the average day flows.

The recommendations of this PER include the following improvements:

- Install remote read water meters on all services served by the Town, in order to account for all water sold by the Town, and move to monthly billing.
- Move the Town's water supply from the infiltration gallery and scattered wells to a consolidated well field at the Twin Creeks Well Field site. This will allow for all sources to be controlled, treated, and metered at one location, and will provide for better protection of the source supply.
- Abandon the existing 8" cast iron water main in Middle Burnt Fork Road from the existing reservoir to Park Street, and install a 16" transmission main from the Twin Creeks Well Field to Town along ALC way connecting at the intersection of Park and 5$^{th}$ Street.
- Improve the distribution system in Town to provide a 12" "backbone" along Church Street to deliver fire and peak flows to Downtown and the School. Loop existing water mains on the north side of Town to increase flows and improve water quality on dead end mains.
- Install Pressure Reducing Valves (PRV) and a booster station to serve the east end of Town, reducing dangerously high water pressures on the west side of town to less than 100 psi and increasing the marginal pressures in the Creekside Meadows subdivision.

It is recommended that improvement of the Town's storage facility is delayed until accurate information is available from monthly water metering to determine actual water usage of the Town, and leaks are reduced to lower the overall storage requirements of the system. Considerable savings will be realized by the Town, and potential problems associated with an oversized storage tank will be avoided by delaying the design and construction of new storage facilities.

**G. Project Cost Summary**

It is estimated that this project will cost approximately $4,220,831 to complete Phases II and III of the project. Additional funds will be required to complete Phase IV which includes the upgrades to the storage facility. A breakdown of project costs and secured funding for Phases II & III is shown below:

**Table I.G.1 Project Cost Summary**

## PHASE II IMPROVEMENTS

| Water System Improvements Phase II Scope of Work and Estimated Costs | |
|---|---|
| **Description** | **Estimated Cost** |
| Meter Installation | $ 243,072 |
| Engineering & Contract Administration | $ 24,026 |
| Contingency | $ 24,307 |
| **Metering Total** | **$ 291,405** |

| | | |
|---|---|---|
| Transmission Main Installation | $ | 852,863 |
| Road Repair | $ | 108,723 |
| Engineering & Contract Administration | $ | 144,238 |
| Contingency | $ | 96,159 |
| **Transmission Main Total** | **$** | **1,201,983** |

| Phase II Improvement Summary | | |
|---|---|---|
| Meter Improvements | $ | 291,405 |
| Transmission Main Improvements | $ | 1,201,983 |
| **Total Phase II** | **$** | **1,493,388** |

| Phase II Funding Summary | | |
|---|---|---|
| Meter Improvements - USACE/WRDA 2008 | $ | 175,000 |
| Transmission Main Improvements - USACE/WRDA 2008 | $ | 487,500 |
| **Total Phase II Funding Secured** | **$** | **662,500** |

| Phase II Funding Needed | | |
|---|---|---|
| **Total Phase II Funding Needed** | **$** | **830,888** |

## PHASE III IMPROVEMENTS

| Water System Improvements Phase III Scope of Work and Estimated Costs | | |
|---|---|---|
| **Description** | | **Estimated Cost** |
| Water Supply Well Installation | $ | 380,000 |
| Pumphouse & Treatment | $ | 396,250 |
| Engineering & Contract Administration | $ | 116,438 |
| Contingency | $ | 77,625 |
| **Water Supply & Treatment Total** | **$** | **970,313** |
| Distribution System Improvements | $ | 1,537,183 |
| Decommission Infiltration Gallery | $ | 70,000 |
| Engineering & Contract Administration | $ | 241,077 |
| Contingency | $ | 160,718 |
| **Distribution System Improvements Total** | **$** | **2,008,979** |
| Pressure Reducing Valves & Booster Station | $ | 165,000 |
| Engineering & Contract Administration | $ | 12,750 |
| Contingency | $ | 16,500 |
| **PRV & Booster Station Total** | **$** | **194,250** |

| Phase III Improvement Summary | | |
|---|---|---|
| Water Supply & Treatment Improvements | $ | 970,313 |
| Distribution System Improvements | $ | 2,008,979 |
| Pressure Reducing Valves & Booster Station | $ | 194,250 |
| **Total Phase II** | **$** | **3,173,541** |

| Phase III Funding Summary | | |
|---|---|---|
| RRGL 2008 | $ | 100,000 |
| TSEP 2008 | $ | 500,000 |
| **Total Phase II Funding Secured** | **$** | **600,000** |

| Phase III Funding Needed | | |
|---|---|---|
| **Total Phase II Funding Needed** | **$** | **2,573,541** |

PROJECT SUMMARY

| | | |
|---|---|---|
| **Total Project Cost** | **$** | **4,666,929** |
| **Total Project Funding To Date** | **$** | **1,262,500** |
| **Total Funding Needed To Complete Project** | **$** | **3,404,429** |

### H. Project Cost per User

Based on the above cost estimates and the Water and Sewer Rate Study performed by HDR (included in Appendix E), the following increases in rates are expected from this project through 2014 if no additional grant funds are available:

**Table I.H.1 HDR Recommended Rate Increases**

| Projected Rate Increases w/o Additional Grant Funding | |
|---|---|
| 2010 | 40.0% |
| 2011 | 30.0% |
| 2012 | 3.0% |
| 2013 | 3.0% |
| 2014 | 3.0% |

Based on current interest rates, loan terms, and the potential to receive approximately 40% grant the Town of Stevensville wishes to pursue funding from USDA Rural Development, if available. Based on 60% loan and 40% grant from USDA Rural Development a rate increase of approximately $10.40 per EDU could be expected including a 10% contingency to cover the required debt service. Under this funding scenario the estimated monthly water rates would be as follows for each service size.

**Table I.H.2 Estimated Rate Increase with 40% Grant Funding**

| Meter Size | Current Monthly Rate | Expected Monthly Rate |
|---|---|---|
| 3/4 Inch (1 EDU) | $19.27 | $29.67 |
| 1 Inch (1.79 EDU) | $34.35 | $52.97 |
| 1-1/2 Inch (4 EDU) | $76.56 | $118.16 |
| 2 Inch (7.14 EDU) | $136.53 | $210.79 |

## I. Project Implementation

It is the goal of the Town to proceed with these improvements as soon as possible. However, additional funding is required to bring this project to a successful completion. Based on discussions with USDA – Rural Development and TSEP, This project has the greatest chance of success if Phases II & III are completed simultaneously. The estimated funding required to complete Phases II & III of this project is $3,404,429. Current funding would allow for the design and bidding of the project to be awarded by March, 2010.

Based on the above projected user rates, obtaining the remaining funds required for the project from USDA – Rural Development with 60% loan and 40% grant would allow the Town to complete the water project without excessive increases in rates. It is our understanding that the PER must be approved by USDA Rural Development and construction contracts awarded by March 2010 to receive funds.

The Town, with the help of John Anderson, has worked diligently over the last year to obtain a well field, perform a hydrogeologic investigation to determine the quantity and quality of water available, obtain easements for required transmission main routes, and determine the financial health of their water system funds.

However, in order to achieve the extensive goals and fulfill the water system needs of this growing community, the Town must continue to improve their metering data, continue leak detection, and repair any leaks found in the distribution system to achieve the reductions in lost water set forth in this PER. Accurate metering data and extensive leak reductions will allow the Town to proceed to Phase IV and complete their water system improvement project.

It is this PER's recommendation that the Town move forward with the improvements as proposed by obtaining the funding from USDA – Rural Development. A PER update addressing the storage tank will be prepared at a later date to address Phase IV - Storage.

## Section II. PROBLEM DEFINITION

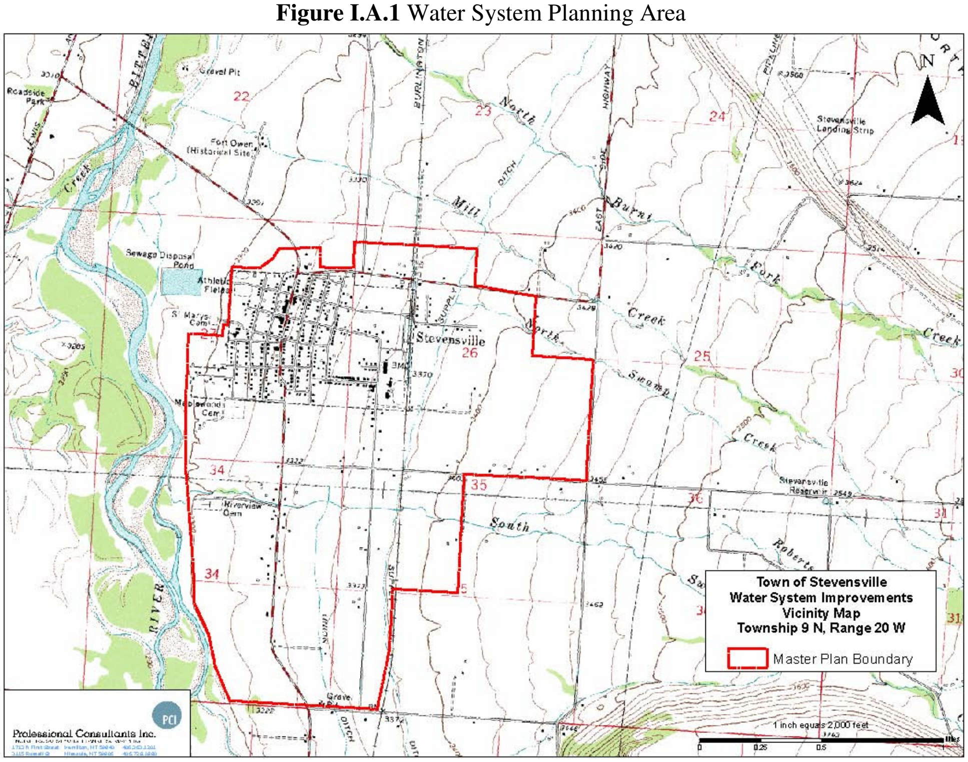
### A. Existing and Planned Service Area.

### 1. Location

The Town of Stevensville is located in the Bitterroot Valley in the northern portion of Ravalli County approximately 25 miles south of the City of Missoula in western Montana. It is situated on a valley plain bounded on the west by the Bitterroot Mountains and on the east by the Sapphire Mountains. Next to Hamilton, it is the second largest of 10 communities within Ravalli County. Stevensville is on the east side of the Bitterroot River and east of US Highway 93. The Town is located at 46 degrees 30.57 minutes north latitude and 114 degrees 5.77 minutes west longitude.

The Stevensville Planning Area for this study encompasses the present Town Limits and unincorporated county areas to the northeast, east and south, and is comprised of about 1,438 acres (2.25 square miles). In this area there is sufficient land to support the future growth of the Town. Growth is currently occurring in this area and is expected to continue during the planning period. The Planning Area includes the extended zoning district as adopted by ordinance of February 8, 2007, as well as other areas of logical extension of municipal services. Further expansion to the west is constrained by the Bitterroot River and its associated floodplain. A map of the Planning Area is shown below in Figure I.A.1.

**Figure I.A.1** Water System Planning Area



## 2. Physical Characteristics of the Area

### 2.1 Geology:
According to information in the book *"Roadside Geology of Montana"* by David Alt and Donald W. Hyndman, the principal geologic elements deeply underlying the Stevensville area are granite rocks of the Idaho Batholith. Overlying the basement rock are valley fill sediments of the Renova formation, eroded off the Bitterroot Mountains to the west. Atop this are more geologically recent sediments from successive washouts from Glacial Lake Missoula during several cycles of heavy glaciation followed by periods of melting and catastrophic flooding. These sediments have been reworked and redistributed by the Bitterroot River during more recent geological history.

Stevensville sits on a low terrace adjacent to the relict flood plain of the Bitterroot River, which meandered widely during recent geological history. Surface deposits underlying the area consist of alluvium of modern channels and flood plains (quaternary) consisting of well-rounded gravel and sand with lesser amounts of silt and clay.

### 2.2 Topography:
The surface topography of Stevensville is relatively flat sloping from east to west towards the Bitterroot River at about 1 to 2 percent. The average surface elevation of the Town is approximately 3,370 feet MSL. A topographic map of the planning area is included in Appendix A.

### 2.3 Soil Types:
The majority of the Town of Stevensville, particularly the northern, central and southern portion, is situated on soil classified as Dominic Cobbly Loam (NRCS mapping symbol "Da") on slopes less than 2%. This soil type is described as shallow, gravelly and cobbly, loose sandy soils that occur on low fans and terraces on the east side of the Bitterroot Valley. This soil type is characterized by very dark grayish-brown, coarse, porous surface soils and dark grayish-brown cobbly or gravelly sandy loam subsoils. These soils have very rapid permeability. Depth to groundwater normally ranges from a high of 9 feet below the land surface (BLS) to more than 30 feet BLS.

The northeastern portion of the Town and some areas southeast of the Town are situated on soils of the Corvallis Series (NRCS mapping symbols "C3u" and "C3r"). Soils in this series are described as loam or silt loam to the depth of 48 inches and underlain by sands or mixed sands and gravel with high permeability (6.3 to 20.0 inches per hour). Depth to seasonal groundwater in these areas is indicated at only one to two feet BLS.

Soils in the western portion of the Town at the edge of the Bitterroot River floodplain and in the eastern segment of the planning area, generally outside of the existing Town limits but within the planning area, consist of the Grantsdale Series (NRCS mapping symbols "G2n" and "G21"). This soil series consists of loam and cobbly loam of low permeability in the upper part and sand, gravel and cobbles of high permeability in the lower part of the soil profile. Seasonal groundwater is reported as being 2 to 5 feet BLS.

A soils map of the area is included with the Environmental Checklist in Appendix B.

**2.4 Groundwater:**

As noted above under soil types, groundwater depths in the area around Stevensville are relatively shallow. Thus, dewatering of pipeline trenches and structure foundations will likely be required during the construction of system improvements.

A review of well logs in the area indicates that typical depths to groundwater are in the range of 3 to 20 feet BLS. The depth to groundwater also varies with the irrigation of the surrounding land with high groundwater being reported during the months of more intense irrigation of nearby farmlands in June, July and August. The general direction of groundwater flow underlying the area is to the west towards the Bitterroot River. The river surface generally represents the governing "line sink" relative to groundwater levels and localized hydrogeology.

**2.5 Surface Water:**

The Bitterroot River is the primary surface water body in the area and is located at the western fringe of the Stevensville planning area. Waters in this river are classified by MDEQ as "B-1" and are considered suitable for drinking after conventional treatment. Other suitable uses under this classification include bathing, swimming and aquatic recreation, growth and propagation of salmonid fishes and aquatic life, waterfowl and furbearer habitat, and agricultural and industrial water supply. Flows in the river vary primarily in response to rainfall and snowmelt from the surrounding mountains. In addition, flows in the river are regulated to a considerable extent by the Painted Rocks Reservoir, located on the West Fork of the Bitterroot River upstream of Conner, Montana. In addition to this base flow, four (4) other major tributary streams (Sleeping Child Creek, Skalkaho Creek, Blodgett Creek and Bear Creek) contribute substantial flows upstream of Stevensville.

Flows from the river and some of the primary tributary streams are diverted into irrigation ditches to support agricultural activities in the valley. The Supply Ditch is the primary irrigation ditch within the Planning Area and runs from south to north through the Town of Stevensville.

Within the Planning Area there are two smaller tributaries of the Bitterroot River that are of significance, Mill Creek and North Swamp Creek. The Town of Stevensville obtains a substantial portion of its raw water supply indirectly from these two streams by means of a subsurface infiltration system (see map in Appendix A) of tile pipe laid parallel between the two creeks. A direct discharge from North Swamp Creek is available in winter months. MDEQ considers the water from this source to be "groundwater under the direct influence of surface water" and therefore subject to EPA Surface Water Treatment Requirements.

## 2.6 Climatological Information:

Climatological information for the Town of Stevensville is summarized in **Table II.2.6.A.** The information in this table was obtained from the National Climatic Data Center (NCDC) in Asheville, NC and covers the period from 1911 to 2004. Average annual precipitation is 12.56 inches, which places Stevensville in the “semiarid” category. On an annual average basis, the average maximum temperature is 58.5°F and the average minimum temperature is 31°F.

**TABLE II.2.6.A**

LOCAL CLIMATOLOGICAL SUMMARY FOR STEVENSVILLE, MONTANA (247894)
Period of Record Monthly Climate Summary
Period of Record : 8/23/1911 to 6/30/2004

| **Average** | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year Avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max. Temp. (F) | 33.1 | 39.7 | 48.8 | 59.5 | 68.0 | 75.2 | 84.8 | 83.4 | 72.1 | 59.1 | 43.3 | 34.6 | 58.5 |
| Min. Temp. (F) | 14.9 | 19.0 | 24.5 | 30.6 | 37.4 | 44.0 | 47.1 | 45.3 | 38.1 | 30.5 | 23.1 | 17.0 | 31.0 |
| Total Precip. (in.) | 1.07 | 0.85 | 0.78 | 0.83 | 1.49 | 1.65 | 0.87 | 0.90 | 1.07 | 0.88 | 1.06 | 1.09 | 12.56 |
| Total SnowFall (in.) | 7.7 | 5.8 | 4.1 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 3.0 | 5.9 | 27.3 |
| Snow Depth (in.) | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |

Percent of possible observations for period of record.
Max. Temp.: 98.4%, Min. Temp.: 98.3%, Precipitation: 98.7%, Snowfall: 47.2%, Snow Depth: 48.3%

## 2.7 Floodplains:

Appendix A includes the FEMA floodplain map for the Planning Area. The Planning Area and the proposed improvements are located outside of the 100-year floodplain of the Bitterroot River.

## 2.8 Vegetation and Wetlands:

In view of the fact that Stevensville is the oldest permanent settlement in Montana, dating back to 1841, most, if not all of the original native vegetation within the existing town limits has been replaced with cultivated varieties of trees, shrubs and grasses. Outside of the existing town limits and within the eastern extent of the Planning Area, homesteads and small farms with irrigated hay fields or grassy rangelands spread out beyond the Town. For the most part, native grasses and other indigenous herbaceous plants have been replaced with hay and alfalfa fields. With the exception of scatted groupings of pine and fir trees, there are no real stands of native timber left within the Planning Area. Trees mainly consist of Cottonwoods and scattered fruit bearing trees (mainly apple, pear and plum trees) which are generally found along the edges of the creeks and man-made irrigation ditches where there is sufficient year- round moisture to sustain vibrant growth.

Wetlands within the Planning Area are generally found within the floodplain of the Bitterroot River and immediately adjacent to area creeks. These wetlands are generally confined to the edges of these streams or in isolated pockets were groundwater levels are at or near the surface. Substantial wetland areas along with highly valued waterfowl habitat are found mainly within the confines of The Lee Metcalf National Wildlife Refuge which is located just north of the Planning Area. This refuge contains a diverse combination of wetland types and forested river bottom habitat and is highly protected from any disturbances or perturbations by man.

## 3. Environmental Resources Present

### 3.1 Uniform Environmental Checklist:

As a prelude to the formulation of this PER, information on the environmental resources present in the Planning Area was collected, and anticipated impacts to the resources from the proposed projects were summarized in the *Uniform Environmental Checklist* (UEC). Included with the checklist was a narrative summary of the proposed project which is further detailed in this PER. This information was then submitted to local, regional, state and federal agencies for comments on the project. A copy of the checklist with the accompanying narrative and agency comments received are included in Appendix B. This information is used in part to determine if any environmental resources will be impacted by the project. Potential impacts along with any mitigation measures, where pertinent, are discussed in the following subsections with frequent reference to the UEC and the individual agency responses found in Appendix B.

### 3.2 Historical and Archeological Resources:

Saint Mary's mission, located at the end of 4th Street in the Town of Stevensville, was the first Catholic Mission in the northwest and the first permanent white settlement in Montana. The Mission was established in 1841 by Father Pierre DeSmet, who came to the Bitterroot Valley in response to requests for "Black Robes" by various Indian tribes of present-day Montana and Idaho. The mission complex includes the chapel/residence, Father Anthony Ravalli's log house and pharmacy, Chief Victor's cabin and the Indian burial plot. All buildings have been restored to the 1880 era and are furnished with items built by Father Ravalli, Montana's first medical doctor. Chief Victor's cabin is restored as an Indian museum. Nearby DeSmet Park was dedicated in 1991 to commemorate the 150th anniversary of the establishment of St. Mary's Mission.

Also included in the complex is The Stevensville Museum. This facility features the early growth and development of the Bitterroot Valley with displays of artifacts, pictures and information panels regarding the history of the American Indian population (the Salish Indians), the Lewis and Clark Corps of Discovery expedition through the valley in 1805-1806, the arrival of Father DeSmet in 1841, the establishment of the earliest mission in what is now Montana, the development of Fort Owen as one of the earliest trading posts and the history of Stevensville itself.

This historic Catholic Mission complex along with Fort Owen will not be impacted by the activities associated with the subject project. The response from the State's Historic Preservation Officer (SHPO) to the Environmental Checklist regarding this PER is included in Appendix B. It indicates a low likelihood of significant impact to both archaeological and historical resources for the proposed project due to the fact that virtually all actions will be conducted in previously disturbed areas.

**3.3 Fish, Wildlife and Endangered Species:**

During the preparation of the UEC, the database of the *Montana Natural Heritage Program* was checked for the presence of sensitive animal, fish or plant species within the Planning Area. No conflicts relative to the proposed project were noted.

The response received from the US Fish and Wildlife Service, USDI indicated that there are three (3) threatened species that may occur in the Planning Area, namely, the Canada Lynx, The Bull Trout and the Bald Eagle. In addition, the Gray Wolf, considered to be a nonessential experimental species introduced into the area, and the Yellow-billed Cuckoo, a candidate threatened species, may also occur in the area. The response indicated that, considering the nature, scope and location of the project, this agency does not anticipate adverse impacts to any federally listed threatened, endangered, candidate or proposed species or critical habitat.

**3.4 Agricultural Land:**

The Planning Area includes many agricultural parcels. The principal agriculture activities conducted within the Planning Area are the raising and pasturing of livestock, primarily cattle and horses, and hay cropping on irrigated lands. Eventually, the upgrade and expansion of the Town of Stevensville's water system will permit nearby agricultural lands to be developed as residential or commercial use. Overall, higher density development on lands provided with municipal level facilities will require less of the available land area and will ultimately serve to reduce impacts on agricultural lands throughout the general area.

The improvements proposed by this PER are primarily replacements or upgrades to existing facilities and do not directly impact agricultural lands or uses. However, the new transmission main route and the well field location on the south side of Middle Burnt Fork Road will result in the loss of approximately 4-6 acres of farmland/grazing land. The removal of this relatively small amount of land from agricultural use will have minimal impacts on agricultural activities in the area as sufficient useable fallow agricultural land is available to compensate for the minor loss.

**3.5 Surface Waters, Floodplains and Wetlands:**
The improvements proposed by this PER do not adversely impact any surface waters, floodplains or wetlands. All work will be conducted away from surface waters, outside of the 100-year flood zone and away from area wetlands. There is potential for one (1) stream crossing by a new water transmission main programmed as a part of this project. However, the stream is conveyed inside a culvert at the point of crossing and the line will be installed under the culvert thereby eliminating any impacts to the stream itself or to wetlands within the confines of the streambed.

Preliminary comments received from the Helena Regulatory Office of the US Army Corps of Engineers (USACE) indicated that they thought that the proposed new well site may be located in wetlands. Wetland delineation was completed for the Twin Creeks Well Site by PCI in March of 2008. The delineation concluded that the wetlands associated with Robertson Creek were jurisdictional wetlands and would require a USACE permit if disturbed. Ideally the new water transmission mains will be conveyed through the proposed Twin Creeks Subdivision and not disturb the wetlands on the north side of the well field.

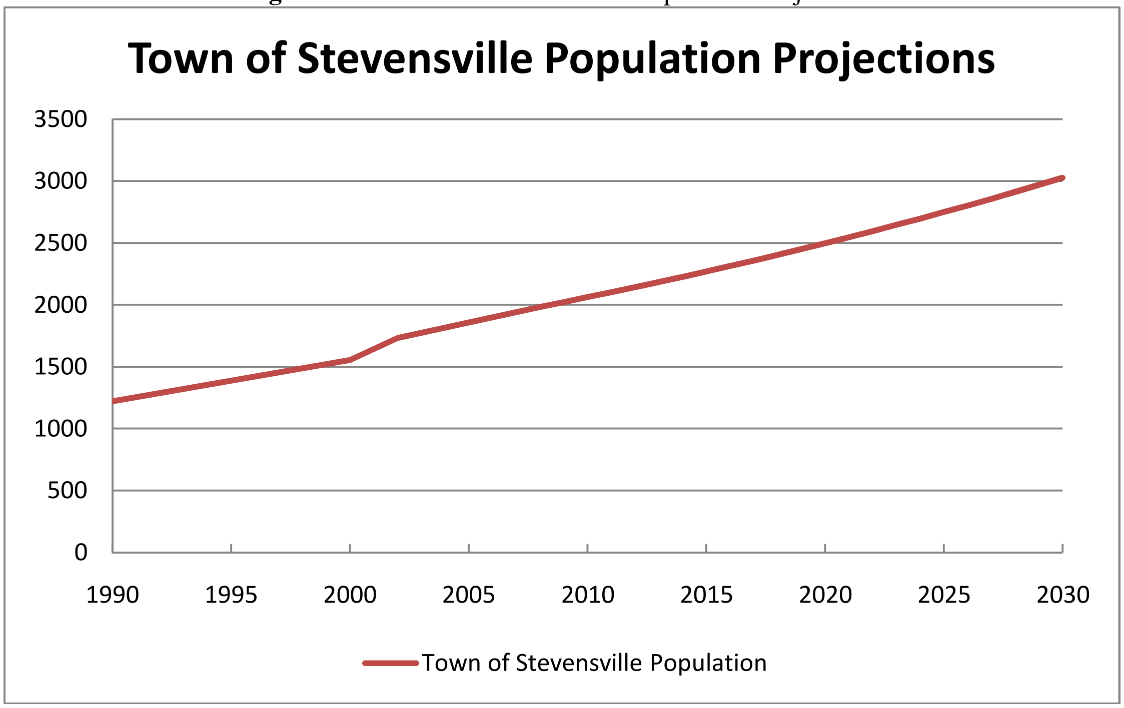
**3.6 Groundwater:**
Groundwater under the Planning Area is known to be plentiful and generally of good quality. The near surface waters are seasonal and supported by summer irrigation of integral and surrounding pasture lands and hayfields.

Water quality testing of Stevensville's municipal drinking water supply both from the infiltration gallery and from the wells has not indicated any persistent or recurring water quality issues.

**4. <u>Growth Areas and Population Trends</u>**

According to U.S. Census Bureau statistics, the Town of Stevensville had an estimated population of 1,984 persons in 2008. The year 2000 census population was 1,553 and the year 1990 census population was 1,221. There was a 27.2 percent increase in population over the decade from 1990 to 2000 and a 3.5% annual increase from 2000 to 2008. By the same token, Ravalli County in general posted a 44.2 % growth rate over the decade from 1990 to 2000, for a 3.7% compounded annual growth rate. Projections by the Montana Department of Commerce project a 77.8% population increase for Ravalli County from the 2000 census to the year 2030, this works out to an average increase of 1.9% per year. The population growth in the Town is expected to mirror population growth throughout Ravalli County as a whole. The twenty-year growth projection for Stevensville is shown graphically in **Figure II.A.4**. Growth trends are such that future growth of the Town is expected to be primarily towards the east and south where there is available suitable land for development. Based on the above projections and current population estimates a population of 3,025 persons is forecast for the Planning year 2030.

**Figure II.A.4** Town of Stevensville Population Projections




**B. Evaluation of Existing Facilities.**

**1. Schematic Layout**

As shown in Appendix C, the existing water system for the Town of Stevensville is generally bounded by the Middle Burnt Fork Road on the south; the Bitterroot River floodplain on the west; the Eastside Highway on the north; and Logan Road on the east. The water system presently serves a few connections outside the Town limits, along the Burnt Fork Road.

The existing water system includes the following components:

1) Supply from 3 groundwater wells
2) The Swamp / Mill Creek infiltration gallery (Appendix A)
3) Rapid sand filter for the infiltration gallery with chlorine disinfection
4) 435,000 gallon concrete storage reservoir
5) 10,000 feet each of 8" and 10" supply mains from reservoir to Town
6) 12.3 miles of 4", 6", 8" and 10"distribution piping
7) Corrosion control by ortho-phosphate fed at Well No.1 and treatment plant

## 2. History

The Town of Stevensville's water supply was constructed in 1909 with over 6.2 miles of 4", 6" and 8" wooden water pipe and a small concrete reservoir located between Mill Creek and North Swamp Creek. The Town appropriated 5 cubic feet per second (CFS) from North Swamp Creek that fall and the $20,035 construction cost was paid with a voted bond. Water rates were set in December, 1909 at $1.00 per residence and $1.50 for restaurants and saloons per month. Livery barns and hotels were charged $3.00. Although the wooden pipe is no longer in use, sections of the 8" main still remain under Middle Burnt Fork Road.

In the 1930's, an infiltration system was constructed that gathers shallow groundwater from below the surface of the fields between Mill and North Swamp Creeks. Initially, a total of 8,134 linear feet of drainage pipe was installed generally parallel to North Swamp Creek with the intent of capturing and routing subsurface flow down to the municipal reservoir. Three (3) concrete caisson collector wells were constructed approximately 1,200 to 1,500 feet upgradient of the reservoir. Collector Well #3 receives water from approximately 6,100 linear feet of drainage tile along North Swamp Creek. Collector Wells #2 & #3 are connected by approximately 200 linear feet and 425 linear feet of drainage tile to Collector Well #1.

A number of modifications and improvements have been made to this original system, including the addition of 443 linear feet of new drain pipe in 1974. This additional drain pipe is connected to Collector Well #3 and consists of a 14.5 foot deep trench filled with 8.5 feet of 3/4" washed gravel over a 10" perforated pipe oriented roughly perpendicular to Mill and North Swamp Creeks. The original 6,100 feet of drain tile was disconnected from the Collector Well #3 and was left to drain into the gravel filled trench. As the original drain pipe does not have any systematically applied surface water, the origin of flow in this part of the system is subsurface groundwater. While the 1974 drain improvement was also intended to capture groundwater, at present the principal source of water is from applied surface water infiltrating into the newer 443 linear feet of line connected directly to Collector Well #3.

Originally the raw water collected from the subsurface infiltration system was delivered to a large concrete storage tank at the water treatment plant site, and then piped to Town in an 8" wooden pipe. The wooden main was abandoned in about 1936 when the cast iron pipe was installed. The 8" cast iron pipe is generally on the north edge of Middle Burnt Fork Road and this pipe has "leaded hub" joints which fail on occasion and require excavation to repair. These joints are fairly "rigid" and ground movement from heavy traffic loads may cause them to separate and fail. In 2006 Hughes Supply performed a leak detection survey and found numerous leaks along the cast iron main near the railroad crossing on Middle Burnt Fork Road estimated at over 140,000 gallons/day. These repairs have not been completed since abandonment of the 8" line is proposed and was supposed to take place in early 2009. The Public Works staff reports only 4 to 5 repairs have been made to this line in the past 20 years, Therefore, many leaks are still present in this line. The Town is hesitant to repair the leaks in this line as they wish to abandon it as soon as possible. The large number of leaks in this main and the patching requirements of the

Ravalli County Road and Bridge Department on Middle Burnt Fork Road make temporary repair of this line very cost prohibitive.

In about 1977 a rapid-sand filter was constructed to treat the collected water from the infiltration system and a second transmission main was installed in Middle Burnt Fork Road. This pipe is a 10" PVC laid generally on the north edge of the right-of-way although it crosses to the south edge approximately 6,000 linear feet west of the water treatment plant and again to the north edge just west of the Montana Rail Link railroad tracks. In 1990 a 3-way valve was added to the Plant discharge to automatically dump the back-wash water to waste.

In addition to the water supply from the Mill and Swamp Creek infiltration system, the Town has 3 groundwater wells. Well No. 1 was drilled in 1957 and a 50 HP line-shaft turbine pump installed. Well No. 2 was drilled in 1968 and a 20HP submersible pump installed in 1998. Well No. 3 was drilled in 1976 and a 20HP submersible pump installed in 1991. The concrete storage tank is approximately 430,000± gallons and all the supply from the tank to the Town is via the 8" cast iron and 10" PVC pipelines.

## 3. <u>Analysis of Existing Facilities</u>

### 3.1 Current Water Demand:

An analysis of the present water demands requires a compilation of historical and past use from Town records. Because only 69% of the water services are metered, precise measurement of "sold" or used water is not available. In addition, not all of the Town's water supplies are metered. Water entering the system from the treatment plant is measured through a recording meter at the plant discharge. Well No. 1 has a totalizing turbine meter on the discharge pipe and both meters are read daily by Town staff. Wells No. 2 and 3 are not metered, but daily run-time records are kept by Town staff, and a flow rate is assumed. Current water use has been estimated using the metered data available for 2008 plus an estimated use for the flat rate customers. Flat rate water use was estimated at 125% of the metered average.

In order to reduce water demands to a common and comparable basis, the "equivalent dwelling unit" (EDU) will be used. An EDU may be considered as the typical water demand of a 3/4" size water service. Currently the Town differentiates between "residential" and "commercial" uses, metered or unmetered, and service size. Potential water use is only considered as being related to the size of the water service line or meter. For instance, in 2008 the "EDU's" are determined as below:

**TABLE II.B.3.1.A: 2008 Inventory of Connections by Water Service Line Size**

| Meter Size | Number of Connections | Multiplier | EDU's |
|---|---|---|---|
| 3/4 Inch | 713 | 1 | 713 |
| 1 Inch | 36 | 1.79 | 64.44 |
| 1-1/2 Inch | 15 | 4 | 60 |
| 2 Inch | 3 | 7.14 | 21.42 |
| **TOTALS** | **708** | | **858.86** |

A summary of the annual water production from each of the Town's sources, and the EDU's served for the years 2006 through 2008 are shown in **Table II.B.3.1.B**. The Plant flows and Well No. 1 flows are taken from metered records. Flows from Well No. 2 and No. 3 are derived from the run-time records multiplied by the pump curve data of 190 gpm for Well No. 2 and 220 gpm for Well No. 3. Town staff reports the production from Wells No. 2 and 3 as 190 gpm average for purposes of annual water use inventory reports. An exact measurement of production from Wells No. 2 and 3 is not available due to a lack of metering. The number of EDU's for each year are based on the Town's water records and billing information.

**TABLE II.B.3.1.B: 3 Year Annual Water Production**

| Year | Annual Production in Million Gallons | | | | | AADF | Total | Average |
|---|---|---|---|---|---|---|---|---|
| | Plant | Well 1 270 gpm [1] | Well 2 190 gpm | Well 3 220 gpm | Total | (gpm) | EDU's | gpd/edu |
| 2006 | 163.65 | 40.5 | 14.23 | 49.8 | 268.18 | 510 | 793 | 927 |
| 2007 | 159.78 | 70.5 | 24.37 | 44.35 | 299 | 569 | 835 | 981 |
| 2008 | 135 | 93.32 | 30.35 | 36.44 | 295.11 | 561 | 859 | 941 |

[1] The impeller in Well No. 1 was adjusted in May 2005 and production increased from 150 gpm to 270 gpm.

Table II.B.3.1.C shows a detailed view of the 2008 water production records in order detail the water production on a monthly and daily peak basis.

**TABLE II.B.3.1.C: Water Production in 2008**

| Month | days | Plant | gpm[1] | Well 1 | Well 2 | Well 3 | Total | GPD/ |
|---|---|---|---|---|---|---|---|---|
| | | | | 270 gpm | 190 gpm | 220 gpm | gallons | EDU |
| Jan | 31 | 6,420,000 | 144 | 11,420,000 | 0 | 0 | 17,840,000 | 670 |
| Feb | 28 | 5,593,000 | 139 | 10,793,000 | 0 | 0 | 16,386,000 | 681 |
| Mar | 31 | 5,561,000 | 125 | 10,348,000 | 0 | 0 | 15,909,000 | 598 |
| Apr | 30 | 7,860,000 | 182 | 11,196,000 | 0 | 0 | 19,056,000 | 740 |
| May | 31 | 13,589,000 | 304 | 12,090,000 | 3,716,400 | 4,943,400 | 34,338,800 | 1290 |
| Jun | 30 | 11,937,000 | 276 | 10,856,000 | 3,522,600 | 9,504,000 | 35,819,600 | 1390 |
| July * | 31 | 19,587,000 | 439 | 13,042,000 | 8,481,600 | 9,820,800 | 50,931,400 | 1913 |
| Aug | 31 | 13,720,000 | 307 | 9,240,000 | 8,481,600 | 9,820,800 | 41,262,400 | 1550 |
| Spt | 30 | 16,595,000 | 384 | 2,084,000 | 6,144,600 | 2,349,600 | 27,173,200 | 1055 |
| Oct | 31 | 15,820,000 | 354 | 0 | 0 | 0 | 15,820,000 | 594 |
| Nov | 30 | 11,900,000 | 275 | 691,000 | 0 | 0 | 12,591,000 | 489 |
| Dec | 31 | 6,420,000 | 144 | 1,562,000 | 0 | 0 | 7,982,000 | 300 |
| Total | 365 | 135,002,000 | 257 | 93,322,000 | 30,346,800 | 36,438,600 | 295,109,400 | 941 |
| **Average Daily Flow** | | | | | | | **808,519** | **GPD** |

* The peak day recorded flow at the plant was in July was 831,000 gallons with all 3 wells operational; the peak day's total production was 1,953,400 gallons.

[1] Average gpm through the plant on a monthly basis. Daily records indicate a "peak day capacity" from the plant of 960 gpm.

Since all connections are not metered accurate water use data for Stevensville is not available. For the purpose of this report we will assume that once all connections are metered, the water usage for all users will be close to the average metered use. The 2008 metered water use consisted of 617.86 EDU's of the 858.86 total EDU's. The average water use from 2008 metered billing records was 274.95 gpd/Metered EDU. If this logic is applied to all EDU's, the average daily water use would be 236,140 gpd. Comparing this use to the water production records for 2008 results in 70.8% unaccounted for water. This number does not consider the fact that flat rate customers most likely use more water than metered users. Assuming flat rate customers use 25% more water than metered customers, lost water would still be 68.75% of production. This loss rate results in approximately 556,000 gpd of lost water. This amount of unaccounted for water is unacceptable and must be addressed by accurate metering and distribution system repairs and improvements. An estimate of water use and lost water is shown below

**TABLE II.B.3.1.C2: Estimated water use and lost water**

| Year | **2006** | **2007** | **2008** |
|---|---|---|---|
| Population (Estimated) | 1909 | 1946 | 1984 |
| [1]Total Accounts (EDU) | 793 | 835 | 859 |
| [1]Ave Production GPD/EDU | 926.53 | 981.05 | 941.23 |
| [1]Annual Production (MG) | 268.18 | 299 | 295.11 |
| [1]Annual Metered Water Use (MG) | 58.05 | 62.29 | 62.01 |
| [1]Metered Accounts (EDU) | 452 | 568 | 618 |
| [2]Percentage Metered by EDU | 57.00% | 68.02% | 71.94% |
| [2]Average Metered Use (GPD/EDU) | 351.84 | 300.46 | 274.88 |
| [3]Estimated Water Use (MG) | 112.79 | 98.89 | 92.23 |
| [4]Estimated Unaccounted for Water (MG) | 155.39 | 200.11 | 202.88 |
| Percentage Unaccounted for Water | 57.94% | 66.93% | 68.75% |

[1] From Town of Stevensville Records
[2] Calculated from Town records
[3] Estimate based on metered use plus unmetered connections estimated at 125% metered water use.
[4] Annual Production minus Estimated Water Use

Further confirmation of "lost" water can be deduced from measured wastewater treatment plant flows for the Town. Although there are a few water connections (out of Town) that are not connected to the wastewater plant, there are also a few sewer service connections that have their own water supply. The accounting for these users is not significant. **Table II.B.3.1.D** below summarizes the flows measured at the wastewater plant and compares to water system production records for 2008.

**TABLE II.B.3.1.D**, 2008 Average Daily Water Production and Wastewater Treatment Plant Flows by Month

| Month | Water production (GPD) | Wastewater Plant Inflow (GPD) | Difference (GPD) |
|---|---|---|---|
| Jan | 594,667 | 204,000 | 390,667 |
| Feb | 546,200 | 242,000 | 304,200 |
| Mar | 530,300 | 264,000 | 266,300 |
| April | 635,200 | 219,000 | 416,200 |
| May | 1,144,627 | 240,000 | 904,627 |
| June | 1,193,987 | 231,000 | 962,987 |
| July | 1,697,713 | 217,000 | 1,480,713 |
| August | 1,375,413 | 192,000 | 1,183,413 |
| Sept | 905,773 | 202,000 | 703,773 |
| Oct | 527,333 | 196,000 | 331,333 |
| Nov | 419,700 | 238,000 | 181,700 |
| Dec | 266,067 | 206,000 | 60,067 |
| Average | 819,748 | 220,917 | 598,832 |

The following observations and conclusions can be made from **Table II.B.3.1D**:

1. The wastewater plant flows are not adjusted for infiltration which is known to occur due to high groundwater. If adjustments are made for infiltration, the "lost" water would be even greater.
2. Winter time wastewater flows in February, March, and November exceed the annual average flows, most likely due to water users leaving fixtures open to prevent freezing. This is known by Town staff to occur.
3. A comparison of winter months wastewater inflow and water production confirm that a significant amount of produced water is "lost".
4. Average water production is approximately 941 gpd/EDU while average wastewater plant inflow is 257 gpd/EDU

Projections for future water use in Stevensville should be based on a significant reduction in "lost water". This reduction will occur over time and will most likely not resolve all leaks. Stevensville's billing records for "sold" water through metered services averaged 275 gpd/EDU in 2008, while "produced" water totaled 939 gpd/EDU a difference of 664 gpd/EDU. Water production for the Town of Stevensville is much higher than production in systems of similar size. The Town of Plains produced 425 gpd/EDU in 2004 on a base of 650 EDU's and the City of Hamilton reports 575 gpd/EDU in 2004 with 2,555 EDU's.

For maximum monthly and peak day demands, the calculations from the 2006 PER will be used. The records of the 2005 production year will be used to develop peaking factors for the community. For purposes of projecting water use demands, the 2005 production values will be adjusted to assume that 350,000 gpd in "lost" water is corrected. The following Table identifies the Peaking Factors for the existing flow conditions (2005 and estimates Peaking Factors for use in flow projections.

**TABLE II.B.3.1.E**
Peaking Factors for 2005 and adjustments for Projected Water Needs

| | 2005 actual | | Corrected for " Lost Water" | |
|---|---|---|---|---|
| | Flow (gallons/day) | PF | Flow (gallons/day) | PF |
| Average Annual Daily Flow (AADF) | 772,000 | 1.00 | 422,000 | 1.00 |
| Maximum Month Flow (July) | 1,499,952 | 1.94 | 1,149,952 | 2.73 |
| Peak Daily Flow (July 14) | 1,924,000 | 2.49 | 1,574,000 | 3.73 |

**Projected Water Demand:**
In order to project a water demand for 20 years in the future, we must predict the number of connections and population to be served in the year 2030. The graph of population projections shown in **Figure II.A.4** indicates that Stevensville can expect approximately 3,025 persons in 2030. If the growth rate of the water service connections is the same rate as the population growth rate, then there are 1,310 EDU's expected in 2030.

Based on the last leak detection survey completed in 2006, there are known leaks in the Middle Burnt Fork Road 8" cast iron main of approximately 140,000 gpd. This leak represents approximately 18% of the average daily production. In addition the Alliance for Water Efficiency states that unmetered water consumption is reduced 15% - 30% when metering and commodity rates are implemented. Based on the current metered use and the number of connections currently unmetered, a 2.3% reduction in daily production could be realized by metering all users. A reasonable approach to determining a required production quantity for the Town is to start with the current production rate and reduce the water demand with known improvements. Based on the above information, abandoning the 8" water main in Middle Burnt Fork Road (140,000 gpd) and moving to metering (25% reduction = 16,500 gpd) could be expected to reduce the overall water demand approximately 20%. This would reduce average day production to approximately 751 gpd/EDU as soon as these improvements are implemented.

Based on the large amount of unaccounted for water, it is assumed that there are a large number of leaks in the system that need to be repaired as they are found. We can expect that leaks will be found and repaired over time. If the Town of Stevensville is able to reduce "lost" water to approximately 15% of production by 2030, the water demand will be as follows:

**Table II.B.3.1.F**

Projected Water Demands

| Year / Parameter | 2008 [1] | 2010 | 2015 | 2020 | 2025 | 2030 [2] |
|---|---|---|---|---|---|---|
| Estimated Population | 1984 | 2155 | 2379 | 2498 | 2900 | 3025 |
| EDU's | 859 | 893 | 982 | 1081 | 1190 | 1310 |
| Average Production (gpd/EDU) | 941 | 750 | 650 | 600 | 550 | 500 |
| Annual Production (MG) | 295.11 | 244.46 | 232.98 | 236.74 | 238.89 | 239.08 |
| Average Annual Daily Flow (AADF) MG | 0.81 | 0.67 | 0.64 | 0.65 | 0.65 | 0.66 |
| AADF (gpm) | 561 | 465 | 443 | 450 | 455 | 455 |
| Max. month (2.73 x AADFx31)MG | 68.43 | 56.68 | 54.02 | 54.89 | 55.39 | 55.43 |
| Peak Day (3.73 AADF) MG | 3.02 | 2.50 | 2.38 | 2.42 | 2.44 | 2.44 |
| Required Supply (gpm) | 2094 | 1735 | 1653 | 1680 | 1695 | 1697 |

[1] These values are actual measured production figures for the year 2008.
[2] Expected water production if "lost water" is reduced to 15% of production by 2030.

In addition to the domestic demands on the water system as identified above, the water system must serve the fire protection needs of Stevensville. The Hydrant Flow Data Summary produced by the ISO Commercial Risk Services in 1996 (a copy is included in Appendix C), indicates a desired fire flow in the downtown commercial areas as high as 3,500 gpm and 3,000 gpm at the school. Based on the water model, in its current state the water system is only capable of delivering 1,000 gpm or more to 6 of 118 intersections in Town under peak day conditions (See fire flow data in Appendix C). Improvements to supply, distribution and storage will be needed to meet ISO fire flow demands. The domestic demands and fire flow rate must be met from a combination of supply and storage.

**3.2 Adequacy of Supply:**

Stevensville presently relies upon its infiltration gallery with treatment plant and three (3) groundwater wells for water supply. A summary of those supplies is presented in **Table II.B.3.2.** The total current available supply from all three (3) wells and the treatment plant is 1580 gpm peak capacity. The supply does not currently meet the peak requirements of the Town of Stevensville. It should be noted that there is presently no back-up power available for the water supplies. Should power completely fail, the storage tank maintains about a 12 hour supply at AADF. Water rights abstracts can be found in Appendix F.

**Table II.B.3.2:**
Existing Well & Infiltration System Production and Water Right Summary

| Water Source | Peak Flows 2008 (gpm) | Volume Recorded 2008 (Acre-feet) | Water Right Number | Water Right Type | Source | Permitted Flow (gpm) | Claimed Volume Acre-feet | Period of Use |
|---|---|---|---|---|---|---|---|---|
| Infiltration Gallery / Treatment Plant | 900 | 414.31 | 214147 | Claim / decreed | Mill Creek | 1122 | 1120 | 1/1 - 12/31 |
| | | | 214149 | Claim / decreed | Mill Creek | 561 | 900 | 1/1 - 12/31 |
| | | | 76H 76760 00 | Provisional permit | N Swamp Creek | 337.5 | 272.2 | 10/15-4/15 |
| | | | 76H 88532 00 | Provisional Permit | groundwater | 345.3 | 556.97 | 1/1-12/31 |
| Well No. 1 | 270 [1)] | 286.39 | 76H 89376 00 | Provisional Permit | groundwater | 500 | 919.86 | 1/1 - 12/31 |
| Well No. 2 | 190 | 93.13 | 76H 7286 00 | Provisional Permit | groundwater | 240 | 40 | 1/1 - 12/31 |
| Well No. 3 | 220 | 96.58 | 76H 9186 00 | Provisional Permit | groundwater | 220 | 340 | 1/1 - 12/31 |
| Total | 1580 | 890.41 | | | | 3325.8 | 4149.03 | |

[1] The impeller for Well No. 1 was adjusted in May, 2005 and the capacity increased from 150 gpm to 270 gpm.

**Surface Water / Treatment Plant Supply:**
As summarized in **Table II.B.3.2**, the source water collected by the infiltration gallery and brought into the treatment plant is from three (3) basic sources: 1) groundwater through an infiltration gallery; 2) Mill Creek water which is applied to the surface and percolates to the infiltration gallery; and 3) direct withdrawal from North Swamp Creek. While the total water claimed or permitted from these sources is more than sufficient to meet the demands of the Town, the practical acquisition of this quantity is much more problematic. The Mill Creek and Swamp Creek sources are a part of the Burnt Fork drainage which is the earliest appropriated drainage in Montana and perhaps has some of the most contested claims for water. While the Bitterroot Basin 76H is closed to further appropriations of surface water, the closure does not apply to municipal water supplies [MCA 85.2.344(2)(b)]. Even so, the Town staff does not feel that it is likely that any additional water could be collected for the treatment plant than is currently appropriated. Seasonal average daily flows from plant have been 150 to 650 gpm with peaks to over 900 gpm. It is not anticipated that this flow rate can be increased. The design flow from the treatment plant is 784 gpm, as described in the *"Water Treatment Plant Preliminary Engineering Report" by* Welch Comer, This report is available from the Town of Stevensville upon request.

**Groundwater Well Supply:**
The Town's three (3) groundwater supply wells are very dated and in fair to poor condition. Well 1 was completed in 1957, Well 2 was constructed in 1968 and Well 3 was completed in 1976. Each well pumps separately and directly into the distribution grid. Wells 2 and 3 are located in street right-of-ways or limited easements with insufficient area for proper controls or improvements. A copy of available and Groundwater Information Center (GWIC) information on each well is included in Appendix C. A summary of each well follows:

**Well No.1** is located near the intersection of Main Street and Eastside Highway on the north side of Town, within a small city park. The well has a 10" steel casing drilled to a depth of 460 feet BLS with perforations at 362 to 370 feet. It appears that a screen was pulled and the well was perforated in 1957. In May, 2005, the City contracted to have the pump impellers adjusted and the production rate was improved to approximately 400 gpm. However, production was limited to 270 gpm due to excessive sand production at flows above 270 gpm. (Approximately 400lbs per day of sand was generated during test pumping) Recently the Town has been receiving sand complaints near Well 1 and this well is assumed to be at the end of its useful life.

**Well No. 2** is located at the northeast intersection of South Avenue and Mission Street in the southern portion of the Town. The location is within the edge of the street right-of-way and the wellhead is located below the ground surface in a pit. The well has an 8" steel casing drilled to a depth of 56 feet BLS. The casing is perforated in the 36' to 56' range. There is no screen. It has a 20 hp submersible pump set at a depth of 47 feet. The pump installer indicated the pump was producing 190 gpm at 100 psi when installed. The well is un-metered, but the claimed rate is consistent with the supplied pump characteristics. The Department of Environmental Quality has expressed concerns about this well including pump control and vent locations to the pump being set below the perforations in the casing.

**Well No. 3** is located adjacent to the Maplewood Cemetery in the southwest portion of the Town. The well has an 8" steel casing drilled to a depth of 75 feet BLS. The casing is perforated in the 40' to 75' range. There is no screen. It has a 20 hp submersible pump set at a depth of 61 feet. The pump is rated at 220 gpm according to the installer. The Department of Environmental Quality has expressed similar concerns with this well as to Well No. 2.

The maximum historical daily production with all wells in operation plus the treatment plant was experienced on July 4, 2003. The recorded flow was 2.19 MGD or 1,518 gpm. However, the tank at the treatment plant was almost drained dry on that day in order to supply the demand on the distribution system.

The adequacy of the water supply is typically judged on the capacity to meet the peak day demand with the largest producer out of service per DEQ Circular 1, Section 3.2.1.1.a. For Stevensville, the largest producer is the treatment plant at 900 gpm. The adequacy of Stevensville's existing water supply to meet the demands over the next 20 years is shown below:

**Table II.B.3.2.A**, Existing Water Supply vs. Future Demand with Largest Source Out of Service
(*) 2009-2030 Flows based on significant reduction in lost water to achieve 15% lost water by 2030

| | Average Day (gpm) | | | Peak Day Conditions (gpm) | | |
|---|---|---|---|---|---|---|
| Year | Demand | Supply [1] | Shortage | Demand | Supply [1] | Shortage |
| 2008 | 552 | 680 | - | 2059 | 680 | 1379 |
| 2009 | 456 | 680 | - | 1701 | 680 | 1021 |
| 2010 | 465 | 680 | - | 1734 | 680 | 1054 |
| 2011 | 474 | 680 | - | 1768 | 680 | 1088 |
| 2012 | 483 | 680 | - | 1802 | 680 | 1122 |
| 2013 | 492 | 680 | - | 1837 | 680 | 1157 |
| 2014 | 502 | 680 | - | 1872 | 680 | 1192 |
| 2015 | 443 | 680 | - | 1654 | 680 | 974 |
| 2016 | 452 | 680 | - | 1686 | 680 | 1006 |
| 2017 | 461 | 680 | - | 1719 | 680 | 1039 |
| 2018 | 470 | 680 | - | 1752 | 680 | 1072 |
| 2019 | 479 | 680 | - | 1786 | 680 | 1106 |
| 2020 | 451 | 680 | - | 1681 | 680 | 1001 |
| 2021 | 459 | 680 | - | 1713 | 680 | 1033 |
| 2022 | 468 | 680 | - | 1746 | 680 | 1066 |
| 2023 | 477 | 680 | - | 1780 | 680 | 1100 |
| 2024 | 487 | 680 | - | 1815 | 680 | 1135 |
| 2025 | 455 | 680 | - | 1696 | 680 | 1016 |
| 2026 | 463 | 680 | - | 1729 | 680 | 1049 |
| 2027 | 472 | 680 | - | 1762 | 680 | 1082 |
| 2028 | 482 | 680 | - | 1796 | 680 | 1116 |
| 2029 | 491 | 680 | - | 1831 | 680 | 1151 |
| 2030 | 455 | 680 | - | 1697 | 680 | 1017 |

[1] Based on capacity with largest supply (treatment plant) out of service.

It should be noted that the infiltration gallery peak supply (900 gpm) is likely the most susceptible to short-term drought conditions (shortage of irrigation water) which will be co-incident with peak summer demands. The infiltration gallery is also subject to frequent rejection of water during peak runoff in the spring and after rain events when filtered water exceeds allowable turbidity standards.

The above table shows that the Town's existing sources are not adequate to meet current peak demands of the system due to excessive leakage, and cannot meet future demands even with leak reduction. Combined with the fact that the Town's storage is also below the requirements outlined in DEQ Circular 1, Section 7.0.1. this places the Town at risk of running out of water during peak use events. It also shows that even if the Town repairs/replaces its leaking transmission mains the existing source is not able to keep up with peak flow demands over the next 20 years.

In addition, the lack of automated controls is greatly hampering the efficiency of the water supply system. At this time, all wells are manually controlled. Wells are turned on by staff at times they feel or note that the treatment plant supplies will not keep up with demands, and wells often run when the plant could keep up with demand. Any modifications to the water supply should include telemetry and controls to automate the system and provide alarms for low and high water conditions.

**3.3 Source Water Protection Plan:**
A Source Water Protection Plan (SWPP) for Stevensville was completed by Western Groundwater Services of Bozeman, MT in the year 2000 and subsequently adopted by the Town and accepted by the Department of Environmental Quality. This Plan identified the sensitivity of the well and near surface water sources to contamination and inventoried potential contamination sources in the vicinity of each raw water source point. The Plan identified Wells 2 and 3 and the infiltration gallery source as having a "High" sensitivity classification. Well No. 1 was classified as having a "moderate" level of sensitivity to contamination due to its depth and the fact that it draws its water from a semi-confined aquifer. The Plan reviews emergency procedures including source isolation in the event of contamination and details alternative raw water sources for the Town.

Chapter 5 of the Plan recommends alternative sources of supply as being groundwater wells located south east of Town along the Burnt Fork Road. Applicable portions of the Source Water Protection Plan are included in Appendix D. Other well locations have also been explored by the Town and are described in more detail in the Alternatives Analysis Section of this PER.

**3.4 Treatment:**
Treatment facilities for the Town's supplies include chlorination and ortho-phosphate feed at the treatment plant for the surface water collection system, and ortho-phosphate feed at Well No. 1 as a corrosion control measure to mitigate copper leaching. Chlorination is currently approved for Well No. 1 and being added.

Appendix C includes a schematic diagram of the existing water treatment plant which is located at the southwest corner of Middle Burnt Fork and South Burnt Fork Roads. The treatment plant was designed in 1978 and was constructed in 1979. The plant was designed for a maximum daily flow of 784 gpm. Modifications since that time have included chlorine residual sampling, turbidity sampling, and a backwash wastewater bypass. Refer to the "*Water Treatment Plant Preliminary Engineering Report*" by Welch-Comer & Associates for more detailed information on the Treatment Plant.

At this time, only the treatment plant discharge is being chlorinated before it is introduced into the distribution system. The Well supplies are not chlorinated and it will not be feasible to add chlorination to Well No. 2 & 3 due to lack of available space. The EPA's Groundwater Treatment Rule requires chlorination of groundwater sources in a manner to provide contact time prior to the first user of the water if required by source water monitoring. As configured, none of Stevensville's wells will be able to meet this condition. Space is not available at any of the well sites to allow storage or piping sufficient to provide contact time for 4-log disinfection if required by the Groundwater Rule.

The Town's water supply has been shown to be corrosive towards lead and copper with recurring violations of copper exceeding regulatory limits. In 2001 the City prepared and adopted a MDEQ approved corrosion control plan and began feeding ortho-phosphate into the supply at the Treatment Plant and at Well No. 1 during the fall of 2001. Lead and copper samples taken since indicate that the program is successful and the Town will continue and expand the ortho-phosphate corrosion control measures.

Preliminary testing of the Town's groundwater and surface water supplies have indicated there should be no issues with radio-nuclides. Likewise, preliminary testing for disinfection byproducts (DBP) appears to be satisfactory. Arsenic concentrations are below the current and proposed MCL's. The proposed radon standard, if adopted, will most likely mean that Stevensville will have to aerate, or otherwise treat, its supplies. Since the current groundwater well sites are limited and lack sufficient area future wells or "well fields" must consider adequate space for future treatment needs of the groundwater supply.

### 3.5 Storage:

The Town's only water storage facility is located at the treatment plant. The nominal 430,000± gallon concrete tank is 110 feet in diameter with a total water depth of 6 feet. In order to maintain an adequate contact time for chlorine through the tank, MDEQ has defined the minimum operating volume of the reservoir at 295,000 gallons and allowed a "baffling factor" of 0.2. The resulting contact time is adequate to provide 4-log disinfection for viruses at a flow of 900 gpm at a chlorine concentration of 0.5 mg/L without counting the transport time in the transmission main.

The tank was cleaned and video inspected in November, 2004, by *Liquivision Technology* of Klamath Falls, OR. The complete report and photos are available from the Town of Stevensville upon request. After cleaning a significant amount of sand and silt, the tank was found to be in good condition. One (1) seam on the tank bottom was found and leak tested as satisfactory. A video of the tank inspection is available at Town Hall.

DEQ Circular 1 states that the minimum storage must accommodate domestic water needs for the 24 hour average day, and fire flow demands as recommended by the State Fire Code and the Insurance Service Office (ISO). The most recent ISO rating and Hydrant Flow Data Summary (1996) is included in Appendix C and the "needed fire flow" (NFF) ranges from 1000 gpm in the residential areas to 3500 gpm in the downtown commercial district. The ISO recommends a 2 hour duration for fires of less than 3,000 gpm and a 3 hour minimum duration for greater than 3,000 gpm. The fire flow is in addition to supplies available for the 24 hour average flow. Since no major changes to the water system have occurred since 1996 it is assumed that these requirements are still valid.

The following **TABLE II.B.3.5A** summarizes the total storage volume recommended for existing system demands (2008) and the projected demands of 2030.

**TABLE II.B.3.5A** System Storage Requirements

| | 2008 conditions | | 2030 Projected | |
|---|---|---|---|---|
| System Average Day (gpm) | 561 | 561 | 455 | 455 |
| System Peak Day (gpm( | 2,094 | 2,094 | 1,697 | 1,697 |
| Required Fire Flow (NFF) | 1,000 | 3,500 | 1,000 | 3,500 |
| Total Flow required (gpm) | 3,094 | 5,594 | 2,697 | 5,197 |
| Less available supply (gpm) | 1,580 | 1,580 | 2,262 | 2,262 |
| Net rate from storage (gpm) | 1,514 | 4,014 | 435 | 2,935 |
| Fire Storage Volume Required (gal) | 181,680 | 722,520 | 52,200 | 528,300 |
| 24-hour Average Day | 807,840 | 807,840 | 655,200 | 655,200 |
| TOTAL RECOMMENDED VOLUME (gal) | 989,520 | 1,530,360 | 707,400 | 1,183,500 |

The Table above shows that the existing storage reservoir (435,000 gallons) is insufficient for both existing and future needs. However, it should also be noted that the system leaks also drastically affect the sizing of the storage tank. Without accurate metered use records, and assumed production numbers, it is difficult to accurately size the storage tank, and may result in an oversized storage tank which could pose water quality issues as the leaks are reduced and more accurate metering data becomes available.

Based on discussions with Rural Development and TSEP, it would not be in the Towns best interest to size and design a water tank at this time. Due to the fact that the Town of Stevensville is currently unmetered, and that there is a large amount of leaks in the distribution system, sizing a tank based on estimated usage and leaks would result in an oversized tank. Over sizing of the tank could lead to water quality issues such as stagnation, and would add additional cost to an already expensive project. A detailed water use and fire flow analysis will be performed after the Town's leaks have been reduced through the proposed distribution improvements and there is at least one year of metered use records for the Town. From this information a more accurate and cost effective tanks sizing will be able to be performed.

**3.6 Distribution System:**
The water distribution piping system consists of mains ranging in size from 2" to 10" in diameter and made of galvanized iron, cast iron, steel and PVC. The Town has employed leak detection services to inventory the water mains and the most recent in March of 2006, uncovered five (5) leaks with an estimated leakage rate of 217,080 gpd of which over 140,000 gpd was found in the 8" cast iron main in Middle Burnt Fork Road (see Appendix A). This accounts for almost 30% of the "lost" water indicated by the production records and wastewater treatment plant measured inflows. The cast iron main in Middle Burnt Fork Road is assumed to be the main source of water loss for the Town.

It has been the Town maintenance staff's experience that leakage in Town may be predominantly in service lines and their connections to the mains. Copper "loops" as flex joint connections to the main were common and corrosion of the copper is reported frequently. Due to porous gravel soils, leaks are generally undetected until they get severe enough to cause noise in the serviced, or adjoining, homes. These leaks are fixed by the Town's staff as they are found.

Piping replacements and improvements should be made to improve fire flows to ISO standards and loop dead-end mains for improved water quality and dependability.

**3.7 Utilization of Water Meters:**
On the supply side, only the treatment plant and Well No. 1 have metered discharges. Flow from wells No. 2 and 3 are estimated based on pump curve data and run time. On the distribution side, approximately 68% of the services connected to the Town are metered. Due to the lack of complete metering of "produced" and "sold" water, there can be no accurate accounting for "lost" water. Based on the 2008 reported production rates and sewer flows during the winter months, it is estimated that over 500,000 gallon per day of produced water is lost through leaks in the distribution system; this represents over 68% of the produced water on an annual average. Metering of all supplies and of all water service lines is expected to have a significant impact on water conservation.

For the past several years, all new connections to the water system have required meters. In addition, Town ordinances require installation of meters when a house is sold or transferred. The Town recognizes the benefit of installing meters on the remaining 250 unmetered connections, and intends to establish a metering program as part of the improvement project. Most grant funding programs require metering of all customers as a funding condition.

**3.8 Operational and management practices and capabilities:**
At present two (2) persons at the supervisory level share the Public Works duties within the Town. Daily operation of the water system is handled by one of these supervisors, with the assistance of 2 field personnel and the water & sewer billing clerk.

Although the system has been historically reliable and is relatively simple and easy to operate, the aged condition of the supply and distribution elements, together with pending regulatory requirements, mean that replacement and upgrades are urgently needed. The lack of an automated control system means that all well functions are done by hand at times dictated by operator knowledge, and wells often run when not needed. A lack of meters on all supplies and 31% of services make monitoring of water use and production impossible. The water system operators have expressed interest in minimizing technology and complicated controls in any new system, but installation of automated controls will greatly improve efficiency and conserve water and power.

## 4. Financial Status of Facilities -

**Water Rates:**
The Town of Stevensville has experienced growth in the water system consistent with the rapid population growth of the community. However, there have been few changes, improvements or upgrades to the system for over 25 years. As a result, there has been no debt service obligation for the water system users in about 10 years, but the water system infrastructure is aging and in several instances, beyond its useful life.

The Town's present water rate system includes both a flat rate for unmetered customers and a metered rate for those customers whose water usage is metered. The water rate includes a "base rate" according to the user's water service size. Metered connections enjoy a lower "base rate" but sustain a charge for water use over 10,000 gallons per quarter.

The Town's current water rates are billed quarterly based as follows:

| | |
|---|---|
| ¾" Flat Rates: | $51.31/quarter + $32.90 annual irrigation |
| ¾" Metered Rates: | $43.96 + $0.55/1000 gal over 10,000 gallons/quarter |

In addition, each water account is charged the $2.00 annual DEQ water fee.

The typical residential monthly water rates are shown in the following table for flat rate and metered rate customers, based on a 3/4" meter and the average annual water use per EDU. The average annual water use is estimated from the 2008 billing records for metered customers at 100,375 gal/EDU/year.

**TABLE II.4.1.A** Current Estimated typical monthly water bill (1 EDU)

| | Annual fees | | | | |
|---|---|---|---|---|---|
| Account type | base rate | irrigation | MDEQ fee | usage[1] | monthly cost |
| Flat rate 3/4" Service | $205.24 | $32.90 | $2.00 | N/A | $20.01 |
| 3/4 Metered Service | $175.84 | | $2.00 | $33.21 | $17.59 |

[1] Usage is based on the 2008 metered average of 100,375 gal/year/EDU less 10,000 gal/quarter base allocation.

**Sewer Rates:**
Sewer rates are based on water service line sizes and the EDU system. The current sewer rate was adopted in July, 2004, and may be summarized:

**TABLE II.4.2.A** Sewer Rates

| Water meter size | EDU factor | Annual cost | Quarterly cost | Monthly cost |
|---|---|---|---|---|
| 3/4" | 1 | $ 421.08 | $ 105.27 | $ 35.09 |
| 1" | 1.79 | $ 753.72 | $ 188.43 | $ 62.81 |
| 1 1/2" | 4 | $ 1,684.32 | $ 421.08 | $ 140.36 |
| 2" | 7.14 | $ 3,006.48 | $ 751.63 | $ 250.54 |

**Infrastructure Access Fee (IAF):**
In addition to the water and sewer fees above, the Town adopted an "Infrastructure Access Fee" in 1996 that is in addition to connection charges and other service charges and is assessed to any new developments to help defray the cost of excess water and sewer system capacity. The charge represents the proportionate capacity of the 'general benefit' facilities required by the new development, and revenues collected from the IAFs are used to retire any debt encountered in constructing the general benefit facilities, or in contributions to the system capital improvement fund. Because the sewer system had been funded in part with GO bonds spread over different portions of the Town, the IAF is variable depending on the location of the new construction. The water portion is a constant $2,400 (3/4" service) and the sewer ranges from $365 to $1,000 (per 3/4" water service) depending on the location of the new construction. The calculation of the IAF has not been updated since its inception in 1996 and the Town is encouraged to do so.

The Water and Sewer rate Schedules and the Ordinance establishing the IAF are included in Appendix E.

The following Table illustrates the Water Fund condition for the past 3 years and the projected Budget for the 2009 - 2010 fiscal year.

| WATER FUND [1] | | | | |
|---|---|---|---|---|
| | Actual | | | Budgeted |
| Item | **FY 06-07** | **FY 07-08** | **FY 08-09** | **FY 09-10** |
| Total Accounts (2) | 739 | 745 | 767 | 787 |
| EDU's | 792.65 | 834.65 | 858.86 | 881 |
| O & M Expense | $216,070 | $199,127 | $309,394 | $271,395 |
| Debt Service | $0 | $0 | $0 | $0 |
| **Total water operation expense** | **$216,070** | **$199,127** | **$309,394** | **$271,395** |
| Total Water Sales (3) | $164,225 | $207,632 | $233,041 | $228,380 |
| Other revenue (4) | $24,539 | $10,970 | $2,017 | $2,017 |
| Infrastructure Access Fees | $32,952 | $3,415 | $0 | $0 |
| Investment earnings (5) | $9,097 | $5,114 | $0 | $0 |
| Grants | $40,690 | $0 | $0 | $0 |
| **Total Water Revenues** | **$271,503** | **$227,131** | **$235,058** | **$230,397** |
| Net Revenue Surplus/Shortfall | $55,433 | $28,004 | ($74,336) | ($40,998) |
| % Surplus/Shortfall | 26% | 14% | -24% | -15% |

Notes:
(1) Combines the revenues and expenses from both the Water Fund and the Water Replacement Funds as kept by the Town.
(2) Total Water Service accounts billed
(3) This is the revenue actually received and not the amount billed.
(4) Sources for these revenues include materials sold such as piping, valves, fittings, backflow preventers, etc.
(5) From CDs on deposit at local banks.

From inspection of the actual water revenues vs. expenses for the past 3 years, it is apparent that water charges are not keeping up with the operating expenses. Note that there is no debt service in place at this time.

HDR has evaluated the Town's water and sewer rates and prepared a rate study to help the Town properly budget for proposed improvements, as well as building up a operating reserve, debt reserve, capital reserve and rate stabilization reserve. These revenue requirements were presented to Town Council on October 26, 2009 and cover through the year 2014, at which point they should be reevaluated. A copy of the Revenue Requirements Presentation is included in Appendix E.

## C. Description and Documentation of the Need for the Project

### 1. Health and Safety -

### 1.1 Treatment:

The treatment plant, located on Middle Burnt Fork Road southeast of the Town, was constructed in 1978 with a design capacity of 933,000 gpd. Due to the fact that there is no raw water turbidity meter in the plant, and that the plant is often unable to meet the turbidity requirements of EPA's Long Term 1 Enhanced Surface Water Treatment Rule, which had a January 14, 2005 deadline for compliance. The Town is currently out of compliance with this rule. However, the filtration plant is equipped with a bypass valve which discharges water to waste that does not meet the turbidity requirements; therefore, there have been no turbidity violations at the plant. Although this method protects the health and safety of the residents in Town, it also takes the treatment plant out of production during spring runoff and after large rain events. This rule is designed to insure that municipal water systems reduce disease incidence associated with *Cryptosporidium*, a protozoan parasite present in surface waters, and other pathogenic microorganisms. See the *"Water Treatment Plant Report"* by Welch-Comer for a complete discussion.

The current 9-ft x 40.67-ft rapid sand filter consists of 6-inches of filter media on 6-inches of support gravel, and does not meet the following design requirements established in DEQ Circular 1, Section 4.2. Section 4.2.1.3 requires a minimum of two (2) filters be provided, with each capable of meeting the projected maximum daily demand. Section 4.2.1.4 requires a minimum filter box depth of 8-1/2 feet (currently 7.66-ft). Section 4.2.1.6 requires a total filter media depth of not less than 24 inches and generally not more than 30 inches.

### 1.2 Transmission:

There are 2 existing water supply lines from the storage tank to Town. An 8" cast iron line with leaded hubs was installed in the right-of-way of Middle Burnt Fork Road in the 1930's. Leaded hub joint pipe is always a concern for lead leaching, however, testing for lead and copper during 1993, 1994 and 2001 only indicated 1 recordable level of lead (0.008 mg/l) and the regulatory limit is twice that reading at 0.015 mg/l. A leak detection survey in the Spring of 2006 found approximately 12 leaking hubs (joints) in a 3000 foot stretch of the 8" main totaling over 140,000 gpd. These leaks have yet to be repaired since it is the Town's preference to abandon/replace this main, and considerable cost would be associated with the repair. Additional leaks can be expected with time and traffic on the roadway if this main is kept in service as the 8" main is far past its useful life (50 years maximum). A 10" PVC line was constructed in 1978 which parallels the 8" main to town. This 10" line is not capable of delivering peak demands to the Town's distribution system on its own. However, if additional source capacity is developed in Town this main is capable of delivering up to 2400 gpm without exceeding the 10 ft/sec velocity as recommended by AWWA.

The Ravalli County Road and Bridge Department reports that they endure recurring failures in the road subgrade on Middle Burnt Fork Road due to periodic collapse of the old wooden water main and transport of groundwater via the wooden conduit. Installation of a new transmission main should co-incidentally replace the wooden line or insure it is properly abandoned.

As can be seen in **TABLE II.B.3.5A**, required flows during a fire event will be 2,700 to 5,200 gpm if both fire and domestic flows are delivered in the transmission main during peak day usage. It is recommended that the leaking 8" cast iron main be replaced or abandoned in-place. Adequate transmission mains should be installed to deliver ISO required fire flows and peak day domestic demands from the new source to Town. Replacement of the 10" main to the existing storage tank does not appear to be necessary if a consolidated well field is developed in or near Town and water from this source can be delivered to Town.

**1.3 Storage**:
The present Town storage is a concrete tank of 430,000 gallons constructed in the late 1950's or early 1960's with an open top. In 1979 a sealed concrete lid was added. The tank was cleaned and inspected in 2004 and found to be generally in good condition. The tank has no baffling and the "baffling factor" has been determined by DEQ as 0.2 based on a peak flow of 900 gpm. The tank is sufficiently sized to provide 4-log chlorination at a free chlorine residual of 0.5 mg/L.

**TABLE II.B.3.5A** indicates that additional storage is needed to meet DEQ and ISO requirements currently and for the 20 year projected growth. However, due to the fact that accurate metering information is unavailable, tank sizing should be delayed until water use and loss can be accurately assessed.

**1.4 Supply**:
In 2003, the Town was not able to keep up with demands during the peak summer months. Only severe watering restrictions prevented the storage tank from running empty. After realizing that Well No. 1 was producing only about 25% of it's original capacity, the Town had the impellers adjusted in May, 2005, and recovered an additional 120 gpm.

However, review of production records from the Town's existing supplies for the past 3 years indicate that the production from the system supplies is more than twice what should be expected (annual averages of 900 to 1000 gpd/edu). The present production capability does not meet the requirements of DEQ Circular 1, Section 3.2.1.1.a. for peak day flow, and becomes worse over the 20 year design period.

The Source Water Protection Plan, approved and adopted in 2000, identified Wells 2 & 3 as highly susceptible to point source contamination. These wells are in the shallow aquifer with no surface seals and have no easement or land area for protection, installation of back-up power, or disinfection equipment. These wells should be phased out of service.

Well No. 1 was deepened in 1957 and a line-shaft turbine was installed. In May, 2005, the City contracted to have the pump impellers adjusted and the production rate was improved to approximately 400 gpm. However, production was limited to 270 gpm due to excessive sand production at flows above 270 gpm. Recently the Town has been receiving sand complaints near Well 1 and this well is assumed to be at the end of its useful life. Due to its age (near 50 years), condition (50% efficient), and the fact that it pumps directly into the distribution system, replacement of this well should be considered. If this well is to continue in service, a new pump, pumphouse, piping, and control system should also be considered. The Well is in a small city park and lacks adequate space to provide adequate contact time should disinfection become a requirement.

A well field along the Burnt Fork Road corridor was suggested in the Source Water Protection Plan (2000). The Twin Creeks Subdivision located in this area has agreed to provide 4-6 acres for a municipal well field. A test well was drilled in May 2007 and a *PWS-6 Source Water Protection Delineation* was prepared by Geomatrix Consultants, Inc. in November 2007. This test determined that there was adequate high quality water available for a consolidated well field. In April of 2008 a 10" diameter production well was drilled on the proposed well field property, and in August 2008 AMEC Geomatrix, Inc. prepared a *Hydrogeologic Assessment Report and Criteria Addendum Evaluation in Support of Application for Beneficial Use Permit*. A 72-hour pump test was performed to test the well capacity and establish the capacity of the aquifer. The test demonstrated that a capacity of 1,100 gpm was physically available from the production well.

An automatic control system is needed on the wells to bring them on and off based on tank water level. Such controls will save on pumping costs and conserve water as well as provide a reliable water supply under all flow scenarios, including fire flow conditions.

**1.5 Distribution**:
An ISO study and report in 1996 requested a goal of 3000 gpm at the School, 3500 gpm in the downtown area and 1000 gpm in most residential areas to assure fire protection. The current system of 4", 6", 8" and 10" piping cannot meet these requirements in most locations (see Appendix C). In addition, a review of water production records indicates that the system has over 60% lost water on average, most likely due to leakage. However, since the water system is not completely metered an accurate accounting of lost water cannot be made.

Dead-end lines should be completed as a looped system for assured water quality, disinfection, and service redundancy. Leaking water mains and services are a potential source of chlorine and ortho-phosphate contamination to the high groundwater levels prevalent in the Stevensville area. High groundwater levels are supported by summertime flood irrigation throughout the area. The coarse gravel alluviums provide a direct link of leaking water mains to the Bitterroot River. Leaking mains and services also provide a potential mechanism for bacteriological contamination from known leaking sewer mains and from the prevalence of on-site septic systems in the rapidly developing areas east and south of the Town. It is estimated that 600 pounds of phosphates and 200 pounds of chlorine are added annually to local groundwater due to leaking pipe systems.

It is the experience of the Town maintenance staff that most of the leakage excluding Middle Burnt Fork Road originates from copper service lines which are corroding at the corp. stop. The copper either corrodes through or breaks off at the connection. Once the leak is severe enough, a pressure drop at the house or the noise level of the moving water is noticed by occupants of the home. The last leak detection survey was completed in March, 2006. This survey identified several leaks in mains and services in town and found significant leakage in the 8" cast iron main in Middle Burnt Fork Road. Continuing leak detection and repair are necessary maintenance items and are expected to continue.

Additional water mains and water main replacement are required to complete the system grid and improve peak and fire flow capacities as well as to improve water quality. Water main and service line replacements are needed to reduce lost water to an acceptable level, reduce production and chemical costs and prevent groundwater pollution. The water distribution improvements shown in Appendix C will bring the present system into ISO compliance and provide service for the Planning period.

**1.6 Metering:**
Approximately 31% of the water system users are un-metered and currently pay a flat rate for water service. Metering of all services will help reduce "lost water" and also makes sense from a fiscal and water conservation standpoint. Most grant funding programs will require metering of all customers as a funding condition.

The Town needs to install water meters on the remaining 248 un-metered customers in order to meet loan and/or grant funding conditions and to better inventory water uses and losses due to leakage. With all customers metered, the Town will be better equipped to collect fair and adequate revenues from all connected users, and will be able to more accurately determine water use for storage tank sizing.

**2. System O&M –**

In general the Stevensville water system has not had any significant improvements in over 20 years and most components are well past their useful life. However, required water quality testing is current, and the system has had no significant violations or issues with water quality. Testing to date for disinfection byproducts (DBP), radionuclides (radon) and arsenic do not indicate any problems, even with the new EPA standard of 10 parts per billion for arsenic. A copy of the Water Quality Summary from the MDEQ website is included in Appendix G. Regular monitoring of the water supply will help to ascertain when and if these issues need further attention.

**2.1 Treatment:**
As documented earlier, treatment plant upgrades are needed if the treatment plant is to remain online as a source of water for the Town. In order to meet EPA turbidity requirements without discharging to waste, and the requirements of DEQ Circular 1, filter upgrades must be completed. Due to limited staffing, the treatment system must remain simple and reduce operator interaction.

The Town presently injects ortho-phosphate at the treatment plant and at Well No. 1 for purposes of lead-copper corrosion control. Chlorine is added at the treatment plant in order to maintain a system wide chlorine residual. The use of both of these chemicals could be reduced by 1/3 to 2/3's if leaks in the distribution system and "lost" water can be reduced, for an estimated cost saving of about $1,000-$2,000 annually.

Installation of a consolidated well field would reduce the operation and maintenance requirements of the system. If all wells are connected to a common header and treated together, one treatment plant would serve the entire water supply for the Town. It is estimated that operation and maintenance time could be reduced by half if the Town moved to a consolidated groundwater source.

**2.2 Transmission:**
The existing 8" cast iron transmission main is old and of inadequate capacity to meet fire flow demands. The 8" cast iron main is subject to more and more frequent repairs as it ages well beyond its useful life. The 10" PVC main appears to be in good condition and is still serviceable from the tank to Eastside Highway. Replacement of the 8" line in place was originally considered from the well field to Town. However, with the acquisition of easement from the Kelley's and MRL the same benefits to the system are available at a lower price. This option would also relocate the Town's water main from under Middle Burnt Fork Road allowing better access for repairs and maintenance.

**2.3 Storage**:
The need for additional storage is documented herein, to meet minimum conditions of DEQ Circular 1, Section 7.0.1. However, at this time the necessary information required to properly size the storage tank is not available. It is recommended that the Town complete metering and distribution system improvements to reduce lost water and provide accurate production and use records to determine proper sizing of the new storage tank. Sizing and location of the storage tank should be evaluated when this information becomes available.

**2.4 Supply**:
Although the pump in Well #1 was replaced in 2005, it is still only operating at about 50% efficiency, and due to the fact that Wells 2 and 3 are relatively shallow and are drilled into an unconfined aquifer, it is considered best to abandon them and drill new replacement wells. The susceptibility of Wells 2 and 3 is evident in the elevated nitrates (1.5 to 2.7 ppm) seen in these Wells compared to the deeper aquifer of Well No.1 (0.3 ppm).

A consolidated “well field” will allow adequate protection of the well heads and recharge area. A storage tank located at the well field would provide adequate contact time (CT) through the tank for chlorine disinfection and provide for future treatment options if required.

A control system to automatically turn on and off pumps with the water level in the storage tank is essential to efficient power use and providing adequate water in fire flow situations.

**2.5 Distribution**:
The need for increased flows in the downtown area for fire protection is well documented. Leaking mains and service lines in this aged piping are expensive and disruptive to repair, and lost water is wasting power and leaking disinfection and corrosion control chemicals into the groundwater which has a direct link to the Bitterroot River. Known leaky sewer mains and a heavy concentration of subsurface wastewater treatment systems in the developed areas around Town also have the potential to contaminate the water system. Replacement of aged piping in the Downtown area will provide increased flow for fire protection and will provide a leak-free reliable water system backbone through Town.

The static pressure in the Town’s water system ranges from 35 psi on the eastern side of the system to over 105 psi on the west side of Town. The Town Council has received many complaints about inadequate pressure on the east side of the water system as well as high pressure on the west side of the system. In considering revisions to the water system and storage scenarios, provisions for reducing pressure on the west side of Town and increasing pressure on the east side of Town should also be considered.

**2.6 Metering:**
Approximately 31% of the water system users are un-metered and currently pay a flat rate for water service. Metering of all services will help Town staff identify changes in produced and sold water which will help identify potential problems with wells and possible leaks in the system. Metering will also provide accurate water use data for sizing of the new storage facilities in Phase IV.

**3. Growth -**

**TABLE II.B.3.1.F.** Projected Water Demands developed water system requirements to the year 2030. Future water use projections are based on community wide success in reducing “lost water” to 15% by 2030. If this is done, the required supply capacity in 2030 is 1,697 gpm. It should be noted that this capacity is only 117 gpd more than the current system supply. Population projections as developed earlier in this section are for continued steady growth at 1.9% annual to a population of 3,026 persons in 2030. The Project Improvements suggested by this PER are not driven by growth and development, but rather by the need to update an aging and deficient system for the present users. However, prudent planning for normal and expected growth is good management practice so that the upgraded system is not soon over capacity.

Although water and sewer rates were increased in April 2004, no rate increase have occurred since this time and currently the water system has a deficiency of funds of about 27.4% of their operating budget. Furthermore, there are significant improvements required in the storage, supply, and distribution in order for the Town to “catch up” to reasonable standards. The improvements recommended by this Report will not completely solve the systems shortfalls - but will bring the system into a manageable condition and provide the Town with the tools required to run a more efficient system. Scheduling and phasing of improvements has been considered and is discussed below:

Overall, the proposed improvements of this PER consist of five (5) separate and distinct projects:

1) Meter all remaining water system customers, complete leak detection studies, and efforts to identify “lost water”.
2) Construct a new transmission main from the consolidated well field along ALC Way to the Town’s distribution system.
3) Upgrade supply to meet water quality and quantity standards per DEQ & EPA requirements
4) Complete distribution system improvements with new mains to complete the system grid, up-size existing mains to provide for improved hydraulic capacity, and break the system into two pressure zones.
5) Construct a new water storage tank on the Twin Creeks Well Site along Middle Burnt Fork Road.

These five projects are unrelated to each other from a construction standpoint and can be programmed as five separately designed and constructed projects. However, they are interrelated from a systems standpoint and all ultimately need to be completed in order to meet current and future demands. The projects are listed in a recommended order of priority for possible phasing of the work.

## 4. Unresolved Problems -

Once the five Projects identified above are complete, there should be no known unresolved problems with the Town’s water system. The improvements identified herein form a significant re-construction of most all components of the system, and the Project will take several years and phases of construction to complete.

## D. General Design Requirements for Improvements

### Water Model

The water model for the Town of Stevensville was originally developed in 1996 using WaterCAD, which is a computer program that aids with full water system analysis. Information such as elevations, pipe location, size and material, pumps, and tanks were already set-up in the model when PCI was retained in 2004 by the Town of Stevensville to begin work on the previous water system PER. This updated PER uses the same water model, however, field checks, survey information and further interviews with maintenance staff helped in cleaning up the model and re-calibrating it.

LiDAR information, from a report created by Watershed Sciences Incorporated dated August 20, 2008, was used to check all original elevations in the model. All elevations, on average, were approximately ±3 feet compare to the LiDAR elevation data. Another method of checking elevation accuracy is by evaluating the difference between field and water model static pressures. Eleven (11) flow tests were conducted on October 1, 2009 by PCI employees under the supervision of Stevensville maintenance staff in which static pressures as well as residual pressures for various flows were collected. The difference in static pressure ranges from 0.3 psi to 4.4 psi.

Present day domestic water demands for the Town were evenly split among the nodes in the model except for the nodes connected to the 8” cast iron main along Middle Burnt Fork Road. As mentioned, a leak detection survey estimates approximately 140,000 gpd (97.2 gpm) leaking from this 8” cast iron pipe. Therefore, to create an accurate model, two nodes connected to this pipe were given a demand of 48.6 gpm. As shown in **Table II.B.3.1.F**, the 2008 average day demand is 561 gpm, 2008 peak day demand is 2094 gpm, 2030 average day demand is 455 gpm, and 2030 peak day demand is 1697 gpm.

The model was calibrated by using the results from the eleven (11) fire flow tests mentioned above. The boundary conditions for October 1, 2009 were: 1.) Storage Tank Full; Water Treatment Plant producing 800 gpm, 2.) Well 1 On, Well 2 & 3 Off. Each fire flow test was replicated in the water model and the residual hydraulic grade line (HGL) results were checked against the field (HGL) results. If the deviation was greater than 12 feet (5.19 psi), adjustments were made to the model until the variation was less than 12 feet (5.19 psi). Twelve (12) is a reasonable variation allowing for the non-accuracy of fire flow equipment and other testing errors. The Hazen-Williams friction loss C-coefficient was primarily the item adjusted because our pipe sizes, materials, and elevations were already fairly accurate. C-coefficients chosen for the model can be seen in **Table II.D.1.A** and the calibration results for the Town are in **Table II.D.1.B**

**Table II.D.1.A - Calibrated Hazen-Williams friction coefficient for various pipe material**

| Pipe Material | Hazen-Williams C-coefficient |
|---|---|
| 1930's Cast Iron | 63 |
| 1940's Ductile Iron | 120 |
| Newer Ductile Iron | 140 |
| Newer PVC | 150 |

**Table II.D.1.B - Calibration Fire Flow Test Results**

| Test # | Field Static HGL | Total Flow GPM | Field Residual HGL | Model Static HGL | Model Residual HGL | Delta Residual (Model - Field) HGL | Test Node | Flow Node |
|---|---|---|---|---|---|---|---|---|
| 1 | 3555.83 | 1250 | 3544.28 | 3546.80 | 3467.20 | -77.08 | J-61 | J-63 |
| 2 | 3553.08 | 530 | 3499.95 | 3546.70 | 3510.60 | 10.65 | J-40 | J-6 |
| 3 | 3551.03 | 920 | 3539.48 | 3546.70 | 3478.40 | -61.08 | J-12 | J-26 |
| 4 | 3549.89 | 460 | 3515.24 | 3547.00 | 3523.00 | 7.76 | J-55 | J-57 |
| 5 | 3539.90 | 380 | 3489.08 | 3546.30 | 3481.30 | -7.78 | J-70 | J-84 |
| 6 | 3548.71 | 840 | 3490.96 | 3546.90 | 3482.20 | -8.76 | J-59 | J-52 |
| 7 | 3553.66 | 790 | 3507.46 | 3547.00 | 3498.30 | -9.16 | J-37 | J-13 |
| 8 | 3548.48 | 890 | 3495.35 | 3546.80 | 3486.70 | -8.65 | J-27 | J-29 |
| 9 | 3545.96 | 798 | 3485.90 | 3546.70 | 3487.70 | 1.80 | J-18 | J-21 |
| 10 | 3556.85 | 798 | 3485.24 | 3546.80 | 3496.70 | 11.46 | J-89 | J-87 |
| 11 | 3551.92 | 798 | 3510.34 | 3546.90 | 3507.40 | -2.94 | J-93 | J-97 |

Other factors that might control the model calibration are water system unknowns such as fully closed or partially closed water valves, broken water mains, undocumented connections, etc. In addition to adding 97.2 gpm of "lost water" on nodes connected to the old cast iron 8" on Middle Burnt Fork Road, P-223 was considered partially closed. According to Stevensville maintenance staff, the 8" PVC water main just northeast of the high school, has had problems in the past. These problems since then have been fixed, but there is a chance, if the water model is properly calibrated, that there still might be some debris in the main or a partially closed valve. A high minor loss factor was added to P-223 to imitate a pipe with restrictive flow. The maintenance staff will investigate and check all valves. Scenarios in the water model for the future water system assume this problem is fixed and the pipe is flowing full.

Fire flow test #1 and #3 are outside the recommended variation of 12 feet (5.19 psi). Since most of the other fire flow tests, which were within the 12 feet variation, were performed near the areas of test #1 and #3, it is acceptable to remove these tests from the calibration set.

The design requirements and regulatory approvals for each element of this water improvement project include the following:

**1. Treatment**

1. General Design Standards: Design analyses and recommendations included in this report are based in part on Montana DEQ Circular 1 "Standards for Water Works" and "Recommended Standards for Water Works," 1982 Edition, prepared by the Upper Great Lakes Upper Mississippi River Board of Sanitary Engineers (Otherwise known as the "10 States Standards.")
2. Surface Water Treatment Rule - EPA's Long Term 1 Enhanced Surface Water Treatment Rule sets the maximum contaminant level goal (MCLG) at zero. Filtered systems must physically remove 99% (2-logs) of *Cryptosporidium,* 99.9% (3-logs) of *Giardia* and 99.99% (4-logs) of viruses while maintaining 0.2 mg/l disinfectant residual entering the distribution system. In order to achieve these goals, the turbidity levels in the combined filter effluent must not exceed 5 nephelometric turbidity units (NTU) at any time and a limit of 1 NTU in at least 95% of the measurements taken each month.

**2. Transmission**

1. Sizing of the replacement transmission main line has been done with the help of a water hydraulic model and with the goal of achieving the ISO recommended fire flows and peak demands throughout the distribution system. A deviation from DEQ 1 Section 8.5.3, if needed, should be sought in order to have a depth of bury on the transmission line in Middle Burnt Fork at 4 ½' of cover. The 10" PVC line installed in 1978 has 4' to 4 ½' of cover and has never exhibited a freezing problem. The very shallow depth to groundwater through this area prevents deep freezing. Significant cost savings in pipe installation could result from the shallow bury depth.

2. Requirements for the location of any new storage tanks are that the minimum working pressure anywhere in the system grid is 35 psi. Due to the elevation difference across town, pressures in the west end of the system currently exceed 105 psi. According to DEQ 1, Section 7.3.1., consideration should be given to pressure reducing devises on the main lines when system pressures exceed 100 psi. Division of the water system into two pressure zones should be considered.

3. All new main piping and valves will be AWWA approved. Service lines and fittings will be NSF approved. Chlorinated test water will be de-chlorinated and flushed to waste. Lines will be pressure tested to 1½ times working pressures.

4. When designing transmission mains the velocity and head loss during a fire flow event should be considered. The maximum water velocity, according to AWWA recommendations, should be limited to 10 ft/s and the head loss should not exceed 6 ft/1000 ft. Future domestic demand (1697 gpm according to Table II.B.3.1.F) and fire flow demand together during peak day is the worst case scenario for water main sizing

and will be used in the water model. There is more discussion on this in Section V of this report. See Appendix C for future average day and peak day available fire flow reports.

**3. Storage**

1. SIZING - The recommended total storage volume is based on ISO requirements for meeting fire flow plus 24 hour average day demand. It is assumed that all supplies will have back-up power to contribute to the fire flow.
2. DEQ 1 - Chapter 7, Finished Water Storage will dictate the required construction methods associated with the reservoir. Concrete and steel tank alternatives should be considered. In either case, the tank shall conform to AWWA standards for construction and coatings. In the case of concrete, it will be partially buried in the ground or, if steel, attractively painted and landscaped to soften views by the public. The Tank is to be disinfected per AWWA C652. Chlorinated water used for the disinfection process will be de-chlorinated and then sprayed on Town property as irrigation water.

**4. Water Supply**

1. Per DEQ 1, Chapter 3, The water supply will meet the peak day demand with the largest well out of service.

2. A Source Water Delineation and Assessment Report has been prepared by Western Groundwater Services for the Town. The Report meets the requirements of PWS-6. AMEC Geomatrix has prepared a PWS-6 for the new Twin Creeks well field.

3. The Town of Stevensville has filed rights to all of its existing wells and surface water sources. It has Statements of Claim on file with DNRC for the surface water sources and Provisional Permits for all existing wells. Water rights applications associated with the Twin Creeks Well Field have been filed with DNRC, and are currently in the process. Upon approval of the Twin Creeks Water Right, the Town will apply for a water rights transfer to the Twin Creeks Well Field. This process will be lengthy, but based on the obtained rights for all other raw water sources, few objections are anticipated.

4. Any new wells will be drilled and developed in accordance with DEQ 1, Chapter 3 and Title 37, Chapter 43, MCA and Title 36, Chapter 21, ARM.

5. The new pump house, plumbing, disinfection and chemical feed (ortho-phosphate) will be in accordance with the applicable sections of DEQ Circular 1.

6. Design considerations for the well field pumps is a little difficult because the new storage tank cannot be sized until all water services and sources have meters. With meters installed, system leakage areas are easier to locate. After most of the leaks are fixed, the domestic water demand for average day should be easily found. The total storage volume will be based on the new average day domestic demand. The water model will be the perfect tool to use to size the new well pumps after total storage is determined. The well

field will most likely be built before the new storage tank so the new well pumps will need to provide adequate fire flow for the water system with the existing storage tank in-place.

**5. Distribution**

1. Adhere to DEQ 1 - Chapter 8 Transmission Mains and Distributions Systems.

2. According to The Hydrant Flow Data Summary in Appendix C, needed fire flows (NFF) in the commercial areas downtown should be 3500 gpm, the school area should be 3000 gpm, and residential areas should be 1000 gpm. The existing water system with all sources producing (Water Treatment Plant, Well 1, 2 & 3) was analyzed in the model to check available fire flow (AFF). The fire flow analysis was performed for both average day and peak day domestic demand; available fire flow (AFF) was determined by sustaining a minimum zone pressure of 20 psi. If AFF was less than NFF, new water mains were added or existing infrastructure was upgraded until the AFF was equal to or greater than the NFF. See Appendix C for existing average day and peak day available fire flow reports.

**6. Metering:**

1. Meters will be sized to meet the required flow demands of the category of the user, whether residential or commercial. The Town anticipates installing meter pits at the right-of-way edge with remote read heads on all new service connections, where groundwater conditions allow.

## III. Alternative Screening Process

There are many alternatives for each of the proposed major elements of this project. The proposed elements are: treatment, transmission, water storage, water supply, distribution improvements and metering. Some of the possible alternatives are clearly not feasible or are cost prohibitive. All considered alternatives are discussed below:

### A.Water Supply and Treatment

Since different water supply options require different treatment options, these two items will be evaluated together. The options listed below should address all practical configurations for rehabilitation or replacement of the Town's existing water supply and treatment systems.

No Action: No action will perhaps have little immediate consequence to the Town, however, on a peak demand day, system needs may not be met and shortages may occur. Further, if a severe fire should occur at the same time, fire flows will be insufficient to properly control the conflagration resulting in the possible loss of life and property. Loss of any of the existing wells, by failure of antiquated equipment, by loss of power, or by loss due to contamination, will have a serious consequence to the integrity of the water supply. The "No action" alternative will not protect the health and safety of the citizens of Stevensville, and will not be considered in the Alternative Analysis in Section IV.

Other Water Suppliers or Systems: There are no other water suppliers or systems in the area with capacity to serve all, or a portion, of the Town of Stevensville's demands. Other water suppliers or systems are not considered in the Alternative Analysis in Section IV.

Rehabilitation of Existing Wells, Infiltration Gallery, and Treatment Plant: The rehabilitation of Well #1 was performed in 2006 and 2007. This resulted in a minor increase in capacity, but the well is still limited by excessive sand production at flows above 275 gpm (approximately 400lbs/day sand production). Rehabilitation of the other two (2) existing wells is also a possibility, however, the wells are relatively shallow (50'-75' with 28' to 30' static water levels) and are not adequately protected from contamination. Thus, in order to improve these wells, the wells must be deepened so that they enter a semi-confined aquifer thereby affording improved wellhead protection. In addition to rehabilitation of the wells, the existing infiltration gallery and treatment plant requires upgrades to meet the current EPA surface water treatment rules. This option presents some difficult practical, engineering and logistical problems due to lack of available space, and excessive expense for a system that will marginally meet the requirements of the Town. However, this option will be considered in the Alternative Analysis in Section IV for comparison.

Identify New Well Site(s): The Source Water Protection Plan, September 2000, (Appendix D) recommended new well supplies along the south side of Burnt Fork Road and above the Eastside Highway as likely producing sufficient water and having a lower susceptibility to contamination. A further study of possible production rates reached the same conclusions. Several well sites have been investigated in the past, including test wells on the northeast corner of town at the old Foremost Creamery in the early 1990's, and a test well drilled at the current treatment plant site in the early 1960's. Recently a test well and hydrogeologic assessment have been completed on a piece of property south of Middle Burnt Fork Road as part of the development of the Twin Creeks Subdivision, and found this site to be suitable for locating a consolidated well field for the Town of Stevensville. Alternative well sites will be considered in the Alternative Analysis of Section IV.

New or Alternative Surface Source and Treatment Plant: The Bitterroot River is a Class B-1 rated water body, but the River Basin is closed to new surface water rights, with the exception of municipal supplies [MCA 85.2.344(2)(b)]. Nonetheless, surface water rights even for municipal use, would be expected to be highly contested. In addition, the regulatory requirements for use of surface water vs. the ready availability of good quality groundwater render this alternative moot. A new or alternative surface supply is not considered in the Alternative Analysis in Section IV.

### B. Water Storage

Based on discussions with USDA Rural Development and TSEP, it would not be in the Towns best interest to size and design a water tank at this time. Due to the fact that the Town of Stevensville is currently unmetered, and that there is a large amount of leaks in the distribution system, sizing a tank based on current estimated usage and leaks would result in an oversized tank that may not be in the best interest of the Town. Over sizing of the tank could lead to water quality issues, and would add additional cost to an already expensive project. A detailed water use and fire flow analysis will be performed after the Town's leaks have been reduced through the proposed distribution improvements and there is at least one year of metered use records for the Town. From this information a more accurate and cost effective tanks sizing will be able to be performed.

No Action: Hydraulic analyses associated with the development of this PER have concluded that additional storage is needed to meet daily and fire flow demands as required by DEQ Circular 1. The existing 0.43 MG reservoir is inadequate in terms of capacity and if required may not be adequate to provide contact time for 4-log disinfection, depending on the source location. The current tank could possibly run out of water completely in a major fire event. Due to the fact that the Town is unmetered and the distribution system contains significant leaks this option will be considered in the Alternative Analysis in Section IV.

Once adequate information is available to size the storage tank, the following options should be considered:

Tank Replacement in Existing Location: Complete replacement of the existing reservoir is a possibility with a new tank in one of several locations. However, replacement in its current location would be impossible without severe disruptions to the delivery of water to Town. The present tank appears to be in good condition (Tank Inspection Report, 2004) although the tank base dates to the late 1950's and the concrete lid was added in 1978. The location of the tank limits its use for gaining chlorine contact time unless all sources are piped to the tank before being returned to distribution. This option will not be considered in the Alternative Analysis in Section IV.

New Storage Tank with Removal of Existing Tank: Installation of a new storage tank could occur in several locations, and in several different forms (gravity, elevated, ground level boosted, etc.). The most desirable scenario would be to have the new storage tank located near the source and treatment facilities so it could be utilized for disinfection contact time if 4-log disinfection is required in the future. Upsizing the new tank and removal of the existing tank may prove to be more economical than maintenance of an aging concrete tank and the additional transmission main. This option will not be considered in the Alternative Analysis in Section IV.

New Storage Tank Keeping Existing Tank: Installation of a new storage tank could occur in several locations, and in several different forms. The most desirable scenario would be to have the new storage tank located near the source and treatment facilities so it could be utilized for disinfection contact time if 4-log disinfection is required in the future. However, keeping the current tank may prove to be an economical advantage to the Town, as well as providing the benefit of redundancy for tank maintenance. This option will not be considered in the Alternative Analysis in Section IV.

## C. Transmission

No Action: The existing 8" cast iron main is far past its useful life and leaking badly. The 10" PVC main alone cannot deliver peak demand flows to the Town distribution system from the existing reservoir. No action will mean that the Town will have to rely on these lines for the foreseeable future to deliver water to the Town system. Frequent repairs to the 8" line can be expected to continue. Ravalli County has proposed reconstructing Middle Burnt Fork Road and will most likely restrict pavement cuts, limiting access to the line for emergency repairs. This may force the Town to abandon this line in place and rely solely on the 10" main to deliver flows to the Town. The capacity of the 10" main cannot supply peak demands or fire flows. The 8" main is believed to be the largest source of leaks in the Town's water system and needs to be rehabilitated or replaced; therefore the "No Action" alternative will not be considered in the Alternative Analysis in Section IV.

Rehabilitate 8" Transmission Main in Place: The existing 8" cast iron line could be rehabilitated in place by pipe bursting or splitting. However, pipe bursting is usually limited to an upsize of three pipe sizes (eg. 8-inch to 12-inch) and a length of 300-400 ft without causing excessive ground movement and requiring more powerful equipment. Based on the length of pipe that needs to be replaced and the pipe size required to meet the expected demands of the system; pipe rehabilitation does not appear to be a logical or cost effective solution and will not be considered in the Alternative Analysis in Section IV.

Replace 8” Transmission Main in Existing Location: Replacement of the 8” cast iron main in its existing location will solve multiple problems for the Town of Stevensville. Installation of the main should include removal of the old wooden main to reduce the liability of the Town for collapses in Middle Burnt Fork Road. The size of the new transmission main will be selected to provide present and future peak demands and fire flows. Pipe material such as PVC and Ductile Iron will be evaluated for cost. Any pipe used must be AWWA approved. In the larger pipe sizes, costs can be very comparable and these pipe types should be specified as alternates, and the cost difference evaluated at that time of construction. Replacement of the 8” transmission main in place will be considered in the Alternative Analysis in Section IV.

Alternative Pipeline Routes: The route of the new pipeline along and within the right of way of Middle Burnt Fork Road is the most direct route to the Town distribution system; however, other routes are available and could provide the same benefits to the water system while minimizing the road repair costs to the Town. If alternate routes are chosen abandonment of the existing 8” line from the reservoir to town should be strongly considered. An alternate route may involve setting the pipeline in “virgin” areas or across open previously undisturbed land. Alternative routes may also have the potential for greater environmental impacts to local resources, greater distances and probable easement acquisition costs. However, given the potential cost savings associated with minimizing road repairs alternative pipeline routes will be considered in the Alternative Analysis in Section IV.

**D. Distribution Improvements**

No Action: This alternative does not address the problems of inadequate fire flow and frequent flushing required for the dead end mains in Town. The looping of dead ends and replacement of leaking and undersized piping in the system will help reduce the potential for contamination, and improve the currently inadequate fire protection that puts the Town and its citizens at risk. System leaks may also continue to increase if the system is not repaired and improved. The “No Action” alternative is not considered in the Alternative Analysis in Section IV.

Full Distribution Replacement: The full replacement of the water distribution system is not considered necessary, or financially feasible. A good leak detection program will identify sections of problem piping and hydraulic modeling will identify sections of undersized mains which are in need of upsizing. The full replacement of the distribution piping is not considered in the Alternative Analysis in Section IV.

Main Upsizing and Looping of Dead Ends: This alternative is designed to improve the overall efficiency of the distribution system and to insure that system flows and pressures will be adequate for fire protection even during peak demand periods. Areas of leaking piping indentified in leak detection surveys must be repaired or replaced to reduce the amount of water leaking from the distribution system. The replacement of critical mains and completion of looped distribution will be considered in the Alternative Analysis in Section IV.

Pressure Zones: Due to elevations changes across Town, many residents have water pressure that is less than ideal and in many cases unsafe. On the west side of Town pressures can reach up to 110 psi, while pressure at the upper end of the distribution system can be as low as 35 psi. Depending on the storage location selected, division of the water system into two pressure zones may be required to provide adequate and safe pressure to all water system users.

**E. Metering**

No Action: The no action alternative maintains the current situation in Town, in which approximately 66% of the services are metered with the balance being unmetered. Currently all new services, and houses at transfer of ownership, are required to be metered, but there would be no concerted effort to meter all existing services on the system. This option will have several long term negative effects, namely, it will hinder the ability of the Town to quantify the extent of system leaks and it will likely prevent the Town from obtaining certain grants and loans for needed system improvements, as such funding programs normally require that all users be metered. This option is not considered in the Alternative Analysis in Section IV.

Metering of all services: This alternative involves the installation of meters on all remaining unmetered water services on the Town's water system. This option will enable the Town to account and bill for all water used, and better quantify system losses due to leakage. This alternative will help insure that the Town is eligible for grants and loans that will help support the water system improvements recommended in this PER. The technology of remote read-outs will greatly reduce staff time and allow monthly meter reading in a shorter period of time than is taken currently. Monthly reading of meters promotes water conservation and assists with the water funds cash flow. Full metering of the Town is considered a necessary part of the improvements and will be considered in the Alternative Analysis in Section IV.

# IV. Alternatives Analysis

The water system alternatives that are reasonable for the Town to consider have been reduced to:

**Water Supply and Treatment Alternatives**

1. Rehabilitate Infiltration Gallery and Treatment Plant – Rehabilitate existing wells or move to well/wells in consolidated well field.
2. Identify new consolidated well field location

**Storage Alternatives**

1. No Action – Keep existing storage tank

**Transmission Alternatives**

1. Replace 8" cast iron main in place
2. Alternative transmission main routes

**Distribution System Improvements**

1. Main upsizing and looping of dead end mains
2. Addition of Second Pressure Zone

**Metering**

1. Meter all service connections

Each of these elements is more thoroughly discussed below.

## 1. Water Supply and Treatment Alternatives

A. **Description:** Based on the current and projected water use for the Town of Stevensville, improvements to the quantity and quality of the Town's drinking water are required. These improvements can be handled in a number of ways, but based on the alternative screening process the two most realistic improvement scenarios would be 1.) to rehabilitate the existing infiltration gallery and treatment plant located up Middle Burnt Fork Road and rehabilitate the existing wells or move to a small consolidated well field, or 2.) Abandon the current supply and move to an all groundwater well supply from a consolidated well field located in or near Town.

B. **Schematic Layout:** The two options listed above cover a large area. The rehabilitation of the existing wells and infiltration gallery would require improvements at the three well locations in Town and the infiltration facility and treatment plant located up Middle Burnt Fork Road (See current water system map in Appendix C).

The construction of a new consolidated well field has been investigated at the following locations and would require the drilling of three or four wells and construction of a pump house and treatment building which would all be located at the consolidated well field:

Creamery Well Site - A well site had been under consideration near the old Foremost Creamery in the NE corner of the Town and in 1990, a 6" test well was drilled to a depth of 550 feet BLS near the Creamery. An analysis on the feasibility of this well site by

*Howard Newman*, ultimately concluded 600 to 1000 gpm is available from aquifers from 300' to 330' BLS (*Newman*, letter of May 25, 1990). The Test Well site is not considered a feasible site today as sufficient land around the site is no longer available, and connection to the water distribution system would require additional pipeline and possibly storage and secondary pumping to meet chlorine contact times if required.

Treatment Plant Test Well Site - A test well had been completed near the treatment plant site in 1963 to 510 feet. Little is known about the well other than the “casing was pulled from hole; did not produce enough water”.

Twin Creeks Well Site - As part of an annexation agreement with the Town of Stevensville, 4-6 acres of land on the south side of Middle Burnt Fork Road has been reserved for a municipal well field as part of the Twin Creeks Subdivision. A Source Water Protection Delineation (PWS-6), was performed by Geomatrix of Missoula in November 2007, and found the site suitable for locating a consolidated well field for the Town. This site provides adequate room to construct the well field, treatment facility, and additional storage. The site also fronts Middle Burnt Fork Road which provides easy access by Town Staff and provides connectivity with the existing water mains in Middle Burnt Fork Road. With its close proximity to Town this site would also reduce the required transmission main length to Town.

Based on the information available and the work completed by the Twin Creeks Subdivisions, the most likely site for the consolidated well field is the Twin Creeks Well Site. This site has adequate land available for a pump house and treatment facility, as well as room for an additional water storage tank in Phase IV.

C. **Operational Requirements:** The operational requirements of the two water supply and treatment options vary greatly. A surface water treatment plant utilizing a slow sand filter, as recommended by Welch Comer (February 2005), will require a Class II water operator when the Town’s population exceeds 2,500 (estimated 2020). Based on the Treatment Plant PER performed by Welch Comer, a slow sand filter treatment plant would require the following manpower requirements under normal operating conditions:

- Full time operator 2-3 hours per day
- One backup operator (as required by DEQ)
- Cleaning operations for one filter bed:
    - One full time operator for oversight– 50 hours
    - Manual removal of Schmutzdecke – 50 man-hours
    - Mechanical wet harrowing – 12 man-hours

A consolidated well field would require the following manpower under normal operating conditions:

- Full time operator 1-2 hours per day

D. **Energy Requirements:** If rehabilitation is chosen the slow sand filter will require a raw water booster pump. The treatment plant is estimated to have power consumption of \$1,500 to \$2,500 annually (as outlined in the Water Treatment Plant PER, Welch Comer). In addition to the treatment plant power requirements there will be additional power required for approximately 500 gpm from the existing well supply. The well supply is assumed to be needed 12 hours/day for 6 months of the year. The pumping conditions are estimated as follows:

Total Dynamic Head = 261'
At 85% Efficiency 39 HP required to pump 500 gpm.
Kilowatts = HP x 0.7457 = 29.8 KW @ \$8.31/KW demand charge = \$2,975
Estimated annual runtime = 2160 hours @ \$0.055/KWhr = \$3,540
Total annual power cost = \$2,500 + \$2,975 + \$3,540 = \$9,015

If the infiltration gallery and the associated treatment plant are de-commissioned the energy requirements will be all in pumping the groundwater wells. If on an annual basis, 239.08 MG are to be pumped (after leakage reduction in 2030, TABLE II.B.3.1.F) and we assume an average 9.6 hour pumping day, the pumped rate is 1140 gpm. As above:

Total Dynamic Head = 400'
At 85% Efficiency 150 HP (2 wells) is required to pump 1140 gpm.
Kilowatts = HP x 0.7457 = 111.9 KW @ \$8.31/KW demand charge = \$11,159
Estimated annual runtime = 3504 hours @ \$0.055/KWhr = \$21,565
Total annual power cost = \$11,159 + \$21,565 = \$32,724

E. **Regulatory Compliance & Permits:** If the treatment plant is upgraded, it must meet the requirements of DEQ Circular 1 as well as be capable of meeting the requirements of the Environmental Protection Agency's (EPA), Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) and Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The Town of Stevensville is currently on track for completing the required e-coli monitoring for the LT2ESWTR. Water rights for all existing sources are in place and will be retained with this alternative. Rehabilitation of the existing wells should include provisions for meeting the EPA Groundwater Rule requirements for 4-log virus inactivation should they not pass EPA triggered source water monitoring as required by December 1, 2009. Sufficient capacity is not available from the existing wells to meet the requirements of DEQ Circular-1, Chapter 3 for source capacity. New wells if required would most likely be only one well short of an all groundwater source.

If a consolidated well field is chosen as the preferred alternative all elements of the source and treatment must comply with all requirements of DEQ Circular 1, Standards for Water Works. In addition, all new groundwater sources constructed after November 30, 2009 must meet EPA triggered source water monitoring requirements, or conduct compliance monitoring for 4-log virus inactivation. Source capacity must meet the requirements of DEQ Circular-1, Section 3.2.1.1.

F. **Land Requirements:** Rehabilitation of the Treatment Plant and Infiltration gallery would not require any additional land acquisition by the Town. Rehabilitation of the existing wells would require additional easement, which in some cases may not be available. Moving the wells to a consolidated well field would be the most efficient solution due to the fact that the Twin Creeks well field will be deeded to the Town prior to final plat of the Twin Creeks Subdivision, and already has public water supply well in place which was 72-hour pump tested at 1,100 gpm.

Moving to a consolidated well field would require no land acquisition by the Town of Stevensville. As part of the Twin Creeks Subdivision a parcel of land will be deeded to the Town for use as a municipal well field. The site is large enough to accommodate the wells, treatment, and future storage requirements. The Twin Creeks Subdivision has already gained approval of the PWS-6 and drilled the first well on this property.

G. **Environmental Considerations:** Environmental impacts from either of these alternatives will be minimal. The backwash from the upgraded treatment plant will be recycled as to not affect surface water turbidity. The construction of the new well field will withdraw water from a deep aquifer which has been shown to be very prolific, as shown in the AMEC Geomatrix *Hydrogeologic Assessment Report and Criteria Addendum Evaluation in Support of Application for Beneficial Use Permit* prepared for the Town of Stevensville. Removal of water from the aquifer for either alternative is not thought to be environmentally significant. Disturbance at either site will be kept to a minimum and avoidance of environmentally sensitive areas, such as wetlands will be avoided.

H. **Construction Problems:** Repair of the infiltration gallery may be subject to high groundwater tables in the infiltration gallery area (1'-3' BLS). Pumping of groundwater should be expected for any repairs to the infiltration gallery.

No construction problems are anticipated with the drilling of the consolidated well field. Although high groundwater is present, suitable soils exist at the well field site and roadways and foundations should not be a problem with proper construction techniques.

I. **Cost Estimates:** The following tables compare the estimated Project Costs, Annual O&M Costs, and the 40 year Present Worth for both Supply Alternatives. A 3% interest rate was used for all calculations in the 40 year Present Worth Analysis:

**Table IV.1.A Treatment Plant Upgrade and 1,700 gpm well field**

| Item | Description | Qty | Units | Unit Cost | Total |
|---|---|---|---|---|---|
| 1 | Slow Sand Filter (Welch Comer PER) | 1 | LS | $1,899,400 | $1,899,400 |
| 2 | Supply Main-Plant to Tank-10" PVC | 1100 | LF | $45.45 | $50,000 |
| 3 | De-Commission Existing Plant/Supply | 1 | LS | $50,000 | $50,000 |
| 4 | Land acquisition Well Field | 4 | Acre | $25,000 | $100,000 |
| 5 | Access Road and Site Pad Well Field | 1 | LS | $20,000 | $20,000 |
| 6 | 3 phase Electrical Service | 1 | LS | $10,000 | $10,000 |
| 7 | Production Wells, 450' 500-600 gpm | 2 | EA | $75,000 | $150,000 |
| 8 | Well Pumps- line shaft 50 HP | 2 | EA | $40,000 | $80,000 |
| 9 | Well House, electrical & chlorination | 1 | EA | $100,000 | $100,000 |
| 10 | Back-up generator & transfer switch | 1 | LS | $50,000 | $50,000 |
| 11 | Telemetry Control System | 1 | EA | $75,000 | $75,000 |
| 12 | Connect to existing 10" supply line | 700 | LF | $50 | $35,000 |
| **Subtotal, Construction Cost** | | | | | $2,619,400 |
| **Engineering, Design & Construction** | | | | | $523,880 |
| **Total Project Cost** | | | | | **$3,143,280** |
| Treatment Plant Salvage Value ( based on 50 year life) | | | $759,760 | | |
| Well Salvage value (7+8+9 based on 50 year life) | | | $132,000 | | |
| **Present value of salvage (P/F @ 3%)** | | | **$203,410** | | |
| **Annual O & M Costs** | | | | | |
| | Treatment Plant (Welch Comer PER) | | $12,500 | | |
| | Well Production Energy Consumption | | $9,000 | | |
| | Pump Replacement (25 year life) | | $3,200 | | |
| | subtotal, annualized O & M Costs | | $24,700 | | |
| | **40 Year Present Worth of O & M (P/A @ 3%)** | | **$570,941** | | |
| | **Net Present Worth** | | **$3,917,631** | | |

**Table IV.1.B Consolidated Well Field (2300 gpm)**

| Item | Description | Qty | Units | Unit Cost | Total |
|---|---|---|---|---|---|
| 1 | Surveys & legal | 1 | LS | $5,000 | $5,000 |
| 2 | 10" Production well. Completed | 3 | EA | $117,500 | $352,500 |
| 3 | Submersible turbine pump (Twin Creeks Well) | 1 | EA | $15,000 | $15,000 |
| 4 | Abandon Existing Wells | 3 | EA | $2,500 | $7,500 |
| 5 | Access road and Site Pad | 1 | LS | $20,000 | $20,000 |
| 6 | Pump house / Treatment building | 1 | LS | $156,250 | $156,250 |
| 7 | Well House Plumbing and Valves | 1 | LS | $30,000 | $30,000 |
| 8 | 350 kW Backup Power Generation | 1 | LS | $90,000 | $90,000 |
| 9 | Disinfection & corrosion control system | 1 | LS | $25,000 | $25,000 |
| 10 | Electrical service connection | 1 | LS | $15,000 | $15,000 |
| 11 | Fencing and Security | 1 | LS | $15,000 | $15,000 |
| 12 | Telemetry & Controls For Existing Tank | 1 | LS | $45,000 | $45,000 |
| **SUBTOTAL, PRODUCTION WELLS, PUMPHOUSE & TREATMENT** | | | | | **$776,250** |
| Contingency (10%) | | | | | $77,625 |
| Engineering (15%) | | | | | $116,438 |
| **TOTAL NEW WATER SUPPLY WELLS, PUMPHOUSE & TREATMENT** | | | | | **$970,313** |

| | | |
|---|---|---|
| Treatment Plant Salvage Value ( based on 50 year life) | | $158,500 |
| Well Salvage value (2+3+9 based on 50 year life) | | $157,000 |
| **Present value of salvage (P/F @ 3%)** | | **$71,966** |
| **Annual O & M Costs** | | |
| | Well Field Treatment Plant | $10,400 |
| | Well Production Energy Consumption | $32,724 |
| | Pump Replacement (25 year life) | $3,200 |
| | subtotal, annualized O & M Costs | $46,324 |
| | **40 Year Present Worth of O & M (P/A @ 3%)** | **$1,070,779** |
| | **Net Present Worth** | **$1,969,126** |

J. **Selection of Preferred Alternative:** The Town has historically been in favor of the infiltration gallery and treatment plant because of the perception of "free" gravity delivered water, as was initially conceived at the turn of the 20th century when Mill Creek was first tapped with wooden mains to Town. It has become apparent that with the EPA's Surface Water Treatment Rule requirements and the technical nature of design and operation of a Surface Water Treatment Plant that the water is no longer "free". In addition, pressures on water rights from all the consumers on the Burnt Fork drainage have made reliable delivery of the Town's claimed rights even more risky. In addition, sensitivity of the filter plant to potential contaminant sources is considered to be HIGH (Appendix D). The interconnectivity of Mill and Swamp Creek with the Bitterroot Irrigation District Canal, which brings water all the way from Lake Como, is also a concern. A matrix comparison of the Supply Alternatives is in **TABLE IV.1.C**. A matrix system of evaluating the alternatives is employed. Impacts on the listed elements are rated from 1 to 3, with 3 representing the higher impact, greater difficulty, higher cost, etc. The alternative with the lowest total value is deemed to be in the best interest of the community.

*Rating System*

*Less Impact* ⇒ *Greater Impact*

*1* *2* *3*

**TABLE IV.1.C** Water Supply Source Alternative Selection Matrix

| | Treatment Plant & 900 gpm Well Field | De-Commission Treatment Plant & 2300 gpm Well Field |
|---|---|---|
| Operational Requirements | 3 | 1 |
| Energy Requirements | 1 | 3 |
| Regulatory Requirements | 3 | 2 |
| Land Requirements | 1 | 1 |
| Air Quality | 1 | 1 |
| Source Water Sensitivity | 3 | 1 |
| Flood Plain | 1 | 1 |
| Socio / Economic | 1 | 1 |
| Transportation | 1 | 1 |
| Noise | 1 | 1 |
| Biological Resources | 1 | 1 |
| Construction Problems | 2 | 1 |
| Cost | 3 | 1 |
| TOTALS | 22 | 16 |

As can be seen from the Table, the preferred alternative is to de-commission the treatment plant and infiltration gallery and move the Town water supply to a consolidated well field and rely on groundwater wells for all source water needs.

## 2. Storage Alternatives

Based on discussions with USDA Rural Development and TSEP, it would not be in the Towns best interest to size and design a water tank at this time. Due to the fact that the Town of Stevensville is currently unmetered, and that there is a large amount of leaks in the distribution system, sizing a tank based on current estimated usage and leaks would result in an oversized tank that may not be in the best interest of the Town. Over sizing the tank could lead to water quality issues, and would add additional cost to an already expensive project. A detailed water use and fire flow analysis will be performed after the Town's leaks have been reduced through the proposed distribution improvements and there is at least one year of metered use records for the Town. From this information a more accurate and cost effective tank sizing will be able to be performed.

A. **Description:** In order to maintain present and adequate Town pressures, and to utilize the present tank volume, the new tank normal operational levels should be from 3543' to 3549' MSL (1988 NAVD). The existing treatment plant site lacks the space to accommodate a new reservoir, unless the present reservoir is dismantled first. This is not considered to be a viable option due to need for continued storage volume during the construction period. The Town may have opportunity to acquire property on the south side of Middle Burnt Fork Road and about 30 vertical feet below the existing treatment plant site. Thus, a tank at this site is expected to be a tall tank with a daily operation volume above the 3543' level. Options for an additional tank include <u>concrete</u> or <u>steel</u> tanks. A concrete tank has the advantage of being able to be partially "buried" in the ground affording a low profile and therefore shielded from neighboring views. Except for periodic cleaning of the interior, a concrete tank has little in the way of long term maintenance requirements. A steel tank is expected to have a lower initial cost, yet will require more maintenance with periodic coatings inside and out. A steel tank will need to be constructed completely above ground on a concrete pad making it more visible to the public. However, the tank can be shielded from neighborhood views with partial excavation and earth / landscaped berms.

   In addition to tank material and location of the tank, the tank type must also be considered. Two options include building an elevated storage tank, this could include a water tower or a tank built to meet the current operating levels, or building a ground level tank with a booster station at an elevation lower than the current operating levels.

   <u>Elevated storage tank</u>: An elevated storage tank can be constructed close to Town with a height sufficient to equal the existing tank. Finished storage will be at the 3543 to 3549 elevation. Elevated tanks are typically steel of the ellipsoid or hydro-pillar configuration. A concrete base with steel tank may also be an option.

   <u>Ground level tank with Booster Station</u>: A ground level tank can be placed at virtually any elevation if a booster station is utilized to provide system pressure instead of gravity

flow. This alternative will require less energy to lift the well water to the tank, but additional energy to pressurize the water system.

B. **Schematic Layout:** The existing tank and site will be utilized until metering and leak reduction can be completed and an accurate assessment of water use can be used to design the new tank. Adequate space will be secured at the new well field location for the construction of a new storage tank of approximately 1 million gallons.

C. **Operational Requirements:** The existing tank will be retrofitted with float controls and telemetry to control the consolidated well field in a lead –lag –lag –lag scenario. This will reduce the systems dependence on manual control by the operator and ensure that adequate water is available under all flow conditions.

D. **Energy Requirements:** Utilizing the existing tank will not require any additional energy as compared to elevated tank scenarios. Should ground level storage at the well field be chosen additional well capacity may be available based on the reduction in head pressure on the pumps.

E. **Regulatory Compliance & Permits:** No permitting will be required to use the existing tank.

F. **Land Requirements:** No additional land will be required to use the existing tank. Adequate land will be acquired as part of the Twin Creeks Well Field to construct a new storage tank of approximately 1 million gallons.

G. **Environmental Considerations:** No environmental disturbance will result from the use of the existing tank.

H. **Construction Problems:** No construction problems are anticipated.

I. **Cost Estimates:** The only item required to keep the new storage tank in service would be to repair the roof. Roof repair is estimated at approximately $25,000. Controls such as a pressure transducer and telemetry are covered in the consolidated well field cost estimate, and will be able to be utilized when a new tank is built.

J. **Selection of Preferred Alternative:** At this time the preferred alternative is to utilize the existing storage tank until adequate metering information is available to properly size the new storage tank.

## 3. Transmission Main Alternatives

A. **Description:** Based on the most recent leak detection survey, March 2006, the largest source of leaks in the Town's distribution system is the 8" cast iron water main in Middle

Burnt Fork Road. This main was installed in the 1930's and was constructed with leaded hub joints. Due to vibration and movement associated with traffic on Middle Burnt Fork Road and the railroad crossing, it is assumed that these rigid joints have begun to leak. The 2006 leak survey uncovered five (5) leaks with an estimated leakage rate of 217,080 gpd of which over 140,000 gpd was found in the 8" cast iron main in Middle Burnt Fork Road. This accounts for almost 30% of the "lost" water indicated by the production records and wastewater treatment plant measured inflows.

In addition to being the main source of lost water for the Town, the two mains running down Middle Burnt Fork Road are inadequately sized to provide adequate fire flow and peak domestic flows to Town from the new well field. Based on the results of the water model, the estimated peak demand of 1,697 gpm and the ISO required fire flow of 3,500 gpm are unable to be delivered to Town through these two mains. Increasing the main size to 16" from the well field to Town will allow the required fire and domestic flows to be delivered to the Town. Three possible routes have been identified for the transmission main from the well field and are shown on the proposed route map in Appendix C. No improvements are proposed to the 10" main from the well field to the existing storage tank. This line was installed in the 1970's and is in good condition. This line is adequately sized to carry the flow from the well field and provide additional flow under fire flow conditions.

B. **Schematic Layout:** The three proposed transmission main routes include the following: <u>Middle Burnt Fork Road:</u> The Middle Burnt Fork Road option will replace the existing 8" cast iron main in place from the new well field to Eastside Highway in Stevensville. This option will have the least impact environmentally, as all disturbance will be in previously disturbed areas; however, the financial impacts due to the extensive road repair required by the Ravalli County Road and Bridge Department will likely make this the most expensive option.

<u>ALC Way:</u> Another option is to abandon the 8" cast iron main in place and install a new main along ALC Way, through the Stevensville School property, and connect to the proposed 12" upgrades on 6$^{th}$ Street. This option would increase the length of pipe installed, but a majority of the installation would occur in gravel roadway and City owned right of way which would significantly reduce the road repair costs.

<u>Park Street:</u> This option would place the new main out north of the Middle Burnt Fork Road right-of way from the new well field to Park Street and continue up Park and connect to the 12" upgrade in 5$^{th}$ Street. This option will require less easement to be completed, but may have higher costs due to road repair that would be required along Park Street.

C. **Operational Requirements:** Any of the above listed alternatives would be a drastic improvement as compared to the current configuration. The Ravalli County Road and

Bridge Department has expressed continued concern over the old wooden main and the leaking 8” main and their effect on the structural integrity of Middle Burnt Fork Road. A new transmission main would lower maintenance costs due to repairs, and increase the reliability of the water system.

D. **Energy Requirements:** The replacement of the leaking transmission main will dramatically reduce the pumping costs of the Stevensville water system. The leaks in the 8” cast iron main alone are estimated at approximately 100 gpm. Reduction of these leaks will improve the overall efficiency of the water system and reduce pumping and storage requirements.

E. **Regulatory Compliance & Permits:** Replacement of the 8” cast iron main will bring the Town into general compliance with DEQ Circular 1, Section 8. In particular Section 8.2.3 Fire Protection.

F. **Land Requirements:** The Middle Burnt Fork Road option would not require any additional land acquisition as it would replace the Town’s water main in its existing location. A right of way encroachment permit would be required from the Ravalli County Road and Bridge Department to perform this work in the Middle Burnt Fork Road right of way. The Park Street route would most likely require additional easement from the Kelley property and the Stevensville Community Center property. The Town staff has indicated that these easements would most likely be easily obtained. The ALC option would require easement from the Kelley property and Montana Rail Link, which would most likely be easily obtained.

G. **Environmental Considerations:** Replacement of the transmission main will have little or no environmental consequence. The reduction in lost water will result in corresponding reductions in chlorine and phosphates leaking into the groundwater and associated pumping energy.

H. **Construction Problems:** Certain areas of Stevensville have seasonally high groundwater which may create additional construction costs. The risk of encountering high groundwater is equal for all proposed alternatives. The Middle Burnt Fork Road option as well as the Park Street option would require extensive work along Middle Burnt Fork Road. Construction in the tight right of way of Middle Burnt Fork Road could cause delays and may pose a hazard during construction.

I. **Cost Estimates:** Detailed cost estimates for all three routes are included in Appendix H. The general costs associated with each route are shown below:

| II.2.a NEW SUPPLY TRANSMISSION MAIN & BURNT FORK RECONSTRUCTION | |
|---|---|
| Subtotal, New Supply Transmission Main | $ 948,846 |
| Subtotal, Middle Burnt Fork Re-construction | $ 446,969 |
| **TOTAL, TRANSMISSION MAIN & BURNT FORK RE-CONSTRUCTION** | **$ 1,395,815** |
| **II.2.b NEW SUPPLY TRANSMISSION MAIN (Route 2 - Park Street)** | |
| Subtotal, New Supply Transmission Main | $ 1,158,310 |
| Subtotal, Road Repair | $ 298,635 |
| **TOTAL, TRANSMISSION MAIN & ROAD REPAIR** | **$ 1,456,945** |
| **II.2.c NEW SUPPLY TRANSMISSION MAIN (Route 3 - ALC Way to 5th Street)** | |
| Subtotal, New Supply Transmission Main | $ 1,066,078 |
| Subtotal, Road Repair | $ 135,903 |
| **TOTAL, TRANSMISSION MAIN & ROAD REPAIR** | **$ 1,201,982** |

J. **Selection of Preferred Alternative:** Based on the hydraulic model, any of the above proposed transmission main routes will provide the required domestic and fire flows to Town while meeting DEQ requirements and AWWA recommendations. A matrix comparison of the Transmission Main Alternatives is shown below. Impacts on the listed elements are rated from 1 to 3, with 3 representing the higher impact, greater difficulty, higher cost, etc. The alternative with the lowest total value is deemed to be in the best interest of the community.

*Rating System*

*Less Impact* ⇒ *Greater Impact*

*1* *2* *3*

**TABLE IV.3.C** Transmission Main Alternative Selection Matrix

| | Alternate A<br>Middle Burnt Fork Road | Alternate B<br>Park Street | Alternate C<br>ALC Way |
|---|---|---|---|
| Operational Requirements | 1 | 1 | 1 |
| Energy Requirements | 1 | 1 | 1 |
| Regulatory Requirements | 2 | 1 | 1 |
| Land Requirements | 1 | 2 | 2 |
| Construction Problems | 3 | 2 | 1 |
| Cost | 2 | 3 | 1 |
| TOTALS | 10 | 10 | 7 |

As can be seen from the selection matrix, the preferred alternative appears to be the ALC Transmission Main Route. This route will provide the greatest benefit for the cost to the Town.

## 4. Distribution System Improvement Alternatives

A. **Description:** The issue here is the proper selection of pipe sizes and replacements in the distribution system for optimum efficiency in supplying peak demands and fire flows throughout the Town. In order to determine the most cost effective solution for distribution system upgrades, the Town's water distribution system was modeled using Bentley WaterCAD. Schematics of the system and selected print-out of hydraulic calculations are presented in Appendix C.

In addition to the pipelines identified herein for replacement, other pipelines may be found during continued leak detection operations that warrant full replacement. According to Town staff, the main lines are sound, but copper service lines are corroded and leaking.

B. **Schematic Layout:** Schematic's for both the existing water distribution system and the proposed improved system are shown in Appendix C. The pipeline improvements were selected to reach the following goals:

1. Eliminate "dead-end" lines to improve water quantity, quality and reliability.
2. Provide the ISO required fire flow of 1,000 gpm in residential areas, 3,000 gpm at the School, and 3,500 gpm in the commercial areas (Main Street).

Results of the model lead to suggested pipeline additions and replacement which are summarized in Appendix C. The pipelines identified are needed to bring the present Town grid into compliance with ISO flow requirements and with sound engineering practices. The bulk of future growth in the Stevensville area is expected to be to the south and southeast of Town. This growth will be served by water main extensions funded by the developments in a pattern consistent with the Town's Water and Sewer Master Plan.

C. **Operational Requirements:** The installation of new and replacement pipelines can be expected to reduce the operational duties of the Water staff. Reduction in dead-end lines will reduce flushing activities and improve water quality with better circulation of chlorine and ortho-phosphates.

D. **Energy Requirements:** The installation of new and replacement pipelines will have little effect on the energy requirements of the water system. However, any reduction in leaks will reduce pumping costs for the system.

E. **Regulatory Compliance & Permits:** Looping the dead end lines and meeting ISO fire flow requirements will bring the Town into general compliance with DEQ Circular DEQ 1, Sections 8.2.3 "Fire Protection" and 8.2.4 "Dead ends". In addition, the completion of a looped grid system can be expected to help in the even distribution of chlorine and ortho-phosphates for improved water quality.

F. **Land Requirements:** No new lands are required for these alternatives. All main replacements and new lines are expected to be within existing public right-of-ways.

G. **Environmental Considerations:** These water main installations will have little or no environmental consequence, with the exception of any associated reduction in "lost water" and the corresponding reduction in chlorine and ortho-phosphates and energy costs.

H. **Construction Problems:** Certain areas of Stevensville, notably the northeast portion and along Middle Burnt Fork have seasonal high groundwater that will create additional construction expense. There are no other special considerations that need to be made.

I. **Cost Estimates:** Detailed cost estimates for recommended system upgrades are listed in Appendix H. It is recommended that the Town adopt a minimum water main size of 8" for hydraulic capacity. Pipe materials should be either ductile iron or PVC, both with AWWA approvals. The general experience is that in smaller sizes PVC is most cost effective, while ductile iron is usually more competitive in larger sizes. It may be good practice to specify either type for a specific project and let the market forces make the selection.

J. **Selection of Preferred Alternative:** Several alternatives and scenarios were tested in the hydraulic model. From the model the following improvements are recommended:

1. In its current condition the distribution system is unable to deliver the required fire flow throughout Town. The hydraulic model predicts that with average day flows 38 out of 118 junctions failed to deliver needed fire flows. During peak flow 112 out of 118 junctions failed to deliver required flows. The maximum available fire flow in the commercial areas was 1986 gpm at average day flow and 392 gpm at peak day flows.

2. According to The Hydrant Flow Data Summary in Appendix C, needed fire flows (NFF) in the commercial areas downtown should be 3500 gpm, the school area should be 3000 gpm, and residential areas should be 1000 gpm. The existing water system with all sources producing (Water Treatment Plant, Well 1, 2 & 3) was analyzed in the model to check available fire flow (AFF). The fire flow analysis was performed for both average day and peak day domestic demand; available fire flow (AFF) was determined by sustaining a minimum zone pressure of 20 psi. If AFF was

less than NFF, new water mains were added or existing infrastructure was upgraded until the AFF was equal to or greater than the NFF. See Appendix C for existing average day and peak day available fire flow reports.

3. Based on the results of the water model the following pipe upgrades are recommended to achieve NFF at all locations during peak day flows:

**Table IV.4.A – Recommended Pipe Upgrades**

See Appendix G for a Schematic of Proposed Improvments

| Pipe # | Upgrade Description | Quantity | Units |
|---|---|---|---|
| 37 | 12" Pipe | 570 | LF |
| 38 | 12" Pipe | 575 | LF |
| 39 | 12" Pipe | 330 | LF |
| 12 | 12" Pipe | 230 | LF |
| 180 | 12" Pipe | 380 | LF |
| 72 | 12" Pipe | 1000 | LF |
| 245 | 12" Pipe | 540 | LF |
| 244 | 12" Pipe | 500 | LF |
| 201 | 12" Pipe | 525 | LF |
| 202 | 12" Pipe | 280 | LF |
| 203 | 12" Pipe | 450 | LF |
| 204 | 12" Pipe | 365 | LF |
| 236 | 12" Pipe | 165 | LF |
| 237 | 12" Pipe | 370 | LF |
| 238 | 12" Pipe | 1960 | LF |
| 247 | 12" Pipe | 235 | LF |
| 239 | 12" Pipe | 700 | LF |
| **Total 12" Upgrades** | | **9175** | **LF** |
| 75 | 8" Pipe | 365 | LF |
| 246 | 8" Pipe | 350 | LF |
| 58 | 8" Pipe | 350 | LF |
| 199 | 8" Pipe | 372 | LF |
| 198 | 8" Pipe | 340 | LF |
| 200 | 8" Pipe | 144 | LF |
| 197 | 8" Pipe | 325 | LF |
| 66 | 8" Pipe | 75 | LF |
| 64 | 8" Pipe | 150 | LF |
| 207 | 8" Pipe | 215 | LF |
| 208 | 8" Pipe | 75 | LF |
| 221 | 8" Pipe | 750 | LF |
| **Total 8" Upgrades** | | **3511** | **LF** |

## V. Detailed Description of the Preferred Alternative.

The preferred alternative will include the following elements:

1. Metering: Metering is recommended for all un-metered services. Installation of meters in existing services should include leak detection and replacement of the services to the main where indicated. Accurate metering of all services and supplies will allow the Town to accurately track water use, quantify the leaks in the system, and generate revenue for the water system on a more regular basis. Remote radio read technology should be utilized to reduce staff hours in meter reading and to begin reading and billing of water use on a monthly basis.

2. Transmission: A new 16" transmission main from the Twin Creeks Well Field to the Town distribution system is required to deliver the required domestic and fire flows to the Town as required by DEQ Circular 1, and the 1996 ISO fire flow recommendations. The main will be located in a water and sewer utility easement along ALC Way and will head east through the Kelley and Montana Rail Link property to Phillips Street and then north on Park Street to 5$^{th}$ Street.

3. Storage: Until accurate metering data is available, the preferred alternative is to use the existing storage tank and 10" main to provide storage and peak flows to the Town.

4. Supply & Treatment: The Town should begin conversion to a consolidated Well Field. The preferred location is the Twin Creeks Well Field along the south side of Middle Burnt Fork Road. Transfer of the well field property to the Town is a condition of the Twin Creeks Subdivision approval, and the Town is currently working on an agreement with Anderson should the subdivision process not be completed. Twin Creeks has installed a test well and has confirmed the aquifer capacity and water quality. Once the supply is secure, the existing wells and treatment plant can be phased out of the system.

5. Distribution: Water distribution mains identified in the WaterCAD model should be replaced or installed as identified. This will bring the existing system into compliance with DEQ and ISO requirements. In addition, leaks identified during main replacement shall be repaired, leaking service lines shall be replaced to the curb stop, and all services shall be metered.

### A. Site Locations and Characteristics

1. Meters will be installed on all un-metered services. Curb-side vaults will be constructed within the existing street right-of-way where required and groundwater conditions permit. Where possible, meter placement will be within the home.

2. 16" Transmission main will be installed from the new well field to Town providing a significant increase in capacity. The 8" cast iron main shall be abandon as required by DEQ Circular 1, Section 8.14. The ALC route appears to be the most financially responsible for the Town. Seasonally high groundwater will most likely be encountered and should be budgeted as a construction expense.

3. Storage The existing tank will be utilized until accurate data is available to size the new storage tank. At that time the location, size and type of tank will be determined. Adequate space for a new tank will be acquired at the well field site as part of the well field agreement.

4. Supply & Treatment: The development of a consolidated well field capable of 2300 gpm will require approximately 4-6 acres. Up to 8 acres was offered for a Town well field as part of the Twin Creeks Subdivision application and is currently under negotiation. A test well was drilled by the Twin Creeks Subdivision and confirmed adequate quantity and quality water (see Appendix D). Sufficient area will be acquired to adequately protect the well heads and provide a location for future storage needs.

5. Distribution improvements will be located within existing Town right-of-ways and easements. Replacements of pavement and some concrete will be necessary as part of these improvements.

**B. Operational Requirements**:
None of the proposed improvements require operation expertise beyond a Class 2 water operator, which the Town currently employs. The only new equipment for operation will be the telemetry system to control the well pumps and reservoir levels and a booster station to provide additional pressure to the upper end of the distribution system. After brief training, staff will quickly become familiar with the operation of this system. The well field control system should include data collection for continuous pump records and water production. Conversion to all metered accounts through-out the Town and a monthly read and billing cycle will allow full accounting for produced and sold water, and greatly improve the financial health of the water enterprise fund.

**C. Impact on Existing Facilities**:
The proposed improvements will benefit the Town's water system. Metering of all users will most likely reduce the water used by flat rate customers by 15%-30%. The impacts on the existing water facilities will be significant in that the improvements will greatly reduce the amount of water leaking from the system, and discontinue the use of aged and "at risk" supplies. Wells #1, 2 and 3 will be gradually phased out of production as new well supplies are brought on line. Wells 2 and 3 are particularly at risk for contamination and Well No. 1 is far past its useful life at near 60 years old and is starting to produce excessive amounts of sand.

**D. Design Criteria**

Design of these improvements will be in accordance with DEQ Circular DEQ 1, Standards for Water Works:

1. Metering: All new supplies will be metered with continuous recording to the control system. All service lines will be metered with a remote read system for monthly meter reads and billing. Meters shall comply with AWWA C700 and all piping and fittings shall be NSF approved. Full metering will allow the Town to accurately assess its water loss and account for all water sold to customers. Complete metering will easily pay for itself within the first few years, if leaks can be reduced and the Storage Tank sized on actual metered use.

2. Transmission: The transmission main has been sized by hydraulic modeling with Bentley WaterCAD to provide peak day plus fire flow from the well field to the Town. Alternative routes were evaluated based on cost, environmental impact, and their ability to provide adequate flow to the Town distribution system. The ALC route will allow the existing 8" cast iron main in Middle Burnt Fork Road to be abandoned and will provide a third connection to Town should other mains need to be shut down for repairs. The transmission main will be designed per DEQ 1, Chapter 8 and will utilize AWWA and ANSI/NSF approved pipe, fittings and valves.

3. Storage: The current tank does not meet the requirements of DEQ Circular 1, Section 7.0.1. However, improvements to the source and reduction of leaks in the system will provide more fire flow and make the existing storage last longer than it previously did. When accurate data is available, the new storage will be designed in accordance with DEQ Circular 1, Section 7.0.1, and be specified to meet AWWA and ANSI/NSF standards. The new tank will most likely be located at the Twin Creeks Well field to provide a means of providing contact time for 4-log disinfection if required in the future.

4. Supply & Treatment: DEQ 1, Chapter 3, Source Development applies to the new well sites. Water quality will be tested and must meet the requirements set forth in Title 17, Chapter 38, Sub-Chapter 2, of the Administrative Rules of Montana. The new groundwater source will be developed on the Twin Creeks Well Field property and deeded to the Town as a final plat condition of the subdivision. Pumps will be specified to meet the peak day demand with the largest producing source out of service. It is assumed that all wells will be developed at the same capacity to reduce the amount of wells required. The Town will need to make application for relocation and correction of water rights to DNRC as new well supplies are developed.

   It is assumed based on the water quality information obtained by AMEC Geomatrix that the only treatment that will be required for the new source will be chlorination and injection of corrosion control chemicals (orthophosphate blend). Controls, metering, and treatment will all be located in a well house on the Twin Creeks Well Field property. No treatment discharge is expected from the treatment required.

5. Distribution: DEQ Circular 1, Chapter 8, Transmission Mains, Distribution Systems, Piping & Appurtenances applies to the main replacements. Increases in main size are supported by the hydraulic modeling completed in WaterCAD, and are shown on the Preferred Alternative System Map in Appendix C. Industry standard, AWWA and ANSI/NSF approved, ductile iron or PVC piping will be bid as equals. AWWA recommendations for flow velocities and head loss limits will also be considered in the design of this project.

   The booster station required to provide additional pressure to Creekside Meadows subdivision will meet the requirements of DEQ Circular 1, Chapter 6. This booster station was approved by DEQ as part of the Creekside Meadows subdivision (see approval in Appendix C), but was never installed. The booster station will be located as shown in the approved DEQ plans.

## E. Environmental Impacts and Mitigation

1. Affected Environment/Environmental Consequences - Based on the responses to the Uniform Environmental Checklist (see Appendix B), it can be concluded that the work will have no significant adverse impacts on the environment. The proposed improvements will have very little negative impact excluding the normal problems associated with any construction activity.

2. Mitigation - The typical problems associated with the construction work include equipment noise, dust, odors and impact on vehicular traffic. Enforcing the work hours, maintaining noise suppressants (mufflers) on the equipment, applying dust controls (water, dust screens, etc.) and providing temporary traffic signage and controls will help to minimize the temporary impacts associated with construction actions. The water main replacements in the Downtown area have been designed to be a block east of Main Street to minimize impact on the business community and reduce costs of working on a State Highway.

3. Correspondence - Responses to the Environmental Checklist are included in Appendix B. No adverse impacts to the proposed project were identified.

4. Exhibits/Maps – Soil descriptions and flood plain delineations are show with The Uniform Environmental Checklist in Appendix B.

## F. Cost Summary for the Selected Alternative

Detailed cost estimates for the identified improvements are given in Appendix H.

1. Project Costs - As detailed in Appendix H, the following are summaries of the "Activity Costs" of the PHASE II and PHASE III Projects. In addition to these costs will be administrative, legal, and financing costs that are specific to each potential funding

source. Those costs must be included in the appropriate funding applications, and can be expected to be 5% to 7% of the "Activity Costs".

## PHASE II IMPROVEMENTS

| Water System Improvements Phase II Scope of Work and Estimated Costs | | |
|---|---|---|
| **Description** | | **Estimated Cost** |
| Meter Installation | $ | 243,072 |
| Engineering & Contract Administration | $ | 24,026 |
| Contingency | $ | 24,307 |
| **Metering Total** | **$** | **291,405** |
| Transmission Main Installation | $ | 852,863 |
| Road Repair | $ | 108,723 |
| Engineering & Contract Administration | $ | 144,238 |
| Contingency | $ | 96,159 |
| **Transmission Main Total** | **$** | **1,201,983** |

| Phase II Improvement Summary | | |
|---|---|---|
| Meter Improvements | $ | 291,405 |
| Transmission Main Improvements | $ | 1,201,983 |
| **Total Phase II** | **$** | **1,493,388** |

| Phase II Funding Summary | | |
|---|---|---|
| Meter Improvements - USACE/WRDA 2008 | $ | 175,000 |
| Transmission Main Improvements - USACE/WRDA 2008 | $ | 487,500 |
| **Total Phase II Funding Secured** | **$** | **662,500** |

| Phase II Funding Needed | | |
|---|---|---|
| **Total Phase II Funding Needed** | **$** | **830,888** |

# PHASE III IMPROVEMENTS

| Water System Improvements Phase III Scope of Work and Estimated Costs | | |
|---|---|---|
| **Description** | | **Estimated Cost** |
| Water Supply Well Installation | $ | 380,000 |
| Pumphouse & Treatment | $ | 396,250 |
| Engineering & Contract Administration | $ | 116,438 |
| Contingency | $ | 77,625 |
| **Water Supply & Treatment Total** | **$** | **970,313** |
| Distribution System Improvements | $ | 1,537,183 |
| Decommission Infiltration Gallery | $ | 70,000 |
| Engineering & Contract Administration | $ | 241,077 |
| Contingency | $ | 160,718 |
| **Distribution System Improvements Total** | **$** | **2,008,979** |
| Pressure Reducing Valves & Booster Station | $ | 165,000 |
| Engineering & Contract Administration | $ | 12,750 |
| Contingency | $ | 16,500 |
| **PRV & Booster Station Total** | **$** | **194,250** |

| Phase III Improvement Summary | | |
|---|---|---|
| Water Supply & Treatment Improvements | $ | 970,313 |
| Distribution System Improvements | $ | 2,008,979 |
| Pressure Reducing Valves & Booster Station | $ | 194,250 |
| **Total Phase II** | **$** | **3,173,541** |

| Phase III Funding Summary | | |
|---|---|---|
| RRGL 2008 | $ | 100,000 |
| TSEP 2008 | $ | 500,000 |
| **Total Phase II Funding Secured** | **$** | **600,000** |

| Phase III Funding Needed | | |
|---|---|---|
| **Total Phase II Funding Needed** | **$** | **2,573,541** |

2. Annual Operating Budget – The annual operating budget for the period 2009 through 2014 has been estimated in HDR's rate study which is included in Appendix E. The Town is currently in the process of evaluating their current rates, and is prepared to adopt a new rate structure based on HDR's Rate Study. The Rate Study was prepared assuming that all remaining improvements including approximately $1 million for Phase IV improvements to storage would be funded with current grants and a loan for the remaining value. Any additional grant funding would lower the rate increases proposed by HDR and help make this project more affordable to the Town. HDR's rate study includes: revenue, O&M costs, capital improvements, debt service and reserves

3. Reserves - HDR's rate study, which is included in Appendix E, budgets for the creation of an Operating Reserve Fund, Capital Reserve Fund, and Rate Stabilization/Emergency Reserve Fund. The Town currently has only a Capital Reserve Fund with a balance of approximately $300,000.

# VI. Recommendations and Implementation

## A. Funding Strategy

The needs of the Stevensville water system are extensive. It will not be possible for the water users to fund such extensive needs from user rates alone. The Town is in need of grant and loan funds in order to complete the recommended Projects. It is proposed that this project be completed in 4 phases.

Phase I: Complete
Phase II: Metering and Transmission Main Improvements
Phase III: Consolidated Well Field & Distribution System Improvements
Phase IV: Storage System Improvements

The Town has received the following grants to help complete this project to date:

WRDA 2008 - $175,000, Phase II
WRDA 2008 Special Appropriation - $487,500, Phase II
RRGL 2008 - $100,000, Phase III
TSEP 2008 - $500,000, Phase III

Additional funding will be required to finish Phases II & III. It is the opinion of this PER that Phases II & III must be completed before Phase IV can be designed for proper sizing of the tank. Accurate water use data will allow for more accurate sizing of the storage tank, and reduction in leaks in the system will reduce the required size of the storage tank, saving the Town a considerable amount of money.

It is desired that the remaining funding for Phases II & III be obtained through grant and loan from USDA Rural Development.

Current water rates are shown in the Table below:

| | Annual fees | | | | current |
|---|---|---|---|---|---|
| Account type | base rate | irrigation | MDEQ fee | usage[1] | monthly cost |
| Flat rate 3/4" Service | $205.24 | $32.90 | $2.00 | N/A | $20.01 |
| 3/4" Metered Service | $175.84 | | $2.00 | $53.35 | $19.27 |
| 1" Metered Service | $314.75 | | $2.00 | $95.50 | $34.35 |
| 1-1/2" Metered Service | $703.36 | | $2.00 | $213.40 | $76.56 |
| 2" Metered Service | $1,255.50 | | $2.00 | $380.92 | $136.53 |

[1] Usage is based on the 2003 metered 137,000 gal/year/EDU less 10,000 gal/quarter base allocation.

The typical average residential metered monthly bill as developed in Table II.4.1.A is $19.27 /month. The average 3/4" sewer rate is $35.09 (see Table II.4.2.A) and the combined water and sewer billing is $54.36 / month. The target rates for water and sewer from the Department of Commerce website for Stevensville are as follows: water only is $32.61 /month, wastewater only is $20.96 and the combined water and wastewater rate is $53.57 / month. The "target rate" is the amount the Agencies expect the water and sewer users to be paying for operation, maintenance and debt service before the system is eligible for grant funds. Stevensville is currently at approximately 101% of target with no debt service and a projected budget shortfall of approximately 15% for 2009. A 40% rate increase is proposed next year, and extensive expenses expected for both the water and sewer system in the near future.

The ultimate increase in water rate will depend on the success of the community in obtaining grants from the various programs. The rate study performed by HDR determined that water and sewer rates needed to be adjusted to meet the current operating expenses as well as to handle the debt service from the proposed improvements. The rate study projected a 40% increase in water rates and a 45% increase for sewer rates in 2010 if no further grant funding is obtained. A copy of HDR's rate study is included in Appendix E.

If no further grant funding is obtained the estimated increases in water rates to complete the project (including Phase IV) are shown below:

| **Projected Rate Increases w/o Additional Grant Funding** | |
|---|---|
| 2010 | 40.0% |
| 2011 | 30.0% |
| 2012 | 3.0% |
| 2013 | 3.0% |
| 2014 | 3.0% |

## B. Implementation

This Project has been developed in four phases in order to correct potential health and safety issues and repair major operational problems facing the system first. The completion of the hydrogeologic evaluation of the Twin Creeks Well Field by AMEC Geomatrix has allowed the Town to move forward with this project knowing that they have a viable well field which produces adequate quantity and quality water for the Town. Within each phase of this project are several separate elements, which may also be constructed as "stand alone" projects if needed. Some of these project elements are particularly suited to a specific funding source. The following is a listing of each project element and a brief discussion of the current funding sources.

**PHASE I: COMPLETE**

**PHASE II: Total $1,493,387**

II.1 Meter Improvements ($291,405) This improvement is necessary to accurately determine the actual amount of water produced and sold for the Stevensville water system. This improvement will promote water and energy conservation as well as the fair and equitable sharing of water supply costs to each user. Full metering of the system will allow for accurate sizing of the new storage facility in phase IV of this project. WRDA 2008 funds have been secured for the majority of this project. Approximately $30,078 of Town funds are required to complete this portion of Phase II.

II.2 Transmission Main Replacement & Road Repair ($1,201,982) This project was initially proposed as a joint project between the Town and Ravalli County governments, with the original preferred alternative being replacement of the 8" cast iron main in its existing location. The 8" cast iron main is one of the largest known sources of leaks in the Town's distribution system, and Middle Burnt Fork Road is in a poor state of repair and has been in need of repair for some time due to failing sub-grades and poor asphalt condition. After extensive negotiations with the county, adequate funds to repair the road to county standards could not be obtained from the Road and Bridge Department budget. The Town has requested that repairs to the road be delayed until at least May 1, 2010 to allow road crossings for the new preferred alternative and service line relocations to be completed before the road is repaired.

The new preferred alternative places the replacement main in the proposed right-of-ways of the Twin Creeks Subdivision, existing utility easements along ALC Way, an easement through the Kelley and Montana Rail Link properties and existing Town right-of-ways. Although this alternative increases the length of main required, a savings of approximately $300,000 is estimated due to reduced road repair requirements. This portion of Phase II has received funding through a special WRDA appropriation of $487,500. Approximately $714,482 of Town funds are required to complete this portion of Phase II.

**PHASE III: Total $3,173,542**

Storage upgrades have been removed from Phase III and moved to Phase IV. A reduction in scope will be required from TSEP to use existing grant funds for Phase III. A lack of accurate water use data could result in inaccurate sizing of the storage upgrades adding additional cost to the project and possibly cause water quality issues in the future. RRGL and TSEP grants have been secured for completing the work associated with Phase III. However a funding shortfall of approximately $2,573,541 still exists.

III.1 New Water Supply, Pumphouse & Treatment ($970,313) A new well supply is the preferred alternative to replace the aging infiltration gallery, treatment plant, and existing shallow wells. Property obtained from the Twin Creeks Subdivision and the Hydrogeologic assessment performed by AMEC Geomatrix have provided a suitable location for a consolidated well field adjacent to the Town's existing distributions system.

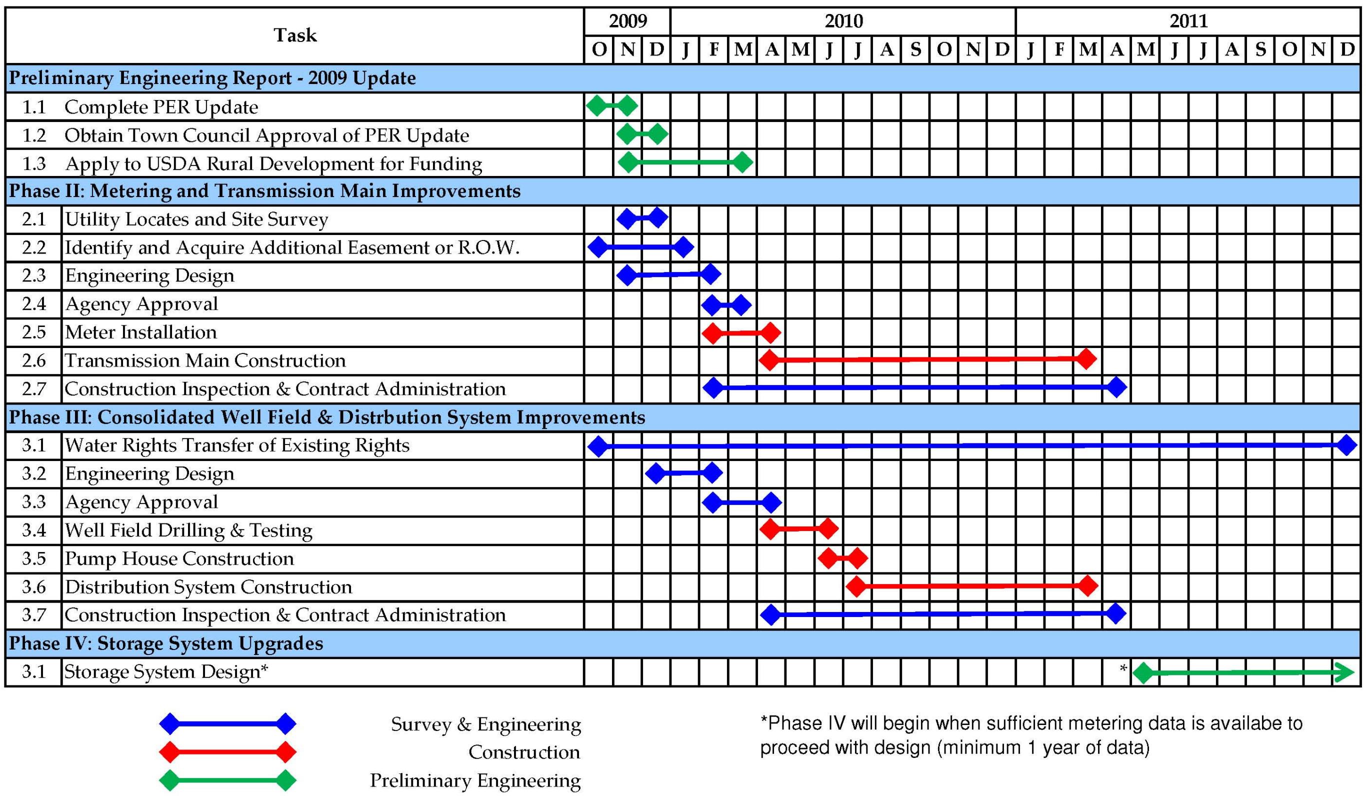
III.2 De-commission Infiltration Gallery & Treatment Plant ($87,500) Upon transfer to the new groundwater source the infiltration gallery and treatment plant must be properly abandon. It may be possible to sell or transfer the collection system to an agricultural use and there is a potential salvage value that has not been included herein. The treatment plant building should be retained and modified to storage and shop space for the water operations.

III.3 Distribution System Improvements ($2,115,729) are necessary to strengthen the flows within the existing system to provide ISO required fire flows, improve water quality and reliability, and reduce dangerously high pressures on the west side of Town. A 12” backbone through Town will provide the ISO required fire flows of 3,500 gpm to downtown businesses and provide water to the proposed industrial district along Eastside Highway.

Due to funding requirements this project must move ahead as quickly as possible. The longest item on the schedule will be the water rights transfer from the current sources to the new consolidated well field. This process has begun with the application for water rights on behalf of the Town by the Twin Creeks Subdivision. Upon approval of their water right, an application from the Town including a place of use change to include the Twin Creeks Subdivision will occur. This process is estimated to take at least two (2) years to complete. A preliminary schedule is shown in Figure VI.B.1.

**Figure VI.B.1**

Town of Stevensville - Water System Improvements - Preliminary Schedule




*Phase IV will begin when sufficient metering data is availabe to proceed with design (minimum 1 year of data)

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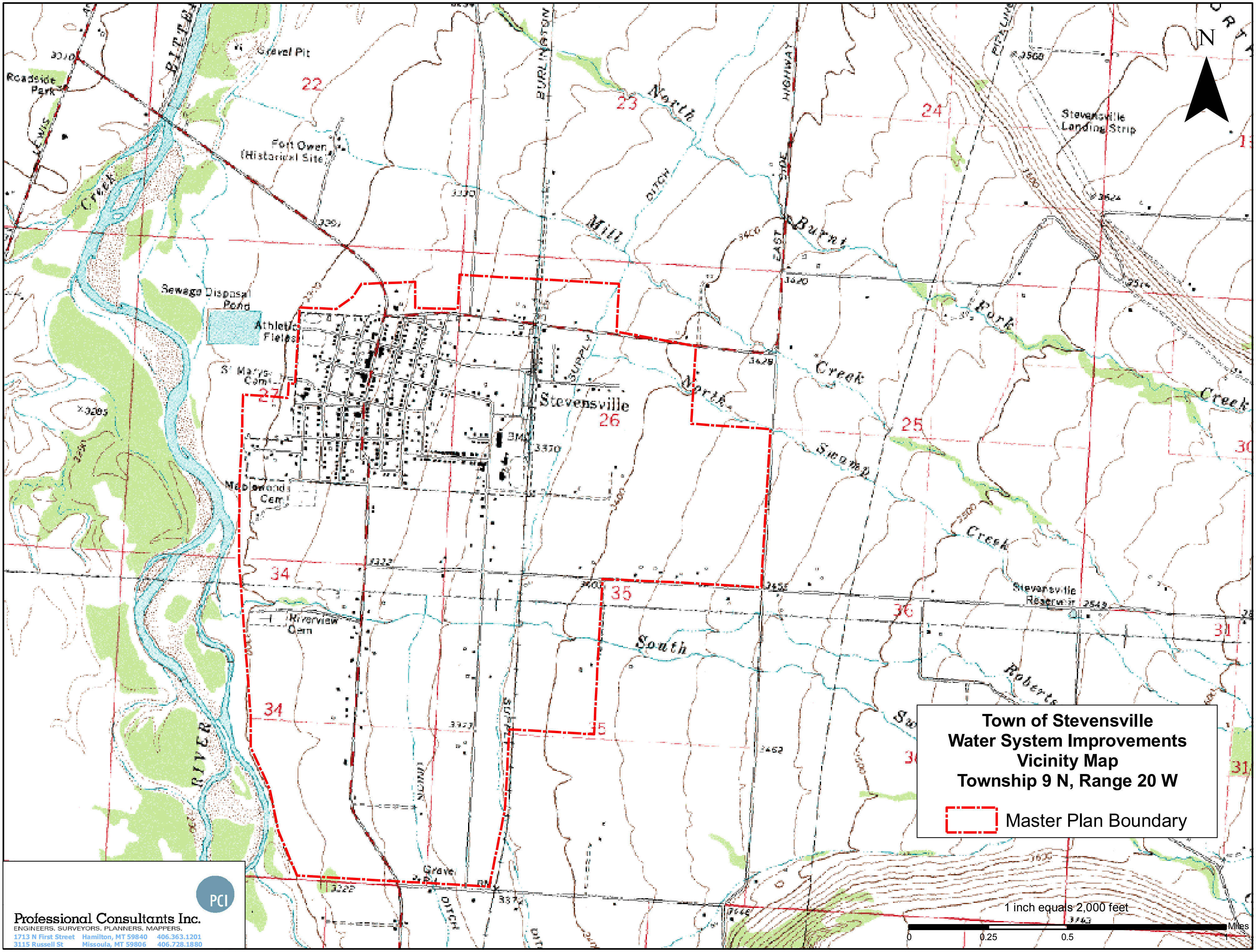
## C. Public Participation

This PER Update is being prepared to amend the Stevensville Water System Improvements PER as amended September 2007. This report will be presented to the Stevensville Town Council on November 9, 2009.

Information and comments will be posted on the Town of Stevensville's Water Improvement Project Blog as the PER and water project progress. www.stevensvillewater.blogspot.com

Public comment on this PER Update will be documented as it is available.


Town of Stevensville
Water System Improvements
Vicinity Map
Township 9 N, Range 20 W
Master Plan Boundary
1 inch equals 2,000 feet
0
0.25
0.5
1
Miles
N
Stevensville
Gravel Pit
Roadside Park
Fort Owen (Historical Site)
Sewage Disposal Pond
Athletic Fields
St Marys Cem
Maplewoods Cem
Riverview Cem
Stevensville Landing Strip
Stevensville Reservoir
North Burnt Fork Creek
North Swamp Creek
South
Roberts
Mill Ditch
Supply Ditch
Burlington
Highway
East Side
River
Creek
22
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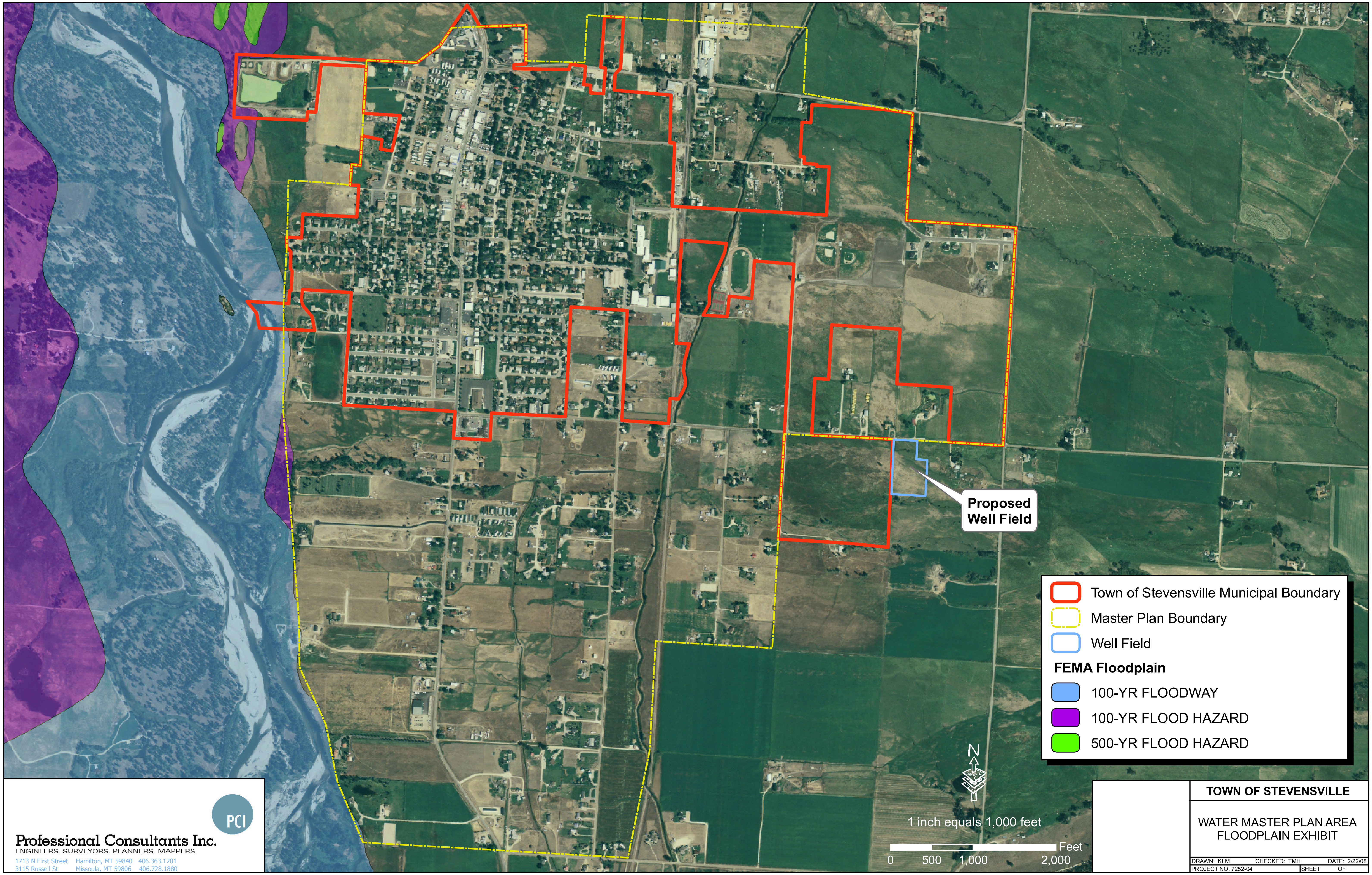
Proposed
Well Field
Town of Stevensville Municipal Boundary
Master Plan Boundary
Well Field
FEMA Floodplain
100-YR FLOODWAY
100-YR FLOOD HAZARD
500-YR FLOOD HAZARD
N
1 inch equals 1,000 feet
Feet
0 500 1,000 2,000
PCI
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3115 Russell St Missoula, MT 59806 406.728.1880
TOWN OF STEVENSVILLE
WATER MASTER PLAN AREA
FLOODPLAIN EXHIBIT
DRAWN: KLM CHECKED: TMH DATE: 2/22/08
PROJECT NO. 7252-04 SHEET OF


# 2009 WATER SYSTEM
## TOWN OF STEVENSVILLE

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Engineers, Surveyors, Planners, Mappers
3115 RUSSELL ST. PO BOX 1750
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HAMILTON, MONTANA 59840
PHONE 406-363-1201
FAX 406-363-1215

PROJECT NO. 7252-04
DRAWN: MEW
CHECKED:
DATE: 10/30/2009
REVISION:
REVISION:
REVISION:

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SHEET 1 OF 1

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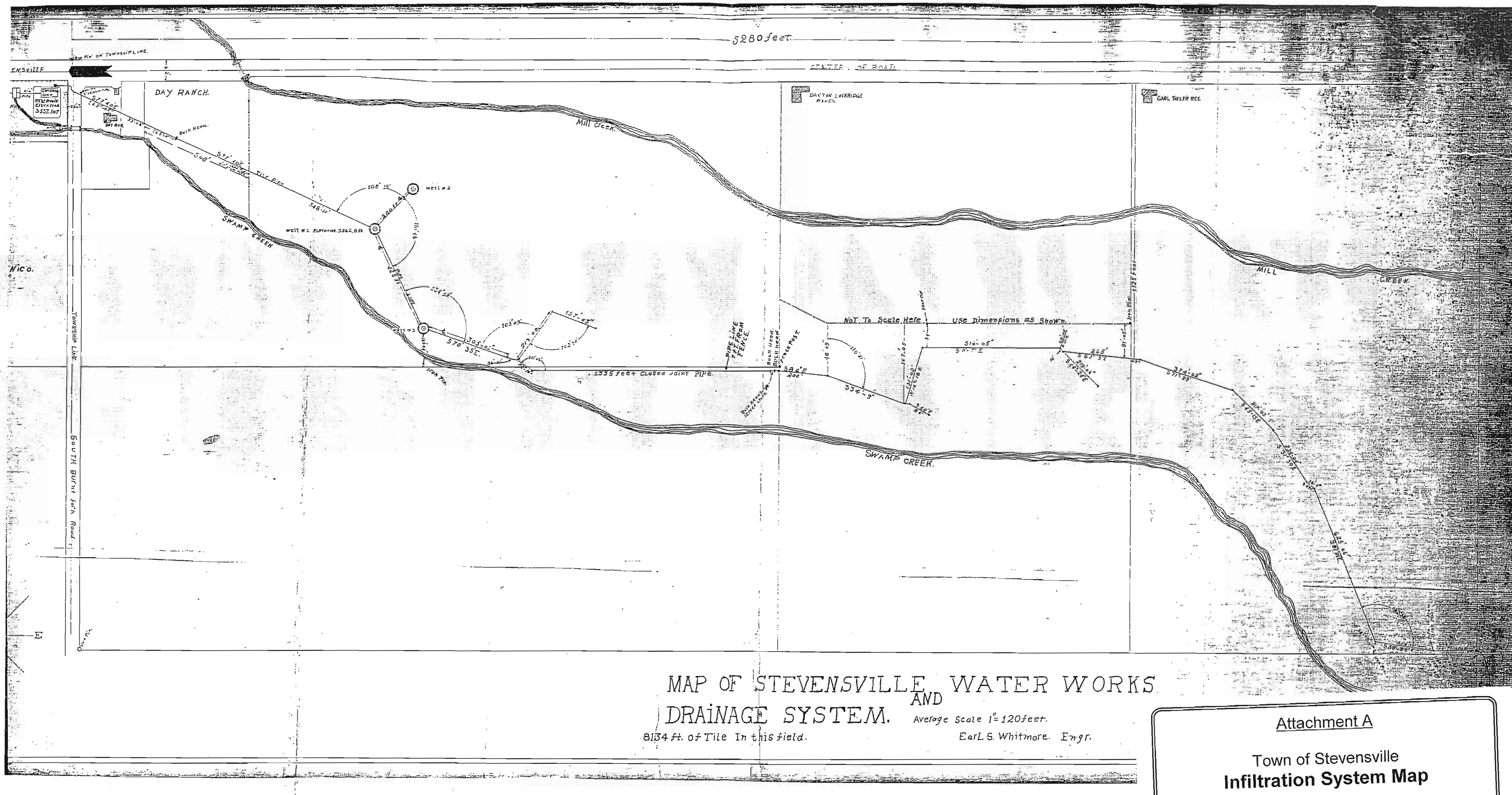


Attachment A

Town of Stevensville
**Infiltration System Map**

*Estimated Production Date ~ 1938*

Montana Department of
ENVIRONMENTAL QUALITY

Brian Schweitzer, Governor

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July 24, 2008

Stevensville, Town of
Mayor Bill Meisner
PO Box 30
Stevensville, MT 59870

Re: Sanitary Survey Inspection of Stevensville public water system (PWSID: #MT0000335).

Dear Mayor Meisner,

I would like to thank George Thomas for assisting me during the sanitary survey inspection of the Stevensville water system. As a community water supply system, your facility is required to have a sanitary survey inspection every three years. These regular inspections offer us an opportunity to look for sanitary deficiencies that have the potential to cause contamination in the water system, as well as pointing out operation and maintenance concerns. Below are a few comments relating to the sanitary survey conducted on 6/25/2008.

**SOURCE(s)**

IN002 (Intake North Swamp Creek and Mill Creek): This source intake collection system has been in place for a considerable period of time and is highly susceptible to runoff and heavy rains. Construction of the intake and caisson would have to be improved if they were required to meet current standards.

Well 1 (WL003 or North Well): This source is significantly deeper (460') than the other Stevensville wells and appears to be drawing from a confined aquifer (intake 362' to 370'). The 50 hp vertical turbine pump assembly has been replaced by a 50 hp submersible pump assembly with VFD controls near the beginning of 2007. It is capable of producing approximately 400 gpm.

- Well 1 produces a significant amount of sand which is pumped directly into distribution.
- I question the need for variable frequency drive (VFD) controls for well 1 since the well is controlled by the storage tank water level. (Water hammer could have been more economically addressed by installing an electrical soft start setup.)

Well 2 (WL004): This source is located on South Ave – Mission St. and is 56' deep with the intake located at 36' to 56' below ground level. Static water level is 30' in this unconfined aquifer. Well 2 has a 20 hp submersible pump assembly that can produce approximately 220 gpm.

- Well 2 is located in a vault with no record of grouting.
- Well 2 does not have a meter to help determine production.
- Well 2 vault is vented through a vent pipe that is lower than the vault flood rim.
- Well 2 controls are located inside the vault and are lower than the flood rim.

- Well 2 is subjected to occasional high ground water. (High ground water is pumped to a nearby ditch via a sump pump.)
- Well 2 vault does not have a permanent ladder affixed to the wall.
- The access hatch to Well 2 does not have a raised collar or gasket hatch.
- Minimal security at Well 2, which is unfenced in a resident's yard.
- The Well 2 log (1968) shows a 3 hour test pump at 300 gpm and the pumping water level was drawn into the perforated intake section. Routine static water level and pumping water level should be routinely monitored to assure the PWL isn't being drawn into the perforated section.
- Manufacturer specifications require submersible pumps to be above the casing intake to accommodate cooling. A flow inducer sleeve should be installed over the submersible pump assembly if it's set below 36'.

Well 3 (WL005): This source is located near the cemetery in a residential area. It is 75' deep with two sections of casing perforations (40' to 50' and 55' to 75'). Static water level is 29' and currently has a 20 hp submersible pump assembly that is capable of producing 220 gpm.

- The well log (1976) shows a test pump at 70 gpm for 1 hour with a 1' drawdown. The current pump is capable of 220 gpm. Our DEQ PWS file in Kalispell did not show an additional pump test was performed to verify Well 3 has the capacity to safely produce 150 gallons more than the well log.
- Well 3 does not have a meter to help determine production.
- The split style well cap is not recommended for outdoor use because it's prone to leaking over a period of time. I recommend Stevensville purchase a quality well cap that more adequately protects the source from contaminants. Example enclosed.
- The control valve vault located next to Well 3 does not have a shoe box style hatch with gasket or ladder permanently affixed to the wall for access.
- The wellhead, control valve vault and electrical control panel are open to trespass and vandalism. Anyone walking past the electrical control panel could easily shut the main breaker off.
- Manufacturer specifications require submersible pump to be above the casing intake to accommodate cooling. A flow inducer sleeve should be installed over the submersible pump assembly if it's set below 40'. Again, static water level and pumping water level should be routinely monitored to assure the PWL isn't being drawn into the perforated section.

**TREATMENT**

Treatment Plant 1 (TP001): This is a single cell sand filter that adds alum, gas chlorine and orthophosphate. It is capable of producing approximately 800 gpm in optimal conditions. The filter bed has never been replaced and still has the original media (sand and pea gravel) that was installed in 1979. Backwashing is automatically triggered by floats and the treatment plant is off-line until complete. A small portable generator is available to operate chemical injection in the case of emergency. See attached schematic for chemical injection locations.

- Raw water enters the plant and flows through the complete treatment process (including chemical injection) and the finished product turbidity is measured prior to entering Stevensville's storage facility. An automatic bypass valve wastes the finished water prior to storage if it exceeds 0.30 NTU. Operators currently shut the treatment plant down until raw water levels reach a more treatable level when the bypass is activated. This form of operation will have problems when held to LT1/LT2 standards.

- The gas chlorination room has an outlet fan that does not operate correctly. The chlorine fumes have completely eaten up the bottom of the door.
- The gas chlorination room does not have a panic bar on the door.
- A scale should be in place under the gas cylinders that are currently in use to verify chlorine use and reserve.
- Chlorine residual is measured immediately after the storage facility from a vault that is subject to high ground water. A small sump pump prevents the vault from flooding. There is an additional pump located in the vault that delivers water to the control room for monitoring chlorine residual. This pump has a history of losing prime which results in inaccurate residual readings and pump failure.

Treatment Plant 2 (TP002): This treatment plant is located at well 1 (WL003) and injects orthophosphate as a corrosion inhibitor prior to distribution.

- Perhaps the installation of a properly sized sand separator may be warranted since well 1 produces a substantial amount of sand.
- Montana DEQ PWS standards require any water treatment (such as orthophosphate injection) must be followed by disinfection. You may call Rachel Clark, P.E. in Helena to discuss this requirement (444-6722).

**DISTRIBUTION:** Distribution is primarily ductile iron and PVC.

- There are leaks in distribution but the extent isn't known because only about half the connections are metered.
- There are a few sections of Stevensville that have dead end lines and require routine flushing. There is also a few sections of undersized distribution. I suggest future projects address both the few areas that have these issues and plans accordingly for growth.

**STORAGE:** 500,000 gallon concrete storage tank with a pre-stressed concrete top. This facility helps achieve CT requirements for the surface water plant and is located immediately after TP001.

- The elevation of the treatment plant filter bed is lower than the storage facility overflow so it has not been needed since original construction. However, the overflow is still in place and the outlet location and condition (screened, flapper valve, etc.) are not known. The outlet location and condition needs to be determined to assure it does not provide access to a large range of contaminants (insects, rodents, etc.).
- The only situation where the storage facility overflow could be needed is if the wells were being used and the float switch failed. Even in this situation the overflow would not be needed unless the TP001 isolation valve was turned off. Otherwise, the water would flow back into the treatment building before it reached the storage tank overflow elevation.
- The storage facility roof is in need of new sealant.
- The area surrounding this partially buried concrete storage tank has confirmed high ground water levels as observed in the nearby chlorine monitoring vault. Regular cleaning and inspection of the concrete storage facility is important because

susceptibility of the storage tank to high ground water and whatever contaminants it contains. A crack in your concrete storage facility could just as easily let water flow in as out.

## PUMPS, PUMP FACILITIES and CONTROLS:

- The submersible pump assemblies in wells 2 and 3 have been replaced 5 or 6 times since George began working for Stevensville in 1993. One of these times was a result of a lightning strike. However, the other replacements may be a direct result of installation outside manufacturer specifications (and DEQ standards) by placing the submersible pump assembly in or below the casing perforations without a flow inducing sleeve. George was not sure what depths the pumps were set at, but the SWL, PWL and perforation records suggest this is very possible. Increased failure rate occurs because water doesn't flow past the submersible motor to promote cooling as designed by manufacturer.
- Control vaults in areas of high ground water that subjects the facility to flooding are not allowed in Montana DEQ PWS standards. Stevensville currently has multiple vaults set in high ground water areas that have sump pumps installed to remove the water as needed. This does not comply with current standards.
- Chlorine residual levels that are monitored immediately after the storage facility are dependent on the operation of the a small booster pump that has had issues with air lock and failure. This booster is also located in one of the vaults with high ground water that is discharged by a sump pump. Perhaps a different setup may prove more reliable to monitor entry point chlorine residual.

## MONITORING, REPORTING and DATA VERIFICATION:

- Wells 1, 2 and 3 do not disinfect despite being directly connected to the surface water treatment plant. Any determination that allowed this operation in the past will be moot in the future when considering LT1, LT2 and the upcoming GWR. Please consider this scenario: The three wells operate in conjunction with the storage facility water level and can potentially deliver water to the storage facility. In turn, the surface water treatment plant achieves disinfection contact time in the 500,000 gallon storage facility. So in the situation where surface water is not entering the storage facility (example: during bypass, backwashing, maintenance, etc.) the storage tank receives unchlorinated ground water from the wells. This dilutes the storage facility chlorine concentration and alters CT calculations.
- Systems that chlorinate fulltime are required to maintain a minimum chlorine residual of **0.2 mg/L throughout distribution.** I am certain this is not possible when the ground water wells are operating. Each day the chorine residual drops below the minimum level is a violation and may be subject to fines.

## MAINTENANCE, MANAGEMENT, SAFETY and OPERATION:

- I strongly recommend key Stevensville staff carefully read LT1, LT2 and the GWR to make sure you're in compliance now and in the future.
- The gas chlorine room is an extreme safety concern and correction should be prioritized to get the exhaust fan fixed and the panic bar installed on the door.

- A new well was recently drilled just west of the existing TP001 and ST001 and pump tests show it is capable of producing approximately 1,100 gpm. George told me the Town of Stevensville is considering creating a well field in this area and discontinue use of the surface water source, surface water treatment plant, well 2, well 3 and possibly well 1. I encourage Stevensville to complete water quality parameters on the new test well and pursue this transition if the water quality is adequate and economical to treat. Otherwise, LT1, LT2 and the Ground Water Rule will certainly affect daily operation and cost of the existing system.
- Take all required precautions when working in the systems multiple enclosed spaces and the gas chlorination room.

**OPERATOR COMPLIANCE WITH STATE REQUIREMENTS:**

Operator George Thomas is properly certified for the current size of Stevensville and is current on his continuing education credits needed to maintain certification.

If you have any questions about this report or public water supply regulations please give me a call at (406) 755-8985 ext 102

Sincerely,

Michael Kropp

Michael Kropp
Environmental Science Specialist
DEQ PWS Kalispell
Phone: (406) 755-8985 ext 102
Fax: (406) 755-8977

CC: Helena PWS file
Kalispell PWS file
George Thomas (operator)
Ravalli County files

Supplemental information attached: Example of good well cap
Franklin submersible maintenance booklet
Backflow prevention brochure

# SANITARY SURVEY FORM - INVENTORY

2/15/06



PWSID **MT0000335** SYSTEM NAME **Stevensville, Town of**

DATE OF SURVEY **7/25/2008** COUNTY **Ravalli** **081** SURVEYOR NAME – **Mike Kropp, DEQ PWS Kalispell**

(SYSTEM REPRESENTATIVE) **George Thomas** (OTHER REPRESENTATIVE) **NA**

**SYSTEM ADDRESS – ADMINISTRATIVE CONTACT**

Addressee George Thomas Primary Address

Street PO Box 30

City Stevensville State MT Zip 59870

System Phone (406)777-3341 Fax ( )

**SYSTEM OWNER**

Addressee Town of Stevensville Owners Address

Street PO Box 30

City Stevensville State MT Zip 59870

Owner Phone (406) 777-5271 Fax ( )

**LOCATION OF SYSTEM**

Nearest City Stevensville Description or Physical Address Town of Stevensville

☐ seasonal operation dates: ____ to ____
☒ year round operation

**OPERATOR OF SYSTEM**

Name George Thomas

Certified Operator? ☒ Yes ☐ No ☐ Not required

Copy of Certificate? ☒ Yes ☐ No Certification # 4568

Phone # (406) 777-5271 Cell Phone # ( )

Fax # ( )

**ALTERNATE OPERATOR OF SYSTEM**

Name Edward Sutherlin

Certified Operator? ☒ Yes ☐ No ☐ Not required

Copy of Certificate? ☐ Yes ☒ No Certification # 3931

Phone # (406) 777-5271 Cell Phone # ( )

**SYSTEM STATUS**

☒ **A** = Active ☐ **P** = Pending *(Add New System)*
☐ **I** = Inactive

**SYSTEM CLASS**

☒ **C** = Community ☐ **NTNC** = Non-Transient Non-Community
☐ **TNC** = Transient Non-Community

Total Service Connections: Residential / Non-Transient: 700 Transient: 10

Total Active Connections: Residential / Non-Transient: 700 Transient: 10

Service Connections Metered? ☒ Yes ☐ No
Percent Metered 50 %

Resident Population 1,750
(Number of permanent residents utilizing PWS daily)

Non-Transient Population 20
(Maximum number of non-transient persons utilizing PWS daily)

Transient Population 150
(Maximum number of transient persons served by PWS daily)

**OWNER TYPE**

☐ 1 Federal Government
☐ 2 Private Subdivision, Investor, Trust, Cooperative, Water Association, etc.
☐ 3 State Government
☒ 4 Local Government Authority, Commission, District, Municipality, City, etc.
☐ 5 Mixed Public/Private
☐ 6 Native American

**SERVICE AREA CHARACTERISTICS LIST**

☐ BR Bar
☐ DC Day Care Center
☐ DI Dispenser
☐ HS Head Start
☐ HA Homeowners Assoc.
☐ HM Hotel/Motel
☐ HR Highway Rest Area
☐ IA Industrial/Agricultural
☐ IC Interstate Carrier
☐ IN Institution
☐ MF Medical Facility
☐ MH Mobile Home Park
☒ MU Municipality
☐ OA Other Area
☐ ON Other Non-Transient Area (____ Average Daily Visitors TNC)
☐ OR Other Residential Area
☐ OT Other Transient Area
☐ PA Recreation Areas
☐ RA Residential Area
☐ RE Retail Employees
☐ RS Restaurant
☐ RV RV Park
☐ SC School
☐ SI Sanitary Improvement District
☐ SK Summer Camp
☐ SR Secondary Residences
☐ SS Service Station
☐ SU Subdivision
☐ WB Water Bottler
☐ WH Wholesaler (Sells Water)

Service Category Description MU - Municipality

Comments: This system will have a difficult time meeting LT1/LT2 and the upcoming GWR as it now operates. Surface water system with ground water wells in distribution that have hich static, treatment , highly susceptable aquifer and are not disinfected. There is limited available choices for the installation of contacts tanks near the existing wells if the upcoming GWR requires 4 log inactivation prior to distribution. Distribution leaks exist but system does not know how severe they are because only +-50% of distribution is metered. The general cleanliness of the facilities is good, but there were virtually no improvements made since the 2005 sanitary survey.

# SANITARY SURVEY FORM – WATER SYSTEM FACILITIES



PWSID MT0000335 | SYSTEM NAME Stevensville, Town of

Water System Facilities (WSF) numbers are WSF Type Codes plus an assigned number. (i.e. source facility numbering starts with 002 and all non-source facilities start with 001). See instruction sheet for a list of WSF Type Codes. When a source is operational it is considered *A*ctive, this includes systems that are seasonal. *I*nactive sources are those which are shut down but can return to active status, such as a system out of business. *P*roposed sources are those that have been identified through the Plan Review process, but are not connected to the water system.

*A **water source facility** is a well, spring, intake, infiltration gallery or consecutive connections from which a system draws or purchases water:*

Total Number of Source Facilities 4

*WATER SYSTEM FACILITIES SUMMARY (WSF)*

| WSF ID | Facility Name | Water Type Code | Purchased | Seller PWSID | Activity Status* |
|---|---|---|---|---|---|
| DS 001 | Distribution System | | | | |
| IN002 | intake north Swamp Creek and Mill Creek | SW | ☐ Yes ☒ No | | active |
| WL003 | Well 1 North | GW | ☐ Yes ☒ No | | active |
| WL004 | Well 2 South Ave Mission St. | GW | ☐ Yes ☒ No | | active |
| WL005 | Well 3 South | GW | ☐ Yes ☒ No | | active |
| TP001 | TP for North Swamp Creek and Mill Creek | | ☐ Yes ☐ No | | active |
| TP002 | TP for Well 1 | | ☐ Yes ☐ No | | active |
| ST001 | storage facility 500,000 gal | | ☐ Yes ☐ No | | active |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |
| | | | ☐ Yes ☐ No | | |

Description of Water System Facility flow: North Swamp Creek and Mill Creek intake (IN002) to treatment plant (TP001) to storage facility (ST001) to distribution (DS001). Well 1 (WL003) to treatment plant (TP002) to distribution (DS001) to storage facility (ST001) to distribution (DS001). Well 2 (WL004) to distribution (DS001) to storage facility (ST001) to distribution (DS001). Well 3 (WL005) to distribution (DS001) to storage facility (ST001) to distribution (DS001).

Example: Well 1 (WL002) to common header (CH001), Well 2 (WL003) to common header (CH001) to treatment plant (TP001) to pressure control assembly (PC001) to distribution system (DS001) to storage tank (ST001) to distribution system (DS001).

*(A)Active, (I)nactive, (P)Proposed

## EMERGENCY POWER

Does the system have emergency power? ☒ Yes ☐ No

If yes, what type: _____

Frequency of testing: _____

Record of primary power failures: _____ in last year

Switchover: ☐ Automatic ☐ Manual

Comments: Operator said a portable emergency generator can be connected to TP001.

# SANITARY SURVEY FORM – WELLS & WELL PUMPS



PWSID **MT0000335** | SYSTEM NAME **Stevensville, Town of**

*(Please copy this sheet for additional wells & pumps)*

**COMPLETE ONE PAGE FOR EACH SOURCE** **STATUS OF SOURCE** ☒ (A)ctive ☐ (I)nactive ☐ (P)roposed

WSF ID WL003 *Entry Point ID* EP503
These are State assigned identification numbers

Source Name Well 1 North
Name of Source – Example Well 1 or South well, etc.

Location of Water Source (TRS or street address) 09N 20W sec27

*Entry Point Name* EP for Well 1 North
Name of EP – Example: Entry point for North Well 1 & South Well 2

*Location of Entry Point* EP @ TP002

Available ☒ Perm ☐ Emerg ☐ Interim ☐ Seasonal ☐ Other
If seasonal: _____ to _____

GWUDISW PA Completed ☒ Yes ☐ No

Log Available? ☒ Yes ☐ No

Average Production 400 gpm (indicate units)

Maximum Production 400+ gpm (indicate units)

Date Drilled 3/1/1957 (if well, date drilled)

Casing Size 10" (size of casing installed in well)

Case Depth 370' (depth of casing installed in well)

Well Depth 460' (depth of well expressed in feet)

Grout Depth unknown (depth of grout used to seal well walls)

Log SWL 30' (static) expressed in feet below ground elevation

Log PWL air tested (pumping) expressed in feet below ground elevation

Test Pump Rate 400 gpm for 12 hrs (expressed in gallons per min)

Intake Type drilled holes/open (type of intake mechanism)

Screened Interval 362' to 370' (expressed in feet below ground elevation)

Well Yield tested at 400 gpm (pump tested in gallons per minute)

Latitude 46°30' 42.3"

Longitude 114°05' 34.6"

## WELLS

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is well metered? | ☒ | ☐ | ☐ | ☐ |
| Is well site protected from flooding? | ☒ | ☐ | ☐ | ☐ |
| Is well protected from potential sources of pollution (includes: surface water, known chemical spills, agricultural use, etc.)? | ☒ | ☐ | ☐ | ☐ |
| If no . . explain _____ | | | | |
| Does casing extend at least | | | | |
| ☐18 inches above outside ground level; | ☐ | ☐ | ☐ | ☐ |
| ☒12 inches above finished floor inside well house; and | ☒ | ☐ | ☐ | ☐ |
| ☒3 feet above 100 year flood elevation? (Check for appropriate distance) | ☐ | ☐ | ☒ | ☐ |
| Is top of the well casing properly sealed? (sanitary seal) | ☒ | ☐ | ☐ | ☐ |
| Is well vented? | ☒ | ☐ | ☐ | ☐ |
| Is well vent properly screened and terminated in a downward position? | ☒ | ☐ | ☐ | ☐ |
| Does well have suitable sampling tap? Raw Water | ☒ | ☐ | ☐ | ☐ |
| Treated | ☒ | ☐ | ☐ | ☐ |
| Are check valves, blow-off valves and water meters maintained and operating properly? | ☒ | ☐ | ☐ | ☐ |
| Is upper termination of well protected (housed or fenced)? | ☒ | ☐ | ☐ | ☐ |
| Is intake located below the maximum drawdown? | ☐ | ☐ | ☒ | ☐ |

Comment: The wellhead looks to be in good condition.

## PUMPS

Type 50 hp submersible with VFD controls
(example: 30 hp line shaft turbine)
Rated Capacity 400+ gpm

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Are pumps operable? | ☒ | ☐ | ☐ | ☐ |
| How frequently are pump(s) replaced? 2007 | | | ☐ | ☐ |
| Are backup pumps/motors provided? | ☐ | ☒ | ☐ | ☐ |
| Are controls functioning properly and adequately protected? | ☒ | ☐ | ☐ | ☐ |
| Do underground compartments have a drain? | ☐ | ☐ | ☐ | ☒ |
| Is facility properly protected against trespassing and vandalism? | ☒ | ☐ | ☐ | ☐ |
| Are pump records maintained (amp, drawdown, discharge, pressure, maintenance schedule, manuals, etc.)? | ☐ | ☒ | ☐ | ☐ |
| Is the plumbing adequately painted to prevent excessive corrosion? | ☐ | ☒ | ☐ | ☐ |
| Are adequate heating, lighting, and ventilation provided? | ☐ | ☒ | ☐ | ☐ |
| Is a preventive maintenance program in operation? | ☐ | ☐ | ☐ | ☐ |
| Are recommended spare parts on hand? | ☐ | ☒ | ☐ | ☐ |
| Cross connection protection provided? | ☐ | ☒ | ☐ | ☐ |

Explain Controls: _____

Comment: Well pump size was increased in 1994 to a 50 hp vertical turbine pump capable of producing arround 500 gpm. A new submersible 50 hp pump assembly was installed near the beginning of 2007 complete with VFD controls that is capable of producing slightly over 400 gpm. I have no idea why this system installed VFD controls on a system that operates with storage facility level.

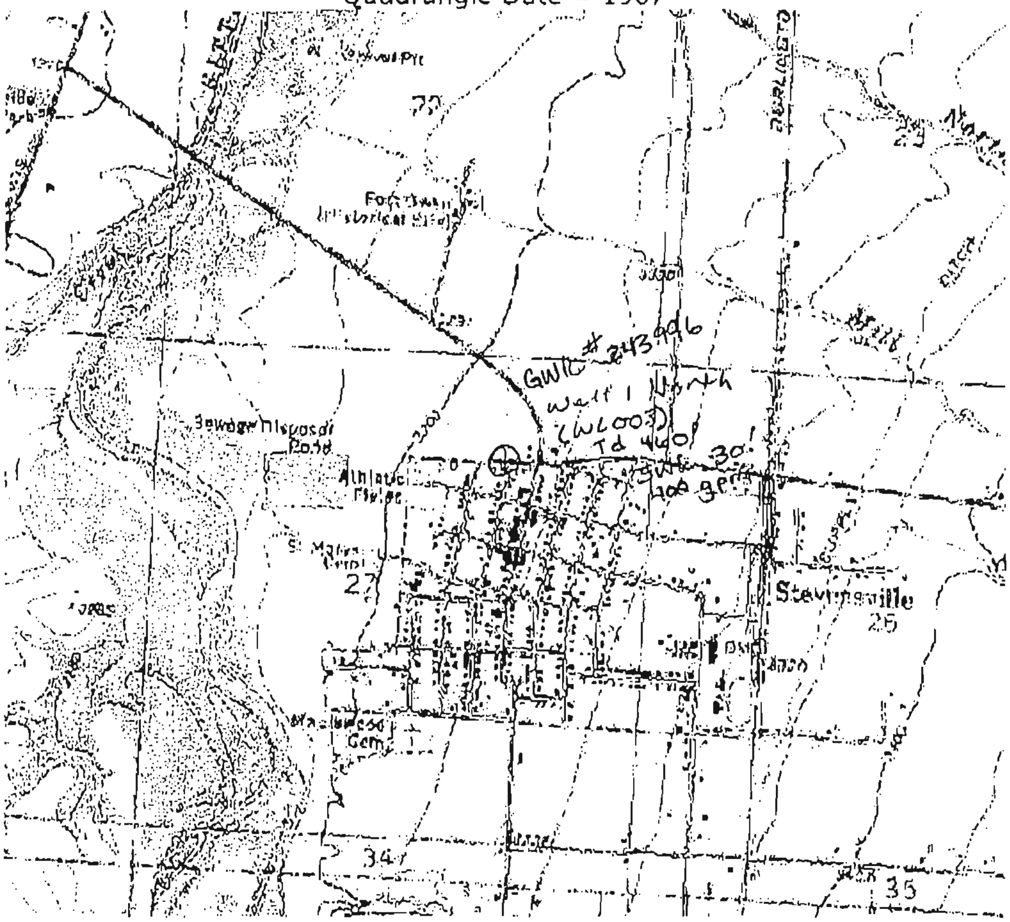
# Montana Topographic Map Finder

**The map is 1.86 miles wide.**

Choose Image Type

Topographic Map | Refresh

Quadrangle Date = 1967

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**Decimal Degr**
Lat 46.51245 Long

**State Plan**
E 247826 N 2

**UTM Zone 1**
E 722918 N 51

**US National G**
11T QM 22918 5

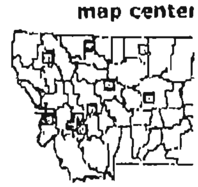
**TRS** T9N R20

**Hydrologic Unit**
Bitterroot Riv

**Download 24K quadrangle:**

**Download 100K quadrangle:**

**Click the small map to n map cente**



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**Legend | He**

**Map Size:** Extra Large | Large | Small | Refresh

Search Top

**Click Here to view other map data for this area.**

Montana Natural Resource Information System

Technical questions about the application can be directed to: nris@m
Please let us know if you have problems with the Topofinder!!

SDWES #WL003

| MONTANA WELL LOG REPORT | Other Options |
|---|---|
| This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report. | Plot this site on a topographic map<br>View scanned document (6/9/2008 7:07:20 PM) |

NOTICE >> This well deepens GWIC Id 50163. << NOTICE

**Site Name: CITY OF STEVENSVILLE**
**GWIC Id: 243996** well 1 north

### Section 1: Well Owner

**Owner Name**
CITY OF STEVENSVILLE
**Mailing Address**

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59870 |

### Section 2: Location

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 27 | SE¼ SE¼ NW¼ NE¼ |

| County | Geocode |
|---|---|
| RAVALLI | |

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.512452 | 114.094126 | TRS-SEC | NAD83 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| | | | |

| Addition | Block | Lot |
|---|---|---|
| | | |

### Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

### Section 4: Type of Work

Drilling Method: CHURN DRILL

### Section 5: Well Completion Date

Date well completed: Friday, March 01, 1957

### Section 6: Well Construction Details

**Borehole dimensions**

| From | To | Diameter |
|---|---|---|
| 117 | 412 | 10 |

**Casing**

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0 | 455 | 10 | | | WELDED | STEEL |

**Completion (Perf/Screen)**

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 362 | 370 | 10 | 16 | 1X3/8 | DRILLED HOLES |

**Annular Space (Seal/Grout/Packer)**

There are no annular space records assigned to this well.

### Section 7: Well Test Data

Total Depth: 460
Static Water Level: 30
Water Temperature:

**Air Test ***

400 gpm with drill stem set at 100 feet for 12 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level _ feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

### Section 9: Well Log

**Geologic Source**
Unassigned

| From | To | Description |
|---|---|---|
| 117 | 130 | CLAY AND SAND |
| 130 | 131 | GRAVEL AND SAND |
| 131 | 140 | CLAY AND SAND |
| 140 | 141 | GRAVEL SAND AND WATER |
| 141 | 150 | CLAY AND SAND |
| 150 | 164 | SAND SOME CLAY |
| 164 | 174 | SAND SMALL HEAVING GRAVEL |
| 174 | 178 | HARD CLAY AND GRIT |
| 178 | 190 | BROWN CLAY WITH GRIT |
| 190 | 219 | GRANITE SOME CLAY |
| 219 | 231 | CLAY MIXED WITH GRAVEL |
| 231 | 239 | GRAVEL SOME CLAY |
| 239 | 275 | CLAY WITH GRIT |
| 275 | 284 | GRANITE |
| 284 | 306 | CLAY WITH GRIT |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: GLENN CAMP
Company:
License No: WWC-7
Date Completed: 3/1/1957

Site Name: CITY OF STEVENSVILLE
GWIC Id: 243996
Additional Lithology Records

| From | To | Description |
|---|---|---|
| 305 | 314 | GRANITE |
| 314 | 319 | CLAY |
| 319 | 324 | GRANITE |
| 324 | 330 | SAND SMALL GRAVEL |
| 330 | 344 | SAND |
| 344 | 347 | PEAT |
| 347 | 350 | CLAY |
| 350 | 357 | CLAY |
| 357 | 370 | SAND WITH GRAVEL |
| 370 | 380 | CLAY |
| 380 | 389 | GRAVEL AND SAND |
| 389 | 412 | CLAY |
| 412 | 413 | GRANITE |
| 413 | 416 | CLAY |
| 416 | 417 | GRANITE |
| 417 | 427 | CLAY |
| 427 | 428 | MEALY SAND |
| 428 | 434 | GRANITE |
| 434 | 438 | CLAY AND SAND |
| 438 | 440 | SAND |
| 440 | 453 | GRANITE |
| 453 | 460 | CLAY SAND |
| 460 | 460 | CLAY AND SAND |

# SANITARY SURVEY FORM – WELLS & WELL PUMPS



PWSID MT0000335 | SYSTEM NAME **Stevensville, Town of**

*(Please copy this sheet for additional wells & pumps)*

**COMPLETE ONE PAGE FOR EACH SOURCE**

**STATUS OF SOURCE** ☒ (A)ctive ☐ (I)nactive ☐ (P)roposed

WSF ID WL004 *Entry Point ID* EP504
These are State assigned identification numbers

Source Name Well 2 South Ave Mission St.
Name of Source – Example: Well 1 or South well, etc

Location of Water Source (TRS or street address) 09N 20W sec27

*Entry Point Name* EP for Well 1 North
Name of EP – Example: Entry point for North Well 1 & South Well 2

*Location of Entry Point* EP @ WL004

Available ☒ Perm ☐ Emerg ☐ Interim ☐ Seasonal ☐ Other
If seasonal: ______ to ______

GWUDISW PA Completed ☒ Yes ☐ No

Log Available? ☒ Yes ☐ No

Average Production 220 gpm (indicate units)

Maximum Production 220 gpm (indicate units)

Date Drilled 2/13/1968 (if well.. date drilled)

Casing Size 8" (size of casing installed in well)

Case Depth 56' (depth of casing installed in well)

Well Depth 56' (depth of well expressed in feet)

Grout Depth unknown (depth of grout used to seal well walls)

Log SWL 30' (static) expressed in feet below ground elevation

Log PWL unknown (pumping) expressed in feet below ground elevation

Test Pump Rate 300 gpm for 3 hrs (expressed in gallons per min)

Intake Type holes (type of intake mechanism)

Screened Interval 36' to 56' (expressed in feet below ground elevation)

Well Yield tested at 300 gpm (pump tested in gallons per minute)

Latitude 46°30' 18"

Longitude 114°05' 46.7"

## WELLS

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is well metered? | ☐ | ☒ | ☐ | ☐ |
| Is well site protected from flooding? | ☐ | ☒ | ☐ | ☐ |
| Is well protected from potential sources of pollution (includes: surface water, known chemical spills, agricultural use, etc.)? | ☐ | ☒ | ☐ | ☐ |

If no . . explain Wellhead in vault is not protected from surrounding contaminants.

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Does casing extend at least | | | | |
| ☒18 inches above outside ground level; | ☐ | ☒ | ☐ | ☐ |
| ☒12 inches above finished floor inside well house; and | ☐ | ☒ | ☐ | ☐ |
| ☒3 feet above 100 year flood elevation? (Check for appropriate distance) | ☐ | ☐ | ☒ | ☐ |
| Is top of the well casing properly sealed? (sanitary seal) | ☒ | ☐ | ☐ | ☐ |
| Is well vented? | ☒ | ☐ | ☐ | ☐ |
| Is well vent properly screened and terminated in a downward position? | ☒ | ☐ | ☐ | ☐ |
| Does well have suitable sampling tap? Raw Water | ☒ | ☐ | ☐ | ☐ |
| Treated | ☐ | ☐ | ☐ | ☒ |
| Are check valves, blow-off valves and water meters maintained and operating properly? | ☒ | ☐ | ☐ | ☐ |
| Is upper termination of well protected (housed or fenced)? | ☐ | ☒ | ☐ | ☐ |
| Is intake located below the maximum drawdown? | ☐ | ☐ | ☒ | ☐ |

Comment: Wellhead is located in a vault with electrical components, wellhead and well vent outlet that are all below flood rim. The well vault is not adequately vented, poorly sealed and does not have a permanent ladder affixed to the wall.

## PUMPS

Type 20 hp submersible
(example: 30 hp line shaft turbine)
Rated Capacity 220 gpm

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Are pumps operable? | ☒ | ☐ | ☐ | ☐ |
| How frequently are pump(s) replaced? unknown | | | ☐ | ☐ |
| Are backup pumps/motors provided? | ☐ | ☒ | ☐ | ☐ |
| Are controls functioning properly and adequately protected? | ☐ | ☒ | ☐ | ☐ |
| Do underground compartments have a drain? | ☐ | ☒ | ☐ | ☐ |
| Is facility properly protected against trespassing and vandalism? | ☐ | ☒ | ☐ | ☐ |
| Are pump records maintained (amp, drawdown, discharge, pressure, maintenance schedule, manuals, etc.)? | ☐ | ☒ | ☐ | ☐ |
| Is the plumbing adequately painted to prevent excessive corrosion? | ☐ | ☒ | ☐ | ☐ |
| Are adequate heating, lighting, and ventilation provided? | ☐ | ☒ | ☐ | ☐ |
| Is a preventive maintenance program in operation? | ☐ | ☒ | ☐ | ☐ |
| Are recommended spare parts on hand? | ☐ | ☒ | ☐ | ☐ |
| Cross connection protection provided? | ☐ | ☒ | ☐ | ☐ |

Explain Controls: Storage facility water level triggers Well 2 operation.

Comment: Electrical controls in a vault that is dependent on a sump pump to eliminate water can not be considered adequately protected.

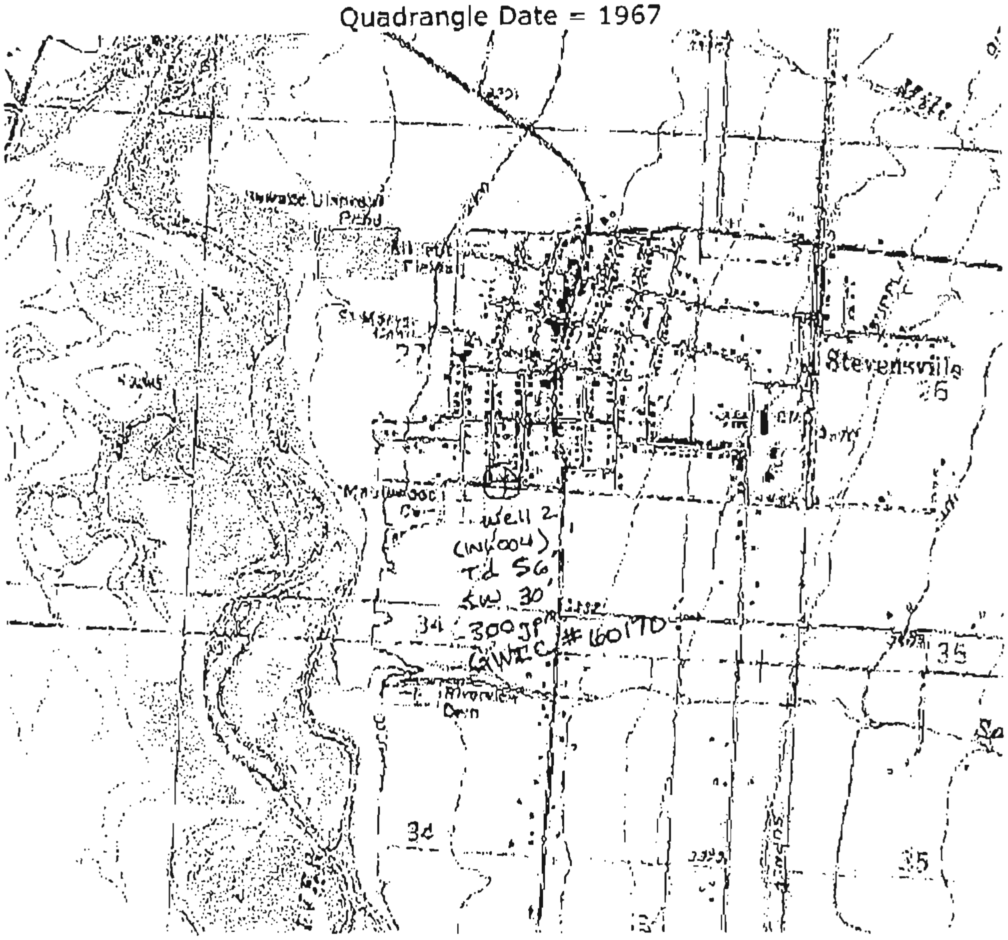
# Montana Topographic Map Finder

**The map is 1.86 miles wide.**

Choose Image Type

Topographic Map | Refresh

Quadrangle Date = 1967

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**Map Contr**

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Datum: NAD83

**Decimal Degr**

Lat 46.505 Long

**State Plan**

E 247726 N 2

**UTM Zone 1**

E 722903 N 51

**US National G**

11T QM 22903 5

**TRS** T9N R20

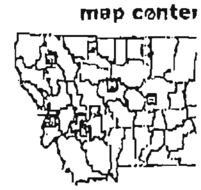
**Hydrologic Unit**

Bitterroot Riv

**Download 24K quadrangle:**

**Download 100K quadrangle:**

**Click the small map to n map cente**



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Legend | He

Search Top

**Map Size:** Extra Large Large Small Refresh

**Click Here to view other map data for this area.**

Montana Natural Resource Information System

Technical questions about the application can be directed to: nris@m
Please let us know if you have problems with the Topofinder!!

SDWIS #WL004

## MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

**Other Options**

Plot this site on a topographic map

View scanned document (6/9/2008 7:16:45 PM)

**Site Name:** CITY OF STEVENSVILLE - WELL ~~X~~ (MK)
**GWIC Id:** 60170
**DNRC Water Right:** P007286-00

Known as: Well 2
South Ave Mission St.

### Section 1: Well Owner

**Owner Name**
CITY OF STEVENSVILLE

**Mailing Address**

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59870 |

### Section 2: Location

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 27 | SE¼ SE¼ NW¼ SE¼ |

| County | Geocode |
|---|---|
| RAVALLI | |

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.505 | 114.0948 | MAP | NAD27 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| | | | |

| Addition | Block | Lot |
|---|---|---|
| | | |

### Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

### Section 4: Type of Work

Drilling Method: CHURN

### Section 5: Well Completion Date

Date well completed: Tuesday, February 13, 1968

### Section 6: Well Construction Details

**Borohole dimensions**

| From | To | Diameter |
|---|---|---|
| 0 | 56 | 8 |

**Casing**

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0 | 56 | 8 | | | | 32 LB STEEL |

**Completion (Perf/Screen)**

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 38 | 56 | 6 | | | 1/4 X 4 HOLES |

**Annular Space (Seal/Grout/Packer)**

There are no annular space records assigned to this well.

### Section 7: Well Test Data

Total Depth: 56
Static Water Level: 30
Water Temperature:

**Bailer Test ***

300 gpm with _ feet of drawdown after 3 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 36 feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

### Section 9: Well Log

**Geologic Source**
Unassigned

| From | To | Description |
|---|---|---|
| 0 | 1 | TOPSOIL |
| 1 | 10 | SAND GRAVEL |
| 10 | 29 | SAND GRAVEL LARGE GLACIAL BOULDERS TIGHT PRESSED |
| 29 | 56 | SAND GRAVEL LOOSE WB |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: RAVALLI DRILLING
License No: WWC-62
Date Completed: 2/13/1968

# SANITARY SURVEY FORM – WELLS & WELL PUMPS

PWSID MT0000335 | SYSTEM NAME Stevensville, Town of

*(Please copy this sheet for additional wells & pumps)*

**COMPLETE ONE PAGE FOR EACH SOURCE**

**STATUS OF SOURCE** ☒ (A)ctive ☐ (I)nactive ☐ (P)roposed

WSF ID WL005 *Entry Point ID* EP505
These are State assigned identification numbers

Source Name Well 3 South
Name of Source – Example: Well 1 or South well, etc.

Location of Water Source (TRS or street address) 09N 20W sec27

*Entry Point Name* EP for Well 2 South
Name of EP – Example: Entry point for North Well 1 & South Well 2

*Location of Entry Point* EP @ WL005

Available ☒ Perm ☐ Emerg ☐ Interim ☐ Seasonal ☐ Other
If seasonal: _____ to _____

GWUDISW PA Completed ☒ Yes ☐ No

Log Available? ☒ Yes ☐ No

Average Production 220 gpm (indicate units)

Maximum Production 220 gpm (indicate units)

Date Drilled 2/6/1976 (if well, date drilled)

Casing Size 6" (size of casing installed in well)

Case Depth 75' (depth of casing installed in well)

Well Depth 75' (depth of well expressed in feet)

Grout Depth 35' natural grout (depth of grout used to seal well walls)

Log SWL 29' ((static) expressed in feet below ground elevation)

Log PWL unknown ((pumping) expressed in feet below ground elevation)

Test Pump Rate 70 gpm for 1 hr (expressed in gallons per min)

Intake Type two sets of slots (type of intake mechanism)

Screened Interval 40' to 50' and 55' tp 75' (expressed in feet below ground elevation)

Well Yield tested at 70 gpm (pump tested in gallons per minute)

Latitude 46°30' 15.3"

Longitude 114°06' 47"

## WELLS

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is well metered? | ☐ | ☒ | ☐ | ☐ |
| Is well site protected from flooding? | ☐ | ☒ | ☐ | ☐ |
| Is well protected from potential sources of pollution (includes: surface water, known chemical spills, agricultural use, etc.)? | ☐ | ☒ | ☐ | ☐ |

If no . . explain Wellhead in vault is not protected from surrounding contaminants.

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Does casing extend at least ☒ 18 inches above outside ground level; | ☒ | ☐ | ☐ | ☐ |
| ☐ 12 inches above finished floor inside well house; and | ☐ | ☐ | ☐ | ☐ |
| ☒ 3 feet above 100 year flood elevation? (Check for appropriate distance) | ☐ | ☐ | ☒ | ☐ |
| Is top of the well casing properly sealed? (sanitary seal) | ☐ | ☒ | ☐ | ☐ |
| Is well vented? | ☒ | ☐ | ☐ | ☐ |
| Is well vent properly screened and terminated in a downward position? | ☒ | ☐ | ☐ | ☐ |
| Does well have suitable sampling tap? Raw Water | ☐ | ☒ | ☐ | ☐ |
| Treated | ☐ | ☐ | ☐ | ☒ |
| Are check valves, blow-off valves and water meters maintained and operating properly? | ☒ | ☐ | ☐ | ☐ |
| Is upper termination of well protected (housed or fenced)? | ☐ | ☒ | ☐ | ☐ |
| Is intake located below the maximum drawdown? | ☐ | ☐ | ☒ | ☐ |

Comment: Wel log shows this well was tested at 70 gpm but now has a submersible pump capable of producing 220 gpm. I did not find a capacity test supporting this increased pump size. Poorly vented control valve vault without a ladder permanently afixed to the wall. The valve vault has a noteable amount of garbage in the bottom. No security at the wellhead. Split style well cap is not a good sanitary seal for outdoor use.

## PUMPS

Type 20 hp submersible
(example: 30 hp line shaft turbine)
Rated Capacity 220 gpm

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Are pumps operable? | ☒ | ☐ | ☐ | ☐ |
| How frequently are pump(s) replaced? unknown | | | ☐ | ☐ |
| Are backup pumps/motors provided? | ☐ | ☒ | ☐ | ☐ |
| Are controls functioning properly and adequately protected? | ☐ | ☒ | ☐ | ☐ |
| Do underground compartments have a drain? | ☐ | ☒ | ☐ | ☐ |
| Is facility properly protected against trespassing and vandalism? | ☐ | ☒ | ☐ | ☐ |
| Are pump records maintained (amp, drawdown, discharge, pressure, maintenance schedule, manuals, etc.)? | ☐ | ☒ | ☐ | ☐ |
| Is the plumbing adequately painted to prevent excessive corrosion? | ☐ | ☒ | ☐ | ☐ |
| Are adequate heating, lighting, and ventilation provided? | ☐ | ☒ | ☐ | ☐ |
| Is a preventive maintenance program in operation? | ☐ | ☒ | ☐ | ☐ |
| Are recommended spare parts on hand? | ☐ | ☒ | ☐ | ☐ |
| Cross connection protection provided? | ☐ | ☒ | ☐ | ☐ |

Explain Controls: _____

Comment: Pump controls are currently operating adequately but are located on a post next to the control vault and is not protected from vandalism.

**MONTANA WELL LOG REPORT**

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**Other Options**

Plot this site on a topographic map
View scanned document (6/9/2008 7:17:10 PM)

**Site Name:** CITY OF STEVENSVILLE - WELL X
**GWIC Id:** 60172
**DNRC Water Right:** P009186-00 MR
Known as: Well 3 South

**Section 1: Well Owner**

Owner Name
CITY OF STEVENSVILLE
Mailing Address

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59870 |

**Section 2: Location**

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 27 | NW¼ NE¼ SW¼ SE¼ |

County: RAVALLI
Geocode:

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.5044 | 114.0948 | MAP | NAD27 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| 3322 | | | |

Addition | Block | Lot

**Section 3: Proposed Use of Water**
PUBLIC WATER SUPPLY (1)

**Section 4: Type of Work**
Drilling Method: CABLE

**Section 5: Well Completion Date**
Date well completed: Friday, February 06, 1976

**Section 6: Well Construction Details**

Borehole dimensions

| From | To | Diameter |
|---|---|---|
| 0 | 75 | 8 |

Casing

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0 | 75 | 8 | | | | 24 LB STEEL |

Completion (Perf/Screen)

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 40 | 50 | 8 | | | 3/8 IN SLOTS |
| 55 | 75 | 8 | | 5 IN | SLOTS |

Annular Space (Seal/Grout/Packer)

| From | To | Description | Cont. Fed? |
|---|---|---|---|
| 0 | 35 | NATURAL | |

**Section 7: Well Test Data**

Total Depth: 75
Static Water Level: 29
Water Temperature:

**Bailer Test ***

70 gpm with _ feet of drawdown after 1 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 30 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

**Section 8: Remarks**
3 FT GRAVEL PACK

**Section 9: Well Log**

**Geologic Source**
110ALVM - ALLUVIUM (QUATERNARY)

| From | To | Description |
|---|---|---|
| 0 | 3 | TOPSOIL |
| 3 | 26 | SAND GRAVEL BOULDERS BROWN |
| 26 | 51 | SAND & GRAVEL WB BROWN |
| 51 | 60 | CLAY & GRAVEL |
| 60 | 75 | SAND & GRAVEL WB BROWN |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: RAVALLI DRILLING
License No: WWC-62
Date Completed: 2/6/1976

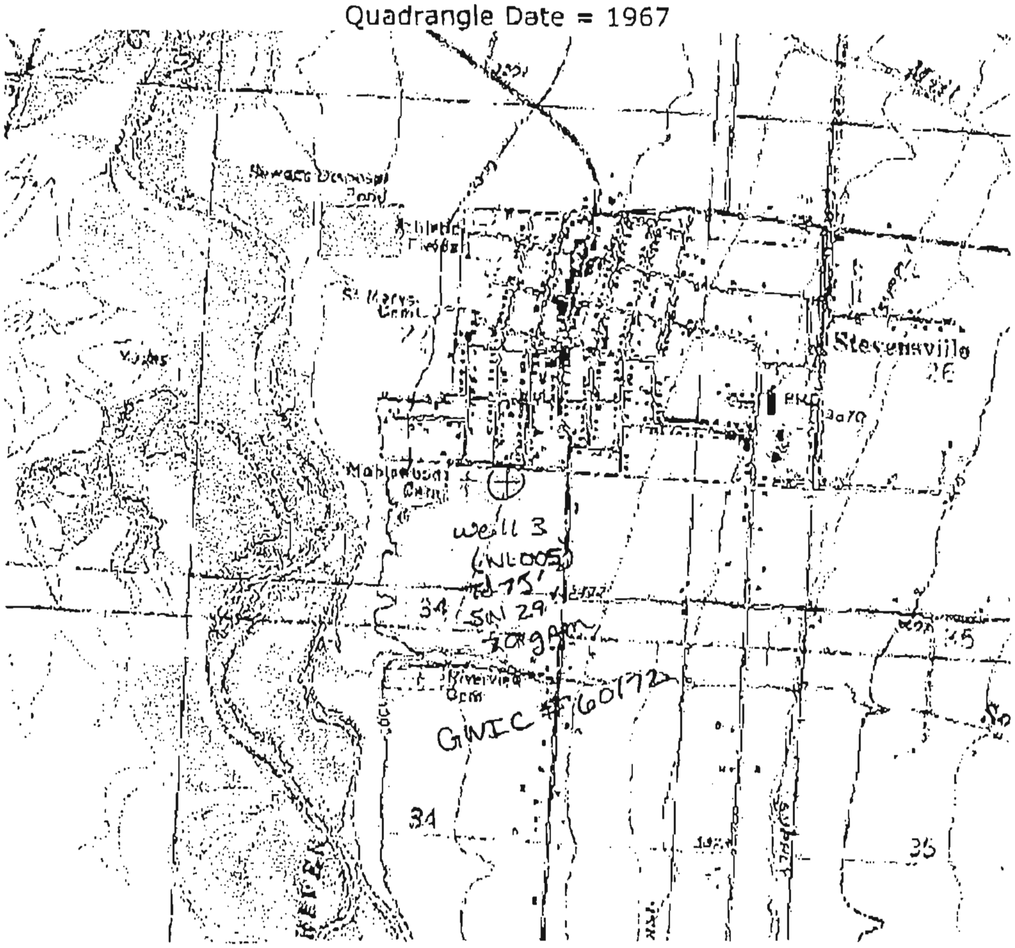
# Montana Topographic Map Finder

**The map is 1.86 miles wide.**

Choose Image Type

Topographic Map | Refresh

Quadrangle Date = 1967




Select a Map Co…
then click on the…

**Map Contr…**

(•) ZoomIn
( ) ZoomOut
( ) New Center

Zoom … 3

Sta…

**Map Center Coor…**
**at Red +**

Datum: NAD83

**Decimal Degr…**
Lat 46.5044 Long

**State Plan…**
E 247722 N 2…

**UTM Zone 1…**
E 722905 N 51…

**US National G…**
11T QM 22905 5…

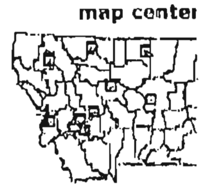
**TRS** T9N R20…

**Hydrologic Unit:**
Bitterroot Riv…

**Download 24K quadrangle:**

**Download 100K quadrangle:**

**Click the small map to n… map center**



**Green squares show are… hi-resolution color p… available.**

Legend | He…

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**Map Size:** ( ) Extra Large ( ) Large (•) Small Refresh

**Click Here to view other map data for this area.**

Montana Natural Resource Information System

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# SANITARY SURVEY FORM - SURFACE WATER, SPRINGS & INFILTRATION GALLERIES

PWSID **MT0000335** | SYSTEM NAME **Stevensville, Town of**

**SOURCES** | **STATUS OF SOURCE** ☒ (A)ctive ☐ (I)nactive ☐ (P)roposed

WSF ID IN002 — *Entry Point ID* EP502
These are State assigned identification numbers

Source Name intake North Swamp Creek and Mill Creek
Name of Source - Example: Well 1 or South well, etc.

Location of Water Source (TRS or street address) **09N 19W sec31**

*Entry Point Name* EP for North Swamp Creek and Mill Creek
Name of EP - Example: Entry point for North Well 1 & South Well 2

*Location of Entry Point* EP @ TP001

Available ☒ Perm ☐ Emerg ☐ Interim ☐ Seasonal ☐ Other
If seasonal: ______ to ______

GWUDISW PA Completed? ☒ Yes ☐ No ☐ Unk ☐ N/A

Average Production varies
Indicate units

Maximum Production +-800 gpm TP001 maximum output.
Indicate units

Latitude 46°29' 58.8"
Longitude 114°02' 23.4"

## SURFACE SOURCES

What is the nature of watershed?

☐ Agricultural
☐ Industrial
☐ Forest
☐ Residential
☒ Other Hay field

Name North Swamp Creek and Mill Creek intake

What is the size of the owned/protected area of the watershed? 26 acres

How is watershed controlled?
☒ Ownership
☐ Ordinances
☐ Zoning
☐ Other _____

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Has a source water protection plan been developed? | ☐ | ☒ | ☐ | ☐ |
| Has management had a watershed survey performed? | ☐ | ☒ | ☐ | ☐ |
| Is there an emergency spill response plan? | ☐ | ☒ | ☐ | ☐ |
| Is the source adequate in quantity? | ☒ | ☐ | ☐ | ☐ |
| Is the source adequate in quality? | ☒ | ☐ | ☐ | ☐ |
| Is the intake protected from sources of contamination? | ☐ | ☒ | ☐ | ☐ |
| Are multiple intakes, located at different levels, utilized? | ☐ | ☒ | ☐ | ☐ |
| Is the highest quality water being drawn? | ☒ | ☐ | ☐ | ☐ |
| Can the raw water transmission line bypass treatment? | ☐ | ☒ | ☐ | ☐ |

How often are intakes inspected? as needed

What conditions cause fluctuations in quality? Runoff and large rain events.

Comment: A series of shallow buried laterals located in a 26 acre hay field diverts water from North Swamp Creek and Mill Creek vicinity to concrete caissons and then piped to the surface water treatment plant. High ground water levels prevents much in terms of construction in this area.

## SPRINGS & INFILTRATION GALLERIES

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is recharge area protected? | ☒ | ☐ | ☐ | ☐ |

If Yes, how? 26 acre ownership

☒ Ownership
☐ Fencing
☐ Ordinances
☐ Other _____

What is the nature of recharge zones? ☐ ☐

☐ Agricultural
☐ Industrial
☐ Forest
☐ Residential
☒ Other Hay field

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is site protected from flooding? | ☐ | ☒ | ☐ | ☐ |
| Is there diversion of surface drainage from site? | ☐ | ☒ | ☐ | ☐ |
| Is collection chamber properly constructed? | ☐ | ☐ | ☒ | ☐ |
| Does hatch cover overlap? | ☒ | ☐ | ☐ | ☐ |
| Is the overflow outlet screened? | ☐ | ☐ | ☒ | ☐ |
| Vented and screened? | ☐ | ☐ | ☒ | ☐ |
| Is supply intake adequate? | ☒ | ☒ | ☐ | ☐ |
| Is site properly protected (from livestock, vandalism, tampering, etc)? | ☐ | ☒ | ☐ | ☐ |

What conditions cause changes to quality of the water? runoff and large rain events

Comment: This intake is more of a infiltration gallary and is highly susceptable to area water level fluctuations. The intake is generally acceptable, with the exception of during runoff and heavy rains.

# SANITARY SURVEY FORM - TREATMENT



PWSID **MT0000335**

SYSTEM NAME **Stevensville, Town of**

***Treatment Objective***

- **B** = Disinfection Byproduct Control
- **C** = Corrosion Control
- **D** = Disinfection
- **E** = Dechlorination
- **F** = Iron Removal
- **I** = Inorganics Removal
- **M** = Manganese Removal
- **N** = *No Treatment at Source*
- **O** = Organics Removal
- **P** = Particulate Removal
- **R** = Radionuclides Removal
- **S** = Softening (Hardness Removal)
- **T** = Taste / Odor Control
- **Z** = Other _____

***WATER TREATMENT FACILITIES***

| WSF ID | Treatment Plant Name | Treatment Objectives and Code | | |
|---|---|---|---|---|
| ____ | ____ | ____ | ____ | ____ |
| TP001 | TP for North Swamp Creek and Mill Creek | P240 | P345 | P660 |
| ____ | ____ | DD401 | C445 | ____ |
| TP002 | TP for well 1 | C445 | ____ | ____ |
| ____ | ____ | ____ | ____ | ____ |
| ____ | ____ | ____ | ____ | ____ |

| WSF ID | Location | |
|---|---|---|
| ____ | Latitude ____° ____' ____" | Longitude ____° ____' ____" |
| TP001 | Latitude 46°30' 03.2" | Longitude 114°02' 45.6" |
| TP002 | Latitude 46°30' 44.3" | Longitude 114°05' 33" |
| ____ | Latitude ____° ____' ____" | Longitude ____° ____' ____" |
| ____ | Latitude ____° ____' ____" | Longitude ____° ____' ____" |

Treatment plant description: There are potentially two points of gas chlorine injection @ TP001 (1. Between alum injection and sand filter 2. After sand filter). Chlorine level monitoring point is located after storagein a poorly vented vault that has high ground water. The vault i s approximately 180 feet from the monitoring equipment and air lock has been an issue on the monitoring pump. Chlorine injection point immediately after alum injection is rarely used. The gas chlorination room remains substandard in terms that is does not have a panic bar on the door, excessive rust, inadequate ventilation and no scale under the tanks. PLANT: Raw water basin to alum (Aqua Hawk 2757) feeder to static mixer to optional gas chlorine injection point (not currently used) single sand filter to gas chlorination to orthophosphate injection to monitoring point to automatic bypass (If turbidity exceeds 0.30 NTU) to storage to chlorine monitoring vault to distribution. There is no line in place that can bypass TP001. See attached schematic.

***FOR SYSTEMS EMPLOYING FULL-TIME DISINFECTION***

What disinfectant is used? gas chlorine

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is the disinfectant used NSF approved? | ☒ | ☐ | ☐ | ☐ |
| Is the amount of disinfectant used recorded? If Yes, amount used: ______lbs/day ______ ppm ______ other (give units) | ☐ | ☒ | ☐ | ☐ |
| Is the amount of disinfectant used compared to water pumped to verify concentration? | ☐ | ☒ | ☐ | ☐ |
| Is chemical storage adequate and safe? If No, explain _____ | ☒ | ☐ | ☐ | ☐ |
| Is disinfectant residual being monitored daily? | ☒ | ☐ | ☐ | ☐ |
| Are residual reports submitted monthly? | ☒ | ☐ | ☐ | ☐ |
| Is the disinfection equipment being operated and maintained properly? | ☒ | ☐ | ☐ | ☐ |
| Is operational standby equipment provided? | ☐ | ☒ | ☐ | ☐ |
| If not, are critical spare parts on hand? | ☒ | ☐ | ☐ | ☐ |
| Has disinfection system been free from failure during the past year – no interruption? | ☐ | ☒ | ☐ | ☐ |

If No, give dates of interruptions No dates given. Booster chlorine pump in the vault immediately after storage has failed in the past. This same pump tends to air lock.

Describe provisions for providing contact time between disinfection point and the first point of use: The 500,000 gallon storage facility is located immediately after chlorine injection and approximately miles of line to get to Stevensville.

***IF USING GAS CHLORINATION***

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is a manifold provided to allow feeding gas from more than one cylinder? | ☒ | ☐ | ☐ | ☐ |
| Is there automatic switchover from cylinder to cylinder? | ☒ | ☐ | ☐ | ☐ |
| Are scales provided for weighing of containers? | ☐ | ☒ | ☐ | ☐ |
| Are chlorine storage and use areas isolated from other work areas? | ☒ | ☐ | ☐ | ☐ |
| Are stored cylinders capped and labeled? | ☒ | ☐ | ☐ | ☐ |
| Is room vented to the outdoors with suction located no more than 6 inches above the floor level? | ☐ | ☒ | ☐ | ☐ |
| Is vent inlet near the ceiling? | ☐ | ☒ | ☐ | ☐ |
| Is room containing chlorination treatment labeled sufficiently (DANGER signs, etc.)? | ☐ | ☒ | ☐ | ☐ |
| Is a view port provided into the room storing chlorine? | ☒ | ☐ | ☐ | ☐ |
| Is a means of leak detection provided? Type? ammonia | ☒ | ☐ | ☐ | ☐ |
| Is a self-contained breathing apparatus available for use during repair of leaks? Where? Main TP control room. | ☒ | ☐ | ☐ | ☐ |
| Are personnel trained to use apparatus? | ☒ | ☐ | ☐ | ☐ |
| Are all doors hinged outward and equipped with panic bars? | ☐ | ☒ | ☐ | ☐ |
| Are all gas cylinders restrained near the top and about half way down by chaining to wall or by other means? | ☒ | ☐ | ☐ | ☐ |

Comment: Outlet vent was near the floor but did not open properly and is currently inadequate. Chlorine gas has eaten the bottom of the metal door. No panic bar on the door. Not scale under the chlorine tanks currently in use. Chlorine room inlet vent is low and in the door. The surface water source is required to treat water and meet CT for disinfection while existing wells do not currently disinfect. DEQ rules also require disinfection after treatment and Well 1 treats with orthophosphate without disinfection.

# SANITARY SURVEY FORM - SURFACE WATER TREATMENT PLANTS
## (Direct and Conventional and other)



PWSID MT0000335

SYSTEM NAME Stevensville, Town of
Latitude 46°30' 03.2"  Longitude 114°02' 45.6"

Type: ☐Direct ☐In-Line ☒Conventional ☐CAC ☐Other (describe) _____

Peak instantaneous flow experienced: plant capacity is approximately 800gpm

| | Chemicals Added | Points of Application | Purpose | Feed Rate (range) |
|---|---|---|---|---|
| 1) | AquaHawk 2757 (alum) | TP001 EP | coagulation | _____ |
| 2) | orthophosphate | TP001 outlet | inhibiter | _____ |
| 3) | gas chlorine | TP001 outlet | disinfection | _____ |
| 4) | _____ | _____ | _____ | _____ |
| 5) | _____ | _____ | _____ | _____ |

How are process control decisions made? Turbidity and chlorine residual levels. Anticipation of high turbidities correlate with spring runoff, heavy rains and other large events and the plant is not used during these periods.

**Describe the following unit processes:**

Rapid Mix: AquaHawk 2757 (alum) has a rapid mixer immediately after injection.

Flocculation:

Theoretical hydraulic detention time:_____Min

Tapered? ☐ Yes ☐ No

Description: _____

Sedimentation:

Surface overflow rate: unknown gpm/ft$^2$

Description: Sedimentation basin at TP001 inlet. Excess water to waste.

Filters:

Type: ☒Rapid Sand ☐Dual Media ☐Multi-media ☐Other (describe) _____

Depth of Media: 7" sand over 5" pea gravel

Surface wash? ☒ Yes ☐ No  If Yes, type: travelling bridge backwash

Air scour? ☐ Yes ☐ No

Disinfection

Log inactivation credit granted: unknown log

Inactivation required: _____log

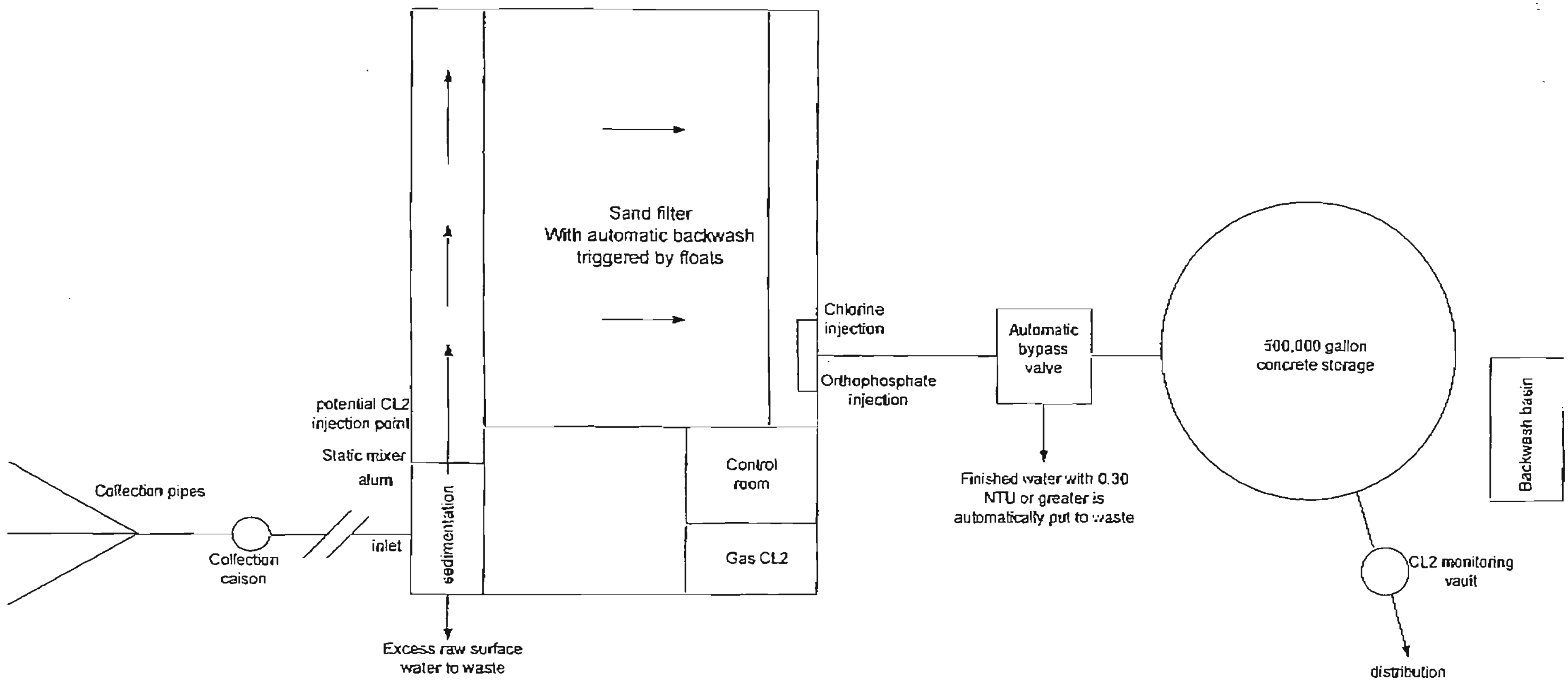
Total reduction: _____log

Is CT adequate under all conditions of flow, temperature and pH? ☐ Yes ☐ No ☒ Unk

Explain: Conditions vary and if the turbidity runs too high the plant is not used.

Comments on process control and finished water quality: There is a 2,200 gallon sedimentation basin at the inlet to TP001 to catch sand, silt, etc.. Surplus water runs over a concrete wall and to a nearby creek drainage. The pipe outlet to the creek was not found and the presence of a screen or flapper cover was not determined.

If a CPE is needed, please comment:_____



Collection pipes
Collection caison
inlet
Static mixer
alum
potential CL2 injection point
sedimentation
Excess raw surface water to waste
Sand filter
With automatic backwash triggered by floats
Control room
Gas CL2
Chlorine injection
Orthophosphate injection
Automatic bypass valve
Finished water with 0.30 NTU or greater is automatically put to waste
500,000 gallon concrete storage
Backwash basin
CL2 monitoring vault
distribution

# SANITARY SURVEY FORM - STORAGE

PWSID MT0000335 | SYSTEM NAME Stevensville, Town of

## COMPLETE ONE SECTION FOR EACH STORAGE FACILITY

Total storage provided? 500,000 gallons | How much treated storage is provided 500,000 gallons | Storage provides 1.5 days days of water reserve

### *STORAGE FACILITY*

WSF ID ST001

Location: Description +- 3 miles east of Stevensville
Latitude: 46°30' 02.9" Longitude: 114°02' 44.9"

Storage Volume? 500,000 gallons
Year constructed: unknown
Condition: ☐ Good ☒ Fair ☐ Poor

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Does surface runoff and underground drainage drain away? | ☐ | ☐ | ☒ | ☐ |
| Is the site protected against flooding? | ☐ | ☒ | ☐ | ☐ |
| Is the site protected against trespass/vandalism? | ☒ | ☐ | ☐ | ☐ |
| Ladders caged and locked? | ☐ | ☐ | ☐ | ☒ |
| Are overflow lines, air vents, drainage lines or clean out pipes turned downward or covered, screened and terminated a minimum of 3 diameters above the ground or storage tank surface? | ☐ | ☐ | ☒ | ☐ |
| Overflow pad? | ☐ | ☐ | ☒ | ☐ |
| Is access hatch sealed properly and locked? | ☐ | ☐ | ☐ | ☐ |
| Are surface coatings in contact with water ANSI / NSF approved? | ☐ | ☐ | ☐ | ☐ |
| Is tank protected against icing and corrosion? | ☒ | ☐ | ☐ | ☐ |
| Can tank be isolated from system? | ☐ | ☐ | ☐ | ☐ |
| Is all treated water storage covered? | ☒ | ☐ | ☐ | ☐ |
| Are tanks disinfected after repairs are made? | ☒ | ☐ | ☐ | ☐ |

What is cleaning frequency for tanks? Last cleaned in 2004

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is tank inspected every 5 years by a structural engineer for structural integrity? | ☐ | ☒ | ☐ | ☐ |

____ Date of last inspection    ____ By whom

Comments: Pre-stressed concrete panels were installed on ST001 in 1978. Not sure what the sealant material is or if it's NSF approved. The roof sealant is in need of replacement or repair. There are large cracks and missing chunks in the roof sealant. The concrete tank is partially buried and is likely sitting in high ground water based on the GW level in the nearby vault. Operator isn't sure where the overflow outlet is located. The overflow would probably never be used because it appears the storage tanks flood rim is higher than the treatment plant filter bed. This eliminates overflowing the storage to remove material from the top of the water surface.

### *STORAGE FACILITY*

WSF ID ____

Location: Description ____
Latitude: ____°____'____" Longitude: ____°____'____"

Storage Volume? ____ gallons
Year constructed: ____
Condition: ☐ Good ☐ Fair ☐ Poor

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Does surface runoff and underground drainage drain away? | ☐ | ☐ | ☐ | ☐ |
| Is the site protected against flooding? | ☐ | ☐ | ☐ | ☐ |
| Is the site protected against trespass/vandalism? | ☐ | ☐ | ☐ | ☐ |
| Ladders caged and locked? | ☐ | ☐ | ☐ | ☐ |
| Are overflow lines, air vents, drainage lines or clean out pipes turned downward or covered, screened and terminated a minimum of 3 diameters above the ground or storage tank surface? | ☐ | ☐ | ☐ | ☐ |
| Overflow pad? | ☐ | ☐ | ☐ | ☐ |
| Is access hatch sealed properly and locked? | ☐ | ☐ | ☐ | ☐ |
| Are surface coatings in contact with water ANSI / NSF approved? | ☐ | ☐ | ☐ | ☐ |
| Is tank protected against icing and corrosion? | ☐ | ☐ | ☐ | ☐ |
| Can tank be isolated from system? | ☐ | ☐ | ☐ | ☐ |
| Is all treated water storage covered? | ☐ | ☐ | ☐ | ☐ |
| Are tanks disinfected after repairs are made? | ☐ | ☐ | ☐ | ☐ |

What is cleaning frequency for tanks? ____

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Is tank inspected every 5 years by a structural engineer for structural integrity? | ☐ | ☐ | ☐ | ☐ |

____ Date of last inspection    ____ By whom

Comments: ____

# SANITARY SURVEY FORM - MISCELLANEOUS

PWSID **MT0000335** | SYSTEM NAME **Stevensville, Town of**

## *DISTRIBUTION SYSTEM EVALUATION*

Distribution description DS001- Ductile Iron and PVC

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| System drawings available? | ☒ | ☐ | ☐ | ☐ |
| Accurate As-Built drawing(s) on-site? | ☒ | ☐ | ☐ | ☐ |
| Lines adequately sized? | ☐ | ☐ | ☒ | ☐ |
| Adequate pressure maintained? | ☒ | ☐ | ☐ | ☐ |
| Mains protected from freezing? | ☒ | ☐ | ☐ | ☐ |
| Distribution system free of leaks? | ☐ | ☒ | ☐ | ☐ |
| Asbestos concrete pipe used? | ☐ | ☒ | ☐ | ☐ |
| Fire hydrants? | ☒ | ☐ | ☐ | ☐ |
| Dead end lines minimized by looping mains? | ☐ | ☐ | ☐ | ☐ |
| Flushing program? | ☒ | ☐ | ☐ | ☐ |
| Pressure reducing stations? Number _____ | ☐ | ☒ | ☐ | ☐ |
| Booster stations? Number _____ | ☐ | ☒ | ☐ | ☐ |
| Are individual booster pumps on any service lines? (see DEQ-1 8.9.2) | ☐ | ☒ | ☐ | ☐ |
| Were cross connections observed? | ☐ | ☐ | | |

Comments: Potential cross connections include well 1 to irrigation with only an inline double check valve, bypass outlet, storage tank overflow outlet, excess raw water outlet.

## *SAFETY*

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| **Were confined spaces observed?** | ☒ | ☐ | ☐ | ☐ |

Describe any confined spaces observed Well 2 vault, well 3 control vault, chlorine monitoring vault near the storage facility, storage facilty and substandard chlorine treatment room.

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Confined space safety adequate? | ☐ | ☒ | ☐ | ☐ |
| Fall risks adequately mitigated? | ☐ | ☒ | ☐ | ☐ |

Note all safety deficiencies (consider items such as ladders, tank supports, guards on rotating electrical equipment, lightning protection for pumps, etc.) No permanent ladder in well 2 vault or well 3 control vault. Sump pumps in vaults to remove high ground water. The TP001 gas chlorine room does not meet standards and poses enclosed space concerns.

## *MONITORING AND RECORDKEEPING EVALUATION*

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Does the system have a current Monitoring Schedule? | ☒ | ☐ | ☐ | ☐ |
| Bacti monitoring records maintained? (5 years) | ☒ | ☐ | ☐ | ☐ |
| Bacti Sample Site Plan submitted? | ☒ | ☐ | ☐ | ☐ |
| Familiar with repeat sampling? | ☒ | ☐ | ☐ | ☐ |
| Chemical monitoring records maintained? (10 years) | ☒ | ☐ | ☐ | ☐ |
| System specific records / plans maintained? (DBP, PB/CU, treatments, waivers, violations, etc.) | ☒ | ☐ | ☐ | ☐ |
| Familiar with Public Notice requirements? | ☒ | ☐ | ☐ | ☐ |
| Did Surveyor take a bacteriological sample? | ☐ | ☒ | | |

If Yes, date of Sample: _____ Time of Sample: _____

Comments: Record keeping appears adequate at this time. LT1/LT2 and GWR will have major issues for the system and management to address that could prove to costly.

## *MANAGEMENT*

| | Yes | No | Unk | N/A |
|---|---|---|---|---|
| Are there sufficient personnel? | ☒ | ☐ | ☐ | ☐ |
| Are operators properly certified? | ☒ | ☐ | ☐ | ☐ |
| Are personnel adequately trained? | ☒ | ☐ | ☐ | ☐ |
| Is there a current O&M manual on-site? | ☒ | ☐ | ☐ | ☐ |
| Is an emergency plan on-site and workable? | ☒ | ☐ | ☐ | ☐ |
| Has system addressed concerns from previous sanitary survey(s) or technical visit(s)? | ☐ | ☒ | ☐ | ☐ |
| Budget exists? | ☒ | ☐ | ☐ | ☐ |
| Does system maintain an emergency fund? | ☐ | ☒ | ☐ | ☐ |
| Does system contribute to facility replacement fund? | ☒ | ☐ | ☐ | ☐ |
| Are abandoned wells present? | ☒ | ☐ | ☐ | ☐ |
| Do abandoned wells appear to be properly abandoned? (see ARM 36.21.670) | ☐ | ☒ | ☐ | ☐ |

Comments: Very few items from previous sanitary survey have been addressed.

PWSID MT0000335 | SYSTEM NAME Stevensville, Town of

The State, or an authorized agent, must conduct sanitary surveys for all public water supply systems in Montana. DEQ believes that periodic sanitary surveys, along with appropriate corrective actions, are indispensable for assuring the long-term quality and safety of drinking water. When properly conducted, sanitary surveys can provide important information on a water system's design and operations and can identify minor and significant deficiencies for correction before they become major problems.

Minor deficiencies do not pose serious health threats. However, corrective action of minor deficiencies can be critical in the long-term operation and safety of a public water system. Minor deficiencies are generally described as suggested or recommended corrections in the letter to system owner(s).

Significant deficiencies can be defined as a defective water supply component(s) having or likely to have an adverse influence on public health. Significant deficiencies require immediate corrective action in efforts to protect consumers.

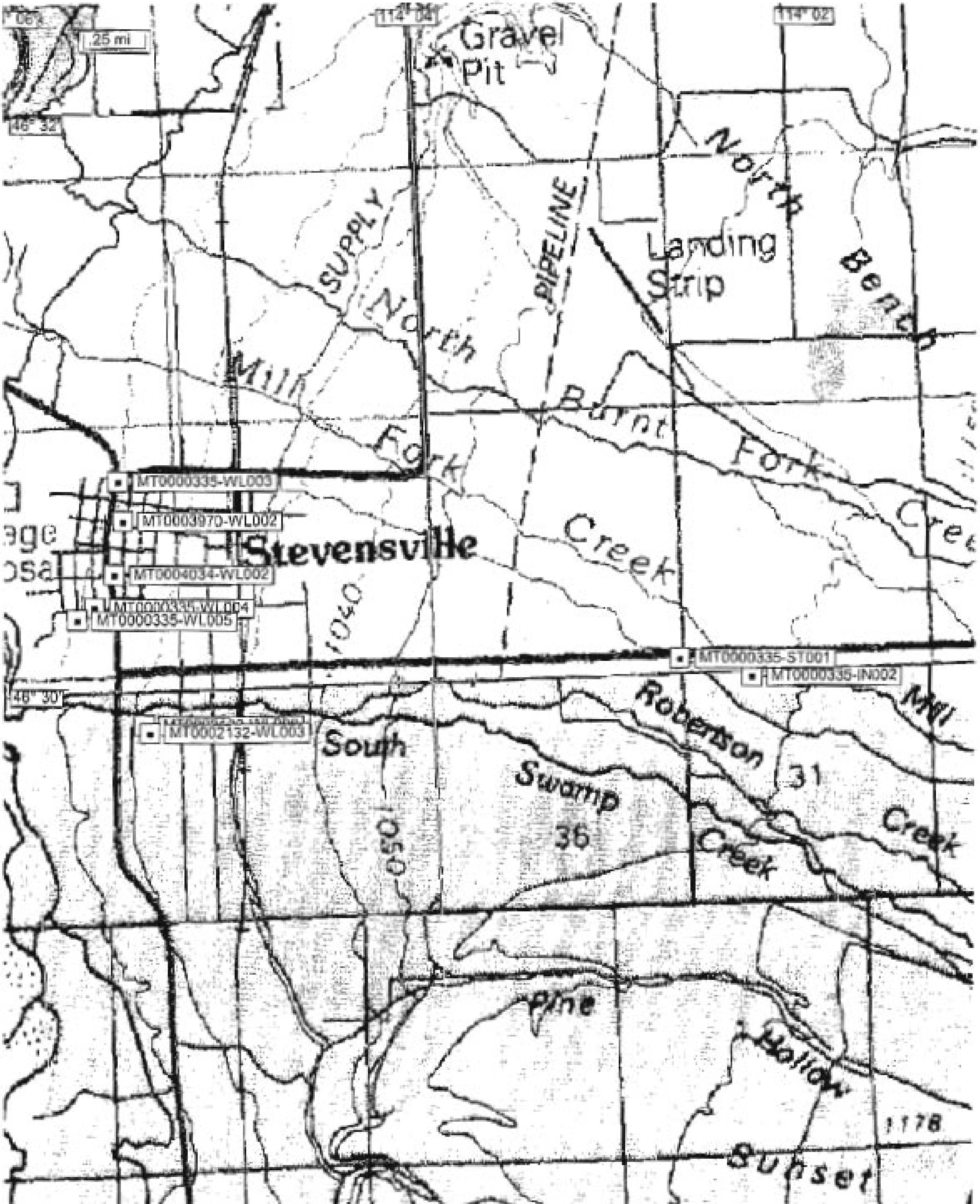
EPA and ASDWA guidance identifies eight broad components that should be covered in a sanitary survey. Using these eight broad components as a guide, minor and significant deficiencies should be described in the letter to system owner(s).

1) Source
2) Treatment
3) Distribution system
4) Finished water storage
5) Pumps, pump facilities, and controls
6) Monitoring and reporting, and data verification
7) System management and operation
8) Operator compliance with State requirements

With consideration that significant deficiencies may influence regulatory decisions and monitoring requirements, please list all significant deficiencies observed and corrective action(s) taken below.

Comments: ____

*** Required full time disinfection of what is considered a surface water source means all sources must disinfect to maintain adequate residual in distribution. The three ground water wells currently do not disinfect. LT1, LT2 and the upcoming GWR reaffirm the need for treatment. The GWR (Dec. 2009) may eventually require 4 log removal of viruses prior to the entry point of each of the ground water well if they are determined to be highly susceptable. (Please consider: Well 2 is located in a vault, has intake holes that begin at 36' and a total depth of 56'. Well 3 has intake holes beginning at 40' and a total depth of 75'. Both these sources are in unconfined aquifers composed primarily of gravel, boulders and sand. Well 1 is significantly deeper, but injects orthophosphate without subsequent disinfection.)**



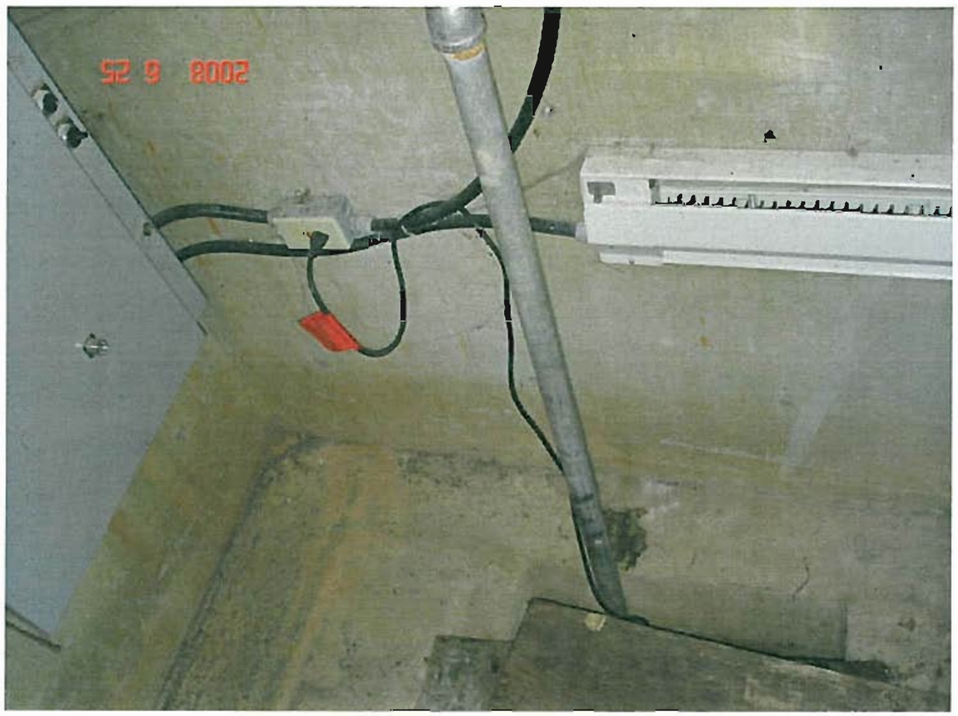
114° 04'
114° 02'
.25 mi
46° 32'
46° 30'
Gravel Pit
SUPPLY
PIPELINE
North
Landing Strip
North Bench
North
Mill
Fork
Burnt
Fork
Creek
Creek
Stevensville
MT0000335-WL003
MT0003970-WL002
MT0004034-WL002
MT0000335-WL004
MT0000335-WL005
MT0000335-ST001
MT0000335-IN002
MT0002132-WL003
1040
South
Swamp
36
Creek
Robertson
31
Mill
Creek
1050
Pine
Hollow
1178
Sunset

STEVENSVILLE, TOWN OF PWSID #MT0000335

Operator: George Thomas

inspected 6/25/2008 by Mike Kropp, DEQ PWS


Top left: Well 2 (WL004) is located on the corner of Mission Street and South Avenue. The wellhead is in the locked vault shown in this picture.



Lower left: The control panel, heater and wall outlet are some of electrical components located in the vault. High water levels inside the vault is reduced through use of a sump pump that draws from a depression in the floor. The sump pump is plugged into a wall outlet located in the vault a few feet above the floor level. So if water rose faster than the sump pump capacity, the vault would flood and shut the breakers off to all electrical components (including the sump pump).



The pictures on this page show the remaining components in the well 2 (WL004) vault.

Top left: The wellhead is vented, but it terminates below the vaults flood rim along with an additional electrical box. The ladder is not permanently fixed to the side wall. The access hatch is not properly gasketed.

Top right: Well 2 (WL004) entry point to distribution can be seen running into the vault floor. A 2" blow-off pipe extends through the wall and terminates in a nearby ditch. This blow-off outlet is currently capped.




Upper left: Well 3 (WL005) wellhead. Split cap for outside use not recommended. Vent is screened. Well 3 is surrounded by homes.

Upper right: Well 3 control vault.

Lower left: Inside well 3 vault. Garbage in vault with some sign of high water. Not a permanent affixed ladder.

Lower right: Well 3 control panel +- 10' from control vault.



Well 1 (WL003) pictures are shown this page with orthophosphate treatment. (No disinfection in place @ WL003). Injection point for TP002. This well has VFD controls but is set to operate like a standard motor. I can only assume it was installed to minimize hammer at start and stop because VFD used in conjunction with storage tank float controls doesn't seem to be overly beneficial. PVC line goes to spigot. I recommended the operator write the length of the sounding tube on the face of the pressure gauge for easy reference when using the depth gauge set up. The fire hose is used for blow-off purposes.



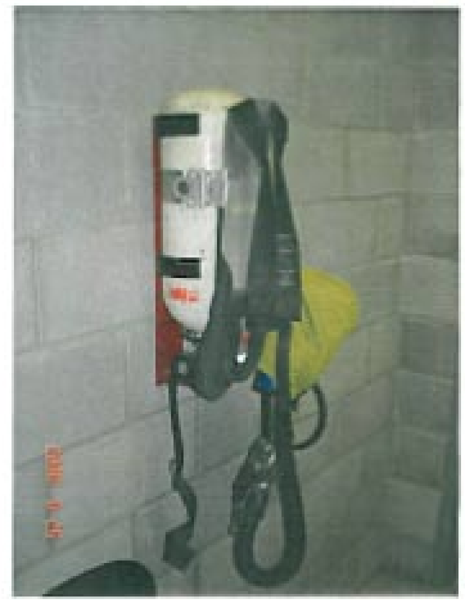

Top left: Surface water inlet from Swamp Creek and Mill Creek sources (TP001). Excess water flows over a wall at the far end of the entry basin and goes to storm drain. Coagulant (alum) is added and flows through settling basin. Chlorine injection is available at this point, but is not used.

Lower left: The sand filter bed can be seen. Chlorine injection point is at the far left side of the picture as the filtered water goes to the 500,000 gallon storage tank (ST001).



Stevensville uses gas chlorination at T001 (surface water plant). Deficiencies include no panic bar on door, no scale under tanks in use and vent outlet doesn't open with exhaust fan operation. Accumulation of chlorine gas at floor level has eaten the bottom of the door up.

SCUBA unit is hung in control room. George said the staff is trained on its' use.




Turbidimeter, colorimeter, and chart graphs are located in the treatment plant control room. Orthophosphate is added for corrosion control.

System has an automatic bypass if the surface water treatment plant exceeds acceptable turbidity measurements prior to entering the storage tank. No turbidity recorder on raw water.



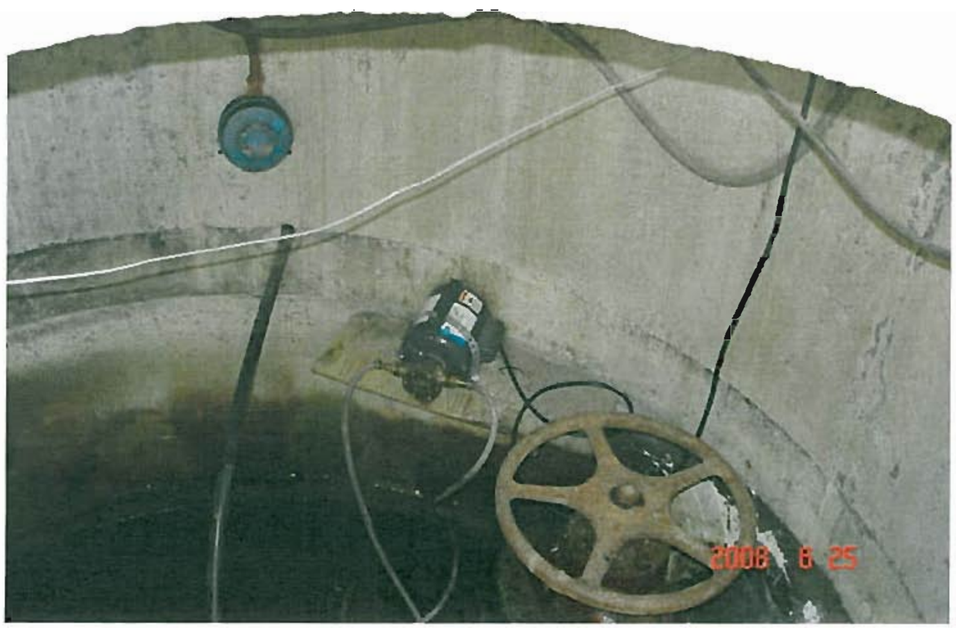
Top left: Top of 500,000 gallon storage tank (ST001) looking toward the surface water treatment building (TP001). The small shed located between TP001 and ST001 houses the automatic bypass valve if turbidity levels exceed acceptable levels leaving the plant.

Top right: Top of the storage tank with the facility roof vent shown in the front of picture. Vent was screened.

Bottom left: TP001, bypass structure, ST001 and a meter vault where a chlorine booster pump injects water leaving ST001 as it enters distribution.

NOTE: System doesn't know for sure where the bypass or ST001 overflow outlets are located, or if they're screened.






Top left: Existing 500,00 gallon storage tank (ST001) to the left – old storage tank structure that is now used for wastewater disposal near far fence – framed metal siding is used for lid to meter vault that also has a post storage chlorine injector and sump pup to keep ground water below components.

Top right: Picture in meter vault shows meter, sump pump and high ground water. Sump pump goes to old storage tank. Note: Current DEQ standards would not allow a vault in high ground water. DEQ-1 section 8.6

Bottom left: Booster chlorine injection pump can be seen in the same vault. This booster has had to be replaced a few times because of loss of head and it burned out. There is no redundant pump and it's in a vault subject to high ground water levels.

# Water Line Leak Location Project

# Final Report

# Prepared For

# City of Stevensville

# Stevensville, MT

Project Dates:

03/13/06 to 03/14/06

Prepared by:

HUGHES®

**Hughes Supply, Inc.**
*Utility Services Group*
10013 Martin Luther King Jr. Way South
Seattle, Washington 98178

# TABLE OF CONTENTS

# COVER LETTER

**Hughes Supply, Inc.**
Utility Services Group
10013 MLK Jr Way South
Seattle, WA 98178
T 800.621 9292
F 206 725.5932

HUGHES®

May 5, 2006

City of Stevensville
Attn: George Thomas
PO Box 30
Stevensville, MT 59870

Dear Mr. Thomas:

Hughes Supply, Inc., Utility Services Group (Hughes) is pleased to submit the enclosed Final Report on leak detection services recently completed.

A total of approximately **3.82** miles (estimated by Field Technician) were surveyed, including all intersecting lines. Approximately **14.58** hours of fieldwork were spent during this project. A total of **five (5)** leaks were pinpointed. Water loss due to leakage was estimated to be approximately **217,080 GPD**. Details of this information are enclosed.

Please note that leakage that was detected and pinpointed may be larger or smaller than estimated. Estimates are based on several variables including type and size of pipe, pressure and interpretation of correlation filter results.

**As you review this Final Report, please pay close attention to the Field Technician's remarks and field observations in the Project Observation section of this report. These may assist you in determining the best course of action regarding specific leaks.**

**We strongly suggest you contact us prior to excavating any leak that we have labeled with "CAUTION" for further explanation.**

The leak detection survey is productive since we pinpointed leakage that, when repaired, can reduce your water loss, saving the City of Stevensville dollars now and in the future. We appreciate your confidence in Hughes. If you have any questions, call us at (800) 621-9292 or (206) 725-3441.

Sincerely,

Stephanie Davison

for Rob Meston
Manager

# EXECUTIVE SUMMARY

# Summary of Survey and Pinpointing Report

**Client:** City of Stevensville, MT **Date:** 03/15/2006

**Period Covered:** 03/13/06 to 03/14/06

**General Area Covered:** Older steel and cast iron water distribution lines.

**TOTAL ANNUAL WATER LOSS**

(formula leak GPM x min/hour x hours/day x days/year)

79,234,200.0 **GALLONS**

*SURVEY DATA*

**Distance Surveyed :** 20174.000 **feet ,** 3.820 **miles**

**Time Spent Surveying :** 5.50 **hours**

| Points Surveyed | |
|---|---|
| Hydrants | 37 |
| Valves | 61 |
| Services | 12 |
| Other | 0 |
| Total | 110 |

**Access Points Requiring further investigation**

(points that are returned to for pinpointing or elimination)

| | | |
|---|---|---|
| Leak sounds on: | Valves | 12 |
| | Hydrants | 4 |
| | Services | 0 |
| | Other | 0 |
| | Total | 16 |

*PINPOINTING DATA*

| LEAK TYPE | NUMBER of LEAKS | TIME SPENT PINPOINTING (hours) | TOTAL, GALLONS PER MIN | TOTAL, GALLONS PER DAY | LARGEST, GALLONS PER MIN | LARGEST, GALLONS PER DAY | SMALLEST, GALLONS PER MIN | SMALLEST, GALLONS PER DAY | AVERAGE LEAK SIZE GPM |
|---|---|---|---|---|---|---|---|---|---|
| MAIN LINE | 4 | 4.50 | 150.0 | 216000.0 | 100.0 | 144000.0 | 5.00 | 7200.00 | 37.50 |
| VALVE | | | | | | | | | |
| HYDRANT | 1 | 0.08 | 0.7 | 1080.0 | 0.7 | 1080.0 | 0.75 | 1080.00 | 0.75 |
| METER | | | | | | | | | |
| CURB STOP | | | | | | | | | |
| SERVICE LINE | | | | | | | | | |
| SERVICE CONN | | | | | | | | | |
| OTHER | | | | | | | | | |
| UNDEFINED | | | | | | | | | |
| **TOTALS** | 5 | 4.58 | 150.75 | 217080 | n.a. | n.a | n.a | n.a | 30.15 |

| | |
|---|---|
| Sites Investigated for Pinpointing | 16 |
| Other Time Spent on Project (includes pinpointing false leak sounds) | **4.50 hrs.** |

# Leak Detection/Benefits Analysis

| | | |
|---|---|---|
| A. | Total water produced or delivered to distribution system in gallons per year (estimate if exact figures are not available) | _______ GPY |
| B. | Yearly cost of system operation including costs for labor + maintenance + interest + insurance + pumping + treating + depreciation + billing, etc. | $_______ /YEAR |
| C. | Estimated water production cost per 1000 gallons (B% x A% x 1000) | $ _______/1000 GAL |
| D. | Total water sales and other water use in gallons per year. To estimate use (100 GPD per person + industrial, commercial, parks, fire, street cleaning, etc.) | _______ GPY |
| E. | Total non-revenue water (A – D) | _______ GPY |
| F. | Percentage of non-revenue water (E ÷ 100) | _______ % |
| G. | Estimate of leakage (0.8 x E) | _______ GPY |
| H. | Estimate cost to produce water lost to leakage | $ _______/YEAR |
| I. | Estimated leak detection survey cost based on _______ miles of main* | $ _______ |
| J. | Yearly benefits after leakage repair (H – I) | $ _______/YEAR |

*Cost of estimate for Leak Detection Project, supplied by Hughes Utility Services, is based on the number of miles of distribution main to be covered.

# PROJECT OBSERVATIONS

# PROJECT OBSERVATIONS
## (Water Distribution Lines)

### GENERAL
On March 14, 2006, Hughes completed a two-day leak detection project for the City of Stevensville, MT. The focus of this project was the older steel and cast iron mains in the water distribution system. A total of 3.82 miles were surveyed and five leaks were pinpointed.

### SPECIFICS
The project was broken down in two different phases:

1. ***Survey Phase*** – sounding of appurtenances and recording leak type noises that were detected.

2. ***Pinpointing Phase*** – pinpointing noises that were detected during the Survey Phase.

#### 1. Survey Phase Information
The first step of the survey phase was to review the system maps and identify any potential problem areas. It was decided that the survey would begin in the west side of town and work toward the east side of town.

The survey progressed through the requested areas, making contact with 110 appurtenances, including 37 hydrants, 61 valves and 12 customer services. Leak noise was detected on several of these contact points and were noted for further investigation during the pinpointing phase.

#### 2. Pinpointing Phase Information
Sixteen possible leak sites were identified during the surveying phase. All were further investigated. Four mainline leaks and one hydrant leak were reported. Details of each can be found in the Leak Reports section of this Final Report. However, please pay close attention to the following:

Leak Report #4 – 183 Middle Burnt Fork Rd. Correlations were not possible in this area due the significant amount of leak noise detected. The line was surveyed using an LD-12 Subsurface listening device. The roadway was then marked with orange paint at each location where leak noise was detected. There were a total of ten locations. These may be joints on the 8" CI line which have developed leaks. We estimated the cumulative leak rate at 100 GPM. We recommend that these areas be further investigated for verification.

Leak Report #5 – 4$^{th}$ St & Mission St. This is a large main line leak. We estimated leak rate at 35 GPM. It should be noted that the leak noise detected was extremely loud. This may have impacted the correlation results. An LD-12 Subsurface listening device was used to verify correlation results. Leak noise was loudest at a hydrant branch line.

Please note that leakage that was detected and pinpointed may be larger or smaller than estimated. Estimates are based on several variables including type and size of pipe, pressure and interpretation of correlation filter results.

## CONCLUSION

We were able to locate and pinpoint leakage, indicating that leaks do not readily surface in the system. However, overall, the areas surveyed seem to be in good condition with regards to leakage. Make note of any discrepancies in our estimates as they may have a substantial effect on non-revenue water calculations.

We recommend that the city consider follow-up leak detection following the repairs of the leaks detected during this project to determine if any additional leaks exist in the system.

I would like to thank George Thomas for field assistance, which proved invaluable. We look forward to working with the City of Stevensville on future conservation projects.

Tony Baker
Field Technician

# LEAK REPORTS

# LEAK REPORT

**Hughes Utility Services**

Repair Date: ______________ GPM's __________

Remarks ____________________________________________

**Date** 03/14/2006

**Location** Intersection of Fourth Street & Mission Street

**Remarks** Correlations were verified with the ground unit to hydrant tee.

## Leak Type

MAIN

**Time spent pinpointing** 60 minutes

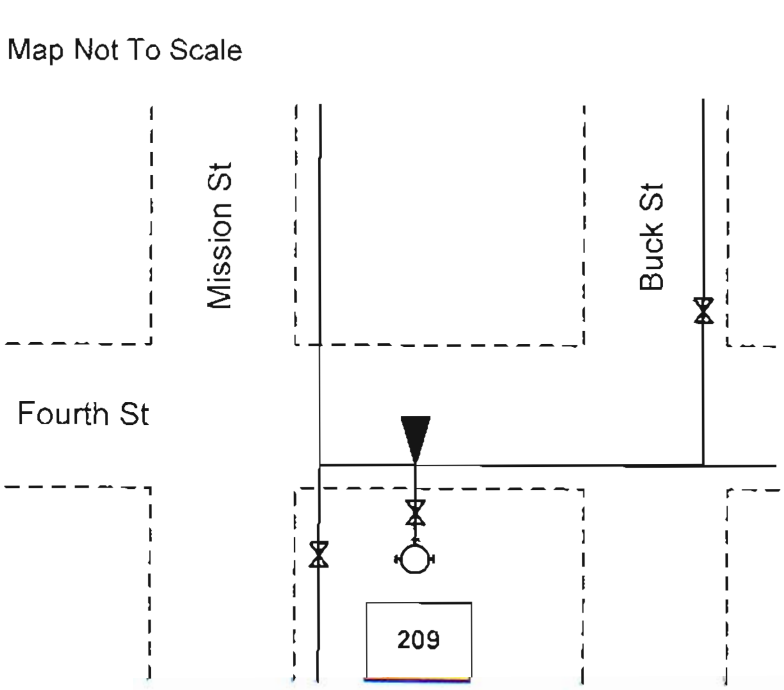
**Leak Site Marked** Yes

**Cover Type:** Soil

| Computerized Correlator Results | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | #12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation Scan Time | | | | | | | | | | | | |
| Band Pass Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Correlated Point Height | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Footage from "A" | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |

**Leak #** 5 **Estimated GPM** 35.00 **Leak Classification** III

Map Not To Scale




**Water loss (this leak, in gallons)**

| | |
|---|---|
| *DAILY* | 50,400 |
| *WEEKLY* | 352,800 |
| *MONTHLY* | 1,562,400 |

= Location of Leak

**Technician** TB

**Job #** 62144

**Page** 5

# *LEAK REPORT*

***Hughes Utility Services***

Repair Date:______________ GPM's __________

Remarks ________________________________

Date 03/13/2006

Location 424 College Street

Remarks Excellent correlation results were verified with ground unit. Leaking approximately 271' from the "Red" Station.

## Leak Type

MAIN

Time spent pinpointing 60 minutes

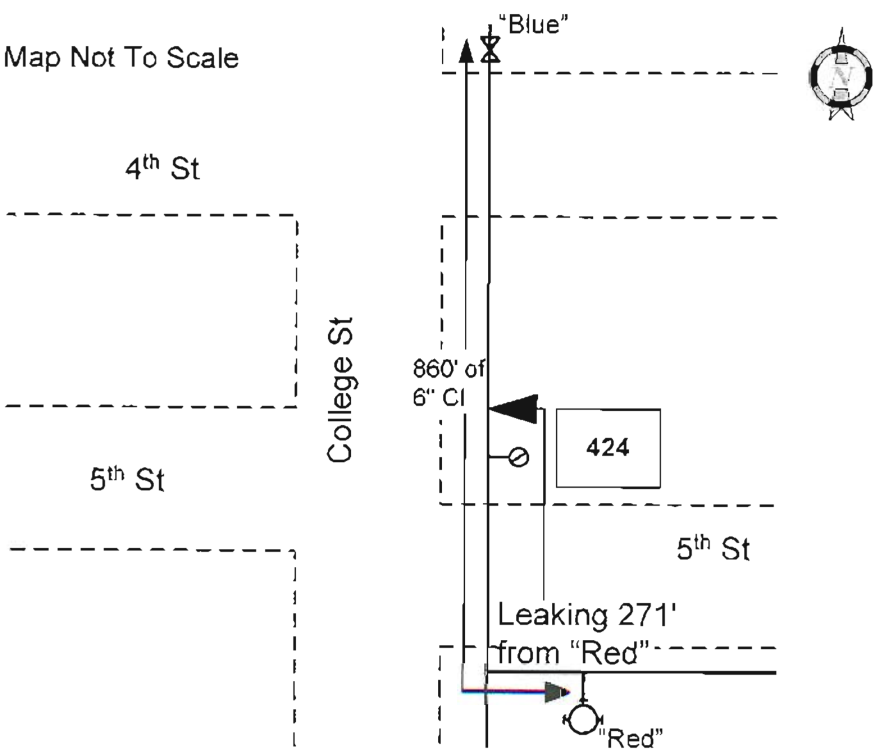
Leak Site Marked Yes

Cover Type:

| Computerized Correlator Results | *#1* | *#2* | *#3* | *#4* | *#5* | *#6* | *#7* | *#8* | *#9* | *#10* | *#11* | *#12* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation Scan Time | | | | | | | | | | | | |
| Band Pass Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Correlated Point Height | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Footage from "A" | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |

**Leak #** 1 **Estimated GPM** 10.00 **Leak Classification** III

Map Not To Scale




**Water loss (this leak, in gallons)**

| | |
|---|---|
| *DAILY* | 14,400 |
| *WEEKLY* | 100,800 |
| *MONTHLY* | 446,400 |

◀ = Location of Leak

Technician TB

Job # 62144

Page 1

# *LEAK REPORT*

***Hughes Utility Services***

Repair Date:______________ GPM's __________

Remarks ____________________________________

Date 03/13/2006

Location 310 Pine Street

Remarks Excellent correlation results were verified with the ground unit. Leaking approx. 131' to 132' from the "Blue" Station.

**Leak Type**

MAIN

Time spent pinpointing
30 minutes

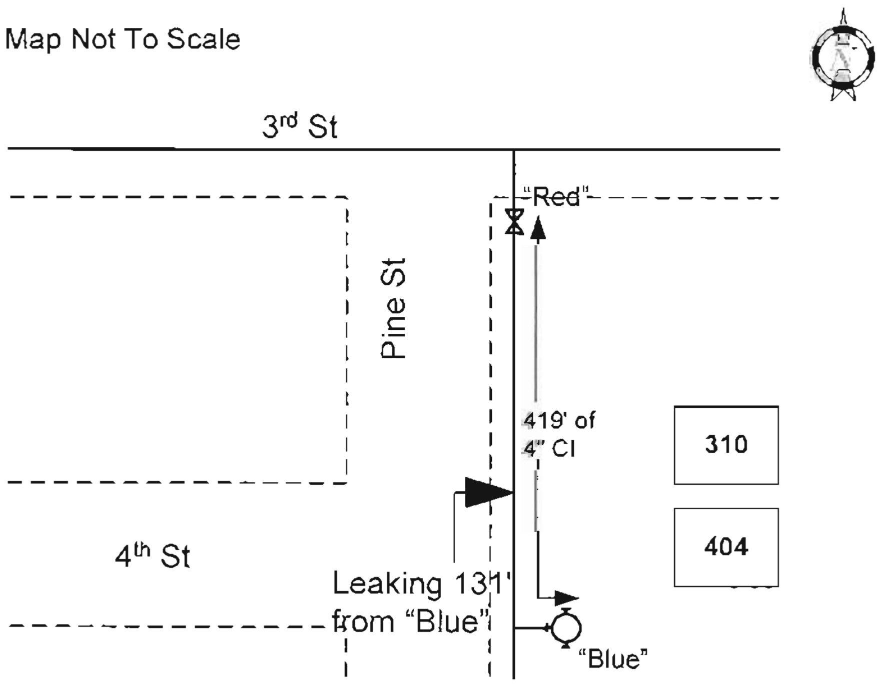
Leak Site Marked Yes

Cover Type:
Soil

| Computerized Correlator Results | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | #12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation Scan Time | | | | | | | | | | | | |
| Band Pass Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Correlated Point Height | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Footage from "A" | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |

**Leak #** 2 **Estimated GPM** 5.00 **Leak Classification** III

Map Not To Scale




**Water loss**
**(this leak, in gallons)**

| | |
|---|---|
| *DAILY* | 7,200 |
| *WEEKLY* | 50,400 |
| *MONTHLY* | 223,200 |

= Location of Leak

Technician TB

Job # 62144

Page 2

# LEAK REPORT

***Hughes Utility Services***

Repair Date: ______________ GPM's __________

Remarks ________________________________

Date 03/13/2006

Location 311 Spring Street

Remarks The hydrant not seating properly. Tightening the operating nut slowed but did not stop leak.

**Leak Type**

HYDRANT

Time spent pinpointing
5 minutes

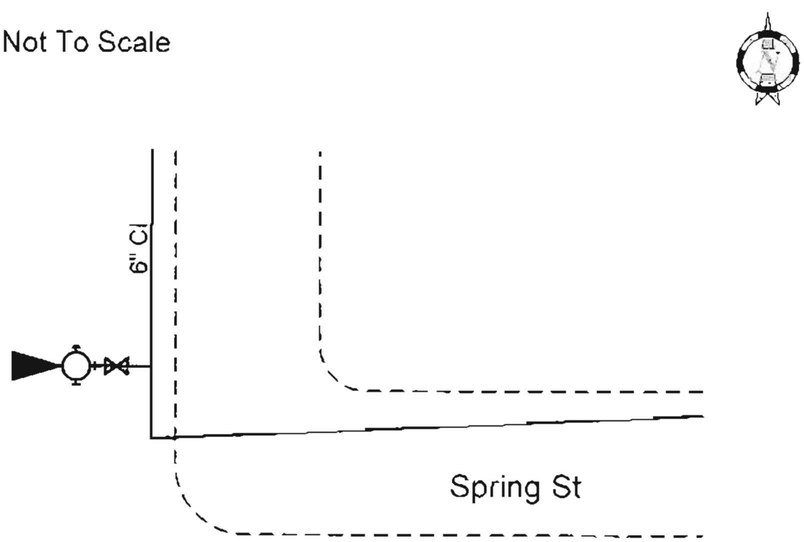
Leak Site Marked Yes

Cover Type:
Soil

| Computerized Correlator Results | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | #12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation Scan Time | | | | | | | | | | | | |
| Band Pass Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Correlated Point Height | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Footage from "A" | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |

**Leak #** 3 **Estimated GPM** 0.75 **Leak Classification** III

Map Not To Scale




**Water loss (this leak, in gallons)**

| | |
|---|---|
| *DAILY* | 1,080 |
| *WEEKLY* | 7,560 |
| *MONTHLY* | 33,480 |

◀ = Location of Leak

Technician TB

Job # 62144

Page 3

# *LEAK REPORT*

***Hughes Utility Services***

Repair Date: ______________ GPM's __________

Remarks ______________________________

**Date** 03/13/2006

**Location** 183 Middle Burnt Fork Road to 244 Middle Burnt Fork Road

**Remarks** Ground unit used to detected noise in several spots along the north side of the road. All spots are marked with orange paint. There may be multiple joint leaks along the 8" cast iron water main in this area.

## Leak Type

MAIN

**Time spent pinpointing**
120 minutes

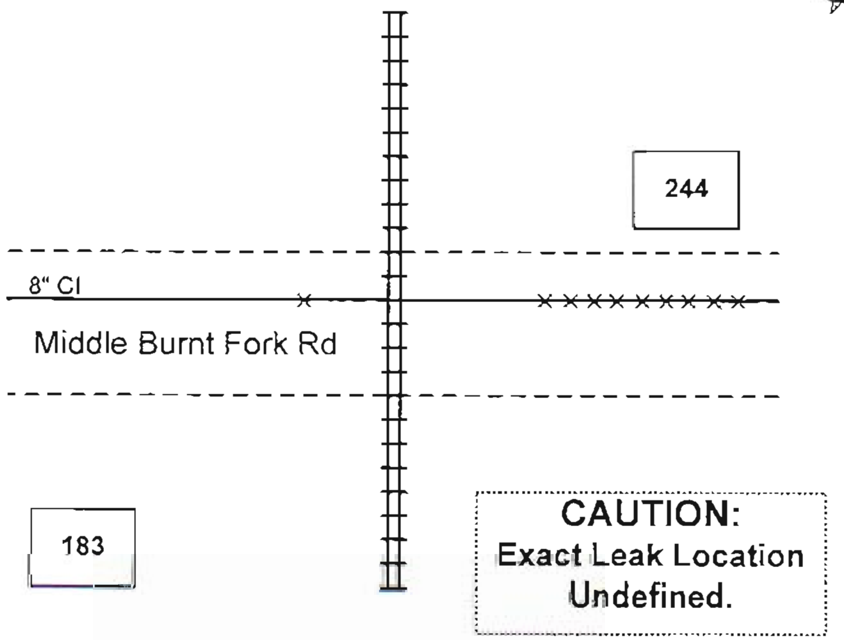
**Leak Site Marked** Yes

**Cover Type:**
Asphalt

| Computerized Correlator Results | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | #12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation Scan Time | | | | | | | | | | | | |
| Band Pass Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Correlated Point Height | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Footage from "A" | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0. |

**Leak #** 4 **Estimated GPM** 100.00 **Leak Classification** III

Map Not To Scale




**Water loss**
**(this leak, in gallons)**

| | |
|---|---|
| *DAILY* | 144,000 |
| *WEEKLY* | 1,008,000 |
| *MONTHLY* | 4,464,000 |

X = Location of Leak

**Technician** TB

**Job #** 62144

**Page** 4

# SURVEY REVIEW

# LEAK SURVEY REVIEW
## (Water Distribution Lines)

From 03/13/06 to 03/14/06, Hughes provided a leak survey for the City of Stevensville. We utilized the latest in leak detection technology available. We employed extremely sensitive sound amplification instruments for the survey and a computer based correlator for leak pinpointing whenever possible. Our Field Technician, Tony Baker, used and appreciated the information provided by George Thomas to expedite and provide an accurate survey.

The survey was accomplished in the following steps:

1. The first step in our survey was to review the distribution maps of the system for familiarization of the pipe network and available appurtenances (valves, hydrants, etc.) to be used for contact points.

2. As the leak survey progressed, we determined the distances that even quiet leak type sounds traveled in various pipe materials, pipe sizes and pressure zones in each area of the system. This was done by slightly turning on fire hydrants, hose bibs, etc., creating a simulated, quiet leak sound. Appurtenances in that area were then checked with a sound amplification instrument to see how far the simulated leak sounds traveled, thus determining how often we would make contact with appurtenances in a given section of the water distribution system. In most areas, contact was made with pipe appurtenances at intervals no greater than 350 feet where contact points were available and accessible. This allowed for even more quiet leaks to be located. Whenever we surveyed PVC lines, all available appurtenances were contacted.

3. We then conducted a comprehensive survey by making physical contact with all available main line appurtenances (valves, hydrants, etc.) and necessary customer services. Hughes used a sonic leak detection amplification instrument designed for this purpose.

4. When normal contact points were not available or could not be created within a reasonable distance, we made an attempt to use a sonic ground listening instrument to make physical ground contact at intervals no greater than 6 feet directly over the pipe. If conditions did not allow this procedure our Field Technician advised you at time of project and are included in the Project Observations. Ground listening devices are employed when ground cover is pavement, cement or similar hard surface.

5. When ground cover was not a hard surface and normal contact points were not available, we made an attempt to use probe rods or a specially designed sounding plate at 6-foot intervals. A sound amplification instrument with 3VG or greater transducer was employed in conjunction with this equipment, directly over the pipe. If conditions did not allow this procedure our Field Technician advised you at time of project and his notes were detailed in the Project Observations section of this Final Report. Direct contact to the main line at intervals outlined in Preparation for Service resulted in the most thorough survey.

6. A detailed report of decibel levels at suspected leak sound locations and observations were compiled during the survey for reinvestigation and possible pinpointing at a later time. This reinvestigation increased the speed of the survey and eliminated correlating on most false leak sounds.

7. All indications of leaks found during the survey were verified a second time, after which, the leaks were pinpointed with a computer based sound correlator when possible. Pinpointing leak locations through interpretation of sound intensity, either by ear, decibel metering or other like methods was not used when contact points were available for use

with the correlator. However, ground listening devises were used as a quick double check on pinpointed leaks.

8. The equipment used did not normally require valves to be operated during surveying and pinpointing. However, on occasion, services or valves were operated to eliminate service draw noises or to change velocity noise.

9. The correlator equipment used had the capability to prompt the operator to input the variables when different pipe sizes and/or pipe material were encountered in the same span to be investigated. This is necessary to insure accuracy of results based on the automatic computation of the correct leak sound velocity in leak pinpointing operations. Our correlators have the capability of correlating up to seven various pipe sizes and types at one time in a given space. To insure effective performance in all field environments encountered in the distribution system (i.e. traffic noise, draw, pump operation, industrial noise, etc.), the correlator equipment provides 12 multi-range High and Low Pass filters.

10. We provided a copy of leak reports, when pinpointed, which included leak locations and estimated GPM loss. These leak reports included a leak priority classification. These classifications are as follows:

    Class I Any leak which is hazardous in terms of potential undermining, possibly resulting in surface collapse, encroachment and/or damage to nearby utilities, commercial or private properties or leaks severe enough to warrant immediate repair.

    Class II All leaks that display water losses significant enough to be monitored on a regular repair schedule.

    Class III Relatively small leaks that should be repaired as workload permits.

11. Whenever any of the leaks detected by Hughes were repaired prior to completion of the field work, we gave the City of Stevensville the option to have that section of the system re-surveyed to be sure no very quiet leaks were missed due to an over powering noisy leak sound.

Hughes furnished a trained Field Technician, leak detection instruments, equipment and tools to complete the survey and leak pinpointing as outlined in our proposal. After reviewing all records relating to this project we feel confident that we have performed our best effort to pinpoint all existing leaks within the areas of the water system we surveyed. However, it is important to remember that not all leaks are easily detected, as such, we can't guarantee the location of all leaks.

We strongly recommend that the City of Stevensville maintain some type of on-going leak detection program. Only through a continuing leak detection program can the City of Stevensville expect to keep the incidence of leakage under control. Such a program will definitely prevent future leak losses from becoming a major contributor to the system's unaccounted for water losses.

In our effort to provide the most comprehensive service possible, we requested in advance to have City of Stevensville personnel prepare the areas to be surveyed by taking measures to ensure that the majority of main line valves were accessible. Efforts were made in this advance preparation. This was greatly appreciated.

# CONCLUSION

**Hughes Supply, Inc.**
Utility Services Group
10013 MLK Jr Way South
Seattle, WA 98178
T 800 621.9292
F 206 725 5932

HUGHES®

# LEAK SURVEY CONCLUSION

Our thanks to George Thomas and all persons involved with this project for their assistance in gathering all the necessary paperwork and personnel to create, with Hughes, a mutually beneficial leak detection project.

With this survey you have demonstrated concern for prudent water utilization and conservation.

Capitalizing on the most advanced leak detection technology available today, Hughes has successfully completed this Leak Detection Survey. The contents of this Final Report provide the City of Stevensville with a permanent record of the activities performed to complete a Leak Survey along with the results achieved.

An important characteristic of this Leak Report is that the facts contained herein can be used in formulating a database for decision making regarding: the need for possible future meter programs, rehabilitation and pipe line replacement and/or the investigation of new water sources, etc. These types of decisions, regarding your utilization of water, now can be predicated more on facts rather than supposition or conjecture.

Prompt repair of any leaks reported provide an immediate benefit to the City of Stevensville, which includes recovery of most water revenue and water conservation, etc.

Having achieved these results, we recommend that you continue to set up the infrastructure necessary to continue investigating leakage in the water distribution system. Implementation of any on-going leak survey program will ensure that leak losses are kept to a minimum, and the added enhancement of saving costs due to emergency call outs.

Hughes Supply, Inc., Utility Services Group is proud to have served the City of Stevensville in this way and we wish to thank you for your substantial assistance and cooperation in this project.

If you or your staff has any questions regarding this Final Report, please feel free to call us at (800) 621-9292 or (206) 725-3441.

Best Regards,

Stephanie Dinsson

for Rob Meston
Manager

**Hughes Supply, Inc.**
Utility Services Group
10013 MLK Jr. Way South
Seattle, WA 98178
T 800.621.9292
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HUGHES®

August 4, 2006

City of Stevensville
Attn George Thomas
PO Box 30
Stevensville, MT 59870

Re: **Leak Detection Re-Check**

Dear Mr. Thomas:

On July 18, 2006 the Utility Services Group of Hughes Supply, Inc. returned to the City of Stevensville to re-check two (2) locations; 5th and College (Leak Report #1 from 3/13/06 and 4th and Pine (Leak Report #2 from 3/13/06).

Upon arrival, our technician, Rick House, met with you and discussed the procedures and methods to be used for the re-check. Rick's first location was 4th and Pine, where he attempted several correlations, which were all inconclusive. We were told there is a reduction from 6" to 4" and can only assume the reduction is creating turbulence, which sounds like a leak. This area should be monitored and re-checked during the next survey.

The second area at College and 5th, Rick pinpointed the leak at approximately 3' to the north of the previously marked location. His field notes also indicate 2 other areas with possible noise, however, the primary leak should be fixed and the area re-sounded once repairs are complete.

We apologize about any inconvenience these dry holes may have caused. While we can't be sure what anomalies affected the accuracy of location the first time, we feel the re-checks should be accurate.

If you have any questions about this project, please don't hesitate to contact us at 1-800-621-9292.

Sincerely,

**Hughes Supply, Inc. – Utility Services Group**

Rob Meston
Branch Manager

# LEAK REPORT

### Hughes Utility Services

Repair Date: ____________ GPM's ________

Remarks ______________________________

**Date** 07/18/2006

**Location** 5th & College

**Remarks** Very good correaltions at 269' from "B" (Blue) sensor. Ground microphone confirmed more than one location.

**Leak Type**

MAIN

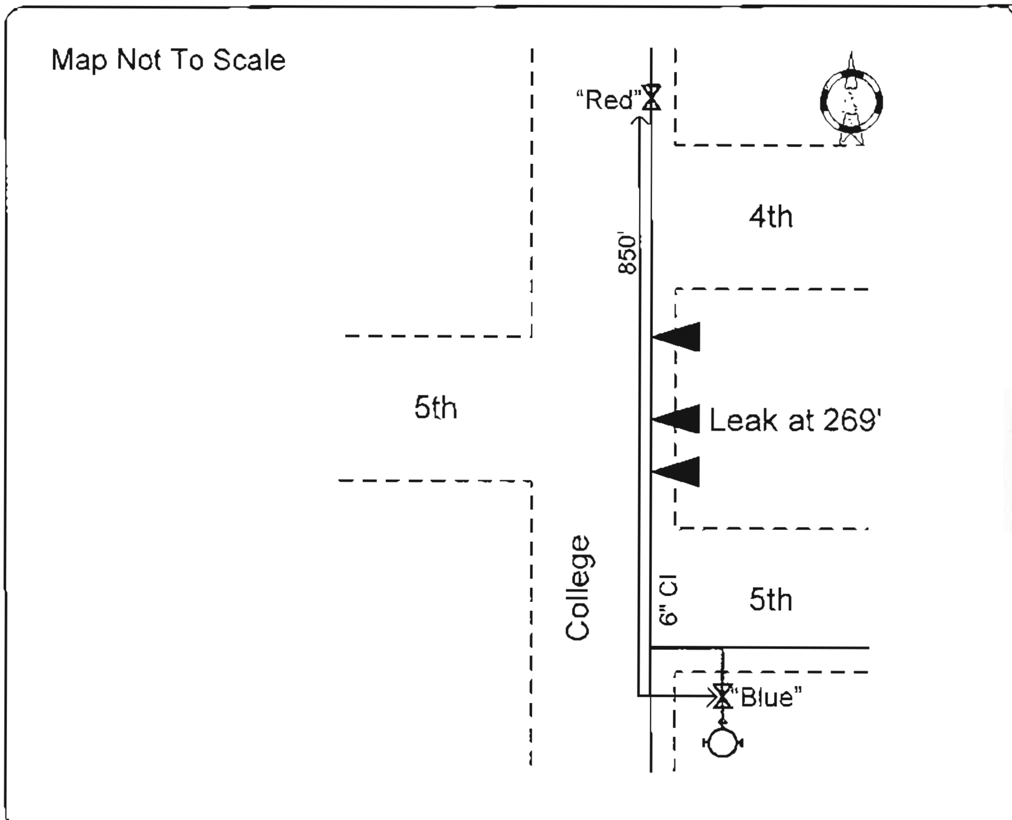
**Time spent pinpointing**
75 minutes

**Leak Site Marked** Yes

**Cover Type:**
Soil

| Computerized Correlator Results | #1 | #2 | #3 | #4 | #5 | #6 | #7 | #8 | #9 | #10 | #11 | #12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Correlation Scan Time | | | | | | | | | | | | |
| Band Pass Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Correlated Point Height | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Footage from "A" | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Leak #** R1 **Estimated GPM** 0.00 **Leak Classification** II




**Water loss (this leak, in gallons)**

*DAILY* 0

*WEEKLY* 0

*MONTHLY* 0

 = Location of Leak

**Technician** TB

**Job #** 62144

**Page** 0

# UNIFORM ENVIRONMENTAL CHECKLIST

**As the engineer that prepared the preliminary engineering report, I** Andy Mefford, P.E., **have reviewed the information presented in this checklist and believe that it accurately identifies the environmental resources in the area and the potential impacts that the project could have on those resources.** In addition, the required state and federal agencies were provided with the required information about the project and requested to provide comments on the proposed public facility project. Their comments have been incorporated into and attached to the Preliminary Engineering Report.
**Engineer's Signature:** ______________________
**Date:** 11/5/2009

**Key Letter:** N – No Impact/Not Applicable B – Potentially Beneficial A – Potentially Adverse
P – Approval/Permits Required M – Mitigation Required

## PHYSICAL ENVIRONMENT

| Key | |
|---|---|
| N or A/M | **1. Soil Suitability, Topographic and/or Geologic Constraints (e.g., soil slump, steep slopes, subsidence, seismic activity)**<br><br>*Comments and Source of Information*: There are no known topographic and/or geologic constraints imposed on the subject project due to steep slopes or subsidence. The Town is located in Seismic Zone "2B" and the design of the tank and foundation will take this into consideration. Soils on the site of the new reservoir and along the pipeline route are listed by the NRCS as consisting one or more of the following soil series (see Soils Map): Grantsdale (Mapping Symbol "G21"), Corvallis (Mapping Symbol "C3u") and/or Dominic (Mapping Symbol "Da"). All of these soil types have severe limitations due to high groundwater conditions. Pipelines will be buried at a depth of 6' BLS and dewatering of pipeline trenches may be required. |
| **Key**<br>N | **2. Hazardous Facilities (e.g., power lines, EPA hazardous waste sites, acceptable distance from explosive and flammable hazards including chemical/petrochemical storage tanks, underground fuel storage tanks, and related facilities such as natural gas storage facilities & propane storage tanks)**<br><br>*Comments and Source of Information*: The only know facility in the project area is a high pressure natural gas main that runs north-south east of Stevensville. This gas main crosses Middle Burnt Fork Road approximately ¼ mile east of Logan Lane. This line will most likely remain undisturbed during construction. Contractors will be required to locate all existing subsurface utilities including natural gas mains and electrical lines before excavation begins in order to avoid any potential hazardous situations. |
| **Key**<br>A/M | **3. Effects of Project on Surrounding Air Quality or Any Kind of Effects of Existing Air Quality on Project (e.g., dust, odors, emissions)**<br><br>*Comments and Source of Information*: Intermittent fugitive dust emissions can be expected during the construction of transmission pipelines, new water lines and the new water reservoir. These emissions can be minimized with effective dust control measures such as water spraying. Exhaust emissions, odors and noise from construction vehicles can be expected during project construction. These impacts cannot be avoided. However, they can be minimized by proper maintenance of the equipment to insure that emission/noise/odor control devices such as engine mufflers are functioning properly. All these negative impacts will cease once construction is completed. |

| Key | |
|---|---|
| B & A/M | **4. Groundwater Resources & Aquifers (e.g., quantity, quality, distribution, depth to groundwater, sole source aquifers)**<br><br>*Comments and Source of Information*: Wells in the Stevensville area yield good quality water in sufficient quantity to be excellent sources of potable water for a municipal system. Existing Well No. 1 was drilled to a depth of 460' BLS into a semi-confined aquifer and is capable of delivering approximately 270 gpm (Limited by excessive sand production). A new well field capable of producing approximately 2,000 to 2,500 gpm will be drilled into the semi-confined aquifer. Groundwater is available in sufficient abundance that depletion of the aquifer is unlikely to be a problem. |
| Key<br>A/M | **5. Surface Water/Water Quality, Quantity & Distribution (e.g., streams, lakes, storm runoff, irrigation systems, canals)**<br><br>*Comments and Source of Information*: Use of BMPs (best management practices), for control of storm water runoff from disturbed areas will be used during construction of the tank and pipelines to prevent any siltation into area streams or rivers. BMPs will include use of silt fences at construction sites and silt fences & check dams in roadside ditches adjacent to pipeline installations. Open cut creek crossings will be avoided when possible. |
| Key<br>N | **6. Floodplains & Floodplain Management (Identify any floodplains within one mile of the boundary of the project.)**<br><br>*Comments and Source of Information*: The floodplain of the Bitterroot River is within a one mile radius of the project area. However, all proposed construction actions will be conducted outside of the 100-year floodplain of the Bitterroot River and its tributaries (see attached Floodplain Map). Mill and North Swamp Creeks are tributaries of the Bitterroot River that are within the project area. These water bodies do not have designated floodplains. |
| Key<br>A/P | **7. Wetlands Protection (Identify any wetlands within one mile of the boundary of the project.)**<br><br>*Comments and Source of Information*: No wetlands are expected to be impacted by the construction actions. The bulk of area wetlands are associated with the floodplain of the Bitterroot River and/or with the Lee Metcalf National Wildlife Refuge west and north of the project area, respectfully. Area creeks too will have some narrow fringing wetlands within their more restrictive floodplains or stream channels. The new reservoir and well site contains wetlands, and the new water supply transmission main extending from the new reservoir to the Town distribution system may need to cross wetlands enroute or require creek crossings. Efforts will be made to minimize the impacts on wetlands and water quality. Ideally the new pipeline will be placed under existing road sections or within the existing road right-of-way. **See attached Wetlands Delineation Report (PCI, March 2008)** |

| | |
|---|---|
| **Key**<br>**A/M** | **8. Agricultural Lands, Production, & Farmland Protection (e.g., grazing, forestry, cropland, prime or unique agricultural lands) (Identify any prime or important farm ground or forest lands within one mile of the boundary of the project.)**<br><br>*Comments and Source of Information*: There are no forestlands within a one-mile radius of the project boundary. In addition, no properties containing soils designated by the NCRS as either "Prime Farmland Soils" or Farmland Soils of Statewide Importance" will be impacted by this project.<br><br>Approximately 4-6 acres of farmland/grazing land will be used to accommodate the new reservoir and well site. Taking this small amount of land out of agricultural use and converting it to municipal use will not result in a significant negative impact on agricultural activities in the surrounding area. There is sufficient useable alternative fallow agricultural land to compensate for the minor loss. No prime or unique agricultural lands or historic ranches will be impacted by the project. |
| **Key**<br>**N** | **9. Vegetation & Wildlife Species & Habitats, Including Fish (e.g., terrestrial, avian and aquatic life and habitats)**<br><br>*Comments and Source of Information*: With the exception of the reservoir and new well site, most construction actions will take place within the rights of way of roads and often under previously paved areas of roads. Therefore, there will be no significant impacts to vegetation or wildlife species. No fish species or habitat will be disturbed as a result of the construction.<br><br>A portion of the 4-6 acre reservoir site and well site will be cleared of pasture grasses and/or alfalfa or hay crops in order to build the reservoir and/or to drill the well and install the well house. Losses of these common forms of vegetation will be relatively insignificant. No sensitive or endangered plant species will be lost at these sites. Disturbed areas will be seeded with native grasses once construction is completed. |
| **Key**<br>**N** | **10. Unique, Endangered, Fragile, or Limited Environmental Resources, Including Endangered Species (e.g., plants, fish or wildlife)**<br><br>*Comments and Source of Information*: The database of the *Montana Natural Heritage Program* was checked relative to the possible presence of any unique, endangered, or fragile species or species of special concern within the project area. No unique, endangered, or fragile animal or plant species will be impacted by the project. Both the Westslope Cutthroat Trout and the Bull Trout are potentially found in area streams and rivers. These fish species are listed as being of "Special Concern." No disturbances to these fish or their habitat will occur as a result of the project. |
| **Key**<br>**N** | **11. Unique Natural Features (e.g., geologic features)**<br><br>*Comments and Source of Information*: There are no unique natural features in the project area and none will be impacted by the project construction. |
| **Key**<br>**N** | **12. Access to, and Quality of, Recreational & Wilderness Activities, Public Lands and Waterways (including Federally Designated Wild & Scenic Rivers), and Public Open Space**<br><br>*Comments and Source of Information*: The project area is remote from all designated wilderness areas. The Lee Metcalf National Wildlife Refuge is located north of the subject project area, but will not be impacted in any way by the implementation of the subject project. |

| HUMAN POPULATION | |
|---|---|
| **Key** <br> **A/M** | **1. Visual Quality – Coherence, Diversity, Compatibility of Use and Scale, Aesthetics** <br><br> *Comments and Source of Information*: Local residents will note the presence of construction equipment during the construction phase of the project and some will consider the presence of such equipment objectionable. Such negative aesthetic impacts are unavoidable. Associated with the equipment will be dust emissions, odors and noise, all of which are unavoidable, but can be mitigated in part by BMPs and proper maintenance of the equipment. All impacts are temporary and all adverse impacts will cease once construction work has been completed. |
| **Key** <br> **A/M** | **2. Nuisances (e.g., glare, fumes)** <br><br> *Comments and Source of Information*: Disruption of local residents due to construction noise, fumes, dust, etc. is unavoidable. Such effects will be mitigated wherever possible by BMPs and control measures. All such nuisances will be temporary in duration and will cease once construction is completed. |
| **Key** <br> **A/M** | **3. Noise -- suitable separation between noise sensitive activities (such as residential areas) and major noise sources (aircraft, highways & railroads)** <br><br> *Comments and Source of Information*: For the most part, densely populated areas will be shielded from most of the noise associated with the construction of the reservoir, the new well and the bulk of the run of the new supply transmission main, as all these actions will take place in relatively rural areas outside of the Town limits. Temporary noise impacts in more populated areas will occur due to programmed improvements to the water distribution system. Such impacts are unavoidable, but will cease once construction is completed. <br><br> The new water well will be equipped with an emergency diesel generator. This unit will be tested by the water system personnel on an intermittent basis (most likely on a monthly basis) and will function continuously during power outages. The unit will be equipped with residential noise attenuation devices to minimize noise impacts to nearby residents. |
| **Key** <br> **N** | **4. Historic Properties, Cultural, and Archaeological Resources** <br><br> *Comments and Source of Information*: No historic properties or archaeological or cultural resources will be impacted by the subject project as virtually all the construction actions will take place in previously disturbed areas. However, should cultural or archaeological materials of significance be unearthed during construction, crews will be asked to stop construction and to notify the proper authorities so that the value of any uncovered materials can be professionally evaluated before construction work is resumed. This way, no valuable resources will be lost. |
| **Key** <br> **N** | **5. Changes in Demographic (population) Characteristics (e.g., quantity, distribution, density)** <br><br> *Comments and Source of Information*: The project is designed to meet the water supply and distribution needs of the Town of Stevensville for the next 20 years (to the year 2030). The construction of these improvements is not expected to result in any overt changes in population density or distribution, as the project is simply a response to normal growth and development caused principally by other factors including a net in migration of new residents to the Bitterroot Valley from other states. |

| | |
|---|---|
| **Key** **N** | **6. Environmental Justice – (Does the project avoid placing lower income households in areas where environmental degradation has occurred, such as adjacent to brownfield sites?)**<br><br>*Comments and Source of Information*: No brownfield sites or remediated toxic waste sites will be impacted by the subject project. All water system users in the Stevensville community will benefit equally from the project improvements. |
| **Key** **N/B** | **7. General Housing Conditions - Quality, Quantity, Affordability**<br><br>*Comments and Source of Information*: The project is not expected to have a pronounced effect on general housing conditions in the Stevensville Area. Such conditions are normally driven by other more profound economic and social factors beyond the scope of water system improvements projects.<br><br>The upgraded and improved water system will result in better and more consistently good water quality, which will benefit local housing conditions. In addition, the improved system will afford increased fire protection for area housing. |
| **Key** **N** | **8. Displacement or Relocation of Businesses or Residents**<br><br>*Comments and Source of Information*: The project will not require the displacement or relocation of any area businesses or residences. All construction actions will take place either within existing roadway rights of way or on land that has not been previously developed for commercial or residential use. |
| **Key** **B** | **9. Public Health and Safety**<br><br>*Comments and Source of Information*: The health and safety of local residents are expected to be improved as a result of the project. The upgrading of Well No. 1 and the drilling of a new high capacity well field into the semi-confined aquifer will reduce the need to rely on other shallow wells that are not well protected from possible contamination. Also, reliance on the near surface infiltration gallery for the bulk of the raw water supply will be eliminated. |
| **Key** **N** | **10. Lead Based Paint and/or Asbestos**<br><br>*Comments and Source of Information*: The proposed project will not result in the disturbance of any lead based paint or asbestos. |
| **Key** **B** | **11. Local Employment & Income Patterns - Quantity and Distribution of Employment, Economic Impact**<br><br>*Comments and Source of Information:* The project implementation may result in the creation of temporary construction jobs for local residents. Also, construction crews will likely support local businesses during the construction of facility improvements. The increased demand for food, lodging, equipment and supplies resulting from the project will have a positive impact on the local economy. |

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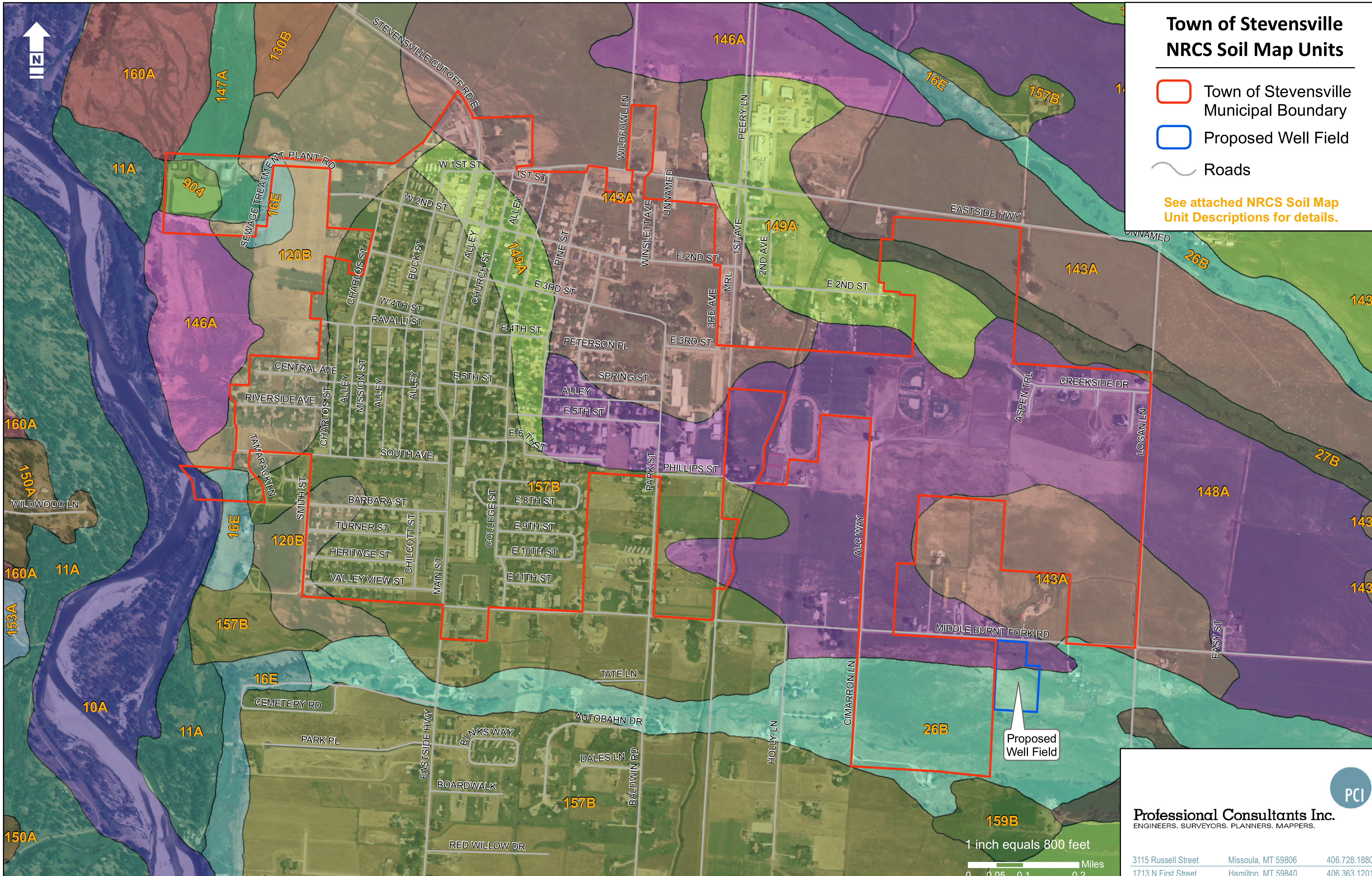
| **Key** <br> **B** | **12. Local & State Tax Base & Revenues** <br><br> *Comments and Source of Information*: The provision of an adequate water system will allow for prudent growth and development in Stevensville resulting in a gradually expanding tax base and sufficient revenues to sustain the system operation and maintenance at a high level. |
| **Key** <br> **B** | **13. Educational Facilities - Schools, Colleges, Universities** <br><br> *Comments and Source of Information*: The upgraded and improved water system will better serve the needs of area public schools. Stevensville District Schools, K-12, are connected to the Stevensville Municipal Water System. The improved system will provide adequate fire flow to Stevensville's schools. |
| **Key** <br> **B** | **14. Commercial and Industrial Facilities - Production & Activity, Growth or Decline** <br><br> *Comments and Source of Information*: The upgraded water system will likely have a positive effect on commercial and industrial facilities. With improved available system capacity, the Town will be in a position to attract limited compatible commercial development and/or light (non-polluting) industrial facilities which will benefit the local economy and result in prudent growth and development. |
| **Key** <br> **B** | **15. Health Care – Medical Services** <br><br> *Comments and Source of Information*: The upgrading of the existing water system will reduce the risk of water borne diseases which will have a positive impact on all system users and will reduce potential need for heath care and medical services by Town residents. |
| **Key** <br> **N** | **16. Social Services – Governmental Services (e.g., demand on)** <br><br> *Comments and Source of Information*: Improvements to the existing municipal water system will likely require additional operation and maintenance actions by local municipal employees. However, this will be offset in part by the retirement of inefficient existing systems and equipment that currently require an inordinate amount of attention by service personnel. The net demand for services related to the water system are likely to remain about the same following project construction. |
| **Key** <br> **N** | **17. Social Structures & Mores (Standards of Social Conduct/Social Conventions)** <br><br> *Comments and Source of Information*: The subject project will have no impacts whatsoever on social structures and mores. |
| **Key** <br> **B/P/M** | **18. Land Use Compatibility (e.g., growth, land use change, development activity, adjacent land uses and potential conflicts)** <br><br> *Comments and Source of Information*: The project will result in an improved water supply system for the Town of Stevensville, which will enable the Town to meet anticipated growth needs for the next 20 years (year 2030). The source of the growth is not the water system itself. Rather, it is required in order to meet both existing and projected needs, which have their origins in other more external factors. However, the improved system will likely make it easier for new subdivisions to be constructed within the Town's service area, which may provide a stimulus for new development. On the positive side of the equation is the fact that such growth will likely occur where municipal services are available making for a more efficient use of land and the reduction of "urban sprawl." |

| | |
|---|---|
| Key<br>B | **19. Energy Resources - Consumption and Conservation**<br><br>*Comments and Source of Information*: The programmed replacement of an inefficient pump at Well #1 will result in lower net energy consumption and a higher yield of water from this source. Furthermore, the repair of the leaks associated with the Middle Burnt Fork water main will result in savings of up to 350,000 GPD of lost water. |
| Key<br>N | **20. Solid Waste Management**<br><br>*Comments and Source of Information*: Minimal solid wastes will be developed from this project. |
| Key<br>N | **21. Wastewater Treatment - Sewage System**<br><br>*Comments and Source of Information*: The upgraded water system will have no adverse impacts on the Stevensville Municipal Wastewater Treatment System. The treatment plant was recently upgraded to meet projected growth demands to the year 2016. |
| Key<br>N | **22. Storm Water – Surface Drainage**<br><br>*Comments and Source of Information*: The Town of Stevensville does not have a municipal storm water collection system. Storm water controls consist of dry well sumps and roadside ditches/swales which either recharge the surficial aquifer or direct flows to natural drainage ways for dissipation. |
| Key<br>B | **23. Community Water Supply**<br><br>*Comments and Source of Information*: The project will provide adequate supplies for domestic uses and fire flows in concert with the 20 year projections for the system. The project will also bring the water system into compliance with current State and Federal (EPA) rules and regulations governing such systems. |
| Key<br>A/M | **24. Public Safety – Police**<br><br>*Comments and Source of Information*: Services from the local police may be required from time to time to provide adequate traffic controls during the construction work, especially those actions that will take place within public rights of way. Such impacts are deemed minimal and temporary and will cease once construction is completed. |
| Key<br>B | **25. Fire Protection – Hazards**<br><br>*Comments and Source of Information*: An ISO Commercial Risk Services, Inc. review of the Town of Stevensville's Water Distribution System in 1996 indicated the need for peak hydrant flows in the downtown area of 3,000 gpm @ 20 psi. Measured flows were only 1,800 gpm. Needed flows at a hydrant at the Town's schools was also 3,000 gpm, while only 1,900 gpm was found. The new improvements are designed to meet the required flows, which will improve fire protection capabilities throughout the system. |

**Key Letter: N** – No Impact/Not Applicable **B** – Potentially Beneficial **A** – Potentially Adverse
**P** – Approval/Permits Required **M** – Mitigation Required

| | |
|---|---|
| **Key**<br>B | **26. Emergency Medical Services**<br><br>*Comments and Source of Information*: The upgraded water system will likely have a positive effect on commercial and industrial facilities. With improved available system capacity, the Town will be in a position to attract limited compatible commercial development and/or light (non-polluting) industrial facilities which will benefit the local economy and result in prudent growth and development. |
| **Key**<br>N | **27. Parks, Playgrounds, & Open Space**<br><br>*Comments and Source of Information*: The project will have no impacts on parks, playgrounds or open space in the Stevensville area. |
| **Key**<br>N | **28. Cultural Facilities, Cultural Uniqueness & Diversity**<br><br>*Comments and Source of Information*: The project will have no impacts on cultural facilities or cultural uniqueness and diversity in the Stevensville area. |
| **Key**<br>A/M | **29. Transportation Networks and Traffic Flow Conflicts (e.g., rail; auto including local traffic; airport runway clear zones - avoidance of incompatible land use in airport runway clear zones)**<br>*Comments and Source of Information*: Trained personnel and temporary traffic control devices & signs will be required to control and direct vehicular and pedestrian traffic around the construction of the proposed improvement. This will result in brief traffic delays. Such impacts are unavoidable, but temporary, and will cease once the project has been completed. |
| **Key**<br>B | **30. Consistency with Local Ordinances, Resolutions, or Plans (e.g., conformance with local comprehensive plans, zoning, or capital improvement plans)**<br><br>*Comments and Source of Information*: The proposed improvements are in concert with the *Municipal Water Supply Study Plan for the City of Stevensville* (1993), *Stevensville Water & Sewer Facilities Plan* (1996) and with the pending *Preliminary Engineering Report, Stevensville Municipal Water System Improvements* (2009 Update). |
| **Key**<br>N | **31. Is There a Regulatory Action on Private Property Rights as a Result of this Project? (consider options that reduce, minimize, or eliminate the regulation of private property rights.)**<br><br>*Comments and Source of Information*: The proposed project will have no impacts whatsoever on private property rights. |


Town of Stevensville
NRCS Soil Map Units
Town of Stevensville Municipal Boundary
Proposed Well Field
Roads
See attached NRCS Soil Map Unit Descriptions for details.
Proposed Well Field
1 inch equals 800 feet
0 0.05 0.1 0.2 Miles
Professional Consultants Inc.
ENGINEERS. SURVEYORS. PLANNERS. MAPPERS.
3115 Russell Street Missoula, MT 59806 406.728.1880
1713 N First Street Hamilton, MT 59840 406.363.1201
160A
147A
130B
146A
16E
157B
11A
904
120B
143A
149A
26B
146A
27B
148A
160A
150A
16E
120B
157B
11A
10A
153A
159B
150A
STEVENSVILLE CUTOFF RD E
EASTSIDE HWY
MIDDLE BURNT FORK RD
WILDWOOD LN
CEMETERY RD
AUTOBAHN DR
RED WILLOW DR

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 10A--Riverwash-Water-Riverrun complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Riverwash

*Extent:* about 40 percent of the unit
*Landform(s):* bars, flood plains, intermontain basins
*Slope gradient:*
*Parent material:* sandy and gravelly alluvium
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* frequent
*Ponding hazard:* none

*Soil loss tolerance (T factor):*
*Wind erodibility group (WEG):*
*Wind erodibility index (WEI):*
*Land capability class, nonirrigated:*
*Drainage class:*
*Hydric soil:* unranked
*Hydrologic group:*
*Potential frost action:*

*Ecological site(s):* ---

*Representative soil profile:*

| Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|

none

### Water

*Extent:* about 30 percent of the unit
*Landform(s):* flood plains, intermontain basins
*Slope gradient:*
*Parent material:*
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):*
*Wind erodibility group (WEG):*
*Wind erodibility index (WEI):*
*Land capability class, nonirrigated:*
*Drainage class:*
*Hydric soil:* unranked
*Hydrologic group:*
*Potential frost action:*

*Ecological site(s):*

*Representative soil profile:*

| Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|

none

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## Riverrun and similar soils

*Extent:* about 20 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* frequent
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 2
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 6s
*Drainage class:* moderately well drained
*Hydric soil:* yes
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| Representative soil profile: | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 4 in | very gravelly loamy sand | rapid | 0.1 to 0.2 in | 6.1 to 7.3 | .05 | .17 |
| C -- 4 to 60 in | extremely gravelly sand | very rapid | 1.1 to 1.7 in | 6.1 to 7.3 | .02 | .17 |

## Canarway, very poorly drained and similar soils

*Extent:* about 10 percent of the unit
*Landform(s):* abandoned channels, flood plains, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 6 inches
*Flooding hazard:* frequent
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6w
*Drainage class:* very poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

| Representative soil profile: | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| Oe -- 0 to 3 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A -- 3 to 7 in | fine sandy loam | moderately rapid | 0.4 to 0.6 in | 6.6 to 7.3 | .17 | .17 |
| 2C1 -- 7 to 24 in | very gravelly sand | very rapid | 0.3 to 0.7 in | 6.6 to 7.3 | .05 | .17 |
| 2C2 -- 24 to 60 in | extremely gravelly sand | very rapid | 0.7 to 1.4 in | 6.6 to 7.3 | .05 | .17 |

## Minor Components

Canarway, very poorly drained and similar soils: 10 percent of the unit
Water: 30 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 11A--Riverrun-Canarway-Fredburr complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Riverrun and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* occasional
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 6s
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | sandy loam | moderately rapid | 0.6 to 0.7 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 6 to 16 in | gravelly loamy sand | very rapid | 0.3 to 0.7 in | 6.1 to 7.3 | .10 | .17 |
| 2C2 -- 16 to 60 in | very gravelly loamy coarse sand | very rapid | 0.9 to 1.3 in | 6.1 to 7.3 | .02 | .17 |

### Canarway, very poorly drained and similar soils

*Extent:* about 30 percent of the unit
*Landform(s):* abandoned channels, flood plains, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 6 inches
*Flooding hazard:* occasional
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6w
*Drainage class:* very poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oe -- 0 to 3 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A -- 3 to 7 in | fine sandy loam | moderately rapid | 0.4 to 0.6 in | 6.6 to 7.3 | .17 | .17 |
| 2C1 -- 7 to 24 in | very gravelly sand | very rapid | 0.3 to 0.7 in | 6.6 to 7.3 | .05 | .17 |
| 2C2 -- 24 to 60 in | extremely gravelly sand | very rapid | 0.7 to 1.4 in | 6.6 to 7.3 | .05 | .17 |

## Fredburr and similar soils

*Extent:* about 25 percent of the unit

*Landform(s):* flood-plain steps, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* sandy alluvium over gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 33 inches

*Flooding hazard:* occasional

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2

*Wind erodibility group (WEG):* 3

*Wind erodibility index (WEI):* 86

*Land capability class, nonirrigated:* 4w

*Drainage class:* somewhat poorly drained

*Hydric soil:* no

*Hydrologic group:* A

*Potential frost action:* moderate

*Ecological site(s):* Sandy (Sy) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 5 in | fine sandy loam | moderately rapid | 0.5 to 0.7 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 5 to 28 in | sand | very rapid | 0.5 to 1.8 in | 6.1 to 7.3 | .17 | .17 |
| C2 -- 28 to 60 in | extremely gravelly sand | very rapid | 0.6 to 1.0 in | 6.1 to 7.3 | .02 | .17 |

## Minor Components

Water: 0 to 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 12A--Riverrun-Curlew complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Riverrun and similar soils

*Extent:* about 70 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 6s
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | sandy loam | moderately rapid | 0.6 to 0.7 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 6 to 16 in | gravelly loamy sand | very rapid | 0.3 to 0.7 in | 6.1 to 7.3 | .10 | .17 |
| 2C2 -- 16 to 60 in | very gravelly loamy coarse sand | very rapid | 0.9 to 1.3 in | 6.1 to 7.3 | .02 | .17 |

### Curlew and similar soils

*Extent:* about 20 percent of the unit
*Landform(s):* abandoned channels, flood plains, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 8 inches
*Flooding hazard:* rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 5w
*Drainage class:* very poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | silt loam | moderately rapid | 1.7 to 2.0 in | 6.6 to 7.4 | .24 | .24 |
| C1 -- 11 to 24 in | sandy loam | moderately rapid | 1.2 to 1.7 in | 6.6 to 7.4 | .10 | .20 |
| 2C2 -- 24 to 29 in | very gravelly loamy sand | rapid | 0.2 to 0.4 in | 6.6 to 7.4 | .05 | .24 |
| 2C3 -- 29 to 60 in | very gravelly sand | very rapid | 0.6 to 0.9 in | 5.6 to 7.4 | .05 | .20 |

### Minor Components

Fredburr and similar soils:  10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 13A--Fredburr fine sandy loam, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

## Fredburr and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy alluvium over gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* occasional
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 6w
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* moderate

*Ecological site(s):* Sandy (Sy) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 5 in | fine sandy loam | moderately rapid | 0.5 to 0.7 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 5 to 28 in | sand | very rapid | 0.5 to 1.8 in | 6.1 to 7.3 | .17 | .17 |
| C2 -- 28 to 60 in | extremely gravelly sand | very rapid | 0.6 to 1.0 in | 6.1 to 7.3 | .02 | .17 |

## Minor Components

Riverrun and similar soils: 10 percent of the unit
Canarway and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 14F--Chereete-Curlew complex, 0 to 45 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

## Chereete and similar soils

*Extent:* about 65 percent of the unit
*Landform(s):* escarpments, intermontain basins
*Slope gradient:* 8 to 45 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | very gravelly coarse sandy loam | rapid | 0.3 to 0.4 in | 5.6 to 7.3 | .05 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

## Curlew and similar soils

*Extent:* about 25 percent of the unit
*Landform(s):* flood plains, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 8 inches
*Flooding hazard:* rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 5w
*Drainage class:* very poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | silt loam | moderately rapid | 1.7 to 2.0 in | 6.6 to 7.4 | .24 | .24 |
| C1 -- 11 to 24 in | sandy loam | moderately rapid | 1.2 to 1.7 in | 6.6 to 7.4 | .10 | .20 |
| 2C2 -- 24 to 29 in | very gravelly loamy sand | rapid | 0.2 to 0.4 in | 6.6 to 7.4 | .05 | .24 |
| 2C3 -- 29 to 60 in | very gravelly sand | very rapid | 0.6 to 0.9 in | 5.6 to 7.4 | .05 | .20 |

## Minor Components

Perma and similar soils:  10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 16E--Riverside-Tiechute-Curlew complex, 0 to 40 percent slopes

*Mean annual precipitation:* 12 to 15 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Tiechute and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* intermontain basins, stream terraces
*Slope gradient:* 0 to 4 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 7 in | cobbly sandy loam | moderately rapid | 0.6 to 0.9 in | 6.6 to 7.3 | .10 | .20 |
| AC -- 7 to 10 in | very cobbly sandy loam | rapid | 0.1 to 0.2 in | 6.6 to 7.3 | .05 | .20 |
| C -- 10 to 60 in | extremely cobbly loamy sand | very rapid | 0.5 to 1.0 in | 6.6 to 7.3 | .02 | .17 |

### Riverside and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* escarpments, intermontain basins
*Slope gradient:* 15 to 40 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 7 in | cobbly sandy loam | moderately rapid | 0.6 to 0.9 in | 6.6 to 7.3 | .10 | .20 |
| BC -- 7 to 12 in | gravelly sandy loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.8 | .10 | .20 |
| C1 -- 12 to 25 in | very gravelly loamy sand | rapid | 0.4 to 0.7 in | 6.6 to 7.8 | .05 | .17 |
| C2 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 6.6 to 7.8 | .02 | .17 |

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## Curlew and similar soils

*Extent:* about 20 percent of the unit

*Landform(s):* flood plains, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 8 inches

*Flooding hazard:* very rare

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 5w

*Drainage class:* very poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | silt loam | moderately rapid | 1.7 to 2.0 in | 6.6 to 7.4 | .24 | .24 |
| C1 -- 11 to 24 in | sandy loam | moderately rapid | 1.2 to 1.7 in | 6.6 to 7.4 | .10 | .20 |
| 2C2 -- 24 to 29 in | very gravelly loamy sand | rapid | 0.2 to 0.4 in | 6.6 to 7.4 | .05 | .24 |
| 2C3 -- 29 to 60 in | very gravelly sand | very rapid | 0.6 to 0.9 in | 5.6 to 7.4 | .05 | .20 |

## Minor Components

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 20E--Losthorse, rubbly-Poverty-Riverrun, stony, complex, 1 to 35 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 85 to 105 days

### Losthorse, rubbly and similar soils

*Extent:* about 70 percent of the unit
*Landform(s):* escarpments, intermontain basins, moraines
*Slope gradient:* 12 to 35 percent
*Parent material:* sandy and gravelly till derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 7s
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* ---

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| A -- | 0 to 3 in | very stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .05 | .20 |
| Bw -- | 3 to 15 in | very cobbly coarse sandy loam | moderately rapid | 0.6 to 1.2 in | 4.5 to 6.5 | .05 | .20 |
| C1 -- | 15 to 25 in | very cobbly loamy coarse sand | very rapid | 0.2 to 0.3 in | 4.5 to 6.0 | .05 | .17 |
| C2 -- | 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 4.5 to 6.0 | .02 | .17 |

### Riverrun, stony and similar soils

*Extent:* about 15 percent of the unit
*Landform(s):* flood plains, intermontain basins
*Slope gradient:* 2 to 6 percent
*Parent material:* sandy and gravelly alluvium derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 7s
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 4 in | very cobbly coarse sandy loam | moderately rapid | 0.3 to 0.4 in | 5.6 to 7.3 | .10 | .17 |
| AC -- 4 to 7 in | very cobbly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.6 to 7.3 | .10 | .17 |
| C1 -- 7 to 17 in | very gravelly loamy coarse sand | rapid | 0.3 to 0.5 in | 5.6 to 7.3 | .05 | .17 |
| C2 -- 17 to 60 in | very gravelly loamy coarse sand | very rapid | 0.9 to 1.3 in | 6.1 to 7.3 | .02 | .17 |

## Poverty and similar soils

*Extent:* about 15 percent of the unit

*Landform(s):* intermontain basins, outwash terraces

*Slope gradient:* 0 to 4 percent

*Parent material:* sandy and gravelly alluvium derived from granite

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 18 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 48

*Land capability class, nonirrigated:* 6w

*Drainage class:* poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oe -- 0 to 1 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A -- 1 to 5 in | cobbly sandy loam | moderately rapid | 0.4 to 0.5 in | 5.1 to 7.3 | .20 | .20 |
| Bw -- 5 to 10 in | cobbly sandy loam | moderately rapid | 0.4 to 0.6 in | 5.1 to 7.3 | .20 | .20 |
| C1 -- 10 to 14 in | cobbly coarse sandy loam | rapid | 0.0 to 0.4 in | 5.1 to 6.5 | .10 | .17 |
| C2 -- 14 to 19 in | very cobbly loamy coarse sand | very rapid | 0.0 to 0.1 in | 5.1 to 6.5 | .05 | .17 |
| C3 -- 19 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.2 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 26B--Grayhorse silt loam, 0 to 4 percent slopes

*Mean annual precipitation:* 12 to 15 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 90 to 115 days

## Grayhorse and similar soils

*Extent:* about 85 percent of the unit

*Landform(s):* inset fans, intermontain basins, stream terraces

*Slope gradient:* 0 to 4 percent

*Parent material:* fine-loamy alluvium over sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 28 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4

*Wind erodibility group (WEG):* 4L

*Wind erodibility index (WEI):* 86

*Land capability class, nonirrigated:* 3w

*Drainage class:* somewhat poorly drained

*Hydric soil:* no

*Hydrologic group:* B

*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A1 -- 0 to 12 in | silt loam | moderate | 1.7 to 2.1 in | 6.6 to 8.4 | .37 | .37 |
| A2 -- 12 to 18 in | loam | moderate | 0.9 to 1.1 in | 6.6 to 7.8 | .37 | .37 |
| C1 -- 18 to 29 in | gravelly loam | moderate | 1.2 to 1.8 in | 6.6 to 7.8 | .24 | .37 |
| 2C2 -- 29 to 34 in | very cobbly sandy loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.8 | .10 | .20 |
| 2C3 -- 34 to 60 in | extremely gravelly loamy sand | very rapid | 0.5 to 0.8 in | 6.6 to 7.3 | .02 | .17 |

## Minor Components

Sweathouse and similar soils: 10 percent of the unit

Fairway and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 27B--Curlew-Groff silt loams, 0 to 4 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Curlew and similar soils

*Extent:* about 75 percent of the unit
*Landform(s):* drainageways, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 8 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 5w
*Drainage class:* very poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | silt loam | moderately rapid | 1.7 to 2.0 in | 6.6 to 7.4 | .24 | .24 |
| C1 -- 11 to 24 in | sandy loam | moderately rapid | 1.2 to 1.7 in | 6.6 to 7.4 | .10 | .20 |
| 2C2 -- 24 to 29 in | very gravelly loamy sand | rapid | 0.2 to 0.4 in | 6.6 to 7.4 | .05 | .24 |
| 2C3 -- 29 to 60 in | very gravelly sand | very rapid | 0.6 to 0.9 in | 5.6 to 7.4 | .05 | .20 |

### Groff and similar soils

*Extent:* about 15 percent of the unit
*Landform(s):* drainageways, intermontain basins
*Slope gradient:* 0 to 4 percent
*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 5w
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

## Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A1 -- 0 to 8 in | silt loam | moderately rapid | 1.2 to 1.4 in | 6.6 to 7.8 | .32 | .32 |
| A2 -- 8 to 18 in | loam | moderately rapid | 1.5 to 1.9 in | 5.1 to 7.3 | .24 | .32 |
| A3 -- 18 to 28 in | sandy loam | moderately rapid | 0.9 to 1.3 in | 5.1 to 7.3 | .10 | .20 |
| 2C1 -- 28 to 33 in | gravelly loamy coarse sand | very rapid | 0.2 to 0.3 in | 5.1 to 6.5 | .10 | .17 |
| 2C2 -- 33 to 60 in | very gravelly coarse sand | very rapid | 0.3 to 0.8 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Blossberg and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 30D18--Leighcan family, steep mountain slopes, moist

*Mean annual precipitation:* 18 to 47 inches
*Mean annual temperature:* 34 to 39 degrees F
*Frost-free period:* 45 to 70 days

### Leighcan and similar soils

*Extent:* about 80 percent of the unit
*Landform(s):* mountain slopes
*Slope gradient:* 40 to 60 percent
*Parent material:* colluvium derived from granite
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 5
*Wind erodibility group (WEG):* 4
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 7e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* moderate

*Ecological site(s):* ---

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| Oi -- 0 to 2 in | slightly decomposed plant material | very rapid | | 4.0 to 5.8 | | |
| A -- 2 to 4 in | gravelly sandy loam | moderately rapid | 0.1 to 0.2 in | 4.5 to 6.5 | .10 | .20 |
| Bw1 -- 4 to 9 in | gravelly sandy loam | moderately rapid | 0.2 to 0.5 in | 4.5 to 6.5 | .10 | .24 |
| Bw2 -- 9 to 27 in | very gravelly sandy loam | moderately rapid | 0.7 to 1.3 in | 4.5 to 6.0 | .10 | .24 |
| BC -- 27 to 60 in | very gravelly sandy loam | moderately rapid | 1.0 to 2.3 in | 4.5 to 6.0 | .05 | .28 |

### Minor Components

Crawfish and similar soils: 0 to 10 percent of the unit
Leighcan, lesser slopes and similar soils: 0 to 10 percent of the unit
Lolopeak and similar soils: 0 to 10 percent of the unit
Tolby and similar soils: 0 to 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 31B19--Kadygulch-Sharrott families complex, dissected mountain slopes

*Mean annual precipitation:* 20 to 38 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 70 to 95 days

## Kadygulch and similar soils

*Extent:* about 70 percent of the unit
*Landform(s):* mountain slopes
*Slope gradient:* 30 to 60 percent
*Parent material:* colluvium derived from granite
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 5
*Wind erodibility group (WEG):* 4
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 7e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* moderate

*Ecological site(s):* ---

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| Oi -- 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 5.8 | | |
| A -- 1 to 5 in | gravelly sandy loam | moderately rapid | 0.3 to 0.4 in | 5.6 to 6.5 | .10 | .20 |
| Bw -- 5 to 11 in | gravelly sandy loam | moderately rapid | 0.4 to 0.6 in | 5.6 to 6.5 | .10 | .17 |
| BC -- 11 to 19 in | very gravelly sandy loam | moderately rapid | 0.2 to 0.6 in | 5.6 to 6.5 | .05 | .17 |
| C -- 19 to 60 in | very gravelly sandy loam | moderately rapid | 1.2 to 2.9 in | 5.6 to 6.5 | .02 | .17 |

## Sharrott and similar soils

*Extent:* about 15 percent of the unit
*Landform(s):* mountain slopes
*Slope gradient:* 30 to 60 percent
*Parent material:* colluvium over residuum weathered from granite and gneiss
*Restrictive feature(s):* lithic bedrock at 10 to 20 inches
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 1
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 7e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* ---

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oi -- 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 5.8 | | |
| E -- 1 to 6 in | very gravelly sandy loam | moderately rapid | 0.2 to 0.4 in | 5.6 to 7.3 | .05 | .20 |
| Bw -- 6 to 15 in | very gravelly sandy loam | moderately rapid | 0.4 to 0.7 in | 5.6 to 7.3 | .10 | .24 |
| BC -- 15 to 19 in | very gravelly sandy loam | rapid | 0.1 to 0.2 in | 5.6 to 7.3 | .05 | .24 |
| R -- 19 to 60 in | bedrock | impermeable | | | | |

## Minor Components

Macmeal and similar soils: 0 to 10 percent of the unit
Totelake and similar soils: 0 to 10 percent of the unit
Rock outcrop: 0 to 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 31K56--Holter-Whitlash families complex, dissected mountain slopes

*Mean annual precipitation:* 18 to 37 inches
*Mean annual temperature:* 41 to 45 degrees F
*Frost-free period:* 75 to 105 days

### Holter and similar soils

*Extent:* about 65 percent of the unit
*Landform(s):* mountain slopes
*Slope gradient:* 30 to 60 percent
*Parent material:* colluvium over residuum weathered from granite
*Restrictive feature(s):* lithic bedrock at 20 to 60 inches
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 7e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* C
*Potential frost action:* moderate

*Ecological site(s):* ---

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| A -- | 0 to 4 in | very gravelly sandy loam | moderately rapid | 0.2 to 0.4 in | 6.1 to 7.4 | .10 | .32 |
| Bt1 -- | 4 to 9 in | very gravelly sandy clay loam | moderate | 0.3 to 0.5 in | 6.1 to 7.4 | .10 | .32 |
| Bt2 -- | 9 to 26 in | very gravelly sandy clay loam | moderate | 1.2 to 1.7 in | 5.6 to 7.3 | .10 | .32 |
| R -- | 26 to 60 in | bedrock | impermeable | | | | |

### Whitlash and similar soils

*Extent:* about 20 percent of the unit
*Landform(s):* mountain slopes
*Slope gradient:* 30 to 60 percent
*Parent material:* colluvium over residuum weathered from granite and gneiss
*Restrictive feature(s):* lithic bedrock at 10 to 20 inches
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 1
*Wind erodibility group (WEG):* 4
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 7s
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* ---

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 7 in | stony sandy loam | moderately rapid | 0.6 to 0.7 in | 6.1 to 7.3 | .10 | .17 |
| Bw -- 7 to 13 in | very cobbly sandy loam | moderately rapid | 0.2 to 0.4 in | 6.1 to 7.3 | .05 | .20 |
| BC -- 13 to 17 in | very cobbly sandy loam | moderately rapid | 0.1 to 0.3 in | 6.1 to 7.3 | .05 | .24 |
| R -- 17 to 60 in | bedrock | impermeable | | | | |

## Minor Components

Holter, lesser slopes and similar soils: 0 to 10 percent of the unit
Kadygulch and similar soils: 0 to 10 percent of the unit
Rock outcrop: 0 to 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 120B--Holloron loam, 0 to 4 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

## Holloron and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* intermontain basins, stream terraces
*Slope gradient:* 0 to 4 percent
*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 3e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* Silty (Si) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 8 in | loam | moderate | 1.2 to 1.5 in | 6.6 to 7.8 | .32 | .32 |
| Bw -- 8 to 14 in | loam | moderate | 0.9 to 1.2 in | 6.6 to 7.8 | .32 | .32 |
| C -- 14 to 32 in | sandy loam | moderate | 2.5 to 3.2 in | 6.6 to 7.8 | .32 | .32 |
| 2C -- 32 to 60 in | very gravelly loamy sand | very rapid | 0.3 to 1.1 in | 6.6 to 7.3 | .05 | .17 |

## Minor Components

Tiechute and similar soils: 10 percent of the unit
Overwhich and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 122B--Holloron-Tiechute complex, 0 to 4 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Holloron and similar soils

*Extent:* about 50 percent of the unit
*Landform(s):* inset fans, intermontain basins, stream terraces
*Slope gradient:* 0 to 4 percent
*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 3e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* Silty (Si) 10-14" p.z.

| *Representative soil profile:* | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 8 in | cobbly loam | moderate | 0.8 to 1.2 in | 6.6 to 7.8 | .17 | .32 |
| Bw -- 8 to 14 in | loam | moderate | 0.9 to 1.2 in | 6.6 to 7.8 | .32 | .32 |
| C -- 14 to 32 in | sandy loam | moderate | 2.5 to 3.2 in | 6.6 to 7.8 | .32 | .32 |
| 2C -- 32 to 60 in | very gravelly loamy sand | very rapid | 0.3 to 1.1 in | 6.6 to 7.3 | .05 | .17 |

### Tiechute and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* inset fans, intermontain basins, stream terraces
*Slope gradient:* 0 to 4 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 6e
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 7 in | cobbly loam | moderate | 0.7 to 1.1 in | 6.6 to 7.8 | .17 | .32 |
| AC -- 7 to 10 in | very cobbly sandy loam | rapid | 0.1 to 0.2 in | 6.6 to 7.3 | .05 | .20 |
| C -- 10 to 60 in | extremely cobbly loamy sand | very rapid | 0.5 to 1.0 in | 6.6 to 7.3 | .02 | .17 |

## Minor Components

Owenfort and similar soils:  10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 123B--Overwhich-Tiechute complex, 0 to 4 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Overwhich and similar soils

*Extent:* about 55 percent of the unit
*Landform(s):* intermontain basins, stream terraces
*Slope gradient:* 0 to 4 percent
*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 3w
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| A -- | 0 to 11 in | loam | moderate | 1.7 to 2.1 in | 6.6 to 7.8 | .32 | .32 |
| Bw -- | 11 to 17 in | loam | moderate | 0.9 to 1.1 in | 6.6 to 7.8 | .32 | .32 |
| C1 -- | 17 to 33 in | fine sandy loam | moderately rapid | 1.8 to 2.4 in | 6.6 to 7.8 | .20 | .20 |
| 2C2 -- | 33 to 60 in | extremely gravelly loamy sand | very rapid | 0.5 to 0.8 in | 6.1 to 7.3 | .02 | .17 |

### Tiechute and similar soils

*Extent:* about 35 percent of the unit
*Landform(s):* intermontain basins, stream terraces
*Slope gradient:* 0 to 4 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 6e
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 7 in | gravelly loam | moderately rapid | 0.8 to 1.1 in | 6.6 to 7.3 | .17 | .32 |
| AC -- 7 to 12 in | gravelly sandy loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.8 | .10 | .20 |
| C1 -- 12 to 24 in | very gravelly loamy sand | rapid | 0.4 to 0.6 in | 6.6 to 7.8 | .05 | .17 |
| C2 -- 24 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 6.6 to 7.3 | .02 | .17 |

## Minor Components

Holloron, sodic overwash and similar soils:  10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 130B--Hamilton silt loam, 0 to 4 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

## Hamilton and similar soils

*Extent:* about 90 percent of the unit
*Landform(s):* intermontain basins, stream terraces
*Slope gradient:* 0 to 4 percent
*Parent material:* coarse-silty alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 5
*Wind erodibility group (WEG):* 6
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 3e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* C
*Potential frost action:* moderate

*Ecological site(s):* Silty (Si) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 8 in | silt loam | moderate | 1.1 to 1.4 in | 6.6 to 7.8 | .37 | .37 |
| Bk -- 8 to 20 in | silt loam | moderate | 1.7 to 2.2 in | 7.4 to 8.2 | .37 | .37 |
| C1 -- 20 to 54 in | silt loam | moderately rapid | 4.7 to 6.1 in | 6.6 to 8.4 | .37 | .37 |
| 2C2 -- 54 to 60 in | gravelly loamy fine sand | rapid | 0.4 to 0.6 in | 6.6 to 7.8 | .10 | .17 |

## Minor Components

Overwhich and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 132A--Hamilton-Overwhich complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Hamilton and similar soils

*Extent:* about 60 percent of the unit
*Landform(s):* intermontain basins, stream terraces
*Slope gradient:* 0 to 2 percent
*Parent material:* coarse-silty alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 51 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 5
*Wind erodibility group (WEG):* 6
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 3e
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* C
*Potential frost action:* moderate

*Ecological site(s):* Silty (Si) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 8 in | silt loam | moderate | 1.1 to 1.4 in | 6.6 to 7.8 | .37 | .37 |
| Bk -- 8 to 20 in | silt loam | moderate | 1.7 to 2.2 in | 7.4 to 8.2 | .37 | .37 |
| C1 -- 20 to 54 in | silt loam | moderately rapid | 4.7 to 6.1 in | 6.6 to 8.4 | .37 | .37 |
| 2C2 -- 54 to 60 in | gravelly loamy fine sand | rapid | 0.4 to 0.6 in | 6.6 to 7.8 | .10 | .17 |

### Overwhich and similar soils

*Extent:* about 30 percent of the unit
*Landform(s):* intermontain basins, stream terraces
*Slope gradient:* 0 to 2 percent
*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 6
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 3w
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* C
*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | silt loam | moderate | 1.5 to 2.0 in | 6.6 to 7.8 | .37 | .37 |
| Bw -- 11 to 17 in | loam | moderate | 0.9 to 1.1 in | 6.6 to 7.8 | .32 | .32 |
| C1 -- 17 to 33 in | fine sandy loam | moderately rapid | 1.8 to 2.4 in | 6.6 to 7.8 | .20 | .20 |
| 2C2 -- 33 to 60 in | extremely gravelly loamy sand | very rapid | 0.5 to 0.8 in | 6.1 to 7.3 | .02 | .17 |

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## Minor Components

Sweathouse and similar soils:  10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 143A--Fairway-Grayhorse complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 15 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Fairway and similar soils

*Extent:* about 75 percent of the unit
*Landform(s):* inset fans, intermontain basins, stream terraces
*Slope gradient:* 0 to 2 percent
*Parent material:* fine-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 6
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 3w
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* C
*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 8 in | silt loam | moderate | 1.1 to 1.4 in | 6.6 to 7.8 | .37 | .37 |
| Bw -- 8 to 13 in | loam | moderate | 0.7 to 0.9 in | 7.4 to 8.4 | .37 | .37 |
| Bk -- 13 to 21 in | loam | moderate | 1.0 to 1.3 in | 7.4 to 8.4 | .37 | .37 |
| C1 -- 21 to 40 in | loam | moderate | 2.3 to 3.1 in | 7.4 to 8.4 | .37 | .37 |
| 2C2 -- 40 to 60 in | extremely gravelly sand | very rapid | 0.4 to 0.6 in | 6.6 to 7.3 | .02 | .17 |

### Grayhorse and similar soils

*Extent:* about 15 percent of the unit
*Landform(s):* inset fans, intermontain basins, stream terraces
*Slope gradient:* 0 to 2 percent
*Parent material:* fine-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 28 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 4L
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 3w
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A1 -- 0 to 12 in | silt loam | moderate | 1.7 to 2.1 in | 6.6 to 8.4 | .37 | .37 |
| A2 -- 12 to 18 in | loam | moderate | 0.9 to 1.1 in | 6.6 to 7.8 | .37 | .37 |
| C1 -- 18 to 29 in | gravelly loam | moderate | 1.2 to 1.8 in | 6.6 to 7.8 | .24 | .37 |
| 2C2 -- 29 to 34 in | very cobbly sandy loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.8 | .10 | .20 |
| 2C3 -- 34 to 60 in | extremely gravelly loamy sand | very rapid | 0.5 to 0.8 in | 6.6 to 7.3 | .02 | .17 |

## Minor Components

Allwit and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 146A--Curlew-Riverrun complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 90 to 115 days

## Curlew and similar soils

*Extent:* about 65 percent of the unit

*Landform(s):* abandoned channels, flood plains, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 8 inches

*Flooding hazard:* rare

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 5w

*Drainage class:* very poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| A -- | 0 to 11 in | silt loam | moderately rapid | 1.7 to 2.0 in | 6.6 to 7.4 | .24 | .24 |
| C1 -- | 11 to 24 in | sandy loam | moderately rapid | 1.2 to 1.7 in | 6.6 to 7.4 | .10 | .20 |
| 2C2 -- | 24 to 29 in | very gravelly loamy sand | rapid | 0.2 to 0.4 in | 6.6 to 7.4 | .05 | .24 |
| 2C3 -- | 29 to 60 in | very gravelly sand | very rapid | 0.6 to 0.9 in | 5.6 to 7.4 | .05 | .20 |

## Riverrun and similar soils

*Extent:* about 15 percent of the unit

*Landform(s):* flood-plain steps, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 33 inches

*Flooding hazard:* rare

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2

*Wind erodibility group (WEG):* 3

*Wind erodibility index (WEI):* 86

*Land capability class, nonirrigated:* 6s

*Drainage class:* moderately well drained

*Hydric soil:* no

*Hydrologic group:* A

*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | fine sandy loam | moderately rapid | 0.6 to 0.8 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 6 to 16 in | gravelly loamy sand | very rapid | 0.3 to 0.7 in | 6.1 to 7.3 | .10 | .17 |
| 2C2 -- 16 to 60 in | very gravelly loamy coarse sand | very rapid | 0.9 to 1.3 in | 6.1 to 7.3 | .02 | .17 |

## Minor Components

Groff and similar soils: 10 percent of the unit

Fredburr and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 147A--Histic Endoaquolls-Curlew-Water complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 90 to 115 days

## Histic Endoaquolls and similar soils

*Extent:* about 45 percent of the unit

*Landform(s):* abandoned channels, flood plains, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 3 inches

*Flooding hazard:* rare

*Ponding hazard:* occasional

*Soil loss tolerance (T factor):* 4

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 5w

*Drainage class:* very poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* high

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| Oe -- | 0 to 14 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A -- | 14 to 24 in | silt loam | moderately rapid | 1.5 to 1.8 in | 6.6 to 7.8 | .32 | .32 |
| C1 -- | 24 to 39 in | sandy loam | moderately rapid | 1.4 to 1.7 in | 6.6 to 7.8 | .20 | .20 |
| 2C2 -- | 39 to 55 in | very gravelly sandy loam | rapid | 0.6 to 1.1 in | 6.6 to 7.8 | .05 | .20 |
| 2C3 -- | 55 to 60 in | extremely gravelly sand | very rapid | 0.1 to 0.1 in | 5.6 to 7.3 | .02 | .17 |

## Curlew and similar soils

*Extent:* about 35 percent of the unit

*Landform(s):* abandoned channels, flood plains, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 8 inches

*Flooding hazard:* rare

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 5w

*Drainage class:* very poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | silt loam | moderately rapid | 1.7 to 2.0 in | 6.6 to 7.4 | .24 | .24 |
| C1 -- 11 to 24 in | sandy loam | moderately rapid | 1.2 to 1.7 in | 6.6 to 7.4 | .10 | .20 |
| 2C2 -- 24 to 29 in | very gravelly loamy sand | rapid | 0.2 to 0.4 in | 6.6 to 7.4 | .05 | .24 |
| 2C3 -- 29 to 60 in | very gravelly sand | very rapid | 0.6 to 0.9 in | 5.6 to 7.4 | .05 | .20 |

## Water

*Extent:* about 15 percent of the unit

*Landform(s):* flood plains, intermontain basins

*Slope gradient:*

*Parent material:*

*Restrictive feature(s):* none

*Seasonal high water table:* greater than 60 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):*

*Wind erodibility group (WEG):*

*Wind erodibility index (WEI):*

*Land capability class, nonirrigated:*

*Drainage class:*

*Hydric soil:* unranked

*Hydrologic group:*

*Potential frost action:*

*Ecological site(s):* ---

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| none | | | | | | |

## Minor Components

Blossberg and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 148A--Grayhorse-Allwit complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 15 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Grayhorse and similar soils

*Extent:* about 70 percent of the unit
*Landform(s):* inset fans, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* fine-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 28 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 4L
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 3w
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| A1 -- | 0 to 12 in | silt loam | moderate | 1.7 to 2.1 in | 6.6 to 8.4 | .37 | .37 |
| A2 -- | 12 to 18 in | loam | moderate | 0.9 to 1.1 in | 6.6 to 7.8 | .37 | .37 |
| C1 -- | 18 to 29 in | gravelly loam | moderate | 1.2 to 1.8 in | 6.6 to 7.8 | .24 | .37 |
| 2C2 -- | 29 to 34 in | very cobbly sandy loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.8 | .10 | .20 |
| 2C3 -- | 34 to 60 in | extremely gravelly loamy sand | very rapid | 0.5 to 0.8 in | 6.6 to 7.3 | .02 | .17 |

### Allwit and similar soils

*Extent:* about 20 percent of the unit
*Landform(s):* inset fans, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* fine-loamy alluvium over sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 18 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 4w
*Drainage class:* poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* high

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 14 in | cobbly loam | moderately rapid | 1.5 to 1.8 in | 6.6 to 7.3 | .17 | .32 |
| 2BC -- 14 to 22 in | very cobbly loam | moderate | 0.6 to 0.9 in | 6.6 to 7.8 | .15 | .37 |
| 2C1 -- 22 to 32 in | very cobbly sandy loam | moderately rapid | 0.6 to 1.1 in | 6.6 to 7.8 | .10 | .20 |
| 3C2 -- 32 to 60 in | extremely gravelly loamy sand | very rapid | 0.6 to 0.8 in | 6.6 to 7.3 | .02 | .17 |

## Minor Components

Blossberg and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 149A--Grayhorse-Owenfort complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 15 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 90 to 115 days

### Owenfort and similar soils

*Extent:* about 45 percent of the unit

*Landform(s):* inset fans, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* cobbly loamy alluvium over cobbly and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 72 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 48

*Land capability class, nonirrigated:* 4e

*Drainage class:* somewhat excessively drained

*Hydric soil:* no

*Hydrologic group:* B

*Potential frost action:* moderate

*Ecological site(s):* Silty-Droughty (SiDr) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A1 -- 0 to 5 in | cobbly loam | moderate | 0.5 to 0.8 in | 6.6 to 7.8 | .17 | .32 |
| A2 -- 5 to 10 in | very cobbly loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.3 | .10 | .32 |
| BC -- 10 to 42 in | very cobbly sandy loam | moderately rapid | 1.9 to 3.5 in | 6.6 to 7.3 | .05 | .20 |
| C -- 42 to 60 in | extremely gravelly loamy sand | very rapid | 0.4 to 0.5 in | 6.6 to 7.3 | .02 | .17 |

### Grayhorse and similar soils

*Extent:* about 45 percent of the unit

*Landform(s):* inset fans, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* fine-loamy alluvium over sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 28 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4

*Wind erodibility group (WEG):* 4L

*Wind erodibility index (WEI):* 86

*Land capability class, nonirrigated:* 3w

*Drainage class:* somewhat poorly drained

*Hydric soil:* no

*Hydrologic group:* B

*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A1 -- 0 to 12 in | silt loam | moderate | 1.7 to 2.1 in | 6.6 to 8.4 | .37 | .37 |
| A2 -- 12 to 18 in | loam | moderate | 0.9 to 1.1 in | 6.6 to 7.8 | .37 | .37 |
| C1 -- 18 to 29 in | gravelly loam | moderate | 1.2 to 1.8 in | 6.6 to 7.8 | .24 | .37 |
| 2C2 -- 29 to 34 in | very cobbly sandy loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.8 | .10 | .20 |
| 2C3 -- 34 to 60 in | extremely gravelly loamy sand | very rapid | 0.5 to 0.8 in | 6.6 to 7.3 | .02 | .17 |

## Minor Components

Groff and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 150A--Riverrun complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Riverrun and similar soils

*Extent:* about 65 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 6s
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | fine sandy loam | moderately rapid | 0.6 to 0.8 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 6 to 16 in | gravelly loamy sand | very rapid | 0.3 to 0.7 in | 6.1 to 7.3 | .10 | .17 |
| 2C2 -- 16 to 60 in | very gravelly loamy coarse sand | very rapid | 0.9 to 1.3 in | 6.1 to 7.3 | .02 | .17 |

### Riverrun and similar soils

*Extent:* about 20 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 2
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 6s
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 4 in | very gravelly loamy sand | rapid | 0.1 to 0.2 in | 6.1 to 7.3 | .05 | .17 |
| C -- 4 to 60 in | extremely gravelly sand | very rapid | 1.1 to 1.7 in | 6.1 to 7.3 | .02 | .17 |

## Minor Components

Canarway and similar soils:  5 percent of the unit
Gash and similar soils:  10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 153A--Gash-Riverrun complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Gash and similar soils

*Extent:* about 60 percent of the unit
*Landform(s):* drainageways, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 51 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 4e
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* moderate

*Ecological site(s):* Overflow (Ov) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | fine sandy loam | moderately rapid | 0.6 to 0.8 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 6 to 26 in | sandy loam | moderately rapid | 1.4 to 2.6 in | 6.1 to 7.3 | .20 | .20 |
| 2C2 -- 26 to 60 in | very gravelly sand | very rapid | 0.7 to 1.0 in | 6.1 to 7.3 | .02 | .17 |

### Riverrun and similar soils

*Extent:* about 25 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 6s
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | sandy loam | moderately rapid | 0.6 to 0.7 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 6 to 16 in | gravelly loamy sand | very rapid | 0.3 to 0.7 in | 6.1 to 7.3 | .10 | .17 |
| 2C2 -- 16 to 60 in | very gravelly loamy coarse sand | very rapid | 0.9 to 1.3 in | 6.1 to 7.3 | .02 | .17 |

## Minor Components

Fredburr and similar soils:  10 percent of the unit
Canarway and similar soils:  5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 154A--Overwhich-Bandy complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 90 to 115 days

### Overwhich and similar soils

*Extent:* about 80 percent of the unit

*Landform(s):* flood-plain steps, intermontain basins, stream terraces

*Slope gradient:* 0 to 2 percent

*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 33 inches

*Flooding hazard:* very rare

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 3w

*Drainage class:* somewhat poorly drained

*Hydric soil:* no

*Hydrologic group:* B

*Potential frost action:* moderate

*Ecological site(s):* Subirrigated (Sb) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | loam | moderate | 1.7 to 2.1 in | 6.6 to 7.8 | .32 | .32 |
| Bw -- 11 to 17 in | loam | moderate | 0.9 to 1.1 in | 6.6 to 7.8 | .32 | .32 |
| C1 -- 17 to 33 in | fine sandy loam | moderately rapid | 1.8 to 2.4 in | 6.6 to 7.8 | .20 | .20 |
| 2C2 -- 33 to 60 in | extremely gravelly loamy sand | very rapid | 0.5 to 0.8 in | 6.1 to 7.3 | .02 | .17 |

### Bandy and similar soils

*Extent:* about 20 percent of the unit

*Landform(s):* flood plains, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* sandy and gravelly alluvium

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 8 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 5w

*Drainage class:* poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oe -- 0 to 3 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A1 -- 3 to 7 in | loam | moderately rapid | 0.6 to 0.7 in | 5.1 to 7.3 | .32 | .32 |
| A2 -- 7 to 15 in | gravelly sandy loam | moderately rapid | 0.7 to 1.0 in | 5.1 to 6.5 | .15 | .24 |
| 2C1 -- 15 to 18 in | very gravelly sandy loam | rapid | 0.1 to 0.2 in | 5.1 to 6.5 | .05 | .20 |
| 2C2 -- 18 to 60 in | extremely gravelly sand | very rapid | 0.8 to 1.3 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 157B--Owenfort complex, 1 to 4 percent slopes

*Mean annual precipitation:* 12 to 15 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

## Owenfort and similar soils

*Extent:* about 75 percent of the unit
*Landform(s):* inset fans, intermontain basins, stream terraces
*Slope gradient:* 1 to 4 percent
*Parent material:* cobbly loamy alluvium over cobbly and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 4e
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* Silty-Droughty (SiDr) 10-14" p.z.

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| A1 -- | 0 to 5 in | cobbly loam | moderate | 0.5 to 0.8 in | 6.6 to 7.8 | .17 | .32 |
| A2 -- | 5 to 10 in | very cobbly loam | moderately rapid | 0.3 to 0.5 in | 6.6 to 7.3 | .10 | .32 |
| BC -- | 10 to 42 in | very cobbly sandy loam | moderately rapid | 1.9 to 3.5 in | 6.6 to 7.3 | .05 | .20 |
| C -- | 42 to 60 in | extremely gravelly loamy sand | very rapid | 0.4 to 0.5 in | 6.6 to 7.3 | .02 | .17 |

## Owenfort and similar soils

*Extent:* about 15 percent of the unit
*Landform(s):* inset fans, intermontain basins, stream terraces
*Slope gradient:* 1 to 4 percent
*Parent material:* very cobbly loamy alluvium over cobbly and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 38
*Land capability class, nonirrigated:* 6s
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* Silty-Droughty (SiDr) 10-14" p.z.

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| A -- | 0 to 10 in | very cobbly loam | moderately rapid | 0.7 to 1.1 in | 6.6 to 7.3 | .10 | .32 |
| BC -- | 10 to 42 in | very cobbly sandy loam | moderately rapid | 1.9 to 3.5 in | 6.6 to 7.3 | .05 | .20 |
| C -- | 42 to 60 in | extremely gravelly loamy sand | very rapid | 0.4 to 0.5 in | 6.6 to 7.3 | .02 | .17 |

## Minor Components

Tiechute and similar soils:  10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 160A--Riverrun-Gash-Curlew complex, 0 to 2 percent slopes

*Mean annual precipitation:* 12 to 14 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 90 to 115 days

### Riverrun and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* flood-plain steps, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 33 inches
*Flooding hazard:* very rare
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6s
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 7 in | gravelly sandy loam | moderately rapid | 0.5 to 0.8 in | 6.1 to 7.3 | .10 | .20 |
| C1 -- 7 to 16 in | gravelly loamy sand | very rapid | 0.3 to 0.6 in | 6.1 to 7.3 | .10 | .17 |
| 2C2 -- 16 to 60 in | very gravelly loamy coarse sand | very rapid | 0.9 to 1.3 in | 6.1 to 7.3 | .02 | .17 |

### Gash and similar soils

*Extent:* about 35 percent of the unit
*Landform(s):* drainageways, intermontain basins
*Slope gradient:* 0 to 2 percent
*Parent material:* coarse-loamy alluvium over sandy and gravelly alluvium
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 51 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 86
*Land capability class, nonirrigated:* 4e
*Drainage class:* moderately well drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* moderate

*Ecological site(s):* Overflow (Ov) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | fine sandy loam | moderately rapid | 0.6 to 0.8 in | 6.1 to 7.3 | .20 | .20 |
| C1 -- 6 to 26 in | sandy loam | moderately rapid | 1.4 to 2.6 in | 6.1 to 7.3 | .20 | .20 |
| 2C2 -- 26 to 60 in | very gravelly sand | very rapid | 0.7 to 1.0 in | 6.1 to 7.3 | .02 | .17 |

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## Curlew and similar soils

*Extent:* about 25 percent of the unit

*Landform(s):* abandoned channels, flood plains, intermontain basins

*Slope gradient:* 0 to 2 percent

*Parent material:* sandy and gravelly alluvium derived from mixed

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 8 inches

*Flooding hazard:* rare

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 5w

*Drainage class:* very poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 11 in | silt loam | moderately rapid | 1.7 to 2.0 in | 6.6 to 7.4 | .24 | .24 |
| C1 -- 11 to 24 in | sandy loam | moderately rapid | 1.2 to 1.7 in | 6.6 to 7.4 | .10 | .20 |
| 2C2 -- 24 to 29 in | very gravelly loamy sand | rapid | 0.2 to 0.4 in | 6.6 to 7.4 | .05 | .24 |
| 2C3 -- 29 to 60 in | very gravelly sand | very rapid | 0.6 to 0.9 in | 5.6 to 7.4 | .05 | .20 |

## Minor Components

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 304D--Chereete cobbly coarse sandy loam, 8 to 15 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

### Chereete and similar soils

*Extent:* about 90 percent of the unit
*Landform(s):* intermontain basins, outwash fans
*Slope gradient:* 8 to 15 percent
*Parent material:* sandy and gravelly grus derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | cobbly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Sheafman and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 305C--Victor gravelly coarse sandy loam, 4 to 8 percent slopes

*Mean annual precipitation:* 13 to 17 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 80 to 100 days

## Victor and similar soils

*Extent:* about 90 percent of the unit

*Landform(s):* intermontain basins, outwash terraces

*Slope gradient:* 4 to 8 percent

*Parent material:* gravelly coarse-loamy outwash over sandy and gravelly outwash derived from granite and gneiss

*Restrictive feature(s):* none

*Seasonal high water table:* greater than 60 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 3

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 4e

*Drainage class:* somewhat excessively drained

*Hydric soil:* no

*Hydrologic group:* A

*Potential frost action:* low

*Ecological site(s):* Sandy (Sy) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 12 in | gravelly coarse sandy loam | moderately rapid | 0.9 to 1.5 in | 5.1 to 7.2 | .10 | .20 |
| BC -- 12 to 30 in | gravelly sandy loam | moderately rapid | 1.4 to 2.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 30 to 48 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.9 in | 5.1 to 7.0 | .05 | .17 |
| C2 -- 48 to 60 in | extremely gravelly coarse sand | very rapid | 0.1 to 0.4 in | 5.1 to 7.0 | .02 | .17 |

## Minor Components

Sheafman and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 306B--Sheafman gravelly coarse sandy loam, 1 to 4 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

### Sheafman and similar soils

*Extent:* about 80 percent of the unit
*Landform(s):* intermontain basins, outwash fans
*Slope gradient:* 1 to 4 percent
*Parent material:* coarse-loamy outwash over very gravelly, very cobbly or extremely gravelly sandy outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 4e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 10 in | gravelly coarse sandy loam | moderately rapid | 0.8 to 1.2 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 10 to 14 in | cobbly coarse sandy loam | moderately rapid | 0.3 to 0.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 30 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.8 in | 5.1 to 6.5 | .05 | .17 |
| C2 -- 30 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 0.9 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Victor and similar soils: 10 percent of the unit
Chereete and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 306C--Sheafman gravelly coarse sandy loam, 4 to 8 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

## Sheafman and similar soils

*Extent:* about 80 percent of the unit
*Landform(s):* intermontain basins, outwash fans
*Slope gradient:* 4 to 8 percent
*Parent material:* coarse-loamy outwash over very gravelly, very cobbly or extremely gravelly sandy outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 4e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 10 in | gravelly coarse sandy loam | moderately rapid | 0.8 to 1.2 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 10 to 14 in | cobbly coarse sandy loam | moderately rapid | 0.3 to 0.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 30 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.8 in | 5.1 to 6.5 | .05 | .17 |
| C2 -- 30 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 0.9 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Chereete and similar soils: 10 percent of the unit
Victor and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 308E--Chereete very cobbly sandy loam, 15 to 35 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 95 to 120 days

## Chereete and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* escarpments, intermontain basins
*Slope gradient:* 15 to 35 percent
*Parent material:* sandy and gravelly alluvium derived from mixed
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | cobbly sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Brid and similar soils: 5 percent of the unit
Burnt Fork and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 310D--Losthorse very stony sandy loam, 8 to 15 percent slopes

*Mean annual precipitation:* 17 to 22 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 55 to 75 days

## Losthorse, extremely stony and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* intermontain basins, moraines
*Slope gradient:* 8 to 15 percent
*Parent material:* stony, cobbly, and gravelly sandy till derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 7
*Wind erodibility index (WEI):* 0
*Land capability class, nonirrigated:* 7s
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* ---

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| Oi -- 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 6.0 | | |
| A -- 1 to 3 in | very stony sandy loam | moderately rapid | 0.1 to 0.2 in | 4.5 to 6.5 | .05 | .20 |
| E -- 3 to 6 in | stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| Bw -- 6 to 15 in | very cobbly coarse sandy loam | moderately rapid | 0.5 to 0.9 in | 4.5 to 6.5 | .05 | .20 |
| C1 -- 15 to 25 in | very cobbly loamy coarse sand | very rapid | 0.2 to 0.3 in | 4.5 to 6.0 | .05 | .17 |
| C2 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 4.5 to 6.0 | .02 | .17 |

## Minor Components

Chereete, stony and similar soils: 10 percent of the unit
Repkie, bouldery and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 310E--Losthorse very stony sandy loam, 15 to 35 percent slopes

*Mean annual precipitation:* 17 to 22 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 55 to 75 days

### Losthorse, extremely stony and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* escarpments, intermontain basins, moraines
*Slope gradient:* 15 to 35 percent
*Parent material:* stony, cobbly, and gravelly sandy till derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 7
*Wind erodibility index (WEI):* 0
*Land capability class, nonirrigated:* 7s
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* ---

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| Oi -- | 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 6.0 | | |
| A -- | 1 to 3 in | very stony sandy loam | moderately rapid | 0.1 to 0.2 in | 4.5 to 6.5 | .05 | .20 |
| E -- | 3 to 6 in | stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| Bw -- | 6 to 15 in | very cobbly coarse sandy loam | moderately rapid | 0.5 to 0.9 in | 4.5 to 6.5 | .05 | .20 |
| C1 -- | 15 to 25 in | very cobbly loamy coarse sand | very rapid | 0.2 to 0.3 in | 4.5 to 6.0 | .05 | .17 |
| C2 -- | 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 4.5 to 6.0 | .02 | .17 |

### Minor Components

Chereete, stony and similar soils: 10 percent of the unit
Repkie, bouldery and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 314D--Sheafman-Chereete cobbly coarse sandy loams, 8 to 15 percent slopes, stony

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

## Sheafman, stony and similar soils

*Extent:* about 50 percent of the unit
*Landform(s):* eroded fan remnants, intermontain basins, outwash fans
*Slope gradient:* 8 to 15 percent
*Parent material:* coarse-loamy outwash over very gravelly, very cobbly or extremely gravelly sandy outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 4e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 10 in | cobbly coarse sandy loam | moderately rapid | 0.8 to 1.2 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 10 to 14 in | cobbly coarse sandy loam | moderately rapid | 0.3 to 0.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 30 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.8 in | 5.1 to 6.5 | .05 | .17 |
| C2 -- 30 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 0.9 in | 5.1 to 6.5 | .02 | .17 |

## Chereete, stony and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* eroded fan remnants, intermontain basins, outwash fans
*Slope gradient:* 8 to 15 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | cobbly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Victor and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 314E--Sheafman-Chereete cobbly coarse sandy loams, 15 to 35 percent slopes, stony

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 95 to 120 days

### Sheafman, stony and similar soils

*Extent:* about 50 percent of the unit
*Landform(s):* eroded fan remnants, escarpments, intermontain basins
*Slope gradient:* 15 to 35 percent
*Parent material:* coarse-loamy outwash over very gravelly, very cobbly or extremely gravelly sandy outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 10 in | cobbly coarse sandy loam | moderately rapid | 0.8 to 1.2 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 10 to 14 in | cobbly coarse sandy loam | moderately rapid | 0.3 to 0.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 30 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.8 in | 5.1 to 6.5 | .05 | .17 |
| C2 -- 30 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 0.9 in | 5.1 to 6.5 | .02 | .17 |

### Chereete, stony and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* eroded fan remnants, escarpments, intermontain basins
*Slope gradient:* 15 to 35 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | cobbly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Victor and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 321C--Poverty sandy loam, 4 to 8 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

### Poverty and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* intermontain basins, outwash terraces
*Slope gradient:* 4 to 8 percent
*Parent material:* sandy and gravelly alluvium derived from granite
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 18 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 6w
*Drainage class:* poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| Oe -- | 0 to 1 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A -- | 1 to 5 in | cobbly sandy loam | moderately rapid | 0.4 to 0.5 in | 5.1 to 7.3 | .20 | .20 |
| Bw -- | 5 to 10 in | cobbly sandy loam | moderately rapid | 0.4 to 0.6 in | 5.1 to 7.3 | .20 | .20 |
| C1 -- | 10 to 14 in | cobbly coarse sandy loam | rapid | 0.0 to 0.4 in | 5.1 to 6.5 | .10 | .17 |
| C2 -- | 14 to 19 in | very cobbly loamy coarse sand | very rapid | 0.0 to 0.1 in | 5.1 to 6.5 | .05 | .17 |
| C3 -- | 19 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.2 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Nirling and similar soils: 10 percent of the unit
Bandy and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 324B--Victor-Chereete complex, 1 to 4 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 85 to 105 days

## Victor and similar soils

*Extent:* about 55 percent of the unit
*Landform(s):* intermontain basins, outwash terraces
*Slope gradient:* 1 to 4 percent
*Parent material:* gravelly coarse-loamy outwash over sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 72 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 3e
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Silty (Si) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 12 in | loam | moderately rapid | 1.7 to 2.1 in | 5.1 to 7.3 | .32 | .32 |
| BC -- 12 to 30 in | gravelly sandy loam | moderately rapid | 1.4 to 2.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 30 to 48 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.9 in | 5.1 to 7.0 | .05 | .17 |
| C2 -- 48 to 60 in | extremely gravelly coarse sand | very rapid | 0.1 to 0.4 in | 5.1 to 7.0 | .02 | .17 |

## Chereete and similar soils

*Extent:* about 40 percent of the unit
*Landform(s):* intermontain basins, outwash terraces
*Slope gradient:* 1 to 4 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | gravelly sandy loam | moderately rapid | 0.5 to 0.7 in | 6.6 to 7.3 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Bandy and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 325C--Chereete gravelly coarse sandy loam, 4 to 8 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

### Chereete and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* intermontain basins, outwash terraces
*Slope gradient:* 4 to 8 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | gravelly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Victor and similar soils: 5 percent of the unit
Sheafman and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 325D--Chereete gravelly coarse sandy loam, 8 to 15 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

### Chereete and similar soils

*Extent:* about 90 percent of the unit
*Landform(s):* intermontain basins, outwash terraces
*Slope gradient:* 8 to 15 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | gravelly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Sheafman and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 326B--Sheafman-Chereete gravelly coarse sandy loams, 1 to 4 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 85 to 105 days

### Sheafman and similar soils

*Extent:* about 55 percent of the unit
*Landform(s):* intermontain basins, outwash fans
*Slope gradient:* 1 to 4 percent
*Parent material:* coarse-loamy outwash over very gravelly, very cobbly or extremely gravelly sandy outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 4e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 10 in | gravelly coarse sandy loam | moderately rapid | 0.8 to 1.2 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 10 to 14 in | cobbly coarse sandy loam | moderately rapid | 0.3 to 0.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 30 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.8 in | 5.1 to 6.5 | .05 | .17 |
| C2 -- 30 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 0.9 in | 5.1 to 6.5 | .02 | .17 |

### Chereete and similar soils

*Extent:* about 35 percent of the unit
*Landform(s):* intermontain basins, outwash terraces
*Slope gradient:* 1 to 4 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | gravelly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Victor and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 327D--Losthorse, extremely stony-Chereete, stony, complex, 8 to 15 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

### Losthorse, extremely stony and similar soils

*Extent:* about 70 percent of the unit
*Landform(s):* intermontain basins, moraines, outwash terraces
*Slope gradient:* 8 to 15 percent
*Parent material:* stony, cobbly, and gravelly sandy till derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 7
*Wind erodibility index (WEI):* 0
*Land capability class, nonirrigated:* 7s
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* ---

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| Oi -- | 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 6.0 | | |
| A -- | 1 to 3 in | stony coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| E -- | 3 to 6 in | stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| Bw -- | 6 to 15 in | very cobbly coarse sandy loam | moderately rapid | 0.5 to 0.9 in | 4.5 to 6.5 | .05 | .20 |
| C1 -- | 15 to 25 in | very cobbly loamy coarse sand | very rapid | 0.2 to 0.3 in | 4.5 to 6.0 | .05 | .17 |
| C2 -- | 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 4.5 to 6.0 | .02 | .17 |

### Chereete, stony and similar soils

*Extent:* about 25 percent of the unit
*Landform(s):* eroded fan remnants, escarpments, intermontain basins
*Slope gradient:* 8 to 15 percent
*Parent material:* sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 3
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6e
*Drainage class:* excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| Representative soil profile: | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | cobbly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Nirling and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 327E--Losthorse, extremely stony-Chereete, stony, complex, 15 to 25 percent slopes

*Mean annual precipitation:* 13 to 17 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 80 to 100 days

### Losthorse, extremely stony and similar soils

*Extent:* about 70 percent of the unit

*Landform(s):* intermontain basins, moraines, outwash terraces

*Slope gradient:* 15 to 25 percent

*Parent material:* stony, cobbly, and gravelly sandy till derived from granite and gneiss

*Restrictive feature(s):* none

*Seasonal high water table:* greater than 60 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2

*Wind erodibility group (WEG):* 7

*Wind erodibility index (WEI):* 0

*Land capability class, nonirrigated:* 7s

*Drainage class:* somewhat excessively drained

*Hydric soil:* no

*Hydrologic group:* A

*Potential frost action:* low

*Ecological site(s):* ---

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| Oi -- 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 6.0 | | |
| A -- 1 to 3 in | stony coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| E -- 3 to 6 in | stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| Bw -- 6 to 15 in | very cobbly coarse sandy loam | moderately rapid | 0.5 to 0.9 in | 4.5 to 6.5 | .05 | .20 |
| C1 -- 15 to 25 in | very cobbly loamy coarse sand | very rapid | 0.2 to 0.3 in | 4.5 to 6.0 | .05 | .17 |
| C2 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 4.5 to 6.0 | .02 | .17 |

### Chereete, stony and similar soils

*Extent:* about 25 percent of the unit

*Landform(s):* eroded fan remnants, escarpments, intermontain basins

*Slope gradient:* 15 to 25 percent

*Parent material:* sandy and gravelly outwash derived from granite and gneiss

*Restrictive feature(s):* none

*Seasonal high water table:* greater than 60 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2

*Wind erodibility group (WEG):* 3

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 6e

*Drainage class:* excessively drained

*Hydric soil:* no

*Hydrologic group:* A

*Potential frost action:* low

*Ecological site(s):* Shallow to Gravel (SwGr) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| A -- 0 to 6 in | cobbly coarse sandy loam | moderately rapid | 0.5 to 0.6 in | 5.1 to 7.2 | .10 | .20 |
| Bw -- 6 to 14 in | gravelly sandy loam | moderately rapid | 0.7 to 0.9 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 14 to 18 in | very gravelly coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .20 |
| C2 -- 18 to 25 in | very gravelly loamy coarse sand | rapid | 0.2 to 0.3 in | 5.1 to 7.0 | .05 | .17 |
| C3 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.1 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Nirling and similar soils: 5 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 345C--Victor-Bandy complex, 0 to 8 percent slopes

*Mean annual precipitation:* 13 to 17 inches

*Mean annual temperature:* 39 to 45 degrees F

*Frost-free period:* 80 to 100 days

## Victor and similar soils

*Extent:* about 60 percent of the unit

*Landform(s):* intermontain basins, outwash terraces

*Slope gradient:* 2 to 8 percent

*Parent material:* gravelly coarse-loamy outwash over sandy and gravelly outwash derived from granite and gneiss

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 72 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 3

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 3e

*Drainage class:* somewhat excessively drained

*Hydric soil:* no

*Hydrologic group:* A

*Potential frost action:* low

*Ecological site(s):* Silty (Si) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 12 in | gravelly loam | moderately rapid | 1.7 to 2.1 in | 5.1 to 7.3 | .32 | .32 |
| BC -- 12 to 30 in | gravelly sandy loam | moderately rapid | 1.4 to 2.5 in | 5.1 to 7.0 | .10 | .20 |
| C1 -- 30 to 48 in | very gravelly loamy coarse sand | rapid | 0.5 to 0.9 in | 5.1 to 7.0 | .05 | .17 |
| C2 -- 48 to 60 in | extremely gravelly coarse sand | very rapid | 0.1 to 0.4 in | 5.1 to 7.0 | .02 | .17 |

## Bandy and similar soils

*Extent:* about 30 percent of the unit

*Landform(s):* intermontain basins, outwash terraces

*Slope gradient:* 0 to 4 percent

*Parent material:* sandy and gravelly outwash

*Restrictive feature(s):* none

*Seasonal high water table:* approximately 8 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):* 3

*Wind erodibility group (WEG):* 5

*Wind erodibility index (WEI):* 56

*Land capability class, nonirrigated:* 5w

*Drainage class:* poorly drained

*Hydric soil:* yes

*Hydrologic group:* D

*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oe -- 0 to 3 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A1 -- 3 to 7 in | loam | moderately rapid | 0.6 to 0.7 in | 5.1 to 7.3 | .32 | .32 |
| A2 -- 7 to 15 in | gravelly sandy loam | moderately rapid | 0.7 to 1.0 in | 5.1 to 6.5 | .15 | .24 |
| 2C1 -- 15 to 18 in | very gravelly sandy loam | rapid | 0.1 to 0.2 in | 5.1 to 6.5 | .05 | .20 |
| 2C2 -- 18 to 60 in | extremely gravelly sand | very rapid | 0.8 to 1.3 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Sheafman and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

# 349C--Losthorse, extremely stony-Poverty complex, 1 to 8 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 85 to 105 days

## Losthorse, extremely stony and similar soils

*Extent:* about 65 percent of the unit
*Landform(s):* intermontain basins, moraines, outwash terraces
*Slope gradient:* 2 to 8 percent
*Parent material:* stony, cobbly, and gravelly sandy till derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 7
*Wind erodibility index (WEI):* 0
*Land capability class, nonirrigated:* 6s
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* ---

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oi -- 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 6.0 | | |
| A -- 1 to 3 in | stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| E -- 3 to 6 in | stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| Bw -- 6 to 15 in | very cobbly coarse sandy loam | moderately rapid | 0.5 to 0.9 in | 4.5 to 6.5 | .05 | .20 |
| C1 -- 15 to 25 in | very cobbly loamy coarse sand | very rapid | 0.2 to 0.3 in | 4.5 to 6.0 | .05 | .17 |
| C2 -- 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 4.5 to 6.0 | .02 | .17 |

## Poverty and similar soils

*Extent:* about 25 percent of the unit
*Landform(s):* intermontain basins, outwash terraces
*Slope gradient:* 1 to 4 percent
*Parent material:* sandy and gravelly alluvium derived from granite
*Restrictive feature(s):* none
*Seasonal high water table:* approximately 18 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 6w
*Drainage class:* poorly drained
*Hydric soil:* yes
*Hydrologic group:* D
*Potential frost action:* moderate

*Ecological site(s):* Wet Meadow (WM) 10-14" p.z.

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oe -- 0 to 1 in | mucky peat | rapid | | 4.0 to 6.0 | | |
| A -- 1 to 5 in | cobbly loam | moderately rapid | 0.4 to 0.5 in | 5.1 to 7.3 | .20 | .20 |
| Bw -- 5 to 10 in | cobbly sandy loam | moderately rapid | 0.4 to 0.6 in | 5.1 to 7.3 | .20 | .20 |
| C1 -- 10 to 14 in | cobbly coarse sandy loam | rapid | 0.0 to 0.4 in | 5.1 to 6.5 | .10 | .17 |
| C2 -- 14 to 19 in | very cobbly loamy coarse sand | very rapid | 0.0 to 0.1 in | 5.1 to 6.5 | .05 | .17 |
| C3 -- 19 to 60 in | extremely gravelly coarse sand | very rapid | 0.4 to 1.2 in | 5.1 to 6.5 | .02 | .17 |

## Minor Components

Nirling and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 367C--Hartbench loam, wet, 4 to 8 percent slopes

*Mean annual precipitation:* 13 to 17 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 80 to 100 days

### Hartbench, wet and similar soils

*Extent:* about 85 percent of the unit
*Landform(s):* intermontain basins, outwash fans
*Slope gradient:* 4 to 8 percent
*Parent material:* fine-loamy outwash over sandy and gravelly outwash derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 6
*Wind erodibility index (WEI):* 48
*Land capability class, nonirrigated:* 3e
*Drainage class:* somewhat poorly drained
*Hydric soil:* no
*Hydrologic group:* C
*Potential frost action:* moderate

*Ecological site(s):* Silty (Si) 10-14" p.z.

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| A -- 0 to 8 in | loam | moderate | 1.1 to 1.4 in | 5.1 to 7.2 | .37 | .37 |
| Bt -- 8 to 22 in | clay loam | moderate | 2.0 to 2.7 in | 5.1 to 7.0 | .32 | .32 |
| BC -- 22 to 30 in | gravelly sandy loam | moderately rapid | 0.6 to 1.1 in | 5.1 to 7.0 | .15 | .24 |
| 2C -- 30 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 0.9 in | 5.1 to 6.5 | .02 | .17 |

### Minor Components

Blossberg and similar soils: 5 percent of the unit
Victor and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 391D--Losthorse-Repkie complex, 8 to 15 percent slopes, bouldery

*Mean annual precipitation:* 17 to 22 inches
*Mean annual temperature:* 39 to 45 degrees F
*Frost-free period:* 55 to 75 days

### Losthorse, bouldery and similar soils

*Extent:* about 60 percent of the unit
*Landform(s):* intermontain basins, moraines, outwash terraces
*Slope gradient:* 8 to 15 percent
*Parent material:* stony, cobbly, and gravelly sandy till derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 2
*Wind erodibility group (WEG):* 7
*Wind erodibility index (WEI):* 0
*Land capability class, nonirrigated:* 7s
*Drainage class:* somewhat excessively drained
*Hydric soil:* no
*Hydrologic group:* A
*Potential frost action:* low

*Ecological site(s):* ---

*Representative soil profile:*

| Horizon | Depth | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|---|
| Oi -- | 0 to 1 in | slightly decomposed plant material | very rapid | | 4.0 to 6.0 | | |
| A -- | 1 to 3 in | stony coarse sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| E -- | 3 to 6 in | stony sandy loam | moderately rapid | 0.2 to 0.3 in | 4.5 to 6.5 | .10 | .20 |
| Bw -- | 6 to 15 in | very cobbly coarse sandy loam | moderately rapid | 0.5 to 0.9 in | 4.5 to 6.5 | .05 | .20 |
| C1 -- | 15 to 25 in | very cobbly loamy coarse sand | very rapid | 0.2 to 0.3 in | 4.5 to 6.0 | .05 | .17 |
| C2 -- | 25 to 60 in | extremely gravelly coarse sand | very rapid | 0.3 to 1.0 in | 4.5 to 6.0 | .02 | .17 |

### Repkie, bouldery and similar soils

*Extent:* about 30 percent of the unit
*Landform(s):* moraines on glacial-valley floors
*Slope gradient:* 8 to 15 percent
*Parent material:* till derived from granite and gneiss
*Restrictive feature(s):* none
*Seasonal high water table:* greater than 60 inches
*Flooding hazard:* none
*Ponding hazard:* none

*Soil loss tolerance (T factor):* 4
*Wind erodibility group (WEG):* 5
*Wind erodibility index (WEI):* 56
*Land capability class, nonirrigated:* 6s
*Drainage class:* well drained
*Hydric soil:* no
*Hydrologic group:* B
*Potential frost action:* moderate

*Ecological site(s):* ---

# Map Unit Descriptions (MT)

Bitterroot Valley Area, Montana

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

| *Representative soil profile:* | *Texture* | *Permeability* | *Available water capacity* | *pH* | *Kw* | *Kf* |
|---|---|---|---|---|---|---|
| Oe -- 0 to 1 in | moderately decomposed plant material | rapid | | 4.0 to 6.0 | | |
| E -- 1 to 2 in | bouldery sandy loam | moderate | 0.1 to 0.1 in | 4.5 to 6.5 | .10 | .32 |
| Bw -- 2 to 6 in | very bouldery ashy loam | moderate | 0.4 to 0.6 in | 4.5 to 6.5 | .10 | .32 |
| 2BC -- 6 to 44 in | very stony sandy loam | moderately rapid | 1.5 to 3.0 in | 4.5 to 6.0 | .10 | .24 |
| 2C -- 44 to 60 in | very cobbly loamy sand | very rapid | 0.3 to 0.6 in | 4.5 to 6.0 | .05 | .24 |

## Minor Components

Chereete, very stony and similar soils: 10 percent of the unit

[Data apply to the entire extent of the map unit within the survey area. Map unit and soil properties for a specific parcel of land may vary somewhat and should be determined by onsite investigation.]

## 904--Dumps, landfill

*Mean annual precipitation:*

*Mean annual temperature:*

*Frost-free period:*

### Dumps, landfill

*Extent:* about 100 percent of the unit

*Landform(s):*

*Slope gradient:*

*Parent material:*

*Restrictive feature(s):* none

*Seasonal high water table:* greater than 60 inches

*Flooding hazard:* none

*Ponding hazard:* none

*Soil loss tolerance (T factor):*

*Wind erodibility group (WEG):*

*Wind erodibility index (WEI):*

*Land capability class, nonirrigated:*

*Drainage class:*

*Hydric soil:*

*Hydrologic group:*

*Potential frost action:*

*Ecological site(s):* ---

*Representative soil profile:*

| | Texture | Permeability | Available water capacity | pH | Kw | Kf |
|---|---|---|---|---|---|---|
| none | | | | | | |

### Minor Components

Big Sky. Big Land. Big History.
**Montana**
**Historical Society**

*Historic Preservation*
*Museum*
*Outreach & Interpretation*
*Publications*
*Research Center*

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October 19, 2009

Chris Cobb-Taggart
Professional Consultants Inc.
1713 N. First Street
Hamilton MT 59840

RE: STEVENSVILLE PROPOSED WATER SYSTEM IMPROVEMENTS, RAVALLI CO.
SHPO Project #: 2008022512 / 2009101902

Dear Chris:

Thank you for your follow up letter regarding the above-cited projects potential route changes. I have conducted a cultural resource file search for proposed Routes 2, 3, and re-looked at Route 1. According to our records there have been a few previously recorded sites within the designated search locales. In addition to the sites there have been a few previously conducted cultural resource inventories done in the areas. If you would like any further information regarding these sites or reports you may contact me at the number listed below.

By the looks of aerial photos the proposed well field looks to have been previously disturbed by agricultural practices and as long as the project stays within the proposed routes, along existing roadways, we feel there is a low likelihood cultural properties will be impacted. We, therefore, feel that a recommendation for a cultural resource inventory is unwarranted at this time. However, should cultural materials be inadvertently discovered during this project we would ask that our office be contacted and the site investigated.

If you have any further questions or comments you may contact me at (406) 444-7767 or by e-mail at dmurdo@state.mt.us.

Sincerely,

Damon Murdo
Cultural Records Manager

File: DEQ/AIR&WATER WASTE MNG/2009

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P.O. Box 201201
Helena, MT 59620-1201
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# United States Department of the Interior
## Fish and Wildlife Service

Ecological Services
Montana Field Office
585 Shepard Way
Helena, Montana 59601-6287
Phone: (406) 449-5225 Fax: (406) 449-5339


September 24, 2009

Ms. Chris Cobb-Taggart
Planning Technician
Professional Consultants, Inc.
P.O. Box 1750
Missoula, MT 59806

Dear Ms. Cobb-Taggart:

We have reviewed the project description and the maps submitted to us with your letter dated September 14, 2009, concerning the proposed Town of Stevensville, Water System Improvement Project, in Ravalli County, Montana. Due to the semi-urban location of the proposed improvements (primarily within the city confines), this project is unlikely to have any significant adverse effects upon fish, wildlife, or habitat resources under the purview of the U.S. fish and Wildlife Service.

Please telephone me at 406/449-5225, ext. 205, if you have any questions regarding this matter.

Sincerely,

R. Mark Wilson

R. Mark Wilson
Field Supervisor

Montana Fish, Wildlife & Parks

Region 2 Office
3201 Spurgin Road
Missoula, MT 59804-3101
406-542-5500
Fax 406-542-5529
November 6, 2009

Chris Cobb-Taggart
Professional Consultants, Inc.
1713 N. 1st Street
Hamilton, MT 59840

Reference: Proposed water system improvements for Stevensville--Phases 2 (meters and new supply transmission main) and 3 (new water supply wells and storage tank installation)

Dear Ms. Cobb-Taggart:

We have reviewed your letter requesting our review for any biological or natural resource impacts that could occur relative to this project. Potential occurrences in or near the project area of Threatened or Endangered Species (under the Federal Endangered Species Act) and Montana Species of Concern[1] can be obtained from the Montana Natural Heritage Program. Requests can be made under the data tab at http://mtnhp.org.

Based on our knowledge of the biological resources within the project area, we believe the project is not likely to have significant affects on fish or wildlife resources.

Thank you for providing the opportunity for FWP to comment on this proposal.

Sincerely,

Jeff Daniel for

Mack Long
Regional Supervisor

ML/sr

[1] A native animal breeding in Montana that is considered to be "at risk" due to declining population trends, threats to its habitats, and/or restricted distribution. The purpose of Montana's SOC listing is to highlight species in decline and encourage conservation efforts to reverse population declines and prevent the need for future listing as Threatened or Endangered Species under the Federal Endangered Species Act.

# *WETLANDS DELINEATION REPORT*

FOR
TOWN OF STEVENSVILLE WELL FIELD SITE

LOCATED ON MIDDLE BURNT FORK ROAD
IN SECTION 35, T9N, R20W, RAVALLI COUNTY, MONTANA

March 2008

*Prepared By:*
**Professional Consultants, Inc. (PCI)**
**Hamilton, MT**
PCI Project # 7252-04

Professional Consultants Inc.
Unmatched Experience. Uncompromising Standards.

## Wetlands Delineation Report For Town Of Stevensville Well Site

## Table of Contents



### List of Tables



### List of Figures



### List of Attachments

**Wetlands Delineation Report for Town of Stevensville Well Field Site**

**Section 1.0 Introduction & Scope of Work**

This Wetland Delineation Report was prepared by Professional Consultants, Inc. (PCI), Hamilton, MT for the Town of Stevensville's proposed Well Field Site. The proposed well field property is located south of Middle Burnt Fork Road about 1000 feet west of its intersection with Logan Lane, placing it southeast of the Town of Stevensville in Section 35, Township 9 North, Range 20 West, Ravalli County, MT. **Figure 1 - Topographic Map** shows the location of the site on a pertinent segment of the USGS Quadrangle Map for the area. Also shown diagrammatically on **Figure 1** are several phases of a Water Improvements Project for the Town Of Stevensville. The well field is an integral part of an overall water system improvements project to provide an adequate water supply for the Town's future needs.

**Figure 2 - Aerial Photograph** shows the location of the subject well field property superimposed on an aerial photograph of the property and its immediate environs. Several photos of the property from different angles as captured during the site reconnaissance phase of the wetlands investigation are found in **Attachment A - Site Photos.**

The scope of work performed for this wetland delineation includes a preliminary data review, site reconnaissance, delineation of the wetland/upland boundary, and a functions and values assessment. The field investigations were conducted over the period of February 25 to March 7, 2008 by William E. Burnett, Environmental Scientist with PCI. It should be noted that the field investigations were able to be successfully completed; however, the vegetation survey portion of the investigation was constrained due in part to a recent history of intense livestock (cattle) grazing on the property and the fact that it was conducted at the end of the dormant season and prior to the onset of the spring growing season for vascular plants.

Wetlands with "jurisdictional status" are "Waters of the United States" (WUS) as regulated by Section 404 of the Clean Water Act (CWA) or the Swampbuster Provision under the Food Security Act, and defined by Title 33 Code of Federal Regulations Part 328 (33 CFR 328). In general, the term WUS includes all of the traditional navigable waters of the United States, which include all waters that are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce. In addition, WUS include all interstate waters, interstate wetlands, and all impoundments, tributaries or wetlands adjacent to any water body defined as a WUS. A recent Supreme Court ruling (known as the SWANCC decision) removed "isolated wetlands" from the U. S. Army Corps of Engineers' (USACE) jurisdiction. Isolated wetlands are those that have no connection with any tributary system that flows into traditional navigable waters or interstate waters (i.e., intrastate lakes, streams, prairie potholes, etc.). However, this court decision does not alter existing state or tribal jurisdiction over wetlands. Regulatory authority over isolated wetlands varies from state to state. This delineation identifies any occurring wetlands at the site and makes professional determinations as to their status, be it isolated or jurisdictional.

This document describes the methods used to achieve the project objectives, stated above, as well as the results of the study. Supporting information, data sheets and site photographs showing key features of the property are included in attachments to this document.

## Section 2.0 Methods

### *2.1 Preliminary Data Review*

Prior to the site reconnaissance, several sources of relevant information were reviewed to assist in the wetland delineation.

National Wetlands Inventory (NWI) maps, developed by the United States Fish and Wildlife Service (USFWS) and the United States Geological Survey (USGS) were reviewed using the online Wetlands Mapper System maintained by the USFWS. This review identified previously mapped wetlands in the general vicinity of the subject property (mainly to the west of the site along the Bitterroot River). However, no previously mapped wetlands were found to be present directly on the subject site. These online maps are based on aerial photography, soil survey maps, precipitation records and other historical information, and identify areas that *appear* to have the vegetation and physical features of wetlands. They are generally considered to be a general planning tool designed to alert one to the possible presence of wetlands in an area, but are often not very site specific.

A USGS 7.5 minute topographic map for the area was used to identifying drainage patterns in and around the site. A copy of pertinent portion of the USGS topographic map of the property and its environs is shown in **Figure 1.** This map shows a segment of Robertson Creek passing through the southern portion of the property. NOTE: Although not shown on the USGS map, another branch of Robertson Creek passes through the northern portion of the property. These creeks tend to define the hydrology of the subject property.

Information on site soils was obtained from the Web-Based Soil Survey of the Bitterroot Valley Area, Montana prepared by the Natural Resource Conservation Service (NRCS). A soil survey map of the property was prepared for the subject site and is found in **Attachment B - Soil Map & Soil Descriptions**.

Site soils consist of Grayhorse silt loam, 0 to 4 percent slopes (NRCS Mapping Symbol "26B") found primarily in the southern 2/3s of the property and Grayhorse-Allwitt Complex, 0 to 2 percent slopes (NRCS Mapping Symbol "148A") in the northern 1/3 of the property nearest Middle Burnt Fork Road. These soil types were cross-referenced with Hydric Soils of the United States (NRCS 2007b). Grayhorse-Allwitt Complex soils are considered to be partially hydric, while Grayhorse silt loam is considered to be a non-hydric soil. However, site specific hydrological conditions will generally influence whether a given soil type is indeed hydric. Thus, while NRCS soil maps are useful in identifying general soil types existing in an area, on-site soil conditions were used by PCI to make the wetland determination for this property.

### *2.2 Site Reconnaissance*

Field investigations were performed over the period of February 25 to March 14, 2008 by William E. Burnett, Environmental Scientist with PCI. These on-site investigations were designed to describe dominant plant species, hydrological characteristics and site specific soil properties as they relate to the presence of wetlands. Snow covered the property during the week of February 25th. However, by the week of March 3rd, the winter snow had mostly melted allowing soils investigations and the wetlands delineation to proceed.

Wetland identification was based on the current federal regulatory definition of wetlands as generally defined in, and regulated under 33 CFR, and 40 CFR 230, Environmental Protection Agency (EPA). For an area to be classified as a wetland, the area must have the following positive wetland indicators in concert (i.e, present together) namely, hydrophytic (water loving) vegetation, hydric soils and wetland hydrology. Generally speaking, wetlands hydrology involves the presence of water (or indirect evidence of the presence of water) in the upper 12 inches of the soil column during the spring growing season for vascular plants.

The procedures used in this study generally followed the Routine Approach, Level 2 Onsite Inspection methodologies described in the January 1987 *Corps of Engineers Wetlands Delineation Manual* (Wetlands Research Program Technical Report Y-87-1). The simplified method was dictated by the relative small size of the property, general homogeneous conditions present across the entire property and the fact that the vegetation has been disturbed in the recent past by intensive cattle grazing.

Briefly, this simplified wetlands delineation method includes the following actions:

- Determination of site conditions;
- Selection of observation points;
- Characterization of plant community types and determination of hydrophytic vegetation status;
- Determination of whether wetland hydrology and hydric soils are present; and,
- Performance of the wetland delineation and determination of the wetlands / upland boundary and mapping of these areas on a scaled plan of the property.

### *2.3 Site Survey*

The wetlands /uplands boundary was determined in the field mainly by using soil test pits produced in a grid pattern and using these test holes to determine prevailing soil and hydrological conditions. These results were then combined with information on plant types to complete the assessment. Once the boundary was ascertained, then the line was measured off of known features and the line was recorded on a scaled map of the property.

In the case of this property, the established wetlands / uplands boundary is considered to be conservative, in that, given the shallow topography of the land and its history of prior disturbance for cattle grazing, small isolated pockets of uplands may exist within the overall wetlands area. However, these pockets are relatively small and not worthy of detailed mapping.

### *2.4 Functions and Values Assessment*

The Montana Department of Transportation (MDT) Montana Wetland Assessment method (Berglund 1999) was used to evaluate wetland functions and values on the project site. The MDT Wetland Assessment method assesses and assigns each of twelve (12) recognized functions and values ratings of "low", "moderate", or "high" (or, in some cases, "exceptional"), and scores each on a scale of 0.1 (lowest) to 1 (highest) "functional points." Functional points were totaled on the data form and expressed as a percentage of the possible total. Functions that do not apply to a given wetland were assigned a rank of "NA" and not included in point totals. This percentage was then used in conjunction with other criteria to provide an overall wetland ranking into one of four categories. Category I is the highest overall ranking a wetland can receive and implies that the wetland has a very high functions and values from an ecological standpoint. This rating is followed by Category II, Category III, and Category IV, with the latter category being the least valuable with highly impaired functions and values. Once tallied by this method, functional points can be multiplied by the total existing acreage in the assessment area (AA) to determine the total "functional units" existing at a given site. This is usually done to provide for some form of mitigation - be it either on or off site. However, in this case, this latter method was not employed at this particular site.

## Section 3.0: Results

The preliminary investigation of the site indicated that the wetlands on this property were most likely to be found associated with the two (2) segments of Robertson Creek that traverse the property. As mentioned previously, the on-site reconnaissance of the property revealed that there are actually two (2) branches of Robertson Creek that traverse the property from east to west, but only one is shown on the area USGS map (**Figure 1**). One branch of this creek crosses the northern portion of the property and the other is found along the southern property line of the site. Extending off of the southern branch of this creek are several relict man-made irrigation ditches that were used to flood irrigate the property in the past. These ditches now appear to be abandoned, but likely affected the near surface hydrology of the southern portion of the property in the recent past. The intent is to abandon these ditches, as the site will no longer be flood irrigated. Therefore, the periodic discharges of water from these ditches will no longer influence the near surface hydrology of relevant portions of the property.

A paved access road to the property is proposed to extend from the proposed Twin Creeks Subdivision located to the west of the subject site. Thus, the northern edge of the right of way of this road (60 - foot wide right of way) served to define the southern limit of this wetlands investigation. The northern boundary of the investigation was the southern edge of the right of way of Middle Burnt Fork Road. Thus, the area of this investigation was confined to that portion of the property that surrounds the northern branch of Robinson Creek, which traverses the northern portion of the property. Due to the proposed presence of the access road, the wetlands surrounding the southern branch of Robinson Creek were not delineated as a part of this investigation.

The locations of the wetlands on this property are shown on **Figure 3 - Wetlands Map**.

The wetlands that were delineated are classified as "riverine wetlands." This type of wetland is typically located within floodplains and/or within riparian corridors and is associated with stream channels. Water sources for the wetland plants come from overbank flow from the adjacent stream (usually during the spring snow melt period) and from subsurface hydraulic connections between the stream channel and the wetlands. These riverine wetlands on the property have ultimate connectivity with the Bitterroot River (see **Figure 1**). Thus, it is highly probable that the wetlands on this site are Waters of the US and "jurisdictional," placing them under the purview of regulations administered by the US Army Corp of Engineers.

### *3.1 Vegetation:*

The field investigation was completed during the latter part of the dormant season for plants. Thus, plant identification was somewhat difficult due to the lack of distinguishing plant features present. This was especially the case for the grasses and sedges in the understory layer. However, despite these limitations, the majority of plants were able to be identified at least to the genus level and in some cases to the species level. In all cases, the wetland indicator status was able to be determined for the purpose of wetland delineation. An additional factor hindering plant identification was due to impacts (extensive browsing and trampling) from recent historic livestock grazing.

The dominant vegetation within the wetland areas was dominated by bentgrass, sedge species, brome species, willow species (a few isolated clumps), reed canary grass, and cattails (in a few isolated clumps). The dominant wetlands species are listed in **Table 1.** The vegetation within the wetlands areas was determined to be hydric vegetation as a majority of the dominant plant species had a wetland indicator status of OBL, FACW, or FAC (See the notes in **Table 1** for definitions of these terms).

### *3.2 Soils:*

The NRCS soil survey has mapped the soils on this property as consisting of Grayhorse silt loam and Grayhorse - Allwitt Complex. The former soil type is as mapped by the NRCS is found primarily in the southern 2/3s of the property and the latter type is located in the northern 1/3 of the property nearest Middle Burnt Fork Road. Both of these soil types were recently named by the NRCS and both tend to be high in organic matter and typically found within floodplains. Grayhorse - Allwitt Complex soils are considered to be partially hydric, while Grayhorse silt loam soils are considered to be non-hydric.

Several soil pits were dug within the investigated wetland area and also outside of the wetland area. The soil pits were developed to a depth of approximately 1 to 1.3 feet below the land surface or, alternately, to refusal due to extensive cobbles, whichever occurred first. Soils closest to the creek were found to be high in organic matter with few cobbles until the depth exceed 1 foot at which extensive cobbles were encountered. Soils outside of the wetland area were found to very high in cobbles at a depth of only few inches and penetrating beyond this level was very difficult. It was of interest to find that the developed soil pits tended to mirror the NRCS soils as previously described and mapped for this property (See **Attachment B**).

Excavated soils within the wetland area exhibited reduced matrix and low chroma (7.5YR2.5/1) and mottling (5YR 5/8). See **Attachment C - Data Forms** for additional field documentation. Due to the low chroma and mottling, the soils within the wetland area were determined to be hydric.

Excavated soils in the upland areas were characterized by a shallow organic layer to a depth of 3 to 4 inches and then extensive cobbles found in a matrix of lighter colored sand. No mottling was noted in these soils. Soils in this area were deemed to be non-hydric.

### *3.3 Hydrology:*

The riverine wetlands that were delineated on this property displayed connectivity to the north branch of Robinson Creek. It was observed that the water source for these wetlands originates in part from overbank flow from the adjacent creek. In addition, there are apparent subsurface hydraulic connections between the creek channel and adjacent wetlands. The high concentration of cobbles in the soil profile likely facilitates this subsurface connection. Furthermore, the wetlands that are located to the south of the creek channel and extending from the southeast to northwest appear to have subsurface sources of water that are located farther to the east of the subject property. We did not try to further identify this source.

During the field investigation, positive indicators of wetland hydrology observed were the obvious drainage pattern of the wetlands and the subsurface connectivity of the riverine wetlands to the creek via the presence of extensive cobbles in the subsurface in concert with evidence of mottling in the soil column in pits developed within the wetlands.

## 4.0 Functions and Values Assessment

The functions and values assessment was completed for the delineated jurisdictional wetlands on this property. The Wetlands Assessment Form is found in **Attachment D - Wetlands Assessment Form**. These wetlands were ranked as Category III wetlands which describes the wetlands as common, generally less diverse and often smaller that Category I and II wetlands (Berglund 1999). They are also highly disturbed due to a history of intense cattle grazing and trampling.

## 5.0 Conclusions and Recommendations

The field investigation resulted in the delineation of jurisdicational riverine wetlands on both the north and south sides of the north branch of Robertson Creek that traverses the northern portion of the property. Approximately 3.1 acres of jurisdicational riverine wetlands were delineated and these wetlands were ranked as Category III wetlands during the functions and values assessment. Riverine wetlands are typically located in floodplains and are associated with stream channels. Water sources come from overbank flow from the adjacent stream and subsurface hydraulic connections between the stream channel and adjacent wetlands. Category III wetlands are considered to be relatively common wetlands within the watershed basin and are generally less diverse and often smaller that Category I and II wetlands (Berglund 1999). The delineated wetlands were also highly disturbed due to intense cattle grazing and trampling in the past and so received a relatively low ranking as to functions and values.

Due to the fact that the delineated wetlands are classified as jurisdictional, any crossing of the wetlands with pipelines or roads will require a permit from the US Army Corps of Engineers. However, any minor loss of wetlands due to these crossings will most likely not require any mitigation due to the fact that the wetlands rank quite low in terms of functions and values.

It is recommended that future water production wells be located outside of the delineated wetlands and that the wetlands be allowed to recover from their disturbance from cattle grazing and trampling, thereby increasing their ecological functions and values over time. In addition, avoidance of the wetlands is recommended. If pipelines from the proposed municipal wells and reservoir are placed outside of the wetlands and within existing or proposed street rights-of-way that avoid wetlands, then no permits from the US Army Corps of Engineers will be required.

## 6.0 References

The following published references were used in the wetlands delineation and in the preparation of this report:

**Berglund, J. 1999.** Montana Wetland Assessment Method. Montana Department of Transportation, Environmental Services. Helena, Montana.

**Hitchcock, A. S. 1935.** Manual Of The Grasses Of The United States. United States Department of Agriculture Miscellaneous Publication No. 200, United States Government Printing Office, Washington, D.C.

**Hoag, J.C. 2007.** Simple Identification Key to Common Willows, Cottonwoods, Alder, Birch, and Dogwood of the Intermountain West. Riparian/Wetland Project Information Series No. 19, NRCS, Plant Materials Center, Aberdeen, ID.

**Lesica, P. and Husby, P. 2001.** Field Guide to Montana's Wetland Vascular Plants. Montana Wetlands Trust, Helena, MT.

**Munsell Soil Color Charts. 1994.** Macbeth Division of Kollmorgan Instruments Corporation, New Windsor, NY.

**Natural Resource Conservation Service (NRCS). 2007a.** Montana Soil Survey Reports.

**Natural Resource Conservation Service (NRCS). 2007b**. Hydric soils list MT645 Bitterroot Valley Area, Montana Soil Survey.

**Petrides, G.A. 1958.** A Field Guide to Trees and Shrubs. Houghton Mifflin Company, Boston, MA.

**United States Army Corps of Engineers. 1987.** Wetland Delineation Manual. Waterways Experiment Station Technical Report Y-87-1, Vicksburg, MS.

**United States Department of Interior, Bureau of Land Management 1994.** Willows of Montana. Riparian Technical Bulletin No. 2, Billings, MT.

**United States Fish and Wildlife Service (USFWS). 1988**. Region 9 Plant List.

**United States Fish and Wildlife Service (USFWS).** National Wetland Inventory Maps.

# *Wetlands Delineation Report*

## Town of Stevensville Well Field Site

## TABLES & FIGURES

**Table 1**

Dominant Plant Species List Identified within Riverine Wetland Area

| Scientific Name | Common Name | Wetland Indicator * |
|---|---|---|
| *Agrostis stolonifera* | Bentgrass | FAC+ |
| *Bromus spp.* | Brome Species | FACU |
| *Carex spp* | Sedge Species | FAC |
| *Phalaris arundinacea* | Reed Canary Grass | FACW |
| *Salix spp.* | Willow Species | FACW+ |
| *Typha latifolia* | Broad-leaf cattail | OBL |

---------------------------

**Notes:**

* Definition of Indicator Status (USFWS 1988):

FAC = Equally likely to occur in wetlands or non-wetlands (estimated probability 34% - 66%).

FACW = Usually occurs in wetlands (estimated probability 67% - 99%), but occasionally found in non-wetlands.

FACU = Usually occur in non-wetlands (estimated probability 67% - 99%) but occasionally found in wetlands (estimated probability 1% - 33%).

OBL = Occur almost always (estimated probability > 99%) in wetlands under natural conditions.

A plus (+) indicates a frequency towards the wetter end of the category while a minus (-) indicates a frequency towards the drier end of the category.

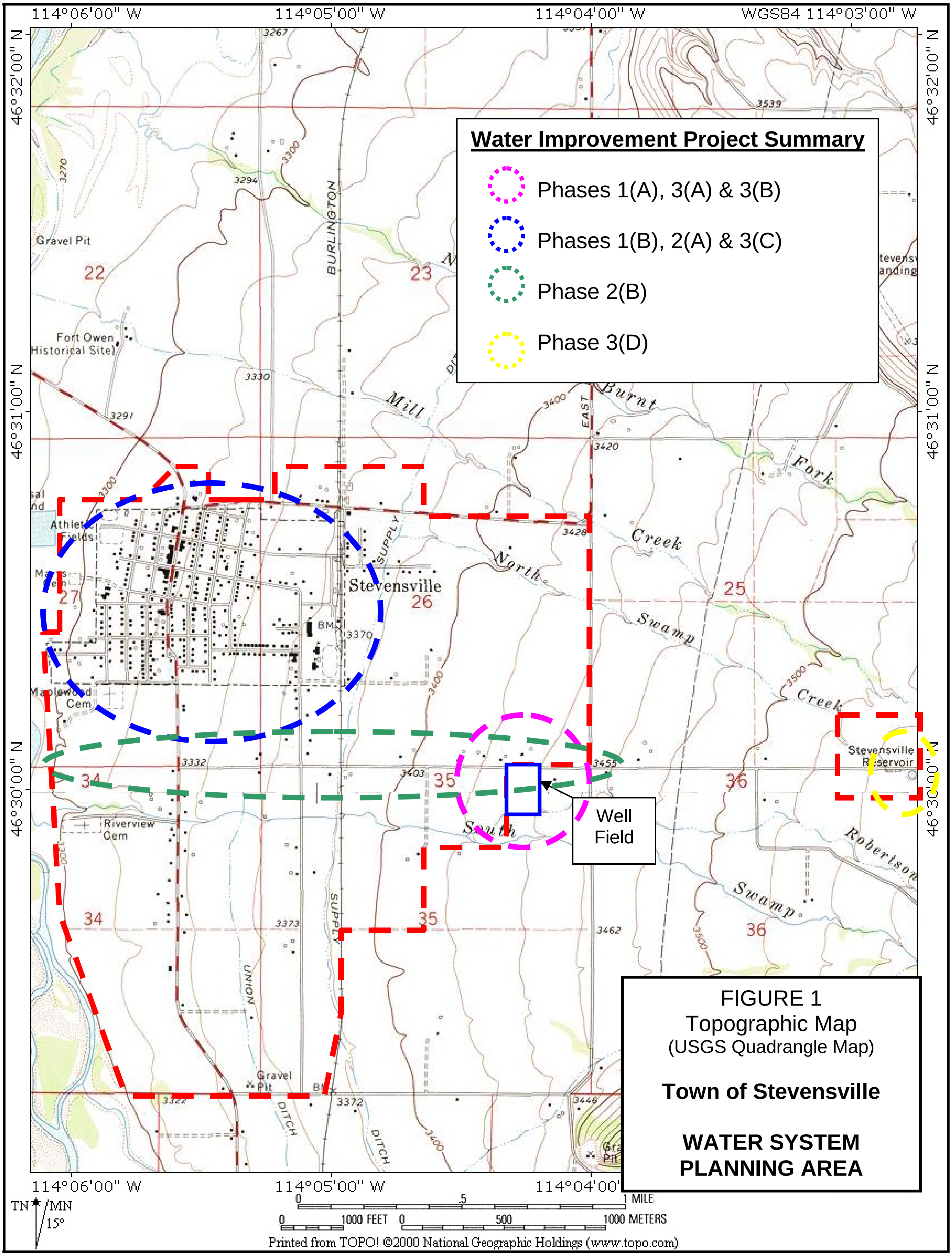



FIGURE 1
Topographic Map
(USGS Quadrangle Map)

**Town of Stevensville**

**WATER SYSTEM PLANNING AREA**

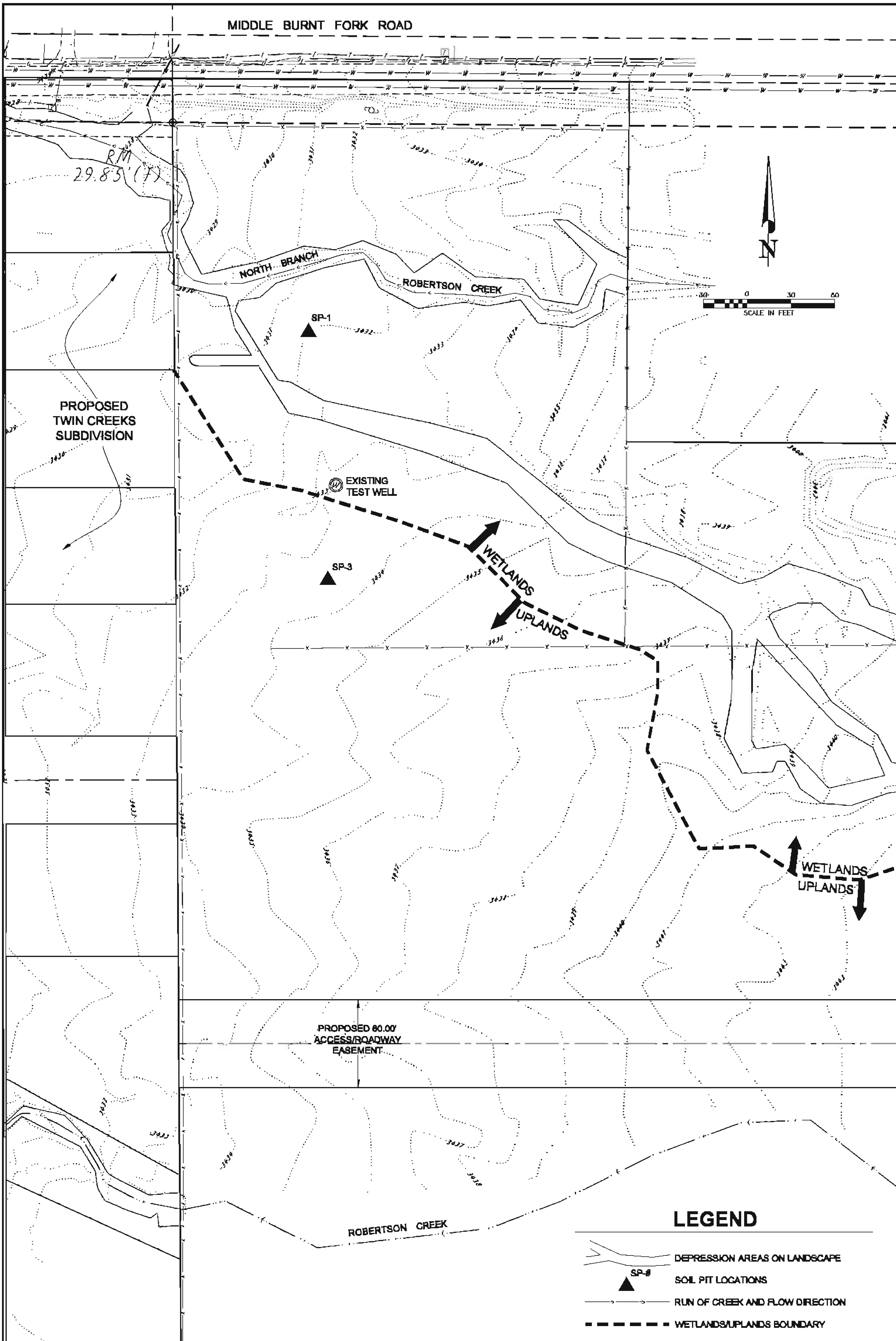

Professional Consultants Inc.
ENGINEERS. SURVEYORS. PLANNERS. MAPPERS.
1713 N First Street Hamilton, MT 59840 406.363.1201
3115 Russell St Missoula, MT 59806 406.728.1880

Figure 2

TOWN OF STEVENSVILLE

PROPOSED WELL SITE
AERIAL EXHIBIT

| | | |
|---|---|---|
| DRAWN: KLM | CHECKED: WEB | DATE: 3/6/08 |
| PROJECT NO. 7252-04 | SHEET OF | |




WETLANDS DELINEATION MAP
1
SHEET 1 OF 1

# WETLANDS DELINEATION MAP

PROPOSED MUNICIPAL WELLFIELD, TOWN OF STEVENSVILLE
Section 35, T9N, R20W, PMM,
Ravalli County, Montana

PROJECT #: 7253-04
DATE: 3/11/04
REVISION:
REVISION:
REVISION:
REVISION:
REVISION:
REVISION:

Professional Consultants Inc.

# *Wetlands Delineation Report*

## Town of Stevensville Well Field Site

## ATTACHMENT A

# SITE PHOTOS

**SITE PHOTOS, Page 1:**

Photo 1: This photograph shows an overall view of the wetlands portion of the Stevensville Well Field Site as viewed from Middle Burnt Fork Road. The view here is to the southeast with the Sapphire Mountains in the background. The vegetation in the center of the photo consists of willows that define the location of the north branch of Robertson Creek that traverses the property from east to west.

**SITE PHOTOS, Page 2:**

Photo 2: This image shows a close up view of the north branch of Robertson Creek that traverses the northern portion of the Stevensville Well Field Site. The creek channel is well defined with a gravel bottom. Note the presence of the willow in the upper right hand corner of the photograph. The vegetation has been grazed and trampled by cattle, which until recently were allowed to graze on the property.

**SITE PHOTOS, Page 3:**

Photo 3: This image shows one of the depressional areas on the property that tend to pond surface water during the spring wet season, thereby providing wetlands hydrology for wetland plants. The view is to the southeast. The existing test well is visible in the far right of this photo.

**SITE PHOTOS, Page 4:**

Photo 4: This image shows a view of another segment of the depressional area within the jurisdictional wetlands on the property that contains remnants of cattails from the previous growing season. Grazing and trampling by cattle is clearly evident in this photo. The view here is to the north.

**SITE PHOTOS, Page 5:**

Photo 5: This image shows a close up view of the soil from the B1 horizon from Soil Pit SP-1, which was developed within the wetland area (see Figure 3 for location). The orange mottling is clearly visible in the soil indicating the presence of soil moisture within the upper 12” of the soil column and resulting in the classification of the soil as a hydric soil.

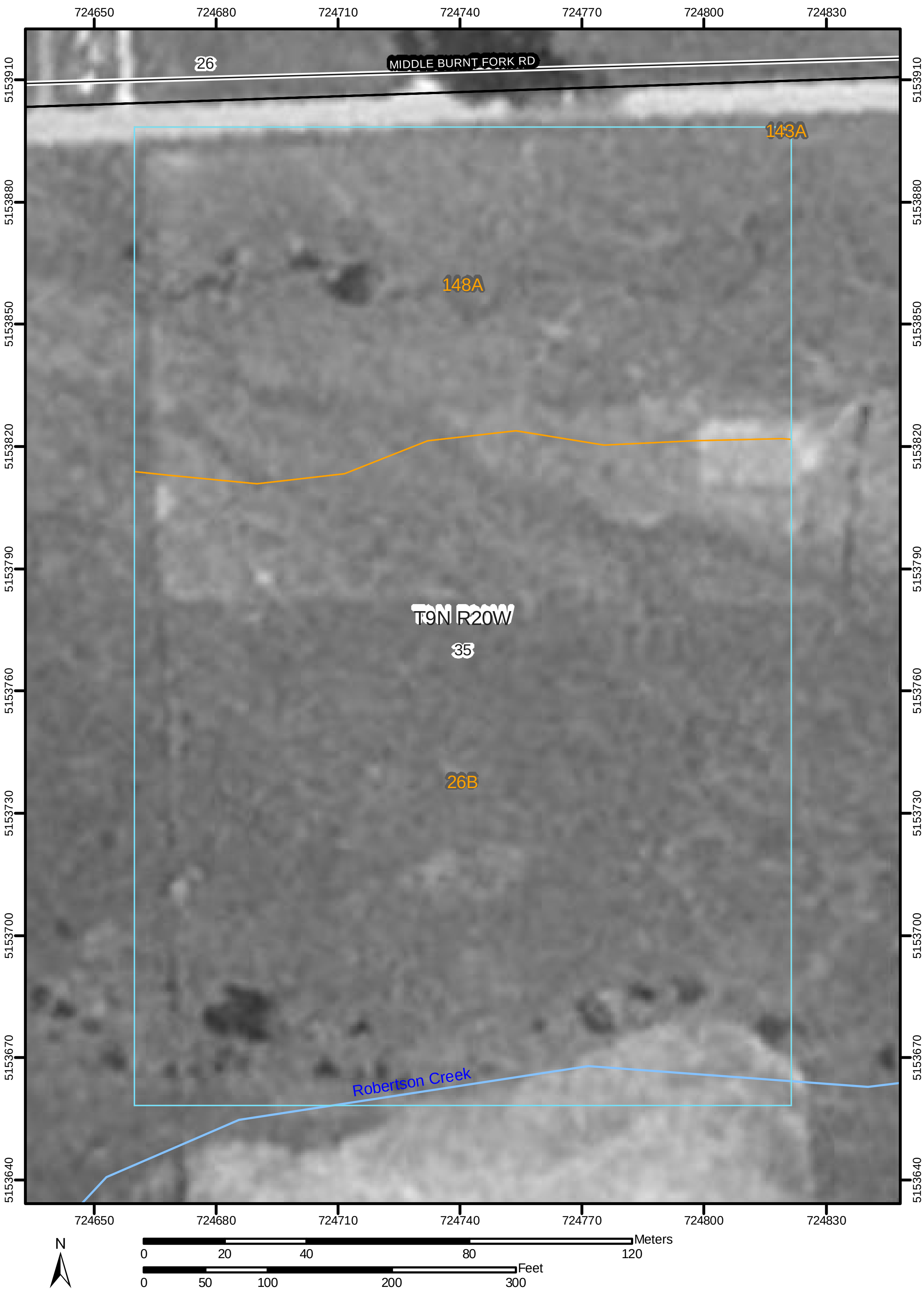
# *Wetlands Delineation Report*

## Town of Stevensville Well Field Site

## ATTACHMENT B

# SOIL MAP & SOIL DESCRIPTIONS

Soil Map–Bitterroot Valley Area, Montana
(Stevensville Well Field)



## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

Soil Map Units

**Special Point Features**

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

**Special Line Features**

- Gully
- Short Steep Slope
- Other

**Political Features**

**Public Land Survey**

- Township and Range
- Section

**Municipalities**

- Cities
- Urban Areas

**Water Features**

- Oceans
- Streams and Canals

**Transportation**

- Rails

**Roads**

- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

## MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bitterroot Valley Area, Montana
Survey Area Data: Version 8, Feb 4, 2008

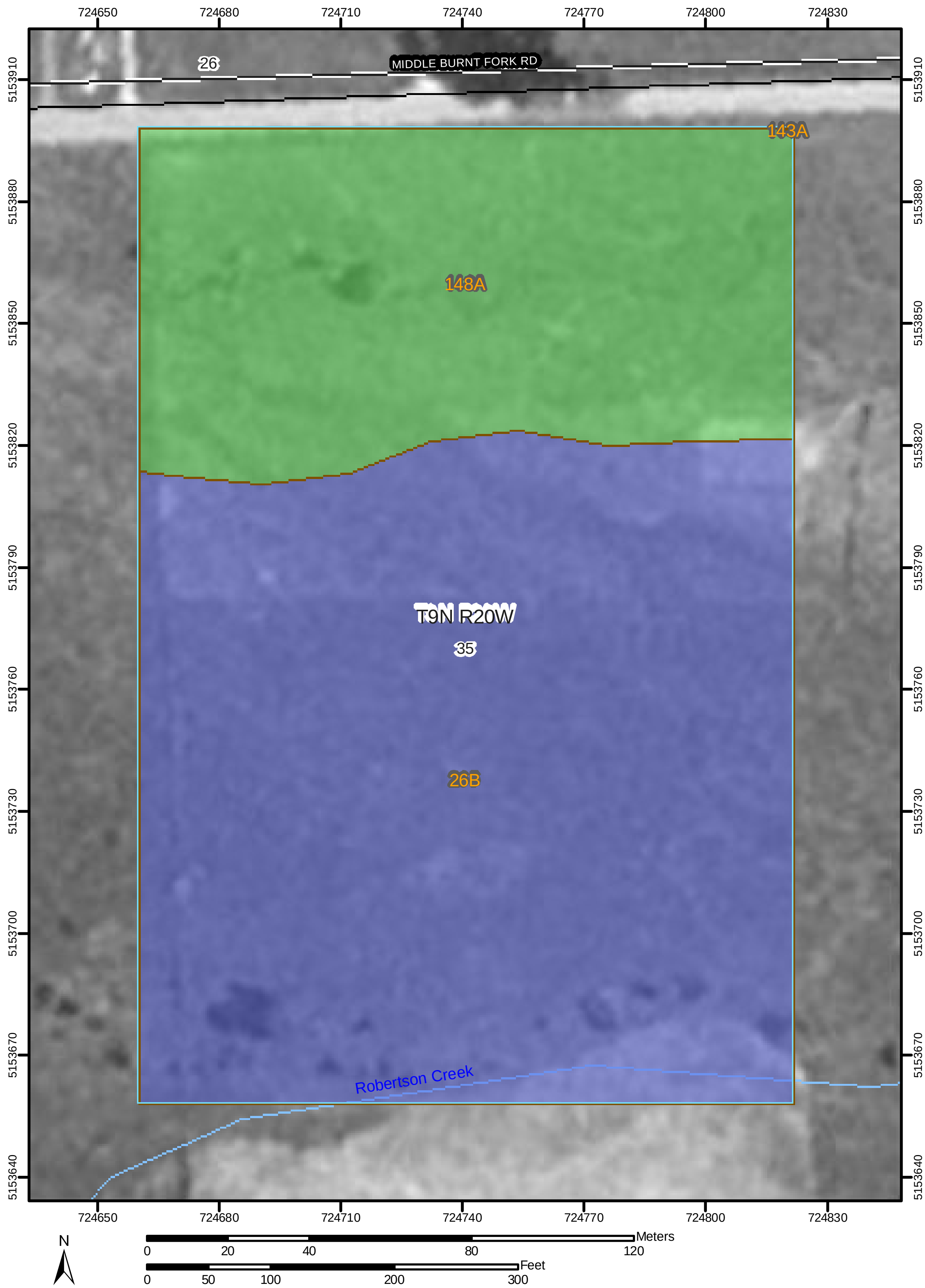
Date(s) aerial images were photographed: 7/31/1995; 8/19/1995

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Map Unit Legend

| Bitterroot Valley Area, Montana (MT645) | | | |
|---|---|---|---|
| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
| 26B | Grayhorse silt loam, 0 to 4 percent slopes | 6.4 | 66.6% |
| 143A | Fairway-Grayhorse complex, 0 to 2 percent slopes | 0.0 | 0.0% |
| 148A | Grayhorse-Allwit complex, 0 to 2 percent slopes | 3.2 | 33.4% |
| Totals for Area of Interest (AOI) | | 9.6 | 100.0% |

# Hydric Rating by Map Unit–Bitterroot Valley Area, Montana
(Stevensville Well Field Hydric Rating)



## MAP LEGEND

**Area of Interest (AOI)**
- Area of Interest (AOI)

**Soils**
- Soil Map Units

**Soil Ratings**
- All Hydric
- Partially Hydric
- Not Hydric
- Unknown Hydric
- Not rated or not available

**Political Features**

**Public Land Survey**
- Township and Range
- Section

**Municipalities**
- Cities
- Urban Areas

**Water Features**
- Oceans
- Streams and Canals

**Transportation**
- Rails

**Roads**
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

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Soil Survey Area: Bitterroot Valley Area, Montana
Survey Area Data: Version 8, Feb 4, 2008

Date(s) aerial images were photographed: 7/31/1995; 8/19/1995

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

# Hydric Rating by Map Unit

| Hydric Rating by Map Unit— Summary by Map Unit — Bitterroot Valley Area, Montana | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| 26B | Grayhorse silt loam, 0 to 4 percent slopes | Not Hydric | 6.4 | 66.6% |
| 143A | Fairway-Grayhorse complex, 0 to 2 percent slopes | Partially Hydric | 0.0 | 0.0% |
| 148A | Grayhorse-Allwit complex, 0 to 2 percent slopes | Partially Hydric | 3.2 | 33.4% |
| Totals for Area of Interest (AOI) | | | 9.6 | 100.0% |

## Description

This rating provides an indication of the proportion of the map unit that meets the criteria for hydric soils. Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

## Rating Options

*Aggregation Method:* Absence/Presence

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Absence/Presence" returns a value that indicates if, for all components of a map unit, a condition is always present, never present, partially present, or whether the condition's presence or absence is unknown. The exact phrases used for a particular attribute may vary from what is shown below.

"Always present" means that the corresponding condition is present in all of a map unit's components.

"Never present" means that the corresponding condition is not present in any of a map unit's components.

"Partially present" means that the corresponding condition is present in some but not all of a map unit's components, or that the presence or absence of the corresponding condition cannot be determined for one or more components of the map unit.

"Unknown presence" means that for components where presence or absence can be determined, the corresponding condition is never present, but the presence or absence of the corresponding condition cannot be determined for one or more components.

The result returned by this aggregation method quantifies the degree to which the corresponding condition is present throughout the map unit.

*Tie-break Rule:* Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

# *Wetlands Delineation Report*

## Town of Stevensville Well Field Site

## ATTACHMENT C

# WETLAND DETERMINATION DATA FORMS

## DATA FORM
## ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

| | |
|---|---|
| Project/Site: PROPOSED WELL SITE<br>Applicant/Owner: TOWN OF STEVENSVILLE<br>Investigator: WILLIAM F BURNETT | Date: 03/6/08<br>County: RAVALLI<br>State: MT |
| Do Normal Circumstances exist on the site? Yes **No**<br>Is the site significantly disturbed (Atypical Situation)? **Yes** No<br>Is the area a potential Problem Area? Yes **No**<br>(If needed, explain on reverse.) | Community ID:<br>Transect ID:<br>Plot ID: SP-1 |

### VEGETATION

| Dominant Plant Species | Stratum | Indicator | Dominant Plant Species | Stratum | Indicator |
|---|---|---|---|---|---|
| 1. WILLOW SPP. | S | FACW+ | 9. | | |
| 2. BENTGRASS | H | FAC+ | 10. | | |
| 3. BROME SPP. | H | FACU | 11. | | |
| 4. REED CANARY | | | 12. | | |
| 5. GRASS | H | FACW | 13. | | |
| 6. BROAD-LEAF | | | 14. | | |
| 7. CATTAIL | H | OBL | 15. | | |
| 8. | | | 16. | | |

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 80%

Remarks: PLANTS HEAVILY GRAZED & TRAMPLED BY CATTLE

### HYDROLOGY

| | |
|---|---|
| ___ Recorded Data (Describe in Remarks):<br>___ Stream, Lake, or Tide Gauge<br>___ Aerial Photographs<br>✓ Other<br>✓ No Recorded Data Available<br><br>Field Observations:<br>Depth of Surface Water: 12 (in.)<br>Depth to Free Water in Pit: ___ (in.)<br>Depth to Saturated Soil: 12 (in.) | Wetland Hydrology Indicators:<br>Primary Indicators:<br>___ Inundated<br>X Saturated in Upper 12 Inches<br>___ Water Marks<br>___ Drift Lines<br>___ Sediment Deposits<br>X Drainage Patterns in Wetlands<br>Secondary Indicators (2 or more required):<br>X Oxidized Root Channels in Upper 12 Inches<br>___ Water-Stained Leaves<br>X Local Soil Survey Data<br>___ FAC-Neutral Test<br>___ Other (Explain in Remarks) |

Remarks:

## SOILS

Map Unit Name (Series and Phase): GRAYHORSE - ALWITT COMPLEX, 0-2% SLOPES

Drainage Class:

Field Observations

Confirm Mapped Type? Yes No

Taxonomy (Subgroup):

Profile Description:

| Depth (inches) | Horizon | Matrix Color (Munsell Moist) | Mottle Colors (Munsell Moist) | Mottle Abundance/ Size/Contrast | Texture, Concretions, Structure, etc. |
|---|---|---|---|---|---|
| 0-2" | A | | | | HUMUS - ROOT MASS |
| 2"-8" | B | 7.5YR 2.5/1 | 5YR 5/8 | 5% | BLACK LOAM |
| 8"-12" | $B_1$ | " | " | " | GRAY SANDY LOAM (MOIST) |

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- X Reducing Conditions
- X Gleyed or Low-Chroma Colors
- X Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

## WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)

Wetland Hydrology Present? Yes No

Hydric Soils Present? Yes No

(Circle)

Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSACE 3/92

## DATA FORM
## ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

| | |
|---|---|
| Project/Site: PROPOSED WELL SITE<br>Applicant/Owner: TOWN OF STEVENSVILLE<br>Investigator: WILLIAM E. BURNETT | Date: 03/6/08<br>County: RAVALLI<br>State: MT |
| Do Normal Circumstances exist on the site? Yes **No**<br>Is the site significantly disturbed (Atypical Situation)? **Yes** No<br>Is the area a potential Problem Area? Yes **No**<br>(If needed, explain on reverse.) | Community ID: ____<br>Transect ID: ____<br>Plot ID: SP-3 |

### VEGETATION

| Dominant Plant Species | Stratum | Indicator | Dominant Plant Species | Stratum | Indicator |
|---|---|---|---|---|---|
| 1. BENTGRASS | H | FAC+ | 9. | | |
| 2. BROME SPP. | H | FACU | 10. | | |
| 3. KNAPWEED | H | FAC– | 11. | | |
| 4. | | | 12. | | |
| 5. | | | 13. | | |
| 6. | | | 14. | | |
| 7. | | | 15. | | |
| 8. | | | 16. | | |

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). < 50%

Remarks: PLANTS HEAVILY GRAZED & TRAMPLED BY CATTLE

### HYDROLOGY

___ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ✓ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: ________(in.)

Depth to Free Water in Pit: ________(in.)

Depth to Saturated Soil: ________(in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- X Drainage Patterns in Wetlands (RELICT IRRIGATION DITCHES)

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks:

## SOILS

Map Unit Name
(Series and Phase): GRAY HOUESE SILT LOAM

Drainage Class: ______

Field Observations
Confirm Mapped Type? Yes No

Taxonomy (Subgroup): ______

Profile Description:

| Depth (inches) | Horizon | Matrix Color (Munsell Moist) | Mottle Colors (Munsell Moist) | Mottle Abundance/ Size/Contrast | Texture, Concretions, Structure, etc. |
|---|---|---|---|---|---|
| 0-3" | A | | | | HUMUS WITH ROOTS |
| 3"-6" | B | 2.5YR 4/2 | (NA) | (NA) | LIGHT BROWN SAND WITH ≥ 2" COBBLES |

REFUSAL @ 6"-8" DUE TO EXTENSIVE COBBLES

Hydric Soil Indicators:

___ Histosol
___ Histic Epipedon
___ Sulfidic Odor
___ Aquic Moisture Regime
___ Reducing Conditions
___ Gleyed or Low-Chroma Colors
___ Concretions
___ High Organic Content in Surface Layer in Sandy Soils
___ Organic Streaking in Sandy Soils
___ Listed on Local Hydric Soils List
___ Listed on National Hydric Soils List
___ Other (Explain in Remarks)

Remarks:

## WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes No (Circle)
Wetland Hydrology Present? Yes No
Hydric Soils Present? Yes No

(Circle)
Is this Sampling Point Within a Wetland? Yes No

Remarks:

Approved by HQUSACE 3/92

# *Wetlands Delineation Report*

## Town of Stevensville Well Field Site

## ATTACHMENT D

# WETLANDS FUNCTIONS & VALUES ASSESSMENT FORM

# MDT Montana Wetland Assessment Form (revised 5/25/1999)

1. Project Name: STEVENSVILLE WELL SITE 2. Project #: 7252-04 Control #: N/A

3. Evaluation Date: Month/ Day/Year 03/06/08 4. Evaluator(s): WE BURNETT 5. Wetlands/Site #(s): ENTIRE SITE

6. Wetland Location(s): i. Legal: T 9 (N) or S; R 20 E or (W) S 35 ; T ___ N or S; R ___ E or W; S ___ ;

ii. Approx. Stationing or Mileposts: MIDDLE BURNT FORK RD 1000' WEST OF INTERSECTION OF LOGAN LANE & MIDDLE BURNT FORK ROAD

iii. Watershed: BITTERROOT RIVER GPS Reference No. (if applies): ___

Other Location Information:

7. a. **Evaluating Agency:** ___;
   b. **Purpose of Evaluation:**
   1. ___ Wetlands potentially affected by MDT project
   2. ✓ Mitigation wetlands; pre-construction
   3. ___ Mitigation wetlands; post-construction
   4. ___ Other

8. **Wetland size:** (total acres) 30 Ac (visually estimated)
   ___ (measured, e.g. by GPS [if applies])

9. **Assessment area:** (AA, tot., ac., see instructions on determining AA) 5.4 Ac (visually estimated)
   ___ (measured, e.g. by GPS [if applies])

10. **Classification of Wetland and Aquatic Habitats in AA** (HGM according to Brinson, first col.; USFWS according to Cowardin [1979], remaining cols.)

| HGM Class | System | Subsystem | Class | Water Regime | Modifier | % of AA |
|---|---|---|---|---|---|---|
| RIVERINE | RIVERINE | LOWER PERENNIAL | EM | C | F | 50 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

(Abbreviations: **System**: Palustrine(P)/ **Subsyst.**: none/ **Classes**: Rock Bottom (**RB**), Unconsolidated bottom (**UB**), Aquatic Bed (**AB**), Unconsolidated Shore (**US**), Moss-lichen Wetland (**ML**), Emergent Wetland (**EM**), Scrub-Shrub Wetland (**SS**), Forested Wetland (**FO**)/ **System**: Lacustrine (**L**)/, **Subsyst.**: Limnetic (**2**)/ **Classes**: RB, UB, AB/ **Subsystem**: Littoral (**4**)/ **Classes**: RB, UB, AB, US, EM/ **System**: Riverine (**R**)/ **Subsyst.**: Lower Perennial (**2**)/ Classes: RB, UB, AB, US, EM/ **Subsystem**: Upper Perennial (**3**)/ Classes: RB, UB, AB, US/ **Water Regimes**: Permanently Flooded (**H**), Intermittently Exposed (**G**), Semipermanently Flooded (**F**), Seasonally Flooded (**C**), Saturated (**B**), Temporarily Flooded (**A**), Intermittently Flooded (**J**) **Modifiers**: Excavated (**E**), Impounded (**I**), Diked (**D**), Partly Drained (**PD**), Farmed (**F**), Artificial (**A**) **HGM Classes**: Riverine, Depressional, Slope, Mineral Soil Flats, Organic Soil Flats, Lacustrine Fringe

11. **Estimated relative abundance:** (of similarly classified sites within the same Major ~~Montana Watershed~~ Basin, see definitions)
   (Circle one) Unknown Rare Common Abundant
   **Comments:**

12. **General condition of AA:**
   i. **Regarding disturbance:** (use matrix below to determine [circle] appropriate response)

| *Conditions within AA* | *Predominant conditions adjacent to (within 500 feet of) AA* | | |
|---|---|---|---|
| | Land managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or buildings. | Land not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to minor clearing; contains few roads or buildings. | Land cultivated or heavily grazed or logged; subject to substantial fill placement, grading, clearing, or hydrological alteration; high road or building density. |
| AA occurs and is managed in predominantly natural state; is not grazed, hayed, logged, or otherwise converted; does not contain roads or occupied buildings. | low disturbance | low disturbance | moderate disturbance |
| AA not cultivated, but moderately grazed or hayed or selectively logged; or has been subject to relatively minor clearing, fill placement, or hydrological alteration; contains few roads or buildings. | moderate disturbance | moderate disturbance | high disturbance |
| AA cultivated or heavily grazed or logged; subject to relatively substantial fill placement, grading, clearing, or hydrological alteration; high road or building density. | high disturbance | high disturbance | high disturbance |

**Comments:** (types of disturbance, intensity, season, etc.): HIGHLY GRAZED & TRAMPLED BY CATTLE

ii. **Prominent weedy, alien, & introduced species (including those not domesticated, feral):** (list)
SCATTERED KNAPWEED

iii. **Provide brief descriptive summary of AA and surrounding land use/habitat:** HIGHLY GRAZED PASTURELAND SURROUNDED BY HIGHLY GRAZED PASTURELAND & SMALL FARMS.

**13. Structural Diversity:** (based on number of "Cowardin" ***vegetated*** classes present [do not include unvegetated classes], see #10 above)

| *# of "Cowardin" vegetated classes present in AA (see #10)* | ≥ 3 vegetated classes (or ≥ 2 if one is forested) | 2 vegetated classes (or 1 if forested) | ≤ 1 vegetated class |
|---|---|---|---|
| *Rating (circle)* | High | Moderate | Low |

**Comments:**

## SECTION PERTAINING to FUNCTIONS & VALUES ASSESSMENT

**14A. Habitat for Federally Listed or Proposed Threatened or Endangered Plants or Animals:**

**I.** AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S

Secondary habitat (**list species**) D S

Incidental habitat (**list species**) D S BULL TROUT (JUVENILES ONLY)

No usable habitat D S

**II. Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

| *Highest Habitat Level* | doc./primary | sus/primary | doc./secondary | sus./secondary | doc./incidental | sus./incidental | None |
|---|---|---|---|---|---|---|---|
| *Functional Points and Rating* | 1 (H) | .9 (H) | .8 (M) | .7 (M) | .5 (L) | .3 (L) | 0 (L) |

Sources for documented use (e.g. observations, records, etc):

**14B. Habitat for plant or animals rated S1, S2, or S3 by the Montana Natural Heritage Program:** (not including species listed in14A above)

**i.** AA is Documented (D) or Suspected (S) to contain (circle one based on definitions contained in instructions):

Primary or critical habitat (**list species**) D S

Secondary habitat (**list species**) D S

Incidental habitat (**list species**) D S WEST SLOPE CUTTHROAT TROUT (JUVENILES ONLY)

No usable habitat D S

**II. Rating** (use the conclusions from i above and the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

| *Highest Habitat Level* | doc./primary | sus/primary | doc./secondary | sus./secondary | doc./incidental | sus./incidental | None |
|---|---|---|---|---|---|---|---|
| *Functional Points and Rating* | 1 (H) | .8 (H) | .7 (M) | .6 (M) | .2 (L) | .1 (L) | 0 (L) |

Sources for documented use (e.g. observations, records, etc.):

**14C. General Wildlife Habitat Rating:**

**i. Evidence of overall wildlife use in the AA** (circle substantial, moderate, or low based on supporting evidence):

***Substantial*** (based on any of the following [check]):

- __ observations of abundant wildlife #'s or high species diversity (during any period)
- __ abundant wildlife sign such as scat, tracks, nest structures, game trails, etc.
- __ presence of extremely limiting habitat features not available in the surrounding area
- __ interviews with local biologists with knowledge of the AA

✓ ***Low*** (based on any of the following [check]):

- ✓ few or no wildlife observations during peak use periods
- ✓ little to no wildlife sign
- ✓ sparse adjacent upland food sources
- __ interviews with local biologists with knowledge of the AA

***Moderate*** (based on any of the following [check]):

- __ observations of scattered wildlife groups or individuals or relatively few species during peak periods
- __ common occurrence of wildlife sign such as scat, tracks, nest structures, game trails, etc.
- __ adequate adjacent upland food sources
- __ interviews with local biologists with knowledge of the AA

**ii. Wildlife habitat features** (working from top to bottom, circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) rating. Structural diversity is from #13. For class cover to be considered evenly distributed, vegetated classes must be within 20% of each other in terms of their percent composition of the AA (see #10). Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; T/E = temporary/ephemeral; and A = absent [see instructions for further definitions of these terms].)

| *Structural diversity (see #13)* | High | | | | | | | | Moderate | | | | | | | | Low | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Class cover distribution (all vegetated classes)* | Even | | | | Uneven | | | | Even | | | | Uneven | | | | Even | | | |
| *Duration of surface water in ≥ 10% of AA* | P/P | S/I | T/E | A | P/P | S/I | T/E | A | P/P | S/I | T/E | A | P/P | S/I | T/E | A | P/P | S/I | T/E | A |
| **Low** disturbance at AA (see #12i) | E | E | E | H | E | E | H | H | E | H | H | M | E | H | M | M | E | H | M | M |
| **Moderate** disturbance at AA (see #12i) | H | H | H | H | H | H | H | M | H | H | M | M | H | M | M | L | H | M | L | L |
| **High** disturbance at AA (see #12i) | M | M | M | L | M | M | L | L | M | M | L | L | M | L | L | L | L | L | L | L |

**iii. Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

| *Evidence of wildlife use (i)* | *Wildlife habitat features rating (ii)* | | | |
|---|---|---|---|---|
| | Exceptional | High | Moderate | Low |
| **Substantial** | 1 (E) | .9 (H) | .8 (H) | .7 (M) |
| **Moderate** | .9 (H) | .7 (M) | .5 (M) | .3 (L) |
| **Minimal** | .6 (M) | .4 (M) | .2 (L) | .1 (L) |

**Comments:** ALL VASCULAR PLANTS WERE IMPACTED BY CATTLE GRAZING

**14D. General Fish/Aquatic Habitat Rating:** (Assess this function if the AA is used by fish or the existing situation is "correctable" such that the AA could be used by fish [i.e., fish use is precluded by perched culvert or other barrier, etc.]. If the AA is not or was not historically used by fish due to lack of habitat, excessive gradient, etc., circle **NA** here and proceed to the next function. If fish use occurs in the AA but is not desired from a resource management perspective [such as fish use within an irrigation canal], then Habitat Quality [i below] should be marked as "Low", applied accordingly in ii below; and noted ih the comments.)

**i. Habitat Quality** (circle appropriate AA attributes in matrix to arrive at exceptional (E), high (H), moderate (M), or low (L) quality rating.

| *Duration of surface water in AA* | Permanent / Perennial | | | Seasonal / Intermittent | | | Temporary / Ephemeral | | |
|---|---|---|---|---|---|---|---|---|---|
| *Cover - % of waterbody in AA containing cover objects such as submerged logs, large rocks & boulders, overhanging banks, floating-leaved vegetation, etc.* | >25% | 10–25% | <10% | >25% | 10–25% | <10% | >25% | 10–25% | <10% |
| Shading - **>75%** of streambank or shoreline within AA contains riparian or wetland scrub-shrub or forested communities | E | E | H | H | H | M | M | M | M |
| Shading – **50 to 75%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities | H | H | M | M | M | M | M | L | L |
| Shading - **< 50%** of streambank or shoreline within AA contains rip. or wetland scrub-shrub or forested communities | H | M | M | M | L | L | L | L | L |

**ii. Modified Habitat Quality** (Circle the appropriate response to the following question. If answer is Y, then reduce rating in i above by one level [E = H, H = M, M = L, L = L]). *Is fish use of the AA precluded or significantly reduced by a culvert, dike, or other man-made structure or activity* ***or*** *is the waterbody included on the MDEQ list of waterbodies in need of TMDL development with listed "Probable Impaired Uses" including cold or warm water fishery or aquatic life support?* Y N Modified habitat quality rating = (circle) E H M L

**iii. Rating** (use the conclusions from i and ii above and the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function)

| *Types of fish known or suspected within AA* | *Modified Habitat Quality (ii)* | | | |
|---|---|---|---|---|
| | Exceptional | High | Moderate | Low |
| **Native game** fish | 1 (E) | .9 (H) | .7 (M) | .5 (M) |
| **Introduced game** fish | .9 (H) | .8 (H) | .6 (M) | .4 (M) |
| **Non-game** fish | .7 (M) | .6 (M) | .5 (M) | .3 (L) |
| **No** fish | .5 (M) | .3 (L) | .2 (L) | .1 (L) |

**Comments:** NO FISH WERE OBSERVED IN THE STREAM

**14E. Flood Attenuation:** (applies only to wetlands subject to flooding via in-channel or overbank flow. If wetlands in AA are not flooded from in-channel or overbank flow, circle **NA** here and proceed to next function.)

**i. Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function)

| *Estimated wetland area in AA subject to periodic flooding* | ≥ 10 acres | | | <10, >2 acres | | | ≤2 acres | | |
|---|---|---|---|---|---|---|---|---|---|
| *% of flooded wetland classified as forested, scrub/shrub, or both* | 75% | 25-75% | <25% | 75% | ~~25-75%~~ | <25% | 75% | 25-75% | <25% |
| AA contains **no outlet or restricted outlet** | 1(H) | .9(H) | .6(M) | .8(H) | .7(H) | .5(M) | .4(M) | .3(L) | .2(L) |
| AA contains **unrestricted outlet** | .9(H) | .8(H) | .5(M) | .7(H) | .6(M) | .4(M) | .3(L) | .2(L) | .1(L) |

**ii.** Are residences, businesses, or other features which may be significantly damaged by floods located within 0.5 miles downstream of the AA (circle)?
Y N

**Comments:** CULVERT UNDER MIDDLE BURNT FORK ROAD WILL LIMIT FLOW & COULD CAUSE FLOODING OF WETLAND AREA

**14F. Short and Long Term Surface Water Storage:** (Applies to wetlands that flood or pond from overbank or in-channel flow, precipitation, upland surface flow, or groundwater flow. If no wetlands in the AA are subject to flooding or ponding, circle **NA** here and proceed with the evaluation.)

**i. Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Abbreviations for surface water durations are as follows: P/P = permanent/perennial; S/I = seasonal/intermittent; and T/E = temporary/ephemeral [see instructions for further definitions of these terms].)

| *Estimated maximum acre feet of water contained in wetlands within the AA that are subject to periodic flooding or ponding* | >5 acre feet | | | <5, >1 acre feet | | | ≤1 acre foot | | |
|---|---|---|---|---|---|---|---|---|---|
| *Duration of surface water at wetlands within the AA* | P/P | S/I | T/E | P/P | S/I | T/E | P/P | S/I | T/E |
| Wetlands in AA flood or pond ≥ **5 out of 10 years** | 1(H) | .9(H) | .8(H) | .8(H) | .6(M) | .5(M) | .4(M) | ~~.3(L)~~ | .2(L) |
| Wetlands in AA flood or pond < **5 out of 10 years** | .9(H) | .8(H) | .7(M) | .7(M) | .5(M) | .4(M) | .3(L) | .2(L) | .1(L) |

**Comments:** CULVERT UNDER MIDDLE BURNT FORK ROAD WILL LIMIT FLOW & COULD CAUSE FLOODING OF WETLAND AREA.

**14G. Sediment/Nutrient/Toxicant Retention and Removal:** (Applies to wetlands with potential to receive excess sediments, nutrients, or toxicants through influx of surface or ground water or direct input. If no wetlands in the AA are subject to such input, circle **NA** here and proceed with the evaluation.)

**i. Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

| *Sediment, nutrient, and toxicant input levels within AA* | AA receives or surrounding land use with potential to deliver low to moderate levels of sediments, nutrients, or compounds such that other functions are not substantially impaired. Minor sedimentation, sources of nutrients or toxicants, or signs of eutrophication present. | | | | Waterbody on MDEQ list of waterbodies in need of TMDL development for "probable causes" related to sediment, nutrients, or toxicants **or** AA receives or surrounding land use with potential to deliver high levels of sediments, nutrients, or compounds such that other functions are substantially impaired. Major sedimentation, sources of nutrients or toxicants, or signs of eutrophication present. | | | |
|---|---|---|---|---|---|---|---|---|
| *% cover of wetland vegetation in AA* | ≥ 70% | | < 70% | | ≥ 70% | | < 70% | |
| *Evidence of flooding or ponding in AA* | Yes | No | Yes | No | Yes | No | Yes | No |
| AA contains **no or restricted outlet** | 1 (H) | .8 (H) | .7 (M) | .5 (M) | .5 (M) | .4 (M) | .3 (L) | .2 (L) |
| AA contains **unrestricted outlet** | .9 (H) | .7 (M) | .6 (M) | .4 (M) | .4 (M) | .3 (L) | .2 (L) | .1 (L) |

**Comments:** HORSE & CATTLE PASTURES LOCATED UPSTREAM CAN BE SOURCES OF NUTRIENTS TO STREAM

**14H Sediment/Shoreline Stabilization:** (applies only if AA occurs on or within the banks or a river, stream, or other natural or man-made drainage, or on the shoreline of a standing water body which is subject to wave action. If does not apply, circle **NA** here and proceed to next function)

**i. Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [E = exceptional, H = high, M = moderate, or L = low] for this function.

| *% Cover of wetland streambank or shoreline by species with deep, binding rootmasses* | *Duration of surface water adjacent to rooted vegetation* | | |
|---|---|---|---|
| | permanent / perennial | seasonal / intermittent | Temporary / ephemeral |
| **≥ 65%** | 1 (H) | .9 (H) | .7 (M) |
| **35-64%** | .7 (M) | .6 (M) | .5 (M) |
| **< 35%** | .3 (L) | .2 (L) | .1 (L) |

**Comments:** STREAM & WETLANDS NOT SUBJECT TO WAVE ACTION.

**14I. Production Export/Food Chain Support:**

**i. Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function. Factor A = acreage of vegetated component in the AA; Factor B = structural diversity rating from #13; Factor C = whether or not the AA contains a surface or subsurface outlet; the final three rows pertain to duration of surface water in the AA, where P/P = permanent/perennial; S/I = seasonal/intermittent; T/E /A= temporary/ephemeral or absent [see instructions for further definitions of these terms].)

| A | Vegetated component >5 acres | | | | | | Vegetated component 1-5 acres | | | | | | Vegetated component <1 acre | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | High | | Moderate | | Low | | High | | Moderate | | Low | | High | | Moderate | | Low | |
| C | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No |
| P/P | 1H | .9H | .9H | .8H | .8H | .7M | .9H | .8H | .8H | .7M | .7M | .6M | .7M | .6M | .6M | .4M | .4M | .3L |
| S/I | .9H | .8H | .8H | .7M | .7M | .6M | .8H | .7M | .7M | .6M | .6M | .5M | .6M | .5M | .5M | .3L | .3L | .2L |
| T/E/A | .8H | .7M | .7M | .6M | .6M | .5M | .7M | .6M | .6M | .5M | .5M | .4M | .5M | .4M | .4M | .2L | .2L | .1L |

**Comments:**

**14J. Groundwater Discharge/Recharge:** (Check the indicators in i & ii below that apply to the AA)

**i. Discharge Indicators**
- ___Springs are known or observed
- ___Vegetation growing during dormant season/drought
- ___Wetland occurs at the toe of a natural slope
- ___Seeps are present at the wetland edge
- ___AA permanently flooded during drought periods
- ___Wetland contains an outlet, but no inlet
- ___Other

**ii. Recharge Indicators**
- ✓ Permeable substrate present without underlying impeding layer
- ___Wetland contains inlet but no outlet
- ___Other

**iii. Rating:** Use the information from i and ii above and the table below to arrive at [circle] the functional points and rating [H = high, L = low] for this function.

| *Criteria* | *Functional Points and Rating* |
|---|---|
| AA is known Discharge/Recharge area or one or more indicators of D/R present | 1 (H) |
| No Discharge/Recharge indicators present | .1 (L) |
| Available Discharge/Recharge information inadequate to rate AA D/R potential | N/A (Unknown) |

**Comments:**

**14K. Uniqueness:**

i. **Rating** (working from top to bottom, use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

| *Replacement potential* | AA contains fen, bog, warm springs or mature (>80 yr-old) forested wetland or plant association listed as "S1" by the MNHP | | | AA does not contain previously cited rare types **and** structural diversity (#13) is high **or** contains plant association listed as "S2" by the MNHP | | | AA does not contain previously cited rare types or associations **and** structural diversity (#13) is low-moderate | | |
|---|---|---|---|---|---|---|---|---|---|
| *Estimated relative abundance (#11)* | rare | common | abundant | rare | common | abundant | rare | common | abundant |
| **Low** disturbance at AA (#12i) | 1 (H) | .9 (H) | .8 (H) | .8 (H) | .6 (M) | .5 (M) | .5 (M) | .4 (M) | .3 (L) |
| **Moderate** disturbance at AA (#12i) | .9 (H) | .8 (H) | .7 (M) | .7 (M) | .5 (M) | .4 (M) | .4 (M) | .3 (L) | .2 (L) |
| **High** disturbance at AA (#12i) | .8 (H) | .7 (M) | .6 (M) | .6 (M) | .4 (M) | .3 (L) | .3 (L) | .2 (L) | .1 (L) |

**Comments:**

**14L. Recreation/Education Potential: i. Is the AA a known rec./ed. site:** (circle) Y N (If yes, rate as [circle] High [1] and go to ii; if no go to iii)

**ii. Check categories that apply to the AA:** ___ Educational/scientific study; ___ Consumptive rec.; ___ Non-consumptive rec.; ___Other

**iii. Based on the location, diversity, size, and other site attributes, is there strong potential for rec./ed. use?** Y N
(If yes, go to ii, then proceed to iv; if no, then rate as [circle] Low [0.1])

**iv. Rating** (use the matrix below to arrive at [circle] the functional points and rating [H = high, M = moderate, or L = low] for this function.

| *Ownership* | *Disturbance at AA (#12i)* | | |
|---|---|---|---|
| | low | moderate | high |
| **public** ownership | 1 (H) | .5 (M) | .2 (L) |
| **private** ownership | .7 (M) | .3 (L) | .1 (L) |

**Comments:**

FUNCTION & VALUE SUMMARY & OVERALL RATING

| Function & Value Variables | Rating | Actual Functional Points | Possible Functional Points | Functional Units; (Actual Points x Estimated AA Acreage) |
|---|---|---|---|---|
| A. Listed/Proposed T&E Species Habitat | L | 0.3 | 1 | |
| B. MT Natural Heritage Program Species Habitat | L | 0.1 | 1 | |
| C. General Wildlife Habitat | L | 0.1 | 1 | |
| D. General Fish/Aquatic Habitat | L | 0.1 | 0.5 | |
| E. Flood Attenuation | M | 0.5 | 0.5 | |
| F. Short and Long Term Surface Water Storage | L | 0.3 | 0.4 | |
| G. Sediment/Nutrient/Toxicant Removal | M | 0.5 | 0.5 | |
| H. Sediment/Shoreline Stabilization | L | 0.3 | 1 | |
| I. Production Export/Food Chain Support | M | 0.8 | 1 | |
| J. Groundwater Discharge/Recharge | L | 0.1 | 1 | |
| K. Uniqueness | L | 0.2 | 1 | |
| L. Recreation/Education Potential | L | 0.1 | 1 | |
| Totals: | | 3.4 | 9.9 | |

3.4/9.9 = 34%

**OVERALL ANALYSIS AREA (AA) RATING:** (Circle appropriate category based on the criteria outlined below) I II III IV

**Category I Wetland:** (Must satisfy **one** of the following criteria; if does not meet criteria, go to Category II)
___ Score of 1 functional point for Listed/Proposed Threatened or Endangered Species; **or**
___ Score of 1 functional point for Uniqueness; **or**
___ Score of 1 functional point for Flood Attenuation **and** answer to Question 14E.ii is "yes"; **or**
___ Total actual functional points > 80% (round to nearest whole #) of total possible functional points.

**Category II Wetland:** (Criteria for Category I not satisfied **and** meets any **one** of the following criteria; if not satisfied, go to Category IV)
___ Score of 1 functional point for Species Rated S1, S2, or S3 by the MT Natural Heritage Program; **or**
___ Score of .9 or 1 functional point for General Wildlife Habitat; **or**
___ Score of .9 or 1 functional point for General Fish/Aquatic Habitat; **or**
___ "High" to "Exceptional" ratings for **both** General Wildlife Habitat **and** General Fish/Aquatic Habitat; **or**
___ Score of .9 functional point for Uniqueness; **or**
___ Total Actual Functional Points > 65% (round to nearest whole #) of total possible functional points.

**Category III Wetland:** (Criteria for Categories I, II or IV not satisfied)

**Category IV Wetland:** (Criteria for Categories I or II are not satisfied and all of the following criteria are met; if does not satisfy criteria go to Category III)
___ "Low" rating for Uniqueness; **and**
___ "Low" rating for Production Export/Food Chain Support; **and**
___ Total actual functional points < 30% (round to nearest whole #) of total possible functional points

**MONTANA WELL LOG REPORT**

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**Other Options**

Plot this site on a topographic map
View scanned well log (6/9/2008 6:59:38 PM)

NOTICE >> This well has been deepened by GWIC Id 243996. << NOTICE

**Site Name: CITY OF STEVENSVILLE**
**GWIC Id: 60163**

### Section 1: Well Owner

**Owner Name**
CITY OF STEVENSVILLE
**Mailing Address**

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59670 |

### Section 2: Location

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 27 | |

| County | Geocode |
|---|---|
| RAVALLI | |

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.5123 | 114.0925 | MAP | NAD27 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| | | | |

| Addition | Block | Lot |
|---|---|---|
| | | |

### Section 3: Proposed Use of Water
PUBLIC WATER SUPPLY (1)

### Section 4: Type of Work
Drilling Method:

### Section 5: Well Completion Date
Date well completed: Sunday, April 08, 1956

### Section 6: Well Construction Details

**Borehole dimensions**

| From | To | Diameter |
|---|---|---|
| -1 | 115 | 10 |

**Casing**

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| -1 | 115 | 10 | | | | STEEL |

**Completion (Perf/Screen)**

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 115 | 115 | 10 | | | OPEN BOTTOM |

**Annular Space (Seal/Grout/Packer)**

There are no annular space records assigned to this well.

### Section 7: Well Test Data

Total Depth: 115
Static Water Level:
Water Temperature:

**Air Test** *

70 gpm with drill stem set at _ feet for _ hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 100 feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

### Section 9: Well Log

**Geologic Source**
Unassigned

| From | To | Description |
|---|---|---|
| 0 | 2 | SOIL |
| 2 | 17 | HEAVY GRAVEL |
| 17 | 25 | LITTLE WATER SAND AND GRAVEL |
| 25 | 40 | HEAVING SAND LITTLE WATER |
| 40 | 67 | GRAY CLAY |
| 67 | 75 | DECOMPOSED GRANITE WATER |
| 75 | 105 | HEAVING SAND |
| 105 | 110 | RED CLAY |
| 110 | 115 | MED-COARSE SAND WATER CLAY UNDERNEATH |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

| | |
|---|---|
| Name: | JOHN FARRELL |
| Company: | |
| License No: | WWC- |
| Date Completed: | 4/8/1956 |

## MONTANA WELL LOG REPORT

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**Other Options**

Plot this site on a topographic map
View scanned well log (6/9/2008 7:07:20 PM)

NOTICE >> This well deepens GWIC Id 60163. << NOTICE

**Site Name: CITY OF STEVENSVILLE**
**GWIC Id: 243996**

### Section 1: Well Owner

**Owner Name**
CITY OF STEVENSVILLE
**Mailing Address**

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59870 |

### Section 2: Location

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 27 | SE¼ SE¼ NW¼ NE¼ |

| County | Geocode |
|---|---|
| RAVALLI | |

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.512452 | 114.094126 | TRS-SEC | NAD83 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| | | | |

| Addition | Block | Lot |
|---|---|---|
| | | |

### Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

### Section 4: Type of Work

Drilling Method: CHURN DRILL

### Section 5: Well Completion Date

Date well completed: Friday, March 01, 1957

### Section 6: Well Construction Details

**Borehole dimensions**

| From | To | Diameter |
|---|---|---|
| 117 | 412 | 10 |

**Casing**

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0 | 455 | 10 | | | WELDED | STEEL |

**Completion (Perf/Screen)**

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 362 | 370 | 10 | 16 | 1X3/8 | DRILLED HOLES |

**Annular Space (Seal/Grout/Packer)**

There are no annular space records assigned to this well.

### Section 7: Well Test Data

Total Depth: 460
Static Water Level: 30
Water Temperature:

**Air Test** *

400 gpm with drill stem set at 100 feet for 12 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

### Section 9: Well Log

**Geologic Source**
Unassigned

| From | To | Description |
|---|---|---|
| 117 | 130 | CLAY AND SAND |
| 130 | 131 | GRAVEL AND SAND |
| 131 | 140 | CLAY AND SAND |
| 140 | 141 | GRAVEL SAND AND WATER |
| 141 | 150 | CLAY AND SAND |
| 150 | 164 | SAND SOME CLAY |
| 164 | 174 | SAND SMALL HEAVING GRAVEL |
| 174 | 178 | HARD CLAY AND GRIT |
| 178 | 190 | BROWN CLAY WITH GRIT |
| 190 | 219 | GRANITE SOME CLAY |
| 219 | 231 | CLAY MIXED WITH GRAVEL |
| 231 | 239 | GRAVEL SOME CLAY |
| 239 | 275 | CLAY WITH GRIT |
| 275 | 284 | GRANITE |
| 284 | 305 | CLAY WITH GRIT |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

**Name:** GLENN CAMP
**Company:**
**License No:** WWC-7
**Date Completed:** 3/1/1957

**Site Name: CITY OF STEVENSVILLE**
**GWIC Id: 243996**
**Additional Lithology Records**

| From | To | Description |
|---|---|---|
| 305 | 314 | GRANITE |
| 314 | 319 | CLAY |
| 319 | 324 | GRANITE |
| 324 | 330 | SAND SMALL GRAVEL |
| 330 | 344 | SAND |
| 344 | 347 | PEAT |
| 347 | 350 | CLAY |
| 350 | 357 | CLAY |
| 357 | 370 | SAND WITH GRAVEL |
| 370 | 380 | CLAY |
| 380 | 389 | GRAVEL AND SAND |
| 389 | 412 | CLAY |
| 412 | 413 | GRANITE |
| 413 | 416 | CLAY |
| 416 | 417 | GRANITE |
| 417 | 427 | CLAY |
| 427 | 428 | MEALY SAND |
| 428 | 434 | GRANITE |
| 434 | 438 | CLAY AND SAND |
| 438 | 440 | SAND |
| 440 | 453 | GRANITE |
| 453 | 460 | CLAY SAND |
| 460 | 460 | CLAY AND SAND |

**MONTANA WELL LOG REPORT**

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**Other Options**

Plot this site on a topographic map
View scanned well log (6/9/2008 6:58:37 PM)

**Site Name: CITY OF STEVENSVILLE**
**GWIC Id: 60148**

### Section 1: Well Owner

**Owner Name**
CITY OF STEVENSVILLE
**Mailing Address**

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59870 |

### Section 2: Location

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 27 | |

| County | Geocode |
|---|---|
| RAVALLI | |

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.508363 | 114.098902 | TRS-SEC | NAD83 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| | | | |

| Addition | Block | Lot |
|---|---|---|
| | | |

### Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

### Section 4: Type of Work

Drilling Method: CABLE

### Section 5: Well Completion Date

Date well completed: Friday, September 13, 1974

### Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

**Casing**

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0 | 52 | 6 | | | | STEEL |

**Completion (Perf/Screen)**

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 37 | 52 | 6 | | 5 IN | SLOTS |

**Annular Space (Seal/Grout/Packer)**

| From | To | Description | Cont. Fed? |
|---|---|---|---|
| 0 | 35 | NATURAL | |

### Section 7: Well Test Data

Total Depth: 52
Static Water Level: 9
Water Temperature:

**Bailer Test** *

_70_ gpm with _ feet of drawdown after _9_ hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level _30_ feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

PINES DRILLING FILE NO: 33

### Section 9: Well Log

**Geologic Source**
Unassigned

| From | To | Description |
|---|---|---|
| 0 | 1 | TOPSOIL |
| 1 | 12 | SAND GRAVEL BOULDERS DARK BROWN |
| 12 | 39 | SAND GRAVEL CLAY INTERMITTANT LAYERS TAN |
| 39 | 50 | PEA GRAVEL & SAND TIGHT WB |
| 50 | 53 | CLAY GREY |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

| | |
|---|---|
| **Name:** | |
| **Company:** | PINES |
| **License No:** | WWC-62 |
| **Date Completed:** | 9/13/1974 |

**MONTANA WELL LOG REPORT**

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**Other Options**

Plot this site on a topographic map
View scanned well log (6/9/2008 7:16:45 PM)

**Site Name: CITY OF STEVENSVILLE - WELL 3**
**GWIC Id: 60170**
**DNRC Water Right: P007286-00**

### Section 1: Well Owner

**Owner Name**
CITY OF STEVENSVILLE
**Mailing Address**

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59870 |

### Section 2: Location

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 27 | SE¼ SE¼ NW¼ SE¼ |

| County | Geocode |
|---|---|
| RAVALLI | |

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.505 | 114.0948 | MAP | NAD27 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| | | | |

| Addition | Block | Lot |
|---|---|---|
| | | |

### Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

### Section 4: Type of Work

Drilling Method: CHURN

### Section 5: Well Completion Date

Date well completed: Tuesday, February 13, 1968

### Section 6: Well Construction Details

**Borehole dimensions**

| From | To | Diameter |
|---|---|---|
| 0 | 56 | 8 |

**Casing**

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0 | 56 | 8 | | | | 32 LB STEEL |

**Completion (Perf/Screen)**

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 36 | 56 | 6 | | | 1/4 X 4 HOLES |

**Annular Space (Seal/Grout/Packer)**

There are no annular space records assigned to this well.

### Section 7: Well Test Data

Total Depth: 56
Static Water Level: 30
Water Temperature:

**Bailer Test** *

300 gpm with _ feet of drawdown after 3 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 36 feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

### Section 8: Remarks

### Section 9: Well Log

**Geologic Source**

Unassigned

| From | To | Description |
|---|---|---|
| 0 | 1 | TOPSOIL |
| 1 | 10 | SAND GRAVEL |
| 10 | 29 | SAND GRAVEL LARGE GLACIAL BOULDERS TIGHT PRESSED |
| 29 | 56 | SAND GRAVEL LOOSE WB |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

**Name:**
**Company:** RAVALLI DRILLING
**License No:** WWC-62
**Date Completed:** 2/13/1968

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ISO Commercial Risk Services, Inc. • 1385 S. Colorado Blvd. • Suite 218
Denver, CO 80222 • (303) 759-3511 • (800) 759-3512 • FAX: (303) 759-0742

Read at next council

September 16, 1996

The Honorable William Meisner
Mayor of Stevensville
219 College Street
Stevensville, MT 59870

RE: Public Fire Protection
Stevensville, Ravalli County, Montana

Dear Mayor Meisner:

We wish to thank you, Fire Chief Bob Summers, Water Superintendent Bruce Park, and others for the cooperation given to our representative during our recent survey. We have completed our evaluation of the fire insurance classification for your town and advise that the protection class has improved to 5.

Formerly Class 6 applied; the new classification will result in a decrease in the property insurance premium calculations for many insured commercial properties within the town. The new classification will be effective November 1, 1996.

The purpose of our visit was to gather information needed to determine a fire insurance classification that may be used in the calculation of property insurance premiums. This survey was not conducted for property loss prevention or life safety purposes and no life safety or property loss prevention recommendations will be made.

The change from Class 6 to Class 5 does not affect property insurance premium calculations for sprinklered properties or residential occupancies insured under Homeowners type policies and some other special schedule surveyed property. The change will affect typical mercantile properties to a degree depending upon the type of building construction, the hazard of occupancy and other property insurance premium calculation factors. The overall effect is usually about -11% for wood frame and

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-11% for masonry and non-combustible buildings, and -11% for fire resistive building construction. However, variations in construction, occupancy and private protection can result in increases or decreases from this average.

The above estimates apply only for insurance companies using ISO property insurance premium calculations. However, numerous insurance companies use other than ISO property insurance premium calculations so that the effect of the change in class may be different for their policy holders.

The town classification applies to properties with a needed fire flow of 3,500 gpm or less. The private and public protection at properties with larger needed fire flows are individually evaluated, and may vary from the town classification.

We are attaching a copy of our Grading sheet, Classification Details, and the results of the hydrant flow tests witnessed during our survey. If you have any questions concerning the new classification, or the resulting change in property insurance premium calculations, please let us know.

Very truly yours,

Ronald Kepler

Ronald D. Kepler
Branch Manager

RDK:jeb

Enclosures (3)

SUMMARY SHEET

COMMUNITY- STEVENSVILLE | STATE- MT
COUNTY- RAVALLI | POPULATION- 1350
FIELD REP- M BENNETT | DATE OF SURVEY- 5/11/96
CLASSIFICATION- 5 | DATE OF GRADING- 6/11/96

| RECEIVING & HANDLING FIRE ALARMS | FIRE DEPARTMENT | WATER SUPPLY |
|---|---|---|
| 414- 1.80 | 513- 8.64 | 616- 20.37 |
| 422- 1.68 | 523- 0.43 | 621- 1.38 |
| 432- 3.50 | 532- 5.00 | 631- 0.00 |
| | 549- 3.90 | |
| | 553- 0.28 | |
| | 561- 3.32 | |
| | 571- 3.80 | |
| | 581- 1.98 | |
| 440- 6.98 | 590- 27.35 | 640- 21.75 |

OPERATION CENTER REVIEW ________

REGIONAL OFFICE REVIEW ________

HOME OFFICE REVIEW ________

FINAL APPROVAL ________

BY ________

DIVERGENCE

.5 * [|(ITEM 640) - .8 * (ITEM 590)|]

.5 * [ 21.75 - (.8 * 27.35 )] EQUALS -0.07

SUMMARY

ITEM 440- FIRE ALARMS - 6.98
ITEM 590- FIRE DEPT. - 27.35
ITEM 640- WATER SUPPLY - 21.75
ITEM 700- DIVERGENCE - 0.07
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TOTAL CREDITABLE POINTS- 56.01

| CREDIT | RELATIVE CLASSIFICATION | CREDIT | RELATIVE CLASSIFICATION |
|---|---|---|---|
| 90.00 - 100.00 | 1 | 40.00 - 49.99 | 6 |
| 80.00 - 89.99 | 2 | 30.00 - 39.99 | 7 |
| 70.00 - 79.99 | 3 | 20.00 - 29.99 | 8 |
| 60.00 - 69.99 | 4 | 10.00 - 19.99 | 9 |
| 50.00 - 59.99 | 5 | 0.00 - 9.99 | 10 |

## CLASSIFICATION DETAILS

| | |
|---|---|
| Municipality: STEVENSVILLE | State: MT |
| Population: 1350 | Date Surveyed: 5/11/96 |
| Total Credit: 56.01 | Class: 5 |

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### RECEIVING AND HANDLING FIRE ALARMS

This section of the Fire Suppression Rating Schedule reviews the facilities provided for the general public to report fires, and for the operator on duty at the communication center to dispatch fire department companies to the fires.

| | CREDIT ACTUAL | CREDIT MAXIMUM |
|---|---|---|
| 1. (Item 414) Credit for Telephone Service<br>This item reviews the facilities provided for the public to report fires, including the listing of fire and business numbers in the telephone directory. | 1.80 | 2.00 |
| 2. (Item 422) Credit for Operators<br>This item reviews the number of operators on duty at the communications center to handle fire calls. | 1.68 | 3.00 |
| 3. (Item 432) Credit for Dispatch Circuits<br>This item reviews the dispatch circuit facilities used to transmit alarms to fire department members. | 3.50 | 5.00 |
| 4. (Item 440) Total Credit for Receiving and Handling Fire Alarms | 6.98 | 10.00 |
| Relative Classification for Receiving and Handling Fire Alarms | 4 | |

## CLASSIFICATION DETAILS (continued)

### FIRE DEPARTMENT

This section of the Fire Suppression Rating Schedule reviews the engine, ladder and service companies, equipment carried, response to fires, training and available fire fighters.

| | CREDIT | |
|---|---|---|
| | ACTUAL | MAXIMUM |
| 1. (Item 513) Credit for Engine Companies<br>This item reviews the number of engine companies and the hose and equipment carried. | 8.64 | 10.00 |
| 2. (Item 523) Credit for Reserve Pumpers<br>This item reviews the number of reserve pumpers and the equipment carried on each. | 0.43 | 1.00 |
| 3. (Item 532) Credit for Pump Capacity<br>This item reviews the total available pump capacity. | 5.00 | 5.00 |
| 4. (Item 549) Credit for Ladder Service<br>This item reviews the number of ladder and service companies and the equipment carried. | 3.90 | 5.00 |
| 5. (Item 553) Credit for Reserve Ladder Service<br>This item reviews the number of reserve ladder and service trucks, and the equipment carried. | 0.28 | 1.00 |
| 6. (Item 561) Credit for Distribution<br>This item reviews the percent of the built-upon area of the city which has a first-due engine company within 1 1/2 miles and a ladder service company within 2 1/2 miles. | 3.32 | 4.00 |
| 7. (Item 571) Credit for Company Personnel<br>This item reviews the average number of equivalent fire fighters and company officers on duty with existing companies. | 3.80 | 15.00+ |
| 8. (Item 581) Credit for Training<br>This item reviews the training facilities and their use. | 1.98 | 9.00 |
| 9. (Item 590) Total Credit for Fire Department | 27.35 | 50.00+ |
| Relative Classification for Fire Department | 5 | |

+ This indicates that credit for manning is open-ended, with no maximum credit for this item.

## CLASSIFICATION DETAILS (continued)

### WATER SUPPLY

This section of the Fire Suppression Rating Schedule reviews the water supply system that is available for fire suppression in the municipality.

| | CREDIT | |
|---|---|---|
| | ACTUAL | MAXIMUM |
| 1. (Item 616) Credit for the Water System<br>This item reviews the supply works, the main capacity and the hydrant distribution. | 20.37 | 35.00 |
| 2. (Item 621) Credit for Hydrants<br>This item reviews the type of hydrants and the method of installation. | 1.38 | 2.00 |
| 3. (Item 631) Credit for Inspection and Condition of Hydrants<br>This item reviews the frequency of inspections of hydrants and their conditions. | 0.00 | 3.00 |
| 4. (Item 640) Total Credit for Water Supply | 21.75 | 40.00 |
| Relative Classification for Water Supply | 5 | |

## CLASSIFICATION DETAILS

| | |
|---|---|
| Municipality: STEVENSVILLE | State: MT |
| Population: 1350 | Date Surveyed: 5/11/96 |
| Total Credit: 56.01 | Class: 5 |

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### SUMMARY OF CREDIT

| Feature | Credit Assigned | Maximum Credit |
|---|---|---|
| Receiving and Handling Fire Alarms.............. | 6.98 | 10.00 |
| Fire Department.................................. | 27.35 | 50.00 |
| Water Supply..................................... | 21.75 | 40.00 |
| *Divergence...................................... | 0.07 | |
| Total Credit- | 56.01 | 100.00 |

The Public Protection Classification is based on the total percentage credit as follows:

| Class | Percentage Credited |
|---|---|
| 1 | 90.00 or more |
| 2 | 80.00 to 89.99 |
| 3 | 70.00 to 79.99 |
| 4 | 60.00 to 69.99 |
| 5 | 50.00 to 59.99 |
| 6 | 40.00 to 49.99 |
| 7 | 30.00 to 39.99 |
| 8 | 20.00 to 29.99 |
| 9 | 10.00 to 19.99 |
| 10 | 0 to 9.99 |

*Divergence is a reduction in credit to reflect a difference in the relative credits for Fire Department and Water Supply.

The above classification has been developed for use in property insurance premium calculations.

ISO COMMERCIAL RISK SERVICES, INC.

# HYDRANT FLOW DATA SUMMARY

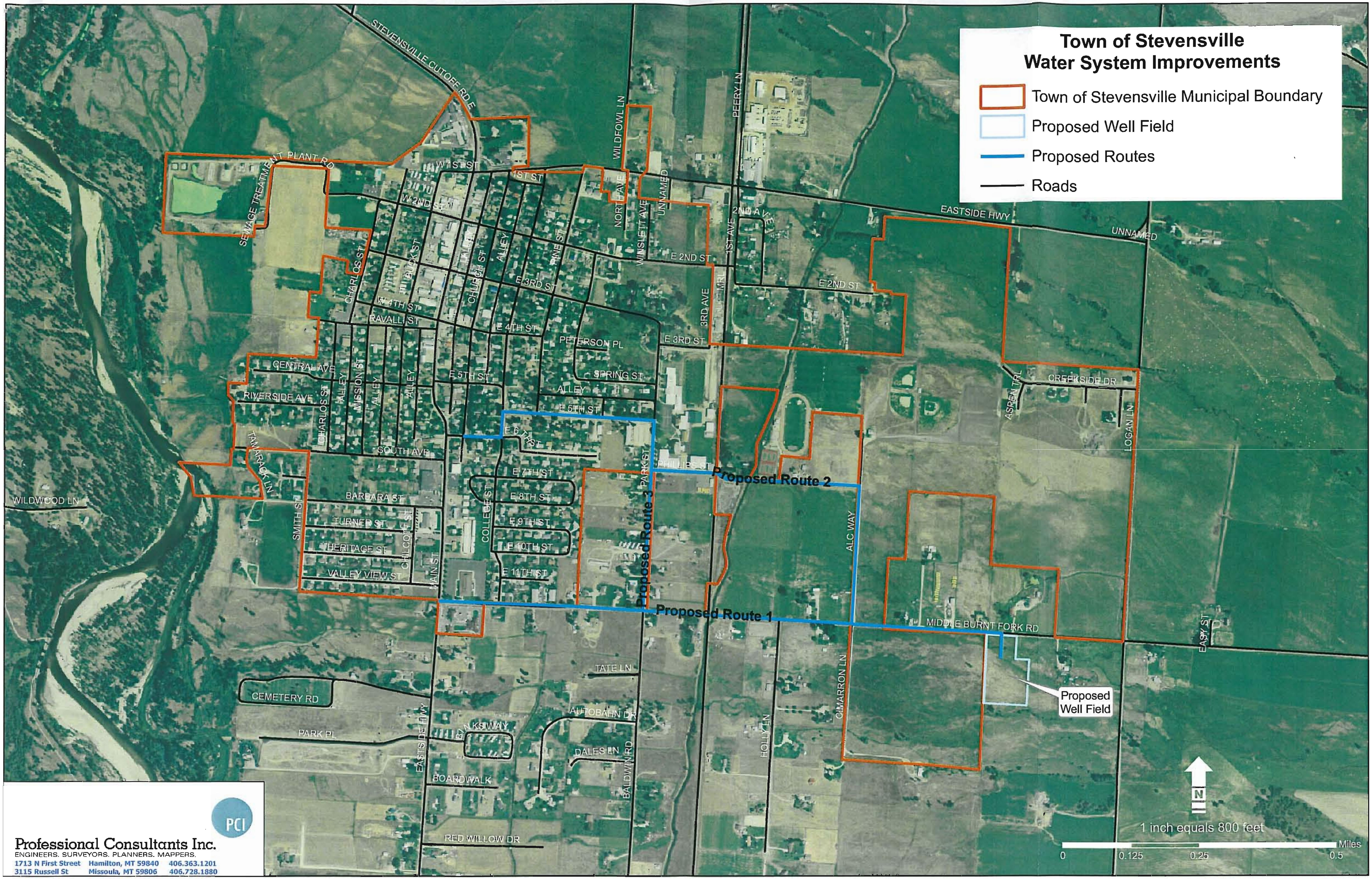
City Stevensville State MT Zip 59870 Witnessed by ISO/CRS Date 5/11/96

| TEST NO. | TYPE DIST.* | TEST LOCATION | SERVICE | FLOW-GPM | | | | PRESSURE PSI | | FLOW AT 20 PSI | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | INDIVIDUAL HYDRANTS | | | TOTAL | STATIC | RESID. | NEEDED ** | AVAIL. | |
| 1 | Res | First @ East Side Hwy | | 880 | | | 880 | 80 | 27 | 1000 | 900 | |
| 2 | Com | College @ 3rd | | 1160 | | | 1160 | 92 | 60 | 3000 | 1800 | |
| 3 | Com | Park @ School | | 1500 | | | 1500 | 80 | 40 | 3000 | 1900 | |
| 4 | Com | 11th @ College | | 1640 | | | 1640 | 82 | 33 | 2500 | 1800 | |
| 5 | Com | Main @ 5th | | 1430 | | | 1430 | 100 | 19 | 3000 | 1400 | |
| 5 | Com | Main @ 5th | | 1430 | | | 1430 | 100 | 19 | 3500 | 1400 | |
| 6 | Res | Riverside @ Charlos | | 650 | | | 650 | 106 | 21 | 1000 | 700 | |

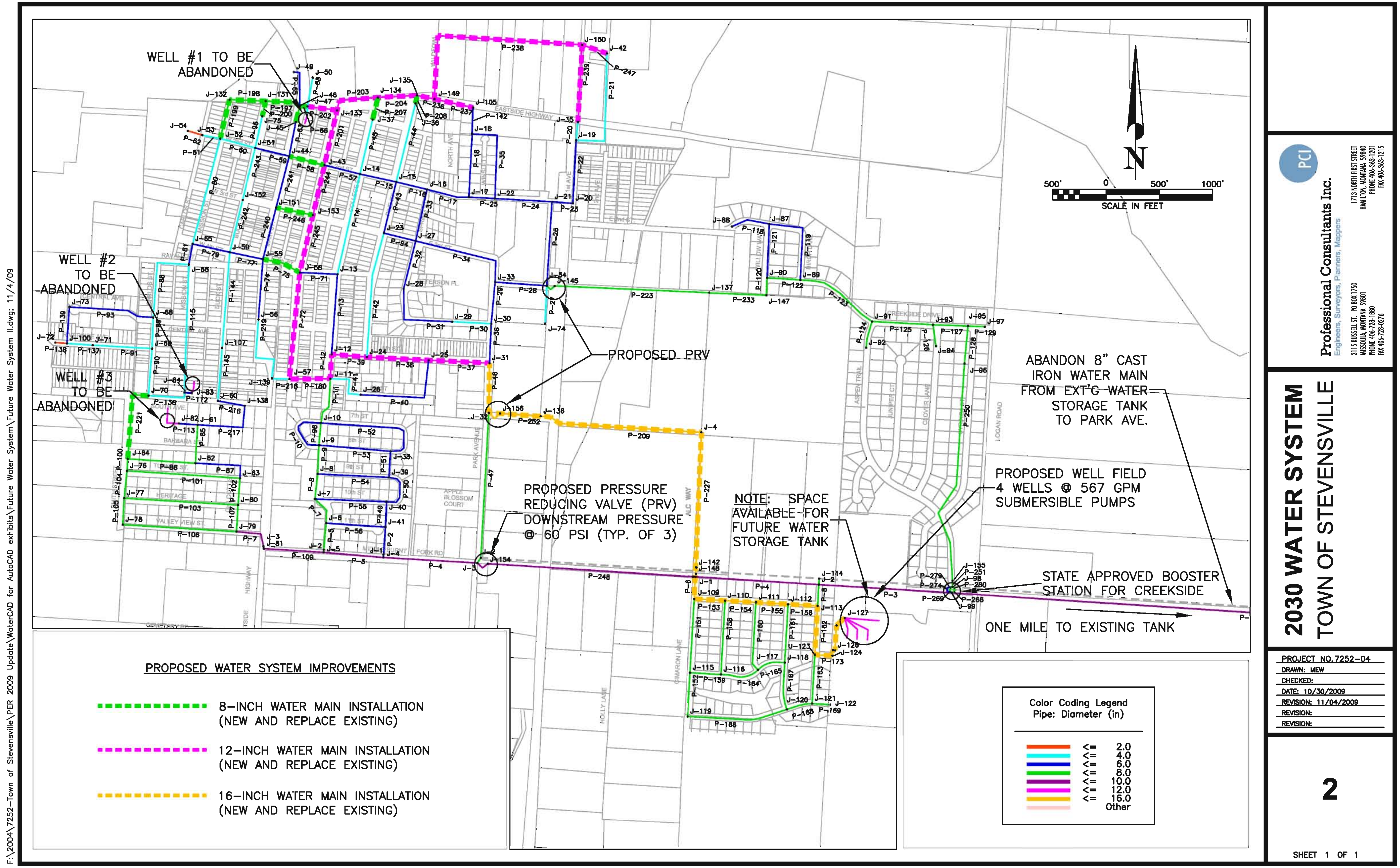
THE ABOVE LISTED NEEDED FIRE FLOWS ARE FOR PROPERTY INSURANCE PREMIUM CALCULATIONS ONLY AND ARE *NOT* INTENDED TO PREDICT THE AMOUNT OF WATER REQUIRED FOR A LARGE SCALE FIRE CONDITION. THE AVAILABLE FLOWS ONLY INDICATE THE CONDITIONS THAT EXISTED AT THE TIME AND AT THE LOCATION WHERE TESTS WERE WITNESSED.

* Comm = Commercial, Res = Residential

** Needed is the rate of flow for a specific duration for a full credit condition. Needed Fire Flows greater than 3,500 gpm are not considered in determining the classification of the city when using the Fire Suppression Rating Schedule.



Town of Stevensville
Water System Improvements
Town of Stevensville Municipal Boundary
Proposed Well Field
Proposed Routes
Roads
Proposed Route 1
Proposed Route 2
Proposed Route 3
Proposed
Well Field
STEVENSVILLE CUTOFF RD E
SEWAGE TREATMENT PLANT RD
W 1ST ST
1ST ST
W 2ND ST
WILDFOWL LN
NORTH AVE
WINSLETT AVE
UNNAMED
PEERY LN
2ND AVE
1ST AVE
EASTSIDE HWY
UNNAMED
E 2ND ST
E 2ND ST
3RD AVE
E 3RD ST
E 3RD ST
CHARLOS ST
BUCK ST
CHURCH ST
ALLEY
PINE ST
W 4TH ST
RAVALLI ST
E 4TH ST
PETERSON PL
SPRING ST
CENTRAL AVE
RIVERSIDE AVE
MISSION ST
E 5TH ST
E 5TH ST
E 6TH ST
SOUTH AVE
TAMARACK LN
PHILLIPS ST
E 7TH ST
E 8TH ST
E 9TH ST
E 10TH ST
E 11TH ST
COLLEGE ST
PARK ST
BARBARA ST
TURNER ST
HERITAGE ST
VALLEY VIEW ST
CHILCOTT ST
SMITH ST
MAIN ST
WILDWOOD LN
CREEKSIDE DR
ASPEN TRL
LOGAN LN
ALC WAY
MIDDLE BURNT FORK RD
EASY ST
CIMARRON LN
TATE LN
CEMETERY RD
PARK PL
AUTOBAHN DR
DALES LN
BALDWIN RD
HOLLY LN
EASTSIDE HWY
BOARDWALK
RED WILLOW DR
N
1 inch equals 800 feet
0
0.125
0.25
0.5
Miles
PCI
Professional Consultants Inc.
ENGINEERS. SURVEYORS. PLANNERS. MAPPERS.
1713 N First Street Hamilton, MT 59840 406.363.1201
3115 Russell St Missoula, MT 59806 406.728.1880


WELL #1 TO BE ABANDONED
WELL #2 TO BE ABANDONED
WELL #3 TO BE ABANDONED
PROPOSED PRV
PROPOSED PRESSURE REDUCING VALVE (PRV) DOWNSTREAM PRESSURE @ 60 PSI (TYP. OF 3)
NOTE: SPACE AVAILABLE FOR FUTURE WATER STORAGE TANK
ABANDON 8" CAST IRON WATER MAIN FROM EXT'G WATER STORAGE TANK TO PARK AVE.
PROPOSED WELL FIELD
4 WELLS @ 567 GPM
SUBMERSIBLE PUMPS
STATE APPROVED BOOSTER STATION FOR CREEKSIDE
ONE MILE TO EXISTING TANK
500' 0 500' 1000'
SCALE IN FEET
N
PROPOSED WATER SYSTEM IMPROVEMENTS
8-INCH WATER MAIN INSTALLATION (NEW AND REPLACE EXISTING)
12-INCH WATER MAIN INSTALLATION (NEW AND REPLACE EXISTING)
16-INCH WATER MAIN INSTALLATION (NEW AND REPLACE EXISTING)
Color Coding Legend
Pipe: Diameter (in)
<= 2.0
<= 4.0
<= 6.0
<= 8.0
<= 10.0
<= 12.0
<= 16.0
Other
PCI
Professional Consultants Inc.
Engineers, Surveyors, Planners, Mappers
3115 RUSSELL ST. PO BOX 1750
MISSOULA, MONTANA 59801
PHONE 406-728-1880
FAX 406-728-0276
1713 NORTH FIRST STREET
HAMILTON, MONTANA 59840
PHONE 406-363-1201
FAX 406-363-1215
2030 WATER SYSTEM
TOWN OF STEVENSVILLE
PROJECT NO. 7252-04
DRAWN: MEW
CHECKED:
DATE: 10/30/2009
REVISION: 11/04/2009
REVISION:
REVISION:
2
SHEET 1 OF 1
F:\2004\7252-Town of Stevensville\PER 2009 Update\WaterCAD for AutoCAD exhibits\Future Water System\Future Water System II.dwg; 11/4/09

# EXISTING AVERAGE DAY FIRE FLOW

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | EAD Zone |
|---|---|---|---|---|---|---|---|
| J-1 | True | 1,000.00 | 1,882.95 | 33.3 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-1 | False | 3,500.00 | 1,905.58 | 50.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-2 | True | 1,000.00 | 1,874.29 | 26.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-2 | True | 1,000.00 | 1,897.42 | 46.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-2 | False | 3,500.00 | 1,908.70 | 54.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-3 | True | 1,000.00 | 1,897.41 | 47.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-3 | False | 3,500.00 | 1,914.82 | 56.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-4 | False | 3,500.00 | 1,905.22 | 52.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-5 | False | 3,500.00 | 1,908.87 | 55.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-6 | False | 3,500.00 | 1,906.84 | 55.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-7 | True | 1,000.00 | 1,906.46 | 55.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-8 | True | 1,000.00 | 1,906.41 | 54.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-9 | True | 1,000.00 | 1,907.31 | 54.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-10 | True | 1,000.00 | 1,907.37 | 54.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-11 | True | 1,000.00 | 1,907.73 | 53.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-12 | True | 1,000.00 | 1,908.05 | 53.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-13 | True | 1,000.00 | 1,925.01 | 37.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-14 | True | 1,000.00 | 1,918.66 | 39.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-15 | True | 1,000.00 | 1,898.08 | 41.6 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-16 | True | 1,000.00 | 1,870.38 | 37.6 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-17 | True | 1,000.00 | 1,841.12 | 21.1 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-18 | True | 1,000.00 | 1,615.35 | 20.0 | 20.0 | 206: J-105 | 63: Zone - 1 |
| J-19 | True | 1,000.00 | 1,058.58 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-20 | True | 1,000.00 | 1,421.26 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-21 | True | 1,000.00 | 1,662.68 | 21.6 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-22 | True | 1,000.00 | 1,773.89 | 20.0 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-23 | True | 1,000.00 | 1,888.62 | 36.9 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-24 | True | 1,000.00 | 1,906.16 | 40.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-25 | True | 1,000.00 | 1,903.30 | 34.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-26 | True | 1,000.00 | 1,619.45 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-27 | True | 1,000.00 | 1,874.69 | 40.5 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-28 | True | 1,000.00 | 1,876.01 | 24.2 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-29 | True | 1,000.00 | 1,495.05 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-30 | False | 3,000.00 | 1,896.18 | 35.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-31 | False | 3,500.00 | 1,899.33 | 41.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-32 | True | 1,000.00 | 1,899.26 | 40.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-33 | False | 3,000.00 | 1,837.02 | 37.8 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-34 | False | 3,000.00 | 1,705.75 | 38.7 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-35 | False | 3,500.00 | 750.28 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-36 | False | 1,000.00 | 537.66 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-37 | False | 1,000.00 | 665.81 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-38 | True | 1,000.00 | 1,907.27 | 44.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-39 | True | 1,000.00 | 1,907.23 | 46.1 | 20.0 | 203: J-98 | 63: Zone - 1 |

## Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)

### Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-40 | True | 1,000.00 | 1,906.99 | 47.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-41 | False | 3,500.00 | 1,906.61 | 48.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-42 | False | 3,500.00 | 383.96 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-43 | False | 3,500.00 | 1,932.01 | 39.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-44 | False | 3,500.00 | 1,941.29 | 38.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-45 | False | 3,500.00 | 1,895.57 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-46 | False | 3,500.00 | 1,535.09 | 20.3 | 20.0 | 155: J-49 | 63: Zone - 1 |
| J-47 | False | 3,500.00 | 1,475.90 | 20.2 | 20.0 | 156: J-50 | 63: Zone - 1 |
| J-49 | True | 50.00 | 1,316.78 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-50 | True | 50.00 | 854.78 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-51 | False | 3,500.00 | 1,946.39 | 21.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-52 | True | 1,000.00 | 1,209.41 | 20.0 | 20.0 | 159: J-53 | 63: Zone - 1 |
| J-53 | False | 1,000.00 | 889.70 | 20.0 | 20.0 | 160: J-54 | 63: Zone - 1 |
| J-54 | True | 50.00 | 230.05 | 20.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-55 | False | 3,500.00 | 1,948.57 | 39.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-56 | True | 1,000.00 | 1,613.91 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-57 | False | 1,000.00 | 899.66 | 20.0 | 20.0 | 655: J-139 | 63: Zone - 1 |
| J-58 | False | 3,500.00 | 1,936.38 | 37.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-59 | False | 3,500.00 | 1,969.02 | 34.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-60 | True | 1,000.00 | 1,601.75 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-61 | True | 1,000.00 | 1,941.48 | 51.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-62 | True | 1,000.00 | 1,932.68 | 54.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-63 | False | 3,500.00 | 1,923.26 | 54.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-64 | True | 1,000.00 | 1,925.25 | 61.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-65 | True | 1,000.00 | 1,947.60 | 20.0 | 20.0 | 172: J-66 | 63: Zone - 1 |
| J-66 | True | 1,000.00 | 1,787.23 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-68 | False | 1,000.00 | 957.98 | 20.0 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-69 | False | 1,000.00 | 951.70 | 20.0 | 20.0 | 176: J-71 | 63: Zone - 1 |
| J-70 | True | 1,000.00 | 1,006.07 | 20.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-71 | False | 1,000.00 | 846.92 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-72 | True | 50.00 | 275.86 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-73 | False | 1,000.00 | 936.70 | 20.4 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-74 | True | 50.00 | 751.45 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-75 | False | 3,500.00 | 785.68 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-76 | True | 1,000.00 | 1,924.04 | 62.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-77 | True | 1,000.00 | 1,922.30 | 62.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-78 | True | 1,000.00 | 1,921.27 | 61.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-79 | False | 3,500.00 | 1,918.23 | 57.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-80 | False | 3,500.00 | 1,921.37 | 55.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-81 | False | 3,500.00 | 1,914.61 | 56.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-82 | True | 1,000.00 | 1,971.52 | 36.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-83 | True | 1,000.00 | 1,101.66 | 20.0 | 20.0 | 190: J-84 | 63: Zone - 1 |
| J-84 | True | 1,000.00 | 1,107.43 | 20.0 | 20.0 | 188: J-83 | 63: Zone - 1 |

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-85 | True | 50.00 | 1,275.25 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-87 | True | 1,000.00 | 1,539.15 | 20.1 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-88 | True | 1,000.00 | 1,306.67 | 20.0 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-89 | True | 1,000.00 | 1,532.26 | 27.4 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-90 | True | 1,000.00 | 1,546.91 | 29.0 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-91 | True | 1,000.00 | 1,477.80 | 24.5 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-92 | True | 1,000.00 | 1,477.60 | 21.3 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-93 | True | 1,000.00 | 1,437.80 | 22.3 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-94 | True | 1,000.00 | 1,434.15 | 20.0 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-95 | True | 1,000.00 | 1,414.25 | 21.3 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-96 | True | 1,000.00 | 1,464.51 | 20.2 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-97 | True | 1,000.00 | 1,362.60 | 20.0 | 20.0 | 200: J-95 | 63: Zone - 1 |
| J-98 | True | 1,000.00 | 1,834.66 | 20.0 | 20.0 | 204: J-99 | 63: Zone - 1 |
| J-99 | True | 1,000.00 | 1,863.40 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-100 | False | 1,000.00 | 909.19 | 20.0 | 20.0 | 177: J-72 | 63: Zone - 1 |
| J-105 | True | 1,000.00 | 1,379.14 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-107 | True | 1,000.00 | 1,103.47 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-114 | True | 1,000.00 | 1,221.53 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-133 | True | 1,000.00 | 1,280.06 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-137 | True | 1,000.00 | 1,594.20 | 31.0 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-138 | True | 1,000.00 | 1,717.11 | 20.0 | 20.0 | 166: J-60 | 63: Zone - 1 |
| J-139 | False | 1,000.00 | 925.17 | 20.0 | 20.0 | 163: J-57 | 63: Zone - 1 |
| J-142 | True | 1,000.00 | 1,304.83 | 20.0 | 20.0 | 215: J-114 | 63: Zone - 1 |
| J-143 | True | 1,000.00 | 1,883.12 | 33.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-145 | True | 1,000.00 | 1,700.58 | 37.7 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-147 | True | 1,000.00 | 1,557.28 | 28.5 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-151 | True | 1,000.00 | 1,946.93 | 27.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-152 | True | 1,000.00 | 1,247.73 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-153 | True | 1,000.00 | 1,233.08 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-154 | True | 1,000.00 | 1,897.28 | 46.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-155 | True | 1,000.00 | 1,836.73 | 20.3 | 20.0 | 203: J-98 | 63: Zone - 1 |

# EXISTING
# PEAK
# DAY
# FIRE FLOW

# *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | EPD Zone |
|---|---|---|---|---|---|---|---|
| J-1 | False | 1,000.00 | 370.76 | 36.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-1 | False | 3,500.00 | 376.27 | 55.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-2 | False | 1,000.00 | 367.75 | 29.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-2 | False | 1,000.00 | 375.10 | 49.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-2 | False | 3,500.00 | 376.77 | 59.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-3 | False | 1,000.00 | 374.40 | 49.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-3 | False | 3,500.00 | 377.20 | 63.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-4 | False | 3,500.00 | 376.88 | 56.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-5 | False | 3,500.00 | 377.47 | 59.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-6 | False | 3,500.00 | 377.39 | 60.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-7 | False | 1,000.00 | 377.41 | 61.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-8 | False | 1,000.00 | 377.45 | 61.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-9 | False | 1,000.00 | 377.50 | 62.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-10 | False | 1,000.00 | 377.53 | 62.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-11 | False | 1,000.00 | 377.65 | 62.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-12 | False | 1,000.00 | 377.73 | 62.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-13 | False | 1,000.00 | 379.72 | 61.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-14 | False | 1,000.00 | 378.71 | 61.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-15 | False | 1,000.00 | 377.19 | 59.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-16 | False | 1,000.00 | 376.72 | 56.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-17 | False | 1,000.00 | 376.19 | 52.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-18 | False | 1,000.00 | 376.16 | 52.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-19 | False | 1,000.00 | 375.75 | 39.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-20 | False | 1,000.00 | 375.76 | 43.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-21 | False | 1,000.00 | 375.75 | 46.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-22 | False | 1,000.00 | 376.07 | 50.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-23 | False | 1,000.00 | 376.85 | 59.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-24 | False | 1,000.00 | 377.46 | 59.3 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-25 | False | 1,000.00 | 377.02 | 54.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-26 | False | 1,000.00 | 377.26 | 56.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-27 | False | 1,000.00 | 376.69 | 56.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-28 | False | 1,000.00 | 376.57 | 56.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-29 | False | 1,000.00 | 376.30 | 50.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-30 | False | 3,000.00 | 375.64 | 51.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-31 | False | 3,500.00 | 376.26 | 51.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-32 | False | 1,000.00 | 376.07 | 50.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-33 | False | 3,000.00 | 375.54 | 51.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-34 | False | 3,000.00 | 374.58 | 47.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-35 | False | 3,500.00 | 375.32 | 31.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-36 | False | 1,000.00 | 377.53 | 22.3 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-37 | False | 1,000.00 | 378.04 | 37.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-38 | False | 1,000.00 | 377.48 | 56.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-39 | False | 1,000.00 | 377.45 | 56.9 | 20.0 | 203: J-98 | 63: Zone - 1 |

# *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-40 | False | 1,000.00 | 377.39 | 57.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-41 | False | 3,500.00 | 377.28 | 56.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-42 | False | 3,500.00 | 264.12 | 20.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-43 | False | 3,500.00 | 379.76 | 64.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-44 | False | 3,500.00 | 380.60 | 67.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-45 | False | 3,500.00 | 380.53 | 66.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-46 | False | 3,500.00 | 380.26 | 65.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-47 | False | 3,500.00 | 380.16 | 65.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-49 | True | 50.00 | 380.26 | 63.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-50 | True | 50.00 | 380.16 | 52.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-51 | False | 3,500.00 | 381.11 | 68.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-52 | False | 1,000.00 | 381.73 | 62.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-53 | False | 1,000.00 | 381.73 | 53.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-54 | True | 50.00 | 174.70 | 20.1 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-55 | False | 3,500.00 | 381.31 | 66.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-56 | False | 1,000.00 | 381.14 | 62.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-57 | False | 1,000.00 | 380.83 | 49.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-58 | False | 3,500.00 | 380.51 | 63.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-59 | False | 3,500.00 | 382.55 | 68.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-60 | False | 1,000.00 | 379.26 | 66.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-61 | False | 1,000.00 | 378.61 | 70.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-62 | False | 1,000.00 | 378.80 | 69.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-63 | False | 3,500.00 | 378.40 | 66.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-64 | False | 1,000.00 | 378.51 | 74.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-65 | False | 1,000.00 | 384.71 | 70.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-66 | False | 1,000.00 | 386.23 | 69.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-68 | False | 1,000.00 | 399.41 | 53.5 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-69 | False | 1,000.00 | 399.72 | 53.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-70 | False | 1,000.00 | 402.56 | 58.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-71 | False | 1,000.00 | 399.63 | 50.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-72 | True | 50.00 | 210.12 | 20.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-73 | False | 1,000.00 | 399.52 | 56.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-74 | True | 50.00 | 374.59 | 32.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-75 | False | 3,500.00 | 381.11 | 48.3 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-76 | False | 1,000.00 | 378.46 | 74.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-77 | False | 1,000.00 | 377.75 | 74.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-78 | False | 1,000.00 | 378.29 | 73.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-79 | False | 3,500.00 | 378.10 | 65.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-80 | False | 3,500.00 | 378.29 | 66.3 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-81 | False | 3,500.00 | 377.88 | 63.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-82 | False | 1,000.00 | 379.90 | 71.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-83 | False | 1,000.00 | 411.53 | 61.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-84 | False | 1,000.00 | 410.78 | 62.0 | 20.0 | 203: J-98 | 63: Zone - 1 |

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-85 | True | 50.00 | 380.17 | 65.3 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-87 | False | 1,000.00 | 365.75 | 33.6 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-88 | False | 1,000.00 | 365.82 | 35.7 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-89 | False | 1,000.00 | 364.00 | 32.2 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-90 | False | 1,000.00 | 367.62 | 34.4 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-91 | False | 1,000.00 | 350.11 | 27.2 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-92 | False | 1,000.00 | 350.11 | 26.9 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-93 | False | 1,000.00 | 337.73 | 23.3 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-94 | False | 1,000.00 | 337.39 | 23.1 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-95 | False | 1,000.00 | 330.39 | 21.3 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-96 | False | 1,000.00 | 343.06 | 20.9 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-97 | False | 1,000.00 | 325.98 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-98 | False | 1,000.00 | 358.99 | 20.0 | 20.0 | 204: J-99 | 63: Zone - 1 |
| J-99 | False | 1,000.00 | 365.24 | 20.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-100 | False | 1,000.00 | 399.56 | 54.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-105 | False | 1,000.00 | 376.16 | 51.3 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-107 | False | 1,000.00 | 379.98 | 58.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-114 | False | 1,000.00 | 367.51 | 26.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-133 | False | 1,000.00 | 380.04 | 60.8 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-137 | False | 1,000.00 | 373.11 | 37.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-138 | False | 1,000.00 | 379.23 | 65.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-139 | False | 1,000.00 | 380.85 | 51.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-142 | False | 1,000.00 | 370.29 | 33.6 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-143 | False | 1,000.00 | 370.81 | 35.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-145 | False | 1,000.00 | 374.51 | 46.9 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-147 | False | 1,000.00 | 369.56 | 34.3 | 20.0 | 202: J-97 | 63: Zone - 1 |
| J-151 | False | 1,000.00 | 381.01 | 66.0 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-152 | False | 1,000.00 | 381.62 | 62.4 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-153 | False | 1,000.00 | 380.30 | 58.7 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-154 | False | 1,000.00 | 374.08 | 49.2 | 20.0 | 203: J-98 | 63: Zone - 1 |
| J-155 | False | 1,000.00 | 359.84 | 21.0 | 20.0 | 203: J-98 | 63: Zone - 1 |

# PROPOSED AVERAGE DAY FIRE FLOW

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | FAD Zone |
|---|---|---|---|---|---|---|---|
| J-1 | True | 1,000.00 | 3,500.00 | 52.8 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-1 | True | 3,500.00 | 5,000.00 | 27.1 | 20.0 | 111: J-4 | 63: Zone - 1 |
| J-2 | True | 1,000.00 | 3,500.00 | 51.7 | 20.0 | 110: J-3 | 63: Zone - 1 |
| J-2 | True | 1,000.00 | 3,500.00 | 43.6 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-2 | True | 3,500.00 | 5,000.00 | 33.8 | 20.0 | 112: J-5 | 63: Zone - 1 |
| J-3 | True | 1,000.00 | 3,500.00 | 53.1 | 20.0 | 109: J-2 | 63: Zone - 1 |
| J-3 | True | 3,500.00 | 5,000.00 | 22.5 | 20.0 | 186: J-81 | 63: Zone - 1 |
| J-4 | True | 3,500.00 | 5,000.00 | 35.1 | 20.0 | 417: J-1 | 63: Zone - 1 |
| J-4 | True | 3,500.00 | 5,000.00 | 38.8 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-5 | True | 3,500.00 | 5,000.00 | 34.4 | 20.0 | 421: J-2 | 63: Zone - 1 |
| J-6 | True | 3,500.00 | 5,000.00 | 33.2 | 20.0 | 148: J-41 | 63: Zone - 1 |
| J-7 | True | 1,000.00 | 3,500.00 | 57.0 | 20.0 | 147: J-40 | 63: Zone - 1 |
| J-8 | True | 1,000.00 | 3,500.00 | 56.8 | 20.0 | 146: J-39 | 63: Zone - 1 |
| J-9 | True | 1,000.00 | 3,500.00 | 57.9 | 20.0 | 145: J-38 | 63: Zone - 1 |
| J-10 | True | 1,000.00 | 3,500.00 | 59.1 | 20.0 | 145: J-38 | 63: Zone - 1 |
| J-11 | True | 1,000.00 | 3,500.00 | 66.8 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-12 | True | 1,000.00 | 3,500.00 | 67.4 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-13 | True | 1,000.00 | 3,500.00 | 25.7 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-14 | True | 1,000.00 | 3,500.00 | 36.9 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-15 | True | 1,000.00 | 3,500.00 | 34.3 | 20.0 | 123: J-16 | 63: Zone - 1 |
| J-16 | True | 1,000.00 | 3,500.00 | 26.4 | 20.0 | 124: J-17 | 63: Zone - 1 |
| J-17 | True | 1,000.00 | 3,367.47 | 20.0 | 20.0 | 129: J-22 | 63: Zone - 1 |
| J-18 | True | 1,000.00 | 3,500.00 | 23.1 | 20.0 | 129: J-22 | 63: Zone - 1 |
| J-19 | True | 1,000.00 | 2,135.42 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-20 | True | 1,000.00 | 2,356.34 | 20.0 | 20.0 | 126: J-19 | 63: Zone - 1 |
| J-21 | True | 1,000.00 | 2,858.93 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-22 | True | 1,000.00 | 3,095.90 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-23 | True | 1,000.00 | 3,250.61 | 20.0 | 20.0 | 134: J-27 | 63: Zone - 1 |
| J-24 | True | 1,000.00 | 3,500.00 | 65.3 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-25 | True | 1,000.00 | 3,500.00 | 62.1 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-26 | True | 1,000.00 | 1,834.44 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-27 | True | 1,000.00 | 3,500.00 | 25.1 | 20.0 | 135: J-28 | 63: Zone - 1 |
| J-28 | True | 1,000.00 | 2,444.05 | 20.0 | 20.0 | 136: J-29 | 63: Zone - 1 |
| J-29 | True | 1,000.00 | 1,560.61 | 20.0 | 20.0 | 135: J-28 | 63: Zone - 1 |
| J-30 | True | 3,000.00 | 3,550.16 | 20.0 | 20.0 | 136: J-29 | 63: Zone - 1 |
| J-31 | True | 3,500.00 | 5,000.00 | 49.7 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-32 | True | 1,000.00 | 3,500.00 | 60.4 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-33 | True | 3,000.00 | 3,431.47 | 20.0 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-34 | True | 3,000.00 | 3,129.39 | 20.8 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-35 | True | 3,500.00 | 3,699.82 | 20.0 | 20.0 | 149: J-42 | 63: Zone - 1 |
| J-36 | True | 1,000.00 | 3,500.00 | 49.5 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-37 | True | 1,000.00 | 3,500.00 | 47.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-38 | True | 1,000.00 | 3,500.00 | 35.5 | 20.0 | 146: J-39 | 63: Zone - 1 |

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-39 | True | 1,000.00 | 3,500.00 | 39.1 | 20.0 | 145: J-38 | 63: Zone - 1 |
| J-40 | True | 1,000.00 | 3,500.00 | 42.0 | 20.0 | 148: J-41 | 63: Zone - 1 |
| J-41 | True | 3,500.00 | 4,795.65 | 20.0 | 20.0 | 147: J-40 | 63: Zone - 1 |
| J-42 | True | 3,500.00 | 3,922.27 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-43 | True | 3,500.00 | 5,000.00 | 42.2 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-44 | True | 3,500.00 | 5,000.00 | 33.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-45 | True | 3,500.00 | 5,000.00 | 25.5 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-46 | True | 3,500.00 | 5,000.00 | 35.8 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-47 | True | 3,500.00 | 5,000.00 | 38.9 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-49 | True | 50.00 | 2,139.63 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-50 | True | 50.00 | 885.27 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-51 | True | 3,500.00 | 3,748.13 | 20.0 | 20.0 | 717: J-152 | 63: Zone - 1 |
| J-52 | True | 1,000.00 | 3,500.00 | 31.2 | 20.0 | 159: J-53 | 63: Zone - 1 |
| J-53 | True | 1,000.00 | 1,141.69 | 20.0 | 20.0 | 160: J-54 | 63: Zone - 1 |
| J-54 | True | 50.00 | 210.52 | 20.0 | 20.0 | 109: J-2 | 63: Zone - 1 |
| J-55 | True | 3,500.00 | 5,000.00 | 32.8 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-56 | True | 1,000.00 | 2,106.71 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-57 | True | 1,000.00 | 3,500.00 | 68.1 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-58 | True | 3,500.00 | 5,000.00 | 46.8 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-59 | True | 3,500.00 | 3,798.32 | 20.0 | 20.0 | 171: J-65 | 63: Zone - 1 |
| J-60 | True | 1,000.00 | 1,602.75 | 20.0 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-61 | True | 1,000.00 | 3,380.10 | 20.0 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-62 | True | 1,000.00 | 3,500.00 | 31.6 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-63 | True | 3,500.00 | 4,378.96 | 20.0 | 20.0 | 185: J-80 | 63: Zone - 1 |
| J-64 | True | 1,000.00 | 3,500.00 | 47.6 | 20.0 | 168: J-62 | 63: Zone - 1 |
| J-65 | True | 1,000.00 | 2,893.77 | 20.0 | 20.0 | 172: J-66 | 63: Zone - 1 |
| J-66 | True | 1,000.00 | 2,486.97 | 20.0 | 20.0 | 171: J-65 | 63: Zone - 1 |
| J-68 | True | 1,000.00 | 1,128.34 | 20.0 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-69 | True | 1,000.00 | 1,186.49 | 20.0 | 20.0 | 173: J-68 | 63: Zone - 1 |
| J-70 | True | 1,000.00 | 3,408.77 | 20.0 | 20.0 | 188: J-83 | 63: Zone - 1 |
| J-71 | False | 1,000.00 | 933.65 | 20.0 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-72 | True | 50.00 | 250.75 | 20.0 | 20.0 | 109: J-2 | 63: Zone - 1 |
| J-73 | True | 1,000.00 | 1,084.50 | 20.0 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-74 | True | 50.00 | 676.21 | 20.0 | 20.0 | 109: J-2 | 63: Zone - 1 |
| J-75 | True | 3,500.00 | 4,479.43 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-76 | True | 1,000.00 | 3,500.00 | 49.4 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-77 | True | 1,000.00 | 3,500.00 | 49.9 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-78 | True | 1,000.00 | 3,500.00 | 46.5 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-79 | True | 3,500.00 | 4,876.92 | 20.0 | 20.0 | 185: J-80 | 63: Zone - 1 |
| J-80 | True | 3,500.00 | 4,586.57 | 20.0 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-81 | True | 3,500.00 | 5,000.00 | 23.1 | 20.0 | 425: J-3 | 63: Zone - 1 |
| J-82 | True | 1,000.00 | 2,351.34 | 20.0 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-83 | True | 1,000.00 | 1,240.77 | 20.0 | 20.0 | 190: J-84 | 63: Zone - 1 |

## Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)

### Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-84 | True | 1,000.00 | 1,284.39 | 20.0 | 20.0 | 188: J-83 | 63: Zone - 1 |
| J-85 | True | 50.00 | 1,680.41 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-87 | True | 1,000.00 | 1,733.52 | 20.0 | 20.0 | 193: J-88 | 687: Zone - 2 |
| J-88 | True | 1,000.00 | 1,358.50 | 20.0 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-89 | True | 1,000.00 | 2,095.76 | 20.2 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-90 | True | 1,000.00 | 2,161.17 | 20.9 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-91 | True | 1,000.00 | 1,879.99 | 20.7 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-92 | True | 1,000.00 | 1,725.20 | 20.0 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-93 | True | 1,000.00 | 1,741.91 | 20.9 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-94 | True | 1,000.00 | 1,632.74 | 20.0 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-95 | True | 1,000.00 | 1,656.46 | 21.3 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-96 | True | 1,000.00 | 1,752.60 | 20.3 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-97 | True | 1,000.00 | 1,549.20 | 20.0 | 20.0 | 200: J-95 | 687: Zone - 2 |
| J-98 | True | 1,000.00 | 2,943.84 | 20.0 | 20.0 | 742: J-155 | 687: Zone - 2 |
| J-99 | True | 1,000.00 | 3,500.00 | 25.0 | 20.0 | 223: J-122 | 687: Zone - 2 |
| J-100 | True | 1,000.00 | 1,034.79 | 20.0 | 20.0 | 177: J-72 | 63: Zone - 1 |
| J-105 | True | 1,000.00 | 3,500.00 | 47.9 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-106 | False | 0.01 | 0.00 | 1.1 | 20.0 | 207: J-106 | 64: Zone - Tank 2 |
| J-107 | True | 1,000.00 | 1,026.40 | 20.0 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-109 | True | 1,000.00 | 3,500.00 | 53.1 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-110 | True | 1,000.00 | 3,500.00 | 51.1 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-111 | True | 1,000.00 | 3,500.00 | 49.0 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-112 | True | 1,000.00 | 3,500.00 | 47.0 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-113 | True | 1,000.00 | 3,500.00 | 45.2 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-114 | True | 1,000.00 | 3,500.00 | 43.1 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-115 | True | 1,000.00 | 3,500.00 | 47.0 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-116 | True | 1,000.00 | 3,500.00 | 46.0 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-117 | True | 1,000.00 | 3,500.00 | 44.1 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-118 | True | 1,000.00 | 3,500.00 | 42.1 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-119 | True | 1,000.00 | 3,500.00 | 39.5 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-120 | True | 1,000.00 | 3,500.00 | 38.9 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-121 | True | 1,000.00 | 3,500.00 | 36.5 | 20.0 | 223: J-122 | 687: Zone - 2 |
| J-122 | True | 1,000.00 | 3,500.00 | 24.0 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-123 | True | 1,000.00 | 3,500.00 | 44.9 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-124 | True | 1,000.00 | 3,500.00 | 43.5 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-125 | True | 1,000.00 | 3,500.00 | 43.6 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-126 | True | 1,000.00 | 3,500.00 | 43.6 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-127 | True | 1,000.00 | 3,500.00 | 47.6 | 20.0 | 517: J-128 | 688: Zone - Tank 3 |
| J-128 | True | 1,000.00 | 3,500.00 | 39.9 | 20.0 | 228: J-127 | 688: Zone - Tank 3 |
| J-131 | True | 1,000.00 | 3,500.00 | 53.2 | 20.0 | 620: J-132 | <None> |
| J-132 | True | 1,000.00 | 3,500.00 | 43.1 | 20.0 | 618: J-131 | <None> |

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

### Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-133 | True | 1,000.00 | 3,500.00 | 64.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-134 | True | 1,000.00 | 3,500.00 | 59.9 | 20.0 | 629: J-135 | <None> |
| J-135 | True | 1,000.00 | 3,500.00 | 54.7 | 20.0 | 627: J-134 | <None> |
| J-136 | True | 1,000.00 | 3,500.00 | 61.5 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-137 | True | 1,000.00 | 2,373.60 | 20.0 | 20.0 | 691: J-147 | 687: Zone - 2 |
| J-138 | True | 1,000.00 | 1,759.77 | 20.0 | 20.0 | 166: J-60 | 63: Zone - 1 |
| J-139 | True | 1,000.00 | 1,626.16 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-142 | True | 1,000.00 | 3,500.00 | 52.8 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-143 | True | 1,000.00 | 3,500.00 | 52.1 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-144 | (N/A) | 1,000.00 | (N/A) | (N/A) | 20.0 | ((N/A)) | 687: Zone - 2 |
| J-145 | True | 1,000.00 | 3,021.50 | 21.1 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-147 | True | 1,000.00 | 2,197.71 | 20.0 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-148 | True | 1,000.00 | 3,500.00 | 52.6 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-149 | True | 1,000.00 | 3,500.00 | 52.4 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-150 | True | 3,500.00 | 3,979.68 | 22.7 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-151 | True | 1,000.00 | 3,500.00 | 59.4 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-152 | True | 1,000.00 | 1,274.71 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-153 | True | 1,000.00 | 3,500.00 | 65.9 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-154 | True | 1,000.00 | 3,500.00 | 52.6 | 20.0 | 204: J-99 | 687: Zone - 2 |
| J-155 | True | 1,000.00 | 2,927.47 | 20.0 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-156 | True | 1,000.00 | 3,500.00 | 63.1 | 20.0 | 204: J-99 | 687: Zone - 2 |

# PROPOSED
# PEAK
# DAY
# FIRE FLOW

# *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

FPD

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-1 | True | 1,000.00 | 3,500.00 | 41.9 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-1 | True | 3,500.00 | 4,523.71 | 20.0 | 20.0 | 148: J-41 | 63: Zone - 1 |
| J-2 | True | 1,000.00 | 3,500.00 | 44.2 | 20.0 | 110: J-3 | 63: Zone - 1 |
| J-2 | True | 1,000.00 | 3,500.00 | 33.2 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-2 | True | 3,500.00 | 4,763.73 | 20.0 | 20.0 | 112: J-5 | 63: Zone - 1 |
| J-3 | True | 1,000.00 | 3,500.00 | 45.5 | 20.0 | 109: J-2 | 63: Zone - 1 |
| J-3 | True | 3,500.00 | 4,390.54 | 20.0 | 20.0 | 186: J-81 | 63: Zone - 1 |
| J-4 | True | 3,500.00 | 4,823.94 | 20.0 | 20.0 | 417: J-1 | 63: Zone - 1 |
| J-4 | True | 3,500.00 | 3,943.42 | 36.8 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-5 | True | 3,500.00 | 4,786.48 | 20.0 | 20.0 | 421: J-2 | 63: Zone - 1 |
| J-6 | True | 3,500.00 | 4,749.15 | 20.0 | 20.0 | 148: J-41 | 63: Zone - 1 |
| J-7 | True | 1,000.00 | 3,500.00 | 48.6 | 20.0 | 147: J-40 | 63: Zone - 1 |
| J-8 | True | 1,000.00 | 3,500.00 | 48.5 | 20.0 | 146: J-39 | 63: Zone - 1 |
| J-9 | True | 1,000.00 | 3,500.00 | 49.7 | 20.0 | 145: J-38 | 63: Zone - 1 |
| J-10 | True | 1,000.00 | 3,500.00 | 51.0 | 20.0 | 145: J-38 | 63: Zone - 1 |
| J-11 | True | 1,000.00 | 3,500.00 | 58.5 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-12 | True | 1,000.00 | 3,500.00 | 59.3 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-13 | True | 1,000.00 | 3,417.87 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-14 | True | 1,000.00 | 3,500.00 | 27.1 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-15 | True | 1,000.00 | 3,500.00 | 24.3 | 20.0 | 123: J-16 | 63: Zone - 1 |
| J-16 | True | 1,000.00 | 3,395.29 | 20.0 | 20.0 | 124: J-17 | 63: Zone - 1 |
| J-17 | True | 1,000.00 | 3,137.67 | 20.0 | 20.0 | 129: J-22 | 63: Zone - 1 |
| J-18 | True | 1,000.00 | 3,303.63 | 20.0 | 20.0 | 129: J-22 | 63: Zone - 1 |
| J-19 | True | 1,000.00 | 2,034.05 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-20 | True | 1,000.00 | 2,216.47 | 20.0 | 20.0 | 126: J-19 | 63: Zone - 1 |
| J-21 | True | 1,000.00 | 2,649.42 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-22 | True | 1,000.00 | 2,898.41 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-23 | True | 1,000.00 | 3,075.35 | 20.0 | 20.0 | 134: J-27 | 63: Zone - 1 |
| J-24 | True | 1,000.00 | 3,500.00 | 57.5 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-25 | True | 1,000.00 | 3,500.00 | 55.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-26 | True | 1,000.00 | 1,813.97 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-27 | True | 1,000.00 | 3,366.53 | 20.0 | 20.0 | 135: J-28 | 63: Zone - 1 |
| J-28 | True | 1,000.00 | 2,340.43 | 20.0 | 20.0 | 136: J-29 | 63: Zone - 1 |
| J-29 | True | 1,000.00 | 1,514.96 | 20.0 | 20.0 | 135: J-28 | 63: Zone - 1 |
| J-30 | True | 3,000.00 | 3,281.82 | 20.0 | 20.0 | 140: J-33 | 63: Zone - 1 |
| J-31 | True | 3,500.00 | 5,000.00 | 32.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-32 | True | 1,000.00 | 3,500.00 | 54.0 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-33 | True | 3,000.00 | 3,164.59 | 20.0 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-34 | False | 3,000.00 | 2,748.48 | 20.8 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-35 | False | 3,500.00 | 3,311.88 | 20.0 | 20.0 | 149: J-42 | 63: Zone - 1 |
| J-36 | True | 1,000.00 | 3,500.00 | 39.5 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-37 | True | 1,000.00 | 3,500.00 | 37.1 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-38 | True | 1,000.00 | 3,500.00 | 27.2 | 20.0 | 146: J-39 | 63: Zone - 1 |

# Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-39 | True | 1,000.00 | 3,500.00 | 30.7 | 20.0 | 145: J-38 | 63: Zone - 1 |
| J-40 | True | 1,000.00 | 3,500.00 | 33.5 | 20.0 | 148: J-41 | 63: Zone - 1 |
| J-41 | True | 3,500.00 | 4,141.52 | 20.0 | 20.0 | 147: J-40 | 63: Zone - 1 |
| J-42 | False | 3,500.00 | 3,446.98 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-43 | True | 3,500.00 | 4,394.81 | 35.9 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-44 | True | 3,500.00 | 4,413.44 | 28.7 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-45 | True | 3,500.00 | 4,341.74 | 24.7 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-46 | True | 3,500.00 | 4,325.85 | 33.1 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-47 | True | 3,500.00 | 4,303.57 | 35.9 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-49 | True | 50.00 | 2,082.78 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-50 | True | 50.00 | 865.71 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-51 | False | 3,500.00 | 3,448.75 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-52 | True | 1,000.00 | 3,500.00 | 20.9 | 20.0 | 159: J-53 | 63: Zone - 1 |
| J-53 | True | 1,000.00 | 1,112.17 | 20.0 | 20.0 | 160: J-54 | 63: Zone - 1 |
| J-54 | True | 50.00 | 199.61 | 20.0 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-55 | True | 3,500.00 | 4,646.21 | 22.3 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-56 | True | 1,000.00 | 2,063.13 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-57 | True | 1,000.00 | 3,500.00 | 59.6 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-58 | True | 3,500.00 | 4,624.32 | 34.9 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-59 | False | 3,500.00 | 3,476.94 | 20.0 | 20.0 | 171: J-65 | 63: Zone - 1 |
| J-60 | True | 1,000.00 | 1,569.62 | 20.0 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-61 | True | 1,000.00 | 3,184.74 | 20.0 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-62 | True | 1,000.00 | 3,500.00 | 21.3 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-63 | True | 3,500.00 | 3,826.36 | 20.0 | 20.0 | 185: J-80 | 63: Zone - 1 |
| J-64 | True | 1,000.00 | 3,500.00 | 37.4 | 20.0 | 168: J-62 | 63: Zone - 1 |
| J-65 | True | 1,000.00 | 2,775.51 | 20.0 | 20.0 | 172: J-66 | 63: Zone - 1 |
| J-66 | True | 1,000.00 | 2,397.37 | 20.0 | 20.0 | 171: J-65 | 63: Zone - 1 |
| J-68 | True | 1,000.00 | 1,067.02 | 20.0 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-69 | True | 1,000.00 | 1,125.43 | 20.0 | 20.0 | 173: J-68 | 63: Zone - 1 |
| J-70 | True | 1,000.00 | 3,200.78 | 20.0 | 20.0 | 188: J-83 | 63: Zone - 1 |
| J-71 | False | 1,000.00 | 886.20 | 20.0 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-72 | True | 50.00 | 237.24 | 20.0 | 20.0 | 180: J-74 | 63: Zone - 1 |
| J-73 | True | 1,000.00 | 1,025.46 | 20.2 | 20.0 | 205: J-100 | 63: Zone - 1 |
| J-74 | True | 50.00 | 646.10 | 20.0 | 20.0 | 141: J-34 | 63: Zone - 1 |
| J-75 | True | 3,500.00 | 3,940.56 | 20.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-76 | True | 1,000.00 | 3,500.00 | 39.2 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-77 | True | 1,000.00 | 3,500.00 | 39.9 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-78 | True | 1,000.00 | 3,500.00 | 36.6 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-79 | True | 3,500.00 | 4,230.09 | 20.0 | 20.0 | 185: J-80 | 63: Zone - 1 |
| J-80 | True | 3,500.00 | 3,994.01 | 20.0 | 20.0 | 169: J-63 | 63: Zone - 1 |
| J-81 | True | 3,500.00 | 4,408.01 | 20.0 | 20.0 | 425: J-3 | 63: Zone - 1 |
| J-82 | True | 1,000.00 | 2,280.54 | 20.0 | 20.0 | 652: J-138 | 63: Zone - 1 |
| J-83 | True | 1,000.00 | 1,211.99 | 20.0 | 20.0 | 190: J-84 | 63: Zone - 1 |

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

## Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-84 | True | 1,000.00 | 1,254.30 | 20.0 | 20.0 | 188: J-83 | 63: Zone - 1 |
| J-85 | True | 50.00 | 1,651.77 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-87 | True | 1,000.00 | 1,456.73 | 20.1 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-88 | True | 1,000.00 | 1,183.38 | 20.0 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-89 | True | 1,000.00 | 1,438.94 | 26.6 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-90 | True | 1,000.00 | 1,472.98 | 28.3 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-91 | True | 1,000.00 | 1,321.94 | 23.4 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-92 | True | 1,000.00 | 1,322.35 | 20.1 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-93 | True | 1,000.00 | 1,232.58 | 21.6 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-94 | True | 1,000.00 | 1,200.06 | 20.0 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-95 | True | 1,000.00 | 1,162.47 | 21.3 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-96 | True | 1,000.00 | 1,231.05 | 20.7 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-97 | True | 1,000.00 | 1,098.32 | 20.0 | 20.0 | 200: J-95 | 687: Zone - 2 |
| J-98 | True | 1,000.00 | 1,881.38 | 20.0 | 20.0 | 742: J-155 | 687: Zone - 2 |
| J-99 | True | 1,000.00 | 3,172.40 | 20.2 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-100 | False | 1,000.00 | 978.99 | 20.0 | 20.0 | 177: J-72 | 63: Zone - 1 |
| J-105 | True | 1,000.00 | 3,500.00 | 38.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-106 | False | 0.01 | 0.00 | 0.9 | 20.0 | 207: J-106 | 64: Zone - Tank 2 |
| J-107 | True | 1,000.00 | 1,009.88 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-109 | True | 1,000.00 | 3,500.00 | 42.3 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-110 | True | 1,000.00 | 3,500.00 | 40.4 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-111 | True | 1,000.00 | 3,500.00 | 38.5 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-112 | True | 1,000.00 | 3,500.00 | 36.6 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-113 | True | 1,000.00 | 3,500.00 | 35.0 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-114 | True | 1,000.00 | 3,500.00 | 32.7 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-115 | True | 1,000.00 | 3,500.00 | 36.4 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-116 | True | 1,000.00 | 3,500.00 | 35.4 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-117 | True | 1,000.00 | 3,500.00 | 33.6 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-118 | True | 1,000.00 | 3,500.00 | 31.6 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-119 | True | 1,000.00 | 3,500.00 | 28.9 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-120 | True | 1,000.00 | 3,500.00 | 28.5 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-121 | True | 1,000.00 | 3,500.00 | 26.2 | 20.0 | 223: J-122 | 687: Zone - 2 |
| J-122 | True | 1,000.00 | 3,166.52 | 20.0 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-123 | True | 1,000.00 | 3,500.00 | 35.0 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-124 | True | 1,000.00 | 3,500.00 | 33.8 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-125 | True | 1,000.00 | 3,500.00 | 33.9 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-126 | True | 1,000.00 | 3,500.00 | 33.8 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-127 | True | 1,000.00 | 3,500.00 | 40.9 | 20.0 | 517: J-128 | 688: Zone - Tank 3 |
| J-128 | True | 1,000.00 | 3,500.00 | 30.4 | 20.0 | 228: J-127 | 688: Zone - Tank 3 |
| J-131 | True | 1,000.00 | 3,500.00 | 43.2 | 20.0 | 620: J-132 | <None> |
| J-132 | True | 1,000.00 | 3,500.00 | 32.9 | 20.0 | 618: J-131 | <None> |
| J-133 | True | 1,000.00 | 3,500.00 | 54.2 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-134 | True | 1,000.00 | 3,500.00 | 50.0 | 20.0 | 629: J-135 | <None> |

## *Fire Flow Node FlexTable: Fire Flow Report (Town of Stevensville Water Model - Calibrated.wtg)*

### Current Time: 0.000 hours

| Label | Satisfies Fire Flow Constraints ? | Fire Flow (Needed) (gpm) | Fire Flow (Available) (gpm) | Pressure (Calculated Residual) (psi) | Pressure (Zone Lower Limit) (psi) | Junction w/ Minimum Pressure (Zone) | Zone |
|---|---|---|---|---|---|---|---|
| J-135 | True | 1,000.00 | 3,500.00 | 44.8 | 20.0 | 627: J-134 | <None> |
| J-136 | True | 1,000.00 | 3,500.00 | 51.7 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-137 | True | 1,000.00 | 1,596.75 | 30.5 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-138 | True | 1,000.00 | 1,720.81 | 20.0 | 20.0 | 166: J-60 | 63: Zone - 1 |
| J-139 | True | 1,000.00 | 1,607.93 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-142 | True | 1,000.00 | 3,500.00 | 41.9 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-143 | True | 1,000.00 | 3,500.00 | 41.2 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-144 | (N/A) | 1,000.00 | (N/A) | (N/A) | 20.0 | ((N/A)) | 687: Zone - 2 |
| J-145 | True | 1,000.00 | 1,971.69 | 37.4 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-147 | True | 1,000.00 | 1,499.69 | 27.9 | 20.0 | 202: J-97 | 687: Zone - 2 |
| J-148 | True | 1,000.00 | 3,500.00 | 41.8 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-149 | True | 1,000.00 | 3,500.00 | 42.5 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-150 | False | 3,500.00 | 3,466.54 | 22.7 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-151 | True | 1,000.00 | 3,500.00 | 50.0 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-152 | True | 1,000.00 | 1,259.72 | 20.0 | 20.0 | 127: J-20 | 63: Zone - 1 |
| J-153 | True | 1,000.00 | 3,500.00 | 56.5 | 20.0 | 142: J-35 | 63: Zone - 1 |
| J-154 | True | 1,000.00 | 3,500.00 | 45.0 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-155 | True | 1,000.00 | 1,914.05 | 20.0 | 20.0 | 203: J-98 | 687: Zone - 2 |
| J-156 | True | 1,000.00 | 3,500.00 | 53.8 | 20.0 | 202: J-97 | 687: Zone - 2 |

Montana Department of
ENVIRONMENTAL QUALITY

Brian Schweitzer, Governor

P.O. Box 200901 • Helena, MT 59620-0901 • (406) 444-2544 • www.deq.mt.gov

November 19, 2007



Gilbert Larson, PE
Professional Consultants, Inc.
3115 Russell Street
PO Box 1750
Missoula, MT 59806

RE: EQ#06-2873, Creekside Meadows Addition, Phase III, Public Water Supply Booster Station, Town of Stevensville, Ravalli County, MT000335

Dear Mr. Larson:

I have reviewed the plans and specifications you submitted for the above-mentioned project in accordance with Department design standards Circular DEQ 1. Approval of these plans is hereby given. A copy of the plans bearing the approval stamp of the Department of Environmental Quality is enclosed. The second set will be retained as Department record. Water and sewer mains for this project were approved on April 11, 2007, by Sam Martinez, under the same EQ#06-2873.

Approval is based on final plans and specifications received on October 3, 2007 under the engineering seal of Andy Mefford, #16208 PE. The proposed project shall consist of a Grundfos MPC-E-2CRE45-1 7.5 hp, 3 x 460V package booster station, with insulated Safe T Cover 1000TDS-AL, and one water-proofed pressure-reducing vault west of Willow Way. The package booster station contains one Amtrol ST-80V pressure tank and two 7.5 hp Grundfos 2 CR 45-1 pumps with variable frequency drive motors. Each pump produces approximately 275 gpm and together they produce about 510 gpm. The booster station is designed to serve 121 homes. (There are 58 residences in Creekside Meadows Phase III.) An operation and maintenance manual must be submitted with the as-builts. Pressure gauges must be installed on both the suction and discharge sides of the pump.

Approval is also given with the understanding that any deviation from the approved plans and specifications must be submitted to the Department for reappraisal and approval. Within 90 days following completion of the project a complete set of "as-built" record drawings must be signed, stamped, certified to be constructed in accordance with approved plans and specifications, and submitted to the Department by the project engineer. The project may not be put into use until the record drawings and specifications have been received by DEQ or the project engineer certifies by letter to the Department that the activated portion of the project was inspected and found to be constructed in accordance with the plans and specifications approved by the Department.

Construction of this project must be completed within three years of this date. If more than three years elapse before completing construction, plans and specifications must be resubmitted and approved before construction begins.

The applicant is responsible for compliance with all applicable federal, state, local, and tribal law, regulations, and ordinances. Approval in this document is limited solely to the matters therein specifically contained and does not constitute approval, implied or otherwise, for the purposes of any other law, regulation, or ordinance.

If there is anything I can do to answer questions or assist, please do not hesitate to call me at 444-5881.

Sincerely,

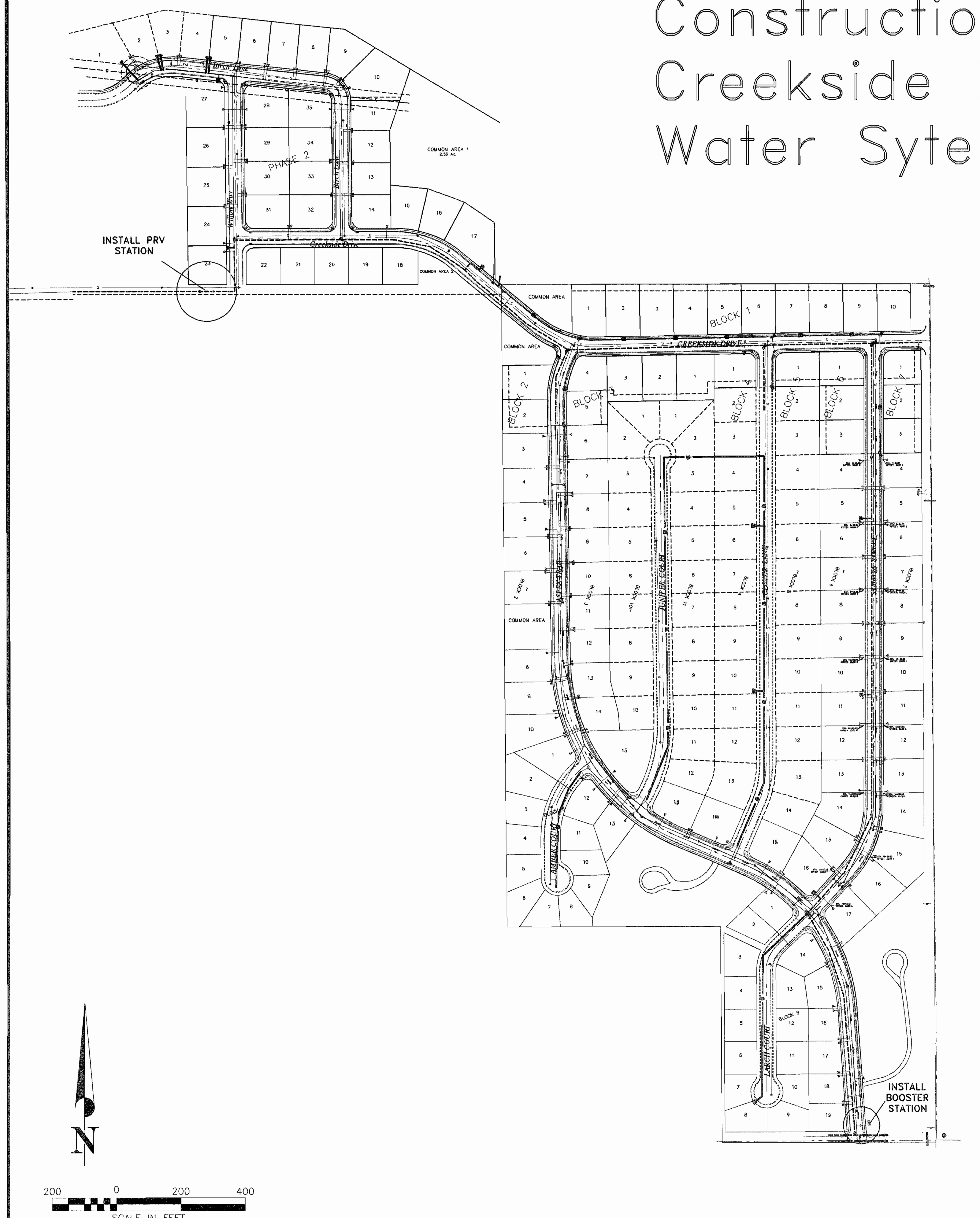
Michele Marsh

Michele Marsh, PE
Environmental Engineer
DEQ, Public Water and Subdivisions Bureau

cc: Ravalli County Health Department
Town of Stevensville, 206 Buck Street, PO Box 30, Stevensville, MT 59870
Plan Review File

Enclosure: One set of approved plans and specifications

# Construction Plans for: Creekside Meadows Addition – Phase 3 Water Sytem Improvements




## GENERAL NOTES

1. DURING CONSTRUCTION IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT EXISTING UTILITY LINES.
2. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY SHOULD ANY CONFLICTS EXIST BETWEEN THE PLANS AND WHAT IS FOUND IN THE FIELD.
3. THE CONTRACTOR SHALL OBTAIN ALL THE NECESSARY PERMITS, AT HIS EXPENSE, TO COMPLETE THE PROPOSED WORK AND SHALL COMPLY WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS.
4. THE CONTRACTOR SHALL NOTIFY APPROPRIATE PERSONNEL FOR UTILITY LOCATIONS AND NOTICE OF CONSTRUCTION COMMENCEMENT TWO BUSINESS DAYS PRIOR TO START OF CONSTRUCTION.
5. CONTRACTOR SHALL PROTECT ALL ADJACENT IMPROVEMENTS (BUILDINGS, ROADWAYS, FENCES, PARKING LOTS, UTILITIES, ETC.) FROM DAMAGE AND EROSION. ALL DISTURBED AREAS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
6. ALL SITE CIVIL CONSTRUCTION SHALL BE IN ACCORDANCE WITH MONTANA PUBLIC WORKS STANDARD SPECIFICATIONS, 5TH EDITION, AS AMENDED.
7. A GRAVEL SOURCE IS PROVIDED ONE MILE NORTH ONTHE EAST SIDE HIGHWAY WITH PIT RUN, 3" MINUS BASE MATERIAL AND 3/4" MINUS SURFACING MATERIAL. NO ROYALTY WILL BE CHARGED.

**CALL UTILITY NOTIFICATION CENTER OF MONTANA**

**1-800-424-5555**

**CALL FOR THE MARKING OF UNDERGROUND UTILITIES 2 BUSINESS DAYS BEFORE YOU DIG, GRADE, OR EXCAVATE**

Sheet List Table

| Sheet # | Sheet Title |
|---|---|
| C1 | Cover |
| C2 | Site Map |
| C3 | Booster and PRV plan and elevation |


PCI
**Professional Consultants Inc.**
Engineers, Surveyors, Planners, Mappers
3115 RUSSELL ST. PO BOX 1750
MISSOULA, MONTANA 59801
PHONE 406-728-1880
FAX 406-728-0276
1713 NORTH FIRST STREET
HAMILTON, MONTANA 59840
PHONE 406-363-1201
FAX 406-363-1215

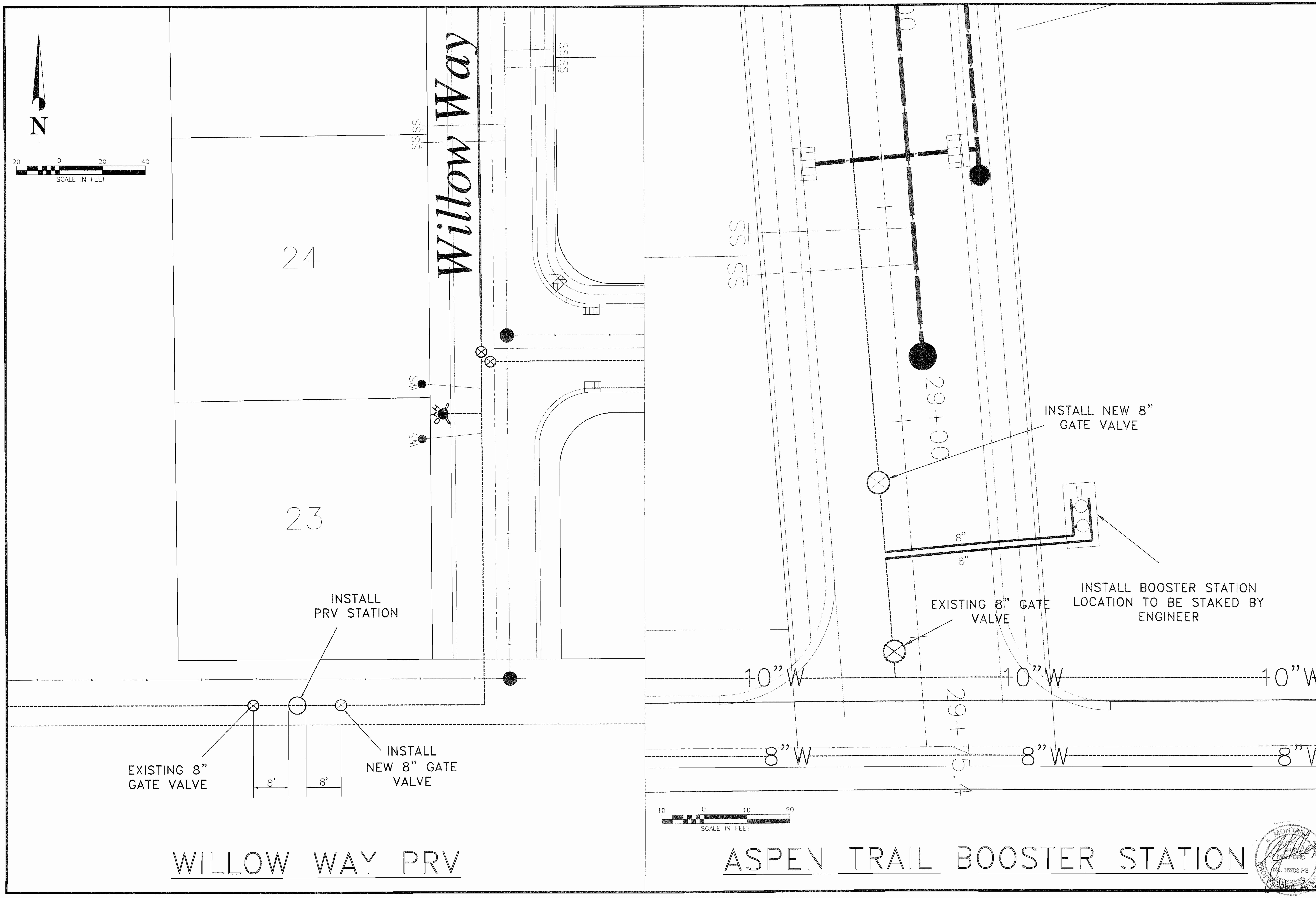

PROJECT #: 6637-02
DRAWN: DRR
CHECKED: AM
DATE: 10/2/2007
REVISION:
REVISION:
REVISION:
REVISION:
REVISION:
REVISION:

**Creekside Meadows Phase III**
Water System Improvements
Ellison Development Company, LLC
Stevensville, Montana

MONTANA ANDY HEFFORD No. 16208 PE PROFESSIONAL ENGINEER

**Cover**

**C1**




Professional Consultants Inc.

Engineers, Surveyors, Planners, Mappers

**Creekside Meadows Phase III**

Water System Improvements

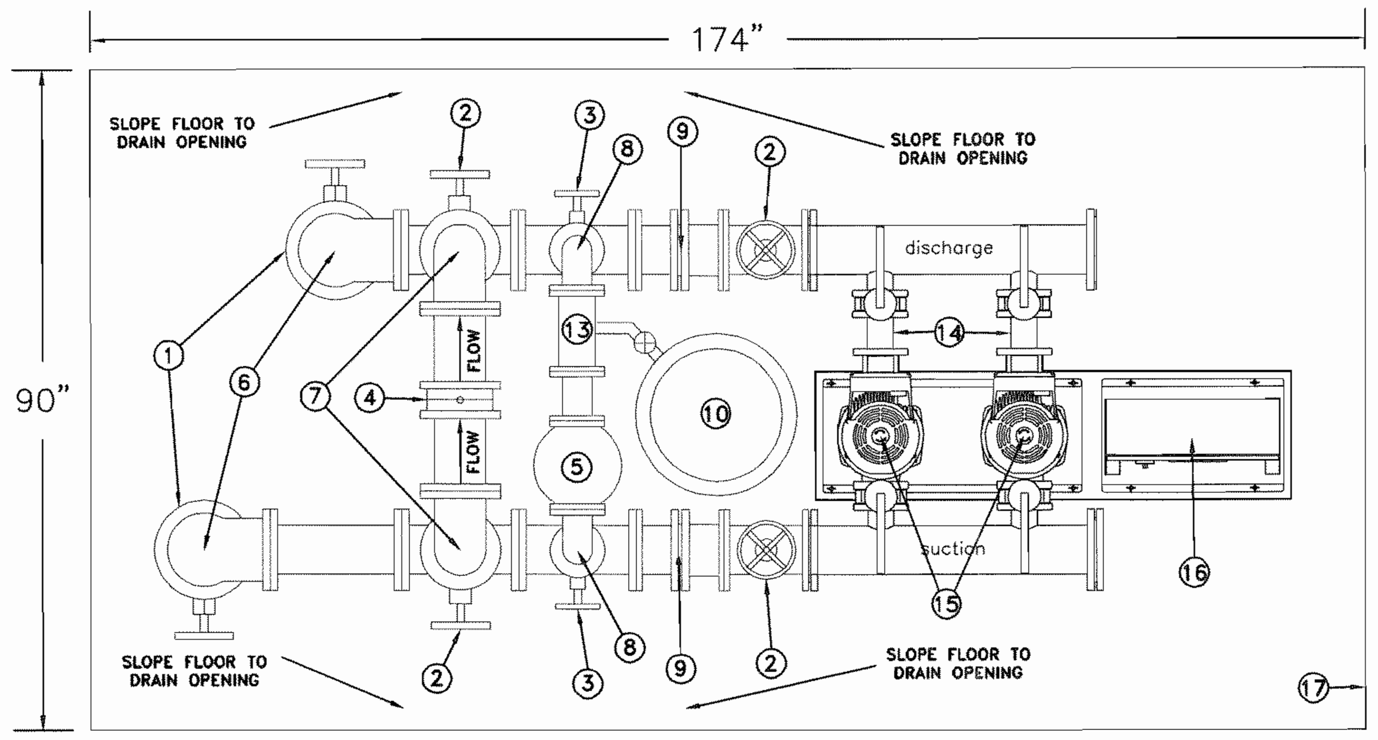
Ellison Development Company, LLC

Stevensville, Montana

**Site Map**

**C2**

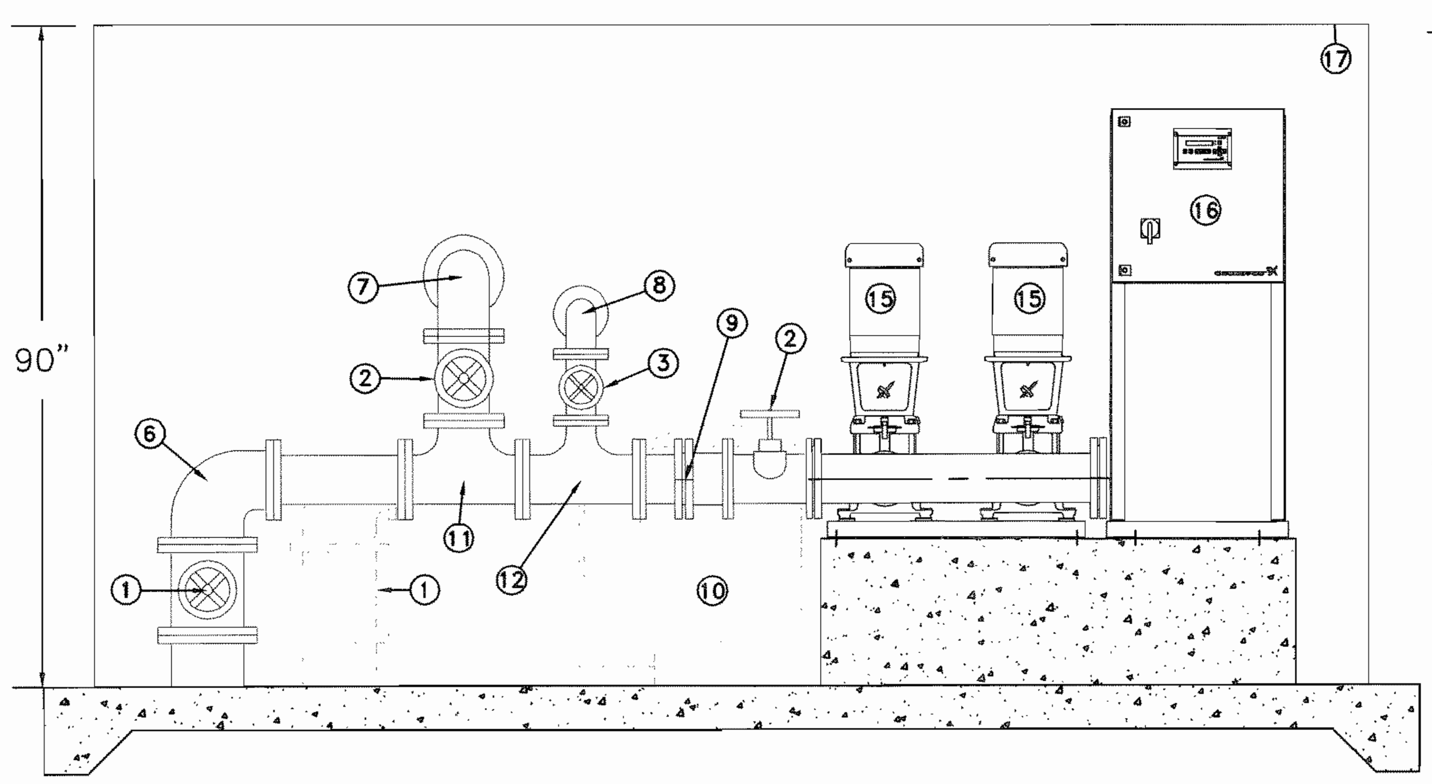
SHEET 2 OF 3




## BOOSTER STATION PLAN VIEW
NOT TO SCALE

## LEGEND

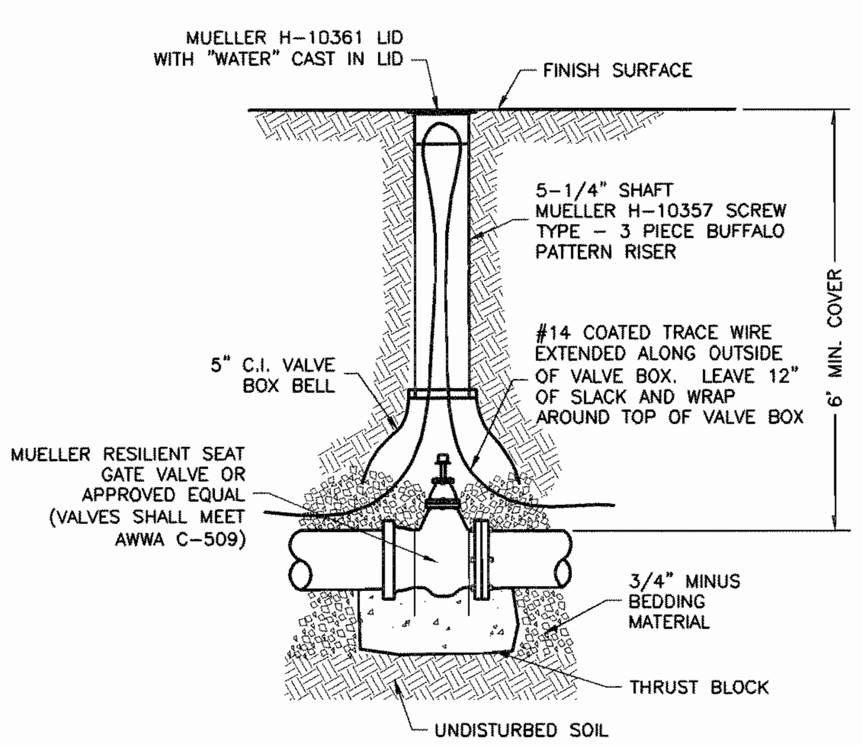
1. 8" GATE VALVE
2. 6" GATE VALVE
3. 3" GATE VALVE
4. 6" WAFER CHECK VALVE CLA-VAL 501A OR EQUAL
5. 3" PRESSURE RELIEF VALVE CLA-VAL 50-01 OR EQUAL
6. 8" X 6" 90 DEGREE REDUCING BEND
7. 6" 90 DEGREE BEND
8. 3" 90 DEGREE BEND
9. 6" DISMANTLING JOINT
10. AMTROL ST-80V INCLUDED WITH BOOSTER STATION
11. 6" X 6" X 6" TEE
12. 6" X 6" X 3" REDUCING TEE
13. 3" TEE REDUCE TO 1-1/4" THREADED OUTLET TO PRESSURE TANK
14. SPRING LOADED NON-SLAM WAFER CHECK VALVE
15. GRUNDFOS CR 45-1 VFD PUMP
16. PUMP CONTROLLER TYPE PMU-2000 OR APPROVED EQUAL
17. SAFE T COVER 1000TDS-AL OR APPROVED EQUAL



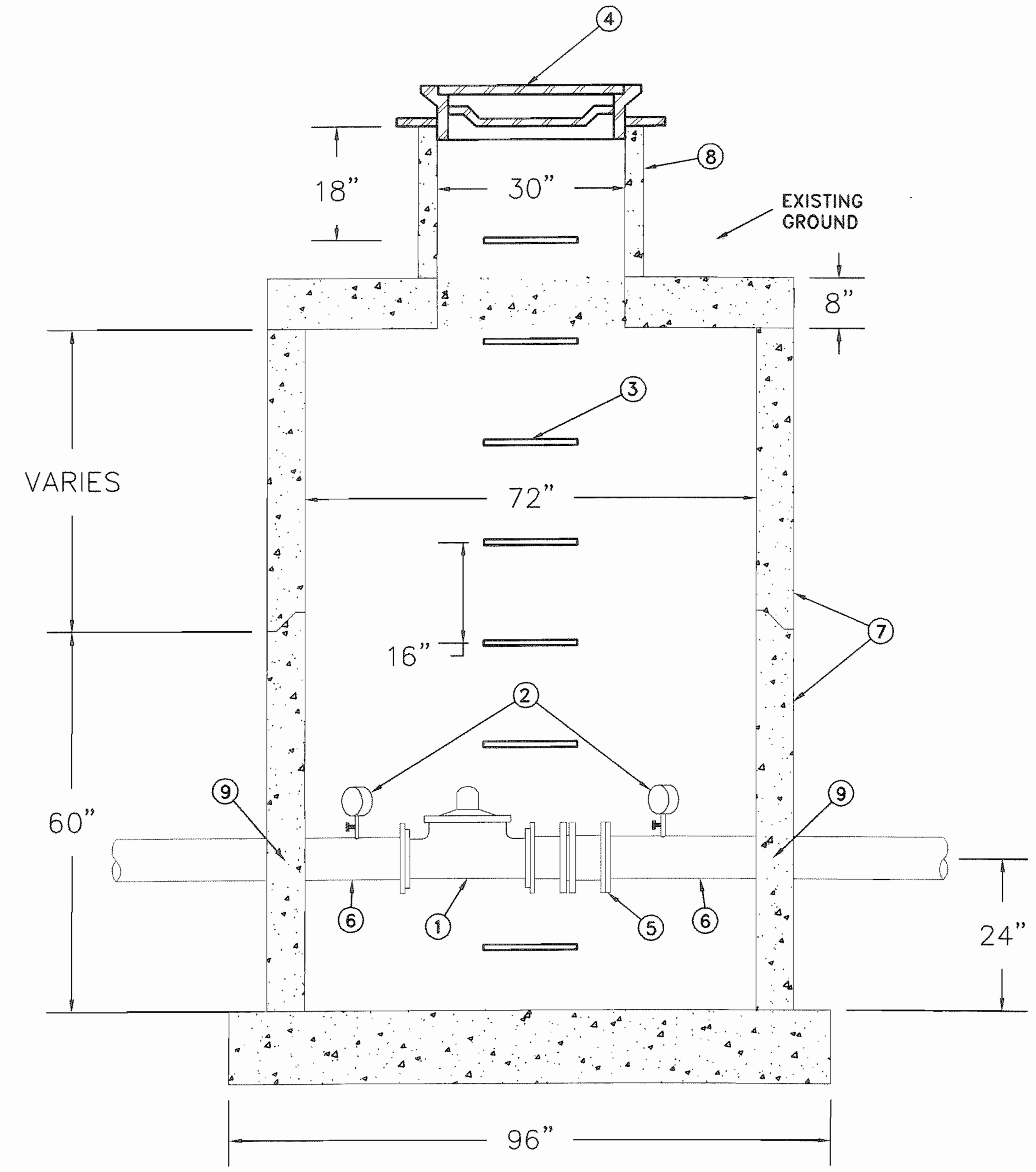

## BOOSTER STATION ELEVATION
NOT TO SCALE

## NOTES

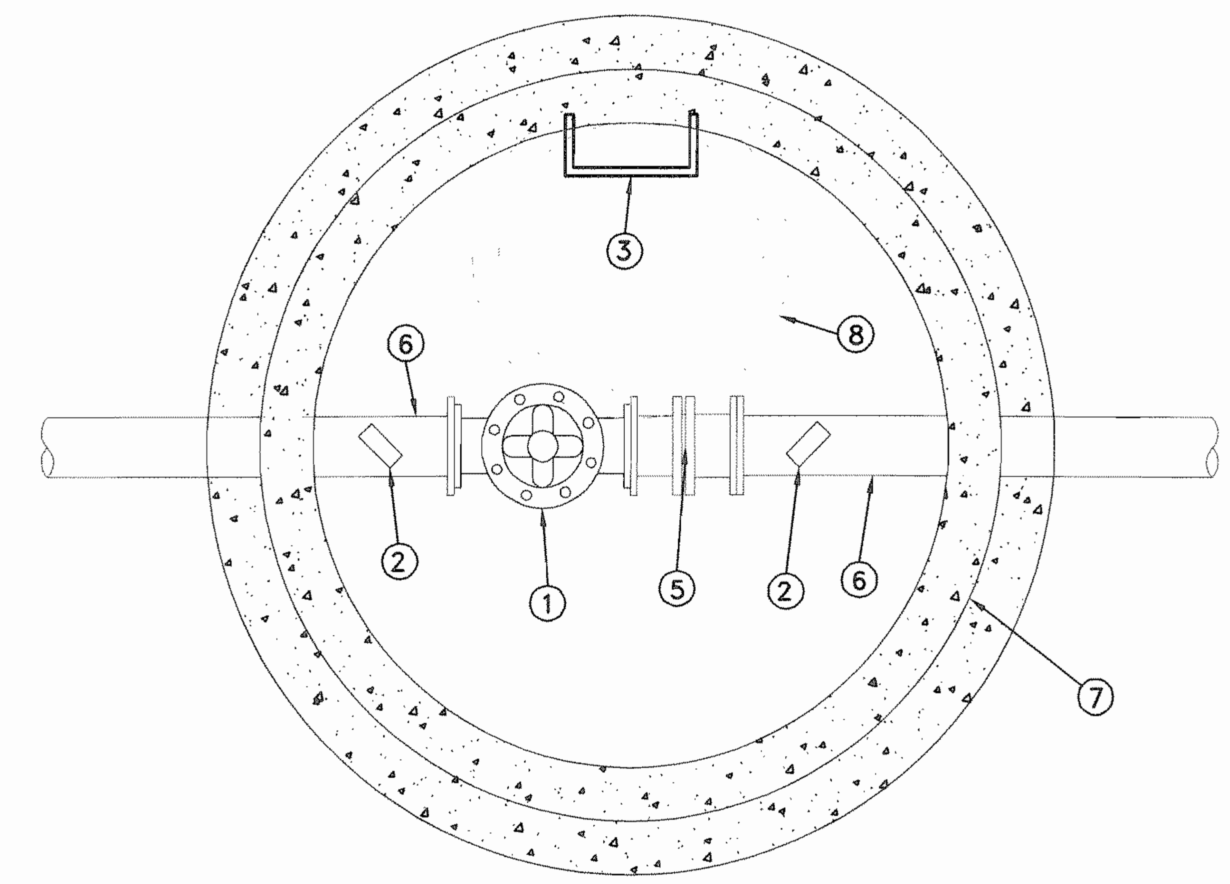
1. BOOSTER STATION SHALL BE GRUNDFOS MPC-E-2CRE45-1 7.5hp 3x460V OR APPROVED EQUAL
2. ENCLOSURE TO BE SAFE-T-COVER 1000TDS-AL 90"W X 174"L X 90"H OR APPROVED EQUAL
3. CONCRETE PAD TO BE 104"W X 188"L X 6" THICK. SLOPE FLOOR TO DRAIN OPENINGS IN ENCLOSURE.
4. WHEN FLOW CONDITIONS EXCEED BOOSTER STATION CAPACITY, BOOSTER STATION WILL BE BYPASSED THROUGH CHECK VALVE.
5. SEE SPECIFICATIONS FOR ENCLOSURE DETAILS.




## WATER VALVE DETAIL
NOT TO SCALE




## 6' MANHOLE ELEVATION
NOT TO SCALE



## 6' MANHOLE PLAN VIEW
NOT TO SCALE

## LEGEND

1. 6" 90G-01YBCS W/RETURN FLOW, C/W POSITION INDICATOR, DI BODY, BRONZE TRIM 150 FLG
2. 4" (0-200 PSI) PRESSURE GAUGE C/W/ GAUGE COCK
3. LADDER AND STEPS 90° FROM PIPE
4. 30" MANHOLE RING AND COVER
5. 6" DISMANTLING JOINT
6. 6" DI SPOOL
7. 6' WATERPROOF MANHOLE
8. 30" I.D. 2' RISER
9. 6" PIPE SEAL ASSEMBLY

## NOTES FOR WATERPROOF VALVE MANHOLE

1. Precast or poured-in-place base. Poured-in-place base, minimum concrete thickness to be 8 inches. Precast base, minimum thickness to be 6 inches per standard drawing 02722-4.
2. The poured-in place concrete base will start one foot from outside manhole and be a minimum of eight inches deep under the manhole with a three inch collar around pipe.
3. See Montana Public Works Standard Specifications (MPWSS) Section 02722.
4. All joints between manhole sections, adjusting rings, manhole ring and top section, and around sewer pipe into manhole shall be watertight. Jointing material shall be "RAM-NEK" or equal for all joints except between sewer pipe and manhole wall. All joints shall also be sealed with joint wrap
5. Manholes placed in unpaved areas shall have the covers placed 18" above finished grade.
6. Base and fill concrete may be poured monolithically.
7. 1/2" spacing may be omitted when base and fill concrete are poured monolithically.
8. Base is to be supported by four cement blocks (CMU) equally spaced around perimeter of M.H.
9. All precast Manhole bases shall have a four-inch concrete base extension outside the manhole for support.
10. All pipe shall be ductile iron through manhole and extend a minimum of 24" past outside of manhole. All penetrations shall be watertight and encased in concrete.
11. Vaccum test manhole in accordance with ASTM #C 1244-93

**Professional Consultants Inc.**
Engineers, Surveyors, Planners, Mappers
3115 RUSSELL ST. PO BOX 1750
MISSOULA, MONTANA 59801
PHONE 406-728-1880
FAX 406-728-0276
1713 NORTH FIRST STREET
HAMILTON, MONTANA 59840
PHONE 406-363-1201
FAX 406-363-1215

PROJECT #: 6637-02
DRAWN: DRR
CHECKED: AM
DATE: 10/2/2007
REVISION:
REVISION:
REVISION:
REVISION:
REVISION:
REVISION:
REVISION:

**Creekside Meadows Phase III**
Water System Improvements
Ellison Development Company, LLC
Stevensville, Montana

**Details**

**C3**

SHEET 3 OF 3

# PWS-6 (SOURCE WATER PROTECTION DELINEATION) AND HYDROGEOLOGIC SUMMARY REPORT

Town of Stevensville Public Water Supply
Ravalli County, Montana

Prepared for:

**Town of Stevensville**
P.O. Box 30
Stevensville, Montana 59870

Prepared by:

**Geomatrix Consultants, Inc.**
1001 South Higgins Avenue, B-1
Missoula, Montana 59801
(406) 542-0129

November 2007
Project No. 13448

Geomatrix

# PWS-6 (SOURCE WATER PROTECTION DELINEATION) AND HYDROGEOLOGIC SUMMARY REPORT

Town of Stevensville Public Water Supply
Ravalli County, Montana

Prepared for:

**Town of Stevensville**
P.O. Box 30
Stevensville, Montana 59870

Prepared by:

**Geomatrix Consultants, Inc.**
1001 South Higgins Avenue, B-1
Missoula, Montana USA 59801

Geomatrix

November 2007

# TABLE OF CONTENTS

Page

## TABLES



## FIGURES



## APPENDICES

# 1.0 INTRODUCTION AND PURPOSE

The purpose of this report is to propose several locations for groundwater wells intended to serve projected increases in future water demand for the Town of Stevensville, Montana (Figure 1; the Town) and to identify potential sources of contamination to these well locations. In addition to adding capacity to the Town's municipal water supply, these new wells would allow the Town to replace a groundwater infiltration gallery with new wells, which are less susceptible to potential groundwater contamination than an infiltration gallery.

Five separate well locations are proposed on an 8-acre parcel of land (the Anderson Well Field) that will be donated to the Town by Mr. John Anderson. Mr. Anderson is proposing the Twin Creeks Subdivision on an approximately 40-acre parcel (Figure 2) adjacent to the proposed well field parcel. According to a Well Field Feasibility Report and Analysis (Appendix A) prepared for the Town of Stevensville by Professional Consultants, Inc (PCI) of Missoula, Montana, the Town of Stevensville is currently seeking to add approximately 2,100 gallons per minute (gpm) of capacity to their existing system. The estimated maximum day demand for the Twin Creeks subdivision is 156 gallons per minute (gpm) with a peak instantaneous demand of 299 gpm.

This report is intended to meet Montana Department of Environmental Quality (DEQ) requirements for the submittal of a PWS-6 report for prior approval of Public Water Supply (PWS) well locations. The primary contact person for this project is Nathan Lucke of Territorial-Landworks (TLI), 620 Addison, Missoula, MT 59806, phone 406.721.0142. This report was completed by Adam Johnson and Adam Perine, hydrogeologists with Geomatrix Consultants. They can be contacted at 1001 South Higgins Ave., Building B, Missoula, MT 59801, phone 406.542.0129.

# 2.0 BACKGROUND INFORMATION

## 2.1 Ravalli County

The town of Stevensville is located near the center of the Bitterroot Valley, a north-south trending intermontane basin in the Northern Rocky Mountains physiographic province (de Blij and Muller 1993). The Bitterroot Valley is bordered on the north by the Missoula Valley, on the west by the Bitterroot Mountains, on the east by the Sapphire Mountains, and on the southeast by the Anaconda Range. Faulting created the steep front separating the Bitterroot Mountains from the valley floor and the more subdued transition between the valley and the Sapphire Range. The elevation of Stevensville is about 3400 feet; to the west, mountains rise from 7,000 to 10,000 feet. The valley averages approximately 7 miles in width and is about 52 miles long. Basin-fill sediments cover most of the valley floor. The Bitterroot River flows toward the north and lies less than one mile west of Stevensville.

Land cover in Ravalli County consists of small urban areas, range and agricultural land, grassland, shrub land, riparian corridors, and coniferous forest. The Stevensville area economy is supported by a variety of activities, including tourism, small businesses, logging, construction, services, and federal, state, and local government. Annual precipitation averages 12.5 inches per year at Stevensville, with 26 inches of snowfall reported. Temperatures range from an average monthly minimum of 33 °F in January to a maximum of 85 °F in July (Western Regional Climate Center 2007).

The proposed well field is located on a parcel along Middle Burnt Fork Road that is owned by Mr. John Anderson (Figures 1 and 2). The property is underlain by alluvial fan and outwash terrace deposits consisting of sand, gravel, cobbles, and boulders (Lonn and Sears 2001).

### 2.2 Stevensville Well Field and Public Water Supply Features

The proposed well field parcel is located approximately one mile southeast of Stevensville on Middle Burnt Fork Road (Figure 2) in Section 35, Township 9 North, Range 20 West. Wells installed within this parcel would serve projected increases in Stevensville's municipal water demand (including the proposed Twin Creeks subdivision) and would replace water currently supplied by an infiltration gallery. Future water demands for the Town were presented in a Preliminary Engineering Report prepared for the Town by PCI. The aquifer in the Middle Burnt Fork Road area was identified as a priority for adding capacity for the Stevensville PWS (Western Groundwater Services 2002).

According to information presented in a Source Water Protection Plan that was prepared for the towns of Stevensville, Darby, and Hamilton, water for the Stevensville PWS system (PWSID #MT0000335) is supplied by three wells (Well #1, Well #2, and Well #3) and an infiltration gallery (Western Groundwater Services 2002). The infiltration gallery receives water by the operators periodically flooding the land area above the gallery. The floodwater recharges the aquifer and percolates down to the infiltration gallery. The three PWS wells and the infiltration gallery are located approximately 1½ miles east of the proposed Twin Creeks subdivision. Well #1 is completed to a total depth of 460 feet with a reported yield of 400 gallons per minute (gpm). This well is reportedly screened in Tertiary Bitterroot gravels, providing groundwater from 330 feet below ground surface (bgs). Wells #2 and #3 are completed in Quaternary alluvium at depths of 56 feet and 75 feet, respectively, and each has a reported normal pumping capacity of 225 gpm.

Mr. Anderson is proposing the Twin Creeks Subdivision on an approximately 40-acre parcel (Figure 2), located within the northwest ¼ of the northeast ¼ of Section 35, Township 9 North, Range 20 West. This property is not currently served by Stevensville's PWS system. The proposed subdivision will include 118 lots, and would require the development of a PWS system to provide water for domestic use and for lawn and garden irrigation. Mr. Anderson proposes to install a single PWS well on the 8-acre Anderson Well Field. This well would then be plumbed into the existing municipal supply system along with subsequent wells, as needed by the Town.

## 3.0 DELINEATION OF GROUNDWATER SOURCES

The following sections describe hydrogeologic conditions, the conceptual model of the groundwater flow system, the design of the proposed wells, and delineation methods and criteria for source-water protection regions. Geomatrix obtained hydrogeologic information from the sources listed in Table 1. Aquifer test results from a test well installed on the Anderson Well Field parcel (TC-TW-1) provided information about aquifer properties and groundwater quality.

**Table 1. Sources of Hydrogeologic Information**

| Reference | Summary |
|---|---|
| GWIC (2007) | The state of Montana's Ground Water Information Center, a repository of well logs, aquifer test results, and water quality data |
| Lafave (2006) | Potentiometric surface of Bitterroot valley-fill aquifers |
| McMurtrey et al. (1972) | Geologic and hydrogeologic study of the Bitterroot Valley |
| Smith (2006a) | Thickness of Quaternary deposits in the Bitterroot Valley |
| Smith (2006b) | Hydrologic framework of the Bitterroot Valley |
| Smith (2006c) | Bitterroot Valley bedrock altitude map |
| Western Groundwater Services (2002) | Source Water Protection Plan (Stevensville, Darby, and Hamilton) |

## 3.1 Hydrogeologic Conditions

The following sections discuss the geologic setting, well installation, aquifer properties, water quality, and source water sensitivity of the source aquifer for the proposed public water supply system.

### *3.1.1 Geologic Setting*

The Bitterroot Valley is a structural basin controlled by faults, which separate the lower elevations from the mountains to the east and west (McMurtrey et al. 1972). The Stevensville area is bounded on the east by the Sapphire Mountain Range, which is composed of Precambrian Belt Series meta-sedimentary rocks and Cenozoic igneous rocks. To the west, the influent Bitterroot River acts as a hydraulic divide. Beyond the river, the Bitterroot Mountains comprise Cretaceous intrusions and metamorphosed Precambrian rocks.

Lonn and Sears (2001) provided a geologic map of the Bitterroot Valley. Alluvial fan and outwash terrace deposits, probably deposited in the Late Pleistocene, blanket the well field parcel (Figure 3). McMurtrey et al. (1972) mapped the sediments at the site as river terrace alluvium. To the west, younger Quaternary alluvium underlies the current Bitterroot River channel, its floodplain, and major tributaries. Well logs throughout the valley indicate that the recent alluvium has an average thickness of approximately 40 feet (McMurtrey and others 1972). Quaternary unconsolidated deposits (alluvium, terraces, and other Quaternary materials) are between 50 and 100 feet thick at Stevensville (Smith 2006a). Tertiary fine- and coarse-grained deposits occur below the Quaternary sediments in the Stevensville area (Smith 2006b) and to the east of the proposed well field (Lonn and Sears, 2001). Based on an approximate bedrock elevation of 1,500 feet above mean sea level (amsl) and a ground surface elevation of 3435 feet amsl at the Anderson Well Field, Tertiary materials extend to over 1800 feet bgs (Smith 2006c). Deep water-bearing zones encountered during drilling of the test well are interpreted as Tertiary ancestral Bitterroot River Deposits (Lonn and Sears 2001).

Groundwater in the Bitterroot Valley is recharged by precipitation, snowmelt runoff, losing streams, leakage from irrigation ditches, and infiltration of excess irrigation water (Western Groundwater Services 2002). According to the GWIC database, wells in section 35 (84 total) are between 12 and 400 feet deep. Wells typically produce less than 100 gpm, and are less than 200 feet deep in unconsolidated clay, silt, sand, and gravel. Static water levels in area wells are generally less than 100 feet bgs.

According to Lafave (2006), groundwater flows to the west-northwest, toward the Bitterroot River. McMurtrey et al. (1972) showed groundwater flow to the west at the well field property. The potentiometric surface of the deep aquifer(s) at the site is approximately 3,300 feet amsl. Given a ground surface elevation of 3,435 feet amsl, the depth to water in the deep aquifer(s) is approximately 135 feet bgs. Groundwater flow is generally parallel to topography and follows the Burnt Fork alluvial fan from the Sapphire Mountains foothills toward the Bitterroot River. The gradient in the Stevensville area is estimated to be approximately 0.02 ft/ft (Western Groundwater Services 2002).

### 3.1.2 *Well Drilling and Installation*

In May 2007, Jerome's Drilling of Missoula, Montana (Jerome's) used an air rotary drilling rig to advance a six-inch diameter borehole and installed a six-inch diameter steel test well (TC-TW-1) at the Anderson well field (Figure 2). Geomatrix provided oversight during well drilling, recorded descriptions of materials encountered, and estimated rates of groundwater production (Appendix B). The well was drilled to a total depth of 398 feet below ground surface (bgs), and the casing was advanced to the same depth. Multiple water-bearing intervals were encountered during drilling, two of which produced more than 100 gallons per minute (gpm) via airlifting. Jerome's installed a total of 43 feet of perforations over five different intervals using a down-hole perforator. Following completion of well TC-TW-1, the static water level was 107 feet bgs.

Lithologic characteristics of the upper 60 feet of sediments (Appendix B) are consistent with the geologic description given by Lonn and Sears (2001) for alluvial fan and terrace sediments (silt, sand and gravel). Below 60 feet bgs, silt, sand, and gravel intervals dominated, but they were separated by several clay units up to 33 feet thick. These deeper fine- and coarse-grained sediments likely represent Tertiary deposits of the ancestral Bitterroot River (Lonn and Sears 2001). The clay units likely create confined conditions within the target aquifers.

The proposed new PWS wells will produce water from multiple water-bearing zones that vary in thickness, according to lithologic logs for the test well (Appendix B). Tertiary sediments underneath the sand and gravel units represent the vertical aquifer boundary. The alluvial aquifer is bounded to the east and west by the Bitterroot and Sapphire Mountains along the respective valley perimeters.

### 3.1.3 *Aquifer Properties*

On August 16, 2007 (Appendix C), Geomatrix performed an eight-hour constant-rate aquifer test on test well TC-TW-1. Due to the tight fit of the high-capacity pump and discharge pipe, a pressure transducer could not be used to collect water level drawdown data. Geomatrix measured water levels in the pumping well by hand with an electronic water level indicator during the pumping and recovery portions of the test. Prior to pumping, the water level in the well was 115.7 feet bgs. The test was started at 10:50 am and an average flow rate of 413 gpm (ranging from 400 to 450 gpm) was maintained for the 8-hour pumping period. A maximum drawdown of 40.1 feet was achieved in the pumping well at the end of the eight-hour test (Appendix C).

Time-drawdown and recovery data for the pumping well were analyzed using standard straight line techniques. Transmissivity estimates range from 3,480 to 3,790 $ft^2$/day, and hydraulic conductivity estimates, which are based on a total aquifer thickness of 270 feet, range from 13 to 14 ft/day. Aquifer test results are summarized in Table 2.

**Table 2.** Summary of Aquifer Test Results for Well TC-TW-1

| **Analysis** | **Transmissivity** ($ft^2$/day) | **Hydraulic Conductivity** (ft/day) |
|---|---|---|
| Drawdown (Cooper-Jacob Solution | 3,480 | 13 |
| Recovery (Theis Recovery Solution) | 3,790 | 14 |

### *3.1.4 Water Quality*

Water quality samples were collected from well TC-TW-1 at the end of the pumping test. Samples were submitted to Energy Laboratories, Inc. of Billings, Montana, for analyses. Water quality results from TC-TW-1 are typical of local groundwater quality in the area. No constituents were detected at concentrations above their respective applicable water quality standards (DEQ 2006). Table 3 presents the general chemistry of the sample collected from TC-TW-1 along with results from samples collected from three additional wells located in township 9N, range 20W. The laboratory analytical report for TC-TW-1 is included in Appendix D.

**Table 3.** Stevensville Area Groundwater Chemistry

| | Analyte | Units | Human Health Standard MDEQ-7(2) | TC-TW-1 (2007) | Randy Jones(4) (2000) | Charles Moody(5) (2000) | Leo Lubbers(6) (1995) |
|---|---|---|---|---|---|---|---|
| Physical Properties | pH | pH | -- | 6.8 | 6.3 | 7.5 | 8.4 |
| | Conductivity | µS/cm | -- | 386 | 116 | 272 | 230 |
| Inorganics | Alkalinity(1) | mg/L | -- | 166 | 119 | 130 | 111 |
| | Chloride | mg/L | -- | NR | 1.6 | 3.5 | 2.0 |
| | Sulfate | mg/L | -- | NR | 3.5 | 15.5 | 7.5 |
| | Fluoride | mg/L | 4,000 | NR | 0.12 | 0.26 | 0.10 |
| | Hardness(1) | mg/L | -- | 166 | 48.7 | 103.4 | 78.1 |
| Nutrients | Nitrate | mg/L | 10 | 0.98 7 | <0.5 | <0.5 | <0.05 |
| Metals (Dissolved) | Calcium | mg/L | -- | 50 | 12.7 | 31.3 | 30.1 |
| | Potassium | mg/L | -- | NR | 0.11 | 4.5 | 1.5 |
| | Sodium | mg/L | -- | NR | 4.2 | 12.9 | 18.0 |
| | Magnesium | mg/L | -- | 10 | 4.1 | 6.1 | 0.7 |
| Metals (Total) | Iron | mg/L | 0.30(3) | 0.12 | <0.05 | 0.05 | 0.20 |
| | Manganese | mg/L | 0.05(3) | <0.01 | 0.05 | 0.007 | 0.006 |
| | Arsenic | µg/L | 10 | <1 | <1 | 2.31 | <1 |

NOTES:
(1) Alkalinity and Hardness as $CaCO_3$
(2) Human Health Standard, Montana Department of Environmental Quality Circular DEQ-7 (2006)
(3) DEQ-7 Secondary MCL based on aesthetic properties such as taste, staining, or odor
(4) GWIC ID 134503; location is T9N R20W Sec 20; sampled by MBMG (2000)
(5) GWIC ID 60137; location is T9N, R20W, Sec 26; sampled by MBMG (2000)
(6) GWIC ID 60031; location is T9N, R20W, Sec 20; sampled by USGS (1995)
(7) Reported as [nitrate + nitrite] as N
Units: µS/cm – micromsiemens per centimeter; mg/L - milligrams per liter; µg/L – micrograms per liter
NR = not reported; -- (No standard)

#### *3.1.5 Source Water Sensitivity*

Sensitivity is a qualitative measure of the likelihood of groundwater contamination or other impacts to the proposed PWS wells. The source aquifer is likely confined based on the presence of numerous silt and clay units encountered between water-bearing zones (Appendix B). The aquifer is not directly connected to surface water. Therefore, the sensitivity of the source groundwater is classified as low.

### 3.2 Conceptual Model and Assumptions

Groundwater in the area of the proposed well fields originates from upgradient (to the east-southeast) Tertiary and Quaternary sediments, fractured Precambrian formations, infiltration of precipitation and snowmelt runoff, stream recharge, irrigation return flows, and leakage from irrigation ditches. Groundwater beneath the property ultimately discharges to the Bitterroot River west and north of the site (Lafave 2006). Based on lithologic observations made during test well drilling (Appendix B), the target aquifers are confined. For the purposes of the source water delineation analysis, it is assumed that the aquifer is isotropic and homogenous and extends underneath the entire property. The ground water flow direction is to the west-northwest. Vertical boundaries include the water table and bedrock below the basal aquifer. Depth to groundwater measured in the test well was 107.1 feet bgs in May 2007.

### 3.3 Well Design

The proposed wells for the Stevensville PWS system will likely be approximately 400 feet deep, with an expected depth to water of about 110 feet bgs. Based on the lithologic log of test well TC-TW-1, production well screens will be installed in water-bearing zones below 300 feet bgs. Screen slot size will be based on sieve analyses performed on drill cuttings collected from within the screened intervals. Analyses of aquifer materials from the test well suggest that the slot width in the three water-bearing intervals will be between 0.04 and 0.07 inches (Appendix E). Submersible pumps in each well will be placed immediately above the top of the uppermost well screen. Collectively, the wells will meet the average day-demand flow rate of 522 gpm projected for the year 2025 (Appendix A). A diagram showing the general proposed construction details of the PWS wells is included as Appendix F.

### 3.4 Delineation Methods and Criteria

Since the wells will be completed in confined zones, three source-water protection regions were delineated for the proposed Stevensville PWS wells (DEQ 1999).

1. Control Zone: Fixed radius of 100 feet surrounding each well; shown on Figure 2.
2. Inventory Region: 1,000 feet for a confined aquifer; shown on Figure 4.
3. Recharge Area: Physical/hydrologic flow system boundary; shown on Figures 3, 5, 6, and 7.

## 4.0 INVENTORY

Geomatrix created a list of potential contaminant sources for each of the three source-water protection regions.

### 4.1 Methods

Potential contaminant sources within the inventory region were determined using Montana's on-line Natural Resource Information System (NRIS), the Montana Department of Environmental Quality's Underground Storage Tank query service, and EPA's on-line Envirofacts Warehouse.

## 4.2 Control Zone

The control zone of the proposed well locations is the area within a 100-ft radius around each of the proposed Stevensville PWS wells (Figure 2). All land inside the proposed control zones is currently used as pasture. These areas will be designated as open space or residential land in the proposed development. Therefore, the primary potential contaminants within these control zones would be from improper disposal of household or automotive products. Because the source aquifer is confined and more than 300 feet bgs, the susceptibility from these contaminants is low.

## 4.3 Inventory Region

The inventory region extends 1,000 feet upgradient from the PWS wells (Figure 4). The inventory did not identify any landfills, RV dumpsites, EPA Superfund sites, EPA Toxic Release Inventory sites, or major U.S. Army Corps of Engineers 404 Permit projects.

One pipeline is shown passing near the inventory region on the USGS Stevensville topographic quadrangle. According to Northwestern Energy, this is a natural gas pipeline. A rail line owned by Montana Rail Link crosses an irrigation canal one half mile west of the proposed well field, but is downgradient and therefore lies outside of the inventory region.

The Stevensville Wastewater Treatment Plant (and associated sewage lagoon and dam) discharges water to the Bitterroot River, northwest of the town and downgradient of the proposed PWS wells. The Selway Corporation discharges (or discharged) seasonal storm water to a flood irrigation ditch in the northwest ¼ of Section 26, Township 9 North, Range 20 West. Although this facility is close to the proposed well field, it lies outside of the inventory region.

## 4.4 Recharge Region

The recharge area extends from the location of the proposed wells to the south and east, up the drainage of the Burnt Fork of the Bitterroot River to the Sapphire Mountains Divide (Figure 5). The recharge area boundary was determined using surface topography, since no known structural features are present that would allow groundwater to enter from other drainage basins. The distance along the drainage between the well locations and the divide is approximately 22 miles.

Geomatrix identified two underground storage tank locations within the recharge region. Both tanks are permanently out of use and have been removed from the ground. Assessments at the time of tank removal did not report evidence of any leaks, and the tanks are not listed in the DEQ leaking tank list. These sites are therefore unlikely to affect source water for the Stevensville PWS system.

An inactive fluorite mine is located in the upper Burnt Fork drainage in Section 25, Township 7 North Range 19 West. Other mines and prospects in the watershed include placer and underground mining operations. Commodities include barium, copper, and iron. Information found in the state databases does not suggest the potential for impacts to the proposed water supply from these mines.

A DEQ remediation response site is located outside of the inventory region but inside the recharge region. Approximately 20 gallons of a solution containing pentachlorophenol was released in 2003 at

2020 Middle Burnt Fork Road (approximately three miles upgradient of well TC-TW-1). Soil excavation and sampling were completed. The DEQ installed a groundwater monitoring well which showed no impacts over two sampling events. In a closure letter, the DEQ indicated that the release was not a threat to groundwater quality.

Land use in the recharge region is shown on Figure 6. Currently, the land proposed for the Anderson Well Field is largely used for pasture. Land cover within the upper watershed includes coniferous forest and rangeland. Tracts of hay pasture and agricultural cropland dominate the lower half of the drainage (NRIS 2007). Small portions of land consist of urban and residential development, although this type of land use is increasing in the Stevensville area. Land in the upper reaches of the recharge area is owned by the state of Montana and the U.S. Forest Service. Private individuals own much of the land in the lower Burnt Fork drainage.

Figure 7 is a septic system density map. Septic system density of most of the watershed (> 95%) was classified as low (< 50 per square mile) in 2000, and is likely still low. The proposed well field is upgradient of the Town of Stevensville sewer system. Small areas of medium and high septic system density occur between the subdivision and the town sewer system. These areas, however, are downgradient of the proposed well locations and therefore lie outside of the inventory and recharge regions. Small areas of medium septic system density occur on Mill Fork Creek, North Burnt Fork Creek, and the Bitterroot Irrigation District Canal. These areas are within the recharge region but are outside of the inventory region.

Roads and highways near the proposed water system expansion are shown on Figure 1. Middle Burnt Fork Road runs east to west along the northern boundary of the subdivision. Highway 269 (the Eastside Highway) is located approximately 1 mile to the north of the proposed well fields. U.S. Highway 93 runs north to south on the west side of the Bitterroot River. A railroad, located approximately ½ mile to the west of the proposed wells, is outside of the source-water protection regions.

## 5.0 SUSCEPTIBILITY

This section describes risks posed by potential contaminant sources to the proposed Stevensville PWS wells. The proximity of a potential contaminant source to the proposed PWS well sites, or the density of non-point sources, determines the threat of contamination. The hazard of each potential contaminant source and the existence of any barriers to contamination determine susceptibility. Barriers include natural or manufactured structures that decrease the likelihood of contaminants reaching the source aquifer at the location of the PWS wells.

Table 4 presents the hazard rating for each potential contaminant source. Using these ratings and the probable contaminant barriers listed in the table, a susceptibility rating was assigned (MDEQ 1999). The primary barriers most applicable to the potential contaminant sources are proper well construction and the series of fine-grained confining units (Appendix B). If completed in accordance with state construction standards, the wells will have low to moderate susceptibility to impacts from potential contaminant sources.

Septic system hazard is generally low based on septic system density. Ninety seven percent of land in the recharge region is associated with the town sewer system or has low septic system density. Three percent of the land has a medium septic system density. Although Middle Burnt Fork Road is located close to the proposed well locations, it is not a high-use route and has minimal truck traffic. Highway 93 is located to the west of the Bitterroot River, which represents a hydraulic divide. The Eastside Highway is located to the north and west of the proposed well fields, out of the source-water protection regions.

In terms of urban land use, about 85% of the inventory area has less than 20 people per square mile. Less than 15% of the land area has a population density of between 20 and 100 people per square mile. Population density is more than 100 people per square mile in approximately 1% of the recharge area. A moderate hazard was assigned for agricultural land usage, since approximately 30-40% of the land in the inventory region is used for irrigated agriculture.

**Table 4.** Hazard Potential and Susceptibility Rating for Proposed PWS Wells

| Potential Contaminant Source Category | Potential Contaminants | Description of Hazard | Hazard Rating | Probable Contaminant Barriers | Susceptibility Rating |
|---|---|---|---|---|---|
| Septic Systems | Pathogens and Nitrates | Leakage of sewage into groundwater | Low/city sewer (97%); Moderate (3%) | Well construction; proper maintenance of septic systems; confining units | Low |
| Roads | Petroleum products; Pesticides; Fertilizers; Hazardous Materials | Spills from vehicles; routine spraying; storm water runoff; infiltration to groundwater | Moderate | Well construction; emergency response plan; low road density; confining units | Low |
| Urban Land Use | Petroleum products; Pesticides; and Fertilizers | Storm water runoff (residential contaminants on ground surface to streams and rivers); infiltration to groundwater | Low to Moderate | Well construction; proper use of petroleum products, pesticides and fertilizers; confining units | Low |
| Cropped Agricultural Land Use | Herbicides, Pesticides, and Fertilizers | Storm water runoff; infiltration to groundwater | Moderate | Well construction; proper use of pesticides and fertilizers; confining units | Low |

The following are best management practices (BMPs) that could be implemented for the Stevensville PWS with respect to protecting groundwater in the area and minimizing the susceptibility of the proposed PWS wells to potential contaminant sources:

- Complete PWS wells according to administrative rules of Montana Board of Water Well Contractors.
- Sample PWS wells on a regular basis.
- Avoid construction of storm-water sumps upgradient of PWS wells.
- Report any suspected improper storage or use of chemicals and petroleum products in the vicinity to MDEQ or USEPA.
- Maintain land within the well control zones as open space.
- Connect the subdivision to the municipal sewer system.
- Support the county emergency response plan for handling spills along roads.
- Encourage and support efforts to educate landowners in the area on the proper application and storage of pesticides, herbicides, and fertilizers, and implementing best management practices.
- Encourage and support efforts to educate the public on proper handling and disposal of industrial and household hazardous wastes and recycling.
- Support efforts by agencies to monitor groundwater in the area.

## 6.0 LIMITATIONS

Identification of potential contaminant sources is limited to those regulated for this class of PWS and is generally based on readily available information and reports. Unregulated activities or unreported contaminant releases are not considered in this report. The delineation method utilizes simplifying assumptions that may not fully represent complex groundwater-flow systems, but is intended to be conservative and protective of public health.

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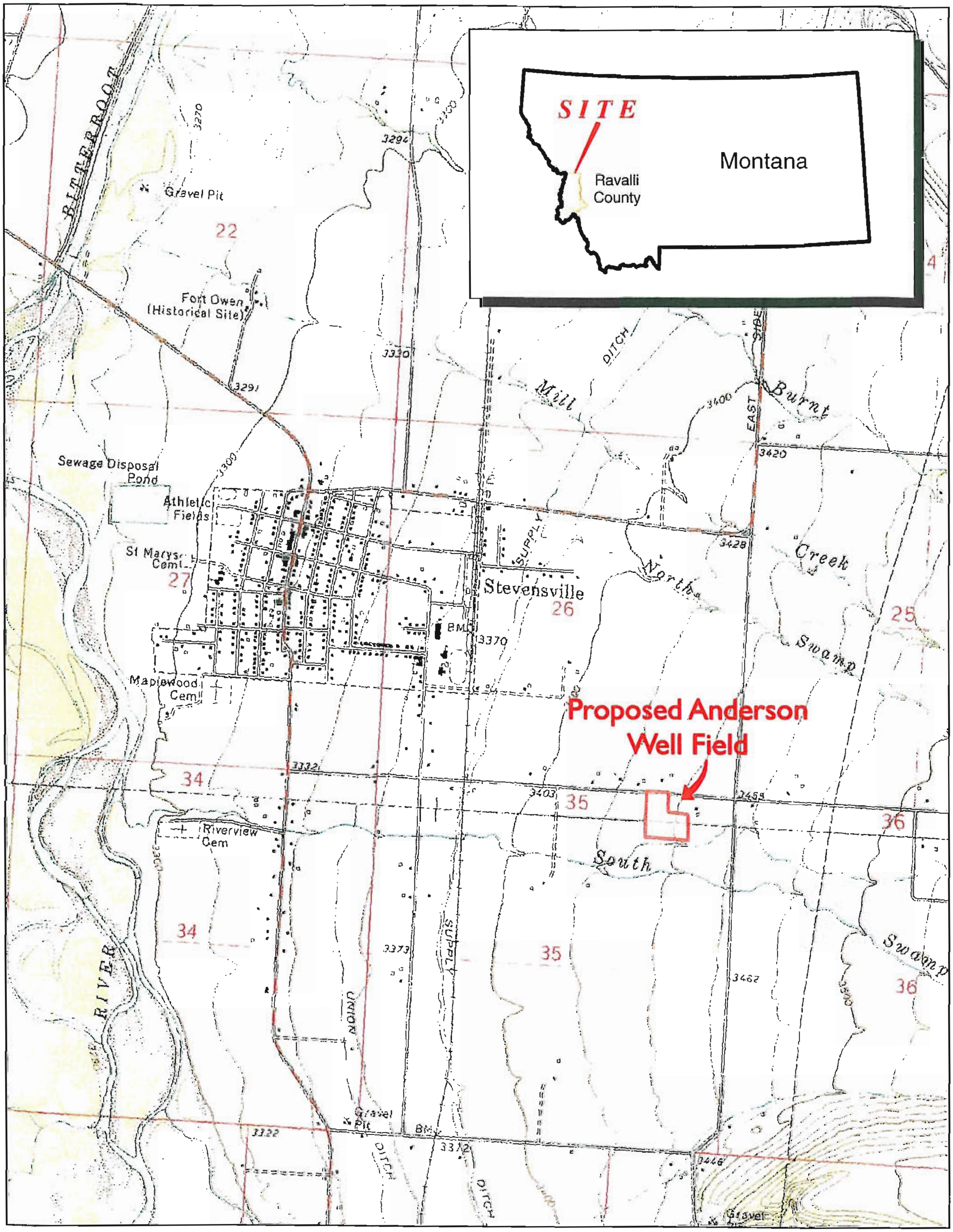
# Figures

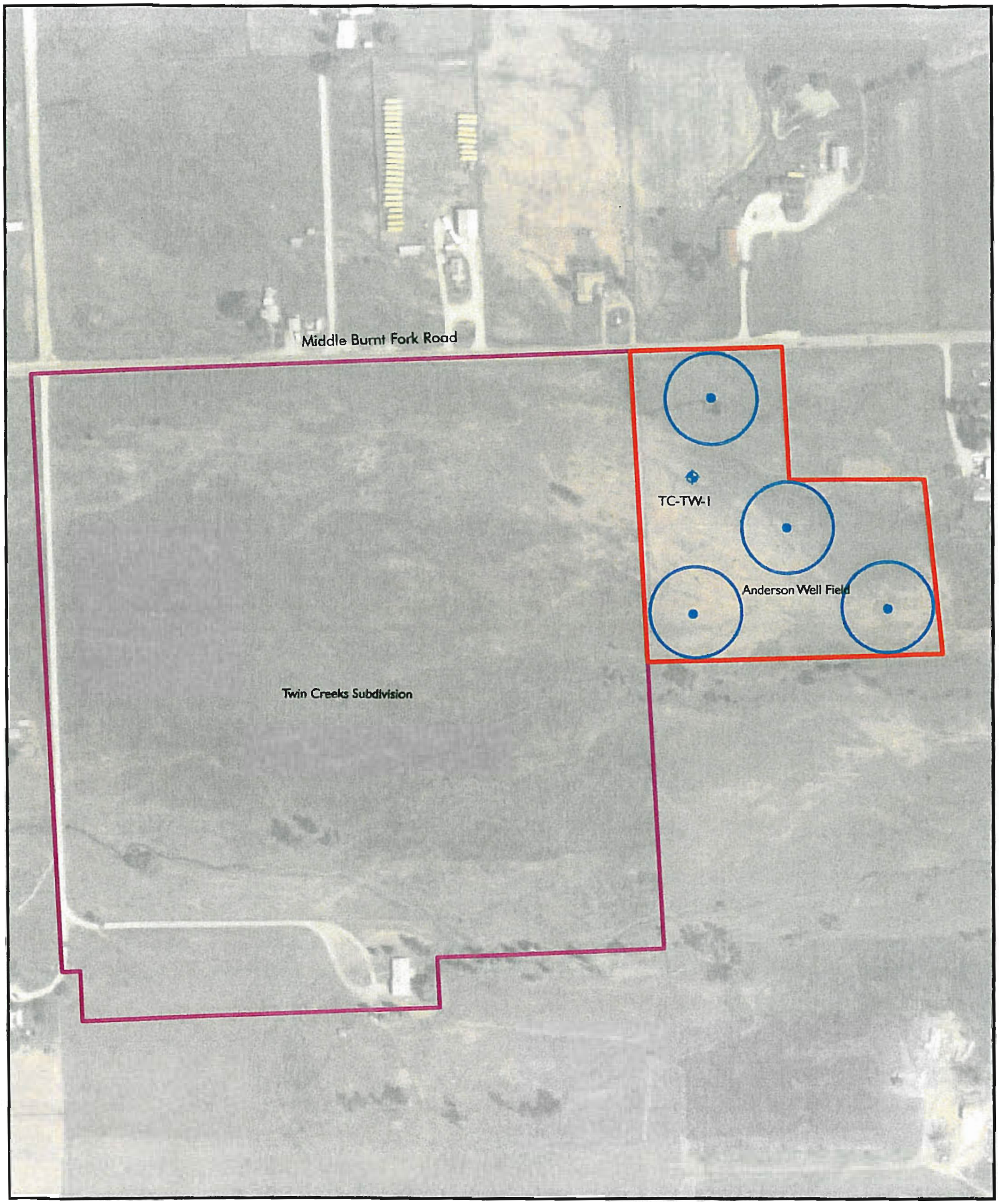



Source: USGS 7.5' Stevensville and Bing Quads

N
Feet
0 1,000 2,000

Geomatrix

Location Map
Stevensville PWS
Stevensville, Montana
FIGURE 1




Source: NAIP 2005, Ravalli County

N

Feet

0 150 300

Geomatrix

Proposed PWS Well

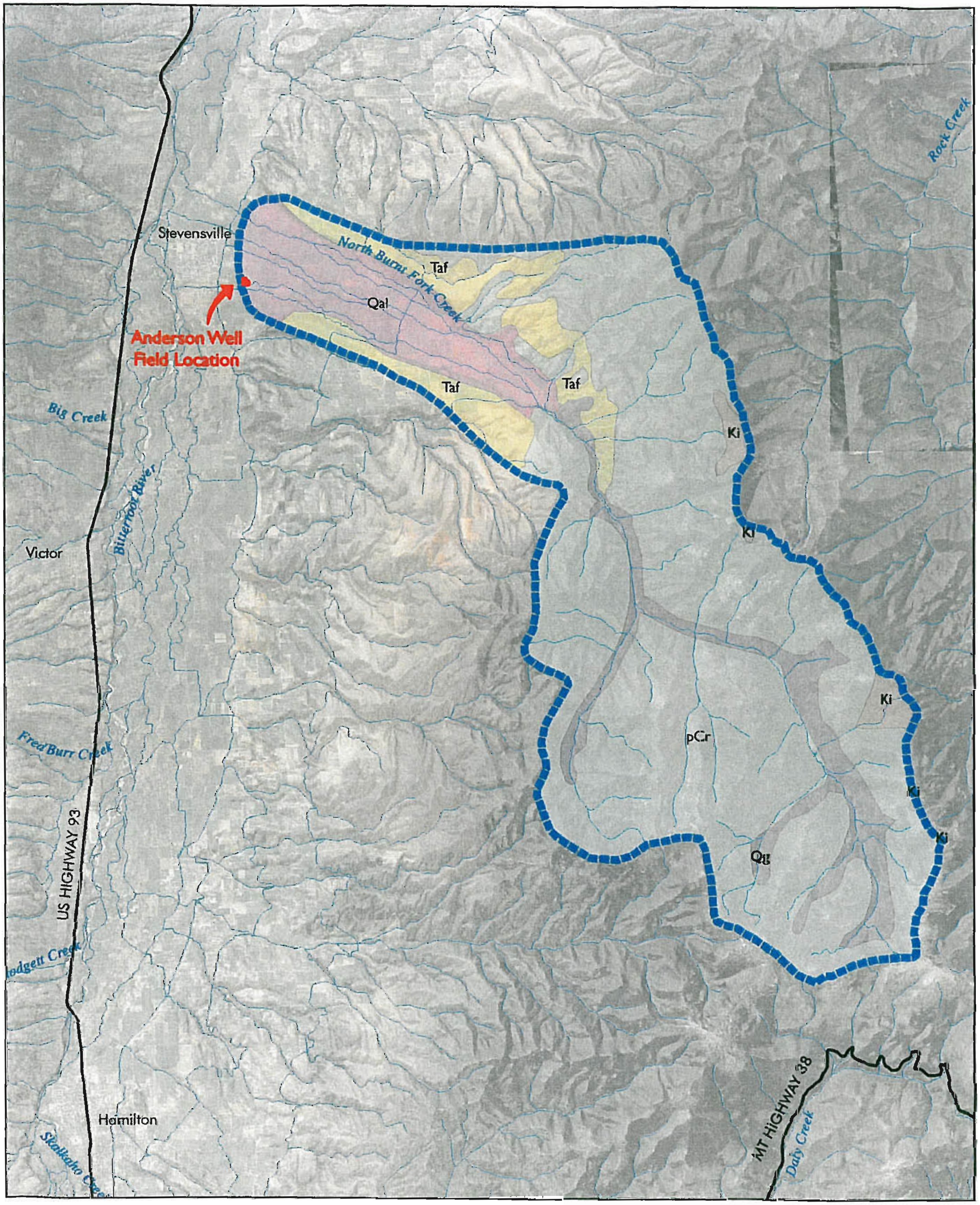
Test Well

100 ft Control Zone

Twin Creeks Subdivision

Approximate Well Field Boundary

**Proposed PWS Well Locations**
**Stevensville PWS**
**Stevensville, Montana**
**FIGURE 2**




Source: NRIS, 1:500,000 U.S. Geological Survey

N

Feet

0 7,500 15,000

Geomatrix

Highway

River/Stream

Approximate Well Field Boundary

Groundwater Recharge Area

Geology

Ki - Cretaceous Intrusive Rocks

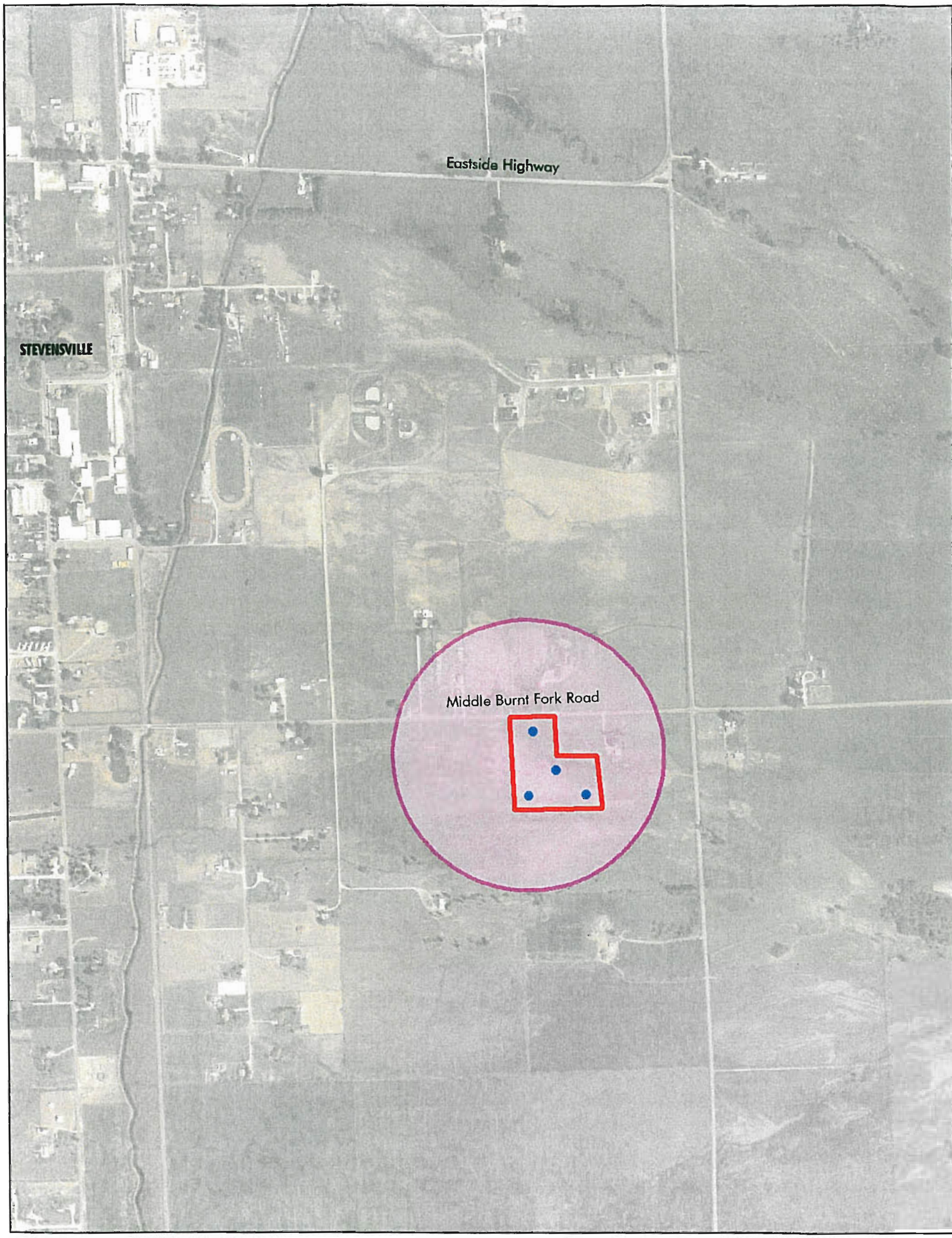
Qal - Undivided PreCambrian Belt Rocks

Qg - Quaternary Gravel (alluvium)

Taf - Tertiary Alluvial Fan

pCr - Undivided PreCambrian Belt Rocks

**Surficial Geology**
**Stevensville PWS**
**Stevensville, Montana**
**FIGURE 3**




Source: USGS 7.5' Stevensville and Bing Quads

Feet
0 500 1,000

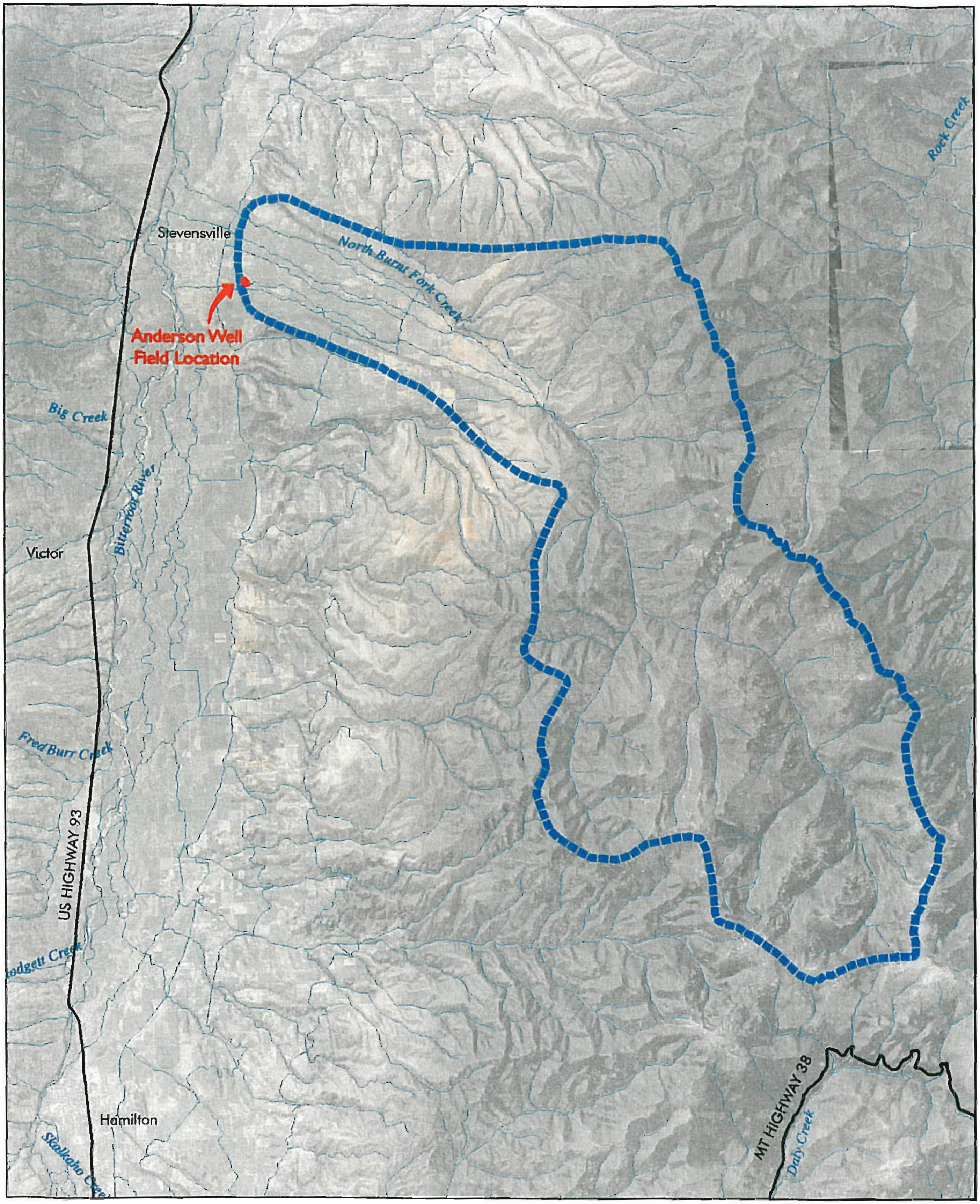
Geomatrix

Proposed PWS Well

Approximate Well Field Boundary

Inventory Region

**Inventory Region**
**Stevensville PWS**
**Stevensville, Montana**
**FIGURE 4**




Source: NRIS, 1:500,000 U.S. Geological Survey

Feet

0 7,500 15,000

Geomatrix

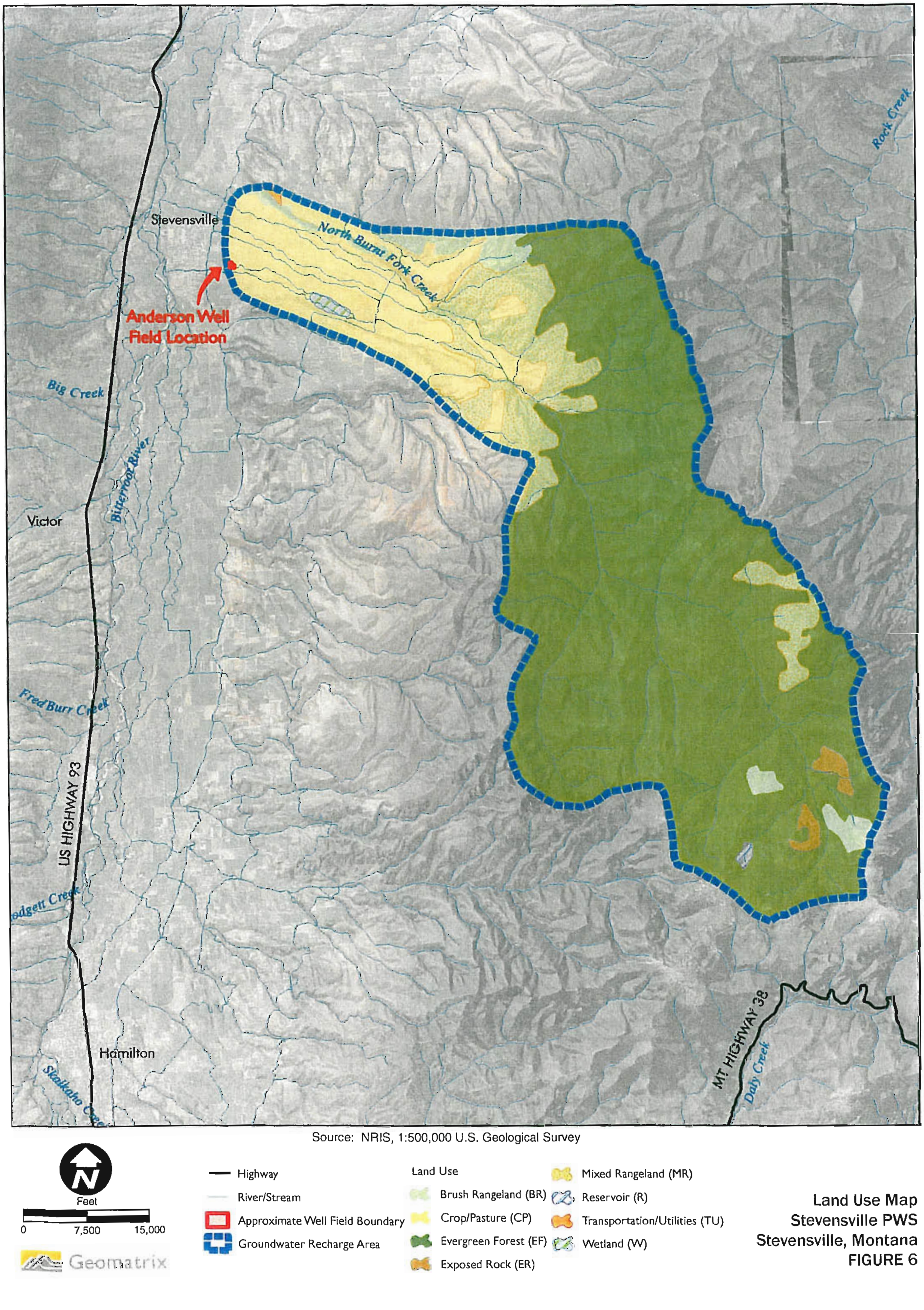
Highway

River/Stream

Approximate Well Field Boundary

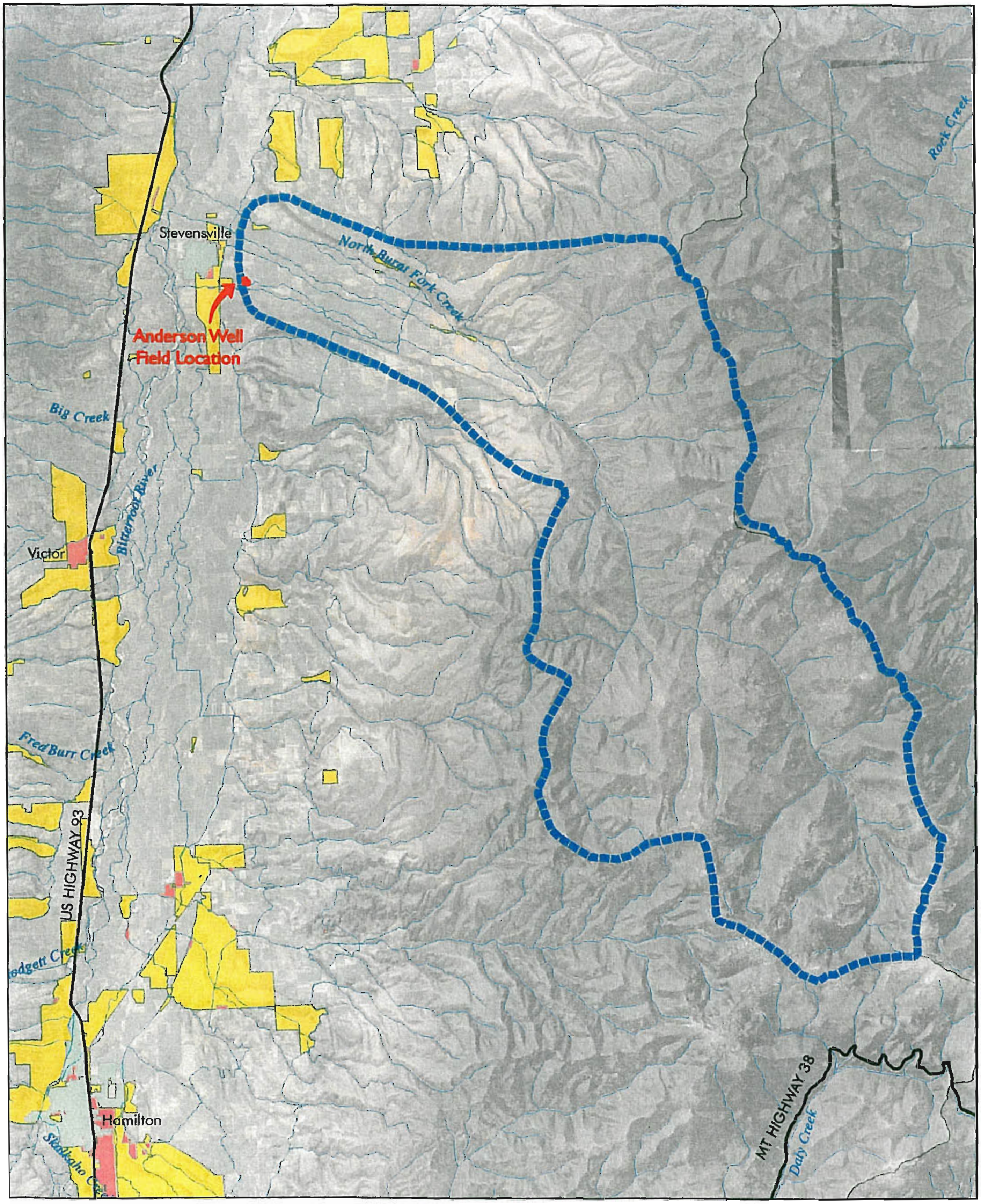
Groundwater Recharge Area

**Recharge/Inventory Region**
**Stevensville PWS**
**Stevensville, Montana**
**FIGURE 5**




Source: NRIS, 1:500,000 U.S. Geological Survey

**Land Use Map**
**Stevensville PWS**
**Stevensville, Montana**
**FIGURE 6**




Source: NRIS, 1:500,000 U.S. Geological Survey

N
Feet
0 7,500 15,000

Geomatrix

Highway
River/Stream
Approximate Well Field Boundary
Groundwater Recharge Area

Septic Density
Low
Medium
High
City Sewer

**Septic Density Map**
**Stevensville PWS**
**Stevensville, Montana**
**FIGURE 7**

# Appendix A

PCI Well Field Feasibility Analysis

# Well Field Feasibility Report and Analysis

Town of Stevensville

## Area Overview

This report looks at the feasibility of three sites for a proposed well field for the Town of Stevensville to use to augment their existing water supplies. These sites are generally located in T9N, R20W NW ¼ Section 34 (Area 1), NE ¼ Section 35 (Area 2), NE ¼ Section 36 (Area 3). See attached USGS map for general location of each area. The Town of Stevensville is attempting to add a total developed capacity of approximately 2100 gpm to their public water supply system (PWS).

A Source Water Delineation and Assessment Report (SWDAR) was done for this PWS in 2000 and looked at alternative water sources for this system including the sites assessed in this report. There are currently three production wells serving Stevensville and the infiltration galley near Area 3. In addition Stevensville has a test well drilled in 1990 and a well drilled in the 1960's near the infiltration galley that was abandoned.

## Geology

The geology of this area is primarily younger alluvial outwash terrace and fan complex deposits overlying older alluvial fan deposits and older river sand and gravel deposits of Tertiary age (Lonn and Sears, 2001). These younger alluvial outwash and fan deposits are typically described as productive aquifers. Recharge to these deposits is from the Sapphire Mountains to the east. The general groundwater flow direction is towards the Bitterroot River approximately in the east-northeast direction. SWDAR Figure 2-5 shows existing well delineation areas.

## Area 1

This area is located closest to the Bitterroot River and west of the Eastside Highway. Nearby well logs indicated they are completed in the modern river sand and gravel (Qal) deposits or upper part of younger alluvial fan deposits (Qafy). Typically nearby wells have no clay layers or only one limited clay layer above the location the well is completed or screened (Well logs marked A1).

Area 1 is located downgradient of the Eastside Highway, the Railroad and a fast growing developed area that included mixed commercial and light industrial uses. There are also agricultural land uses upgradient of Area 1.

## Area 2

This area is located south of Middle Burnt Fork road, east of the railroad tracks and west of Logan Road. Nearby well show completion in the Qafy or older river sand and gravel deposits (Tbg) or older alluvial fan deposits (Taf). These aquifers typically consist of interlaced sand/gravel layers with finer grained materials such as clay. The clay layers act as locally limited confining layer to the underlying water bearing stratums and thus these aquifers can typically be considered semi-confined.

The typical land uses upgradient of Area 2 include agricultural uses and low density residential.

Area 3

This area is located just west of the existing Stevensville Reservoir and south of Middle Burnt Fork Road. Nearby wells show completion in Qafy or older Tbg or Taf deposits. The Town of Stevensville drilled a deep well nearby in the early sixties to 510ft. The well did not produce enough water and was abandoned.

The typical land uses upgradient of Area 3 include agricultural uses and low density residential uses.

Conclusions

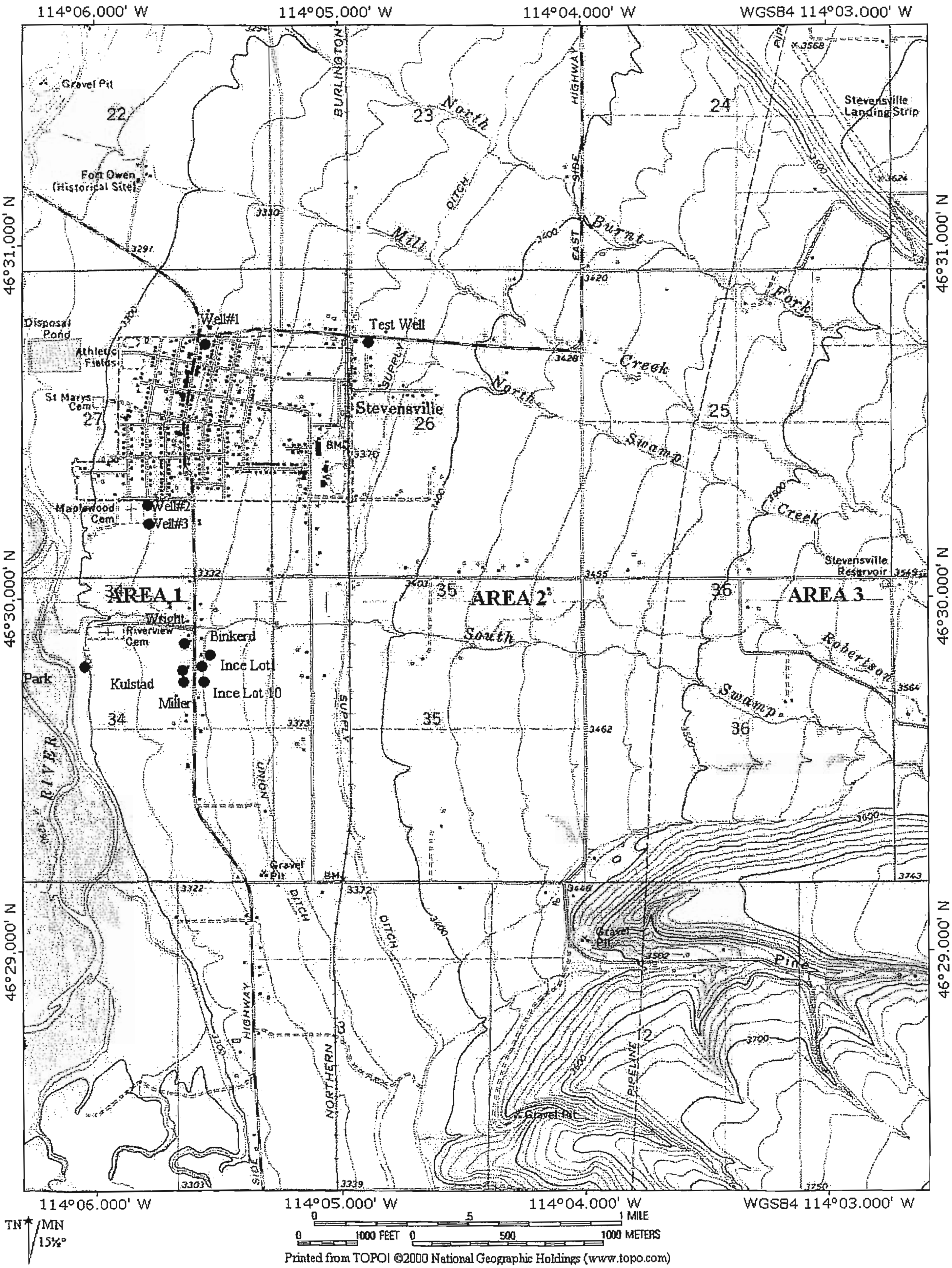
The optimum location for a well field capable of producing the desired capacity is Area 1. However, this location is downgradient of the Eastside Highway, the Railroad and a fast growing developed area that included mixed commercial and light industrial uses. The potential for increased susceptibility of this source to moderate or high hazard levels exists for this location due to upgradient uses and lower level of protection from clay layers. Area 3 would provide the highest potential source water protection due to the limited potential contamination sources up gradient of the site. However, previous attempts to drill high yield wells in this location have not been successful. Therefore there is an increased chance that Area 3 would not supply the needed quantities of water.

Therefore the optimum location for a well field capable of producing the desired capacity balanced with an increased level of protection for the projected source water is Area 2. It is recommended that a test well be drilled at this location to assess whether the desired quantity and quality of water is available at this site prior to drilling production wells.

References

Lonn, J.D., and Sears, J.W., 2001. Surficial geologic map of the Bitterroot valley, Montana: Montana Bureau of Mines Open-File Report 441a, 441b, 441c

Western Groundwater Services. Sept. 2001. Source Water Protection Plan: Town of Darby (PWS #315), City of Hamilton (PWS#1709), Town of Stevensville (PWS# 665).

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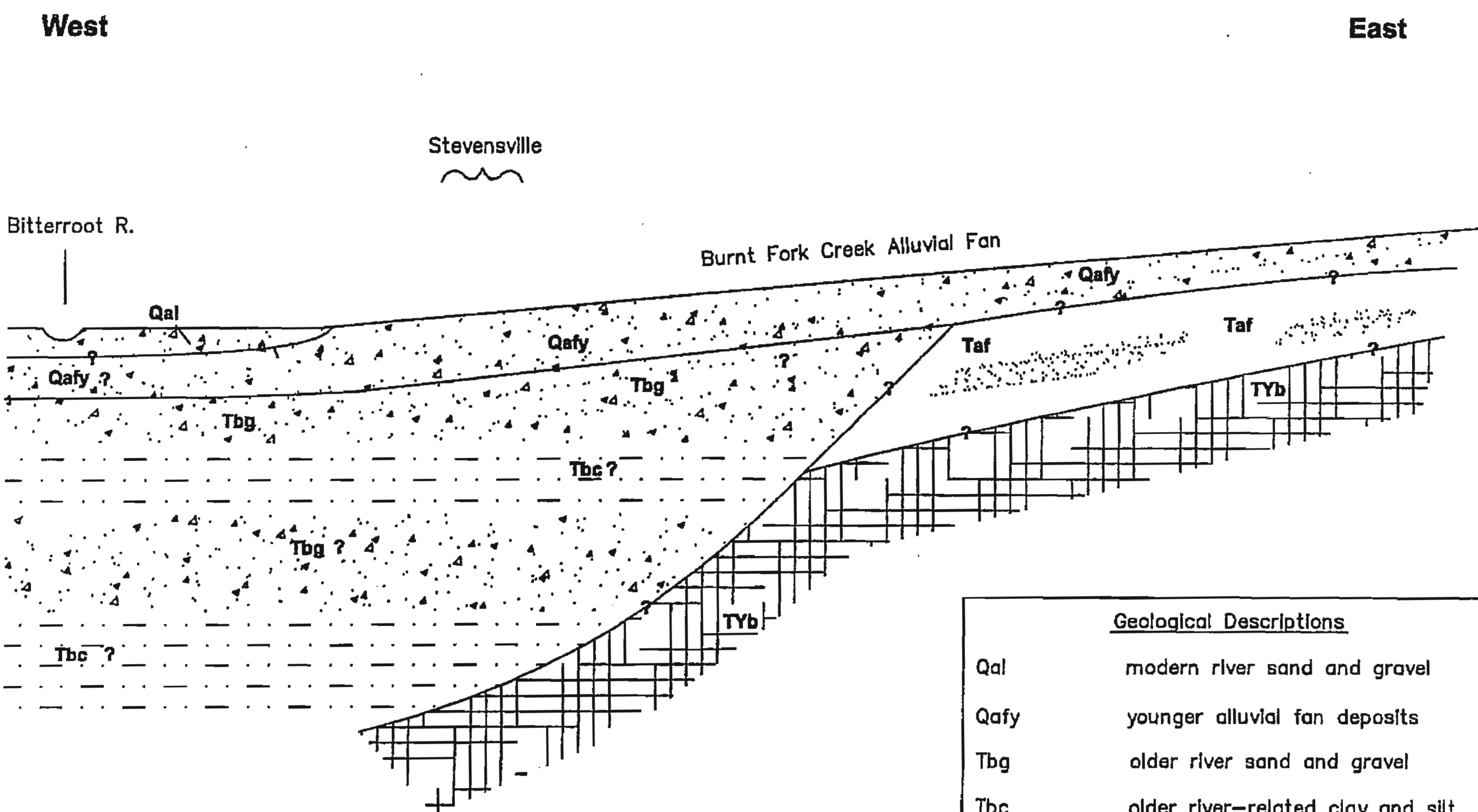



| Geological Descriptions | |
|---|---|
| Qal | modern river sand and gravel |
| Qafy | younger alluvial fan deposits |
| Tbg | older river sand and gravel |
| Tbc | older river—related clay and silt |
| Taf | older alluvial fan deposits |
| TYb | bedrock formations |

**Figure 2-4a**

**Stevensville Area Schematic Geologic Cross Section**

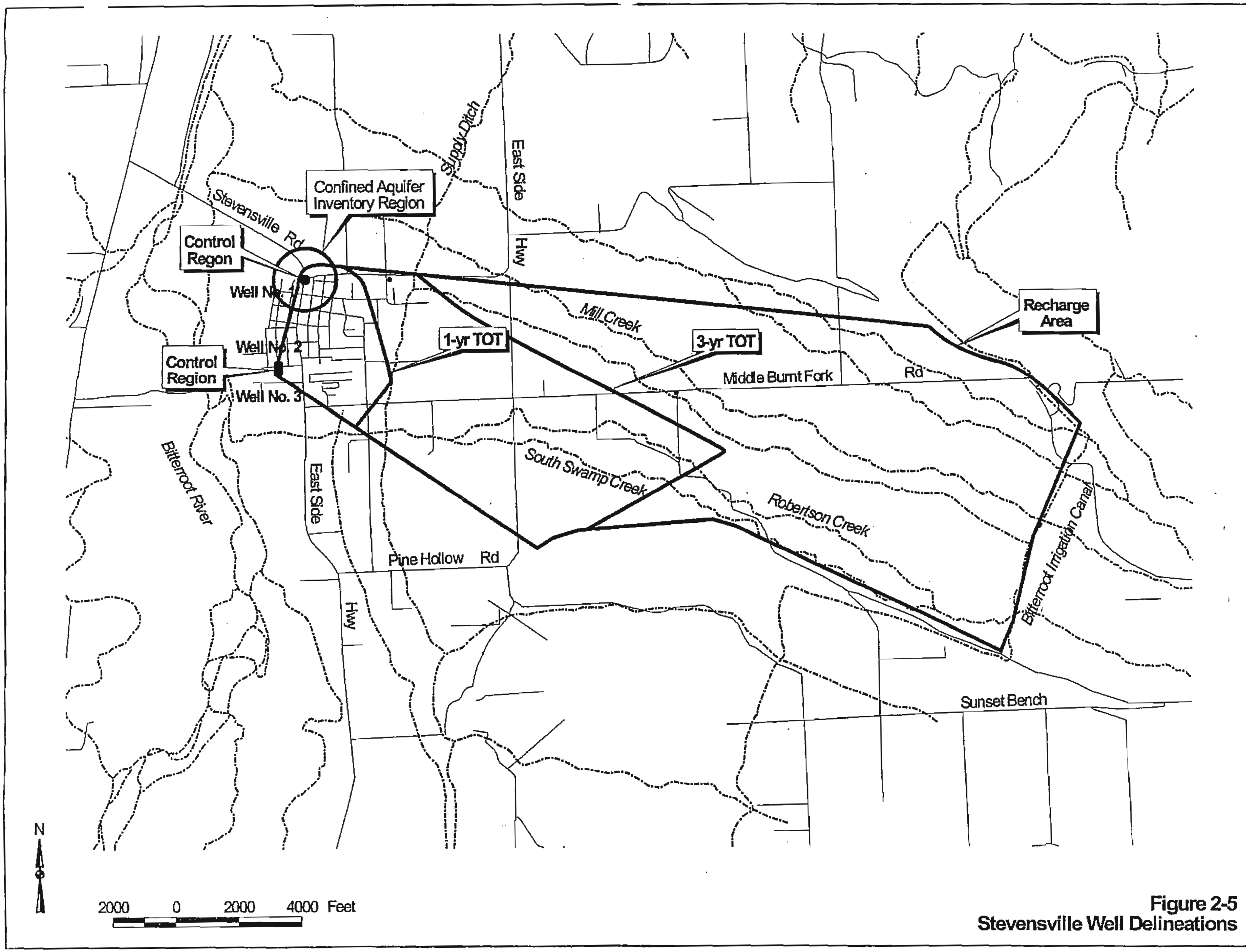



Figure 2-5
Stevensville Well Delineations

Western Groundwater Services

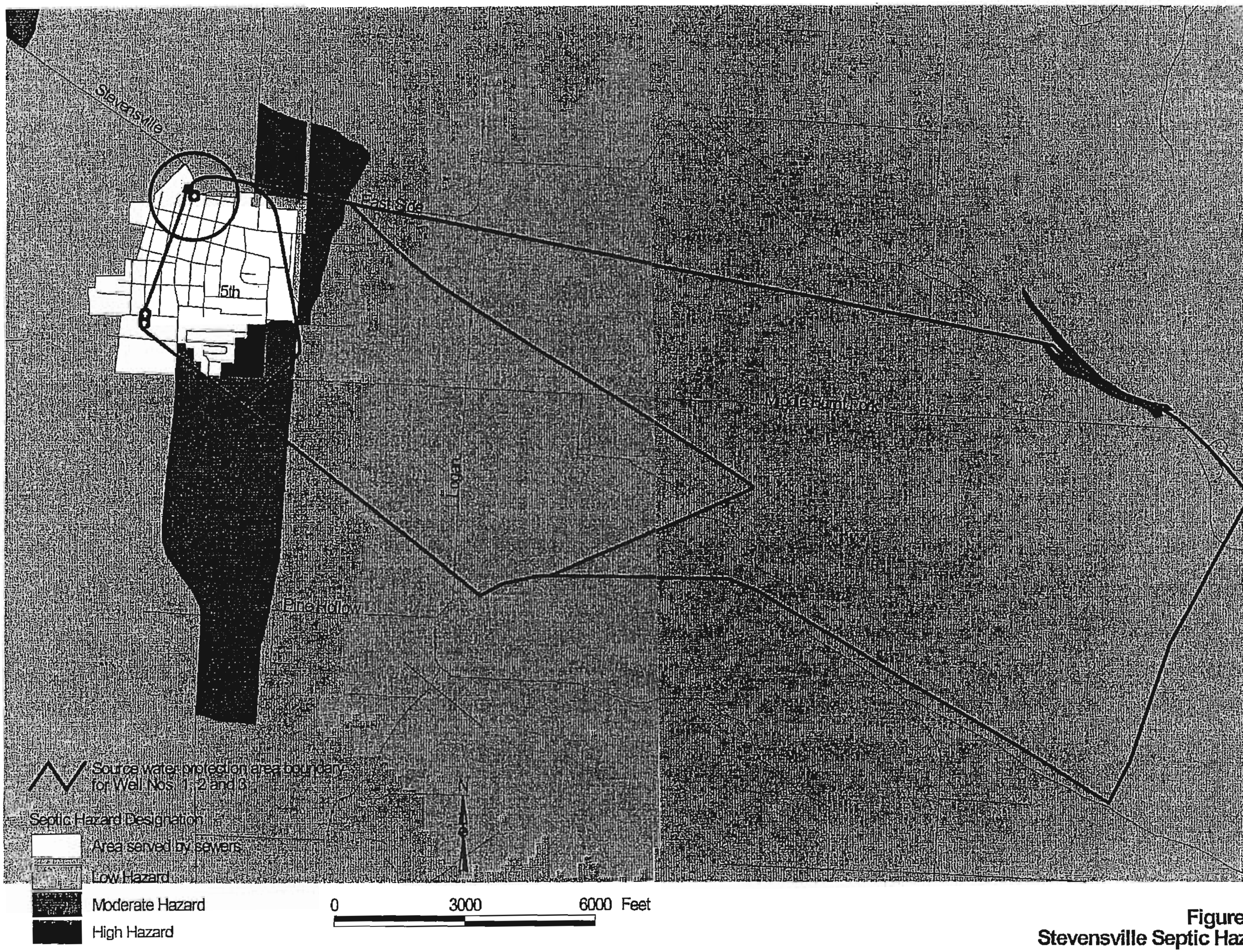



Figure 3-3
Stevensville Septic Hazard

Western Groundwater Services

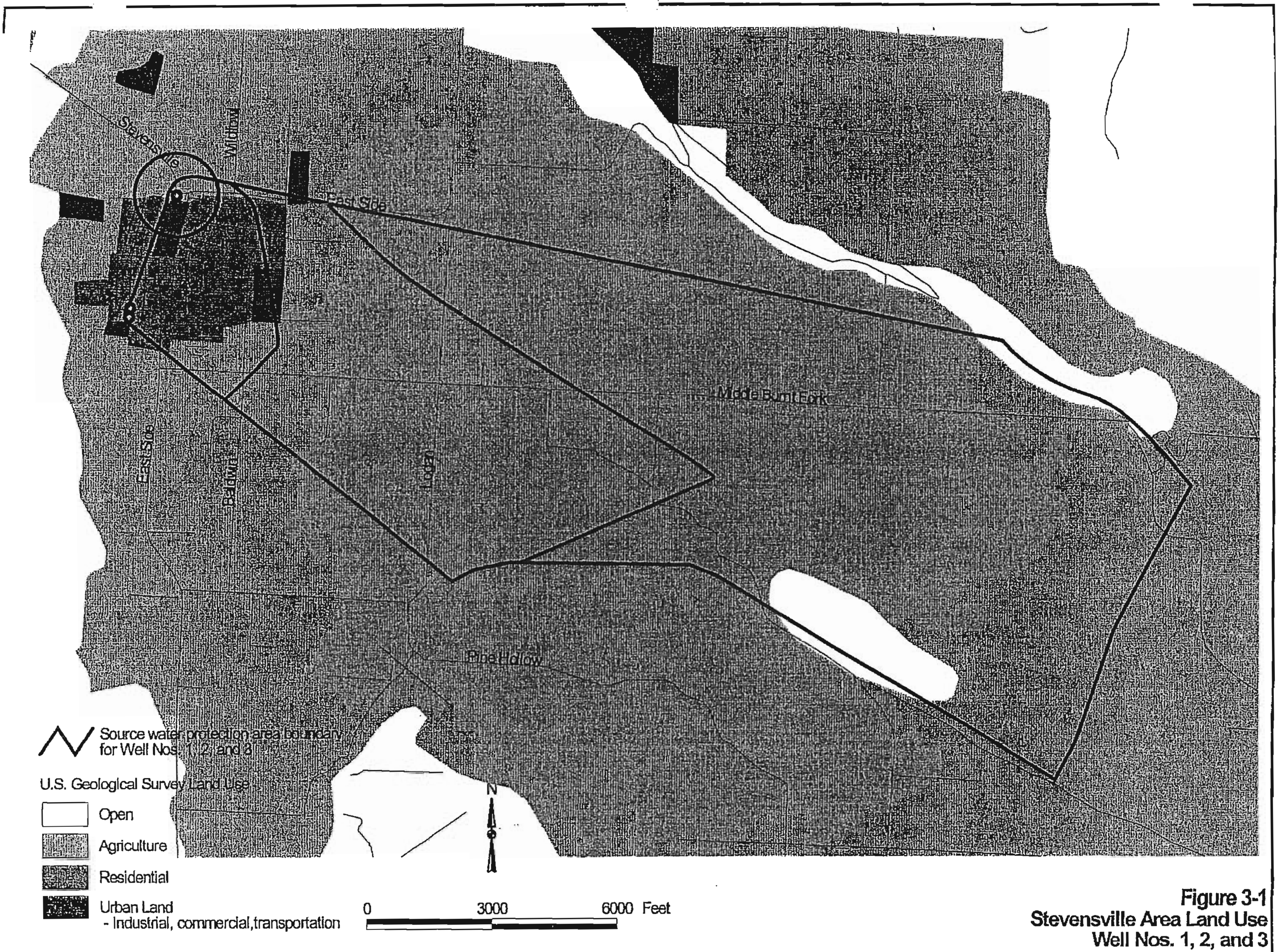
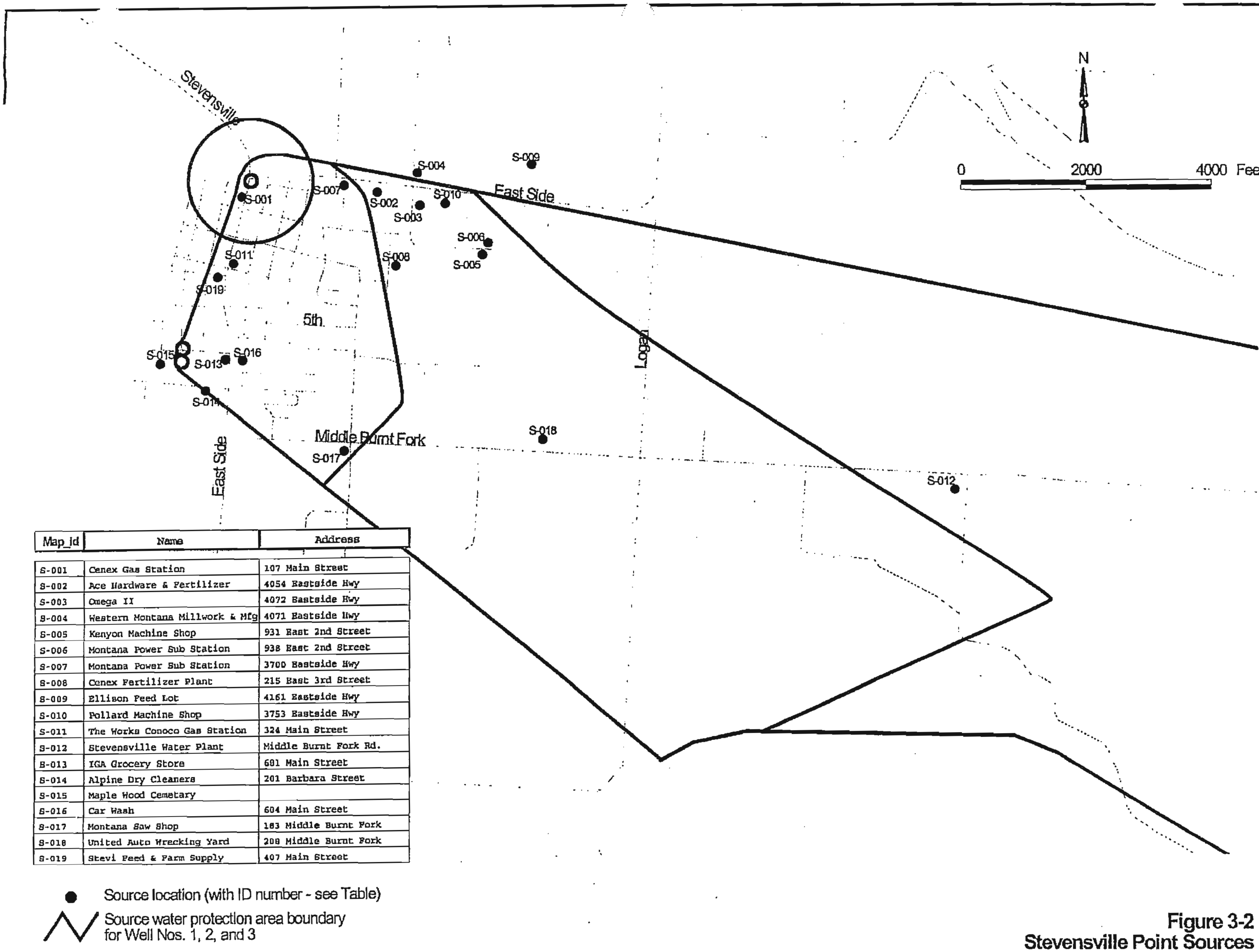



**Figure 3-1**
**Stevensville Area Land Use**
**Well Nos. 1, 2, and 3**




| Map_id | Name | Address |
|---|---|---|
| S-001 | Cenex Gas Station | 107 Main Street |
| S-002 | Ace Hardware & Fertilizer | 4054 Eastside Hwy |
| S-003 | Omega II | 4072 Eastside Hwy |
| S-004 | Western Montana Millwork & Mfg | 4071 Eastside Hwy |
| S-005 | Kenyon Machine Shop | 931 East 2nd Street |
| S-006 | Montana Power Sub Station | 938 East 2nd Street |
| S-007 | Montana Power Sub Station | 3700 Eastside Hwy |
| S-008 | Cenex Fertilizer Plant | 215 East 3rd Street |
| S-009 | Ellison Feed Lot | 4161 Eastside Hwy |
| S-010 | Pollard Machine Shop | 3753 Eastside Hwy |
| S-011 | The Works Conoco Gas Station | 324 Main Street |
| S-012 | Stevensville Water Plant | Middle Burnt Fork Rd. |
| S-013 | IGA Grocery Store | 601 Main Street |
| S-014 | Alpine Dry Cleaners | 201 Barbara Street |
| S-015 | Maple Wood Cemetary | |
| S-016 | Car Wash | 604 Main Street |
| S-017 | Montana Saw Shop | 183 Middle Burnt Fork |
| S-018 | United Auto Wrecking Yard | 208 Middle Burnt Fork |
| S-019 | Stevi Feed & Farm Supply | 407 Main Street |

**Figure 3-2**
**Stevensville Point Sources**

DUPLICATE

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

Top of Ground well 1

(Elev. above sea level.......................)

# Notice of Completion of Groundwater Appropriation by Means of Well

(Under Chapter 237, Montana Session Laws, 1961)

117' to 130' Clay & sand.
130 to 131' gravel & sand
131' to 140' Clay & sand
140 to 141' Gravel, sand some water
141' to 150' Clay & sand
15[illegible] to 164' Sand, some clay
164' to 174' Sand, small heaveing gravel
174' to 178' Hard clay & grit.
178' to 190' Brown clay with grit
190' to 219' Granite, some clay
219' to 231' Clay Mixed with gravel
231' to 239' Gravel some clay
239' to 275' Clay with grit
275' to 284' granite
284' to 305' Clay with grit
305' to 314' granite
314' to 319 clay
319' to 324' Granite
324' to 330' Sand, small gravel
330' to 344' Sand
344' to 347' Peat
347' to 350' Clay
350' to 357' Clay
357' to 370' Sand with gravel ( perforated) Water
370' to 380' Clay
380' to 389' Gravel & sand
389' to 412' Clay
412' to 413' Granite

Owner City of Stevensville Address Stevensville, Mont

Driller Glenn Camp 705 Alder Address Missoula, Mont

Date of Notice of Appropriation of Groundwater.........

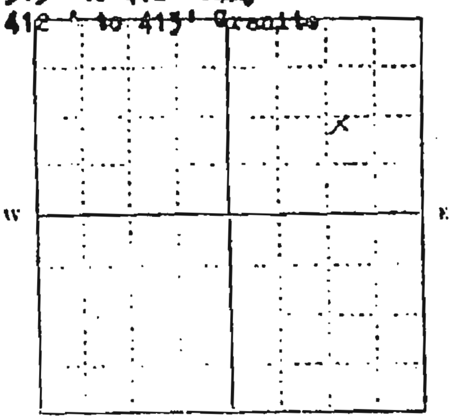
Date well started 12/29/56 Date Completed 3/1/57

Type of well Drilled (dug, driven, bored or drilled) Equipment Used Churn drill (Churn, drill, rotary or other)

Water Use: Domestic ☐ Municipal ☐ Other ☐ Irrigation ☐ Industrial ☐ Drainage ☐ Stock ☐ City

Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which water rises in the well.

| Size of Drilled Hole | Size and Weight of Casing | From (Feet) | To (Feet) | PERFORATIONS Kind Size | From (Feet) | To (Feet) |
|---|---|---|---|---|---|---|
| 10" | 10" 33 lbs ... foot | 1' above G.L. -0 | to 455'-4" | 3/8 by 1" 16 holes to the foot | 362 | 370 |



SE¼NE¼ Sec. 27 T. 9 R. 20

Indicate location of well and place of use, if possible. Each small square represents 10 acres.

413' to 416' clay

Show exact depth of bottom.

416' to 417' granite
4[illegible] to 427' Clay

449' to 453' Granite
453 to 460' Clay & sand
460' we stopped drilling

Static Water Level for non-flowing Well 30 from G.L. feet.

Shut-in Pressure for Flowing Well.........

Pumping Water Level 100 feet at 400 gal. per minute.

Discharge in gal. per min. of flowing well.........

How Tested Compressor & Turbine Pump Length of Test 12 hours with Compressor

Remarks: (Gravel packing, cementing, packers, type of shutoff, location of place of use of groundwater if not at well, and any other similar pertinent information, including number of acres irrigated, if used for irrigation).

None

Dri[illegible]

City Well #1

W 2

ile No. ..............................

RIGINAL

Well #2

T .............. R ..............

Ravalli County

STATE OF MONTANA
ADMINISTRATOR OF GROUNDWATER CODE
OFFICE OF STATE ENGINEER

# Notice of Completion of Groundwater Appropriation by Means of Well

(Under Chapter 237, Montana Session Laws, 1961)

Top of Ground

(Elev. above sea level..................)

1 ft.-Topsoil

10 ft.-Sand, Gravel

29 ft.-Sand Gravel
Large Glacial
Boulders, Tight
Pressed

56 ft.-Sand Gravel
Loose, Water
Bearing

Show exact depth of bottom

Owner City of Stevensville Address Stevensville, Mont.

C. F. Wroble

Driller Ravalli Drilling Co. Address Victor, Montana

Date of Notice of Appropriation of Groundwater ..............................

Date well started Feb. 8, 1968 Date Completed Feb. 13, 1968

Type of well Drilled (dug, driven, bored or drilled) Equipment Used Churn (Churn, drill, rotary or other)

Water Use: Domestic ( ) Municipal (x) Stock ( ) Irrigation ( ) Industrial ( ) Drainage ( ) Other ( )

← Indicate on the diagram the character and thickness of the different strata met with in drilling, such as soil, clay, shale, gravel, rock or sand, etc. Show depth at which water is encountered, thickness and character of water-bearing strata and height to which the water rises in the well.

| Size of Drilled Hole | Size and Weight of Casing | From (Feet) | To (Feet) | PERFORATIONS Kind Size | From (Feet) | To (Feet) |
|---|---|---|---|---|---|---|
| 8" | 8"-32 lbs. per ft. | | | 1/4x4 | 36 | 56 |

N

W E

S

......1/4...... Sec....... T...... R......

Indicate location of well and place of use, if possible. Each small square represents 10 acres.

Static Water Level for non-flowing Well 30 feet.

Shut-in Pressure for Flowing Well ..............................

Pumping Water Level 36 feet at 100 gal. per minute.

Discharge in gal., per min. of flowing well ..............................

How Tested Baled Length of Test 3 hrs.

Remarks: (Gravel packing, cementing, packers, type of shutoff, Location of place of use of groundwater if not at well, and any other similar pertinent information, including number of acres irrigated, if used for irrigation) Well to be pumped to capacity at the raising of the water table.

..............................
Driller's Licens

C. F. W.

Driller's Signa

City Well #2

STATE OF MONTANA
Department of Natural Resources and Conservation

Well #3 WELL LOG REPORT

...requires that this form be filed by the water well driller on ... beginning and after July 1, 1971 within sixty (60) days after completion ...

Name: City of Stevensville Address: Stevensville

LOCATION: County Ravalli : ¼ ¼ ¼, Sec. ___, Twp. ___

USE: ___ Domestic ___ Stock X Municipal ___ Industrial ___ Lawn ...
___ Irrigation ___ Other (if other, specify) ___

DRILLED: X Cable ___ Bored
___ Forward Rotary ___ Reverse Rotary
___ Jetted ___ Other (if other, specify)

WELL CONSTRUCTION:
Diameter of hole 8 inches. Depth 75 ft.
Casing: X Steel ___ Plastic ___ Concrete
___ Threaded X Welded ___ Other (if other, specify)

Weight: Dia.: From: To:
2? lb/ft. 8 inches 0 feet 75 feet
___ lb/ft. ___ inches ___ feet ___ feet
___ lb/ft. ___ inches ___ feet ___ feet

Was perforated pipe used? X Yes ___ No
Length of pipe perforated 30 feet
Was casing left open end? X Yes ___ No
Was a well screen installed? ___ Yes X No
Material ___ Dia. ___ inches
(stainless steel, bronze, etc.)
Perforation type: X slots ___ holes
Size 3/8 set from 40 feet to 50 feet
Size 3" set from 55 feet to 75 feet
Size ___ set from ___ feet to ___ feet
Was a packer or seal used? ___ Yes X No
If so, what material ___
Well type: ___ Straight screen X Graveled
Was the well grouted? X Yes ___ No
To what depth? 35 feet
Material used in grouting Natural
Well head completion: Pitless adapter ___
Above grade X Other ___
(if other, specify)
Was well disinfected? ___ Yes X No

LEVEL:
Static water level 28' ft. below land surface
Flowing: closed-in pressure ___ psi
___ through ___ inch pipe
Controlled by: ___ Valve ___ Reducers
Other, specify ___

TEST DATA: ___ Pump X Bailer ___ Other
(if other, specify)
Level below land surface:
After ___ hrs. pumping ___ gpm

8. WELL LOG:

| Depth (ft.) From | To | Formation |
|---|---|---|
| 0 | 3 | Top Soil |
| 3 | 26 | Sand + Gravel - Boulders - Brown |
| 26 | 57 | Sand + Gravel Water Bearing Brown |
| 57 | 60 | Clay + Gravel |
| 60 | 75 | Sand + Gravel Water Bearing Brown |
| | | 3 ft. ... |

(Use separate sheet if necessary)

9. DATE STARTED: 1-29-76

10. DATE COMPLETED: 2-6-76

11. WAS WELL PLUGGED OR ABANDONED? ___ Yes X No
If so, how ___

12. DRILLER'S CERTIFICATION:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Ravalli Drilling 62
Driller's or Firm Name License No.

...ville Mt.

2/7/76

City Well #3

Form No. 603 (R 2-89)

# WELL LOG REPORT

File No. ______

*State law requires that the Bureau's copy be filed by the water well driller within 60 days after completion of the well.*

**1. WELL OWNER**
Name: TOWN OF STEVENSVILLE

**2. CURRENT MAILING ADDRESS**
P.O. Box 37
Stevensville, MT 59870

**3. WELL LOCATION**
SE ¼ NW ¼ ______ ¼ Section 26
Township 9 N N/S Range 20 W E/W County Ravalli
Gov't Lot ______, or Lot ______, Block ______
Subdivision Name ______
Tract Number ______

**4. PROPOSED USE:** Domestic ☐ Stock ☐ Irrigation ☐
Other ☒ specify Municipal Test Well

**5. TYPE OF WORK:**
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☒
Reconditioned ☐ Rotary ☒ Jetted ☐

**6. DIMENSIONS:** Diameter of Hole
Dia. 6" in. from g.l. ft. to 540 ft.
Dia. ______ in. from ______ ft. to ______ ft.
Dia. ______ in. from ______ ft. to ______ ft.

**7. CONSTRUCTION DETAILS:**
Casing; Steel Dia. 6"ID from +2 ft. to 552 ft.
Threaded ☐ Welded ☒ Dia. ______ from ______ ft. to ______ ft.
Type ______ Wall Thickness .250
Casing; Plastic Dia. ______ from ______ ft. to ______ ft.
Weight ______ Dia. ______ from ______ ft. to ______ ft.

**PERFORATIONS:** Yes ☒ No ☐
Type of perforator used Pulldown
Size of perforations 7/16 in. by 3/4 in.
______ perforations from 310 ft. to 332 ft.
______ perforations from 391 ft. to 394 ft.
______ perforations from ______ ft. to ______ ft.

**SCREENS:** Yes ☐ No ☒
Manufacturer's Name ______
Type ______ Model No. ______
Dia. ______ Slot size ______ from ______ ft. to ______ ft.
Dia. ______ Slot size ______ from ______ ft. to ______ ft.

**GRAVEL PACKED:** Yes ☐ No ☒ Size of gravel ______
Gravel placed from ______ ft. to ______ ft.

**GROUTED:** To what depth? 20 ft.
Material used in grouting bentonite surface seal

**8. WELL HEAD COMPLETION:**
Pitless Adapter ☐ Yes ☐ No

**9. PUMP** (if installed)
Manufacturer's name ______
Type ______ Model No. ______ HP. ______

**10. WELL TEST DATA**
**The information requested in this section is required for all wells. All depth measurements shall be from the top of the well casing.**
All wells under 100 gpm must be tested for a minimum of one hour and provide the following information:

a) Air ______ Pump x Bailer ______
b) Static water level immediately before testing 85 ft. If flowing; closed-in pressure ______ psi. ______ gpm.
Flow controlled by: ______ valve, ______ reducers, ______ other, (specify) ______
c) Depth at which pump is set for test 130
d) The pumping rate: 218 gpm.
e) Pumping water level 130 ft. at 6 hrs. after pumping began.
f) Duration of test: Pumping time 6 hrs.
g) Recovery time 5 min hrs.
h) Recovery water level 85 ft. at 5 min hrs. after pumping stopped.

Wells intended to yield 100 gpm or more shall be tested for a period of 8 hours or more. The test shall follow the development of the well, and shall be conducted continuously at a constant discharge at least as great as the intended appropriation. In addition to the above information, water level data shall be collected and recorded on the Department's "Aquifer Test Data" form.

NOTE: All wells shall be equipped with an access port ½ inch minimum or a pressure gauge that will indicate the shut-in pressure of a flowing well. Removable caps are acceptable as access ports.

**11. WAS WELL PLUGGED OR ABANDONED?** ______ Yes x No
If yes, how? ______

**12. WELL LOG**

| Depth (ft.) From | To | Formation |
|---|---|---|
| 0 | 15 | Clay, Sand & Gravel |
| 15 | 20 | Sand & Water |
| 20 | 23 | Sand, Gravel & Water (12 gpm) |
| 23 | 40 | Clay, Sand & Gravel |
| 40 | 56 | Clay |
| 56 | 140 | Clay, Sand & seeps of Water |
| 140 | 155 | Clay |
| 155 | 165 | Sand & Water |
| 165 | 170 | Clay & Sand |
| 170 | 176 | Clay |
| 176 | 217 | Sand & Water |
| 217 | 223 | Clay |
| 223 | 235 | Sand & Water |
| 235 | 253 | Clay |
| 253 | 278 | Sand & Water |
| 278 | 283 | Clay |
| 283 | 291 | Sand & Water |
| 291 | 294 | Clay |
| 294 | 305 | Sand & Water |
| 305 | 332 | Sand, Gravel & Water |
| 332 | 344 | Clay |
| 344 | 347 | Sand & Water |
| 347 | 358 | Clay |
| 358 | 362 | Sand & Water |
| 362 | 366 | Clay |
| 366 | 368 | Sand & Water |
| 368 | 377 | Clay |
| 377 | 389 | Sand & Water |
| 389 | 394 | Sand, Gravel & Water |
| 394 | 432 | Sand & Water |
| 432 | 438 | Sand, Clay & Water |
| 438 | 448 | Sand & Water |
| 448 | 458 | Sand, Small Gravel & Water |
| 458 | 461 | Sand & Water |

ATTACH ADDITIONAL SHEETS IF NECESSARY

**13. DATE COMPLETED** April 28, 1990

**14. DRILLER/CONTRACTOR'S CERTIFICATION**
This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

April 30, 1990
Date

CAMP WELL DRILLING & PUMP SUPPLY
Firm Name

1522 S. 14th W., Missoula, MT 59801
Address

Phil Bakke
Signature

7
License No.

*MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION*
1520 EAST SIXTH AVENUE HELENA, MONTANA 59620-2301 444-6610
**DNRC**

DEPARTMENT COPY
DRILLER: Please give this copy to the well owner t
OWNER: Complete reverse side and send to DNRC w
and the water has been used beneficially for th

Creamery Test Well

FORM NO. 633 N6/87

Test Well

# AQUIFER TEST DATA

Owner TOWN OF STEVENSVILLE Address P.O. Box 37, Stevensville, MT 59870

Well Location: SE 1/4 NW 1/4 ____ 1/4 Section 26, Township 9 N N/S, Range 20 W E/W, Ravalli County.

Date Test Preformed 4/26/90 Company performing test CAMP WELL DRILLING Measured by meter

Type of water level measuring equipment ____

**Time Data**

Pump on: Date 4/26/90 Time 10:40 a.m. ($t_o$)

Pump off: Date 4/26/90 Time 4:40 p.m. ($t_o$)

Duration of aquifer test:

Pumping ____ Recovery ____

**Water Level Data**

Static water level 85

Measuring point top of casing

Elevation of measuring point ____

**Discharge Data**

How was discharge measured? meter

Depth of pump/airline? ____

| Date | Clock Time | Time Since Pump Started (min.) t | Time Since Pump Stopped (min.) t' | Pumping Water Level Measurement | Recovery Water Level Measurement | Discharge Measurement | Pumping Rate (gpm) | Comments on Factors Affecting Test Data |
|---|---|---|---|---|---|---|---|---|
| 4/26/90 | | | | | | | | |
| | 10:43 | 1 | 1 | 125.75 | | | 220 | |
| | 10:45 | 5 | 5 | 126.90 | | | 220 | |
| | 10:50 | 10 | 10 | 127.30 | | | 220 | |
| | 10:55 | 15 | 15 | 128 | | | 218 | |
| | 11:00 | 20 | 20 | 128 | | | 218 | |
| | 11:05 | 25 | 25 | 130 | | | 218 | |
| | 11:10 | 30 | 30 | 130 | | | 218 | |
| | 11:20 | 40 | 40 | 130 | | | 218 | |
| | 11:30 | 50 | 50 | 130 | | | 218 | |
| | 11:40 | 60 | 60 | 130 | | | 218 | |
| | 12:10 | 90 | 90 | 130 | | | 218 | |
| | 12:40 | 120 | 120 | 130 | | | 218 | |
| | 1:40 | 180 | 180 | 130 | | | 218 | |
| | 2:40 | 240 | 240 | 130 | | | 218 | |
| | 3:40 | 300 | 300 | 130 | | | 218 | |
| | 4:40 | 360 | 360 | 130 | | | 218 | |
| | 4:45 | 420 | 420 | 85 | | | | |
| | | 480 | 480 | | | | | |

Creamery Test Well
Test Results

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

1520 EAST SIXTH AVENUE HELENA, MONTANA 59620-2301 444-6610

DNRC

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**POTTER MARION J**

Plot this site on a topographic map

A1

### Location Information

| | | | |
|---|---|---|---|
| GWIC Id: | 155547 | Source of Data: | LOG |
| Location (TRS): | 09N 20W 34 ABA | Latitude (dd): | 46.5003 |
| County (MT): | RAVALLI | Longitude (dd): | -114.0938 |
| DNRC Water Right: | | Geomethod: | TRS-SEC |
| PWS Id: | | Datum: | NAD27 |
| Block: | 7 WP | Altitude (feet): | |
| Lot: | | Certificate of Survey: | |
| Addition: | | Type of Site: | WELL |

### Well Construction and Performance Data

| | | | |
|---|---|---|---|
| Total Depth (ft): | 73.00 | How Drilled: | CABLE |
| Static Water Level (ft): | 40.00 | Driller's Name: | EAGLE |
| Pumping Water Level (ft): | 65.00 | Driller License: | WWC507 |
| Yield (gpm): | 15.00 | Completion Date (m/d/y): | 11/8/1995 |
| Test Type: | BAILER | Special Conditions: | |
| Test Duration: | 2.00 | Is Well Flowing?: | |
| Drill Stem Setting (ft): | | Shut-In Pressure: | |
| Recovery Water Level (ft): | | Geology/Aquifer: | Not Reported |
| Recovery Time (hrs): | | Well/Water Use: | DOMESTIC |
| Well Notes: | | | |

### Hole Diameter Information

No Hole Diameter Records currently in GWIC.

### Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0.0 | 73.0 | 6.0 | | | | STEEL |

### Annular Seal Information

| From | To | Description |
|---|---|---|
| 0.0 | 18.0 | BENTONITE |

### Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 73.0 | 73.0 | 6.0 | | | OPEN BOTTOM * |

### Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 1.0 | TOPSOIL BLACK |
| 1.0 | 56.0 | GRAVEL BROWN TRACE OF WATER 1-2 GPM |
| 56.0 | 65.0 | CLAY BROWN |
| 65.0 | 73.0 | SAND & GRAVEL BROWN WATER INCREASING TO 15 GPM |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**LOCKWOOD JIM**

Plot this site on a topographic map

A1

## Location Information

| | |
|---|---|
| GWIC Id: 205584 | Source of Data: LOG |
| Location (TRS): 09N 20W 34 ABAB | Latitude (dd): 46.4981 |
| County (MT): RAVALLI | Longitude (dd): -114.0911 |
| DNRC Water Right: | Geomethod: NAV-GPS |
| PWS Id: | Datum: WGS84 |
| Block: | Altitude (feet): |
| Lot: 4 | Certificate of Survey: |
| Addition: | Type of Site: WELL |

## Well Construction and Performance Data

| | |
|---|---|
| Total Depth (ft): 60.00 | How Drilled: ROTARY |
| Static Water Level (ft): 26.00 | Driller's Name: AQWA |
| Pumping Water Level (ft): | Driller License: WWC589 |
| Yield (gpm): 25.00 | Completion Date (m/d/y): 7/12/2003 |
| Test Type: AIR | Special Conditions: |
| Test Duration: 2.00 | Is Well Flowing?: |
| Drill Stem Setting (ft): 50.00 | Shut-In Pressure: |
| Recovery Water Level (ft): 26.00 | Geology/Aquifer: Not Reported |
| Recovery Time (hrs): 0.17 | Well/Water Use: DOMESTIC |
| Well Notes: | |

### Hole Diameter Information

| From | To | Diameter |
|---|---|---|
| 0.0 | 60.0 | 6.0 |

### Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| -1.5 | 60.0 | 6.0 | 0.250 | | WELDED | STEEL |

### Annular Seal Information

| From | To | Description |
|---|---|---|
| 0.0 | 0.0 | BENTONITE |

### Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 56.0 | 60.0 | 6.0 | 15 | 1/8 X 5 IN | TORCH CUTS |

### Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 1.0 | TOP SOIL |
| 1.0 | 60.0 | SAND GRAVEL WATER BEARING |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**WRIGHT CHARLES A.**

Plot this site on a topographic map

A1

## Location Information

GWIC Id: 139824
Location (TRS): 09N 20W 34 ABB
County (MT): RAVALLI
DNRC Water Right:
PWS Id:
Block:
Lot: A
Addition:

Source of Data: LOG
Latitude (dd): 46.5003
Longitude (dd): -114.0965
Geomethod: TRS-SEC
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

## Well Construction and Performance Data

Total Depth (ft): 64.00
Static Water Level (ft): 30.00
Pumping Water Level (ft):
Yield (gpm): 28.00
Test Type: AIR
Test Duration: 1.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:

How Drilled: ROTARY
Driller's Name: ANDERSON
Driller License: WWC469
Completion Date (m/d/y): 12/27/1993
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: DOMESTIC

### Hole Diameter Information

No Hole Diameter Records currently in GWIC.

### Annular Seal Information

| From | To | Description |
|---|---|---|
| 0.0 | 18.0 | BENTONITE |

### Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| -1.5 | 64.0 | 6.0 | | | | STEEL |

### Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 64.0 | 64.0 | 6.0 | | | OPEN BOTTOM * |

### Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 1.0 | TOPSOIL |
| 1.0 | 45.0 | LARGE ROCK GRAVEL |
| 45.0 | 50.0 | REDDISH BROWN SAND |
| 50.0 | 55.0 | GRAY CLAY |
| 55.0 | 63.0 | RIVER GRAVEL SAND |
| 63.0 | 64.0 | GRAVEL & WATER |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**MATHENA WES**

**Plot this site on a topographic map**

## Location Information

A2

GWIC Id: 130900
Location (TRS): 09N 20W 35 AD
County (MT): RAVALLI
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:

Source of Data: LOG
Latitude (dd): 46.4956
Longitude (dd): -114.0685
Geomethod: TRS-SEC
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

## Well Construction and Performance Data

Total Depth (ft): 82.00
Static Water Level (ft): 40.00
Pumping Water Level (ft): 60.00
Yield (gpm): 20.00
Test Type: AIR
Test Duration: 2.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes: RAVALLI DRILLING FILE 3440

How Drilled: ROTARY
Driller's Name: RAVALLI
Driller License: WWC357
Completion Date (m/d/y): 10/8/1992
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: DOMESTIC

### Hole Diameter Information

No Hole Diameter Records currently in GWIC.

### Annular Seal Information

| From | To | Description |
|---|---|---|
| 0.0 | 0.0 | BENTONITE |

### Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| -1.5 | 69.0 | 6.0 | | | | STEEL |
| 62.0 | 82.0 | 4.0 | | | | PVC |

### Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 62.0 | 70.0 | 4.0 | | | #2 AARON SCREEN |
| 64.0 | 49.0 | 6.0 | | | #1 AARON SCREEN |

### Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 1.0 | TOPSOIL |
| 1.0 | 38.0 | BOULDERS GRAVEL SAND |
| 38.0 | 59.0 | GREY CLAY |
| 59.0 | 65.0 | FINE SAND GRAVEL WB |
| 65.0 | 69.0 | GREY CLAY |
| 69.0 | 82.0 | INTERMITTENT CLAY SAND TAN ASH |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**BROWN RALPH #1**

Plot this site on a topographic map

A2

### Location Information

GWIC Id: 60305
Location (TRS): 09N 20W 35 AA
County (MT): RAVALLI
DNRC Water Right: 13417
PWS Id:
Block:
Lot:
Addition:

Source of Data: LOG
Latitude (dd): 46.4993
Longitude (dd): -114.0685
Geomethod: TRS-SEC
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

### Well Construction and Performance Data

Total Depth (ft): 46.00
Static Water Level (ft): 3.00
Pumping Water Level (ft): 19.00
Yield (gpm): 87.00
Test Type: AIR
Test Duration: 5.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):

How Drilled: CABLE
Driller's Name: RAVALLI
Driller License: WWC062
Completion Date (m/d/y): 6/13/1977
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: IRRIGATION

Well Notes: RAVALLI DRILLING FILE NO: 320

### Hole Diameter Information

No Hole Diameter Records currently in GWIC.

### Annular Seal Information

| From | To | Description |
|---|---|---|
| 0.0 | 8.0 | NATURAL |

### Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0.0 | 46.0 | 6.0 | | | | STEEL |

### Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 25.0 | 41.0 | 6.0 | | 5 IN | SLOTS |

### Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 3.0 | TOPSOIL BROWN |
| 3.0 | 37.0 | SAND GRAVEL BOULDERS BROWN WB |
| 37.0 | 52.0 | SAND GRAVEL CLAY TIGHT DRY WHITISH CLAY |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**CITY OF STEVENSVILLE**

Plot this site on a topographic map

A3

**Location Information**

| | | | |
|---|---|---|---|
| GWIC Id: | 60341 | Source of Data: | GW2 |
| Location (TRS): | 09N 20W 36 AA | Latitude (dd): | 46.4993 |
| County (MT): | RAVALLI | Longitude (dd): | -114.0475 |
| DNRC Water Right: | | Geomethod: | TRS-SEC |
| PWS Id: | | Datum: | NAD27 |
| Block: | | Altitude (feet): | |
| Lot: | | Certificate of Survey: | |
| Addition: | | Type of Site: | WELL |

**Well Construction and Performance Data**

| | | | |
|---|---|---|---|
| Total Depth (ft): | 510.00 | How Drilled: | |
| Static Water Level (ft): | 180.00 | Driller's Name: | CAMP |
| Pumping Water Level (ft): | | Driller License: | WWC007 |
| Yield (gpm): | | Completion Date (m/d/y): | 1/15/1963 |
| Test Type: | | Special Conditions: | ABANDONED |
| Test Duration: | | Is Well Flowing?: | |
| Drill Stem Setting (ft): | | Shut-In Pressure: | |
| Recovery Water Level (ft): | | Geology/Aquifer: | Not Reported |
| Recovery Time (hrs): | | Well/Water Use: | PUBLIC WATER SUPPLY |

Well Notes: CASING PULLED FROM HOLE; DID NOT PRODUCE ENOUGH

**Hole Diameter Information**

No Hole Diameter Records currently in GWIC.

**Casing Information**[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0.0 | 451.9 | 6.0 | | | | |

**Annular Seal Information**

No Seal Records currently in GWIC.

**Completion Information**[1]

No Completion Records currently in GWIC.

**Lithology Information**

| From | To | Description |
|---|---|---|
| 0.0 | 0.5 | TOPSOIL |
| 0.5 | 20.0 | CLAY GRAVEL SAND & BOULDERS |
| 20.0 | 33.0 | SAND GRAVEL & CLAY & SOME WATER 30 GPM |
| 33.0 | 39.0 | CLAY & A LITTLE GRAVEL |
| 39.0 | 55.0 | SAND GRAVEL CLAY |
| 55.0 | 97.0 | CLAY |
| 97.0 | 100.0 | SAND FINE GRAVEL SOME WATER |
| 100.0 | 105.0 | SAND & CLAY |
| 105.0 | 125.0 | CLAY |
| 125.0 | 148.0 | SAND & CLAY |
| 148.0 | 168.0 | SANDY CLAY |
| 168.0 | 178.0 | SAND CLAY & WATER |
| 178.0 | 200.0 | CLAY |
| 200.0 | 225.0 | BROWN CLAY |
| 225.0 | 238.0 | SANDY CLAY |
| 238.0 | 263.0 | SANDY CLAY |
| 263.0 | 293.0 | SAND |
| 293.0 | 309.0 | SANDY BROWN CLAY |
| 309.0 | 355.0 | SANDY CLAY |
| 355.0 | 385.0 | CLAY SAND WATER |
| 385.0 | 415.0 | SANDY CLAY |
| 415.0 | 510.0 | DECOMPOSED GRANITE SAND & CLAY |

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

Area 3
City Test Well

These data represent the contents of the GWIC databases at the Montana Bureau of
The information is considered unpublished and is subject to correction and review on
transmission of the data to the original end user. Retransmission of the data to other
responsibility if the material is retransmitted. Note: non-reported casing, completion

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**DEXTER HENRY**

**Plot this site on a topographic map**

A3

## Location Information

GWIC Id: 60342
Location (TRS): 09N 20W 36 AB
County (MT): RAVALLI
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:

Source of Data: GW2
Latitude (dd): 46.4993
Longitude (dd): -114.0529
Geomethod: TRS-SEC
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

## Well Construction and Performance Data

Total Depth (ft): 82.00
Static Water Level (ft): 9.00
Pumping Water Level (ft): 20.00
Yield (gpm): 80.00
Test Type: BAIL/AIR
Test Duration: 2.50
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:

How Drilled: CABLE
Driller's Name: RAY & SONS
Driller License: WWC128
Completion Date (m/d/y): 10/31/1962
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: DOMESTIC

## Hole Diameter Information

No Hole Diameter Records currently in GWIC.

## Annular Seal Information

No Seal Records currently in GWIC.

## Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0.0 | 80.0 | 6.0 | | | | |

## Completion Information[1]

No Completion Records currently in GWIC.

## Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 8.0 | SURFACE SOIL & GRAVEL |
| 8.0 | 18.0 | BROWN CLAY & GRAVEL |
| 18.0 | 28.0 | COBBLE ROCK LAYER AND WATER BED 2 GPM |
| 28.0 | 31.0 | SAND & CLAY |
| 31.0 | 57.0 | BROWN CLAY |
| 57.0 | 62.0 | WATER & FLOWING SAND |
| 62.0 | 69.0 | QUICKSAND |
| 69.0 | 81.0 | BROWN CLAY WHITE FLOWING SAND |
| 81.0 | 99.0 | COARSE SAND & GRAVEL |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**DEXTER HENRY**

Plot this site on a topographic map

A 3

### Location Information

GWIC Id: 60343
Location (TRS): 09N 20W 36 AB
County (MT): RAVALLI
DNRC Water Right:
PWS Id:
Block:
Lot:
Addition:

Source of Data: GW2
Latitude (dd): 46.4993
Longitude (dd): -114.0529
Geomethod: TRS-SEC
Datum: NAD27
Altitude (feet):
Certificate of Survey:
Type of Site: WELL

### Well Construction and Performance Data

Total Depth (ft): 28.00
Static Water Level (ft): 5.00
Pumping Water Level (ft): 23.00
Yield (gpm): 40.00
Test Type: PUMP
Test Duration: 4.00
Drill Stem Setting (ft):
Recovery Water Level (ft):
Recovery Time (hrs):
Well Notes:

How Drilled:
Driller's Name: WILLIAMS
Driller License: WWC151
Completion Date (m/d/y): 8/19/1971
Special Conditions:
Is Well Flowing?:
Shut-In Pressure:
Geology/Aquifer: Not Reported
Well/Water Use: DOMESTIC

### Hole Diameter Information

No Hole Diameter Records currently in GWIC.

### Annular Seal Information

No Seal Records currently in GWIC.

### Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0.0 | 28.0 | 6.0 | | | | |

### Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 28.0 | 28.0 | 6.0 | | | OPEN BOTTOM * |

### Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 2.0 | SOIL |
| 2.0 | 12.0 | SAND & GRAVEL |
| 12.0 | 21.0 | WATER SAND & GRAVEL |
| 21.0 | 25.0 | TAN CLAY SAND & GRAVEL |
| 25.0 | 28.0 | SAND GRAVEL & WATER |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**REED BOB**

**Plot this site on a topographic map**

A 3

## Location Information

| | | | |
|---|---|---|---|
| GWIC Id: | 60344 | Source of Data: | LOG |
| Location (TRS): | 09N 20W 36 AB | Latitude (dd): | 46.4993 |
| County (MT): | RAVALLI | Longitude (dd): | -114.0529 |
| DNRC Water Right: | | Geomethod: | TRS-SEC |
| PWS Id: | | Datum: | NAD27 |
| Block: | | Altitude (feet): | |
| Lot: | | Certificate of Survey: | |
| Addition: | | Type of Site: | WELL |

## Well Construction and Performance Data

| | | | |
|---|---|---|---|
| Total Depth (ft): | 27.00 | How Drilled: | CABLE |
| Static Water Level (ft): | 7.00 | Driller's Name: | RAVALLI |
| Pumping Water Level (ft): | 23.00 | Driller License: | WWC062 |
| Yield (gpm): | 15.00 | Completion Date (m/d/y): | 7/4/1976 |
| Test Type: | BAILER | Special Conditions: | |
| Test Duration: | 2.00 | Is Well Flowing?: | |
| Drill Stem Setting (ft): | | Shut-In Pressure: | |
| Recovery Water Level (ft): | | Geology/Aquifer: | Not Reported |
| Recovery Time (hrs): | | Well/Water Use: | DOMESTIC |

Well Notes: RAVALLI DRILLING FILE NO: 199

## Hole Diameter Information

No Hole Diameter Records currently in GWIC.

## Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0.0 | 27.0 | 6.0 | | | | STEEL |
| 27.0 | 30.0 | 5.0 | | | | PVC |

## Annular Seal Information

| From | To | Description |
|---|---|---|
| 0.0 | 20.0 | NATURAL |

## Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 10.0 | 15.0 | 6.0 | | 3/8 | DRILLED HOLES |
| 17.0 | 27.0 | 5.0 | | | SLOTS |

## Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 1.0 | TOPSOIL |
| 1.0 | 4.0 | SAND & GRAVEL (BROWN) |
| 4.0 | 16.0 | SAND GRAVEL BOULDERS WB (BROWN) |
| 16.0 | 27.0 | SAND & GRAVEL TIGHT PRESSED (TAN) |
| 27.0 | 31.0 | BLUE CLAY |

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

**Montana Bureau of Mines and Geology**
**Ground-Water Information Center Site Report**
**RAGATZ MIKE**

**Plot this site on a topographic map**
**View Hydrograph for this Site**

A3

### Location Information

| | | | |
|---|---|---|---|
| GWIC Id: | 60339 | Source of Data: | LOG |
| Location (TRS): | 09N 20W 36 ABAA | Latitude (dd): | 46.5004 |
| County (MT): | RAVALLI | Longitude (dd): | -114.0512 |
| DNRC Water Right: | | Geomethod: | NAV-GPS |
| PWS Id: | | Datum: | NAD27 |
| Block: | | Altitude (feet): | 3525.00 |
| Lot: | | Certificate of Survey: | |
| Addition: | | Type of Site: | WELL |

### Well Construction and Performance Data

| | | | |
|---|---|---|---|
| Total Depth (ft): | 99.00 | How Drilled: | CABLE |
| Static Water Level (ft): | 60.00 | Driller's Name: | RAVALLI |
| Pumping Water Level (ft): | 80.00 | Driller License: | WWC357 |
| Yield (gpm): | 25.00 | Completion Date (m/d/y): | 1/23/1985 |
| Test Type: | BAILER | Special Conditions: | |
| Test Duration: | 2.00 | Is Well Flowing?: | |
| Drill Stem Setting (ft): | | Shut-In Pressure: | |
| Recovery Water Level (ft): | | Geology/Aquifer: | 120SNGR |
| Recovery Time (hrs): | | Well/Water Use: | DOMESTIC |

Well Notes: RAVALLI DRILLING FILE NO: 1871

### Hole Diameter Information

No Hole Diameter Records currently in GWIC.

### Annular Seal Information

| From | To | Description |
|---|---|---|
| 0.0 | 60.0 | NATURAL |

### Casing Information[1]

| From | To | Dia | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| 0.0 | 99.0 | 6.0 | | | | |

### Completion Information[1]

| From | To | Dia | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 91.0 | 96.0 | 6.0 | | 5 IN | SLOTS |

### Lithology Information

| From | To | Description |
|---|---|---|
| 0.0 | 1.0 | TOPSOIL |
| 1.0 | 36.0 | SAND & COARSE ROCK WB |
| 36.0 | 47.0 | RUSTY CLAY |
| 47.0 | 50.0 | RUSTY SAND SHOWING HEAVY MINERALIZATION WB |
| 50.0 | 86.0 | GRAY CLAY |
| 86.0 | 91.0 | RUSTY SAND & GRAVEL |
| 91.0 | 95.0 | GRAY & WHITE SAND & GRAVEL WB |
| 95.0 | 99.0 | GRAY CLAY |

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

# Appendix B

Test Well Lithologic Log

Geomatrix

## WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: 13412

WELL NO: TC-TW-1

PROJECT: Anderson STATE: MT COUNTY: Ravalli LOGGED BY: ANJ

LEGAL LOCATION: T 9N R 20W S 35 TRACT aab

DESCRIPTIVE LOCATION: South of Middle Burnt Fork Rd., West of Logan Lane Dr., Stevensville

DATE STARTED: 5/18/2007 DATE COMPLETED: 5/25/2007 DRILLING CO/ DRILLER: Randy Kotecki/Jerome's Drilling 5/18; Brian 5/21-5/24

DRILLING METHOD: air rotary (Drilltech D4ok) BOREHOLE DIAM (IN): 6" DRILL FLUIDS USED: air and water

TOTAL DEPTH DRILLED: 398 TOTAL DEPTH CASED: 398 INTERVAL PERFORATED FROM OR SCREENED (FT:): 118-139; 194-197; 319-322; 350-361; 383-388 DIAMETER: 6" CASING TYPE: steel

METHOD OF PERFORATION:
- ___ Open Hole
- ___ Open Bottom
- ___ Saw Slotted
- ___ Factory ___ (size)
- X Other: Holte Perf tool 3/16" x 1"; 8 rows

| DURING WELL CONSTRUCTION WAS/WERE: | YES | NO |
|---|---|---|
| Well Developed | X | |
| Well Pumped | X | |
| Water Samples Collected | X | |
| Material Samples Collected | X | |

**ANNULAR COMPLETION CHARACTERISTICS**

WELL PROTECTOR: LENGTH: ___ DIAM: ___

LOCK NO: ___

| | | FROM: | TO: |
|---|---|---|---|
| SURFACE SEAL TYPE: | bentonite (Enviroplug #8) | 0 | 25 |
| BACKFILL MATERIAL: | NA | | |
| HOLE PLUG: | NA | | |
| FILTER PACK TYPE: | NA | | |

STATIC WATER LEVEL: 107.1 DATE: 5/24/2007

MEASURING POINT DESCRIPTION/ ELEVATION: Top of casing

MEASURING POINT RELATIVE TO GROUND SURFACE (+/-) 3.0

REMARKS: 46.50044; 114.07160; continuous feed bentonite slurry from surface starting at 120'
Airlift development produced 300 gpm for eight hours with drill stem at 390 ft bgs

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 0-1.5 | Topsoil | Water at ~ 8' bgs |
| 1.5-19 | GM-Silty gravel with sand; wet at about 8'; bulk color is moderate yellowish brown; 65% fine-coarse gravel (angular to rounded); 20% silt; 15% sand; rounded gravel up to 1" diameter | 40-50 gpm between 8' and 34' per driller |
| 19-34 | GP-GM-Poorly graded gravel with silt and sand; WB; color as above; 65% gravel; 10% silt; 25% fine-coarse sand | |
| 34-34.5 | ML-Silt; WB; dark yellowish brown (10YR 4/2) | |
| 34.5-45 | SW-Well-graded sand with gravel; gray to tan; 40% coarse sand; 25% fine sand; 5% silt; 30% fine to coarse gravel up to 1.5" diameter, probably derived from granite (quartz, feldspar, mica); WB but discharge not measured | |
| 45-52 | SM-Silty sand; 55% fine-coarse sand; 45% silt; grayish yellow (5Y 8/4); contains clay chunks | |
| 52-59 | SP-SM-Poorly graded sand with silt and gravel; 50% sand; 10% silt; 30% fine-coarse gravel up to 2" in diameter (rounded; gray and pink quartzite) | |
| 59-81 | CL-Clay; yellowish gray (5Y 7/2); plastic; hardness; med-high; can be molded inot a 4" ribbon without bending; cohesive; wet (water added) | |
| 81-94 | SW-SM-Well graded sand with silt; 10% silt; 10% fine gravel; 80% fine-coarse sand; bulk color is yellowish gray (5Y 7/2); WB but flow not measured | Material sample collected (90 ft). 60-80 gpm total from 0-120' (per driller) |

Geomatrix

## WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: 13412

PROJECT: Anderson

WELL NO: TC-TW-1

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 94-118 | CL as above (59-81) | 20-30 gpm @ 120' |
| | Brian (driller) | |
| 118-132 | SW-Well graded sand with gravel; tan and gray; 60% coarse sand; 20% fine-med sand; 20% fine gravel. Water bearing: water cleaned up quickly (<1 min). | 30-40 gpm (122-125); material sample collected (120-125 ft) |
| 132-135 | SW-Well graded sand; 30% fine-med sand; 70% coarse sand | 50 gpm @ 131; material sample collected (132-135) |
| 135-139 | SW-Well graded sand with gravel as above (118-132) | Screen to 137 per Brian |
| 139-165 | CL-Clay with silt; thin (6") sand lenses producing some water; yellowish gray (5Y 7/2); medium hardness; plastic; 75% clay; 25% silt | |
| 165-175 | SW-Well graded sand with gravel; tan and gray; 65% coarse sand; 20% fine-med sand; 15% gravel | 40 gpm @ 170; material sample collected (165-175) |
| 175-194 | CL-Clay; yellowish gray (5Y 7/2); hardness = med to high; plastic | |
| 194-197 | SW-Well graded sand; 60% coarse sand; 20% fine gravel; 20% fine-med sand; gray to tan | 5 gal/7 sec @ 194'=43 gpm |
| 197-230 | CL-Clay with silt; 5Y 7/2; med hardness; plastic | |
| 230-254 | CL-Clay as above; contains brown siltstone (gravel sized) | |
| 254-270 | SM-Silty sand; 75% fine-coarse sand; 25% light brown silt; water discharge initially but then tapered off; not good productive zone according to driller; sand is approx. 75% fine-med sand and 25% coarse sand; contains gravel-size semiconsolidated brown siltstone | ~ 10-20 gpm with lots of heaving sand |
| 270-280 | CL-ML-Silt with clay; semi-plastic; smooth; yellowish gray (5Y 7/2) | |
| 280-289 | Brown siltstone; semiconsolidated; sand and gravel size | 10 gpm @ 280 |
| 289-296 | CL-ML-Silt with clay as above | |
| 296-305 | SM-Silty sand; 70% fine sand; 30% silt; bulk color is yellowish gray (5Y 7/2); contains fine-gravel sized consolidated brown siltstone | |
| 305-308 | SM-Silty sand; 40% fine-med sand; 30% coarse sand; 30% silt | |
| 308-319 | ML-Silt with clay; medium hardness; 5Y 7/2; casing hammer slow starting @ 310' | 5 gal/39 sec=8 gpm @ 316' |
| 319-322 | SW-SM-Well graded sand with silt and gravel; 10% silt; 15% fine gravel; 75% sand; material sample collected | ~75 gpm @ 320'; material sample collected (320 ft) |
| 322-333 | SM-Silty sand; 65% fine-med sand; 35% silt | |
| 333-337 | ML-Silt with sand; 80% silt; 20% fine-med sand | |
| 337-337.5 | SM silty sand as above | |
| 337.5-350 | ML-Silt with sand as above; 80% silt and 20% fine-med sand | |
| | | |

Geomatrix

**WELL LITHOLOGIC AND COMPLETION LOG**

JOB NO: 13412

PROJECT: Anderson

WELL NO: TC-TW-1

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 350-361 | SW-Well-graded sand with gravel; decomposed granite; 15% fine sand; 50% med-coarse sand; 35% fine gravel; contains coarse gravel up to 1" in diameter | 40+ gpm at 350; 5 gal/5 sec @ 359 = 60 gpm (did not catch all water and water leaking out around drillhead seal); 100+ gpm per driller; material samples collected (350 anf 359) |
| 361-366 | SM-Silty sand as above; 70% fine-med sand; 30% silt | |
| 366-373 | SP-Poorly graded sand; 75% med sand; 25% fine sand (10-20 gpm estimated). Material did not clean up well afer 2 minutes of air-lifting. | |
| 373-381 | ML-Silt with sand and clay; 60% brown silt; 25% fine sand; 15% clay (hard) | |
| 381-383 | CL-ML; Silt and clay | |
| 383-388 | SW as above (350-361) | 100+ gpm @ 384 |
| 388-397 | SM-Silty sand as above (361-366) | WB but hard to estimate (mixed with lots of fines) |
| 397 | ML-Silt; yellowish gray (5Y 7/2); soft; low plasticity | |
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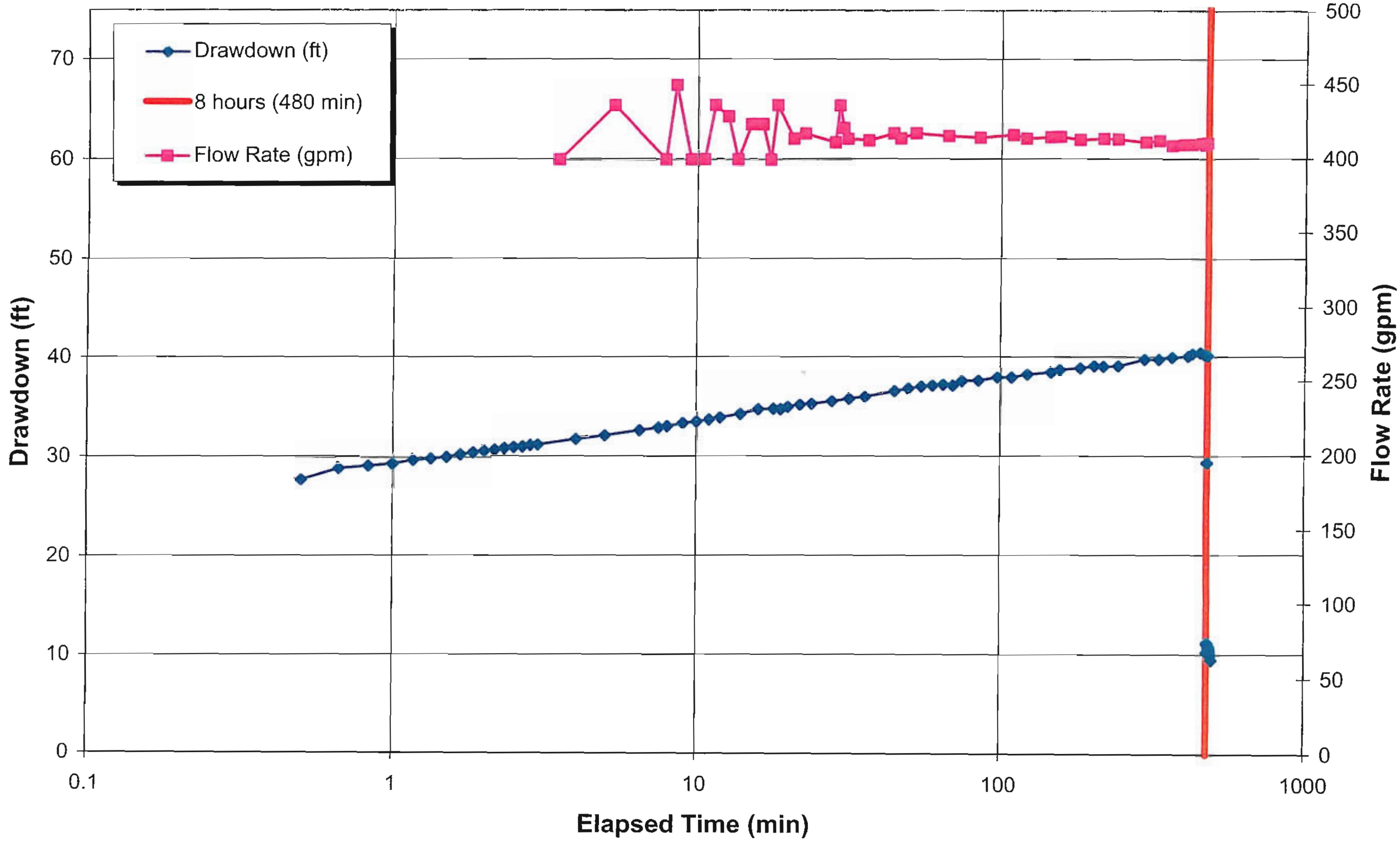
# Appendix C

Aquifer Test Results and Analyses

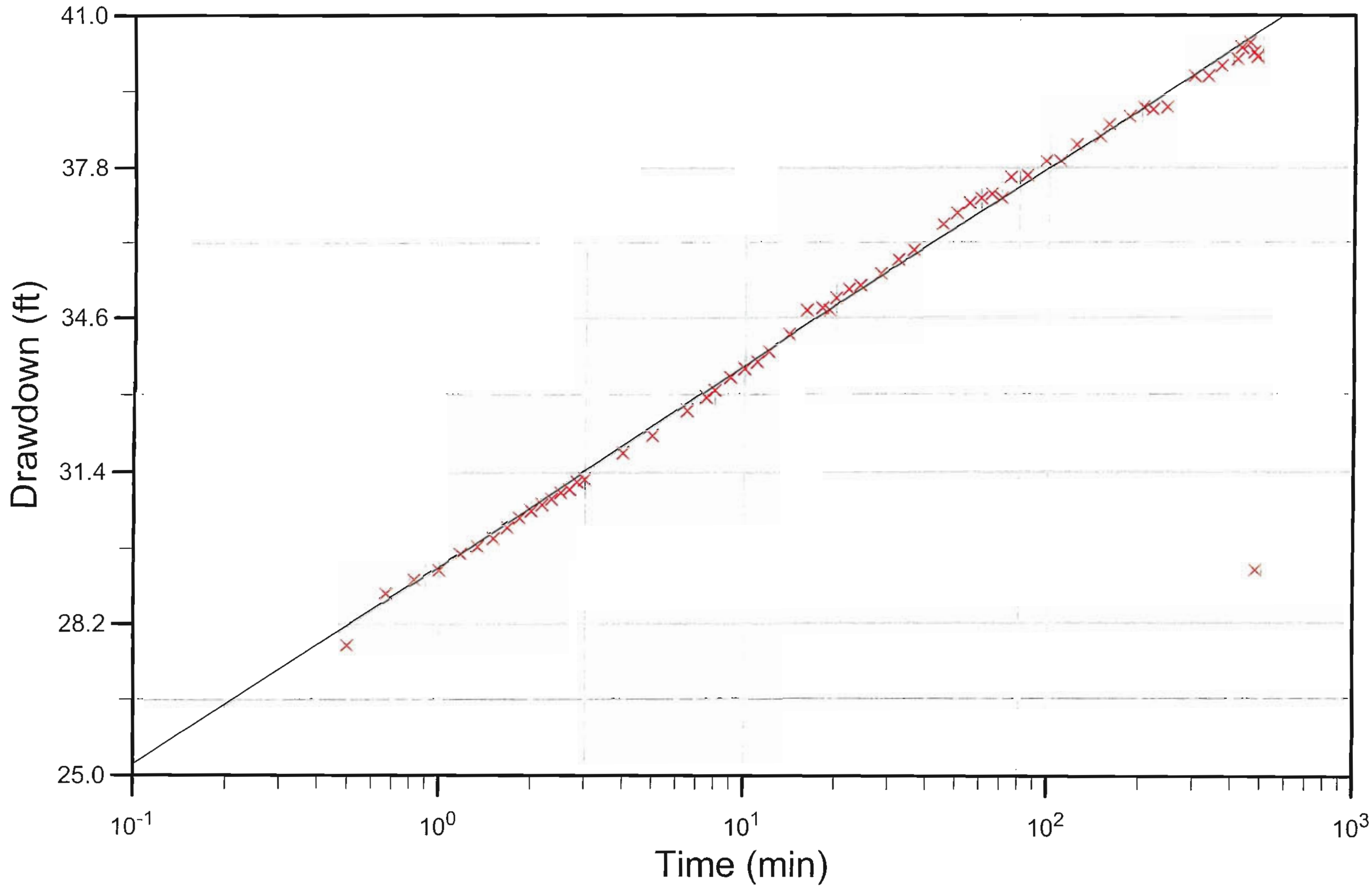
# Appendix C

Well TC-TW-1 8-Hour Pumping Test

Twin Creeks Subdivision, Stevensville, Montana



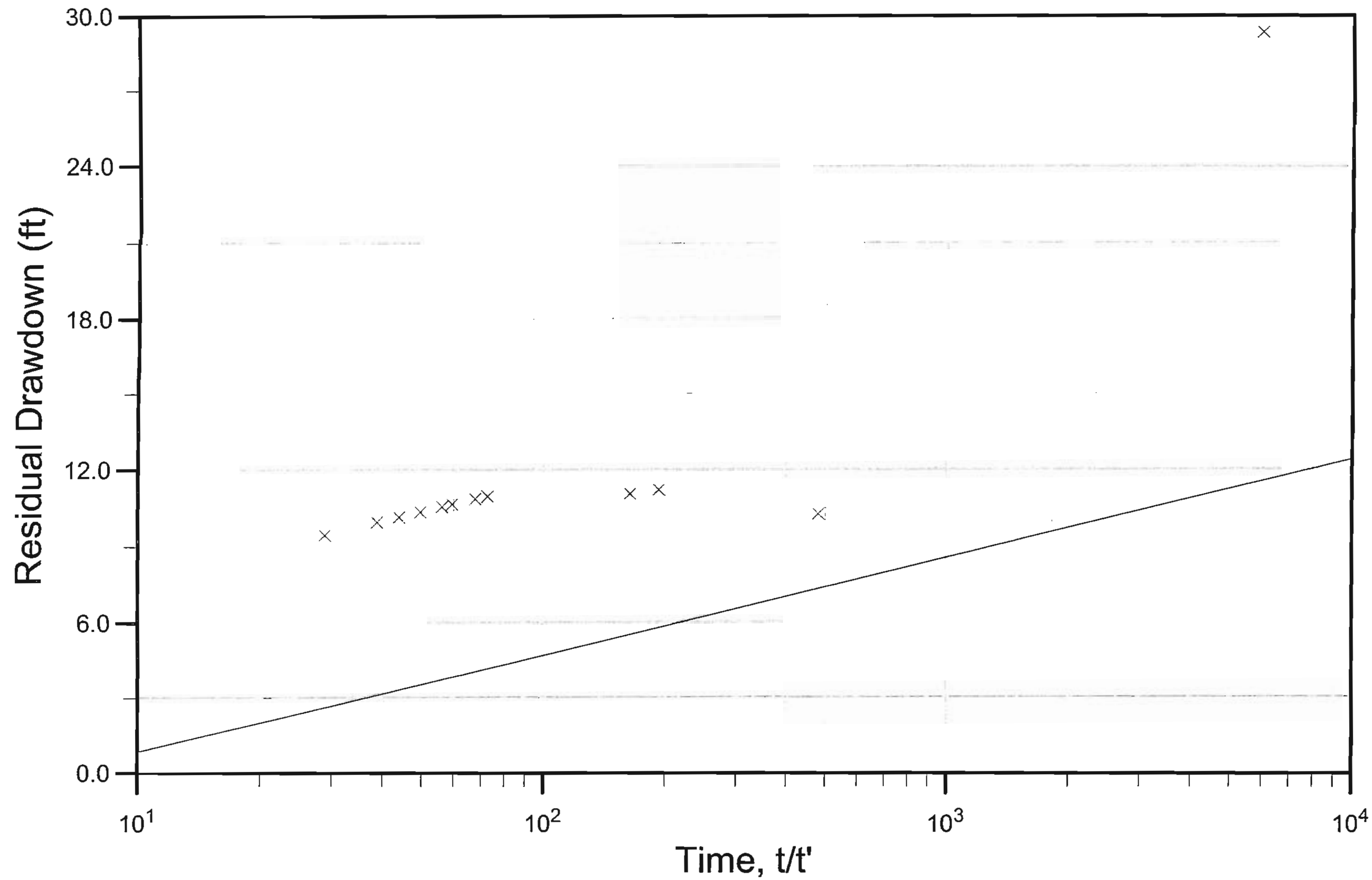
# Cooper and Jacob Solution Match to Drawdown




SC-TW-1
August 16, 2007

Pumping Rate 413 gal/min
Transmissivity 3475.64 sq ft/d
Cooper and Jacob, 1946

# Theis Solution Match to Recovery




Town of Stevensville
August 16, 2007

Pumping Rate 413 gal/min
Transmissivity 3792.86 sq ft/d
Theis, 1946

# Appendix D

Laboratory Analytical Reports for TC-TW-1

# ANALYTICAL SUMMARY REPORT

MISSOULA
Received
GEOMATRIX

August 23, 2007

Adam Johnson
Geomatrix
1001 S Higgins Ave
Suite B-1
Missoula, MT 59801-

Workorder No.: B07081791

Project Name: Twin Creeks Subdivision

Energy Laboratories Inc received the following 1 sample from Geomatrix on 8/20/2007 for analysis.

| Sample ID | Client Sample ID | Collect Date | Receive Date | Matrix | Test |
|---|---|---|---|---|---|
| B07081791-001 | TC-TW-1 | 08/16/07 18:15 | 08/20/07 | Drinking Water | Metals by ICP/ICPMS, Drinking Water<br>Alkalinity<br>Conductivity<br>Hardness as CaCO3<br>Nitrogen, Nitrate + Nitrite<br>pH<br>Metals Digestion by EPA 200.2 |

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except if noted in report comments or the Case Narrative.

If you have any questions regarding these tests results, please call.

**Report Approved By:** Shari Candy

# LABORATORY ANALYTICAL REPORT

| | | | |
|---|---|---|---|
| **Client:** | Geomatrix | **Report Date:** | 08/23/07 |
| **Project:** | Twin Creeks Subdivision | **Collection Date:** | 08/16/07 18:15 |
| **Lab ID:** | B07081791-001 | **DateReceived:** | 08/20/07 |
| **Client Sample ID:** | TC-TW-1 | **Matrix:** | Drinking Water |

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 6.8 | s.u. | | 0.1 | | A4500 H | 08/20/07 09:51 / qed |
| Conductivity | 386 | umhos/cm | | 1 | | A2510 B | 08/20/07 09:51 / qed |
| **INORGANICS** | | | | | | | |
| Alkalinity, Total as CaCO3 | 166 | mg/L | | 1 | | A2320 B | 08/20/07 15:10 / qed |
| Hardness as CaCO3 | 166 | mg/L | | 1 | | A2340 B | 08/22/07 12:08 / klc |
| **NUTRIENTS** | | | | | | | |
| Nitrogen, Nitrate+Nitrite as N | 0.98 | mg/L | | 0.05 | 10 | E353.2 | 08/21/07 13:30 / bls |
| **METALS, TOTAL** | | | | | | | |
| Arsenic | ND | mg/L | | 0.001 | 0.01 | E200.8 | 08/22/07 04:02 / sas |
| Calcium | 50 | mg/L | | 1 | | E200.7 | 08/21/07 16:26 / rlh |
| Iron | 0.12 | mg/L | | 0.03 | | E200.7 | 08/21/07 16:26 / rlh |
| Magnesium | 10 | mg/L | | 1 | | E200.7 | 08/21/07 16:26 / rlh |
| Manganese | ND | mg/L | | 0.01 | | E200.7 | 08/21/07 16:26 / rlh |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

# QA/QC Summary Report

**Client:** Geomatrix
**Project:** Twin Creeks Subdivision

**Report Date:** 08/23/07
**Work Order:** B07081791

| Analyte | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Method: A2320 B** | | | | | | | | | Batch: R98161 |
| **Sample ID: MB** | Method Blank | | | | Run: MAN-TECH_070820A | | | | 08/20/07 14:45 |
| Alkalinity, Total as CaCO3 | 2 | mg/L | 1 | | | | | | |
| **Sample ID: LCS** | Laboratory Control Sample | | | | Run: MAN-TECH_070820A | | | | 08/20/07 14:51 |
| Alkalinity, Total as CaCO3 | 103 | mg/L | 1.0 | 100 | 90 | 110 | | | |
| **Sample ID: B07081791-001AMS** | Sample Matrix Spike | | | | Run: MAN-TECH_070820A | | | | 08/20/07 15:16 |
| Alkalinity, Total as CaCO3 | 338 | mg/L | 1.0 | 100 | 80 | 120 | | | |
| **Sample ID: B07081791-001AMSD** | Sample Matrix Spike Duplicate | | | | Run: MAN-TECH_070820A | | | | 08/20/07 15:22 |
| Alkalinity, Total as CaCO3 | 338 | mg/L | 1.0 | 100 | 80 | 120 | 0.0 | 20 | |
| **Method: A2510 B** | | | | | | | | | Batch: PHSC070820A |
| **Sample ID: PHC1070810A** | Laboratory Control Sample | | | | Run: ORION555A_070820A | | | | 08/20/07 08:20 |
| Conductivity | 5020 | umhos/cm | 1.0 | 100 | 90 | 110 | | | |
| **Sample ID: PHC10802B** | Laboratory Control Sample | | | | Run: ORION555A_070820A | | | | 08/20/07 08:23 |
| Conductivity | 150 | umhos/cm | 1.0 | 100 | 90 | 110 | | | |
| **Sample ID: B07081824-001A** | Sample Duplicate | | | | Run: ORION555A_070820A | | | | 08/20/07 16:29 |
| Conductivity | 469 | umhos/cm | 1.0 | | | | 0.2 | 10 | |
| **Method: A4500 H** | | | | | | | | | Analytical Run: ORION555A_070820A |
| **Sample ID: PHC10803** | Initial Calibration Verification Standard | | | | | | | | 08/20/07 08:22 |
| pH | 6.99 | s.u. | 0.10 | 100 | 98 | 102 | | | |
| **Method: A4500 H** | | | | | | | | | Batch: PHSC070820A |
| **Sample ID: PHC1070412A** | Laboratory Control Sample | | | | Run: ORION555A_070820A | | | | 08/20/07 08:23 |
| pH | 3.93 | s.u. | 0.10 | 98 | 97 | 103 | | | |
| **Sample ID: B07081824-001A** | Sample Duplicate | | | | Run: ORION555A_070820A | | | | 08/20/07 16:28 |
| pH | 7.09 | s.u. | 0.10 | | | | 0.4 | 10 | |

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

# QA/QC Summary Report

**Client:** Geomatrix
**Project:** Twin Creeks Subdivision

**Report Date:** 08/23/07
**Work Order:** B07081791

| Analyte | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Method: E200.7** | | | | | | | | | Analytical Run: ICP202-B_070821A |
| **Sample ID: QCS** | Initial Calibration Verification Standard | | | | | | | | 08/21/07 12:21 |
| Calcium | 50.1 | mg/L | 1.0 | 100 | 90 | 110 | | | |
| Iron | 5.04 | mg/L | 0.030 | 101 | 90 | 110 | | | |
| Magnesium | 50.2 | mg/L | 1.0 | 100 | 90 | 110 | | | |
| Manganese | 5.03 | mg/L | 0.010 | 101 | 90 | 110 | | | |
| **Method: E200.7** | | | | | | | | | Batch: R98253 |
| **Sample ID: MB-SPDIS070821A** | Method Blank | | | | Run: ICP202-B_070821A | | | | 08/21/07 13:08 |
| Calcium | ND | mg/L | 0.009 | | | | | | |
| Iron | ND | mg/L | 0.002 | | | | | | |
| Magnesium | ND | mg/L | 0.01 | | | | | | |
| Manganese | ND | mg/L | 0.0002 | | | | | | |
| **Sample ID: LFB-SPDIS070821A** | Laboratory Fortified Blank | | | | Run: ICP202-B_070821A | | | | 08/21/07 13:12 |
| Calcium | 48.9 | mg/L | 1.0 | 98 | 85 | 115 | | | |
| Iron | 4.98 | mg/L | 0.030 | 100 | 85 | 115 | | | |
| Magnesium | 48.2 | mg/L | 1.0 | 96 | 85 | 115 | | | |
| Manganese | 4.84 | mg/L | 0.010 | 97 | 85 | 115 | | | |
| **Sample ID: B07081853-005CMS2** | Sample Matrix Spike | | | | Run: ICP202-B_070821A | | | | 08/21/07 15:45 |
| Calcium | 124 | mg/L | 1.0 | 100 | 70 | 130 | | | |
| Iron | 13.2 | mg/L | 0.030 | 92 | 70 | 130 | | | |
| Magnesium | 65.9 | mg/L | 1.0 | 99 | 70 | 130 | | | |
| Manganese | 9.80 | mg/L | 0.010 | 88 | 70 | 130 | | | |
| **Sample ID: B07081853-005CMSD2** | Sample Matrix Spike Duplicate | | | | Run: ICP202-B_070821A | | | | 08/21/07 15:50 |
| Calcium | 126 | mg/L | 1.0 | 104 | 70 | 130 | 1.6 | 20 | |
| Iron | 13.3 | mg/L | 0.030 | 93 | 70 | 130 | 0.5 | 20 | |
| Magnesium | 66.7 | mg/L | 1.0 | 100 | 70 | 130 | 1.2 | 20 | |
| Manganese | 10.1 | mg/L | 0.010 | 93 | 70 | 130 | 2.7 | 20 | |

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

# QA/QC Summary Report

**Client:** Geomatrix
**Project:** Twin Creeks Subdivision

**Report Date:** 08/23/07
**Work Order:** B07081791

| Analyte | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Method: E200.8** | | | | | | | | | Analytical Run: ICPMS202-B_070821A |
| **Sample ID: QCS - ME070515A, ME0** | Initial Calibration Verification Standard | | | | | | | | 08/21/07 13:10 |
| Arsenic | 0.0509 | mg/L | 0.0050 | 102 | 90 | 110 | | | |
| **Method: E200.8** | | | | | | | | | Batch: R98252 |
| **Sample ID: LRB** | Method Blank | | | | Run: ICPMS202-B_070821A | | | | 08/21/07 13:54 |
| Arsenic | ND | mg/L | 4E-05 | | | | | | |
| **Sample ID: LFB** | Laboratory Fortified Blank | | | | Run: ICPMS202-B_070821A | | | | 08/21/07 13:59 |
| Arsenic | 0.0505 | mg/L | 0.0050 | 101 | 85 | 115 | | | |
| **Sample ID: B07081832-002CMS** | Sample Matrix Spike | | | | Run: ICPMS202-B_070821A | | | | 08/22/07 04:13 |
| Arsenic | 0.0544 | mg/L | 0.0050 | 109 | 70 | 130 | | | |
| **Sample ID: B07081832-002CMSD** | Sample Matrix Spike Duplicate | | | | Run: ICPMS202-B_070821A | | | | 08/22/07 04:19 |
| Arsenic | 0.0548 | mg/L | 0.0050 | 109 | 70 | 130 | 0.6 | 20 | |
| **Method: E353.2** | | | | | | | | | Analytical Run: FIA203-B_070821B |
| **Sample ID: ICV** | Initial Calibration Verification Standard | | | | | | | | 08/21/07 12:23 |
| Nitrogen, Nitrate+Nitrite as N | 6.92 | mg/L | 0.050 | 102 | 90 | 110 | | | |
| **Method: E353.2** | | | | | | | | | Batch: R98237 |
| **Sample ID: MBLK** | Method Blank | | | | Run: FIA203-B_070821B | | | | 08/21/07 12:24 |
| Nitrogen, Nitrate+Nitrite as N | 0.007 | mg/L | 0.002 | | | | | | |
| **Sample ID: LFB** | Laboratory Fortified Blank | | | | Run: FIA203-B_070821B | | | | 08/21/07 12:25 |
| Nitrogen, Nitrate+Nitrite as N | 1.02 | mg/L | 0.050 | 104 | 90 | 110 | | | |
| **Sample ID: B07081682-008BMS** | Sample Matrix Spike | | | | Run: FIA203-B_070821B | | | | 08/21/07 13:55 |
| Nitrogen, Nitrate+Nitrite as N | 1.00 | mg/L | 0.050 | 102 | 90 | 110 | | | |
| **Sample ID: B07081682-008BMSD** | Sample Matrix Spike Duplicate | | | | Run: FIA203-B_070821B | | | | 08/21/07 13:56 |
| Nitrogen, Nitrate+Nitrite as N | 0.993 | mg/L | 0.050 | 101 | 90 | 110 | 1.1 | 10 | |

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

# Energy Laboratories Inc
# Workorder Receipt Checklist

## Geomatrix

B07081791

Login completed by: Eric L. Frank

Date and Time Received: 8/20/2007 8:00 AM

Reviewed by:

Received by: smr

Reviewed Date:

Carrier name: Hand Del

| | | | |
|---|---|---|---|
| Shipping container/cooler in good condition? | Yes ☑ | No ☐ | Not Present ☐ |
| Custody seals intact on shipping container/cooler? | Yes ☑ | No ☐ | Not Present ☐ |
| Custody seals intact on sample bottles? | Yes ☐ | No ☐ | Not Present ☑ |
| Chain of custody present? | Yes ☑ | No ☐ | |
| Chain of custody signed when relinquished and received? | Yes ☑ | No ☐ | |
| Chain of custody agrees with sample labels? | Yes ☑ | No ☐ | |
| Samples in proper container/bottle? | Yes ☑ | No ☐ | |
| Sample containers intact? | Yes ☑ | No ☐ | |
| Sufficient sample volume for indicated test? | Yes ☑ | No ☐ | |
| All samples received within holding time? | Yes ☑ | No ☐ | |
| Container/Temp Blank temperature in compliance? | Yes ☑ | No ☐ | 4°C |
| Water - VOA vials have zero headspace? | Yes ☐ | No ☐ | No VOA vials submitted ☑ |
| Water - pH acceptable upon receipt? | Yes ☑ | No ☐ | Not Applicable ☐ |

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES

# Chain of Custody and Analytical Request Record



**PLEASE PRINT- Provide as much information as possible.**

| | | | |
|---|---|---|---|
| Company Name: Geomatrix | Project Name, PWS, Permit, Etc. Twin Creeks Subdivision | Sample Origin State: MT | EPA/State Compliance: Yes ☐ No ☐ |
| Report Mail Address: 1001 S. Higgins B-1 Missoula MT 59801 | Contact Name: Adam Johnson Phone/Fax: 542-0129 | Email: ajohnson@geomatrix.com | Sampler: (Please Print) Same |
| Invoice Address: Same | Invoice Contact & Phone: Amy Stuber 542-0129 | Purchase Order: | Quote/Bottle Order: 22679 |

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

- ☒ DW
- ☐ GSA
- ☐ POTW/WWTP
- ☐ State: ______
- ☐ Other: ______
- ☐ A2LA
- ☐ EDD/EDT (Electronic Data)
- Format: ______
- ☐ LEVEL IV
- ☐ NELAC

Number of Containers / Sample Type: A W S V B O / Air Water Soils/Solids Vegetation Bioassay Other

ANALYSIS REQUESTED

| | SAMPLE IDENTIFICATION (Name, Location, Interval, etc.) | Collection Date | Collection Time | MATRIX | Alk/PH/Cond. | Metals | N ($NO_3 + NO_2$) | | | | | | SEE ATTACHED | Normal Turnaround (TAT) | RUSH | LABORATORY USE ONLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TC-TW-1 | 8/16/07 | 1815 | 3-W | X | X | X | | | | | | | X | | ~~B~~0708179[1]-001 |
| 2 | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | |

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments: Logged in per Bottle order

Shipped by: HAND

Cooler ID(s):

Receipt Temp 4 °C

On Ice: Yes No

Custody Seal Y N

Intact Y N

Signature Match Y N

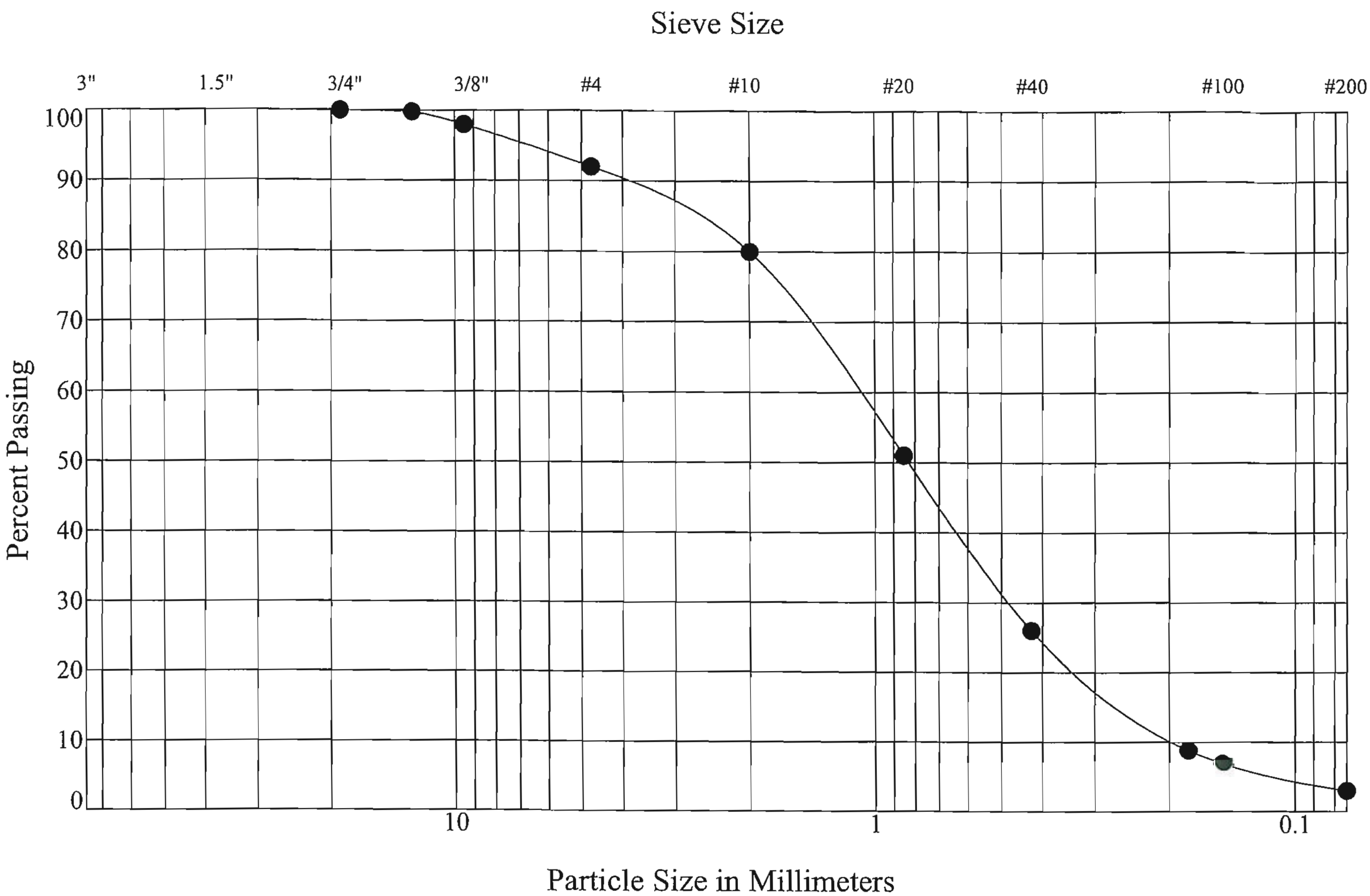
**Custody Record MUST be Signed**

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by (print): [signature] | Date/Time: 8/17/07 1200 | Signature: Adam Johnson | Received by (print): | Date/Time: | Signature: |
| Relinquished by (print): | Date/Time: | Signature: | Received by (print): | Date/Time: | Signature: |
| Sample Disposal: Return to Client: ____ | Lab Disposal: ____ | | Received by Laboratory: Sandy Kusch | Date/Time: 8-20-07 8:00 | Signature: |

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report.

# Appendix E

Sieve Analyses for TC-TW-1




| Gravel | | Sand | | |
|---|---|---|---|---|
| coarse | fine | coarse | medium | fine |

Percent Passing U.S. Standard Sieve Size

| 1 1/2" | 1" | 3/4" | 1/2" | 3/8" | #4 | #10 | #20 | #40 | #80 | #100 | #200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 | 100 | 98 | 92 | 80 | 51 | 26 | 9 | 7 | 3.0 |

Sample No.: 1173
Boring No.: 23
Depth: 320

Date Received: August 27, 2007
Approved By: ____________
Date Approved: ____________

| | |
|---|---|
| Liquid Limit: | |
| Plastic Limit: | |
| Plasticity Index: | |
| Classification: | SP |
| Moisture Content: | |

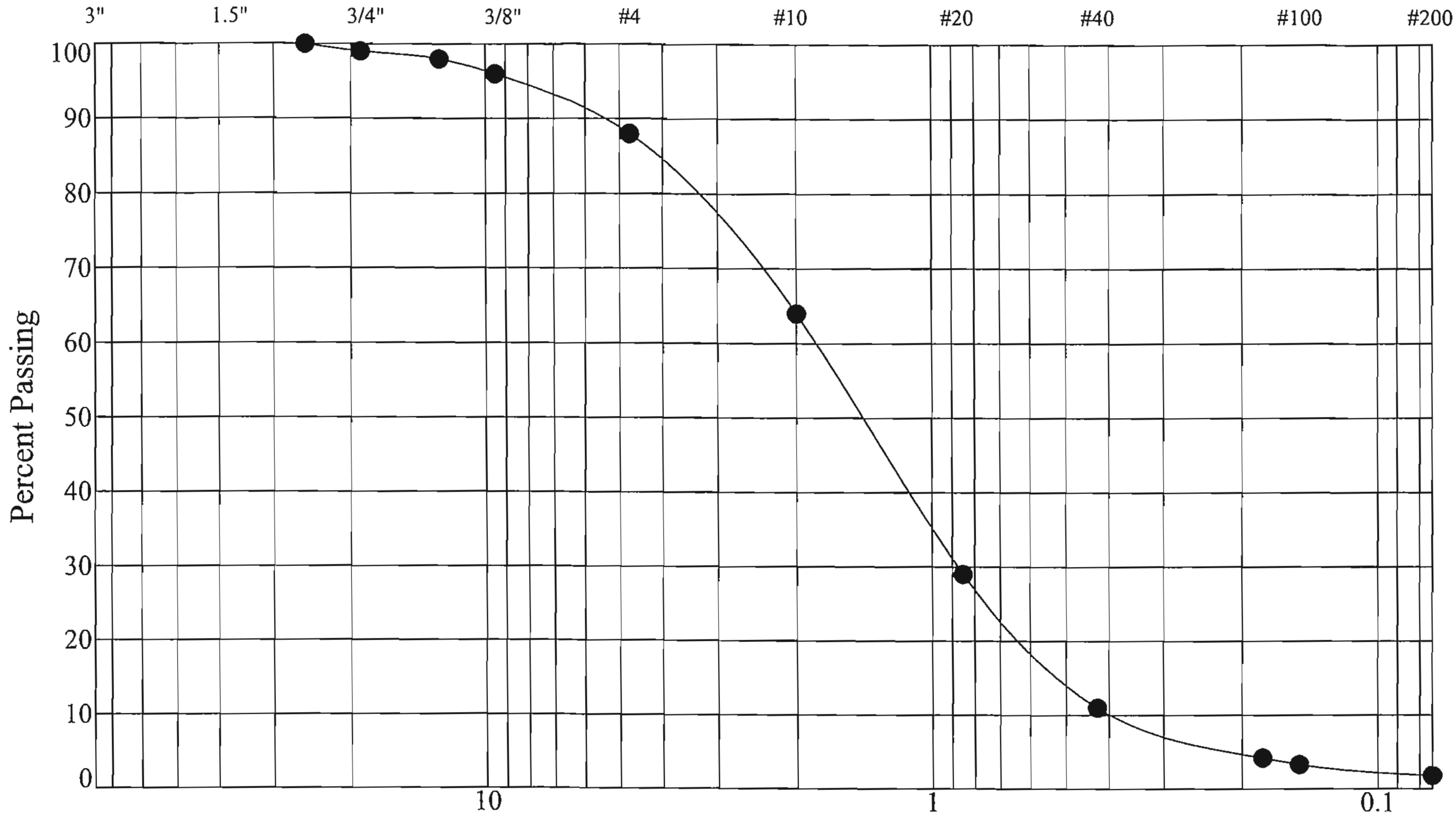
Percent Gravel: 8.0
Percent Sand: 89.0
Percent Silt + Clay: 3.0
ASTM Group Name: Poorly Graded Sand


SK GEOTECHNICAL
4041 Whippoorwill Drive
P.O. Box 16123
Missoula, MT 59808-6123
Phone: 406.721.3391
Fax: 406.721.6233


**Sieve Analysis**
Project Number: 05-7239
Project Name: Twin Creeks Subdivision, Geomatrix # TC-TW-1
Project Location: Stevensville, Montana

8/30/07

## Sieve Size




Particle Size in Millimeters

| Gravel | | Sand | | |
|---|---|---|---|---|
| coarse | fine | coarse | medium | fine |

Percent Passing U.S. Standard Sieve Size

| 1 1/2" | 1" | 3/4" | 1/2" | 3/8" | #4 | #10 | #20 | #40 | #80 | #100 | #200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 99 | 98 | 96 | 88 | 64 | 29 | 11 | 4 | 3 | 1.8 |

Sample No.: 1174
Boring No.: 24
Depth: 359

Date Received: August 27, 2007
Approved By: ________
Date Approved: ________

| | |
|---|---|
| Liquid Limit: | |
| Plastic Limit: | |
| Plasticity Index: | |
| Classification: | SP |
| Moisture Content: | |

Percent Gravel: 12.0
Percent Sand: 86.2
Percent Silt + Clay: 1.8
ASTM Group Name: Poorly Graded Sand


SK GEOTECHNICAL
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P.O. Box 16123
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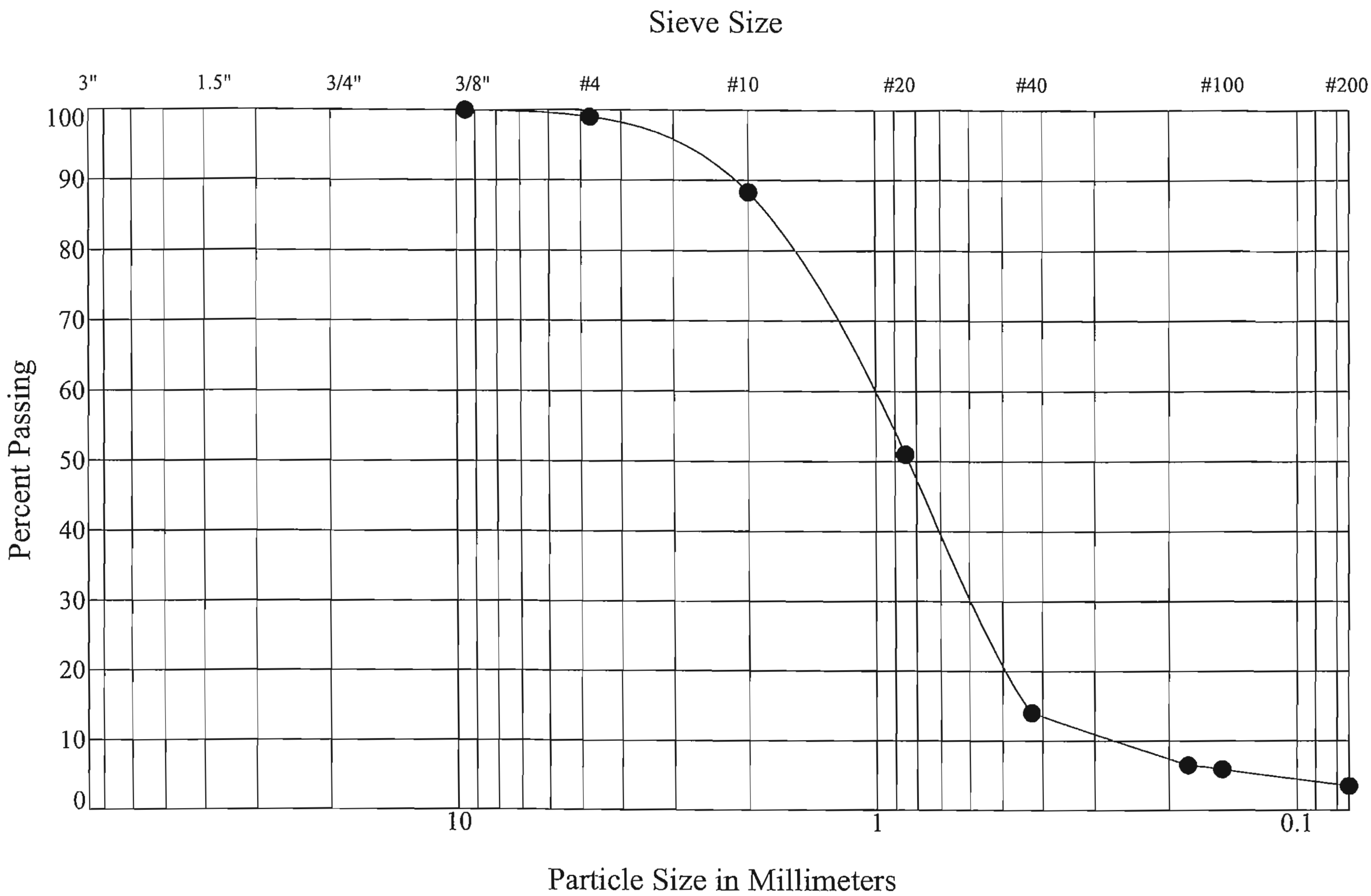
**Sieve Analysis**
Project Number: 05-7239
Project Name: Twin Creeks Subdivision, Geomatrix # TC-TW-1
Project Location: Stevensville, Montana

8/30/07




| Gravel | | Sand | | |
|---|---|---|---|---|
| coarse | fine | coarse | medium | fine |

Percent Passing U.S. Standard Sieve Size

| 1 1/2" | 1" | 3/4" | 1/2" | 3/8" | #4 | #10 | #20 | #40 | #80 | #100 | #200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 | 99 | 88 | 51 | 14 | 7 | 6 | 3.5 |

Sample No.: 1175
Boring No.: 25
Depth: 385

Date Received: August 27, 2007
Approved By: ____________
Date Approved: ____________

| | |
|---|---|
| Liquid Limit: | |
| Plastic Limit: | |
| Plasticity Index: | |
| Classification: | SP |
| Moisture Content: | |

Percent Gravel: 1.0
Percent Sand: 95.5
Percent Silt + Clay: 3.5
ASTM Group Name: Poorly Graded Sand

SK GEOTECHNICAL
4041 Whippoorwill Drive
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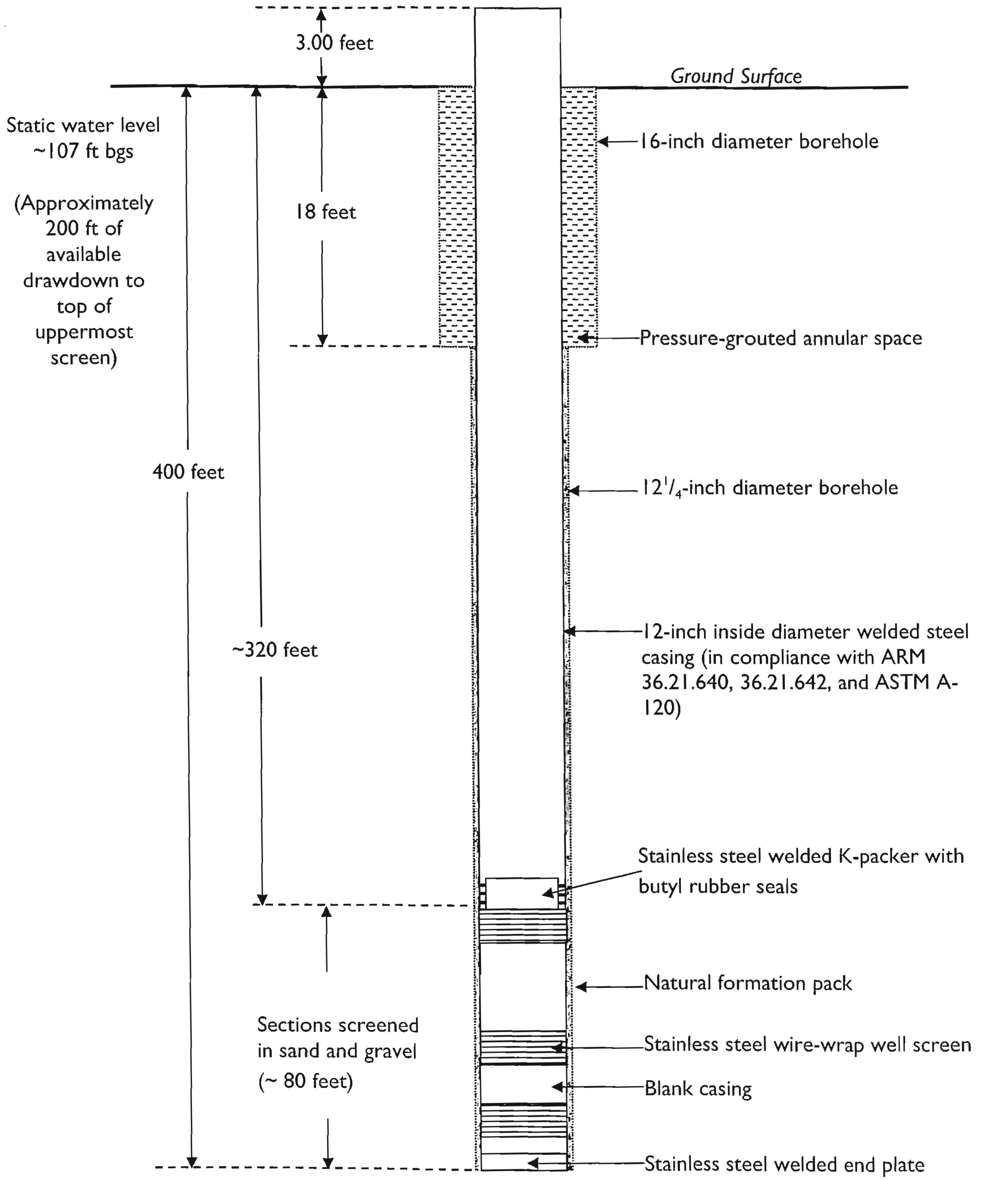
Fax: 406.721.6233

**Sieve Analysis**
Project Number: 05-7239
Project Name: Twin Creeks Subdivision, Geomatrix # TC-TW-1
Project Location: Stevensville, Montana

8/30/07

# Appendix F

Preliminary Well Design Diagram




Geomatrix

**Proposed Well Design**
**Stevensville PWS**
**Ravalli County, Montana**

# Hydrogeologic Assessment Report and Criteria Addendum Evaluation in Support of Application for Beneficial Use Permit

Town of Stevensville
Ravalli County, Montana

Prepared for:

**Town of Stevensville, Montana**
P.O. Box 30
Stevensville, MT 59870

Prepared by:

**AMEC Geomatrix, Inc.**
1001 South Higgins Avenue, B-1
Missoula, Montana 59801
(406) 542-0129

August 2008
Project No. 13412

amec

# Hydrogeologic Assessment Report and Criteria Addendum Evaluation in Support of Application for Beneficial Use Permit

## Town of Stevensville
## Ravalli County, Montana

Prepared for:

Town of Stevensville, Montana
P.O. Box 30
Stevensville, MT 59870

Prepared by:

AMEC Geomatrix, Inc.
1001 South Higgins Avenue, B-1
Missoula, Montana USA 59801

August 2008

## TABLE OF CONTENTS



## LIST OF TABLES



## LIST OF FIGURES

## LIST OF APPENDICES

# 1.0 INTRODUCTION

Twin Creeks, LLC is proposing to develop Twin Creeks Subdivision on an approximately 40-acre parcel located along the south side of Middle Burnt Fork Road immediately southeast of the Town of Stevensville (Town). The parcel is located within the northwest ¼ of the northeast ¼ of Section 35, Township 9 North, Range 20 West (Figure 1). The property is not currently served by Stevensville's existing Public Water Supply (PWS) system. The proposed subdivision will include 117 lots, and will require an estimated 96.3 acre-feet of water per year to meet the demands for domestic use and for lawn and garden irrigation.

In April 2008 AMEC Geomatrix, Inc. (AMEC) provided oversight during drilling, construction, and aquifer testing of a single production well on a 33-acre parcel of land that is adjacent to the proposed subdivision. Twin Creeks, LLC plans to donate a portion of this parcel and the PWS well to the Town. The installed PWS well has a capacity that greatly exceeds the total water demand of the Twin Creeks subdivision.

The PWS well was drilled to a total depth of 430 feet below ground surface (bgs). The well is screened from 400 to 430 feet bgs. The well was drilled deeper than any existing wells in the area, and the water-bearing unit that it is completed in is beneath several low-permeability clay units, including an approximately 26-foot thick clay unit encountered from 270 to 296 feet bgs. Twin Creeks, LLC chose to install the well in this deep aquifer in order to avoid the potential for adverse affects on neighboring wells or nearby surface water sources, and to provide the Town with a well that will be well protected against common sources of potential contamination.

The Town plans to incorporate this well into its existing municipal water supply system, and therefore the Town is applying for the necessary water right. The Town is seeking a water right for Municipal Use to supply water at a maximum flow rate of 1,100 gallons per minute (gpm) and for a volume of 96.3 acre-feet per year (the volume necessary to support the additional demand of Twin Creeks subdivision on the existing municipal system). Territorial-Landworks, Inc. (TLI) of Missoula provided demand estimates for Twin Creeks subdivision to AMEC. TLI is the engineering and design consultant for the project.

This report summarizes hydrogeologic information related to the site presented to support a Montana Department of Natural Resources and Conservation (DNRC) Application for Beneficial Water Use Permit (Form 600 and Criteria Addendum A). The project is located within the Bitterroot Basin Closure. ARM 36.12.120 (2) states that "An applicant must provide a written summary of the application information explaining how their application meets the basin closure exceptions and why their application located in a closed basin can be processed." According to MCA 85-2-344 (2) "As provided in 85-2-319, the department may not process or grant an application for a permit to appropriate water or for a state water reservation within a Bitterroot Basin until the closure for the basin is terminated pursuant to subsection (3) of this section, except for:

(a) an application for a permit to appropriate ground water;"

The Application for Beneficial Water Use Permit submitted to DNRC on behalf of The Town of Stevensville is for one public water supply well that will provide groundwater for Municipal Use. Because this application is for a permit to use groundwater, it complies with the basin closure exception prescribed in MCA 85-2-344 (2) (a). Therefore, DNRC can process this permit.

In addition to fulfilling DNRC requirements, this report presents information required by Montana Department of Environmental Quality (MDEQ) Circular DEQ-1. The report includes a description of well drilling, design, and installation along with details of methods and results of aquifer testing and water quality sampling.

## 2.0 PROJECTED WATER NEEDS

Table 1 summarizes the estimated water demands for domestic and irrigation use after full build-out of the Twin Creeks Subdivision. A detailed breakdown of the water demand for the subdivision is included as Appendix A. Figure 2 shows the proposed lot layout of the subdivision as well as the location of the installed PWS well (TC-PWS-1). The estimated peak instantaneous demand for Phases 1 through 3 of the subdivision is 298.5 gallons per minute (gpm). The average annual daily demand necessary to supply the total annual usage of 96.3 acre-feet is 59.7 gpm, and the estimated maximum daily demand for the development is 155.8 gpm. The Town is seeking a new water right for municipal use with a flow rate of 1,100 gallons per minute (gpm) and an annual volume of 96.3 acre-feet per year. The requested flow rate is higher than the rate required to serve the Twin Creeks subdivision. This flow rate will provide the Town additional flexibility in operating their municipal water supply system, after well TC-PWS-1 is connected to the larger system.

**Table 1.** Total Estimated Water Demand for Twin Creeks Subdivision

| Time Period | | | Annual Demand Volume (acre-feet) | | | Average Demand Rate (gpm) |
|---|---|---|---|---|---|---|
| *Start* | *End* | *No. of Days* | *Domestic* | *Irrigation* | *Total* | *Domestic & Irrigation* |
| January 1 | April 16 | 106 | 9.8 | -- | 9.8 | 20.8 |
| April 17 | October 13 | 180 | 16.6 | 62.7 | 79.3 | 99.7 |
| October 14 | December 31 | 79 | 7.3 | -- | 7.3 | 20.8 |
| | | ***Totals*** | ***33.6*** | ***62.7*** | ***96.3*** | ***Avg. Annual Rate=59.7*** |

## 3.0 HYDROGEOLOGIC SETTING

The Bitterroot Valley is a structural basin controlled by faults that separate the lower elevations from the mountains to the east and west (McMurtrey et al. 1972). The Stevensville area is bounded on the east by the Sapphire Mountain Range, which is composed of Precambrian Belt Series meta-sedimentary rocks and Cenozoic igneous rocks. To the west, the gaining Bitterroot River acts as a hydraulic divide. Beyond the river, the Bitterroot Mountains comprise Cretaceous intrusions and metamorphosed Precambrian rocks.

Lonn and Sears (2001) provided a geologic map of the Bitterroot Valley. Alluvial fan and outwash terrace deposits, probably deposited in the Late Pleistocene, blanket the well field parcel. McMurtrey et al. (1972) mapped the sediments in the vicinity of the well field as river terrace alluvium. To the west, younger Quaternary alluvium underlies the current Bitterroot River channel, its floodplain, and major tributaries. Well logs throughout the valley indicate that the recent alluvium has an average thickness of approximately 40 feet (McMurtrey and others 1972). Quaternary unconsolidated deposits (alluvium, terraces, and other Quaternary materials) are between 50 and 100 feet thick at Stevensville (Smith 2006a).

Tertiary-aged fine- and coarse-grained deposits occur below the Quaternary sediments in the Stevensville area (Smith 2006b) and to the east of the proposed well field (Lonn and Sears, 2001). Based on an approximate bedrock elevation of 1,500 feet above mean sea level (amsl) and a ground surface elevation of 3435 feet amsl at the new PWS well location, Tertiary materials extend to over 1800 feet bgs (Smith 2006c). Deep water-bearing zones encountered during drilling of the test and production wells are interpreted as Tertiary ancestral Bitterroot River deposits (Lonn and Sears 2001).

Groundwater in the Bitterroot Valley is recharged by precipitation, snowmelt runoff, losing streams, leakage from irrigation ditches, and infiltration of excess irrigation water (Western Groundwater Services 2002). Groundwater in the area of the proposed well fields originates from upgradient Tertiary and Quaternary sediments (to the east-southeast), fractured Precambrian formations, infiltration of precipitation and snowmelt runoff, stream recharge, irrigation return flows, and leakage from irrigation ditches. Groundwater beneath the property ultimately discharges to the Bitterroot River west and north of the site (Lafave 2006).

According to the GWIC database, wells in section 35 (84 total) are between 12 and 400 feet deep. Wells typically produce less than 100 gpm, and are less than 200 feet deep in unconsolidated clay, silt, sand, and gravel. Static water levels in area wells are generally less than 100 feet bgs.

According to Lafave (2006), groundwater in the area flows to the west-northwest, toward the Bitterroot River. McMurtrey et al. (1972) showed groundwater flow to the west at the well field property. The potentiometric surface of the deep aquifer(s) at the site is approximately 3,300 feet amsl. Given a ground surface elevation of 3,435 feet amsl, the depth to water in the deep aquifer(s) is approximately 135 feet bgs. Groundwater flow is generally parallel to topography and follows the Burnt Fork alluvial fan from the Sapphire Mountains foothills toward the Bitterroot River. The gradient in the Stevensville area is estimated to be approximately 0.025 (Western Groundwater Services 2002). Based on lithologic observations made during test and production well drilling, the target aquifer is confined.

## 4.0 WELL DRILLING AND INSTALLATION

From May 18 to May 25, 2007, Jerome's Drilling, Inc. (Jerome) of Missoula, Montana used an air-rotary rig to drill and install a six-inch diameter steel test well (designated TC-TW-1). An AMEC hydrogeologist collected samples of drill cuttings, recorded lithologic descriptions, and estimated groundwater production rates via airlifting water from the borehole. The borehole for test well TC-TW-1 was drilled to 398 feet bgs and the casing was advanced to the total borehole depth. The well was perforated with a Holte perforator in several locations between 100 and 400 feet below ground surface (bgs). Water-bearing units collectively produced several hundred gallons per minute (gpm) during airlift pumping performed during drilling.

Between April 14 and April 17, 2008, AK Drilling, Inc. (AK) of Butte, Montana installed a production well (TC-PWS-1) approximately 10 feet south of well TC-TW-1. A 10-inch diameter borehole was drilled to a total depth of 435 feet bgs. Thirty feet of 8-inch diameter continuous-slot stainless steel wire-wrap well screen were installed in the well between 400 and 430 feet bgs. An AMEC field hydrogeologist recorded lithologic descriptions of formation materials and estimated groundwater production rates via airlifting water during the drilling of both installed wells. Well lithologic logs for both the test well and the production well are included in Appendix B.

AMEC designed the production well screen based on the results of grain-size distribution analyses of aquifer material samples collected during the installation of the test well. Field personnel provided oversight during well construction to ensure that the well (casing, screens, and K-packer) was constructed according to design specifications (Attachment E). The production well was developed by airlifting water from the well while moving the drill stem up and down within the entire screened interval for a period of more than 8 hours. Well construction diagrams are included in Appendix C, and results of grain-size distribution analyses are presented in Appendix D.

## 5.0 AQUIFER TESTING

AMEC performed a 72-hour pumping test on well TC-PWS-1 from April 29 to May 2, 2008 in accordance with DEQ and DNRC requirements. Water levels were measured during testing with pressure transducer-data logger units manufactured by Instrumentation Northwest, Inc. (Model PT2X). These instruments are accurate to within 0.001 feet. AMEC also measured water levels periodically during testing using an electronic sounder to verify the accuracy of data collected by transducer. A summary of the pertinent test parameters is provided in Table 2, aquifer test data are presented graphically in Appendix E, and an electronic version of the aquifer testing data (formatted on DNRC form 633) is provided on the attached CD (also in Appendix E). Data included on the CD demonstrates that water-level measurements were collected at time intervals that exceed DNRC's frequency requirements.

AMEC instrumented three wells for the duration of the test. These wells include the pumping well (TC-PWS-1; GWIC No. 244440), the nearby test well (TC-TW-1; GWIC No. 237482), and a shallow observation well (TC-SOW-1; GWIC No. unknown) on the property. The screened intervals of these wells are listed in Table 2. No observation well in the pumping well source aquifer was available for monitoring.

**Table 2.** Summary of Aquifer Test Details and Well Responses

| | | |
|---|---|---|
| Pump Turned On | | 4/29/08 12:10 |
| Pump Turned Off | | 5/2/08 13:10 |
| Test Duration | | 73 hours |
| Time-Weighted Average Flow Rate | | 1106 gpm |
| TC-PWS-1 (Pumping Well) Specific Capacity † | | 4.8 gpm/ft |
| TC-PWS-1 (Pumping Well) Available Drawdown * | | 147 ft |
| Screened Intervals (ft bgs) | TC-PWS-1(GWIC | 400-430 |
| | TC-TW-1 | 118-139; 194-197; 319-322; 350-361; 383-388 |
| | TC-SOW-1 | Open Bottom @ 38 |
| Maximum Observed Drawdown (ft) | TC-PWS-1 | 231.1 |
| | TC-TW-1 | 4.5 |
| | TC-SOW-1 | 0.0 |

NOTES:
† Measured at the end of the pumping test
* Distance between the static water level and the top of the well screen

Water levels were measured once per minute in wells TC-PWS-1 and TC-SOW-1 prior to the start of the test to evaluate background water level trends in the shallow and deep aquifers. Water levels were recorded in well TC-PWS-1 for approximately 58 hours (2.4 days), and water levels in well TC-SOW-1 were collected for approximately 24 hours. Water level data measured in these wells are provided in Appendix E.

The water level in well TC-PWS-1 rose slowly and steadily over the background-monitoring period (0.72 feet in 58 hours or approximately 0.01 feet/hour). The water level in well TC-SOW-1 declined 0.09 feet during the 24-hour background-monitoring period. Drawdown data collected during aquifer testing were not trend-corrected because background water-level trends were relatively minor when compared to drawdown responses.

Because the discharge valve was completely open at the beginning of testing, the flow rate could not be increased later to offset declining production due to drawdown and subsequent increased total dynamic head. As a result, the pumping rate decreased slowly during the test from a maximum of 1230 gpm to a minimum of 1052 gpm. The flow rate, however, was maintained at an average rate of 1106 gpm. Variations in flow rate were taken into account during the curve-matching analyses of drawdown data.

## 5.1 Well Responses to Test Pumping

After turning on the pump, the water level in the pumping well drew down for approximately the first 1700 minutes (28 hours) of the test. The maximum drawdown measured in the pumping well was 231.1 feet. After this initial drawdown period, the water level began to recover during the final 45 hours until the pump was turned off. Water-level recovery during the latter portion of the pumping period was likely due to decreasing flow rates.

One of the two monitored observation wells responded to the pumping of well RDR-PWS-2. The water level in the nearby test well (TC-TW-1) began to decline within 30 minutes of turning on the pump, and a maximum drawdown of approximately 4.5 feet was observed in this well at the end of the test. Drawdown in this well was caused by leakage through confining layer(s) overlying the pumped formation. During the drilling of both the test well and the production well, a thin, high-yield sand and gravel aquifer was encountered between 383 and 388 feet bgs. The test well was screened over this interval (Table 2). A 12-foot fine-grained zone was logged between 388 feet and 400 feet, above the screened interval of the production well. Leakage through this layer from the above aquifer could account for the drawdown response in the test well.

Drawdown was not observed in shallow well TC-SOW-1. The water level in the shallow well rose approximately 0.3 feet during the test. The lack of a response to pumping indicates that the shallow aquifer hosting this well is not in hydraulic communication with the deeper source aquifer. Silt and clay layers of up to 45 feet were observed in both the test well and the production well between 100 and 300 feet below ground surface.

## 5.2 Aquifer Parameter Estimates

Estimates of aquifer characteristics obtained from pumping test data are summarized in Table 3. Curve matching was performed using AquiferWin32 software. Aquifer parameter estimates from pumping well responses were derived using the Theis (1935; confined aquifer) and Papadupolus and Cooper (1967; large diameter well) solutions.

The range of hydraulic conductivity estimates is typical of coarse unconsolidated deposits composed of sand and gravel (Driscoll 1986). Storage coefficients were not calculated because the observation wells were not completed in the same water-bearing zone as the pumping well.

**Table 3.** Summary of Aquifer Test Results

| **Pumping Well** | **Aquifer Thickness** (ft) | **Transmissivity** ($ft^2$/day) | **Hydraulic Conductivity** (ft/day) | **Analytical Method** |
|---|---|---|---|---|
| TC-TW-1 (August 2007) | 43 [1] | 2500 | 58 | Theis (1935) |
| TC-PWS-1 (April-May 2008) | 30 | 1450 | 48 | Theis (recovery analysis) |
| | | 1670 | 56 | Papadupolus and Cooper (1967) |

(1) - Based on the combined thickness of well perforated intervals

## 5.3 Groundwater Quality

AMEC collected water quality samples from wells TC-TW-1 and TC-PWS-1 at the end of the pumping tests. Samples were submitted to Energy Laboratories, Inc. (Energy Labs) in Billings, Montana for analyses of Clean Drinking Water Act parameters. All laboratory analytical reports are included as Appendix F and results are summarized in Table 4.

Water quality data from the test and production wells are representative of groundwater quality in the confined aquifer (Table 3). Groundwater at the site is of the calcium-bicarbonate type and has near-neutral pH. Concentrations of all analytes in all samples were below applicable water quality standards (DEQ 1999; DEQ 2006).

**Table 4.** Summary of Groundwater Sample Results

| Analyte Category | Analyte | Units | GW Standard[1] | TC-TW-1 (2007) | TC-PWS-1 (2008) |
|---|---|---|---|---|---|
| Physical Properties | pH | pH | -- | 6.8 | 7.0 |
| | Total Dissolved Solids | mg/L | -- | NR | 166 |
| | Conductivity | µS/cm | -- | 386 | 223 |
| Inorganic Constituents | Alkalinity (as $CaCO_3$) | mg/L | -- | 166 | 99 |
| | Chloride | mg/L | -- | NR | 2 |
| | Sulfate | mg/L | -- | NR | 14 |
| | Bicarbonate | mg/L | -- | NR | 121 |
| | Fluoride | mg/L | 4,000 | NR | 0.4 |
| | Hardness (as Ca $CO_3$) | mg/L | -- | 166 | NR |
| Nutrients | Nitrogen ($NO_3$ + $NO_2$) | mg/L | 10 | 0.98 | 0.18 |
| Metals | Calcium | mg/L | -- | 50 | 28 |
| | Mercury | mg/L | -- | NR | ND |
| | Sodium | mg/L | -- | NR | 11 |
| | Magnesium | mg/L | -- | 10 | 6 |
| | Iron | mg/L | 0.30 | 0.12 | 0.03 |
| | Manganese | mg/L | 0.05 | ND | ND |
| | Arsenic | µg/L | 10 | ND | ND |
| Pesticides and Herbicides | Various | | | NR | ND |
| Volatile and Semi-Volatile Organic | Various | | | NR | ND |
| Radionuclides | Gross Alpha | pCi/L | 15 | NR | 1.9 |

Notes:
(1) = Montana Numeric Water Groundwater Quality Standards (Circular DEQ-7) or PWS standard (DEQ 1999).
Some constituents not detected are not shown in the table.ND = not detected at the reporting limit. NR = Not reported. mg/L = milligrams per liter. µg/L = micrograms per liter. µS/cm = microsiemens per centimeter. pCi/L = picocuries per liter.

## 6.0 EVALUATION OF CRITERIA FOR WATER USE PERMIT

The following section describes how the criteria of physical and legal availability of water and the potential for adverse impacts to senior water users have been addressed (these criteria are defined in Montana Codes Annotated (MCA), Title 85, Chapter 2, Part 1). DNRC Basin-Closure compliance is required because the proposed subdivision is located within the Bitterroot River Basin-Closure.

### 6.1 Physical Availability of Water

The pumping test performed by AMEC on well TC-PWS-1 (described in Section 5.0) demonstrates that the requested flow rate of 1,100 gpm is physically availability. The maximum drawdown measured in the pumping well (231.11 feet) was significantly less than the total available drawdown (267 feet) in the well. For the purposes of this report, total available drawdown is the difference between the static water level measured prior to the start of aquifer testing and the depth to the top of the well screen.

Figure 3 is a semi-log time-drawdown plot of the pumping well with observed drawdown extrapolated to the period of diversion of 365 days. This plot also shows the total available drawdown in the well. The data collected during aquifer testing suggest that if TC-PWS-1 were pumped at a constant rate of 1,100 gpm for 365 days, approximately 8 feet of available drawdown would remain in the well. These estimates are conservative, because the well will not require continuous pumping throughout the entire period of diversion, and will only be pumped intermittently at the requested rate of 1,100 gpm. Therefore, sufficient available drawdown exists to sustain the requested pumping rate throughout the period of diversion, and water will be physically available at the diversion point.

### 6.2 Legal Availability of Water

To address the question of legal availability of water, AMEC estimated the volumetric flux in the source aquifer within the predicted zone of influence (ZOI) of the installed PWS well and compared that flux to the sum of: 1) the existing groundwater appropriations within the zone of influence and 2) the volume requested by the Town of Stevensville.

The ZOI of the proposed pumping of the PWS well (Figure 4) was estimated with an analytical model developed with Aquifer Win32 software (ESI 2001). Aquifer properties used to delineated the ZOI were as follows:

**Table 5.** ZOI Modeling Parameters

| Aquifer Property | Value | Source |
|---|---|---|
| Transmissivity | 1,500 $ft^2$/day | Site-Specific Aquifer Testing |
| Storativity | 0.10 | Assumed |
| Gradient | 0.025 | Western Groundwater Services (2002) |

Because no observation well completed in the same deep confined source aquifer was available, aquifer storativity could not be estimated from aquifer test data. Storativity (specific yield) was therefore assumed to be 0.10. The choice of this value was based on the following advice from DNRC hydrogeologists.

> *The zone-of-influence delineation was developed primarily for an unconfined alluvial aquifer in which drawdown may impinge upon surface water within the period of diversion. The zone-of-influence delineation is not well suited to a "confined" aquifer because the use of a "confined" storage coefficient (several orders of magnitude less than specific yield) creates an unreasonably wide radius of influence. In this situation, it is suggested that a default specific yield value of 0.10 be used in the zone-of-influence delineation to limit the radial distance of the impacted area within the "confined" aquifer. The application of 0.10 for storativity for purposes of delineating a zone of influence is reasonable if the unlikely event occurs that the "confined" condition suddenly and unexpectedly transitions to an unconfined condition and a hydraulic*

*connection is established with surface water. A zone of influence delineation using a storage coefficient of 0.10 under a "confined" condition then represents a most conservative, worst-case scenario. Otherwise, if "confining" conditions prevail and no hydraulic connection with surface water is established, it is a frivolous exercise to delineate a zone of influence that would extend for tens of thousands of feet).*

Groundwater modeling indicates that the widest dimension of the zone of influence would be approximately 15,720 feet in width (or a radius of 7,860 feet) at the end of the period of diversion after pumping the PWS well at a constant rate of 59.7 gpm for 365 days. This pumping rate is the average pumping rate necessary to appropriate the full volume of 96.3 acre-feet within the 365-day period of diversion (Table 1).

The volumetric aquifer flux moving through this portion of the aquifer (the ZOI) was estimated using Darcy's Law, as follows:

$$\mathbf{Q = T \times i \times W}$$

Where:
Q = discharge (feet$^3$/day)
T = aquifer transmissivity (feet$^2$/day)
i = hydraulic gradient (feet/feet)
W = aquifer width (feet)

Assuming a zone of influence with a width of 15,720 feet, an estimated water table gradient for the aquifer in the vicinity of the site of 0.025 (Figure 4), and a representative T value of 1,500 feet$^2$ per day, the calculated groundwater flux is 5,269 acre-feet per year. The Town is currently seeking a water right for a total of 96.3 acre-feet/year. The total estimated annual volume of water allocated to existing wells within the predicted zone of influence is 4,641 acre-feet/year. A map showing the locations of these points of diversion along with a table listing them by DNRC water right number is included in Appendix G. A total of 59 of the existing groundwater rights within the ZOI have no annual volume associated with them. For these rights, which are mostly Groundwater Certificates, it was assumed that the full volume of 10 acre-feet is being appropriated. These water rights are indicated in blue print in Appendix G.

**Table 6.** Results of Legal Availability Assessment

| Volume Available | Volume Requested | Volume of Existing Rights | Remaining Volume Available |
|---|---|---|---|
| (acre-feet/yr) | | | |
| 5,269 | 96.3 | 4,641 | 532 |

Based on this estimate, 532 acre-feet per year of available aquifer yield would remain within the predicted zone of influence of the PWS well at the end of the proposed period of diversion (365 days). The results of this calculation indicate that the requested appropriation is legally available.

### 6.3 Potential for Adverse Impacts to Senior Groundwater Users

An aquifer test provided data necessary for addressing possible adverse impacts to senior groundwater users from the proposed appropriation. To assess the potential impact to senior water users, the analytical model developed with Aquifer Win32 was used to project drawdown in the aquifer at the end of the period of diversion, and the magnitude of predicted drawdown was examined at the location of each of the existing points of diversion located within the ZOI.

Figure 5 is a contour map of the resulting simulated drawdown at the end of the 365-day period of diversion. The contour interval in these figures is 0.1-foot, and the 0.01-foot drawdown contour is also shown to indicate the predicted zone of influence. It is important to note that this map presents predicted drawdown in the deep confined source aquifer.

Appendix G includes a figure of the ZOI that shows the locations of all of the existing groundwater rights identified within this zone. Also included in Appendix G is a table that lists each of these water rights along with the owners' name and a description of the maximum predicted drawdown at each location. Again, the information presented in Appendix G represents a "worst-case" scenario because it provides the projected drawdown at each location in a well completed in the deep source aquifer. Of the 252 existing wells with water rights identified within the ZOI, only seven are completed at depths greater than 200 feet bgs. The total depth of each well is included in the table presented in Appendix G.

Figure 6 shows predicted drawdown with respect to distance from the pumping well. Predicted drawdown in the wells located within the ZOI ranges from 0.01 feet to 1.81 feet. This magnitude of drawdown would not interfere with the use of an existing well, unless there is a problem with the existing condition of that well. According to DNRC guidance, drawdown interferences less than 4 feet do not typically prevent a senior ground-water user from reasonably exercising their water right. While the predicted drawdown represents a potential impact, it is not an adverse impact to others users with prior rights to use groundwater.

### 6.4 Potential for Adverse Impacts to Senior Surface Water Users

In accordance with MCA 85-2-361, the following subsections present a stream depletion analysis based on the volume of water that will be consumed by the proposed appropriation. Calculations of the consumptive use of both the domestic and irrigation components of the appropriation are presented, followed by a prediction of theoretical net depletion to the Bitterroot River. Table 7 presents the consumptive use rates used in the stream depletion analysis. A more detailed table presenting all of the monthly values used to calculate consumptive use is included as Appendix H.

#### *6.4.1 Domestic Consumptive Use Estimates*

Domestic consumptive use estimates are based in part on information presented in a Technical Memorandum, dated December 31, 1987, on the subject of "Domestic Consumptive Use" written by Dwight W. Kimsey and Patricia K Flood of Wright Water Engineering, Inc. This memorandum was provided to AMEC by DNRC Water Management Bureau staff. The memorandum begins by summarizing the estimates of the following three previous studies performed to determine domestic consumptive use:

| **Study Author** | **Estimated Domestic Consumptive Use** |
|---|---|
| Wright Water Engineers | 2 to 5 percent |
| W.W. Wheeler, P.E. | 2.5 percent |
| Al Hogan, W.W. Wheeler and Associates | 2.5 percent |

Detailed independent research performed by Wright Water Engineering, Inc. quantifies total domestic consumptive use by incorporating measurements of evaporative loss in household fixtures such as the shower, the toilet, the bath tub, and the dishwasher, and by calculating evaporative loss during common domestic practices such as hand washing, clothes washing and drying, surface cleaning, and cooking. Kimsey and Flood (1987) conclude that total domestic consumptive use is between 2.3 and 3.2 percent. We believe that using a domestic consumptive use rate of 5 percent is a conservative figure. The total consumptive use estimates for the Town of Stevensville application are based on a rate of 5 percent for all domestic use.

**Table 7.** Summary of Consumptive Use for Stream Depletion Model Input

| Month | Days | Irrigation Days | Irrigation Consumptive Use | Domestic Consumptive Use | Total Consumptive Use Volume | Total Consumptive Use Flow Rate |
|---|---|---|---|---|---|---|
| | | | (acre-feet) | (acre-feet) | (acre-feet) | (gpm) |
| January | 31 | 0 | 0 | 0.29 | 0.29 | 2.08 |
| February | 28 | 0 | 0 | 0.26 | 0.26 | 2.08 |
| March | 31 | 0 | 0 | 0.29 | 0.29 | 2.08 |
| *April* | *30* | *17* | *1.64* | *0.28* | *1.92* | *14.46* |
| *May* | *31* | *31* | *6.26* | *0.29* | *6.55* | *47.80* |
| *June* | *30* | *30* | *9.11* | *0.28* | *9.38* | *70.78* |
| *July* | *31* | *31* | *12.14* | *0.29* | *12.43* | *90.70* |
| *August* | *31* | *31* | *10.43* | *0.29* | *10.71* | *78.18* |
| *September* | *30* | *30* | *5.93* | *0.28* | *6.20* | *46.80* |
| *October* | *31* | *13* | *1.31* | *0.29* | *1.59* | *11.61* |
| November | 30 | 0 | 0.00 | 0.28 | 0.28 | 2.08 |
| December | 31 | 0 | 0.00 | 0.29 | 0.29 | 2.08 |
| **Totals** | **365** | **183** | **46.81** | **3.36** | **50.17** | |

### 6.4.2 *Lawn and Garden Consumptive Use*

Consumptive use estimates associated with the lawn and garden irrigation component of the proposed appropriation were calculated using procedures detailed in the USDA-National Resource Conservation Service (NRCS) handbook entitled: National Engineering Handbook (NEH), Part 623, Chapter 2 – "Irrigation Water Requirements", dated September, 1993. This information and the resulting plant water requirement estimates were accessed using the NRCS software package Irrigation Water Requirements (IWR version 1.0). This software allows the user to calculate net irrigation requirements for different crop types based on estimated evapotranspiration rates. The evapotranspiration rates are estimated by the software using historic precipitation and temperature measurements from local climatic data stations.

The crop types available in the Montana Irrigation Guide and the IWR software include "Pasture Grass" and "Turf Grass". Of these two crop types, Turf Grass includes the varieties of grasses most commonly planted as lawns (e.g. Kentucky Blue Grass), while Pasture Grass includes varieties less likely to be planted as lawns. Turf Grass has a higher net irrigation requirement (i.e. consumptive use) than Pasture Grass. Estimates of net irrigation requirements for Pasture Grass are available for most Montana climatic data stations, while estimates for Turf Grass are available for a limited number of stations.

Consumptive use estimates for the Town of Stevensville application were calculated using climatic data from the Stevensville station (NRCS Station No. MT7894). This is a station where net irrigation requirements are available for Pasture Grass but not for Turf Grass. To estimate the requirements for Turf Grass using Stevensville climatic data, we determined the difference between Pasture Grass and Turf Grass at several locations around Western Montana (Table 8). We then used the average difference between Pasture Grass and Turf Grass irrigation requirements to estimate Turf Grass requirements in Stevensville.

**Table 8.** Comparison of Pasture Grass and Turf Grass Irrigation Requirements

| ***Weather Station*** | **Net Irrigation Requirement** (in/yr) | | **Difference in Net Irrigation Requirement** (in/yr) |
|---|---|---|---|
| | ***Pasture Grass*** | ***Turf Grass*** | |
| *Billings Wastewater Treatment Plant* | 16.08 | 19.73 | +3.65 |
| *Helena WSO* | 13.79 | 16.36 | +2.57 |
| *Belgrade Airport* | 13.29 | 14.37 | +1.08 |
| *Kalispell* | 10.49 | 14.41 | +3.92 |
| *Great Falls* | 13.34 | 16.97 | +3.63 |
| ***Average Values*** | ***13.40*** | ***16.37*** | **+2.97** |

Appendix I is a summary of the IWR analysis that presents monthly net irrigation requirements for Pasture Grass for both "normal" and "dry" years, using data from the Stevensville weather station. The "normal" year estimates were used. The average annual difference between Pasture Grass and Turf Grass (2.97 inches; Table 1) was added to the net irrigation requirement for Pasture Grass in the Stevensville area on a normal year. The 2.97 inches was distributed evenly throughout the growing season by adding 0.424 inches to the net irrigation requirement for each of the months (April through October; Appendix H). The IWR analysis was performed using these monthly net irrigation requirements along with the total irrigated area of 25.1 acres, and an irrigation period of April 17th through October 13th.

### *6.4.3 Stream Depletion Analysis*

Reaches of several creeks and irrigation ditches lie within the predicted zone of influence of the PWS well, and the nearest point on the Bitterroot River is approximately 1.5 miles to the west of the well. Because well TC-PWS-1 is completed in a deep confined aquifer that is separated from these surface water features by several intervening low-permeability clay units, no hydraulic connection between the creeks or ditches and the source aquifer is expected. For this reason, only the Bitterroot River was considered in the stream depletion analysis.

It is a basic principle of hydrogeology that all groundwater is tributary to surface water. Groundwater in the source aquifer within the zone of influence of well TC-PWS-1 presumably discharges to the Bitterroot River downgradient of the ZOI. Any net stream depletion resulting from the pumping of well TC-PWS-1 is assumed to be in the form of pre-stream capture, and the predicted stream depletion reach on the Bitterroot River is shown on Figure 4.

In order to address the potential for the proposed new groundwater appropriation to affect existing surface water rights on the Bitterroot River, AMEC performed a stream depletion analysis using the Well Pumping Depletion Model (Western Water Consulting, Inc, 2001). The code is an Excel-based adaptation of the analytical stream depletion model by Schroeder (1987). The analysis represents a "worst-case" scenario because the stream depletion analysis assumes a direct connection between the source aquifer and the surface water feature.

The Well Pumping Depletion Model requires input of the following variables:

1. **(X)** is the distance between the proposed pumping well and the surface water feature. The distance from the PWS well to the nearest point on the Bitterroot River is an estimated 8,200 feet.

2. **(W)** represents the distance between the pumping well and the nearest no-flow boundary. The PWS well is located approximately 2.5 miles from the eastern margin of the Bitterroot Valley (the closest valley margin to the site). AMEC assumed that the valley margin is a no-flow boundary and used a value of 13,200 feet for this variable.

3. **(Q)** is the pumping rate. Pumping rates used in the stream depletion evaluation (Table 7) are the average rates that correspond to the consumptive use volumes calculated for the proposed appropriation.

4. **(T)** is the source aquifer transmissivity. A value of 1,500 feet$^2$/day is based on aquifer test results.

5. **(S)** is the source aquifer storativity. The value of 0.10 was used for this variable. The reasoning behind using this value is discussed in section 6.3.

The results of the analytical modeling suggest that stream depletion would begin to develop within the first year of pumping, but would continue to increase slightly each subsequent year. Therefore, the following stream depletion estimates are based on year three hundred of the simulation. Modeling results suggest that the proposed pumping of the new PWS well would, over a 365-day period, result in a total reduction in volume of groundwater discharge to the Bitterroot River of 49.83 acre-feet, compared to non-pumping conditions. If this analytical model were run for an infinite period, the annual volume of stream depletion would equal the annual consumptive use. Therefore, the predicted volume of annual stream depletion from the Bitterroot River is 50.17 acre-feet per year. This volume over the one-year period of diversion is equivalent to an average depletion rate of 0.069 cubic feet per second (cfs) or 30.9 gpm.

The predicted average rate of reduced flow in the Bitterroot River by pumping of the New PWS well is small relative to the flow of the river. As a reference, the lowest monthly mean flow rate measured in the last 48 years at the nearest U.S. Geological Survey (USGS) gauging station (Bitterroot River near Florence, Montana, 30 miles downstream of the site) was 540 cfs (December 2005). The induced depletion rate predicted by the model for the Bitterroot River is 0.013 percent of the 48-year low flow rate for the Bitterroot River near Florence. Because standard stream gauging techniques are only accurate within approximately 10 to 20 percent, the predicted induced change in flow in the Bitterroot River would not be a measurable effect. Because the predicted depletion on the Bitterroot River is small and because the zone of influence will not extend to the river, there would be no adverse impact to senior surface water users on the Bitterroot as a result of the proposed appropriation.

Figure 7 presents the model-calculated depletion rates (in cfs) for the Bitterroot River over a three hundred-year period. Figure 8 presents monthly depletion volumes (from year 300 of the simulation) along with average flow in the Bitterroot River during each month. Average values were calculated from all available data from the Florence station (1957 through 2007).

### 6.5 Adequacy of the Proposed Appropriation Works

The new PWS well will add capacity sufficient to serve 117 residential units and 5 parks in the Twin Creeks subdivision. Estimating an average of 2.23 individuals per household (Census 2000 data), the total population of the Twin Creeks Subdivision will be an estimated 261 individuals. The water system will consist of one well plumbed into the Stevensville municipal water supply system. Well TC-PWS-1 was constructed of 10-inch diameter steel casing, and was completed to a total depth of 430 feet bgs. The well will be equipped with a flow meter and a valve, which will allow the operator to both document and control the flow rate of the well.

Aquifer testing indicates that the aquifer in which the new PWS well is completed has sufficient capacity to meet the demand requested in this permit application. Table 9 lists the details of the pump that will be installed in the well to supply the amount of water requested.

**Table 9.** Summary of Proposed Pump Specifications

| Well | Pump Motor Horsepower | Total Dynamic Head | Pumping Rate Capacity |
|---|---|---|---|
| TC-PWS-2 | 150 | 400 ft | 1,100 gpm |

### 6.6 Beneficial Use

The Montana Codes Annotated 85-2-102 defines beneficial use as "a use of water for the benefit of the appropriator, other persons, or the public, including but not limited to agricultural (including stock water), domestic, fish and wildlife, industrial, irrigation, mining, municipal, power, and recreational uses." This application includes a request for 1,100 gpm up to 96.3 acre-feet/year for municipal use. This proposed use will be beneficial to the residents of the proposed subdivision and those served by the Stevensville municipal water supply system.

### 6.7 Possessory Interest

The installed PWS well is located on land currently owned by John L. and Kristie A. Anderson, 346 El Capitan Loop, Stevensville, Montana 59870. A letter dated May 27, 2008 and signed by the Andersons granting possessory interest to the Town of Stevensville for a DNRC Application for Beneficial Water Use Permit for the municipal groundwater well is included as Appendix J. Ownership of the parcel where the well is located will be transferred to the Town of Stevensville in the future.

## 7.0 REFERENCES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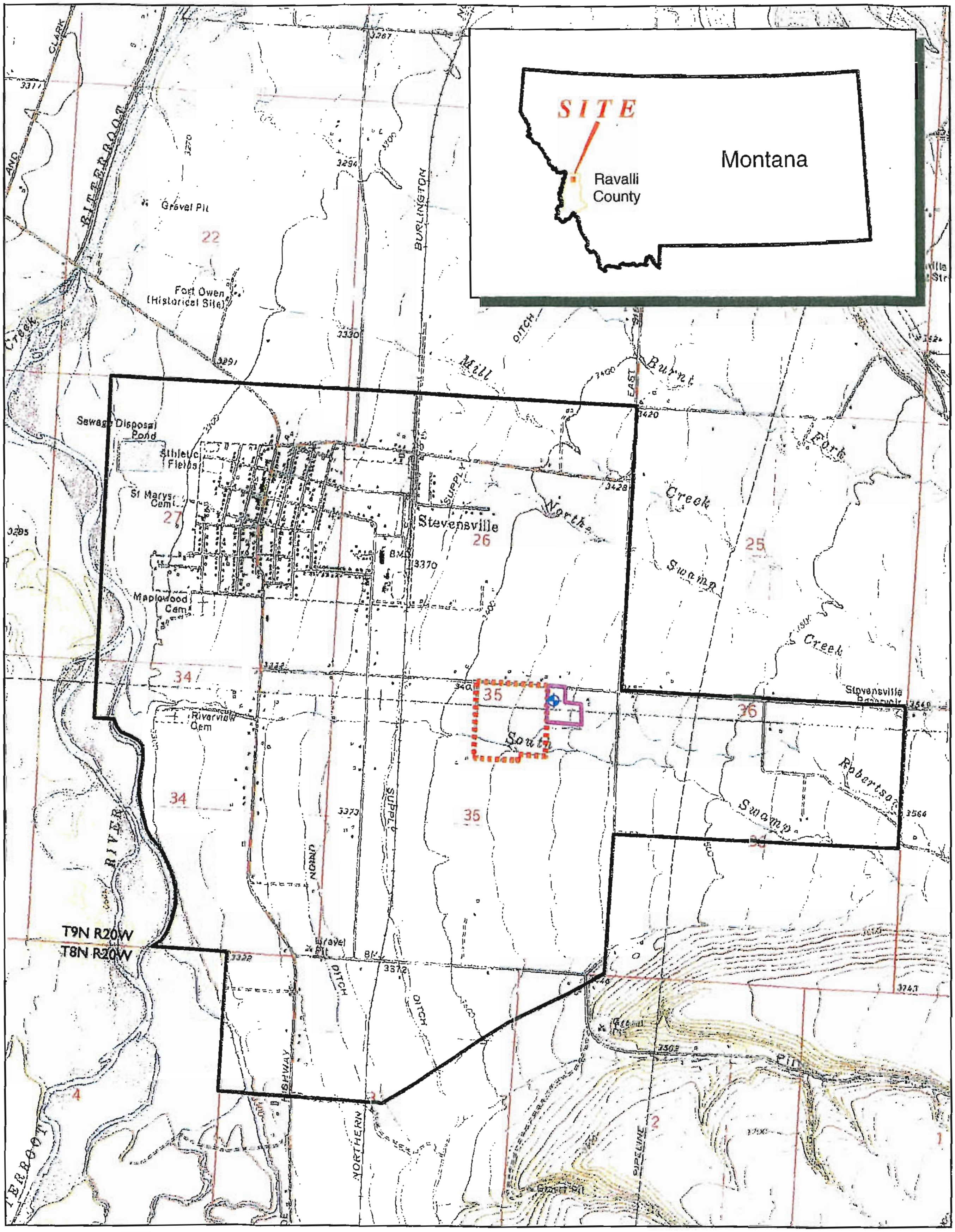
# FIGURES




Source: USGS 7.5' Stevensville and Bing Quads

N

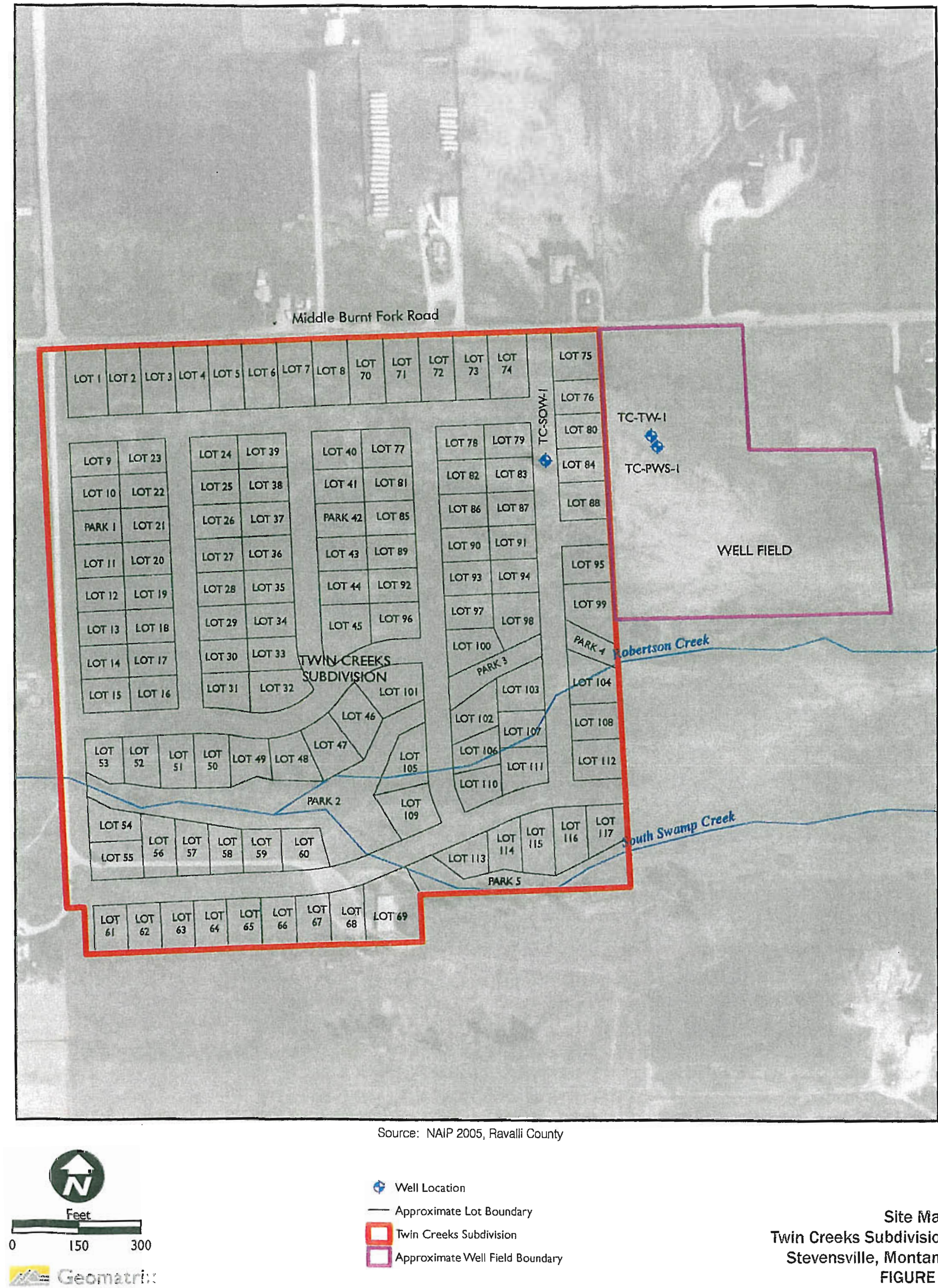
Feet

0 1,250 2,500

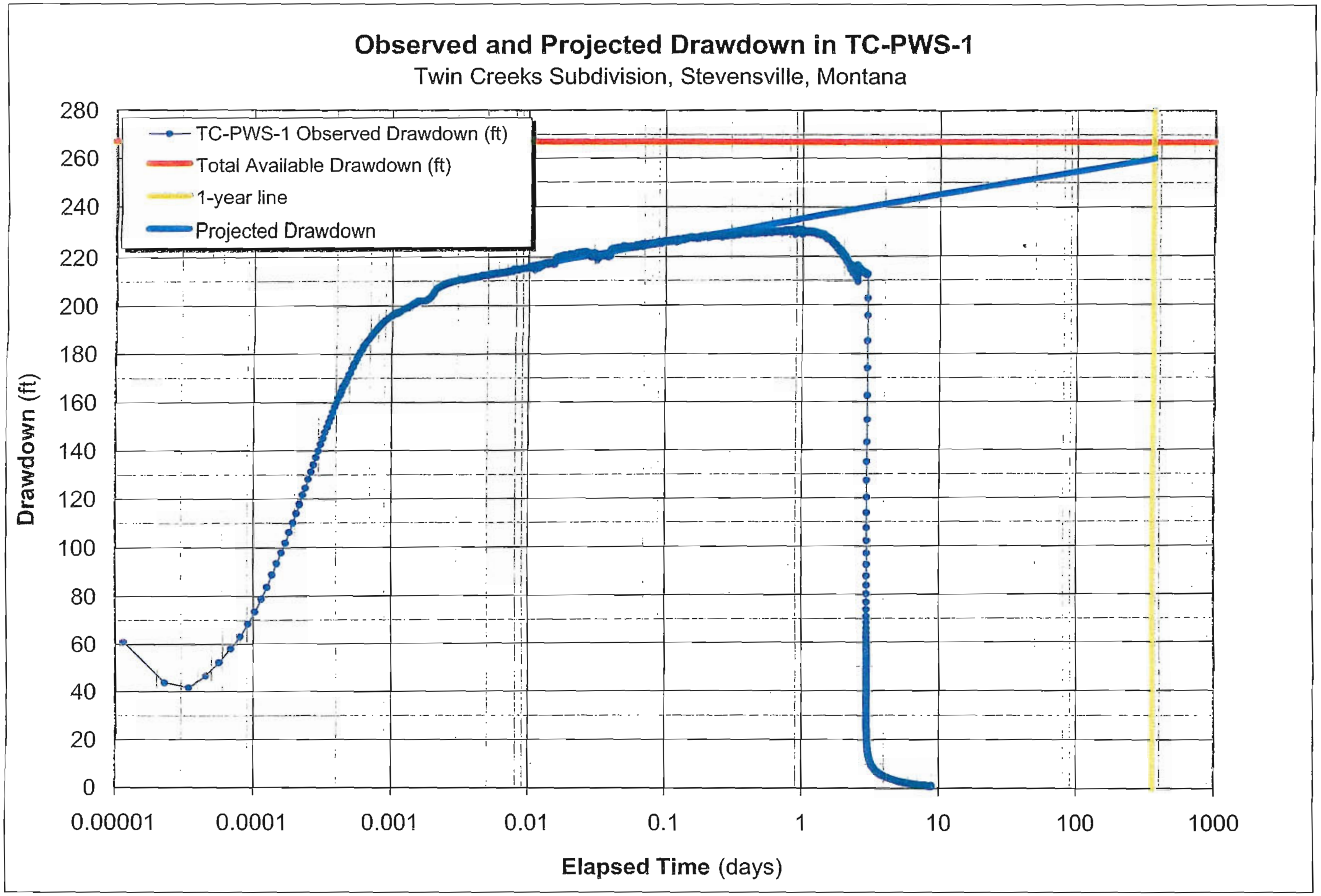
AMEC Geomatrix

- Point of Diversion (TC-PWS-1)
- Proposed Place of Use
- Twin Creeks Subdivision
- Approximate Well Field Boundary

**Location Map**
**Town of Stevensville**
**Stevensville, Montana**
**FIGURE 1**

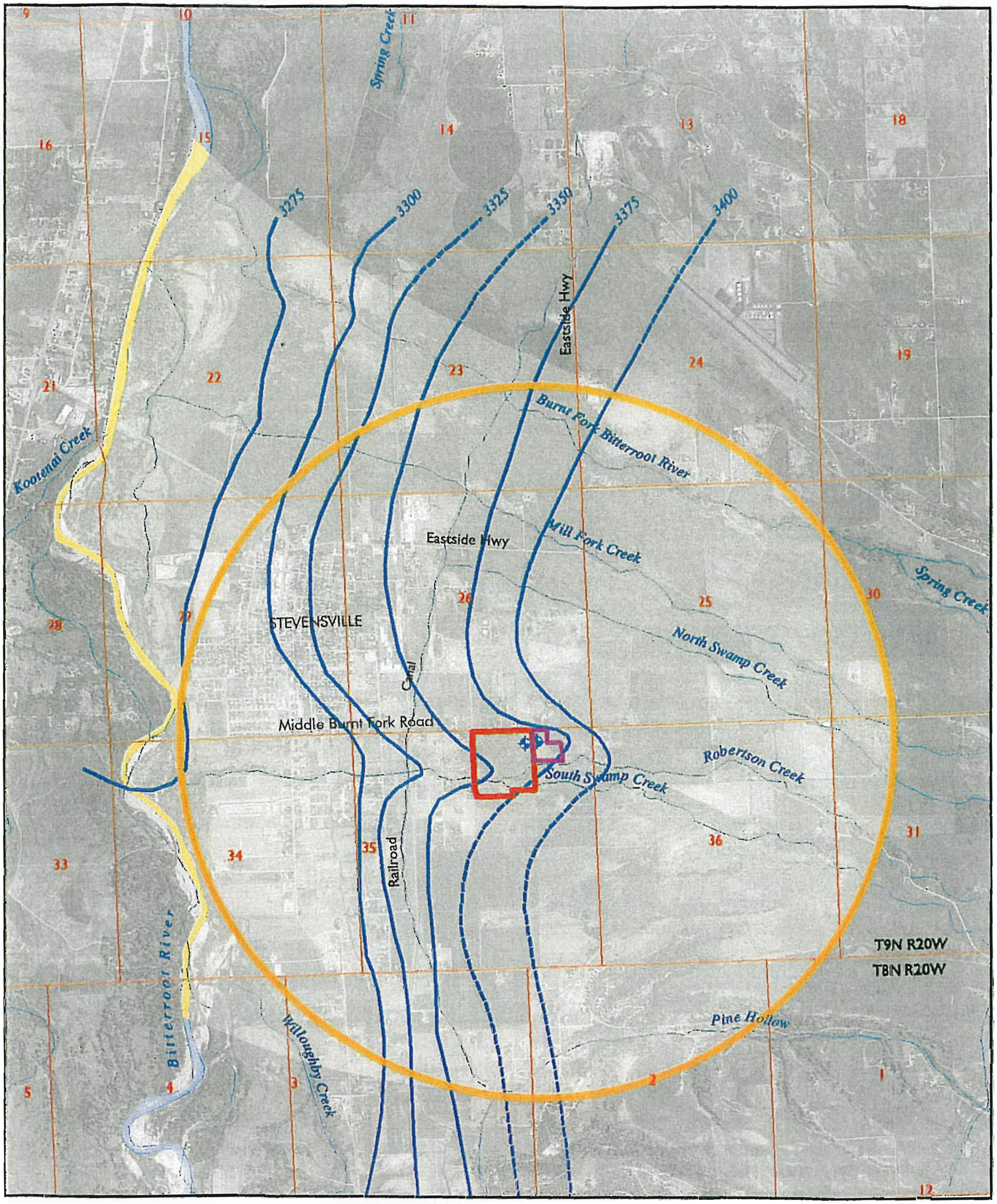



Site Map
Twin Creeks Subdivision
Stevensville, Montana
FIGURE 2




Observed and Projected Drawdown

**FIGURE 3**




Source: NAIP 2005, Ravalli County

Feet

0 1,500 3,000

Geomatrix

Groundwater Elevation Contours (feet above mean sea level) After McMurtrey et al., 1972

Contours dashed where inferred

Potentially Affected River Reach

Estimated Area of Pre-Stream Capture

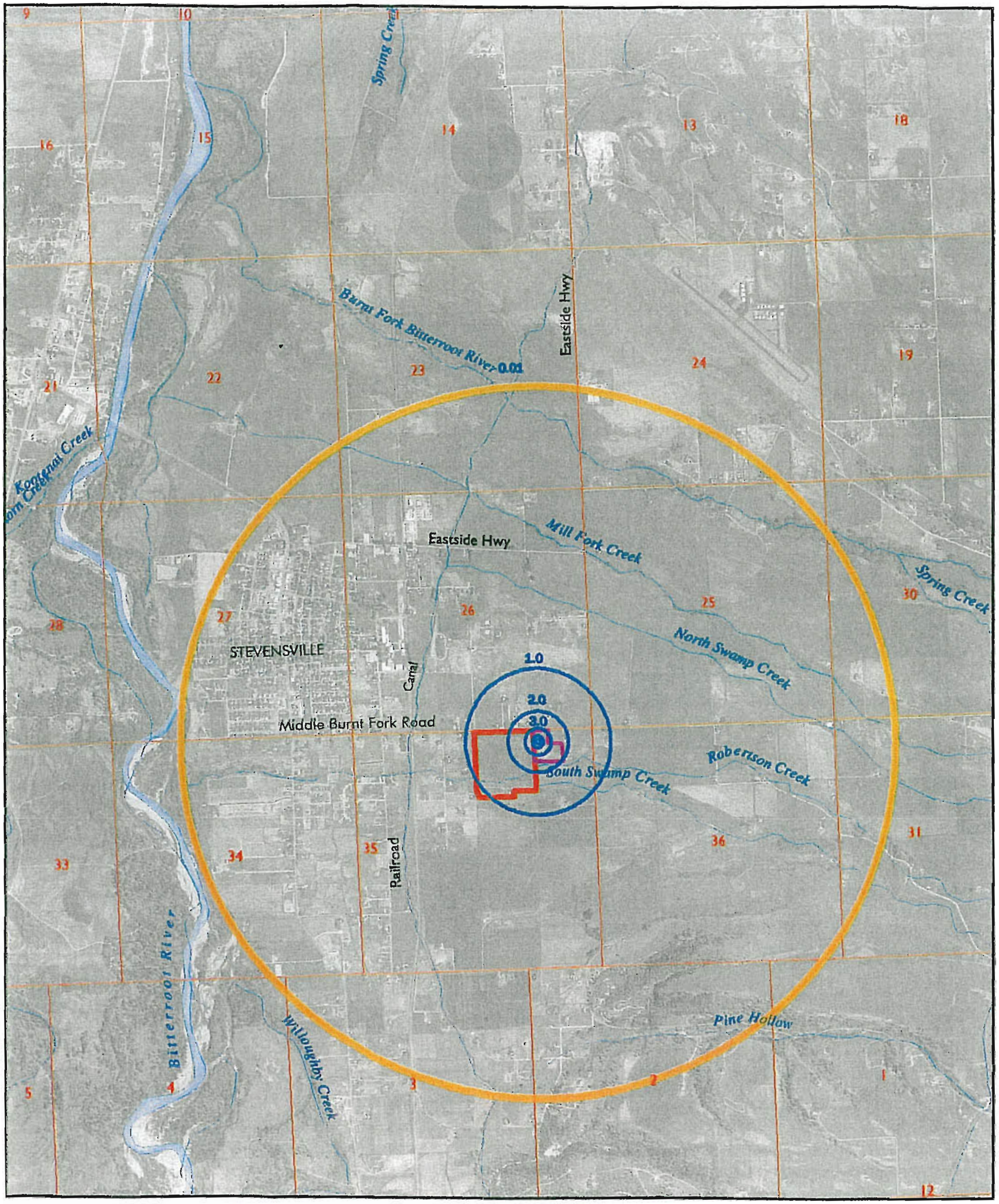
PWS Well

Zone of Influence

Twin Creeks Subdivision

Approximate Well Field Boundary

**Zone of Influence, Potentiometric Contours and Depletion Reach**
**Town of Stevensville**
**Stevensville, Montana**
**FIGURE 4**



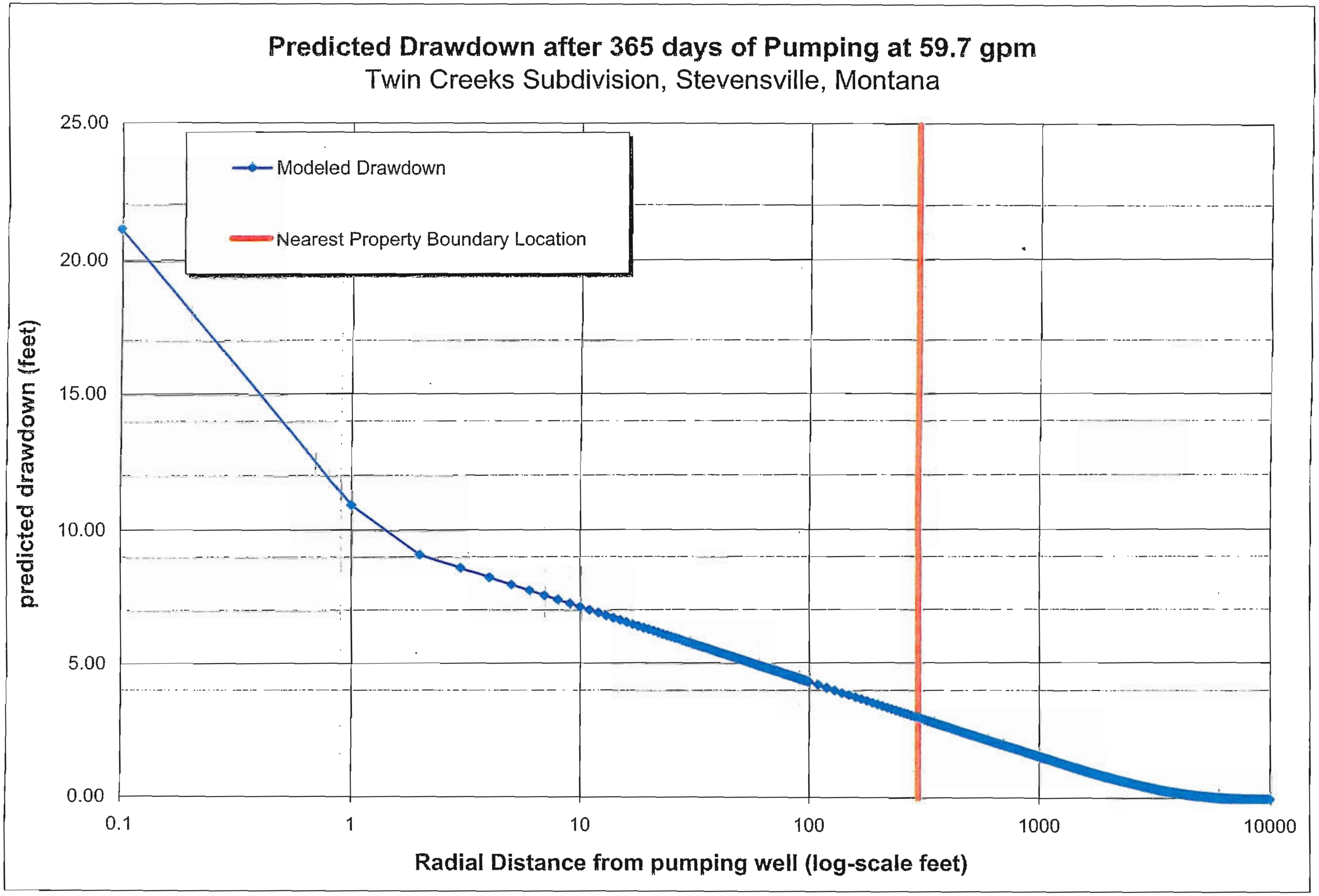

Source: NAIP 2005, Ravalli County

Feet
0 1,500 3,000

Geomatrix

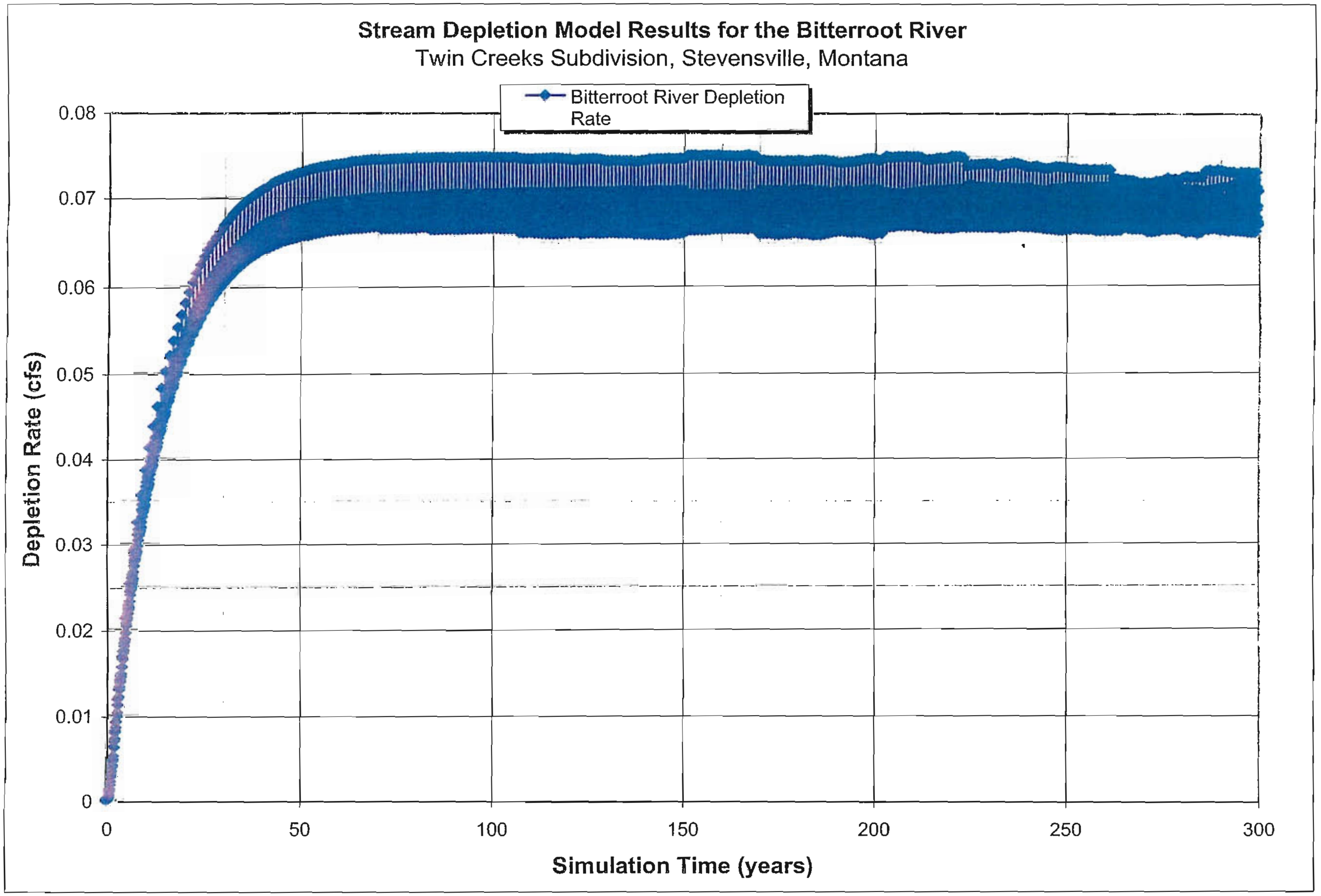
Drawdown Contours
Zone of Influence
Twin Creeks Subdivision
Approximate Well Field Boundary

**Zone of Influence and Drawdown Contours**
**Town of Stevensville**
**Stevensville, Montana**
**FIGURE 5**



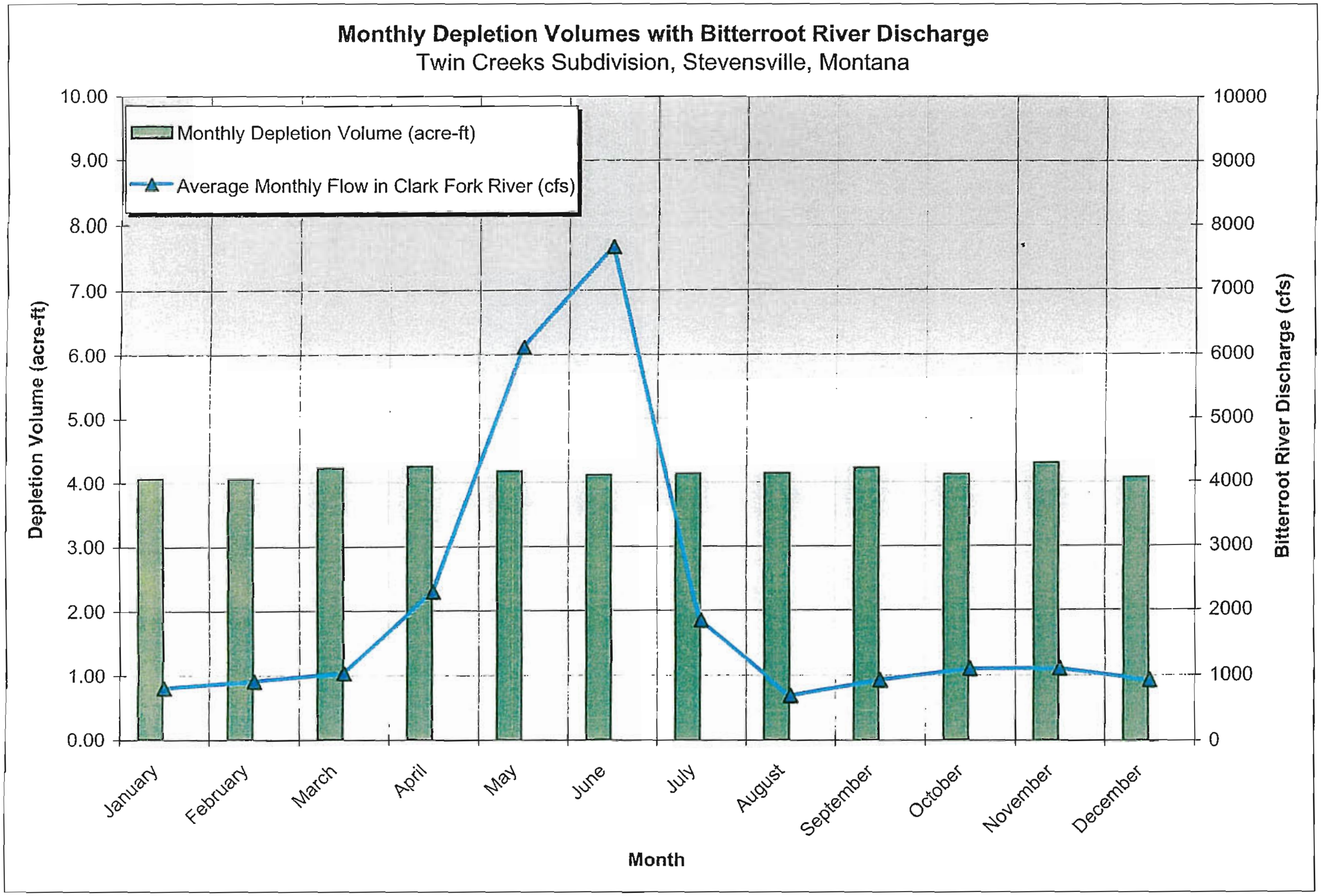

Predicted Drawdown vs. Distance from TC-PWS-1

**FIGURE 6**




Stream Depletion Model Results

**FIGURE 7**




Monthly Stream Depletion Volumes
**FIGURE 8**

# Appendix A
Water Demand Estimate Worksheet

## Attachment A

**PROJECTED WATER DEMAND**
**PROJECT: TWIN CREEKS SUBDIVISION**
**PREPARED BY: TERRITORIAL-LANDWORKS, INC.**
December 19, 2006
Revised: May 29, 2007

| USE TYPE | Phase 1 | Phase 2 | Phase 3 | Totals | Units | Equations and Notes |
|---|---|---|---|---|---|---|
| **DOMESTIC FLOWS:** | | | | | | |
| Ave. Annual Daily Demand per Capita, Qr: | 100 | 100 | 100 | | gpcd | 0 if not applicable |
| No. of Persons per Home (2000 census/residential) | 2.5 | 2.5 | 2.5 | | persons | |
| Wastewater Flow (Commercial or other), Qc: | 0 | 0 | 0 | | gpd | |
| Number of Connections, Nc: | 53 | 43 | 21 | 117 | connec. | |
| Calculated Population: | 132.5 | 107.5 | 52.5 | | people | Calculated |
| Assume a Population, P, of | 135 | 110 | 55 | 300.0 | people | Manual Input |
| | | | | | | |
| **Design:** Total Ave. Annual Daily Demand, Q: | **13,500** | **11,000** | **5,500** | 30,000.0 | gpd | = P X Qr or = Nc X Qc |
| **Water Rights:** Ave Annual Daily Demand, Qwr: | **13,500** | **11,000** | **5,500** | 30,000.0 | gpd | = Q |
| | | | | | | |
| **IRRIGATION FLOWS:** | | | | | | |
| Acres to be Irrigated, A: | 11.86 | 9.12 | 4.09 | 25.1 | acres | |
| Mild Season: Water Application Required, a: | 1.00 | 1.00 | 1.00 | | inch/acre/week | (For April 17 thru June & Sept. thru Oct. 13) |
| Mild Season: Length of Irrigation Season, Tim | 120 | 120 | 120 | | days | |
| Mild Season: Summer Daily Demand, Qim: | 46,003 | 35,390 | 15,879 | 97,272.1 | gpd | = a/(12 in/ft)/(7 days/wk)XAX(43560 $ft^2$/ac)X(7.48 gal/$ft^3$) |
| Hot Season: Water Application Required, a: | 1.50 | 1.50 | 1.50 | | inch/acre/week | (For July and August) |
| Hot Season: Length of Irrigation Season, Tih | 60 | 60 | 60 | | days | |
| Hot Season: Summer Daily Demand, Qih: | 69,005 | 53,084 | 23,819 | 145,908.2 | gpd | = a/(12 in/ft)/(7 days/wk)XAX(43560 $ft^2$/ac)X(7.48 gal/$ft^3$) |
| **Design:** Ave. Annual Daily Irrigation Demand, Qid: | **26,468** | **20,361** | **9,136** | 55,964.8 | gpd | = ((Qim X Tim)+(Qih X Tih))/365 |
| **Water Rights:See Qim & Qih above for the mild & hot month ave daily flows. These are only appropriate for water ri** | | | | | | |
| | | | | | | |
| **FIRE FLOWS:** | | | | | | |
| Fire Demand, Qf: | 0 | 0 | 0 | 0.0 | gpm | = Fire flows by existing town system & tank |
| | | | | | | |
| **SUMMARY:** | | | | | | |
| **DESIGN:** | | | | | | |
| Average Annual Daily Domestic Demand, Q | 13,500 | 11,000 | 5,500 | 30,000.0 | gpd | |
| Average Annual Daily Irrigation Demand, Qid | 26,468 | 20,361 | 9,136 | 55,964.8 | gpd | |
| Total Ave. Annual Daily Demand, Qadd | **39,968** | **31,361** | **14,636** | 85,964.8 | gpd | = Combination of irrigation & domestic |
| Total Ave. Annual Daily Demand, Qadd | **27.8** | **21.8** | **10.2** | 59.7 | gpm | = Qave/1440 minutes |
| Maximum Day Demand, Qmax-day | **105,156** | **81,755** | **37,473** | 224,385.2 | gpd | = 1.4 X Q + Qih X 1.25(†) |
| **Maximum Day Demand, Qmax:** | **73.0** | **56.8** | **26.0** | 155.8 | gpm | = Qmax-day/1440 minutes |
| | | | | | | |
| Peaking Factor (PF): | 5 | 5 | 5 | | | MDEQ recommends 3-6 PF on larger systems |
| Peak Instantaneous Demand, Qp | 138.78 | 108.89 | 50.82 | 298.5 | gpm | = Ave. Annual Demand/(1440 min/day) X PF |
| Fire Supply Demand: | 0.00 | 0.00 | 0.00 | 0.0 | gpm | |
| **Total Peak Demand, Qpl:** | **138.78** | **108.89** | **50.82** | 298.5 | gpm | = Peak Instantaneous Flow |
| **WATER RIGHTS:** | | | | | | |
| Ave. Daily Demand (Oct. 14 thru April 16), ADD | 13,500 | 11,000 | 5,500 | 30,000.0 | gpd | = Qwr from above |
| Ave. Daily Demand (April 17 thru June) | 59,503 | 46,390 | 21,379 | 127,272.1 | gpd | = Qwr + Qim from above |
| Ave. Daily Demand (July thru August) | 82,505 | 64,084 | 29,319 | 175,908.2 | gpd | = Qwr + Qih from above |
| Ave. Daily Demand (Sept. thru Oct. 13) | 59,503 | 46,390 | 21,379 | 127,272.1 | gpd | = Qwr + Qim from above |
| | | | | | | |
| **TOTAL**/Summer Time Peak Demand (Instantaneous) | 138.78 | 108.89 | 50.82 | 298.5 | gpm | = Qpl from above |
| **DOMESTIC**/Winter Time Peak Demand (Instantaneous) | 46.88 | 38.19 | 19.10 | 104.2 | gpm | = ADD/(1440 min/day) X PF (PF is from above) |
| **IRRIGATION** Peak Demand | 91.90 | 70.70 | 31.72 | 194.3 | gpm | = TOTAL - DOMESTIC |
| | | | | | | |
| Domestic Annual Usage | 15.1 | 12.3 | 6.2 | 33.6 | acft/yr | = Q gal/day X 365 day ÷ 7.48 gal/$ft^3$ ÷ 43560 $ft^2$/ac |
| Irrigation Annual Usage | 29.6 | 22.8 | 10.2 | 62.7 | acft/yr | = (Qim X Tim + Qih X Tih) ÷ 7.48 gal/$ft^3$ ÷ 43560 $ft^2$/ac |
| **Total Annual Usage** | **44.8** | **35.1** | **16.4** | 96.3 | acft/yr | = (Qim X Tim + Qih X Tih) ÷ 7.48 gal/$ft^3$ ÷ 43560 $ft^2$/ac |

(†) A four-bedroom home = 350 gpd design flows. Average flows calculated about is 250 gpd per home. Therefore 350 ÷ 250 = 1.40. The hot season daily demain is multiplied by 1.25 for an additional safety factor.

# Appendix B

Twin Creeks Well Lithologic and Completion Logs

Geomatrix

# WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: 13412 **WELL NO:** TC-TW-1

PROJECT: Anderson STATE: MT COUNTY: Ravalli LOGGED BY: ANJ

LEGAL LOCATION: T 9N R 20W S 35 TRACT aab

DESCRIPTIVE LOCATION: South of Middle Burnt Fork Rd., West of Logan Lane Dr., Stevensville

DATE STARTED: 5/18/2007 DATE COMPLETED: 5/25/2007 DRILLING CO/ DRILLER: Randy Kotecki/Jerome's Drilling 5/18; Brian 5/21-5/24

DRILLING METHOD: air rotary (Drilltech D4ok) BOREHOLE DIAM (IN): 6" DRILL FLUIDS USED: air and water

TOTAL DEPTH DRILLED: 398 TOTAL DEPTH CASED: 398 INTERVAL PERFORATED FROM OR SCREENED (FT:): 118-139; 194-197 319-322; 350-361; 383-388 DIAMETER: 6" CASING TYPE: steel

METHOD OF PERFORATION:
- ___ Open Hole
- ___ Open Bottom
- ___ Saw Slotted
- ___ Factory ___ (size)
- X Other: Holte Perf tool 3/16" x 1"; 8 rows

DURING WELL CONSTRUCTION WAS/WERE:

| | YES | NO |
|---|---|---|
| Well Developed | X | |
| Well Pumped | X | |
| Water Samples Collected | X | |
| Material Samples Collected | X | |

**ANNULAR COMPLETION CHARACTERISTICS**

WELL PROTECTOR: LENGTH: ___ DIAM: ___

LOCK NO: ___

| | | FROM: | TO: |
|---|---|---|---|
| SURFACE SEAL TYPE: | bentonite (Enviroplug #8) | 0 | 25 |
| BACKFILL MATERIAL: | NA | | |
| HOLE PLUG: | NA | | |
| FILTER PACK TYPE: | NA | | |

STATIC WATER LEVEL: 107.1 DATE: 5/24/2007 MEASURING POINT DESCRIPTION/ ELEVATION: Top of casing MEASURING POINT RELATIVE TO GROUND SURFACE (+/-) 3.0

REMARKS: 46.50044; 114.07160; continuous feed bentonite slurry from surface starting at 120'
Airlift development produced 300 gpm for eight hours with drill stem at 390 ft bgs

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 0-1.5 | Topsoil | Water at ~ 8' bgs |
| 1.5-19 | GM-Silty gravel with sand; wet at about 8'; bulk color is moderate yellowish brown; 65% fine-coarse gravel (angular to rounded); 20% silt; 15% sand; rounded gravel up to 1" diameter | 40-50 gpm between 8' and 34' per driller |
| 19-34 | GP-GM-Poorly graded gravel with silt and sand; WB; color as above; 65% gravel; 10% silt; 25% fine-coarse sand | |
| 34-34.5 | ML-Silt; WB; dark yellowish brown (10YR 4/2) | |
| 34.5-45 | SW-Well-graded sand with gravel; gray to tan; 40% coarse sand; 25% fine sand; 5% silt; 30% fine to coarse gravel up to 1.5" diameter, probably derived from granite (quartz, feldspar, mica); WB but discharge not measured | |
| 45-52 | SM-Silty sand; 55% fine-coarse sand; 45% silt; grayish yellow (5Y 8/4); contains clay chunks | |
| 52-59 | SP-SM-Poorly graded sand with silt and gravel; 50% sand; 10% silt; 30% fine-coarse gravel up to 2" in diameter (rounded; gray and pink quartzite) | |
| 59-81 | CL-Clay; yellowish gray (5Y 7/2); plastic; hardness; med-high; can be molded inot a 4" ribbon without bending; cohesive; wet (water added) | |
| 81-94 | SW-SM-Well graded sand with silt; 10% silt; 10% fine gravel; 80% fine-coarse sand; bulk color is yellowish gray (5Y 7/2); WB but flow not measured | Material sample collected (90 ft). 60-80 gpm total from 0-120' (per driller) |

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## WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: 13412

PROJECT: Anderson

WELL NO: TC-TW-1

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 94-118 | CL as above (59-81) | 20-30 gpm @ 120' |
| | Brian (driller) | |
| 118-132 | SW-Well graded sand with gravel; tan and gray; 60% coarse sand; 20% fine-med sand; 20% fine gravel. Water bearing: water cleaned up quickly (<1 min). | 30-40 gpm (122-125); material sample collected (120-125 ft) |
| 132-135 | SW-Well graded sand; 30% fine-med sand; 70% coarse sand | 50 gpm @ 131; material sample collected (132-135) |
| 135-139 | SW-Well graded sand with gravel as above (118-132) | Screen to 137 per Brian |
| 139-165 | CL-Clay with silt; thin (6") sand lenses producing some water; yellowish gray (5Y 7/2); medium hardness; plastic; 75% clay; 25% silt | |
| 165-175 | SW-Well graded sand with gravel; tan and gray; 65% coarse sand; 20% fine-med sand; 15% gravel | 40 gpm @ 170; material sample collected (165-175) |
| 175-194 | CL-Clay; yellowish gray (5Y 7/2); hardness = med to high; plastic | |
| 194-197 | SW-Well graded sand; 60% coarse sand; 20% fine gravel; 20% fine-med sand; gray to tan | 5 gal/7 sec @ 194'=43 gpm |
| 197-230 | CL-Clay with silt; 5Y 7/2; med hardness; plastic | |
| 230-254 | CL-Clay as above; contains brown siltstone (gravel sized) | |
| 254-270 | SM-Silty sand; 75% fine-coarse sand; 25% light brown silt; water discharge initially but then tapered off; not good productive zone according to driller; sand is approx. 75% fine-med sand and 25% coarse sand; contains gravel-size semiconsolidated brown siltstone | ~ 10-20 gpm with lots of heaving sand |
| 270-280 | CL-ML-Silt with clay; semi-plastic; smooth; yellowish gray (5Y 7/2) | |
| 280-289 | Brown siltstone; semiconsolidated; sand and gravel size | 10 gpm @ 280 |
| 289-296 | CL-ML-Silt with clay as above | |
| 296-305 | SM-Silty sand; 70% fine sand; 30% silt; bulk color is yellowish gray (5Y 7/2); contains fine-gravel sized consolidated brown siltstone | |
| 305-308 | SM-Silty sand; 40% fine-med sand; 30% coarse sand; 30% silt | |
| 308-319 | ML-Silt with clay; medium hardness; 5Y 7/2; casing hammer slow starting @ 310' | 5 gal/39 sec=8 gpm @ 316' |
| 319-322 | SW-SM-Well graded sand with silt and gravel; 10% silt; 15% fine gravel; 75% sand; material sample collected | ~75 gpm @ 320'; material sample collected (320 ft) |
| 322-333 | SM-Silty sand; 65% fine-med sand; 35% silt | |
| 333-337 | ML-Silt with sand; 80% silt; 20% fine-med sand | |
| 337-337.5 | SM silty sand as above | |
| 337.5-350 | ML-Silt with sand as above; 80% silt and 20% fine-med sand | |
| | | |

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## WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: 13412

PROJECT: Anderson

WELL NO: TC-TW-1

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 350-361 | SW-Well-graded sand with gravel; decomposed granite; 15% fine sand; 50% med-coarse sand; 35% fine gravel; contains coarse gravel up to 1" in diameter | 40+ gpm at 350; 5 gal/5 sec @ 359 = 60 gpm (did not catch all water and water leaking out around drillhead seal); 100+ gpm per driller; material samples collected (350 anf 359) |
| 361-366 | SM-Silty sand as above; 70% fine-med sand; 30% silt | |
| 366-373 | SP-Poorly graded sand; 75% med sand; 25% fine sand (10-20 gpm estimated). Material did not clean up well afer 2 minutes of air-lifting. | |
| 373-381 | ML-Silt with sand and clay; 60% brown silt; 25% fine sand; 15% clay (hard) | |
| 381-383 | CL-ML; Silt and clay | |
| 383-388 | SW as above (350-361) | 100+ gpm @ 384 |
| 388-397 | SM-Silty sand as above (361-366) | WB but hard to estimate (mixed with lots of fines) |
| 397 | ML-Silt; yellowish gray (5Y 7/2); soft; low plasticity | |

09N 20W 35 AA

# MONTANA WELL LOG REPORT

Form No. 603 R2-04

Well ID# RK0508

This log reports the activities of a licensed Montana well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered. **This form is to be completed by the driller and filed with MBMG within 60 days of completion of the work. Acquiring Water Rights is the well owner's responsibility and is not accomplished by the filing of this report.**

Well log information is stored in the Groundwater Information Center at the Montana Bureau of Mines and Geology (Butte) and water right information is stored in the Water Rights Bureau records (Helena).

For fields that are not applicable, enter NA. Optional fields have a grayed background. Record additional information in the REMARKS section.

**1. WELL OWNER:**
Name John Anderson
Mailing address 346 El Capitan Loop
Stevensville MT. 59870

**2. WELL LOCATION:** List ¼ from smallest to largest
___ ¼ NE ¼ NE ¼, Section 35
Township 9 N/S Range 20 E/W County Ravalli
Lot ___ Tract/Blk ___ Subdivision Name ___
Well Address ___
GPS: ☐ Yes X☐ No
Latitude ___ Longitude ___
Error as reported by GPS locator (± feet) ___
Horizontal datum: ☐ NAD27 ☐ WGS84

OK

**3. PROPOSED USE:** X☐ Domestic ☐ Stock ☐ Irrigation ☐ Public water supply ☐ Monitoring Well ☐ Other:

**4. TYPE OF WORK:**
X☐ New well ☐ Deepen existing well ☐ Abandon existing well
Method: ☐ Cable X☐ Rotary ☐ Other: ___

**5. WELL CONSTRUCTION DETAILS:**

Borehole:
Dia. 6 in. from GS ft. to 400 ft.
Dia. ___ in. from ___ ft. to ___ ft.
Dia. ___ in. from ___ ft. to ___ ft.

Casing:
Steel: Wall thickness .250 ☐ Threaded X☐ Welded
Dia. 6 in. from +2 ft. to 400 ft.
Dia. ___ in. from ___ ft. to ___ ft.

Plastic: Pressure Rating ___ lbs. ☐ Threaded ☐ Welded
Dia. ___ in. from ___ ft. to ___ ft.

Perforations/Slotted Pipe:
Type of perforator used Holte
Size of perforations/slots 3/16 in. by 1 in.
50 no. of perforations/slots from 340 ft. to 390 ft.
___ no. of perforations/slots from ___ ft. to ___ ft.

Screens: ☐ Yes X☐ No
Material ___
Dia. ___ Slot size ___ from ___ ft. to ___ ft.
Dia. ___ Slot size ___ from ___ ft. to ___ ft.

Gravel Packed: ☐ Yes X☐ No
Size of gravel ___
Gravel placed from ___ ft. to ___ ft.

Packer: ☐ Yes X☐ No
Type ___ Depth(s) ___

Grout: Material used Bentonite
Depth from ___ ft. to ___ ft. OR X☐ Continuous feed

**6. WELL TEST DATA:**
A well test is required for all wells. (*See details on well log report cover.*)
X☐ Static water level 107 ft. below top of casing or
☐ Closed-in artesian pressure ___ psi.
How was test flow measured:
bucket/stopwatch, weir, flume, flowmeter, etc ___
Yellowstone Controlled Groundwater Area - Water Temperature ___ °F
☐ AQUIFER TEST DATA FORM ATTACHED

Test - 1 hour minimum
Drawdown is the amount water level is lowered below static level.
All depth measurements shall be from the top of the well casing.
Time of recovery is hours/minutes since pumping stopped.

Air test*
300 gpm with drill stem set at 390 ft. for 8 hours
Time of recovery 15 hrs/min. Recovery water level 107 ft.

OR Bailer test*
___ gpm with ___ ft. of drawdown after ___ hours
Time of recovery ___ hrs/min. Recovery water level ___ ft.

OR Pump test*
Depth pump set for test ___ ft.
___ gpm pump rate with ___ ft. of drawdown after ___ hrs pumping
Time of recovery ___ hrs/min. Recovery water level ___ ft.

OR Flowing Artesian*
___ gpm for ___ hours
Flow controlled by ___

**During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the resevoir of the well casing.*

**7. WELL LOG:** PE

| Depth, Feet From | To | Material: color/rock and type/descriptor (example: blue/shale/hard, or brown/gravel/water, or brown/sand/heaving) |
|---|---|---|
| 0 | 8' | Sand Gravel |
| 8' | 45' | Sand, Gravel w/water |
| 45' | 118' | Clay, Pea-Gravel w/water |
| 118' | 175' | Sand, Gravel w/water |
| 175' | 310' | Brown Clay, Shale, Sand |
| 310 | 400' | Brown Shale, Pea-Gravel, Sand |

☐ ADDITIONAL SHEETS ATTACHED

**8. DATE WELL COMPLETED:** 5/25/07

**9. REMARKS:**

RECEIVED
AUG 8 2007
MBMG

**10. DRILLER/CONTRACTOR'S CERTIFICATION:**
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.
Name, firm, or corporation (print) JEROME'S DRILLING Co.
Address BOX 17020 Missoula MT. 59808
Signature [signature]
Date 5/30/07 License no. 600

**Montana Bureau of Mines & Geology**
The University of Montana
1300 West Park Street
Butte, MT 59701

MBMG ID# 237482

Geomatrix

## WELL LITHOLOGIC AND COMPLETION LOG

JOB NO: ______ WELL NO: TC-PWS-1

PROJECT: *Twin Creeks PWS* *STATE:* Montana COUNTY: *Ravalli* LOGGED BY: D. Agnew

LEGAL LOCATION: ______ DESCRIPTIVE LOCATION: East of Stevensville, MT on Bumt Fork Road, on the southside of the road in pasture

DATE STARTED: 04.14.08 DATE COMPLETED: 04.22.08 DRILLING CO/ DRILLER: AK Drilling/Marty

DRILLING METHOD: Dual rotary BOREHOLE DIAM (IN): 10 DRILL FLUIDS USED: air, water, and foam

TOTAL DEPTH DRILLED: 435 TOTAL DEPTH CASED: 430 INTERVAL PERFORATED FROM OR SCREENED (FT:) 400-410 (80-slot) 410-430 (60-slot) DIAMETER: 10-inch casing/8-inch screen CASING TYPE: Steel

METHOD OF PERFORATION:
- ______ Open Hole
- ______ Open Bottom
- ______ Saw Slotted
- ______ Factory ___ (size)
- x Other: wire-wrapped stainless stee

| DURING WELL CONSTRUCTION WAS/WERE: | YES | NO |
|---|---|---|
| Well Developed | X | |
| Well Pumped | X | |
| Water Samples Collected | X | |
| Material Samples Collected | | X |

**ANNULAR COMPLETION CHARACTERISTICS**

WELL PROTECTOR: LENGTH: ______ DIAM: ______

LOCK NO: ______

| | | FROM | TO |
|---|---|---|---|
| SURFACE SEAL TYPE: | Hole plug | 0 | 65 |
| BACKFILL MATERIAL: | | | |
| HOLE PLUG: | | | |
| FILTER PACK TYPE: | | | |

STATIC WATER LEVEL: 137.25 ft bgs DATE: 04.22.08 MEASURING POINT DESCRIPTION/ ELEVATION: ______ MEASURING POINT RELATIVE TO GROUND SURFACE (+/-) ______

REMARKS: 0-67 feet foam was used to getting cuttings retumed while advancing the 16-inch casing. Cuttings were collected for lithologic description, but ma not be representative of the interval due to issues with cuttings retum

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 0-53 | GP, gravel (broken cobbles), light tan color, 95% gravel, subrounded with angular edges where cobbles have been broken during drilling, fine to coarse gravel (<1 inch to 2.5 inch in size), 5% sand, coarse, subangular | Due to the size of the casing at this depth (16 inch), foam was used to retum cuttings. Therefore, it is difficult to know what depth the cuttings represent. |
| 53-55 | CL, sandy clay, yellow color, hamdness is low to medium, low plasticity, cannot form ribbon, cohesive, wet (water added), 90% clay, 10% sand, fine to medium, subangular | |
| 55-65 | CH, clay, yellow brown color, plastic, hardness is firm to medium, can make 2-inch ribbon, wet (water added) | |
| 65-86 | GP, gravel, bulk color, 95% gravel, subangular to angular, 0.5 to 3 inch in size, 5% sand, coarse, subangular, gravels are poor grade, fine to coarse | |
| 86-98 | CL, sandy clay, tan color, 75% clay, medium plasticity, hardness is low, can form 0.5-inch ribbon, cohesive, wet (water added), 25% sand, medium, angular | |
| 98-110 | SW, sand, bulk color, 95% sand, medium to coarse, subround to subangular, 5% clay, well-sorted sand | |
| 110-130 | CH, clay, tan color, plastic, hardness is firm to medium, forms 1-inch ribbon, cohesive, wet (water added) | |
| 130-134 | GP, sandy gravel, tan color, 80% gravel, poor grade, fine to medium (0.5 to 1 inch in size), subangular, 15% sand, medium to coarse, subangular, 5% clay | |
| 134-140 | SW, sand, bulk color, 95% sand, well sorted, coarse, subangular, 5% clay | |
| 140-159 | GW, sandy gravel, bulk color, 90% gravel, fine to medium, well graded, subangular, 10% sand, medium to coarse, subangular to subrounded | |
| 159-203 | CH, clay, tan, high plasticity, hardness is firm to very firm, can form 2-inch ribbon, cohesive, wet | Used foam to get cuttings retumed |
| 203-217 | GW, gravel with sand, bulk color, 95% gravel, fine to medium, well-graded, subrounded to subangular, 5% sand, medium, subrounded | |
| 217-220 | SW, sand, bulk color, 95% sand, fine to coarse, angular to subangular, 5% gravels, fine, subangular, trace clay, well-sorted | |
| 220-230 | CH, clay, tan color, very plastic, hardness is firm to very firm, can form 2-inch ribbon, cohesive, wet | |
| 230-248 | GP-GC, clayey gravel, tan-bulk color, 90% gravel, fine to 1-inch in size, poor grade, subangular, 10% clay, low plasiticty, trace fine sands and medium sands, subangular | |

JOB NO: ______

Geomatrix

**WELL LITHOLOGIC AND COMPLETION LOG**

PROJECT: ____________ WELL NO: ____________

| INTERVAL(FT) below ground surface | LITHOLOGIC DESCRIPTION USCS NAME ( USCS symbol): color, moist, % by weight, plasticity, consistency, structure, cementation, geology | REMARKS |
|---|---|---|
| 248-251 | CL, sandy clay, tan color, 95% clay, low plasticity, hardness is low to medium, does not form ribbon, 5% sand, medium to fine, subangular | |
| 251-269 | SP, sand, bulk color, 90% sand, fine to coarse, subrounded to subangular, poorly sorted, 5% gravel, 0.5 to 1 inch in size, 5% clay | |
| 269-276 | CL, Sandy clay, brown color, 85% clay, medium plasticity, low to medium hardness, does not form ribbon, 15% sand fine to medium, subrounded, well-sorted sand | |
| 276-285 | SW-SC, sand, bulk color, 90% sand, medium to coarse, well-sorted, 10% clay, sand graines are subrounded | |
| 285-298 | GP, gravel, bulk color, 90% gravel, poor grade, subrounded to subangular, 10% sand, medium, subrounded, trace fines/clay | |
| 298-315 | CL, sandy clay, tan color, 75% clay, low plasticity, hardness is medium, 25% sand, medium to coarse, subangular, well-sorted | Flow rate ~ 300 gpm at 315 ft bgs |
| 315-323 | GW, gravel, bulk color, 85% gravel, 0.5-inch in size, rounded to subrounded, 10% sand, fine to medium, subangular, 5% clay, sand is well-sorted | |
| 323-340 | CL, sandy clay, tan color, 85% clay, low plasticity, hardness is low, noncohesive, 10% sand, medium, subrounded to round, 5% gravels, fine, subrounded | Stopped drilling at 335 ft bgs on 04.15.08; resumed at 335 ft bgs on 04.16.08; used foam to getting cuttings returned |
| 340-348 | SW-SC, sand, white-tan color, 90% sand, fine to coarse, subrounded, 10% clay, suspended in matrix | |
| 348-361 | SW, sand with gravels, bulk color, 80% sand, fine to coarse, well-sorted sand, subrounded to subangular, 15% gravel, fine to 1-inch in size, rounded to subround, 5% clay | Flow rate ~25 gpm with large amount of fine sand in water @ 350 ft bgs |
| 361-368 | CL, sandy clay, tan color, 70% clay, plasticity is high, hardness is medium, 30% sand, fine to medium, subrounded, well-sorted sand, forms 3-inch ribbon before bending | Flow rate ~37.5 gpm with a large amount of fine sand @ 361 ft bgs |
| 368-373 | SW, sand with gravel, tan color, 80% sand, fine to coarse, subrounded to round, well-sorted, 15% gravel, fine, subrounded, 5% clay | |
| 373-383 | CL, sandy clay, tan color, 70% clay, low plasticity, hardness is medium, does not form ribbon, 30% sand, medium, subrounded, well sorted | |
| 383-388 | GW, gravel, bulk color, 85% gravel, subrounded to subangular, well-graded, 10% sand, fine to medium, subangular, 5% clay | Flow rate ~30 gpm at 383 ft bgs with a large amount of sediment |
| 388-400 | CL, sand clay, tan color, 70% clay, low plasticity, hardness is medium, does not form ribbon, 30% sand, medium, subrounded, well-sorted | |
| 400-408 | GP, gravel, bulk color, 95% gravel, poor grade, fine to 1.5-inch in size, subangular, 5% sand, medium, subangular, poor grade | |
| 408-410 | CL, sandy clay, tan color, 75% clay, low plasticity, hardness is soft, forms 1-inch ribbon, 10% sand, medium, subangular, 5% very fine gravels | |
| 410-435 | GW, gravel, bulk color, 95% gravel, well graded, fine to 2-inch in size, subangular, 5% sand, coarse, subangular to subround | Flow rate >300 gpm at 410 ft bgs which cleared up quickly |
| | Bottom of hole 435 ft bgs on 04.17.08 | |
| | | |
| | | |
| | | |
| | | |
| | | |

**MONTANA WELL LOG REPORT**

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

**Other Options**

Plot this site on a topographic map

**Site Name: TWIN CREEKS PROPERTY**
**GWIC Id: 244440**

**Section 1: Well Owner**

**Owner Name**
ANDERSON, JOHN
**Mailing Address**
346 EL CAIPTAN LOOP

| City | State | Zip Code |
|---|---|---|
| STEVENSVILLE | MT | 59870 |

**Section 2: Location**

| Township | Range | Section | Quarter Sections |
|---|---|---|---|
| 09N | 20W | 35 | NE¼ NE¼ NW¼ |

| County | Geocode |
|---|---|
| RAVALLI | |

| Latitude | Longitude | Geomethod | Datum |
|---|---|---|---|
| 46.500172 | 114.078718 | TRS-SEC | NAD83 |

| Altitude | Method | Datum | Date |
|---|---|---|---|
| | | | |

| Addition | Block | Lot |
|---|---|---|
| | | |

**Section 3: Proposed Use of Water**
PUBLIC WATER SUPPLY (1)

**Section 4: Type of Work**
Drilling Method: DUAL ROTARY

**Section 5: Well Completion Date**
Date well completed: Tuesday, April 22, 2008

**Section 6: Well Construction Details**

**Borehole dimensions**

| From | To | Diameter |
|---|---|---|
| 0 | 65 | 16 |
| 65 | 435 | 10 |

**Casing**

| From | To | Diameter | Wall Thickness | Pressure Rating | Joint | Type |
|---|---|---|---|---|---|---|
| -3 | 405 | 10.8 | 0.25 | | WELDED | A53B STEEL |

**Completion (Perf/Screen)**

| From | To | Diameter | # of Openings | Size of Openings | Description |
|---|---|---|---|---|---|
| 400 | 410 | 8.6 | | 80-SLOT | SCREEN-CONTINUOUS-STAINLESS |
| 410 | 430 | 8.6 | | 60-SLOT | SCREEN-CONTINUOUS-STAINLESS |

**Annular Space (Seal/Grout/Packer)**

| From | To | Description | Cont. Fed? |
|---|---|---|---|

**Section 7: Well Test Data**

Total Depth: 430
Static Water Level: 138
Water Temperature:

**Air Test** *

_ gpm with drill stem set at _ feet for _ hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

**Section 8: Remarks**
AIR LIFTED MORE WATER THAN WE COULD MEASURE.
GEOMATRIX DID THE FINAL PUMP TEST

**Section 9: Well Log**

**Geologic Source**
Unassigned

| From | To | Description |
|---|---|---|
| 0 | 53 | GP, GRAVEL (BROKEN COBBLES), LIGHT TAN COLOR, 95% GRAVEL, SUBROUNDED WITH ANGULAR EDGES WHERE COBBLES HAVE BEEN BROKEN DURING DRILLING, FINE TO COARSE GRAVEL (<1 INCH TO 2.5 INCH IN SIZE), 5% SAND, COARSE, SUBANGULAR |
| 53 | 55 | CL, SANDY CLAY, YELLOW COLOR, HARNDNESS IS LOW TO MEDIUM, LOW PLASTICITY, CANNOT FORM RIBBON, COHESIVE, WET (WATER ADDED), 90% CLAY, 10% SAND, FINE TO MEDIUM, SUBANGULAR |
| 55 | 65 | CH, CLAY, YELLOW BROWN COLOR, PLASTIC, HARDNESS IS FIRM TO MEDIUM, CAN MAKE 2-INCH RIBBON, WET (WATER ADDED) |
| 65 | 86 | GP, GRAVEL, BULK COLOR, 95% GRAVEL, SUBANGULAR TO ANGULAR, 0.5 TO 3 INCH IN SIZE, 5% SAND, COARSE, SUBANGULAR, GRAVELS ARE POOR GRADE, FINE TO COARSE |
| 86 | 98 | CL, SANDY CLAY, TAN COLOR, 75% CLAY, MEDIUM PLASTICITY, HARDNESS IS LOW, CAN FORM 0.5-INCH RIBBON, COHESIVE, WET (WATER ADDED), 25% SAND, MEDIUM, ANGULAR |
| 98 | 110 | SW, SAND, BULK COLOR, 95% SAND, MEDIUM TO COARSE, SUBROUND TO SUBANGULAR, 5% CLAY, WELL-SORTED SAND |
| 110 | 130 | CH, CLAY, TAN COLOR, PLASTIC, HARDNESS IS FIRM TO MEDIUM, FORMS 1-INCH RIBBON, COHESIVE, WET (WATER ADDED) |
| 130 | 134 | GP, SANDY GRAVEL, TAN COLOR, 80% GRAVEL, POOR GRADE, FINE TO MEDIUM (0.5 TO 1 INCH IN SIZE), SUBANGULAR, 15% SAND, MEDIUM TO |

| | | | |
|---|---|---|---|
| 0 | 65 | BENTONITE | |

| | | |
|---|---|---|
| | | COARSE, SUBANGULAR, 5% CLAY |
| 134 | 140 | SW, SAND, BULK COLOR, 95% SAND, WELL SORTED, COARSE, SUBANGULAR, 5% CLAY |
| 140 | 159 | GW, SANDY GRAVEL, BULK COLOR, 90% GRAVEL, FINE TO MEDIUM, WELL GRADED, SUBANGULAR, 10% SAND, MEDIUM TO COARSE, SUBANGULAR TO SUBROUNDED |
| 159 | 203 | CH, CLAY, TAN, HIGH PLASTICITY, HARDNESS IS FIRM TO VERY FIRM, CAN FORM 2-INCH RIBBON, COHESIVE, WET |
| 203 | 217 | GW, GRAVEL WITH SAND, BULK COLOR, 95% GRAVEL, FINE TO MEDIUM, WELL-GRADED, SUBROUNDED TO SUBANGULAR, 5% SAND, MEDIUM, SUBROUNDED |
| 217 | 220 | SW, SAND, BULK COLOR, 95% SAND, FINE TO COARSE, ANGULAR TO SUBANGULAR, 5% GRAVELS, FINE, SUBANGULAR, TRACE CLAY, WELL-SORTED |
| 220 | 230 | CH, CLAY, TAN COLOR, VERY PLASTIC, HARDNESS IS FIRM TO VERY FIRM, CAN FORM 2-INCH RIBBON, COHESIVE, WET |
| 230 | 248 | GP-GC, CLAYEY GRAVEL, TAN-BULK COLOR, 90% GRAVEL, FINE TO 1-INCH IN SIZE, POOR GRADE, SUBANGULAR, 10% CLAY, LOW PLASITICTY, TRACE FINE SANDS AND MEDIUM SANDS, SUBANGULAR |

**Driller Certification**

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

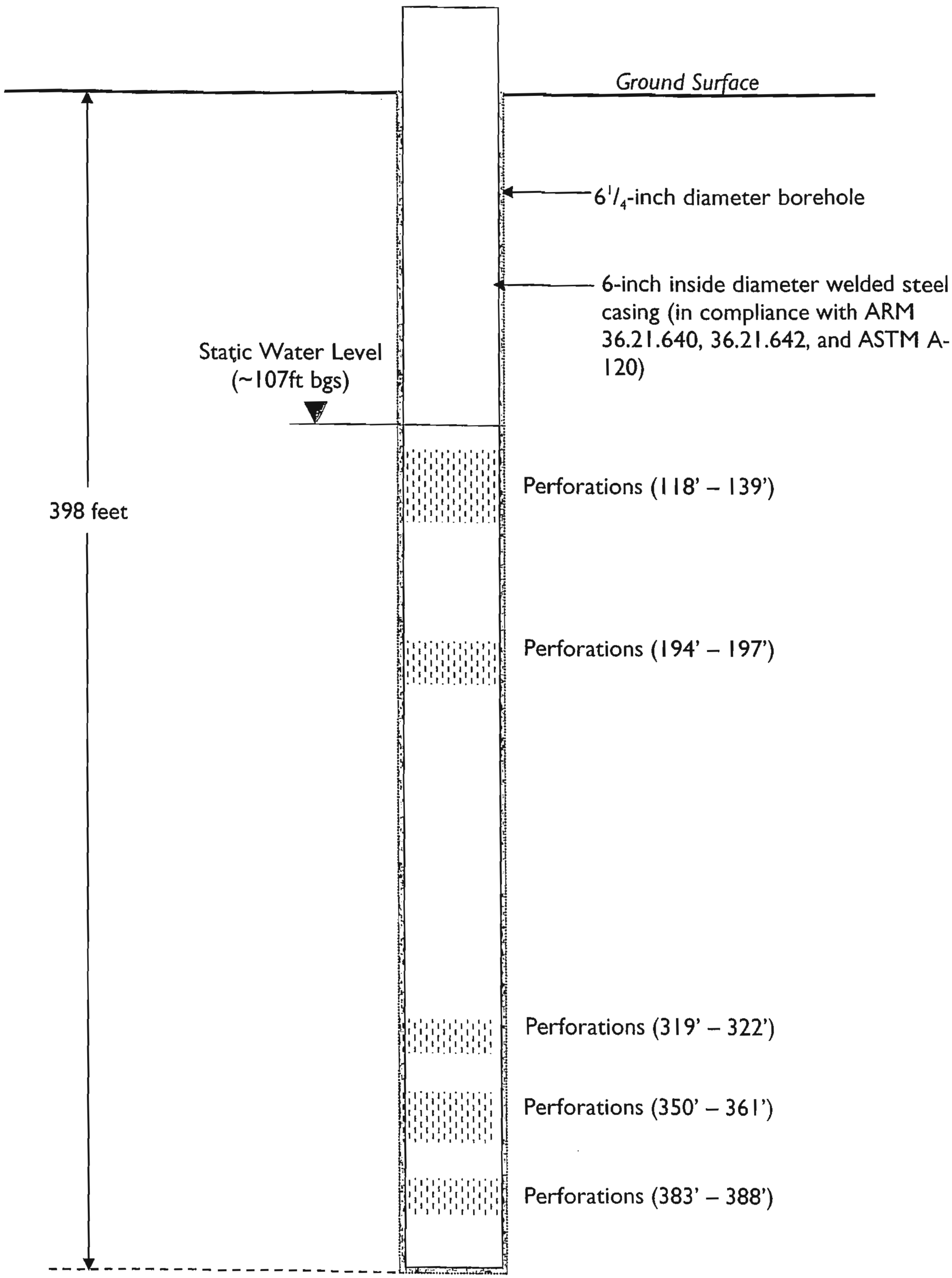
| | |
|---|---|
| **Name:** | MARTIN WILSON |
| **Company:** | AK DRILLING- INC |
| **License No:** | WWC-624 |
| **Date Completed:** | 4/22/2008 |

**Site Name: TWIN CREEKS PROPERTY**
**GWIC Id: 244440**
**Additional Lithology Records**

| From | To | Description |
|---|---|---|
| 248 | 251 | CL, SANDY CLAY, TAN COLOR, 95% CLAY, LOW PLASTICITY, HARDNESS IS LOW TO MEDIUM, DOES NOT FORM RIBBON, 5% SAND, MEDIUM TO FINE, SUBANGULAR |
| 251 | 269 | SP, SAND, BULK COLOR, 90% SAND, FINE TO COARSE, SUBROUNDED TO SUBANGULAR, POORLY SORTED, 5% GRAVEL, 0.5 TO 1 INCH IN SIZE, 5% CLAY |
| 269 | 276 | CL, SANDY CLAY, BROWN COLOR, 85% CLAY, MEDIUM PLASTICITY, LOW TO MEDIUM HARDNESS, DOES NOT FORM RIBBON, 15% SAND, FINE TO MEDIUM, SUBROUNDED, WELL-SORTED SAND |
| 276 | 285 | SW-SC, SAND, BULK COLOR, 90% SAND, MEDIUM TO COARSE, WELL-SORTED, 10% CLAY, SAND GRAINES ARE SUBROUNDED |
| 285 | 298 | GP, GRAVEL, BULK COLOR, 90% GRAVEL, POOR GRADE, SUBROUNDED TO SUBANGULAR, 10% SAND, MEDIUM, SUBROUNDED, TRACE FINES/CLAY |
| 298 | 315 | CL, SANDY CLAY, TAN COLOR, 75% CLAY, LOW PLASTICITY, HARDNESS IS MEDIUM, 25% SAND, MEDIUM TO COARSE, SUBANGULAR, WELL-SORTED 300GPM |
| 315 | 323 | GW, GRAVEL, BULK COLOR, 85% GRAVEL, 0.5-INCH IN SIZE, ROUNDED TO SUBROUNDED, 10% SAND, FINE TO MEDIUM, SUBANGULAR, 5% CLAY, SAND IS WELL-SORTED |
| 323 | 340 | CL, SANDY CLAY, TAN COLOR, 85% CLAY, LOW PLASTICITY, HARDNESS IS LOW, NONCOHESIVE, 10% SAND, MEDIUM, SUBROUNDED TO ROUND, 5% GRAVELS, FINE, SUBROUNDEDSTOPPED DRILLING AT 335 FT BGS ON 04.15.08; RESUMED AT 335 FT BGS ON 04.16.08; USED FOAM TO GETTING CUTTI |
| 340 | 348 | SW-SC, SAND, WHITE-TAN COLOR, 90% SAND, FINE TO COARSE, SUBROUNDED, 10% CLAY, SUSPENDED IN MATRIX |
| 348 | 361 | SW, SAND WITH GRAVELS, BULK COLOR, 80% SAND, FINE TO COARSE, WELL-SORTED SAND, SUBROUNDED TO SUBANGULAR, 15% GRAVEL, FINE TO 1-INCH IN SIZE, ROUNDED TO SUBROUND, 5% CLAY FLOW RATE ~25 GPM WITH LARGE AMOUNT OF FINE SAND IN WATER @ 350 FT BGS |
| 361 | 368 | CL, SANDY CLAY, TAN COLOR, 70% CLAY, PLASTICITY IS HIGH, HARDNESS IS MEDIUM, 30% SAND, FINE TO MEDIUM, SUBROUNDED, WELL-SORTED SAND, FORMS 3-INCH RIBBON BEFORE BENDING FLOW RATE ~37.5 GPM WITH A LARGE AMOUNT OF FINE SAND @ 361 FT BGS |
| 368 | 373 | SW, SAND WITH GRAVEL, TAN COLOR, 80% SAND, FINE TO COARSE, SUBROUNDED TO ROUND, WELL-SORTED, 15% GRAVEL, FINE, SUBROUNDED, 5% CLAY |
| 373 | 383 | CL, SANDY CLAY, TAN COLOR, 70% CLAY, LOW PLASTICITY, HARDNESS IS MEDIUM, DOES NOT FORM RIBBON, 30% SAND, MEDIUM, SUBROUNDED, WELL SORTED |
| 383 | 388 | GW, GRAVEL, BULK COLOR, 85% GRAVEL, SUBROUNDED TO SUBANGULAR, WELL-GRADED, 10% SAND, FINE TO MEDIUM, SUBANGULAR, 5% CLAY FLOW RATE ~30 GPM AT 383 FT BGS WITH A LARGE AMOUNT OF SEDIMENT |
| 388 | 400 | CL, SAND CLAY, TAN COLOR, 70% CLAY, LOW PLASTICITY, HARDNESS IS MEDIUM, DOES NOT FORM RIBBON, 30% SAND, MEDIUM, SUBROUNDED, WELL-SORTED |
| 400 | 408 | GP, GRAVEL, BULK COLOR, 95% GRAVEL, POOR GRADE, FINE TO 1.5-INCH IN SIZE, SUBANGULAR, 5% SAND, MEDIUM, SUBANGULAR, POOR GRADE |
| 408 | 410 | CL, SANDY CLAY, TAN COLOR, 75% CLAY, LOW PLASTICITY, HARDNESS IS SOFT, FORMS 1-INCH RIBBON, 10% SAND, MEDIUM, SUBANGULAR, 5% VERY FINE GRAVELS |
| 410 | 435 | GW, GRAVEL, BULK COLOR, 95% GRAVEL, WELL GRADED, FINE TO 2-INCH IN SIZE, SUBANGULAR, 5% SAND, COARSE, SUBANGULAR TO SUBROUND FLOW RATE >300 GPM AT 410 FT BGS WHICH CLEARED UP QUICKLY |

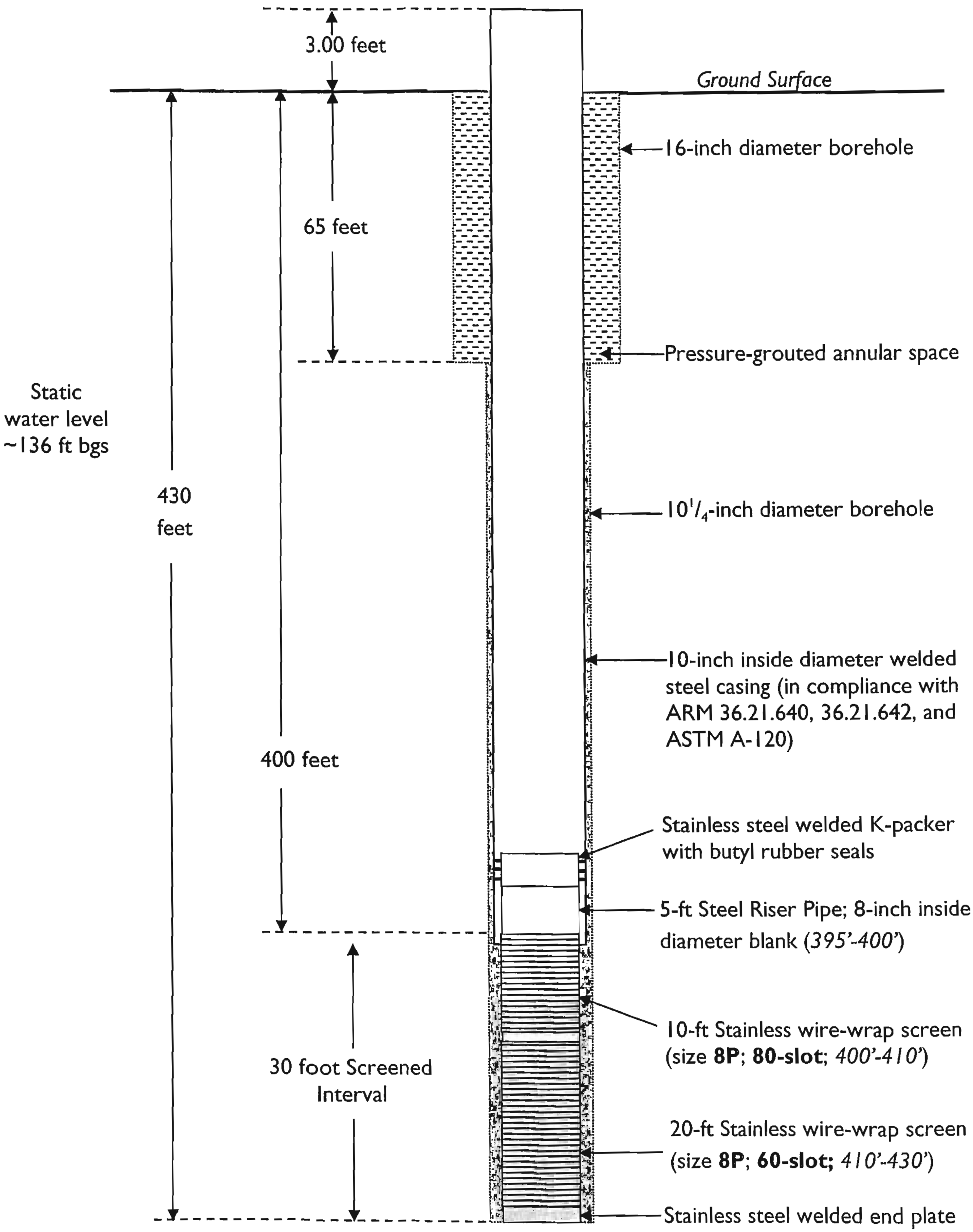
## Appendix C

Well Construction Diagrams




Geomatrix

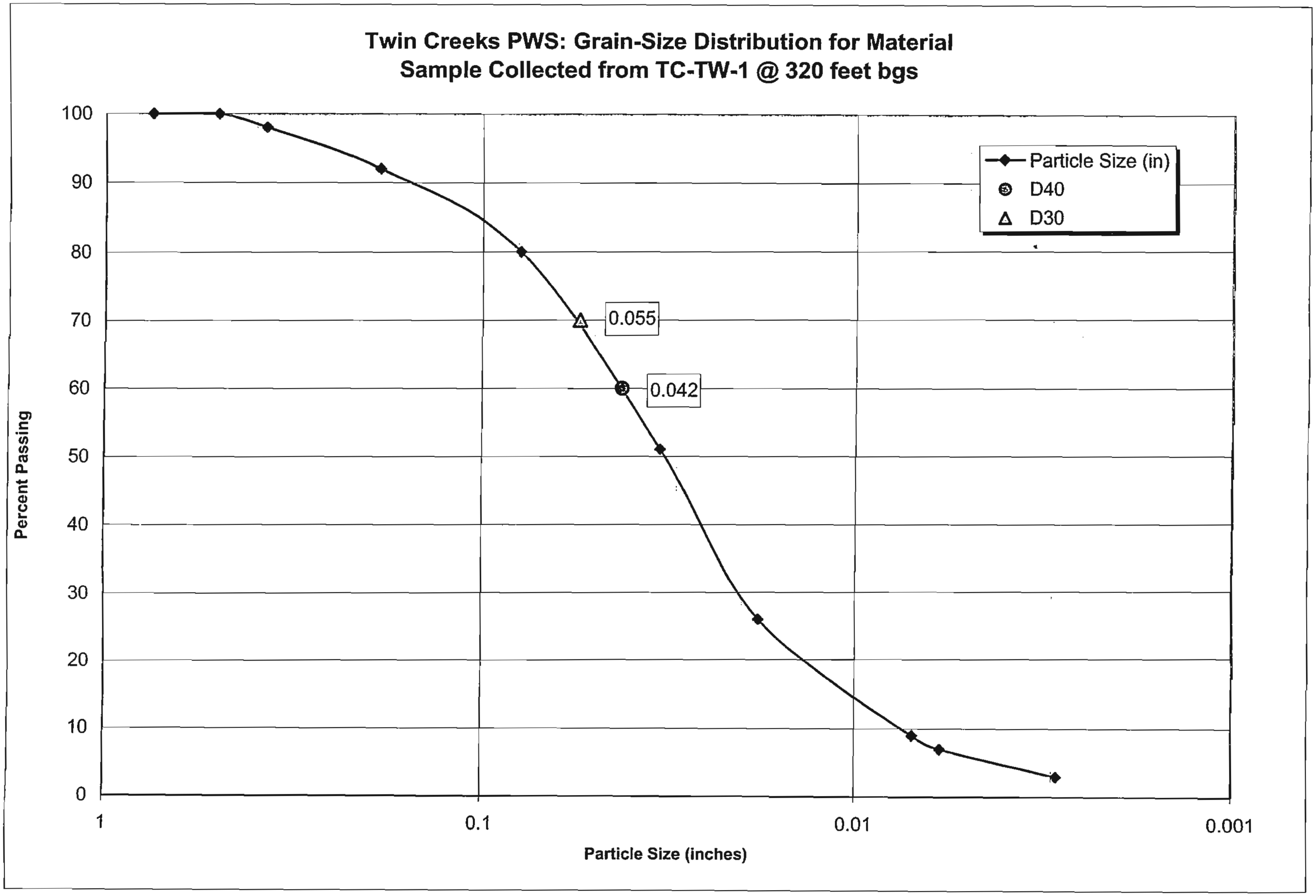
**Test Well Design**
TC-TW-1
Ravalli County, Montana



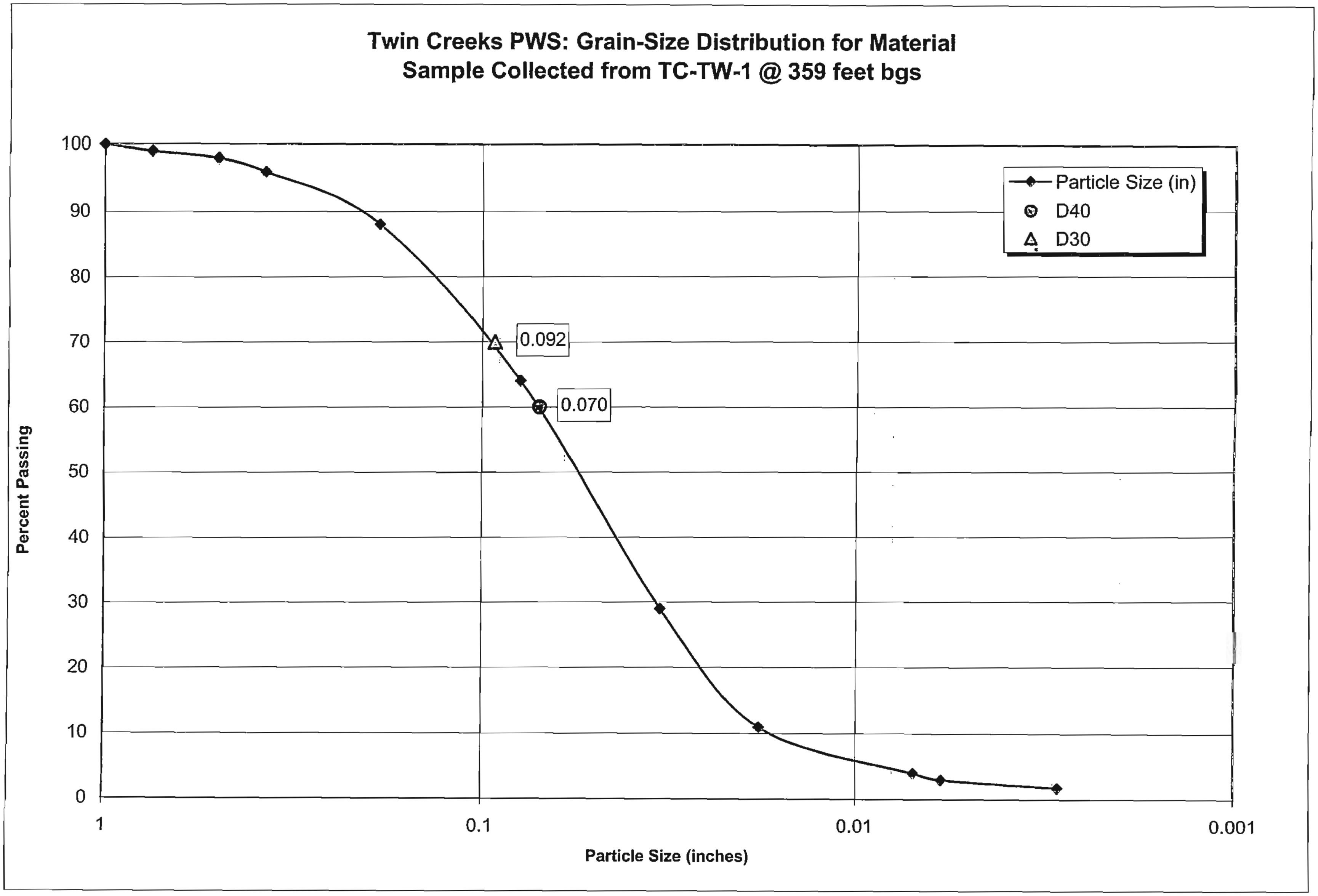

**As-Built Well Diagram**
TC-PWS-1
Ravalli County, Montana

Geomatrix

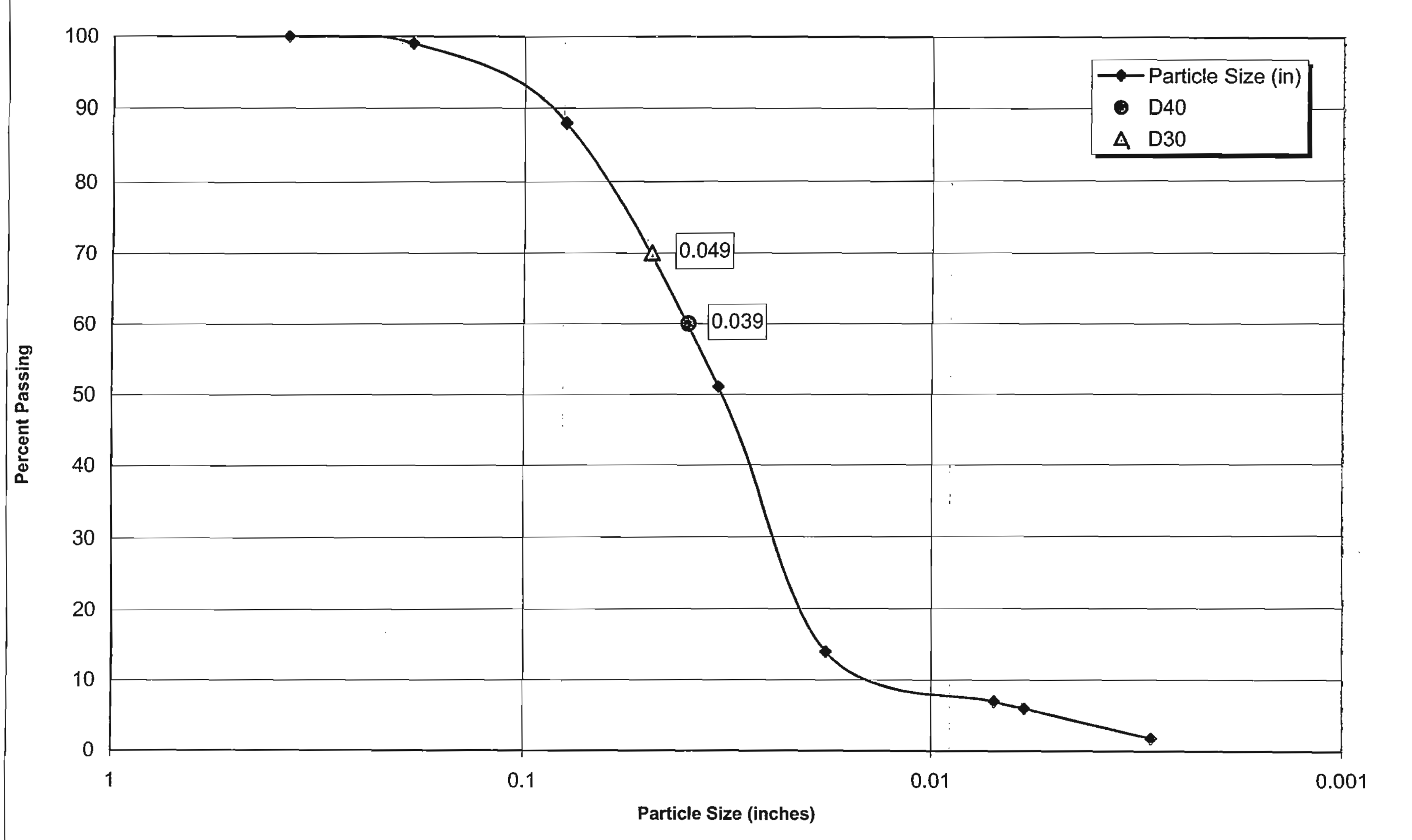
# Appendix D
Results of Grain-Size Distribution Analyses

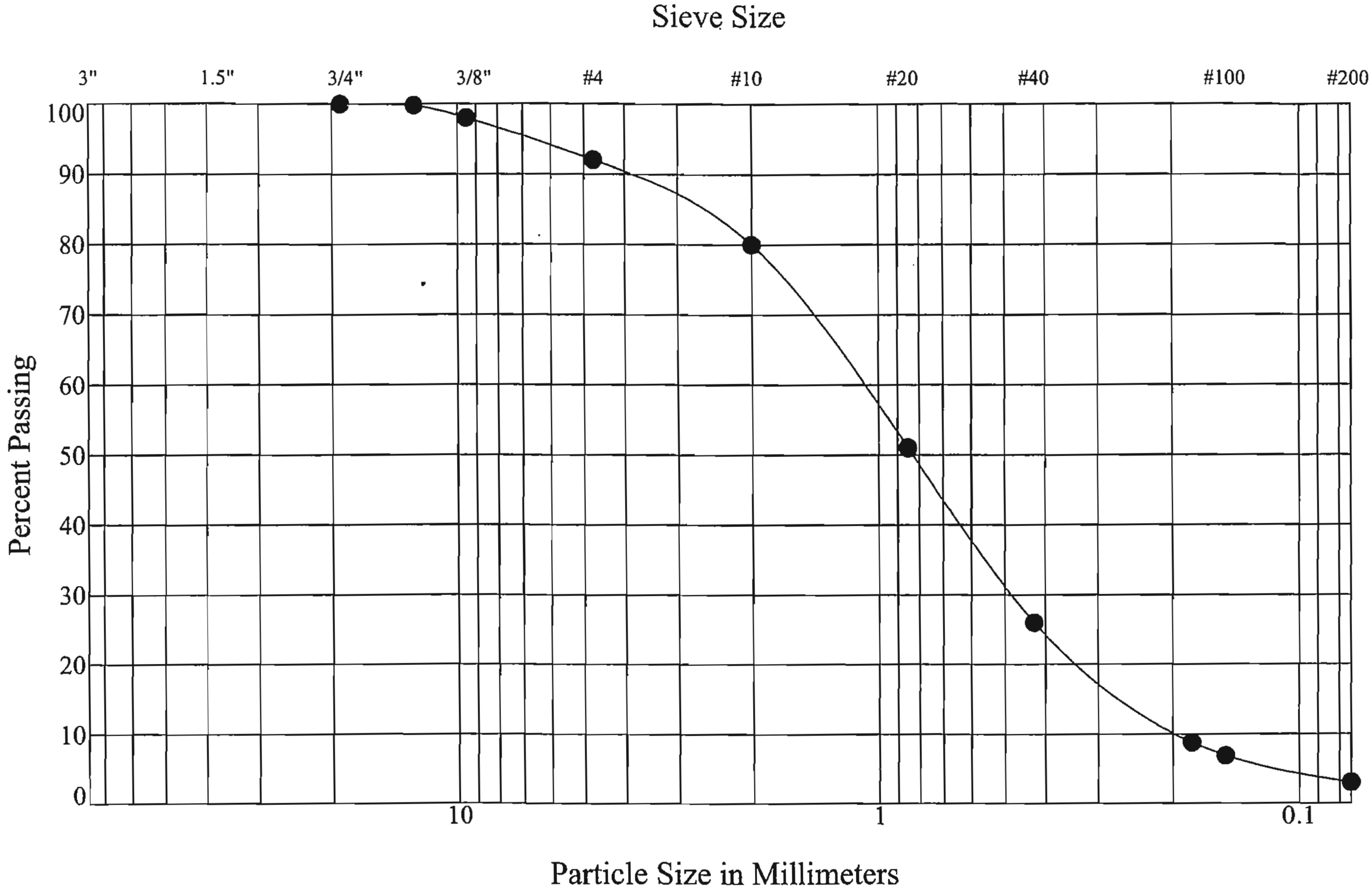


Twin Creeks PWS: Grain-Size Distribution for Material
Sample Collected from TC-TW-1 @ 320 feet bgs
Percent Passing
Particle Size (inches)
Particle Size (in)
D40
D30
0.055
0.042
100
90
80
70
60
50
40
30
20
10
0
1
0.1
0.01
0.001


Twin Creeks PWS: Grain-Size Distribution for Material
Sample Collected from TC-TW-1 @ 359 feet bgs
Percent Passing
100
90
80
70
60
50
40
30
20
10
0
1
0.1
0.01
0.001
Particle Size (inches)
Particle Size (in)
D40
D30
0.092
0.070

## Twin Creeks PWS: Grain-Size Distribution for Material Sample Collected from TC-TW-1 @ 385 feet bgs






| Gravel | | Sand | | |
|---|---|---|---|---|
| coarse | fine | coarse | medium | fine |

Percent Passing U.S. Standard Sieve Size

| 1 1/2" | 1" | 3/4" | 1/2" | 3/8" | #4 | #10 | #20 | #40 | #80 | #100 | #200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 | 100 | 98 | 92 | 80 | 51 | 26 | 9 | 7 | 3.0 |

Sample No.: 1173
Boring No.: 23
Depth: 320

Date Received: August 27, 2007
Approved By: ______
Date Approved: ______

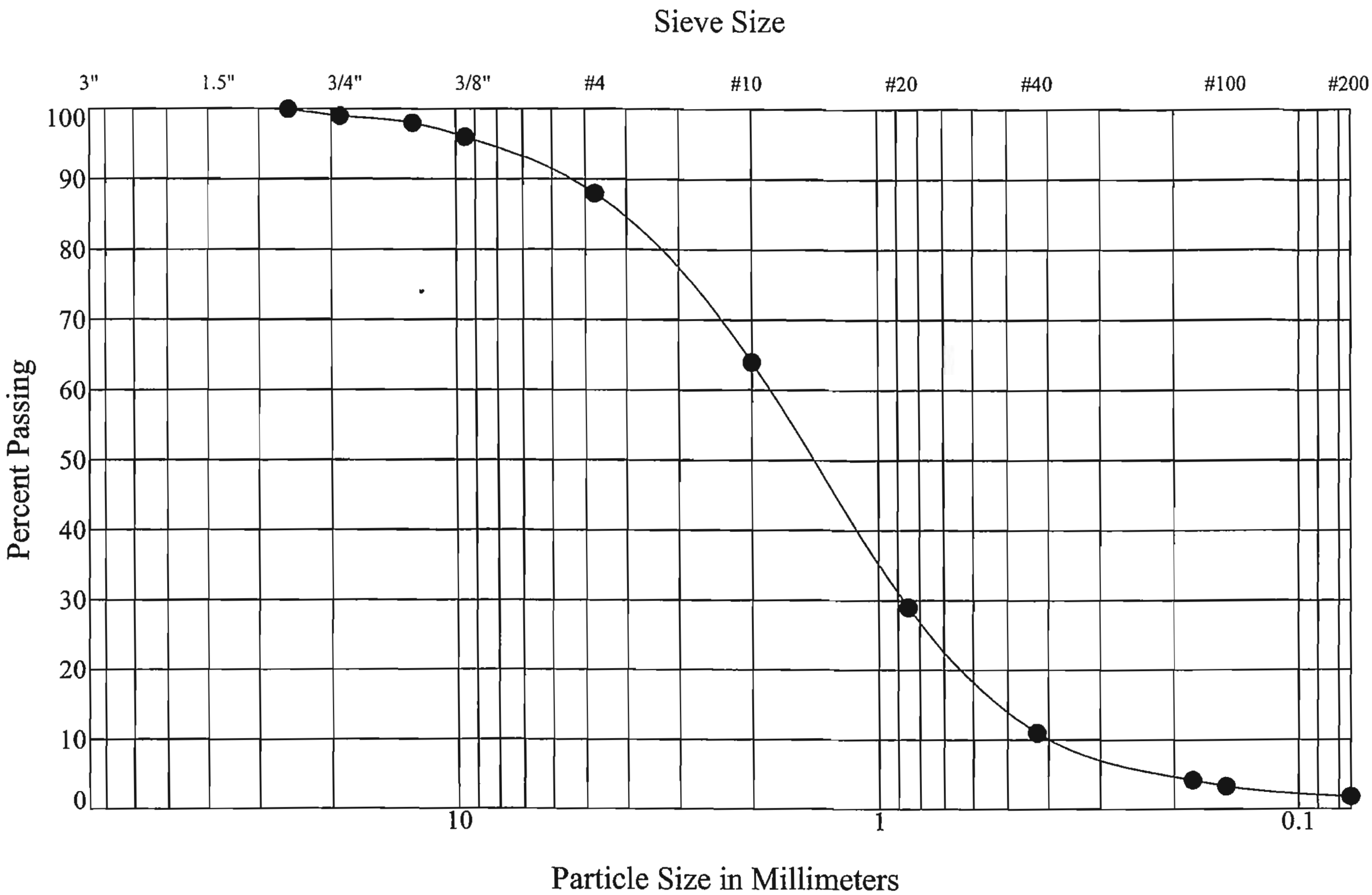
| | |
|---|---|
| Liquid Limit: | |
| Plastic Limit: | |
| Plasticity Index: | |
| Classification: | SP |
| Moisture Content: | |

Percent Gravel: 8.0
Percent Sand: 89.0
Percent Silt + Clay: 3.0
ASTM Group Name: Poorly Graded Sand


SK GEOTECHNICAL
4041 Whippoorwill Drive
P.O. Box 16123
Missoula, MT 59808-6123
Phone: 406.721.3391
Fax: 406.721.6233


**Sieve Analysis**
Project Number: 05-7239
Project Name: Twin Creeks Subdivision, Geomatrix # TC-TW-1
Project Location: Stevensville, Montana

8/30/07




| Gravel | | Sand | | |
|---|---|---|---|---|
| coarse | fine | coarse | medium | fine |

Percent Passing U.S. Standard Sieve Size

| 1 1/2" | 1" | 3/4" | 1/2" | 3/8" | #4 | #10 | #20 | #40 | #80 | #100 | #200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 99 | 98 | 96 | 88 | 64 | 29 | 11 | 4 | 3 | 1.8 |

Sample No.: 1174
Boring No.: 24
Depth: 359

Date Received: August 27, 2007
Approved By: ______
Date Approved: ______

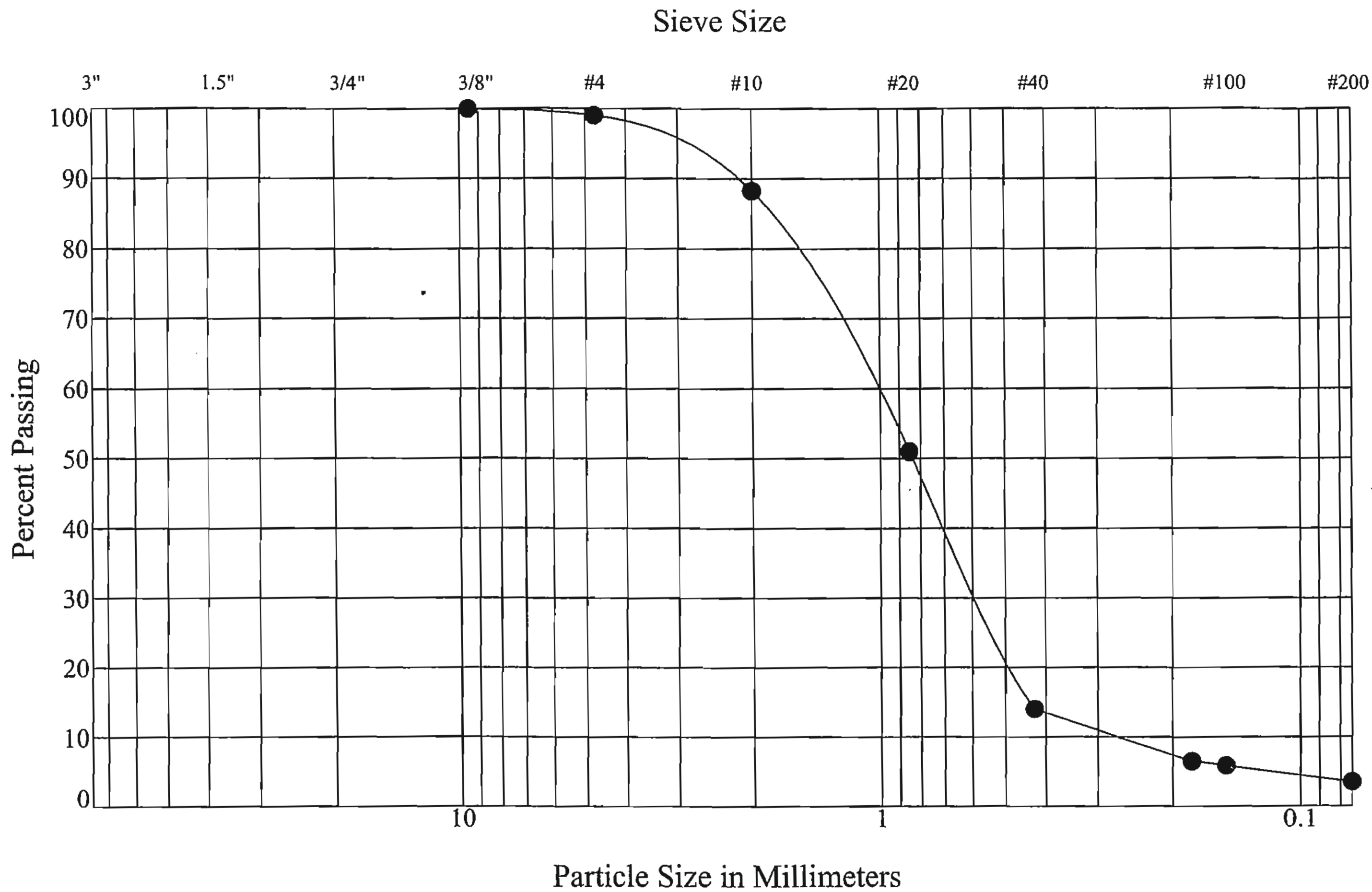
| | |
|---|---|
| Liquid Limit: | |
| Plastic Limit: | |
| Plasticity Index: | |
| Classification: | SP |
| Moisture Content: | |

Percent Gravel: 12.0
Percent Sand: 86.2
Percent Silt + Clay: 1.8
ASTM Group Name: Poorly Graded Sand

SK GEOTECHNICAL
4041 Whippoorwill Drive
P.O. Box 16123
Missoula, MT 59808-6123
Phone: 406.721.3391
Fax: 406.721.6233

**Sieve Analysis**
Project Number: 05-7239
Project Name: Twin Creeks Subdivision, Geomatrix # TC-TW-1
Project Location: Stevensville, Montana

8/30/07




| Gravel | | Sand | | |
|---|---|---|---|---|
| coarse | fine | coarse | medium | fine |

Percent Passing U.S. Standard Sieve Size

| 1 1/2" | 1" | 3/4" | 1/2" | 3/8" | #4 | #10 | #20 | #40 | #80 | #100 | #200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100 | 99 | 88 | 51 | 14 | 7 | 6 | 3.5 |

Sample No.: 1175
Boring No.: 25
Depth: 385

Date Received: August 27, 2007
Approved By: ___________
Date Approved: ___________

| | |
|---|---|
| Liquid Limit: | |
| Plastic Limit: | |
| Plasticity Index: | |
| Classification: | SP |
| Moisture Content: | |

Percent Gravel: 1.0
Percent Sand: 95.5
Percent Silt + Clay: 3.5
ASTM Group Name: Poorly Graded Sand

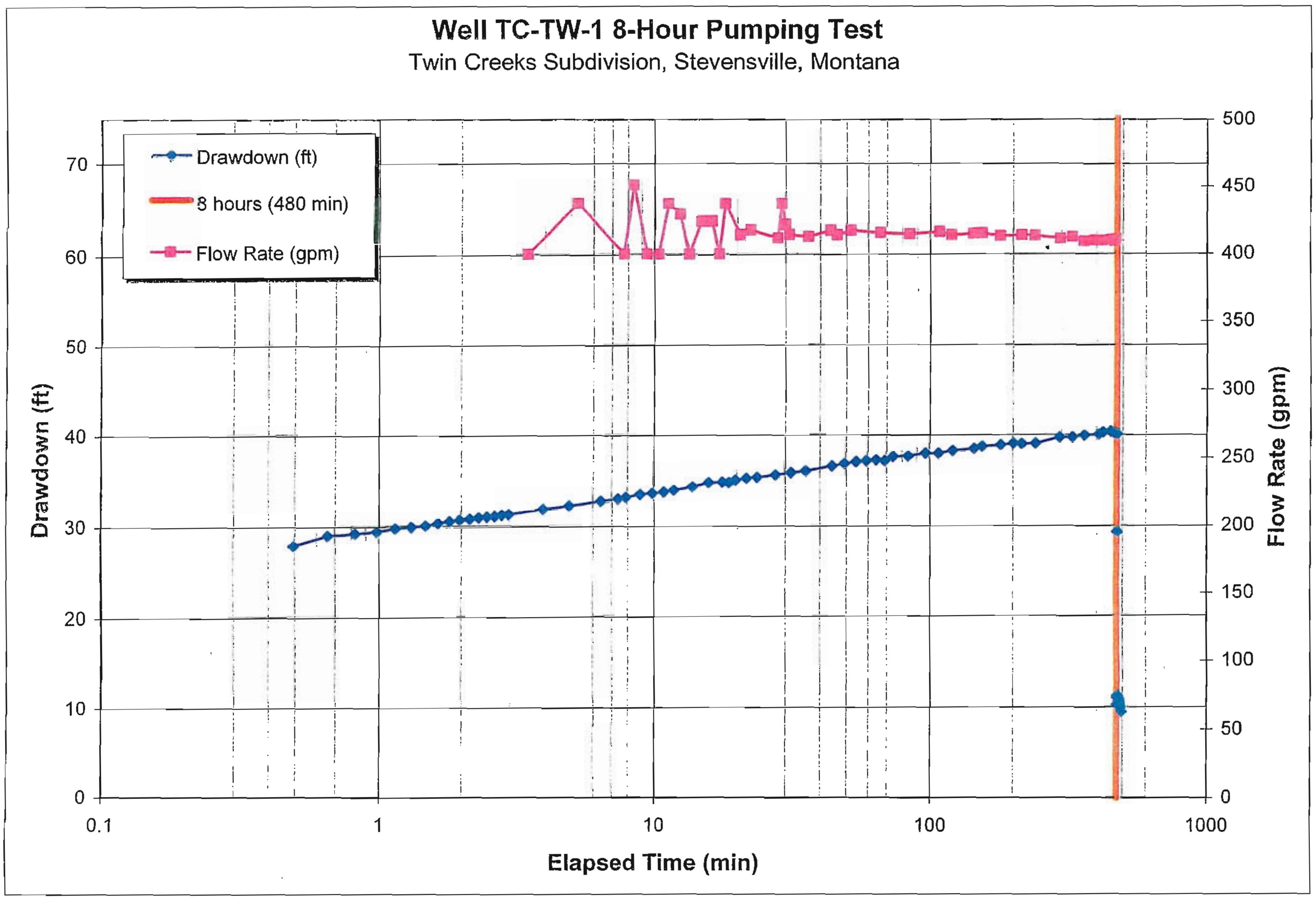

SK GEOTECHNICAL
4041 Whippoorwill Drive
P.O. Box 16123
Missoula, MT 59808-6123
Phone: 406.721.3391
Fax: 406.721.6233


## Sieve Analysis

Project Number: 05-7239
Project Name: Twin Creeks Subdivision, Geomatrix # TC-TW-1
Project Location: Stevensville, Montana

8/30/07

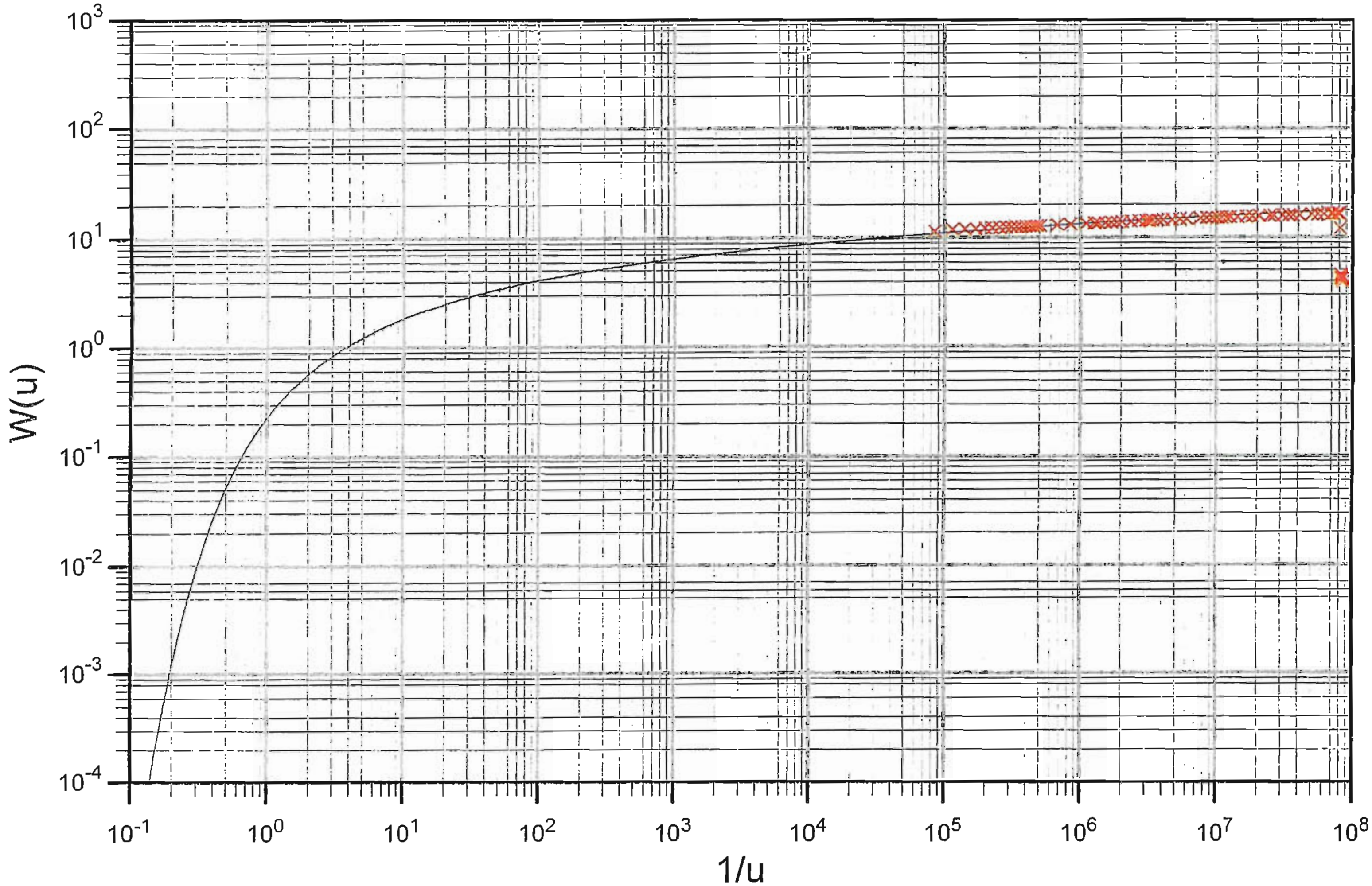
# Appendix E
Aquifer Test Result Plots



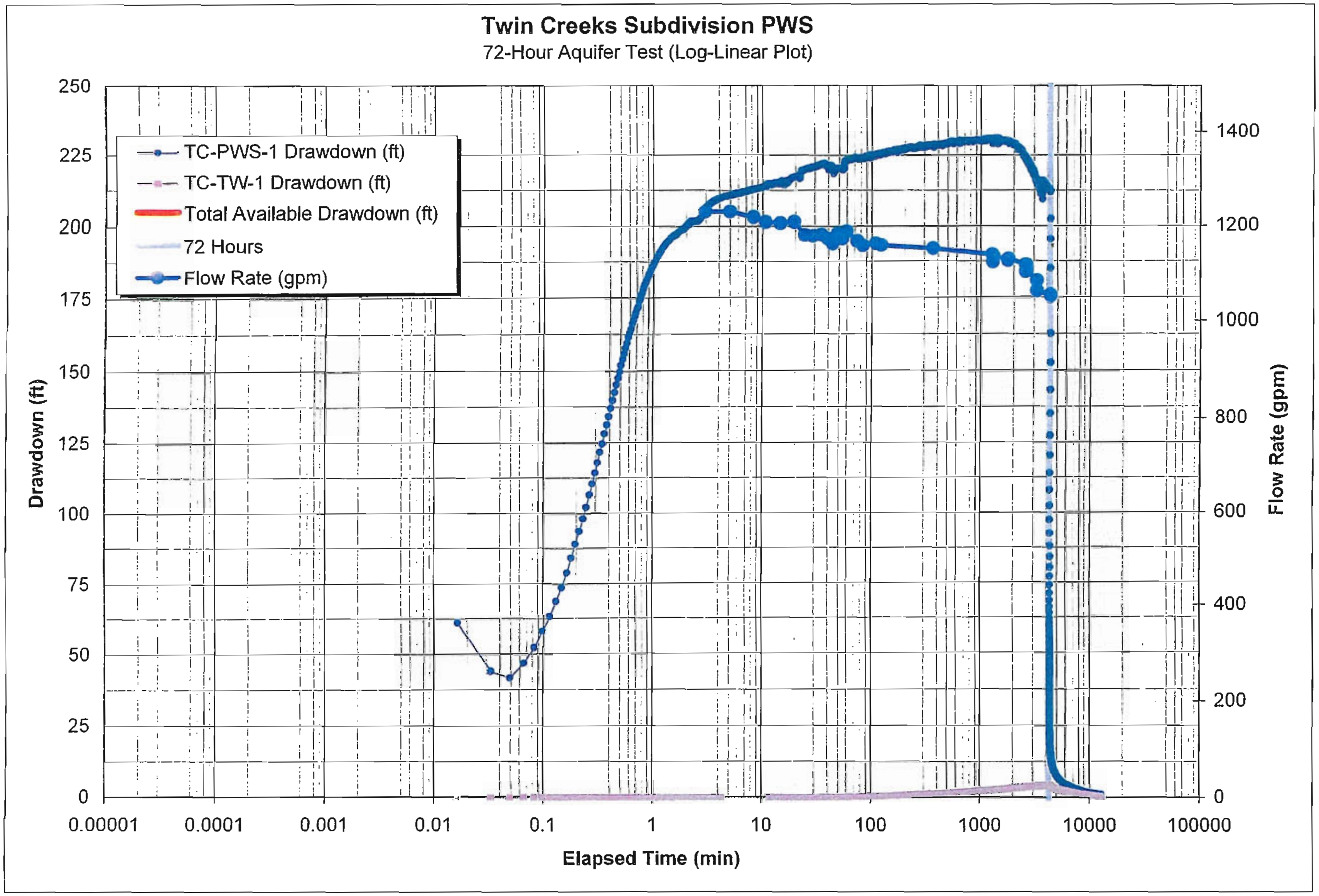
Well TC-TW-1 8-Hour Pumping Test
Twin Creeks Subdivision, Stevensville, Montana
Drawdown (ft)
8 hours (480 min)
Flow Rate (gpm)
0
10
20
30
40
50
60
70
0
50
100
150
200
250
300
350
400
450
500
0.1
1
10
100
1000
Elapsed Time (min)


Appendix E

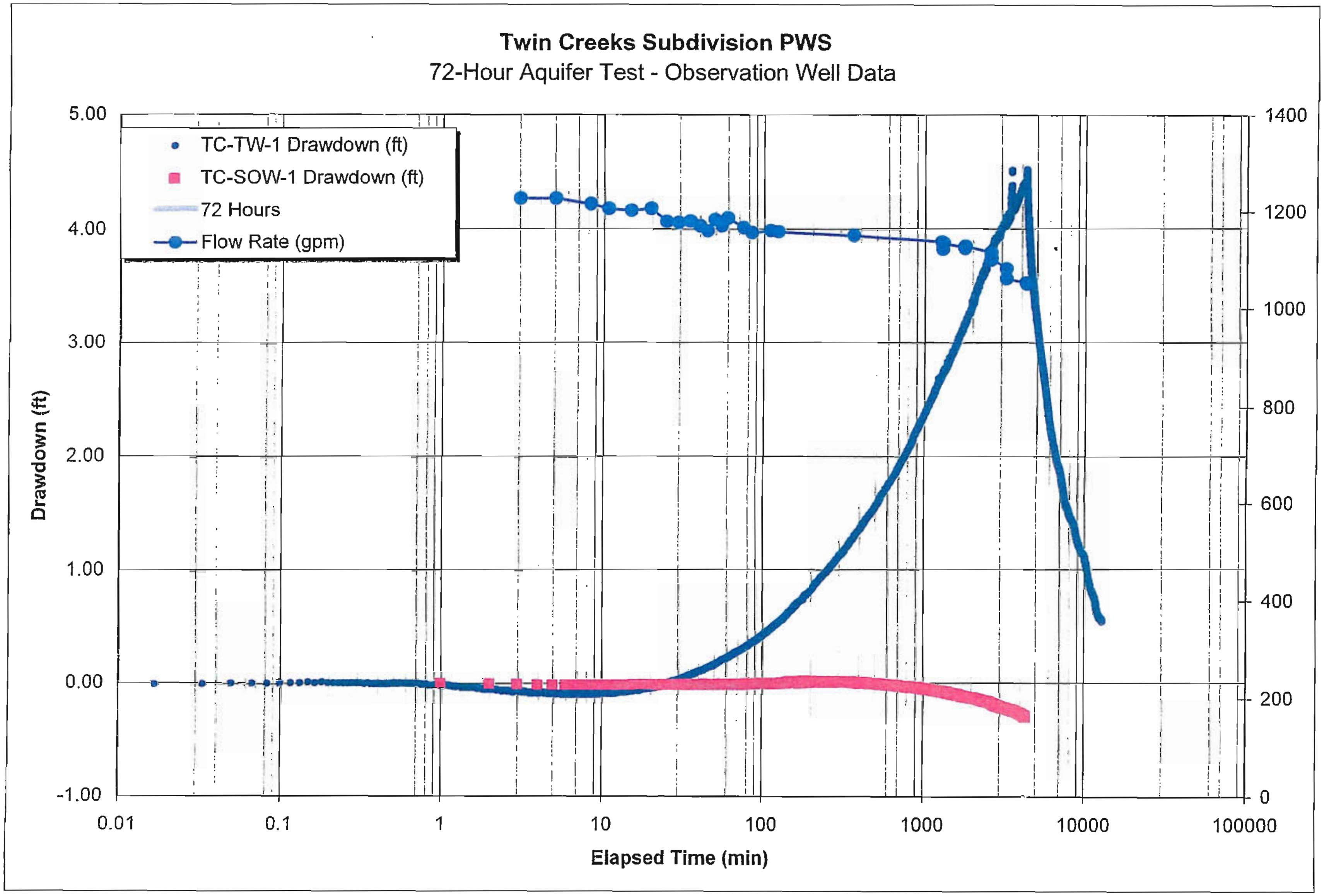
# Theis




| | |
|---|---|
| TC-TW-1<br>August 16, 2007 | Pumping Rate 413 gal/min<br>Transmissivity 2603.56 sq ft/d<br>Theis, 1935 |

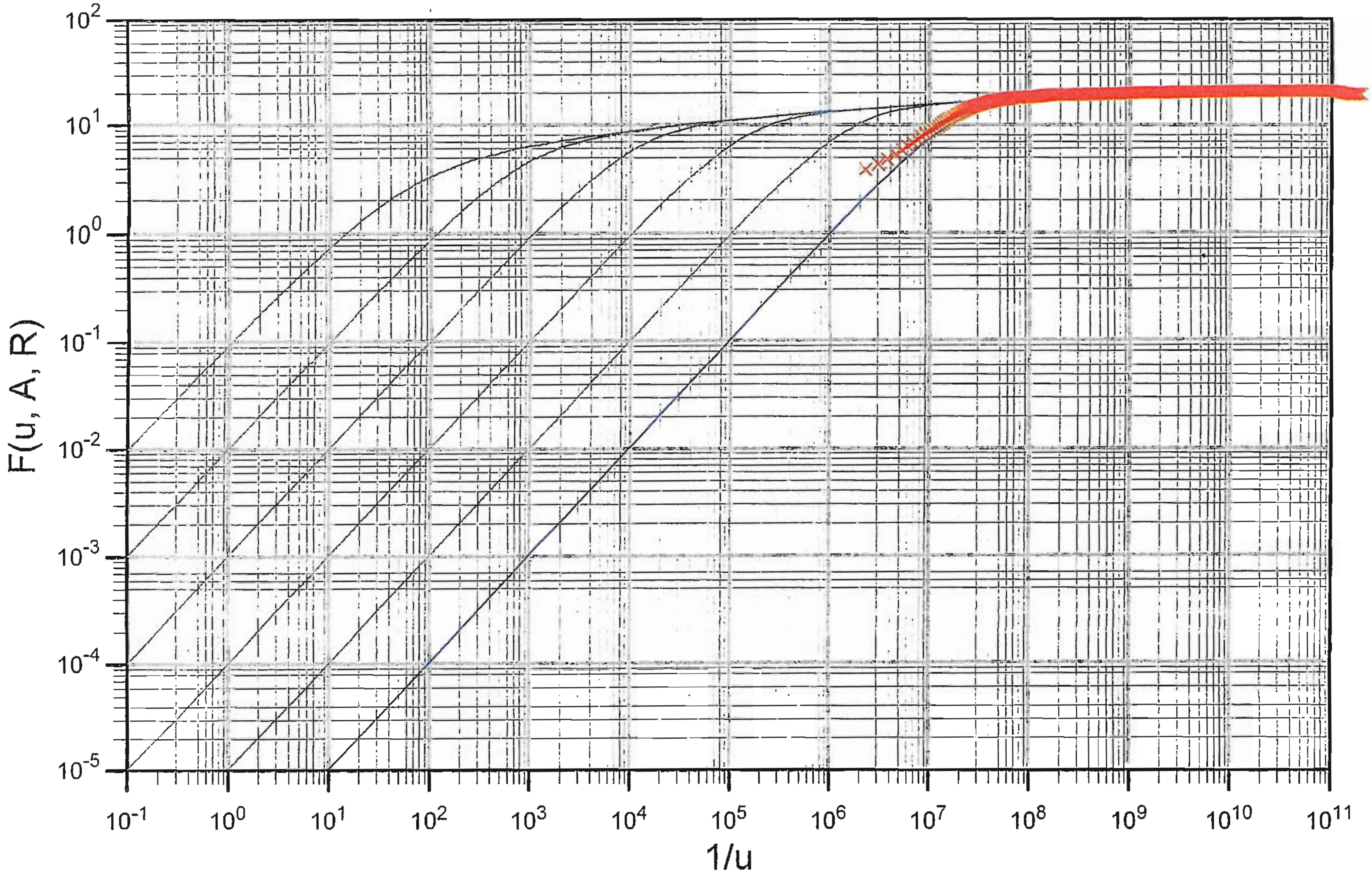


Twin Creeks Subdivision PWS
72-Hour Aquifer Test (Log-Linear Plot)
TC-PWS-1 Drawdown (ft)
TC-TW-1 Drawdown (ft)
Total Available Drawdown (ft)
72 Hours
Flow Rate (gpm)
Drawdown (ft)
250
225
200
175
150
125
100
75
50
25
0
Flow Rate (gpm)
1400
1200
1000
800
600
400
200
0
0.00001
0.0001
0.001
0.01
0.1
1
10
100
1000
10000
100000
Elapsed Time (min)



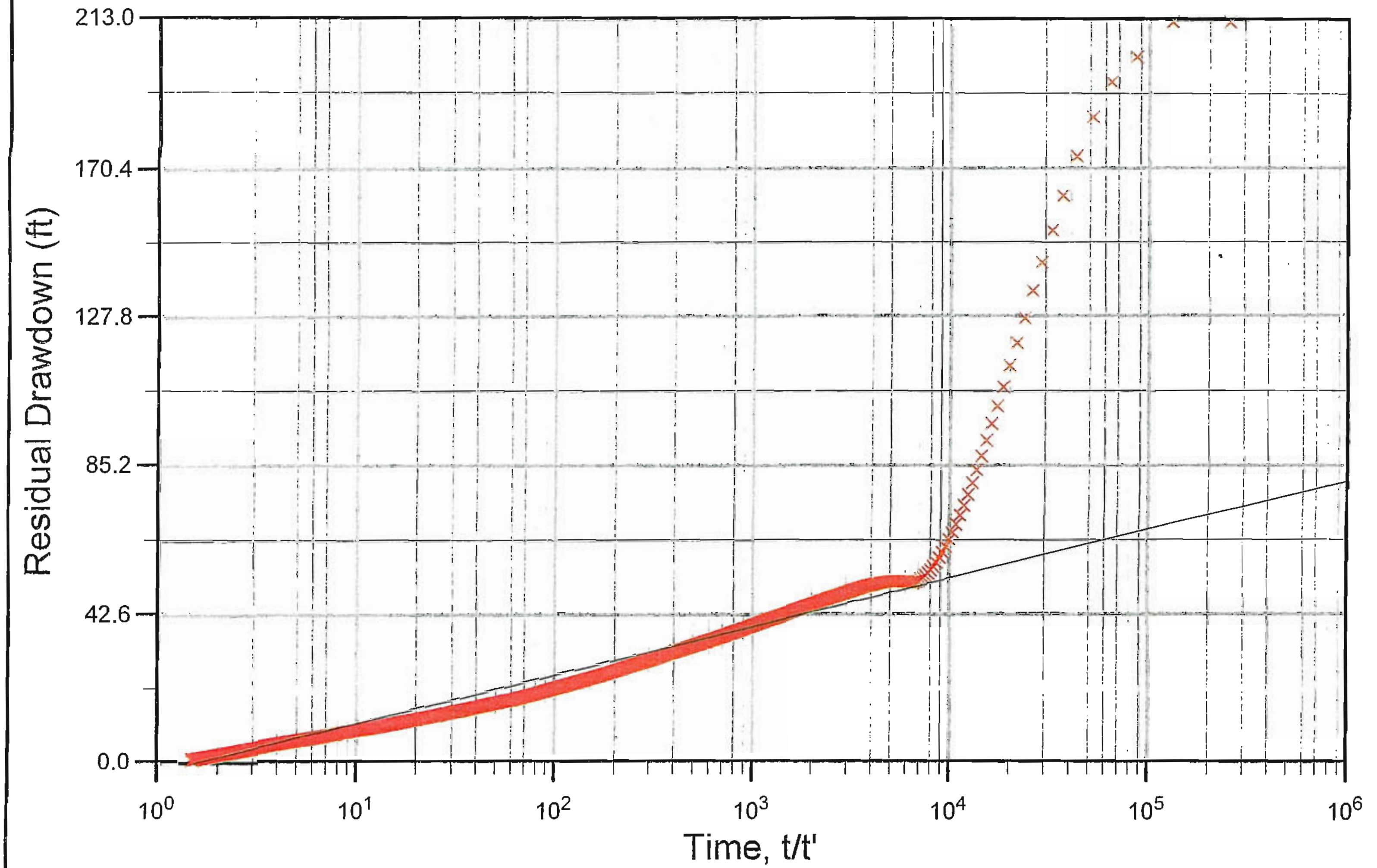
Twin Creeks Subdivision PWS
72-Hour Aquifer Test - Observation Well Data
TC-TW-1 Drawdown (ft)
TC-SOW-1 Drawdown (ft)
72 Hours
Flow Rate (gpm)
Drawdown (ft)
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
1400
1200
1000
800
600
400
200
0
0.01
0.1
1
10
100
1000
10000
100000
Elapsed Time (min)

# Papadopulos and Cooper




| | |
|---|---|
| Twin Creeks 72-hour Aquifer Test<br>April 29 - May 2, 2008<br>Solution for Large Diameter Wells (Papadopolus & Cooper 1967) | Pumping Rate 1106 gal/min<br>Transmissivity 1545.53 sq ft/d |

# Theis Recovery




| | |
|---|---|
| Twin Creeks 72-hour Aquifer Test<br>April 29 - May 2, 2008<br>Solution for Confined Aquifers (Theis 1935) - Recovery Data | Pumping Rate 1100 gal/min<br>Transmissivity 2805.14 sq ft/d |

# Appendix F

Water Quality Sample Lab Analytical Reports

ENERGY LABORATORIES, INC. • P.O. Box 30916 • 1120 South 27th Street • Billings, MT 59107-0916
800-735-4489 • 406-252-6325 • 406-252-6069 fax • eli@energylab.com

# ANALYTICAL SUMMARY REPORT



August 23, 2007

Adam Johnson
Geomatrix
1001 S Higgins Ave
Suite B-1
Missoula, MT 59801-

Workorder No.: B07081791

Project Name: Twin Creeks Subdivision

Energy Laboratories Inc received the following 1 sample from Geomatrix on 8/20/2007 for analysis.

| Sample ID | Client Sample ID | Collect Date | Receive Date | Matrix | Test |
|---|---|---|---|---|---|
| B07081791-001 | TC-TW-1 | 08/16/07 18:15 | 08/20/07 | Drinking Water | Metals by ICP/ICPMS, Drinking Water<br>Alkalinity<br>Conductivity<br>Hardness as $CaCO_3$<br>Nitrogen, Nitrate + Nitrite<br>pH<br>Metals Digestion by EPA 200.2 |

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except if noted in report comments or the Case Narrative.

If you have any questions regarding these tests results, please call.

Report Approved By: Shari Endy

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800-735-4489 • 406-252-6325 • 406-252-6069 fax • eli@energylab.com

# LABORATORY ANALYTICAL REPORT

| | | | |
|---|---|---|---|
| **Client:** | Geomatrix | **Report Date:** | 08/23/07 |
| **Project:** | Twin Creeks Subdivision | **Collection Date:** | 08/16/07 18:15 |
| **Lab ID:** | B07081791-001 | **DateReceived:** | 08/20/07 |
| **Client Sample ID:** | TC-TW-1 | **Matrix:** | Drinking Water |

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 6.8 | s.u. | | 0.1 | | A4500 H | 08/20/07 09:51 / qed |
| Conductivity | 386 | umhos/cm | | 1 | | A2510 B | 08/20/07 09:51 / qed |
| **INORGANICS** | | | | | | | |
| Alkalinity, Total as CaCO3 | 166 | mg/L | | 1 | | A2320 B | 08/20/07 15:10 / qed |
| Hardness as CaCO3 | 166 | mg/L | | 1 | | A2340 B | 08/22/07 12:08 / klc |
| **NUTRIENTS** | | | | | | | |
| Nitrogen, Nitrate+Nitrite as N | 0.98 | mg/L | | 0.05 | 10 | E353.2 | 08/21/07 13:30 / bls |
| **METALS, TOTAL** | | | | | | | |
| Arsenic | ND | mg/L | | 0.001 | 0.01 | E200.8 | 08/22/07 04:02 / sas |
| Calcium | 50 | mg/L | | 1 | | E200.7 | 08/21/07 16:26 / rlh |
| Iron | 0.12 | mg/L | | 0.03 | | E200.7 | 08/21/07 16:26 / rlh |
| Magnesium | 10 | mg/L | | 1 | | E200.7 | 08/21/07 16:26 / rlh |
| Manganese | ND | mg/L | | 0.01 | | E200.7 | 08/21/07 16:26 / rlh |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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800-735-4489 • 406-252-6325 • 406-252-6069 fax • eli@energylab.com

# QA/QC Summary Report

**Client:** Geomatrix
**Project:** Twin Creeks Subdivision

**Report Date:** 08/23/07
**Work Order:** B07081791

| Analyte | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Method: A2320 B** | | | | | | | | | Batch: R98161 |
| **Sample ID: MB** | Method Blank | | | | Run: MAN-TECH_070820A | | | | 08/20/07 14:45 |
| Alkalinity, Total as CaCO3 | • 2 | mg/L | 1 | | | | | | |
| **Sample ID: LCS** | Laboratory Control Sample | | | | Run: MAN-TECH_070820A | | | | 08/20/07 14:51 |
| Alkalinity, Total as CaCO3 | 103 | mg/L | 1.0 | 100 | 90 | 110 | | | |
| **Sample ID: B07081791-001AMS** | Sample Matrix Spike | | | | Run: MAN-TECH_070820A | | | | 08/20/07 15:16 |
| Alkalinity, Total as CaCO3 | 338 | mg/L | 1.0 | 100 | 80 | 120 | | | |
| **Sample ID: B07081791-001AMSD** | Sample Matrix Spike Duplicate | | | | Run: MAN-TECH_070820A | | | | 08/20/07 15:22 |
| Alkalinity, Total as CaCO3 | 338 | mg/L | 1.0 | 100 | 80 | 120 | 0.0 | 20 | |
| **Method: A2510 B** | | | | | | | | | Batch: PHSC070820A |
| **Sample ID: PHC1070810A** | Laboratory Control Sample | | | | Run: ORION555A_070820A | | | | 08/20/07 08:20 |
| Conductivity | 5020 | umhos/cm | 1.0 | 100 | 90 | 110 | | | |
| **Sample ID: PHC10802B** | Laboratory Control Sample | | | | Run: ORION555A_070820A | | | | 08/20/07 08:23 |
| Conductivity | 150 | umhos/cm | 1.0 | 100 | 90 | 110 | | | |
| **Sample ID: B07081824-001A** | Sample Duplicate | | | | Run: ORION555A_070820A | | | | 08/20/07 16:29 |
| Conductivity | 469 | umhos/cm | 1.0 | | | | 0.2 | 10 | |
| **Method: A4500 H** | | | | | | | | | Analytical Run: ORION555A_070820A |
| **Sample ID: PHC10803** | Initial Calibration Verification Standard | | | | | | | | 08/20/07 08:22 |
| pH | 6.99 | s.u. | 0.10 | 100 | 98 | 102 | | | |
| **Method: A4500 H** | | | | | | | | | Batch: PHSC070820A |
| **Sample ID: PHC1070412A** | Laboratory Control Sample | | | | Run: ORION555A_070820A | | | | 08/20/07 08:23 |
| pH | 3.93 | s.u. | 0.10 | 98 | 97 | 103 | | | |
| **Sample ID: B07081824-001A** | Sample Duplicate | | | | Run: ORION555A_070820A | | | | 08/20/07 16:28 |
| pH | 7.09 | s.u. | 0.10 | | | | 0.4 | 10 | |

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

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800-735-4489 • 406-252-6325 • 406-252-6069 fax • eli@energylab.com

# QA/QC Summary Report

**Client:** Geomatrix **Report Date:** 08/23/07
**Project:** Twin Creeks Subdivision **Work Order:** B07081791

| Analyte | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Method:** E200.7 | | | | | | Analytical Run: ICP202-B_070821A | | | |
| **Sample ID:** QCS | Initial Calibration Verification Standard | | | | | | | 08/21/07 12:21 | |
| Calcium | 50.1 | mg/L | 1.0 | 100 | 90 | 110 | | | |
| Iron | 5.04 | mg/L | 0.030 | 101 | 90 | 110 | | | |
| Magnesium | 50.2 | mg/L | 1.0 | 100 | 90 | 110 | | | |
| Manganese | 5.03 | mg/L | 0.010 | 101 | 90 | 110 | | | |
| **Method:** E200.7 | | | | | | | | Batch: R98253 | |
| **Sample ID:** MB-SPDIS070821A | Method Blank | | | | Run: ICP202-B_070821A | | | 08/21/07 13:08 | |
| Calcium | ND | mg/L | 0.009 | | | | | | |
| Iron | ND | mg/L | 0.002 | | | | | | |
| Magnesium | ND | mg/L | 0.01 | | | | | | |
| Manganese | ND | mg/L | 0.0002 | | | | | | |
| **Sample ID:** LFB-SPDIS070821A | Laboratory Fortified Blank | | | | Run: ICP202-B_070821A | | | 08/21/07 13:12 | |
| Calcium | 48.9 | mg/L | 1.0 | 98 | 85 | 115 | | | |
| Iron | 4.98 | mg/L | 0.030 | 100 | 85 | 115 | | | |
| Magnesium | 48.2 | mg/L | 1.0 | 96 | 85 | 115 | | | |
| Manganese | 4.84 | mg/L | 0.010 | 97 | 85 | 115 | | | |
| **Sample ID:** B07081853-005CMS2 | Sample Matrix Spike | | | | Run: ICP202-B_070821A | | | 08/21/07 15:45 | |
| Calcium | 124 | mg/L | 1.0 | 100 | 70 | 130 | | | |
| Iron | 13.2 | mg/L | 0.030 | 92 | 70 | 130 | | | |
| Magnesium | 65.9 | mg/L | 1.0 | 99 | 70 | 130 | | | |
| Manganese | 9.80 | mg/L | 0.010 | 88 | 70 | 130 | | | |
| **Sample ID:** B07081853-005CMSD2 | Sample Matrix Spike Duplicate | | | | Run: ICP202-B_070821A | | | 08/21/07 15:50 | |
| Calcium | 126 | mg/L | 1.0 | 104 | 70 | 130 | 1.6 | 20 | |
| Iron | 13.3 | mg/L | 0.030 | 93 | 70 | 130 | 0.5 | 20 | |
| Magnesium | 66.7 | mg/L | 1.0 | 100 | 70 | 130 | 1.2 | 20 | |
| Manganese | 10.1 | mg/L | 0.010 | 93 | 70 | 130 | 2.7 | 20 | |

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

# QA/QC Summary Report

**Client:** Geomatrix **Report Date:** 08/23/07
**Project:** Twin Creeks Subdivision **Work Order:** B07081791

| Analyte | Result | Units | RL | %REC | Low Limit | High Limit | RPD | RPDLimit | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **Method: E200.8** | | | | | | Analytical Run: ICPMS202-B_070821A | | | |
| **Sample ID: QCS - ME070515A, ME0** | Initial Calibration Verification Standard | | | | | | | 08/21/07 13:10 | |
| Arsenic | 0.0509 | mg/L | 0.0050 | 102 | 90 | 110 | | | |
| **Method: E200.8** | | | | | | | | Batch: R98252 | |
| **Sample ID: LRB** | Method Blank | | | | Run: ICPMS202-B_070821A | | | 08/21/07 13:54 | |
| Arsenic | ND | mg/L | 4E-05 | | | | | | |
| **Sample ID: LFB** | Laboratory Fortified Blank | | | | Run: ICPMS202-B_070821A | | | 08/21/07 13:59 | |
| Arsenic | 0.0505 | mg/L | 0.0050 | 101 | 85 | 115 | | | |
| **Sample ID: B07081832-002CMS** | Sample Matrix Spike | | | | Run: ICPMS202-B_070821A | | | 08/22/07 04:13 | |
| Arsenic | 0.0544 | mg/L | 0.0050 | 109 | 70 | 130 | | | |
| **Sample ID: B07081832-002CMSD** | Sample Matrix Spike Duplicate | | | | Run: ICPMS202-B_070821A | | | 08/22/07 04:19 | |
| Arsenic | 0.0548 | mg/L | 0.0050 | 109 | 70 | 130 | 0.6 | 20 | |
| **Method: E353.2** | | | | | | Analytical Run: FIA203-B_070821B | | | |
| **Sample ID: ICV** | Initial Calibration Verification Standard | | | | | | | 08/21/07 12:23 | |
| Nitrogen, Nitrate+Nitrite as N | 6.92 | mg/L | 0.050 | 102 | 90 | 110 | | | |
| **Method: E353.2** | | | | | | | | Batch: R98237 | |
| **Sample ID: MBLK** | Method Blank | | | | Run: FIA203-B_070821B | | | 08/21/07 12:24 | |
| Nitrogen, Nitrate+Nitrite as N | 0.007 | mg/L | 0.002 | | | | | | |
| **Sample ID: LFB** | Laboratory Fortified Blank | | | | Run: FIA203-B_070821B | | | 08/21/07 12:25 | |
| Nitrogen, Nitrate+Nitrite as N | 1.02 | mg/L | 0.050 | 104 | 90 | 110 | | | |
| **Sample ID: B07081682-008BMS** | Sample Matrix Spike | | | | Run: FIA203-B_070821B | | | 08/21/07 13:55 | |
| Nitrogen, Nitrate+Nitrite as N | 1.00 | mg/L | 0.050 | 102 | 90 | 110 | | | |
| **Sample ID: B07081682-008BMSD** | Sample Matrix Spike Duplicate | | | | Run: FIA203-B_070821B | | | 08/21/07 13:56 | |
| Nitrogen, Nitrate+Nitrite as N | 0.993 | mg/L | 0.050 | 101 | 90 | 110 | 1.1 | 10 | |

**Qualifiers:**

RL - Analyte reporting limit.

ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. • P.O. Box 30916 • 1120 South 27th Street • Billings, MT 59107-0916
800-735-4489 • 406-252-6325 • 406-252-6069 fax • eli@energylab.com

# Energy Laboratories Inc
# Workorder Receipt Checklist

## Geomatrix

B07081791

Login completed by: Eric L. Frank

Date and Time Received: 8/20/2007 8:00 AM

Reviewed by:

Received by: smr

Reviewed Date:

Carrier name: Hand Del

| | | | |
|---|---|---|---|
| Shipping container/cooler in good condition? | Yes ☑ | No ☐ | Not Present ☐ |
| Custody seals intact on shipping container/cooler? | Yes ☑ | No ☐ | Not Present ☐ |
| Custody seals intact on sample bottles? | Yes ☐ | No ☐ | Not Present ☑ |
| Chain of custody present? | Yes ☑ | No ☐ | |
| Chain of custody signed when relinquished and received? | Yes ☑ | No ☐ | |
| Chain of custody agrees with sample labels? | Yes ☑ | No ☐ | |
| Samples in proper container/bottle? | Yes ☑ | No ☐ | |
| Sample containers intact? | Yes ☑ | No ☐ | |
| Sufficient sample volume for indicated test? | Yes ☑ | No ☐ | |
| All samples received within holding time? | Yes ☑ | No ☐ | |
| Container/Temp Blank temperature in compliance? | Yes ☑ | No ☐ | 4°C |
| Water - VOA vials have zero headspace? | Yes ☐ | No ☐ | No VOA vials submitted ☑ |
| Water - pH acceptable upon receipt? | Yes ☑ | No ☐ | Not Applicable ☐ |

Contact and Corrective Action Comments:

None

ENERGY LABORATORIES

# Chain of Custody and Analytical Request Record



PLEASE PRINT- Provide as much information as possible.

| Company Name: Geomatrix | Project Name, PWS, Permit, Etc.: Twin Creeks Subdivision | Sample Origin State: MT | EPA/State Compliance: Yes ☐ No ☐ |
|---|---|---|---|
| Report Mail Address: 1001 S. Higgins B-1 Missoula MT 59801 | Contact Name: Adam Johnson Phone/Fax: 542-0129 | Email: ajohnson@geomatrix.com | Sampler: (Please Print) Same |
| Invoice Address: Same | Invoice Contact & Phone: Amy Stuber 542-0129 | Purchase Order: | Quote/Bottle Order: 22679 |

Special Report/Formats – ELI must be notified prior to sample submittal for the following:

- ☒ DW
- ☐ GSA
- ☐ POTW/WWTP
- ☐ State: ______
- ☐ Other: ______
- ☐ A2LA
- ☐ EDD/EDT (Electronic Data) Format: ______
- ☐ LEVEL IV
- ☐ NELAC

| SAMPLE IDENTIFICATION (Name, Location, Interval, etc.) | Collection Date | Collection Time | Number of Containers Sample Type: A W S V B O Air Water Soils/Solids Vegetation Bioassay Other MATRIX | ANALYSIS REQUESTED: Alk/pH/Cond. | Metals | N (NO3 + NO2) | | | | | | | SEE ATTACHED | Normal Turnaround (TAT) | RUSH | LABORATORY USE ONLY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 TC-TW-1 | 8/16/07 | 1815 | 3-W | X | X | X | | | | | | | | X | | ~~B~~0708179I-001 |
| 2 | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | |

Contact ELI prior to **RUSH** sample submittal for charges and scheduling – See Instruction Page

Comments: Logged in per Bottle order

Shipped by: HAND
Cooler ID(s):
Receipt Temp: 4 °C
On Ice: Yes No
Custody Seal Y N
Intact Y N
Signature Match Y N

**Custody Record MUST be Signed**

| Relinquished by (print): | Date/Time: | Signature: | Received by (print): | Date/Time: | Signature: |
|---|---|---|---|---|---|
| [signature] | 8/17/07 1200 | Adam Johnson | | | |
| Relinquished by (print): | Date/Time: | Signature: | Received by (print): | Date/Time: | Signature: |
| | | | | | |
| | | | Received by Laboratory: Sandy Lusch | Date/Time: 8-20-07 8:00 | Signature: |

Sample Disposal: Return to Client: ______ Lab Disposal: ______

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All sub-contract data will be clearly notated on your analytical report. Visit our web site at www.energylab.com for additional information, downloadable fee schedule, forms, and links.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

# LABORATORY ANALYTICAL REPORT

| | | | |
|---|---|---|---|
| **Client:** | Geomatrix | **Report Date:** | 06/09/08 |
| **Project:** | Stevensville PWS | **Collection Date:** | 05/01/08 18:30 |
| **Lab ID:** | B08050269-001 | **DateReceived:** | 05/05/08 |
| **Client Sample ID:** | PWS-1 | **Matrix:** | Drinking Water |

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **PHYSICAL PROPERTIES** | | | | | | | |
| pH | 7.0 | s.u. | | 0.1 | | A4500 H | 05/05/08 10:08 / kh |
| Conductivity | 223 | umhos/cm | | 1 | | A2510 B | 05/05/08 09:33 / kh |
| Solids, Total Dissolved TDS @ 180 C | 166 | mg/L | | 10 | | A2540 C | 05/05/08 17:06 / afb |
| **INORGANICS** | | | | | | | |
| Alkalinity, Total as CaCO3 | 99 | mg/L | | 1 | | A2320 B | 05/05/08 18:08 / kh |
| Bicarbonate as HCO3 | 121 | mg/L | | 1 | | A2320 B | 05/05/08 18:08 / kh |
| Carbonate as CO3 | ND | mg/L | | 1 | | A2320 B | 05/05/08 18:08 / kh |
| Chloride | 2 | mg/L | | 1 | | E300.0 | 05/06/08 18:40 / qed |
| Sulfate | 14 | mg/L | | 1 | | E300.0 | 05/06/08 18:40 / qed |
| Fluoride | 0.4 | mg/L | | 0.1 | | A4500-F C | 05/05/08 18:08 / kh |
| **NUTRIENTS** | | | | | | | |
| Nitrogen, Nitrite as N | ND | mg/L | H | 0.05 | | E353.2 | 05/07/08 06:58 / bls |
| Nitrogen, Nitrate as N | 0.18 | mg/L | | 0.05 | | E353.2 | 05/07/08 15:06 / rlm |
| Nitrogen, Nitrate+Nitrite as N | 0.18 | mg/L | | 0.05 | 10 | E353.2 | 05/07/08 13:31 / bls |
| - The sample was received after the holding time for Nitrite had expired. | | | | | | | |
| **METALS, TOTAL** | | | | | | | |
| Antimony | ND | mg/L | | 0.003 | 0.006 | E200.8 | 05/08/08 05:14 / aje |
| Arsenic | ND | mg/L | | 0.005 | 0.05 | E200.8 | 05/08/08 05:14 / aje |
| Barium | 0.1 | mg/L | | 0.1 | 2 | E200.7 | 05/05/08 14:53 / rlh |
| Beryllium | ND | mg/L | | 0.001 | 0.004 | E200.8 | 05/08/08 05:14 / aje |
| Cadmium | ND | mg/L | | 0.001 | 0.005 | E200.8 | 05/08/08 05:14 / aje |
| Calcium | 28 | mg/L | | 1 | | E200.7 | 05/05/08 14:53 / rlh |
| Chromium | ND | mg/L | | 0.01 | 0.1 | E200.7 | 05/05/08 14:53 / rlh |
| Iron | 0.03 | mg/L | | 0.03 | | E200.7 | 05/05/08 14:53 / rlh |
| Magnesium | 6 | mg/L | | 1 | | E200.7 | 05/05/08 14:53 / rlh |
| Manganese | ND | mg/L | | 0.01 | | E200.7 | 05/05/08 14:53 / rlh |
| Mercury | ND | mg/L | | 0.0002 | 0.002 | E200.8 | 05/08/08 05:14 / aje |
| Nickel | ND | mg/L | | 0.01 | | E200.8 | 05/08/08 05:14 / aje |
| Selenium | ND | mg/L | | 0.005 | 0.05 | E200.8 | 05/08/08 05:14 / aje |
| Sodium | 11 | mg/L | | 1 | | E200.7 | 05/05/08 14:53 / rlh |
| Thallium | ND | mg/L | | 0.001 | 0.002 | E200.8 | 05/08/08 05:14 / aje |
| **RADIONUCLIDES (CONTRACT LAB WY00002)** | | | | | | | |
| Gross Alpha MDC | 1.3 | pCi/L | | | | E900.0 | 05/13/08 16:25 / eli-c |
| Radium 226 | 0.2 | pCi/L | | | 5 | E903.0 | 05/26/08 16:02 / eli-c |
| Radium 226 precision (±) | 0.1 | pCi/L | | | | E903.0 | 05/26/08 16:02 / eli-c |
| Radium 226 MDC | 0.1 | pCi/L | | | | E903.0 | 05/26/08 16:02 / eli-c |
| Gross Alpha | 1.9 | pCi/L | | | 15 | E900.0 | 05/13/08 16:25 / eli-c |
| Radium 228 | 0.9 | pCi/L | | | 5 | RA-05 | 05/19/08 11:11 / eli-c |

**Report Definitions:**

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.
H - Analysis performed past recommended holding time.

# LABORATORY ANALYTICAL REPORT

| | | | |
|---|---|---|---|
| **Client:** | Geomatrix | **Report Date:** | 06/09/08 |
| **Project:** | Stevensville PWS | **Collection Date:** | 05/01/08 18:30 |
| **Lab ID:** | B08050269-001 | **DateReceived:** | 05/05/08 |
| **Client Sample ID:** | PWS-1 | **Matrix:** | Drinking Water |

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **RADIONUCLIDES (CONTRACT LAB-WY00002)** | | | | | | | |
| Gross Alpha precision (±) | 0.9 | pCi/L | | | | E900.0 | 05/13/08 16:25 / eli-c |
| Radium 228 precision (±) | 0.7 | pCi/L | | | | RA-05 | 05/19/08 11:11 / eli-c |
| Radium 228 MDC | 0.6 | pCi/L | | | | RA-05 | 05/19/08 11:11 / eli-c |
| Radium 226 + Radium 228 | 1.1 | pCi/L | | | 5 | A7500-RA | 05/30/08 15:39 / eli-c |
| Radium 226 + Radium 228 precision (±) | 0.7 | pCi/L | | | | A7500-RA | 05/30/08 15:39 / eli-c |
| **VOLATILE ORGANIC COMPOUNDS** | | | | | | | |
| Benzene | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| Bromobenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Bromochloromethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Bromodichloromethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Bromoform | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Bromomethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| n-Butylbenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| sec-Butylbenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| tert-Butylbenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Carbon tetrachloride | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| 1,2-Dichloroethane | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| Chlorobenzene | ND | ug/L | | 0.50 | 100 | E524.2 | 05/08/08 16:28 / hjc |
| Chlorodibromomethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Chloroethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Chloroform | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Chloromethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 2-Chlorotoluene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 4-Chlorotoluene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,2-Dibromo-3-chloropropane | ND | ug/L | | 1.0 | 0.2 | E524.2 | 05/08/08 16:28 / hjc |
| Dibromomethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,2-Dichlorobenzene | ND | ug/L | | 0.50 | 600 | E524.2 | 05/08/08 16:28 / hjc |
| 1,3-Dichlorobenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,4-Dichlorobenzene | ND | ug/L | | 0.50 | 75 | E524.2 | 05/08/08 16:28 / hjc |
| Dichlorodifluoromethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,1-Dichloroethane | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| 1,2-Dibromoethane | ND | ug/L | | 0.50 | 0.05 | E524.2 | 05/08/08 16:28 / hjc |
| 1,1-Dichloroethene | ND | ug/L | | 0.50 | 7 | E524.2 | 05/08/08 16:28 / hjc |
| cis-1,2-Dichloroethene | ND | ug/L | | 0.50 | 70 | E524.2 | 05/08/08 16:28 / hjc |
| trans-1,2-Dichloroethene | ND | ug/L | | 0.50 | 100 | E524.2 | 05/08/08 16:28 / hjc |
| 1,2-Dichloropropane | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| 1,3-Dichloropropane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 2,2-Dichloropropane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,1-Dichloropropene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| cis-1,3-Dichloropropene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| trans-1,3-Dichloropropene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |

**Report Definitions:**

RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

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Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

# LABORATORY ANALYTICAL REPORT

**Client:** Geomatrix
**Project:** Stevensville PWS
**Lab ID:** B08050269-001
**Client Sample ID:** PWS-1

**Report Date:** 06/09/08
**Collection Date:** 05/01/08 18:30
**DateReceived:** 05/05/08
**Matrix:** Drinking Water

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **VOLATILE ORGANIC COMPOUNDS** | | | | | | | |
| Ethylbenzene | ND | ug/L | | 0.50 | 700 | E524.2 | 05/08/08 16:28 / hjc |
| Hexachlorobutadiene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Isopropylbenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| p-Isopropyltoluene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Methyl tert-butyl ether (MTBE) | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Methylene chloride | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| Naphthalene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| n-Propylbenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Styrene | ND | ug/L | | 0.50 | 100 | E524.2 | 05/08/08 16:28 / hjc |
| 1,1,1,2-Tetrachloroethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,1,2,2-Tetrachloroethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Tetrachloroethene | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| Toluene | ND | ug/L | | 0.50 | 1000 | E524.2 | 05/08/08 16:28 / hjc |
| 1,2,3-Trichlorobenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,2,4-Trichlorobenzene | ND | ug/L | | 0.50 | 70 | E524.2 | 05/08/08 16:28 / hjc |
| 1,1,1-Trichloroethane | ND | ug/L | | 0.50 | 200 | E524.2 | 05/08/08 16:28 / hjc |
| 1,1,2-Trichloroethane | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| Trichloroethene | ND | ug/L | | 0.50 | 5 | E524.2 | 05/08/08 16:28 / hjc |
| Trichlorofluoromethane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,2,3-Trichloropropane | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Trihalomethanes, Total | ND | ug/L | | 0.50 | 80 | E524.2 | 05/08/08 16:28 / hjc |
| 1,2,4-Trimethylbenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| 1,3,5-Trimethylbenzene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Vinyl chloride | ND | ug/L | | 0.50 | 2 | E524.2 | 05/08/08 16:28 / hjc |
| m+p-Xylenes | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| o-Xylene | ND | ug/L | | 0.50 | | E524.2 | 05/08/08 16:28 / hjc |
| Xylenes, Total | ND | ug/L | | 0.50 | 10000 | E524.2 | 05/08/08 16:28 / hjc |
| Surr: p-Bromofluorobenzene | 97.0 | %REC | | 80-120 | | E524.2 | 05/08/08 16:28 / hjc |
| Surr: 1,2-Dichloroethane-d4 | 90.0 | %REC | | 74-127 | | E524.2 | 05/08/08 16:28 / hjc |
| Surr: Toluene-d8 | 94.0 | %REC | | 80-120 | | E524.2 | 05/08/08 16:28 / hjc |
| **SEMI-VOLATILE ORGANIC COMPOUNDS** | | | | | | | |
| Alachlor | ND | ug/L | | 0.10 | 2 | E525.2 | 05/13/08 15:42 / law |
| Aldrin | ND | ug/L | | 0.10 | | E525.2 | 05/13/08 15:42 / law |
| Atrazine | ND | ug/L | | 0.10 | 3 | E525.2 | 05/13/08 15:42 / law |
| Benzo(a)pyrene | ND | ug/L | | 0.10 | 0.2 | E525.2 | 05/13/08 15:42 / law |
| Butachlor | ND | ug/L | | 0.10 | | E525.2 | 05/13/08 15:42 / law |
| Chlordane | ND | ug/L | | 1.0 | 2 | E525.2 | 05/13/08 15:42 / law |
| di(2-ethylhexyl)Adipate | ND | ug/L | | 0.52 | 400 | E525.2 | 05/13/08 15:42 / law |
| di(2-ethylhexyl)Phthalate | ND | ug/L | | 2.1 | 6 | E525.2 | 05/13/08 15:42 / law |
| Dieldrin | ND | ug/L | | 0.10 | | E525.2 | 05/13/08 15:42 / law |
| Endrin | ND | ug/L | | 0.10 | 2 | E525.2 | 05/13/08 15:42 / law |

**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MDC - Minimum detectable concentration
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

ENERGY LABORATORIES, INC. * 1120 S 27th St * PO Box 30916 * Billings, MT 59107-0916
Toll Free 800.735.4489 * 406.252.6325 * FAX 406.252.6069 * eli@energylab.com

# LABORATORY ANALYTICAL REPORT

**Client:** Geomatrix
**Project:** Stevensville PWS
**Lab ID:** B08050269-001
**Client Sample ID:** PWS-1

**Report Date:** 06/09/08
**Collection Date:** 05/01/08 18:30
**DateReceived:** 05/05/08
**Matrix:** Drinking Water

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|
| **SEMI-VOLATILE ORGANIC COMPOUNDS** | | | | | | | |
| gamma-BHC (Lindane) | ND | ug/L | | 0.10 | 0.2 | E525.2 | 05/13/08 15:42 / law |
| Heptachlor | ND | ug/L | | 0.10 | 0.4 | E525.2 | 05/13/08 15:42 / law |
| Heptachlor epoxide | ND | ug/L | | 0.10 | 0.2 | E525.2 | 05/13/08 15:42 / law |
| Hexachlorobenzene | ND | ug/L | | 0.10 | 1 | E525.2 | 05/13/08 15:42 / law |
| Hexachlorocyclopentadiene | ND | ug/L | | 0.10 | 50 | E525.2 | 05/13/08 15:42 / law |
| Methoxychlor | ND | ug/L | | 0.10 | 40 | E525.2 | 05/13/08 15:42 / law |
| Metolachlor | ND | ug/L | | 0.10 | | E525.2 | 05/13/08 15:42 / law |
| Metribuzin | ND | ug/L | | 0.10 | | E525.2 | 05/13/08 15:42 / law |
| Propachlor | ND | ug/L | | 0.10 | | E525.2 | 05/13/08 15:42 / law |
| Simazine | ND | ug/L | | 0.10 | 4 | E525.2 | 05/13/08 15:42 / law |
| Toxaphene | ND | ug/L | | 2.1 | 3 | E525.2 | 05/13/08 15:42 / law |
| Surr: 1,3-Dimethyl-2-nitrobenzene | 89.0 | %REC | | 70-130 | | E525.2 | 05/13/08 15:42 / law |
| Surr: Perylene-d12 | 98.0 | %REC | | 70-130 | | E525.2 | 05/13/08 15:42 / law |
| Surr: Pyrene-d10 | 108 | %REC | | 70-130 | | E525.2 | 05/13/08 15:42 / law |
| Surr: Triphenylphosphate | 109 | %REC | | 70-130 | | E525.2 | 05/13/08 15:42 / law |
| **PESTICIDES, BY HPLC** | | | | | | | |
| Aldicarb | ND | ug/L | | 0.40 | 3 | E531.1 | 05/14/08 17:10 / eli-c |
| Aldicarb sulfone | ND | ug/L | | 0.40 | 2 | E531.1 | 05/14/08 17:10 / eli-c |
| Aldicarb sulfoxide | ND | ug/L | | 0.40 | 4 | E531.1 | 05/14/08 17:10 / eli-c |
| Carbaryl | ND | ug/L | | 0.40 | | E531.1 | 05/14/08 17:10 / eli-c |
| Carbofuran | ND | ug/L | | 0.40 | 40 | E531.1 | 05/14/08 17:10 / eli-c |
| 3-Hydroxycarbofuran | ND | ug/L | | 0.40 | | E531.1 | 05/14/08 17:10 / eli-c |
| Methiocarb | ND | ug/L | | 0.40 | | E531.1 | 05/14/08 17:10 / eli-c |
| Methomyl | ND | ug/L | | 0.40 | | E531.1 | 05/14/08 17:10 / eli-c |
| Oxamyl | ND | ug/L | | 0.40 | 200 | E531.1 | 05/14/08 17:10 / eli-c |
| Surr: BDMC | 118 | %REC | | 70-130 | | E531.1 | 05/14/08 17:10 / eli-c |
| **HERBICIDES** | | | | | | | |
| 2,4-D | ND | ug/L | | 1.0 | 70 | E515.1 | 05/15/08 22:53 / jkh |
| 2,4-DB | ND | ug/L | | 2.5 | | E515.1 | 05/15/08 22:53 / jkh |
| Dalapon | ND | ug/L | | 2.5 | 200 | E515.1 | 05/15/08 22:53 / jkh |
| Dicamba | ND | ug/L | | 0.25 | | E515.1 | 05/15/08 22:53 / jkh |
| Dichlorprop | ND | ug/L | | 1.0 | | E515.1 | 05/15/08 22:53 / jkh |
| Dinoseb | ND | ug/L | | 1.0 | 7 | E515.1 | 05/15/08 22:53 / jkh |
| Pentachlorophenol | ND | ug/L | | 0.040 | 1 | E515.1 | 05/15/08 22:53 / jkh |
| Picloram | ND | ug/L | | 0.50 | 500 | E515.1 | 05/15/08 22:53 / jkh |
| 2,4,5-TP (Silvex) | ND | ug/L | | 0.20 | 50 | E515.1 | 05/15/08 22:53 / jkh |
| Surr: Triclopyr | 88.0 | %REC | | 70-130 | | E515.1 | 05/15/08 22:53 / jkh |
| Surr: DCAA | 87.0 | %REC | | 70-130 | | E515.1 | 05/15/08 22:53 / jkh |

**Report Definitions:**
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# LABORATORY ANALYTICAL REPORT

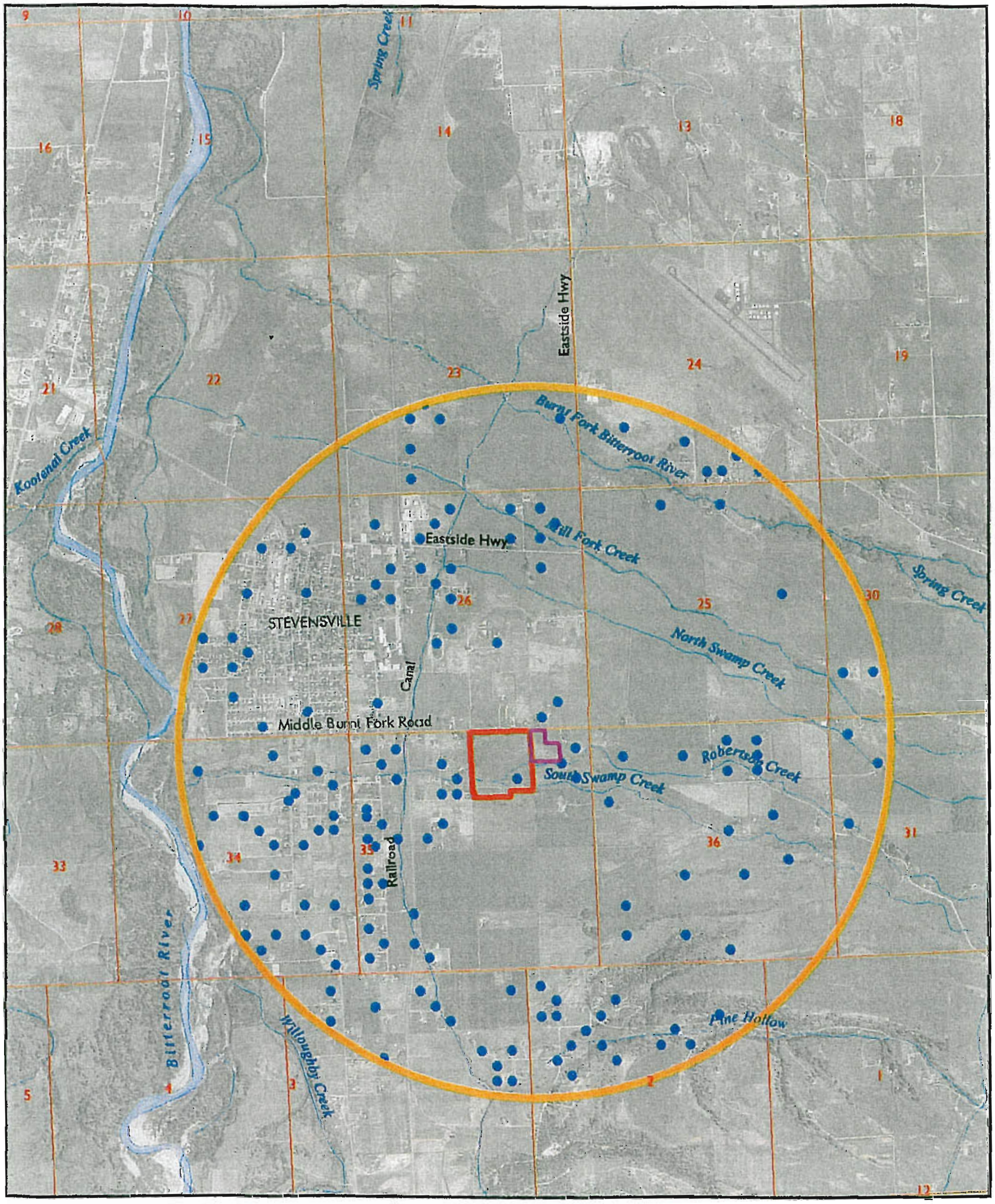
| | | | |
|---|---|---|---|
| **Client:** | Geomatrix | **Report Date:** | 06/09/08 |
| **Project:** | Stevensville PWS | **Collection Date:** | 05/01/08 18:30 |
| **Lab ID:** | B08050269-002 | **DateReceived:** | 05/05/08 |
| **Client Sample ID:** | Trip Blank, Lot #41008, B-JM SHP0234 | **Matrix:** | Trip Blank |

| Analyses | Result | Units | Qualifiers | RL | MCL/ QCL | Method | Analysis Date / By |
|---|---|---|---|---|---|---|---|

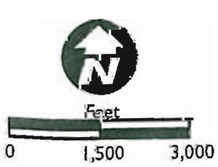
**Report Definitions:**
RL - Analyte reporting limit.
QCL - Quality control limit.
MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

## Appendix G

Map and Table of Existing PODs within the ZOI




Source: NAIP 2005, Ravalli County




Geomatrix

Point of Diversion
Zone of Influence
Twin Creeks Subdivision
Approximate Well Field Boundary

Zone of Influence and
Points of Diversion
Twin Creeks Subdivision
Stevensville, Montana
APPENDIX G

# Appendix G

Existing Groundwater Rights within ZOI

| NAME | WRNUMBER | Maximum Volume (Listed) | Maximum Volume (Assumed) | Well Depth | Modeled Drawdown |
|---|---|---|---|---|---|
| ACUFF HUBERT E | 76H 100416 00 | 14.5 | 14.5 | 110 | -0.31 |
| ADAMS JANE D | 76H 100515 00 | 1.6 | 1.6 | 0 | -0.11 |
| ALLARD DEBORAH A | 76H 100905 00 | 1.8 | 1.8 | 164 | -0.11 |
| ALLEN PAMELA G | 76H 100954 00 | 0.3 | 0.3 | 0 | -0.01 |
| ANDERSON JOHN L | 76H 102362 00 | 1.6 | 1.6 | 0 | -0.01 |
| ANDERSON JOHN L | 76H 102480 00 | 1.6 | 1.6 | 77 | -0.01 |
| ARMSTRONG LOUISE C | 76H 103751 00 | 2.9 | 2.9 | 110 | -0.11 |
| ASHMORE LINDSEY | 76H 103773 00 | 1.8 | 1.8 | 0 | -0.01 |
| BANNING BILLY W | 76H 103787 00 | 1.6 | 1.6 | 77 | -0.01 |
| BANNING BILLY W | 76H 104112 00 | 2.0 | 2.0 | 78 | -0.01 |
| BANNING BILLY W | 76H 103878 00 | 1.6 | 1.6 | 98 | -0.01 |
| BARR ALLEN E | 76H 104587 00 | 15.0 | 15.0 | 0 | -0.01 |
| BARRINGTON MARY ANN | 76H 104589 00 | 15.0 | 15.0 | 0 | -0.01 |
| BAUER TOM | 76H 105015 00 | 2.0 | 2.0 | 0 | -0.11 |
| BAUER TOM | 76H 105014 00 | 2.0 | 2.0 | 20 | -0.01 |
| BAUER WENDIE M | 76H 105017 00 | 2.0 | 2.0 | 0 | -0.01 |
| BELL GAIL | 76H 105019 00 | 2.0 | 2.0 | 169 | -0.01 |
| BENDEWALD ALAN | 76H 105087 00 | 1.6 | 1.6 | 94 | -0.01 |
| BENTON LINDA K | 76H 105278 00 | 75.0 | 75.0 | 0 | -0.01 |
| BERRY ROBERT J | 76H 10700 00 | 15.0 | 15.0 | 171 | -0.11 |
| BINKERD DARRELL M | 76H 108039 00 | 10.0 | 10.0 | 120 | -0.41 |
| BINKERD DARRELL M | 76H 107663 00 | 2.9 | 2.9 | 0 | -0.11 |
| BINKERD DARRELL M | 76H 108692 00 | 1.0 | 1.0 | 46 | -0.01 |
| BINKERD DARRELL M | 76H 107394 00 | 1.6 | 1.6 | 68 | -0.01 |
| BINKERD DARRELL M | 76H 107668 00 | 0.6 | 0.6 | 76 | -0.01 |
| BINKERD DARRELL M | 76H 108074 00 | 1.6 | 1.6 | 115 | -0.01 |
| BODNER JOHN E | 76H 108707 00 | 0.6 | 0.6 | 440 | -0.01 |
| BOULANGER SCOTT D | 76H 109730 00 | 1.6 | 1.6 | 0 | -0.21 |
| BREWER PATRICIA L | 76H 109815 00 | 2.7 | 2.7 | 88 | -0.01 |
| BRINK TAIT | 76H 111043 00 | 1.6 | 1.6 | 40 | -0.31 |
| BROWN DOROTHY ESTATE | 76H 112389 00 | 0.3 | 0.3 | 71 | -0.11 |
| BROWN DOROTHY ESTATE | 76H 112862 00 | 1.6 | 1.6 | 0 | -0.01 |
| BROWN SHARON M | 76H 113549 00 | 3.4 | 3.4 | 163 | -0.31 |
| BUDKE JERRIE J | 76H 114471 00 | 8.5 | 8.5 | 80 | -0.01 |
| BURGETT GARY W | 76H 115320 00 | 2.0 | 2.0 | 0 | -0.01 |
| BURGETT GARY W | 76H 115976 00 | 1.6 | 1.6 | 78 | -0.01 |
| CAMPBELL FAMILY TRUST | 76H 11671 00 | 0.0 | **10.0** | 75 | -0.21 |
| CANFIELD GEORGE W | 76H 118400 00 | 2.5 | 2.5 | 0 | -0.01 |
| CARRANO JAMES A | 76H 13417 00 | 175.0 | 175.0 | 40 | -1.31 |
| CENIS TORREY M | 76H 13417 00 | 175.0 | 175.0 | 40 | -1.31 |
| CHERRY. PATRICK J & BARBARA J TRUST | 76H 13417 00 | 175.0 | 175.0 | 40 | -1.31 |
| CHINN JAMES R | 76H 142778 00 | 1.5 | 1.5 | 0 | -0.11 |
| CHURCH OF CHRIST | 76H 14777 00 | 50.3 | 50.3 | 0 | -1.81 |
| CINFIO CANDICE L | 76H 14798 00 | 63.8 | 63.8 | 40 | -1.81 |
| CLEVELAND HERB D | 76H 14799 00 | 62.3 | 62.3 | 0 | -1.81 |
| COMER EUGENIA C | 76H 14800 00 | 62.3 | 62.3 | 0 | -1.81 |
| COMER EUGENIA C | 76H 151021 00 | 1.5 | 1.5 | 12 | -1.51 |
| CONROY REBECCA C | 76H 15167 00 | 31.6 | 31.6 | 28 | -0.01 |
| COOK DARLENE M | 76H 15230 00 | 0.4 | 0.4 | 105 | -0.01 |

## Appendix G

Existing Groundwater Rights within ZOI

| NAME | WRNUMBER | Maximum Volume (Listed) | Maximum Volume (Assumed) | Well Depth | Modeled Drawdown |
|---|---|---|---|---|---|
| CRAWFORD MARY BETH | 76H 15792 00 | 1.5 | 1.5 | 0 | -0.41 |
| DAHLQUIST HELEN | 76H 16908 00 | 13.7 | 13.7 | 86 | -0.61 |
| DAILEY VON A | 76H 16913 00 | 33.0 | 33.0 | 0 | -0.11 |
| DANFORD DONNA | 76H 17540 00 | 1.5 | 1.5 | 77 | -1.51 |
| DANFORD DONNA | 76H 17512 00 | 0.0 | **10.0** | 28 | -0.11 |
| DANIELS HARRY | 76H 17660 00 | 1.5 | 1.5 | 39 | -0.61 |
| DANIELS LYNETTE M | 76H 18714 00 | 1.5 | 1.5 | 70 | -0.21 |
| DARLOW JACK | 76H 20022 00 | 1.7 | 1.7 | 38 | -0.01 |
| DATSOPOULOS MILTON | 76H 20407 00 | 1.5 | 1.5 | 100 | -0.61 |
| DEWEY ALAN D | 76H 20644 00 | 1.6 | 1.6 | 35 | -0.71 |
| DIETZ HENRY C | 76H 21012 00 | 3.0 | 3.0 | 40 | -0.21 |
| DOBBINS BJ TRUST | 76H 214635 00 | 905.0 | 905.0 | 0 | -0.01 |
| DOICE GARY | 76H 22142 00 | 1.5 | 1.5 | 175 | -0.01 |
| DOLCE CODY | 76H 22267 00 | 1.5 | 1.5 | 200 | -0.01 |
| DOLCE GARY | 76H 2229 00 | 0.0 | **10.0** | 29 | -0.71 |
| DONALDSON JEREMY W | 76H 22510 00 | 12.9 | 12.9 | 0 | -0.01 |
| DOWNS KENNETH | 76H 22533 00 | 1.5 | 1.5 | 34 | -0.41 |
| DRAPER PAULA E | 76H 23282 00 | 1.0 | 1.0 | 0 | -0.01 |
| EDMAN KATHLEEN R | 76H 23291 00 | 0.8 | 0.8 | 0 | -0.01 |
| ELLISON CATTLE CO | 76H 25829 00 | 1.5 | 1.5 | 49 | -0.11 |
| ELLISON CATTLE CO | 76H 24178 00 | 1.5 | 1.5 | 40 | -0.01 |
| ELLISON CATTLE CO | 76H 23305 00 | 1.5 | 1.5 | 44 | -0.01 |
| ELLISON CATTLE CO | 76H 24266 00 | 1.5 | 1.5 | 66 | -0.01 |
| ELLISON CATTLE CO | 76H 25178 00 | 1.5 | 1.5 | 79 | -0.01 |
| ELLISON CATTLE CO | 76H 27157 00 | 1.5 | 1.5 | 160 | -0.01 |
| ELLISON CATTLE CO | 76H 26957 00 | 648.0 | 648.0 | 401 | -0.01 |
| ELLSWORTH BETTY J | 76H 27914 00 | 1.5 | 1.5 | 0 | -0.21 |
| ENZLER MICHAEL E | 76H 28608 00 | 1.5 | 1.5 | 38 | -0.01 |
| ESSARY BENNIE G | 76H 2941 00 | 0.0 | **10.0** | 53 | -0.01 |
| EVANS LUCYLLE H | 76H 29903 00 | 7.5 | 7.5 | 59 | -0.01 |
| EVANS LUCYLLE H | 76H 29531 00 | 1.0 | 1.0 | 63 | -0.01 |
| FARMERS STATE BANK | 76H 30002730 | 3.5 | 3.5 | 68 | -0.21 |
| FERRIE DAVID | 76H 30003841 | 7.5 | 7.5 | 40 | -0.01 |
| FIEBER MIKE | 76H 30004472 | 1.6 | 1.6 | 0 | -0.01 |
| FIEBER MIKE R | 76H 30004884 | 2.8 | 2.8 | 86 | -0.01 |
| FLEMMER DEANNA C | 76H 30005 00 | 1.5 | 1.5 | 172 | -0.21 |
| FLYNN VALERIE J | 76H 30005980 | 0.0 | **10.0** | 0 | -0.01 |
| FORSBERG KRISTI N | 76H 30006589 | 0.0 | **10.0** | 121 | -0.21 |
| FRAZER RICHARD E | 76H 30007595 | 0.0 | **10.0** | 218 | -0.71 |
| FRAZER RICHARD E | 76H 30006660 | 0.0 | **10.0** | 170 | -0.01 |
| GAIL ANNA C | 76H 30008250 | 0.0 | **10.0** | 0 | -0.11 |
| GENSEMER CONSTANCE M | 76H 30008800 | 0.0 | **10.0** | 118 | -0.21 |
| GOLDEN WINGS LLC | 76H 30009053 | 0.0 | **10.0** | 223 | -0.01 |
| GRAYSON CHERYL L | 76H 30009166 | 0.0 | **10.0** | 100 | -0.01 |
| GRIFFIN SHARON | 76H 30009385 | 0.0 | **10.0** | 90 | -0.21 |
| GUINARD WILLIAM E | 76H 30009528 | 0.0 | **10.0** | 60 | -0.01 |
| HARRIS LINDA G | 76H 30010698 | 0.0 | **10.0** | 0 | -0.01 |
| HART BEVERLY J | 76H 30012143 | 0.0 | **10.0** | 138 | -0.01 |
| HAYDEN BRUCE T | 76H 30012630 | 0.0 | **10.0** | 58 | -0.01 |

## Appendix G

Existing Groundwater Rights within ZOI

| NAME | WRNUMBER | Maximum Volume (Listed) | Maximum Volume (Assumed) | Well Depth | Modeled Drawdown |
|---|---|---|---|---|---|
| HAYDEN BRUCE T | 76H 30012597 | 0.0 | **10.0** | 103 | -0.01 |
| HEALD SUSAN L | 76H 30014126 | 0.0 | **10.0** | 65 | -0.01 |
| HENDERSON LETTIE | 76H 30014959 | 0.0 | **10.0** | 140 | -0.01 |
| HERN LOIS A | 76H 30015640 | 0.0 | **10.0** | 0 | -0.11 |
| HERRIOT MICHAEL | 76H 30016339 | 0.0 | **10.0** | 98 | -0.01 |
| HERRIOT MICHAEL | 76H 30015711 | 0.0 | **10.0** | 138 | -0.01 |
| HISTORIC ST MARY'S MISSION INC | 76H 30017199 | 0.0 | **10.0** | 58 | -0.01 |
| HOLLAND HOMER G | 76H 30018316 | 0.0 | **10.0** | 60 | -0.01 |
| HOWARD HENRY G | 76H 30019568 | 0.0 | **10.0** | 0 | -0.01 |
| HOWELL MICHAEL | 76H 30019926 | 0.0 | **10.0** | 0 | -0.61 |
| HOWELL MICHAEL | 76H 30019847 | 0.0 | **10.0** | 130 | -0.41 |
| HOWELL MICHAEL | 76H 30019969 | 0.0 | **10.0** | 65 | -0.31 |
| HOWELL MICHAEL | 76H 30019968 | 0.0 | **10.0** | 120 | -0.31 |
| HOWELL MICHAEL | 76H 30019601 | 0.0 | **10.0** | 0 | -0.01 |
| HOWELL MICHAEL | 76H 30019921 | 0.0 | **10.0** | 0 | -0.01 |
| HOWELL MICHAEL | 76H 30019569 | 0.0 | **10.0** | 126 | -0.01 |
| HUDDLESON DONALD | 76H 30020077 | 0.0 | **10.0** | 96 | -0.01 |
| HUDSON JOE B | 76H 30020871 | 0.0 | **10.0** | 170 | -0.21 |
| HUDSON JOE B | 76H 30021117 | 0.0 | **10.0** | 60 | -0.01 |
| HUWE ARTHUR G | 76H 30021399 | 0.0 | **10.0** | 110 | -0.11 |
| JENKINS HENRY A | 76H 30021490 | 0.0 | **10.0** | 77 | -0.01 |
| JENSEN DOTTIE I | 76H 30022912 | 0.0 | **10.0** | 78 | -0.01 |
| JOHNSON MARCUS B | 76H 30022913 | 0.0 | **10.0** | 102 | -0.01 |
| JOHNSON MARCUS C | 76H 30023704 | 0.0 | **10.0** | 240 | -0.21 |
| JOHNSON ROBERT G | 76H 30024039 | 0.0 | **10.0** | 42 | -0.01 |
| JOHNSTON JIM | 76H 30025183 | 0.0 | **10.0** | 62 | -0.01 |
| KAUFFMAN LINDA | 76H 30025838 | 0.0 | **10.0** | 95 | -0.01 |
| KAY E CREECH TRUSTEES | 76H 30026020 | 0.0 | **10.0** | 58 | -0.01 |
| KEARNEY GLENDA | 76H 30026195 | 0.0 | **10.0** | 59 | -0.01 |
| KELLY CLAIRE L | 76H 30028657 | 0.0 | **10.0** | 0 | -0.01 |
| KELLY CLAIRE L | 76H 30028658 | 0.0 | **10.0** | 0 | -0.01 |
| KELLY CLAIRE L | 76H 30028743 | 0.0 | **10.0** | 180 | -0.01 |
| KESTER DARLENE J | 76H 30041811 | 0.0 | **10.0** | 196 | -0.11 |
| KLEINJAN DENNIS | 76H 30385 00 | 10.0 | 10.0 | 52 | -0.01 |
| KNAPP GARY | 76H 30386 00 | 10.0 | 10.0 | 52 | -0.01 |
| KNIGHT AMY | 76H 3136 00 | 0.0 | **10.0** | 25 | -0.61 |
| KNUTSEN DARREN R | 76H 3598 00 | 0.0 | **10.0** | 30 | -0.01 |
| KORESKI CHRISTOPHER M | 76H 37616 00 | 14.0 | 14.0 | 120 | -0.21 |
| LAUBACH MARIA | 76H 3875 00 | 0.0 | **10.0** | 72 | -0.01 |
| LECOURE JACQUES | 76H 39415 00 | 3.2 | 3.2 | 89 | -0.81 |
| LECOURE TANYA N | 76H 40049 00 | 2.0 | 2.0 | 54 | -0.01 |
| LEWIS FRANK S | 76H 40990 00 | 11.8 | 11.8 | 120 | -0.11 |
| LEWIS FRANK S | 76H 41828 00 | 8.1 | 8.1 | 0 | -0.01 |
| LEWIS MONICA L | 76H 43538 00 | 1.5 | 1.5 | 103 | -0.01 |
| LONG PAUL S | 76H 43974 00 | 1.5 | 1.5 | 0 | -0.01 |
| MARJORIE SCHWADERER TRUST | 76H 44734 00 | 3.1 | 3.1 | 0 | -0.01 |
| MARTIN DIANE L | 76H 45788 00 | 1.5 | 1.5 | 238 | -0.11 |
| MARTIN FAMILY TRUST | 76H 48481 00 | 1.5 | 1.5 | 45 | -0.01 |
| MATTI DAVID R & MARGARET TRUST | 76H 49241 00 | 20.3 | 20.3 | 31 | -0.11 |

## Appendix G

Existing Groundwater Rights within ZOI

| NAME | WRNUMBER | Maximum Volume (Listed) | Maximum Volume (Assumed) | Well Depth | Modeled Drawdown |
|---|---|---|---|---|---|
| MCDONALD DENNIS D | 76H 53898 00 | 1.7 | 1.7 | 61 | -0.01 |
| MCDONALD JANICE K | 76H 53903 00 | 1.6 | 1.6 | 60 | -0.01 |
| MCELFRESH JOANNE | 76H 56776 00 | 1.5 | 1.5 | 65 | -0.01 |
| MCELFRESH JOANNE | 76H 56859 00 | 1.5 | 1.5 | 80 | -0.01 |
| MCELFRESH JOANNE | 76H 56861 00 | 1.5 | 1.5 | 80 | -0.01 |
| MCGOWAN LAWRENCE | 76H 57710 00 | 14.0 | 14.0 | 90 | -0.11 |
| MCGOWAN LAWRENCE | 76H 59922 00 | 1.5 | 1.5 | 104 | -0.11 |
| MCMURTRY EDGAR M | 76H 60010 00 | 12.4 | 12.4 | 70 | -0.01 |
| MCNETT REBECCA E | 76H 6046 00 | 0.0 | **10.0** | 73 | -0.01 |
| MCNULTY MAUREEN V | 76H 61217 00 | 1.5 | 1.5 | 185 | -0.61 |
| MEIER C JAMES | 76H 62548 00 | 1.8 | 1.8 | 36 | -0.01 |
| MERWIN JAMES M | 76H 62644 00 | 3.5 | 3.5 | 0 | -0.01 |
| MILLER CLARA E | 76H 63580 00 | 1.5 | 1.5 | 68 | -0.01 |
| MILLER PATRICIA L TRUST | 76H 63620 00 | 1.5 | 1.5 | 88 | -0.21 |
| MILLER PATRICIA L TRUST | 76H 63624 00 | 1.5 | 1.5 | 86 | -0.01 |
| MONTANA RAIL LINK INC | 76H 63663 00 | 1.3 | 1.3 | 89 | -0.01 |
| MOUNTAIN VIEW WATER SYSTEM | 76H 63689 00 | 33.0 | 33.0 | 142 | -0.11 |
| MULLINS DANNIE | 76H 64579 00 | 1.5 | 1.5 | 60 | -0.01 |
| MUNIS MICHAEL S | 76H 64640 00 | 1.5 | 1.5 | 62 | -0.01 |
| MYERS JANET J | 76H 65731 00 | 1.5 | 1.5 | 150 | -0.21 |
| NEUMAN FAMILY TRUST | 76H 67683 00 | 2.2 | 2.2 | 84 | -0.11 |
| NEUMAN FAMILY TRUST | 76H 65836 00 | 2.3 | 2.3 | 227 | -0.11 |
| NEUMAN FAMILY TRUST | 76H 66701 00 | 1.5 | 1.5 | 110 | -0.01 |
| NEWSOM DARRON | 76H 68453 00 | 1.5 | 1.5 | 109 | -0.01 |
| OFFERDAHL ALEX R | 76H 6890 00 | 0.0 | **10.0** | 36 | -0.01 |
| OMLID CAROL L | 76H 69043 00 | 12.7 | 12.7 | 93 | -0.01 |
| OMLID CODY | 76H 69048 00 | 1.5 | 1.5 | 0 | -0.01 |
| OSBORN NATASHA L | 76H 69625 00 | 6.5 | 6.5 | 36 | -0.01 |
| OUR SAVIOR LUTHERAN CHURCH | 76H 70320 00 | 1.9 | 1.9 | 109 | -0.01 |
| OWEN RICHARD | 76H 70470 00 | 3.0 | 3.0 | 31 | -0.01 |
| OYLER JASON | 76H 71317 00 | 1.5 | 1.5 | 95 | -0.11 |
| PAGE CAROLE | 76H 71355 00 | 1.3 | 1.3 | 72 | -0.01 |
| PATTERSON E G | 76H 7286 00 | 40.0 | 40.0 | 56 | -0.01 |
| PAULSEN DONNA L | 76H 73932 00 | 28.3 | 28.3 | 77 | -0.01 |
| PERSON LOIS E | 76H 74251 00 | 1.5 | 1.5 | 28 | -0.11 |
| PERSON LOIS E | 76H 74794 00 | 1.9 | 1.9 | 28 | -0.01 |
| POLLMAN CARL B | 76H 75665 00 | 1.5 | 1.5 | 130 | -0.31 |
| POPHAM CARLEEN | 76H 76716 00 | 1.6 | 1.6 | 0 | -0.71 |
| POTTER MARION J | 76H 77221 00 | 3.5 | 3.5 | 123 | -0.01 |
| POWELL EDGAR L | 76H 77236 00 | 1.0 | 1.0 | 92 | -0.21 |
| RAGATZ MARIA | 76H 77815 00 | 17.0 | 17.0 | 85 | -0.01 |
| RALLS MIKE C | 76H 78384 00 | 1.5 | 1.5 | 50 | -0.01 |
| REED BETTY D | 76H 79580 00 | 3.5 | 3.5 | 82 | -0.11 |
| REED BETTY D | 76H 78859 00 | 3.8 | 3.8 | 89 | -0.01 |
| ROBINSON BOB L | 76H 80103 00 | 4.3 | 4.3 | 66 | -0.11 |
| ROMAN CATHOLIC BISHOP OF HELENA | 76H 80153 00 | 1.7 | 1.7 | 0 | -0.01 |
| SANDERS SAMUEL P | 76H 81030 00 | 6.0 | 6.0 | 182 | -0.01 |
| SANGSTER ROBERT H | 76H 81734 00 | 6.6 | 6.6 | 71 | -0.11 |
| SANGSTER ROBERT H | 76H 81714 00 | 1.0 | 1.0 | 76 | -0.11 |

# Appendix G
Existing Groundwater Rights within ZOI

| NAME | WRNUMBER | Maximum Volume (Listed) | Maximum Volume (Assumed) | Well Depth | Modeled Drawdown |
|---|---|---|---|---|---|
| SANLIA INC | 76H 81747 00 | 1.3 | 1.3 | 60 | -0.01 |
| SCHMIDT NANCY | 76H 81748 00 | 1.6 | 1.6 | 53 | -0.01 |
| SELWAY CORP | 76H 81750 00 | 3.5 | 3.5 | 65 | -0.11 |
| SMITH RICHARD E | 76H 82085 00 | 0.1 | 0.1 | 0 | -0.11 |
| SMITH RICHARD E | 76H 82155 00 | 3.6 | 3.6 | 0 | -0.01 |
| SNOOK JANICE C | 76H 8255 00 | 0.0 | **10.0** | 98 | -0.21 |
| SNYDER ANDREW A | 76H 82872 00 | 2.3 | 2.3 | 93 | -0.11 |
| SPENCER WILBERT R | 76H 82904 00 | 2.4 | 2.4 | 160 | -0.01 |
| STEIGERWALT DEBRA A | 76H 83658 00 | 1.7 | 1.7 | 31 | -0.01 |
| STEVI PUB SCHOOL DISTRICT #2 | 76H 83868 00 | 1.0 | 1.0 | 82 | -0.31 |
| STEVI PUB SCHOOL DISTRICT #2 | 76H 84562 00 | 0.7 | 0.7 | 0 | -0.21 |
| STEVI 7th DAY ADV CHURCH | 76H 85174 00 | 1.2 | 1.2 | 31 | -0.01 |
| STEVI UNITED METHODIST CHURCH | 76H 8572 00 | 0.0 | **10.0** | 60 | -0.01 |
| STEVII YOUTH SOCCER | 76H 85836 00 | 6.1 | 6.1 | 172 | -0.41 |
| STEVII. TOWN OF | 76H 88350 00 | 1.6 | 1.6 | 83 | -1.31 |
| STEVII. TOWN OF | 76H 89360 00 | 2.9 | 2.9 | 56 | -0.11 |
| STEVII. TOWN OF | 76H 86684 00 | 9.0 | 9.0 | 0 | -0.01 |
| STEVII. TOWN OF | 76H 87110 00 | 4.4 | 4.4 | 0 | -0.01 |
| STEVII. TOWN OF | 76H 87773 00 | 1.1 | 1.1 | 38 | -0.01 |
| STEVII. TOWN OF | 76H 88469 00 | 1.7 | 1.7 | 68 | -0.01 |
| STEVII. TOWN OF | 76H 88421 00 | 1.6 | 1.6 | 120 | -0.01 |
| STOPHER LINDA D | 76H 89374 00 | 12.3 | 12.3 | 54 | -0.01 |
| STUEDEMANN REED A | 76H 89376 00 | 919.9 | 919.9 | 56 | -0.01 |
| SUTHERLIN EDWARD A | 76H 89376 00 | 919.9 | 919.9 | 56 | -0.01 |
| SWARTZ STANLEY L | 76H 89376 00 | 919.9 | 919.9 | 56 | -0.01 |
| TALARICO TOM | 76H 89460 00 | 22.6 | 22.6 | 0 | -0.01 |
| THRALL DEBORAH | 76H 90526 00 | 3.8 | 3.8 | 0 | -0.01 |
| TIPTON SHAWN | 76H 91284 00 | 6.0 | 6.0 | 110 | -0.01 |
| TODD ROBERT | 76H 91305 00 | 3.5 | 3.5 | 95 | -0.11 |
| TURNER ENGINEERING INC | 76H 91307 00 | 2.9 | 2.9 | 0 | -0.11 |
| TURNER LANELL | 76H 91320 00 | 1.3 | 1.3 | 148 | -0.01 |
| UMHEY STACEY L | 76H 91321 00 | 2.9 | 2.9 | 0 | -0.01 |
| VAN WECHEL DONNA M | 76H 9186 00 | 340.0 | 340.0 | 75 | -0.01 |
| VANCE DEAN | 76H 92067 00 | 3.5 | 3.5 | 0 | -1.71 |
| VAUGHN E LOUIS | 76H 92113 00 | 1.6 | 1.6 | 72 | -0.01 |
| VOGEL MARY | 76H 92173 00 | 9.5 | 9.5 | 0 | -0.01 |
| WAKEFIELD DAWN | 76H 92173 00 | 9.5 | 9.5 | 0 | -0.01 |
| WALKER PHILLIP H | 76H 92173 00 | 9.5 | 9.5 | 0 | -0.01 |
| WALLACE JULIE S | 76H 92174 00 | 9.5 | 9.5 | 0 | -0.01 |
| WASSER GEORGE | 76H 92174 00 | 9.5 | 9.5 | 0 | -0.01 |
| WEIDOW TINA R | 76H 92174 00 | 9.5 | 9.5 | 0 | -0.01 |
| WEIGAND ELIZABETH | 76H 92217 00 | 8.6 | 8.6 | 0 | -0.01 |
| WEISBECK DAVID S | 76H 93331 00 | 1.6 | 1.6 | 125 | -0.11 |
| WEST FED SAVINGS & LOAN OF M | 76H 9441 00 | 0.0 | **10.0** | 81 | -0.11 |
| WHITESITT DELPHA | 76H 94971 00 | 3.5 | 3.5 | 0 | -0.01 |
| WICKS PERRY A | 76H 9542 00 | 0.0 | **10.0** | 100 | -0.61 |
| WICKS PERRY A | 76H 96016 00 | 1.6 | 1.6 | 95 | -0.01 |
| WILLIAMS ERIN B | 76H 96079 00 | 2.1 | 2.1 | 59 | -0.01 |
| WOOD RALPH F | 76H 96930 00 | 3.5 | 3.5 | 90 | -0.01 |

## Appendix G

Existing Groundwater Rights within ZOI

| NAME | WRNUMBER | Maximum Volume (Listed) | Maximum Volume (Assumed) | Well Depth | Modeled Drawdown |
|---|---|---|---|---|---|
| WORTMAN BRADLEY R | 76H 97044 00 | 1.2 | 1.2 | 0 | -0.01 |
| WORTMAN BRADLEY R | 76H 98536 00 | 1.1 | 1.1 | 0 | -0.01 |
| WORTMAN BRADLEY R | 76H 99580 00 | 2.3 | 2.3 | 60 | -0.01 |
| WORTMAN BRADLEY R | 76H 99587 00 | 1.6 | 1.6 | 63 | -0.01 |
| WORTMAN BRADLEY R | 76H 97080 00 | 1.2 | 1.2 | 65 | -0.01 |
| WORTMAN BRADLEY R | 76H 99537 00 | 1.6 | 1.6 | 100 | -0.01 |
| | ***Totals*** | ***6302.7*** | ***6892.7*** | | |

# Appendix H
Table of Calculations of Consumptive Use

## Appendix H
Calculated Consumptive Use

| | | |
|---|---|---|
| Enter Irrigated Area | 25.1 | acres |
| Enter Total Domestic Use | 33.6 | acre-ft/yr |
| Enter Low Flow in River | 540 | cfs |
| | | |
| *Calculated Irrigation Consumptive Use* | 1.865 | acre/ft per acre |
| Calculated Depletion Rate of Low River Flow | 0.0128% | |

| Month | Days | Irrigation Days | Irrigation Consumptive Use "Pasture Grass" | Irrigation Consumptive Use "Turf Grass" | Irrigation Consumptive Use | Domestic Consumptive Use | Total Consumptive Use Volume | Total Consumptive Use Flow Rate | Stream Depletion Volume | Stream Depletion Rate | | Average Flow in Bitterroot |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (inches) | | | (acre-feet) | | (gpm) | (acre-feet) | (gpm) | (cfs) | (cfs) |
| January | 31 | 0 | 0 | 0 | 0 | 0.29 | 0.29 | 2.08 | 4.07 | 29.68 | 0.066 | 800 |
| February | 28 | 0 | 0 | 0 | 0 | 0.26 | 0.26 | 2.08 | 4.06 | 32.80 | 0.073 | 906 |
| March | 31 | 0 | 0 | 0 | 0 | 0.29 | 0.29 | 2.08 | 4.22 | 30.83 | 0.069 | 1029 |
| *April* | *30* | *17* | *0.36* | *0.78* | *1.64* | *0.28* | *1.92* | *14.46* | *4.24* | *32.02* | *0.071* | *2294* |
| *May* | *31* | *31* | *2.57* | *2.99* | *6.26* | *0.29* | *6.55* | *47.80* | *4.17* | *30.43* | *0.068* | *6110* |
| *June* | *30* | *30* | *3.93* | *4.35* | *9.11* | *0.28* | *9.38* | *70.78* | *4.11* | *31.01* | *0.069* | *7668* |
| *July* | *31* | *31* | *5.38* | *5.80* | *12.14* | *0.29* | *12.43* | *90.70* | *4.13* | *30.17* | *0.067* | *1847* |
| *August* | *31* | *31* | *4.56* | *4.98* | *10.43* | *0.29* | *10.71* | *78.18* | *4.14* | *30.20* | *0.067* | *688* |
| *September* | *30* | *30* | *2.41* | *2.83* | *5.93* | *0.28* | *6.20* | *46.80* | *4.22* | *31.82* | *0.071* | *921* |
| October | *31* | *13* | *0.20* | *0.62* | *1.31* | *0.29* | *1.59* | *11.61* | *4.12* | *30.05* | *0.067* | *1092* |
| November | 30 | 0 | 0 | 0 | 0.00 | 0.28 | 0.28 | 2.08 | 4.29 | 32.36 | 0.072 | 1100 |
| December | 31 | 0 | 0 | 0 | 0.00 | 0.29 | 0.29 | 2.08 | 4.06 | 29.64 | 0.066 | 928 |
| **Totals** | **365** | **183** | **19.41** | **22.38** | **46.81** | **3.36** | **50.17** | | **49.83** | | | |
| **Average** | | | | | **3.90** | **0.28** | **4.18** | **30.90** | | **30.92** | **0.069** | **2115** |

# Appendix I
IWR Analysis Results

# Irrigation Water Requirements
## Crop Data Summary

Job: **Twin Creeks**
Location: **Stevensville**
By: **A. Perine**
Weather Station: **STEVENSVILLE**
Latitude: **4631** Longitude: **11406**
Computation Method: **Blaney Criddle (TR21)**
Crop Curve: **Blaney Criddle Perennial Crop**
Begin Growth: **4/17** End Growth: **10/13**

Crop: **Pasture (grass)**
County: **Ravalli, MT**
Date: **07/09/08**
Sta No: **MT7894**
Elevation: **3380** feet above sea level

Net irrigation application: **1** inches
Estimated carryover moisture used at season:
Begin: **0.5** inches End: **0.5** inches

| Month | Total Monthly ET (3) inches | Dry Year 80% Chance (1) | | Normal Year 50% Chance (1) | | Average Daily ETc inches | Peak Daily ETPk inches |
|---|---|---|---|---|---|---|---|
| | | Effective Precipitation inches | Net Irrigation Reqirements inches (2) | Effective Precipitation inches | Net Irrigation Reqirements inches (2) | | |
| January | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| February | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| March | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| April | 1.05 | 0.14 | 0.41 | 0.19 | 0.36 | 0.07 | |
| May | 3.33 | 0.57 | 2.76 | 0.76 | 2.57 | 0.11 | 0.13 |
| June | 4.74 | 0.60 | 4.14 | 0.81 | 3.93 | 0.16 | 0.19 |
| July | 5.86 | 0.36 | 5.50 | 0.48 | 5.38 | 0.19 | 0.23 |
| August | 5.16 | 0.45 | 4.71 | 0.60 | 4.56 | 0.17 | 0.20 |
| September | 2.92 | 0.38 | 2.54 | 0.51 | 2.41 | 0.09 | 0.11 |
| October | 0.83 | 0.10 | 0.23 | 0.14 | 0.20 | 0.06 | |
| November | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| December | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| **TOTAL** | **23.89** | **2.59** | **20.30** | **3.48** | **19.41** | | |

(1) For 80 percent occurrence, growing season effective precipitation will be equaled or exceeded 8 out of 10 years. For 50 percent chance occurrence, effective precipitation will be equaled or exceeded 1 out of 2 years.

(2) Net irrigation requirements is adjusted for carryover moisture used at the beginning of the season and carryover moiature used at the end of the growing season.

(3) ET Evapotranspiration) is adjusted upwards 10% per 1000 meters above sea level.

Date: 7/9/2008

# Appendix J

Grant of Possessory Interest Letter

## GRANT OF POSSESSORY INTEREST

John L. and Kristie A. Anderson hereby grant possessory interest to the Town of Stevensville for a DNRC Application for Beneficial Water Use Permit for a municipal groundwater well. The well is located on property currently owned by John and Kristie Anderson, 346 El Capitan Loop, Stevensville Montana, 59870.

The well is being constructed for use by the Town of Stevensville for municipal purposes. The well will supply supplemental water to the current municipal system and include a new proposed subdivision, Twin Creek Subdivision. The well will be located on a parcel in the SENENE Section 35 Township 9N Range 20W. The Twin Creek Subdivision is located in the NWNE Section 35 Township 9N Range 20W.

Ownership of the parcel where the well is being constructed will be transferred to the Town of Stevensville in the future. The Town of Stevensville also has possessory interest in all the lands they serve as the municipality supplying municipal water including the new Twin Creek Subdivision.

The possessory interest hereby granted is limited, at this time, to be for the DNRC Application for Beneficial Water Use Permit and all associated requirements, any and all other rights, interests are hereby reserved to John Anderson, until such a time the property is transferred to the Town of Stevensville.

Signed this 22d day of May, 2008

John L. Anderson

Kristie A. Anderson

Town of Darby
City of Hamilton
Town of Stevensville

# SOURCE WATER PROTECTION PLAN
# VOLUME 1 - REPORT

**Prepared by:**
**Western Groundwater Services**
**Bozeman, Montana**

September 2000

TABLE 1-2
STEVENSVILLE WELL CONSTRUCTION DATA

| Well No. | Year Installed | Total Depth (feet) | Depth of Grout Seal (feet) | Casing Diameter (inches) | Screened (S) or Perforated (P) Interval (feet) | Normal Pumping Capacity (gpm) |
|---|---|---|---|---|---|---|
| Filter Plant | 1979[1] | 7 – 12[2] | NA | 8 | 8,134[3] | 350 |
| 1 | 1956 | 455 | None | 10 | 362 – 370 (P) | 155/500 |
| 2 | 1968 | 56 | None | 8 | 36 – 56 (P) | 225 |
| 3 | 1976 | 75 | None | 8 | 40 – 50 (P)<br>55 – 75 (P) | 225 |
| Test Well | 1990 | 552 | 20 | 6 | 310 – 332 (P)<br>391 – 394 (P) | 500 (site) |

[1] Filtration equipment was installed in 1979. Prior to 1979, the source was used unfiltered.
[2] The filter plant intake consists of horizontal perforated pipe installed into shallow trenches.
[3] The engineer's drawing for the intake system indicates a total of 8,134 ft of tile "in this field" for the infiltration of groundwater.

TABLE 1-3
HAMILTON WELL CONSTRUCTION DATA

| Well No. | Year Installed | Total Depth (feet) | Depth of Grout Seal (feet) | Casing Diameter (inches) | Screened (S) or Perforated (P) Interval (feet) | Normal Pumping Capacity (gpm) |
|---|---|---|---|---|---|---|
| 1 | 1934 | 67 | None | 10 | 54 – 64 (P) | 450 |
| 2 | 1934 | 66 | None | 10 | 50 – 65 (P) | 450 |
| 4 | 1946 | 66 | None | 12 | 50 – 65 (P) | 450 |
| 5 | 1975 | 109 | Unknown | 12 | 85 – 90 (S) | 250 |
| 6 | 1986 | 68 | 20 | 12 | 42 – 58 (S) | 700 |
| 7 | 1999 | 58 | 20 | 10 | 32 – 40 (S) | 470 |

TABLE 1-4
DARBY WELL CONSTRUCTION DATA

| Well No. | Year Installed | Total Depth (feet) | Depth of Grout Seal (feet) | Casing Diameter (inches) | Screened (S) or Perforated (P) Interval (feet) | Normal Pumping Capacity (gpm) |
|---|---|---|---|---|---|---|
| 1 | 1960 | 100 | Unknown | 10 | 87 – 100 (S) | 175/350 |
| 2 | 1973 | 70 | 18 (?) | 8 | 40 – 70 (P) | 350 |
| 4 | 1981 | 80 | 18 | 8 | 61 – 77 (P) | 275 |

## 1.4 Water Quality

This section primarily summarizes information on the groundwater quality in the Bitterroot Valley shallow alluvial aquifer. Sampling data for general water quality indicators provided in published reports (McMurtrey and others 1972) and for the City of Hamilton Well No. 7 are provided in Table 1-5. Other recent water quality data for terrace areas in the Bitterroot Valley is published in Briar and Dutton (2000). As these data show, the groundwater contains a fair amount of dissolved ions, as evidenced by the hardness, alkalinity and total dissolved solids. The water type is calcium-carbonate, which is typical for a shallow groundwater having a relatively short residence time below the land surface (on the order of several years). Essentially all of the hardness is carbonate hardness, and the hardness is considered high by general standards (>150 mg/L as $CaCO_3$). The principal component for carbonate in the groundwater is the bicarbonate ion ($HCO_3$). The pH is neutral or slightly alkaline, which is normally favorable for use in a municipal distribution system.

TABLE 1-5
AMBIENT GROUNDWATER QUALITY DATA

| Parameter | Near Hamilton 6N/20W-4bc1 | Near Stevensville 9N/20W-34ac | Hamilton Well No. 7 |
|---|---|---|---|
| Sample Date | 10/24/55 | 10/18/55 | 4/14/99 |
| Well Depth (ft) | 43 | 54 | 40 |
| Temperature (F) | 52 | 55 | 46 |
| pH (std. units) | 7.7 | 7.1 | 7.3 |
| Alkalinity (mg/L as $CaCO_3$) | 211 | 111 | 177 |
| Total Dissolved Solids (mg/L) | 278 | 139 | 187 |
| Hardness (mg/L as $CaCO_3$) | 183 | 103 | 184 |
| Nitrate (mg/L as N) | 0.88 | 0.38 | 1.66 |

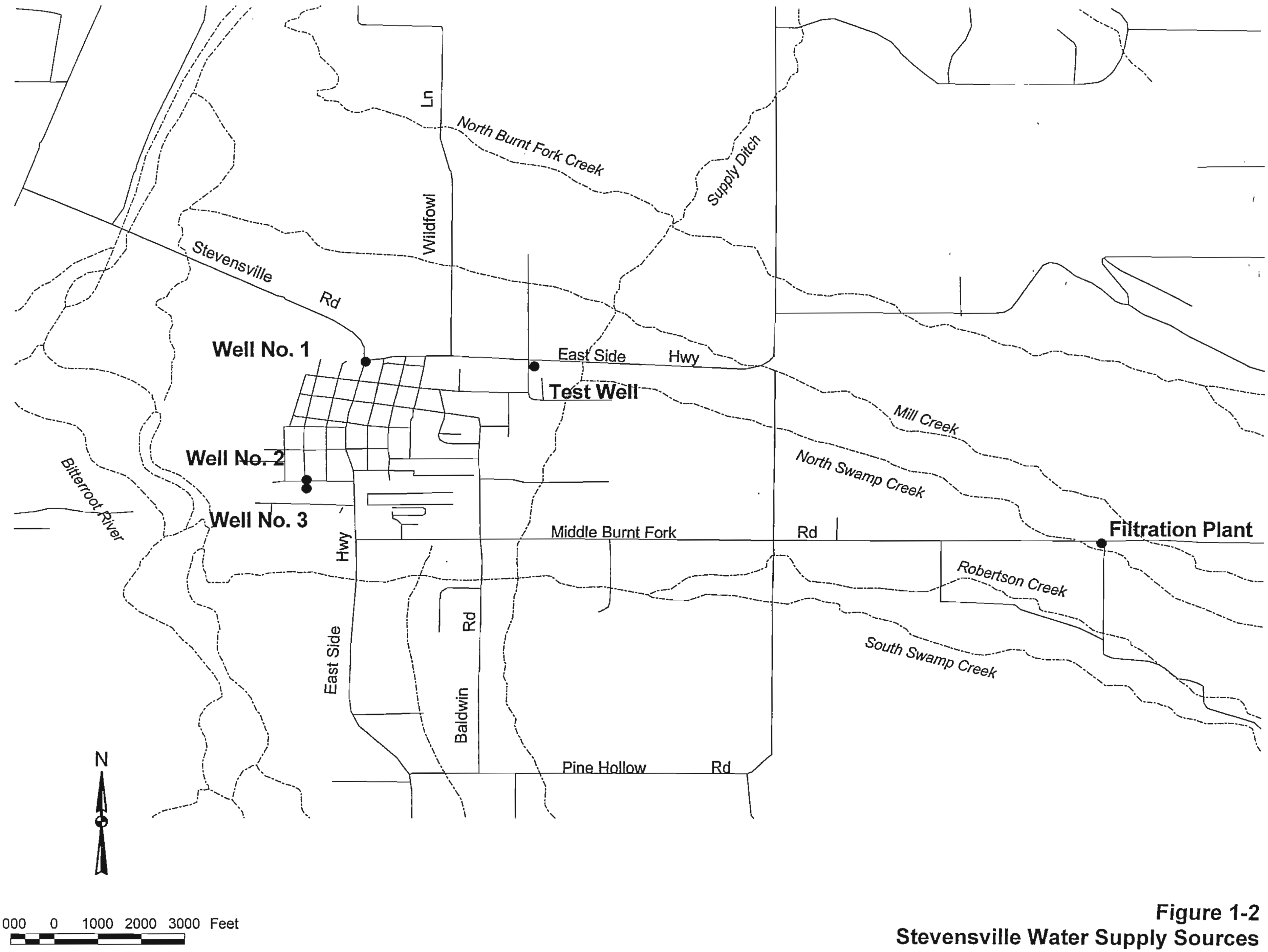



Figure 1-2
Stevensville Water Supply Sources

### 2.3 Source Water Sensitivity

Based on the types of sources from which the communities obtain their water supply, the source may be classified in terms of its sensitivity. Sensitivity refers to the ability of the source to be contaminated, or otherwise impacted, by man's activities. Sources that have low sensitivity have a natural protective barrier. Sources that have high sensitivity are essentially without a barrier. Releases of contaminants can migrate freely to a high sensitivity source, whereas many years of travel are required for a contaminant to reach a low sensitivity source. Table 2-2 summarizes the sensitivity classes for the Stevensville, Hamilton, and Darby water supply sources. The unconfined aquifer conditions of the Bitterroot Valley are classified as high sensitivity. Sand and gravel materials exist at the land surface and there are no protective barriers above the aquifer. A couple of the sources draw groundwater from a semi-confined aquifer, which is sheltered from surface activities by naturally occurring layers of silt and clay materials. The Stevensville Filter Plant has high sensitivity because surface water and groundwater under the direct influence of surface water provide the water supply to this source.

TABLE 2-2
SOURCE WATER SENSITIVITY

| Owner | Source Name | Source Type | Sensitivity Classification |
|---|---|---|---|
| Stevensville | Filter Plant | Surface Water | High |
| | Well No. 1 | Semi-Confined Aquifer | Moderate |
| | Well No. 2 | Unconfined Aquifer | High |
| | Well No. 3 | Unconfined Aquifer | High |
| Hamilton | Well No. 1 | Unconfined Aquifer | High |
| | Well No. 2 | Unconfined Aquifer | High |
| | Well No. 4 | Unconfined Aquifer | High |
| | Well No. 5 | Semi-Confined Aquifer | Moderate |
| | Well No. 6 | Unconfined Aquifer | High |
| | Well No. 7 | Unconfined Aquifer | High |
| Darby | Well No. 1 | Unconfined Aquifer | High |
| | Well No. 2 | Unconfined Aquifer | High |
| | Well No. 4 | Unconfined Aquifer | High |

### 2.4 Hydraulic Properties

Aquifer transmissivity and hydraulic conductivity are the two primary parameters used to describe the hydraulic properties of aquifers. Large values of either are indicative of highly permeable conditions. Low values indicate low, or impermeable conditions. Parameter values must be obtained in order to delineate Source Water Protection Areas.

Existing data provided for the subject wells of this Plan were used to assess transmissivity and hydraulic conductivity. These data primarily consisted of the well specific capacity (pumping rate divided by drawdown) from short-term pumping tests. One exception was the data set for Hamilton Well No. 7, which consisted of a 24-hour pumping test with drawdown and recovery analysis. Table 2-3 summarizes the specific capacity data for the wells.

TABLE 2-3
WELL SPECIFIC CAPACITY DATA

| Owner | Well No. | Pumping Rate (gpm) | Drawdown (ft) | Specific Capacity[1] (gpm/ft) |
|---|---|---|---|---|
| Stevensville | 1 | 400 | 70 | 14.3 |
| | 2 | 100 | 6 | 41.7 |
| | Test Well | 218 | 45 | 12.1 |
| Hamilton | 6 | 882 | 39 | 56.5 |
| Darby | 2 | 500 | 52 | 24.0 |
| | 4 | 250 | 50 | 12.5 |

[1]A well efficiency (Ew) of 40% was assumed for the tests, with the exception of Hamilton No. 6, which was assumed to have 50% efficiency. Tested specific capacity is divided by the well efficiency to determine the table value (i.e., Table Value = (Q/s)/Ew).

Specific capacity values were used to compute the aquifer transmissivity using an approximate method (Driscoll 1986). Hydraulic conductivity was obtained by dividing the transmissivity by the estimated aquifer thickness for the pumping test. These aquifer thickness values were selected from the well logs. Transmissivity for the Hamilton Well No. 7 pumping test was computed by the Cooper-Jacob method and the Theis Recovery method using specialized computer software (Aquifer Test undated). Transmissivity and hydraulic conductivity values are summarized in Table 2-4.

Delineation of Source Water Protection Areas utilizes a computer model for groundwater flow to wells. In application, where multiple wells tap the same aquifer, it is useful to use average hydraulic conductivity and thickness values. In completing the modeling work, hydraulic conductivity average values were computed as the geometric mean value. Average thickness was determined as the simple average. Averages were computed for Stevensville Well No. 1 and the Test Well, for Hamilton Well Nos. 6 and 7, and for Darby Well Nos. 2 and 4. Table 2-5 summarizes the hydraulic conductivity, aquifer thickness, and boundary conditions used in the groundwater delineation modeling.

TABLE 2-4
AQUIFER HYDRAULIC DATA

| Owner | Well No. | Aquifer Type | Transmissivity ($ft^2/d$) | Thickness[1] (ft) | Hydraulic Conductivity (ft/d) |
|---|---|---|---|---|---|
| Stevensville | 1 | Semi-Confined | 3,818 | 35 | 109 |
| | 2 | Unconfined | 8,358 | 39 | 214 |
| | Test Well | Semi-Confined | 3,235 | 57 | 57 |
| Hamilton | 6 | Unconfined | 11,338 | 53 | 214 |
| | 7 | Unconfined | 29,000 | 22 | 1,289 |
| Darby | 2 | Unconfined | 6,427 | 45 | 143 |
| | 4 | Unconfined | 3,342 | 30 | 111 |

[1] Thickness was assigned a value equal to 1.5 x Screen Interval, unless the top and bottom of the aquifer could be identified from the well log.

TABLE 2-5
SUMMARY OF MODELING PARAMETERS

| Delineation | Aquifer Thickness (ft) | Hydraulic Conductivity (ft/d) | Boundary Conditions |
|---|---|---|---|
| Stevensville Well No. 1 | 46 | 79 | Bitterroot Irrigation Canal Bitterroot River |
| Stevensville Well Nos. 1, 2 | 39 | 213 | Bitterroot Irrigation Canal Bitterroot River |
| Hamilton Well Nos. 1 – 7 | 37.5 | 538 115* | Bitterroot Irrigation Canal Bitterroot River |
| Darby Well Nos., 1,2,4 | 37.5 | 128 | West-side Irrigation Canal Bitterroot River |

* This value of hydraulic conductivity was applied to the east-side terrace area.

Other existing hydraulic property data exist in McMurtrey and others (1972), however, they were not used in the delineation calculations. In general, these data were obtained by short-duration tests in shallow wells. The well testing locations also were away from the community water wells addressed in this Plan. Aquifer hydraulic data were also summarized in Briar and Dutton (2000). These data, obtained from driller's records on well logs, were applicable to the terrace areas on either side of the floodplain. Consequently, using the data presented in Table 2-4 is considered to provide a more accurate delineation of the subject wells.

## 2.5 Groundwater Flow

McMurtrey and others (1972) present a water table elevation map for the valley aquifer extending from south of Hamilton to Stevensville. Montana Bureau of Mines and Geology also collected water level data and prepared a water table contour map for the City of Hamilton (MBMG 1996). These information sources were used to generally assess groundwater flow direction, hydraulic gradient, recharge areas, and discharge areas. Unfortunately, similar data do not yet exist for the Darby area. In this case, map interpretations were made to arrive at the same information.

In the Stevensville area, water table elevation mimics land surface elevation. The dominant groundwater flow occurs down the alluvial fan of the Burnt Fork drainage, in a northwesterly direction. Water table contours are very similar in shape to the topographic contours of the alluvial fan. The hydraulic gradient is approximately 0.02 ft/ft, or 2 ft per 100 ft of horizontal distance. Recharge occurs from tributary streams and irrigation canals. Discharge occurs to the Stevensville wells, private wells, and the Bitterroot River.

In the Hamilton area, the water table slopes downward to the northwest. The direction of flow is approximately 20 to 30 degrees west of true north (N 20 W, N 30 W). Both the Bureau of Mines (1996) and the McMurtrey and others (1972) water table maps are consistent with one another. The hydraulic gradient is approximately 0.01 ft/ft, or 1 ft per 100 ft of horizontal distance. Recharge occurs from irrigation canals on the east terrace, and also from tributary streams in the Skalkaho Creek drainage. Discharge occurs to the Hamilton wells, other privately-owned wells, and ultimately the Bitterroot River on the northwest side of Hamilton.

Conditions are slightly different at Darby in comparison to Stevensville and Hamilton. The valley is considerably narrower and the occurrence of bedrock on either side is much closer to the Bitterroot River channel (Figure 2-3). A fine-grained unconsolidated clay and silt formation (map unit Tbc) also occurs at the surface to the west of Town. This surface geology suggests that recharge into the valley plain area from the adjacent highlands will be limited. It is likely that most recharge to the valley plain area will come primarily from the Bitterroot River, and also Tin Cup Creek on the south side of Town where it crosses the valley plain. Given this conceptual model, it is expected that groundwater flow occurs parallel to the Bitterroot River channel in the Darby area. The hydraulic gradient should be similar to that at either Stevensville or Hamilton, in the range of 0.01 to 0.02 ft/ft, or could be flatter.

## 2.6 Delineation Modeling

The state of Montana and EPA have requirements to delineate Source Water Protection Areas[5]. The state recognizes multiple Source Water Protection Areas for water supply sources. The intent of multiple Source Water Protection Areas is to assist in management. Those areas close to the well or surface water intake are managed with more care and detail than the areas farther away.

Three distinct Source Water Protection Areas are defined for each well supply, and referred to as: 1) the control area; 2) the inventory region; and 3) the recharge area. The control area is a 100-ft radius circle surrounding the well casing. The inventory region is defined by the 3-yr time of travel for groundwater to reach the well (3-yr TOT), and must extend at least 1,000 feet from the well. The recharge area encompasses the total recharge area to the water supply well. The work completed also provided a delineation of the 1-yr time of travel boundary (1-yr TOT). Although this region is not required for

[5]These requirements do not apply to the public water system, but only to the state of Montana. However, to obtain a state-certified plan, it is necessary to conform to the requirements.

Source Water Protection Area delineation in Montana, it provides a useful zone for management of water supply sources. It is needed to complete the hazard rankings of the susceptibility analysis.

There is one additional requirement for groundwater sources in unconfined aquifers. An additional Source Water Protection Area must be delineated showing a ½-mile wide buffer surrounding all hydraulically connected surface waters and extending 10-miles upstream. This region is named the acute contaminants inventory area. Acute contaminants include pathogens, such as giardia and cryptosporidium, and nitrate.

Two distinct Source Water Protection Areas are recognized for surface water supplies, referred to as: 1) the spill response region; and 2) the watershed region. The spill response region is defined by a ½-mile wide buffer extending 10-miles upstream from the source intake[6]. The watershed region encompasses the entire watershed, including tributary streams, upstream from the intake.

### 2.6.1 Delineation Methods

Source Water Protection Areas for groundwater sources (all sources except the Stevensville Filter Plant) were delineated using a computer model called TWODAN (TWODAN undated). This model provides simulation of regional groundwater flow with multiple, interacting pumping wells. The model was setup by assigning constant water levels (heads) along irrigation canals and the Bitterroot River, and assigning the average thickness and hydraulic conductivity values documented in Table 2-5. Where geologic formations occurred with different hydraulic conductivity values (heterogeneity) than the aquifer, they were represented in the model. During the modeling process, time was spent to develop model output that was consistent with existing information on the groundwater flow system (primarily flow direction and gradient). The modeling was completed to emulate the published groundwater flow maps for the valley in steady-state conditions, and does not account directly for the influences of multiple irrigation ditches and tributary streams to the Bitterroot River, and the effects of seasonal changes in the direction of groundwater flow. Three separate models were developed for the Stevensville, Hamilton, and Darby areas, respectively. Detailed listings of the model configuration and a graphic output are provided in the appendices (all model output are listed in length units of meters and time units of days due to the state of Montana GIS base mapping which also uses meters).

Source Water Protection Areas based on the ½-mile buffer method were developed using the ArcView GIS software (ArcView GIS undated). In application, new linear elements, drawn as polylines, were temporarily added to the surface water shape file, extending from a point of origin upstream for 10-miles along the selected tributary or irrigation canal. Software commands were used to draw the ½-mile buffers (2,640 ft) on either side of the linear elements. For groundwater sources, the point of origin was taken as the location where the surface water body intersected a Source Water Protection Area region (control area, inventory region, or recharge area). For surface water sources, the point of origin was taken as the location of the source intake. In the case of Stevensville, the point of origin was taken as the Filter Plant.

### 2.6.2 Stevensville

Figures 2-5 through 2-7 present the Source Water Protection Areas for the Stevensville water supply. Source Water Protection Areas for the well supplies have been combined due to the proximity of the wells to one another. The modeled protection area also has been modified by widening it to cover more

[6]This region may be limited to the upstream distance of a 4-hour travel time or 10-miles, whichever is shorter. In western Montana, the 10-mile criterion will normally be shorter, as flow rates exceed 2.5 mph (1.8 ft/s) in virtually all rivers, streams, and creeks during most of the year.

of the valley (compare with model output in Appendix B). The 3-yr TOT boundary shown on Figure 2-5 delineates the inventory region for the groundwater sources. The recharge area extends upgradient to the location of the Bitterroot Irrigation District Canal, which was selected as the upgradient boundary for modeling purposes. It is assumed that this canal marks the uppermost significant recharge source to the shallow groundwater system, and recharge to the well sources does not extend beyond the canal. It is possible, however, for both surface and groundwater higher in the watershed to contribute to the recharge to the groundwater sources. These contributions would occur during periods when the irrigation canal was dry.

Figure 2-5 also presents a confined aquifer inventory region for Well No. 1. This region extends radially for a distance of 1,000 ft, and has been included on the delineation map due to the semi-confined aquifer tapped by Well No. 1. Other wells, private, commercial or public, located within this region are of concern as they can act as conduits for contaminants to reach the deep aquifer utilized by Well No. 1. The acute contaminants inventory region shown on Figure 2-6 is based on hydraulic connection with two irrigation canals, Supply Ditch and the Bitterroot Irrigation District canal, and also Burnt Fork Creek. It applies only to Well Nos. 2 and 3, as Well No. 1 is considered to be installed into a semi-confined aquifer.

Figure 2-7 presents the Source Water Protection Areas for the Filter Plant source. The ½-mile buffers are drawn to surround the Bitterroot Irrigation District canal, and the tributary streams that exist upstream from the source intake, which include Mill Creek, North Swamp Creek, and North Burnt Fork Creek. The watershed region encompasses the entire Burnt Fork drainage and related tributaries. The 1-yr and 3-yr TOT boundaries are located onto the Spill Response Region (dashed lines) because the Filter Plant intake consists of a large infiltration gallery fed by groundwater. These boundaries indicate the travel time for groundwater flow to reach the infiltration gallery, and are based on Darcy's Law calculations[7].

2.6.3 Hamilton

Figures 2-8 and 2-9 present the Source Water Protection Areas for the Hamilton wells. For individual wells, the 3-yr TOT boundary is shown, and would normally delineate the inventory region. However, based on the proximity of these areas to one another, a composite inventory region is proposed for Hamilton. The composite inventory region surrounds all of the wells, extending to the limits of the 3-yr TOT boundary for Well Nos. 1, 4, 5, and 7.

The recharge area shown on Figure 2-8 extends up the east-side terrace to the Bitterroot Irrigation Canal, which coincides approximately with the first outcrop of bedrock. It is a reasonable assumption that the irrigation canal is the uppermost location of significant recharge to the shallow groundwater system. The bedrock terrain to the east has low hydraulic conductivity and will transmit relatively small quantities of water as groundwater. It is possible, however, for some groundwater recharge to occur within the bedrock region.

Figure 2-9 presents the acute contaminants inventory area for Hamilton. This area is based on three irrigation canals, Republican Ditch, Hedge Ditch, and Bitterroot Irrigation, and also one unnamed tributary which runs near to the fish hatchery.

[7] Calculations were based on a hydraulic conductivity of 214 ft/d, a hydraulic gradient of 0.02 ft/ft, and an assumed porosity of 0.25.

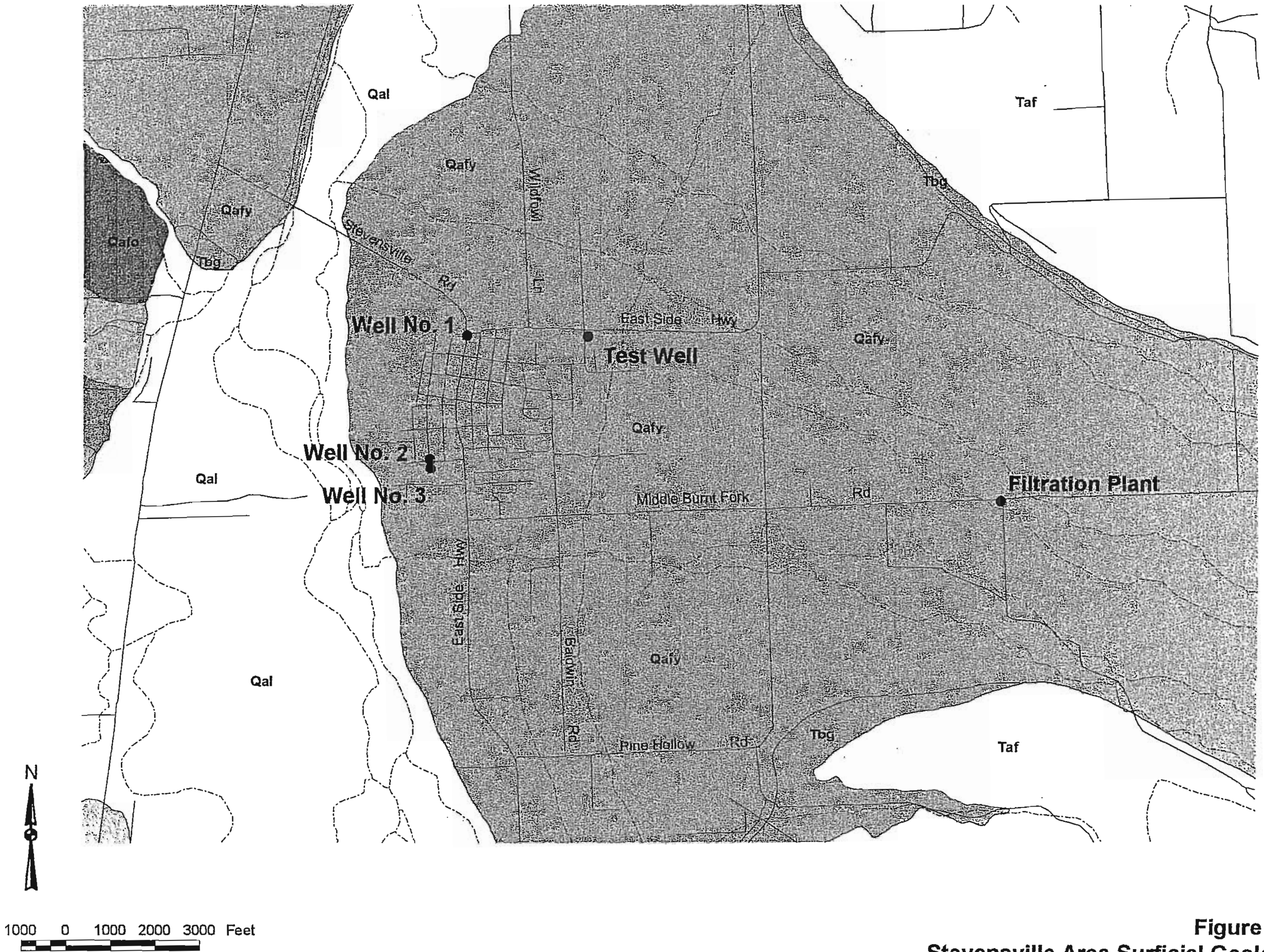



Figure 2-1
Stevensville Area Surficial Geology

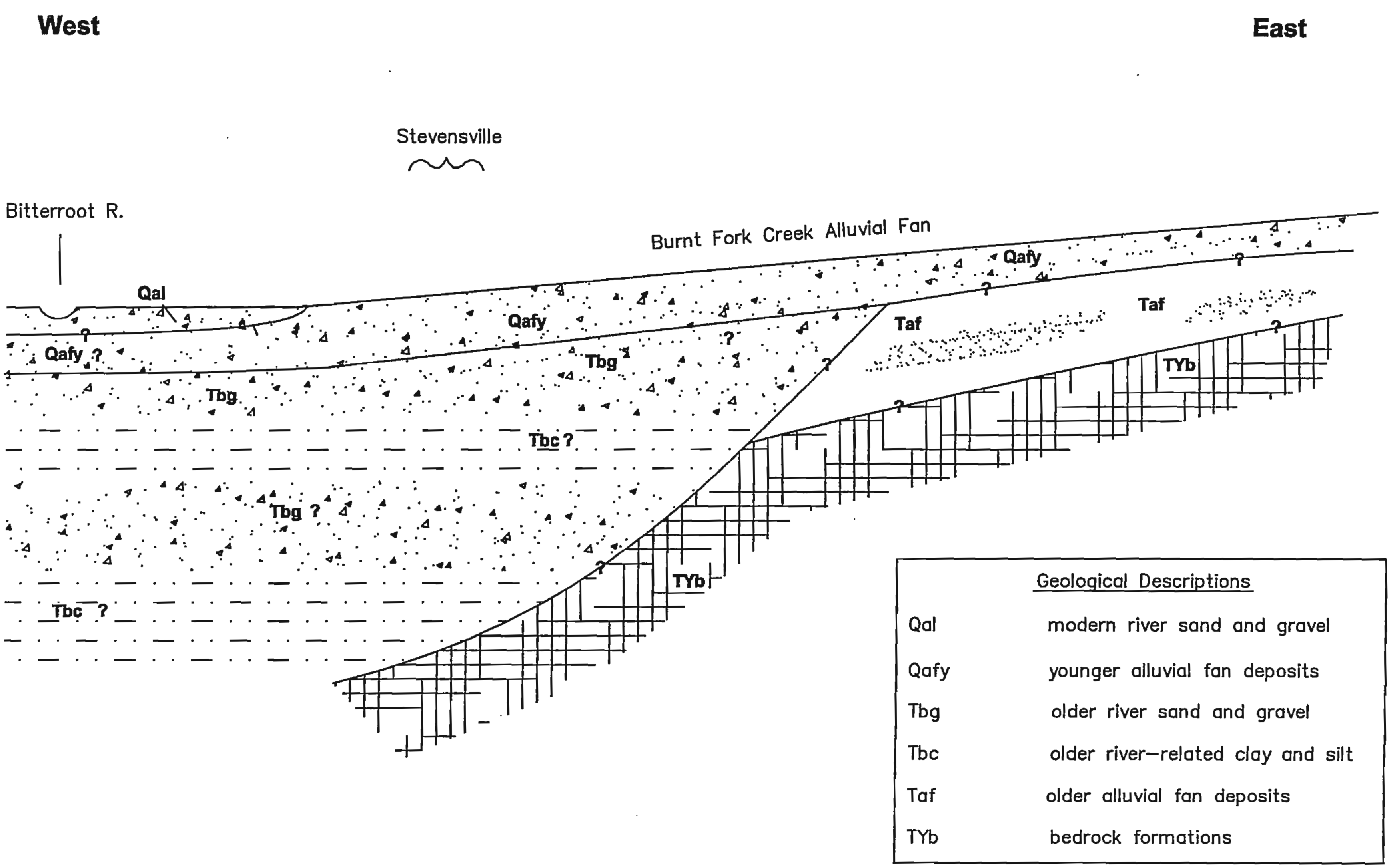



**Figure 2-4a**
**Stevensville Area Schematic Geologic Cross Section**

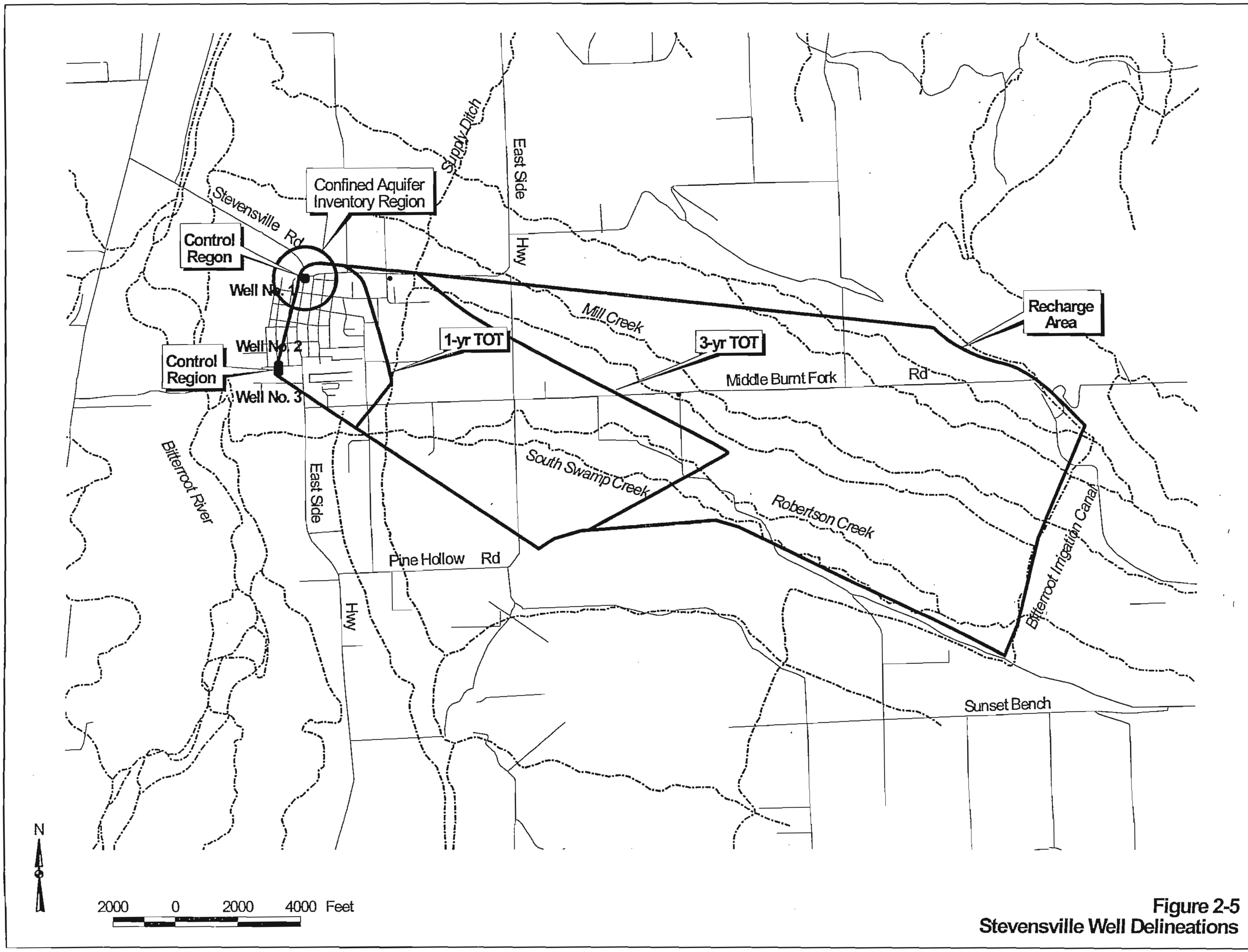



**Figure 2-5**
**Stevensville Well Delineations**

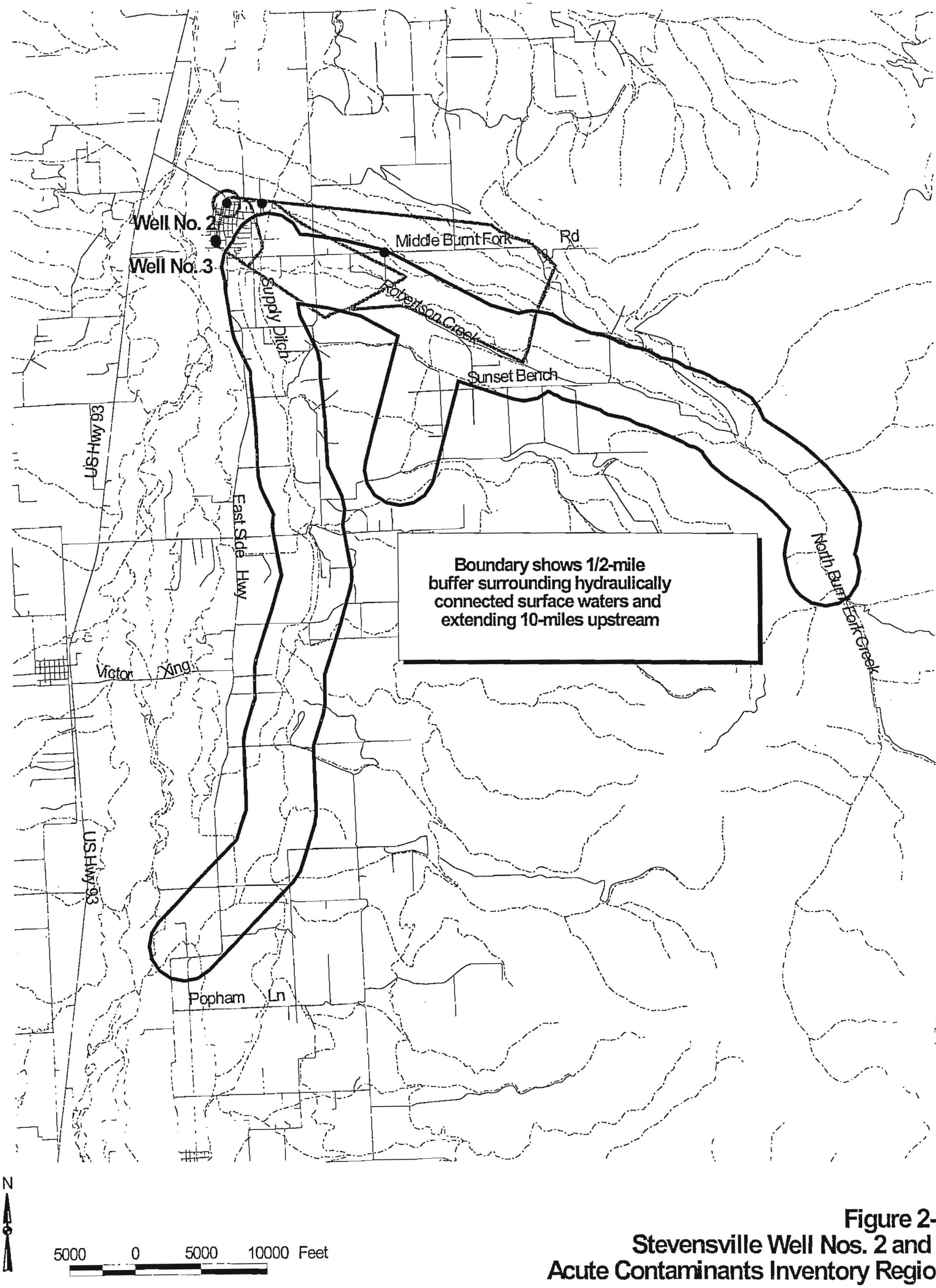



**Figure 2-6**
**Stevensville Well Nos. 2 and 3**
**Acute Contaminants Inventory Region**

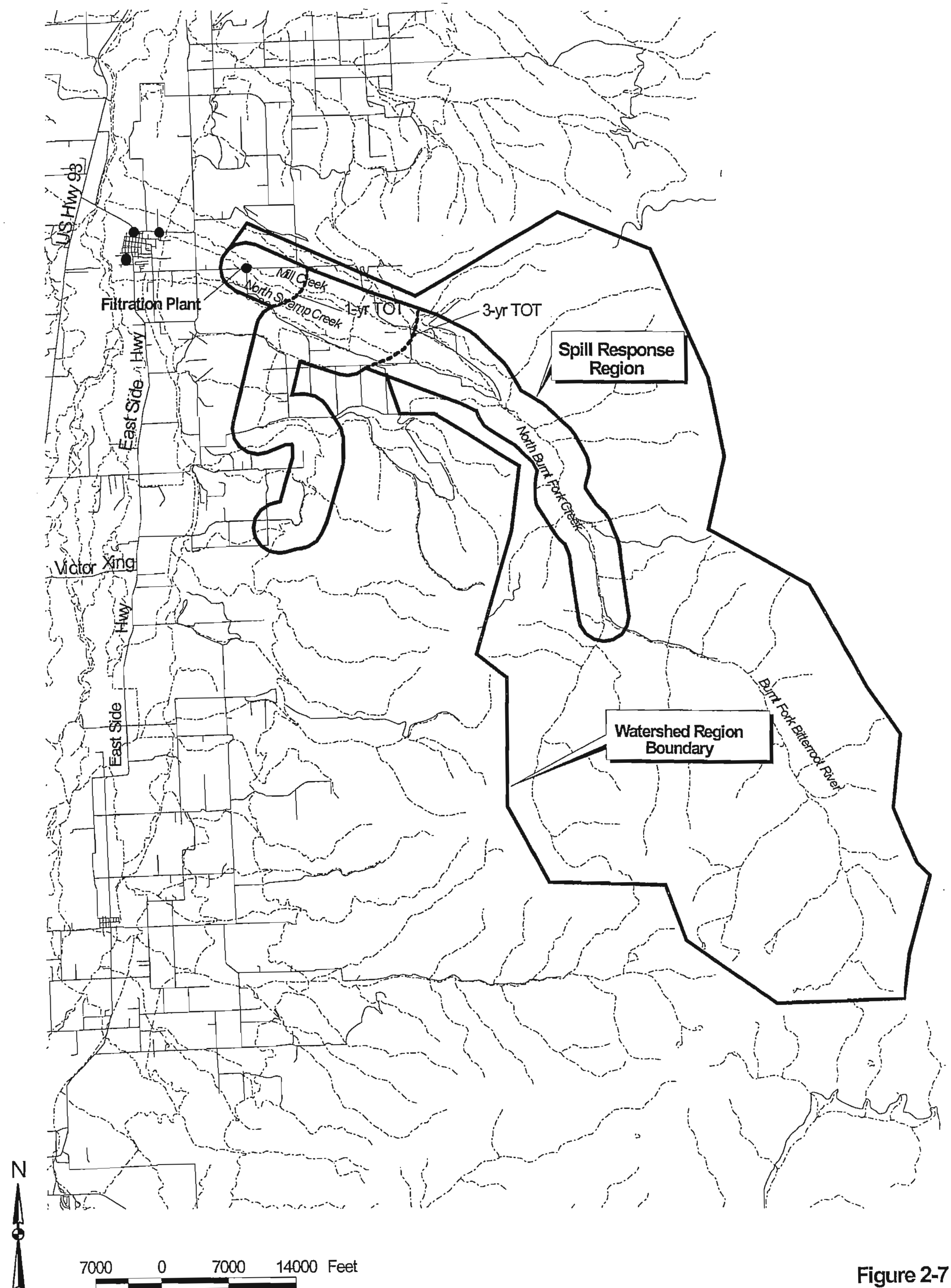



**Figure 2-7**
**Stevensville Filtration Plant Delineations**

### 3.1.2 Inventory Results

Discussion is provided below regarding the potential contaminant sources in each community. Additional information pertaining to EPA regulated facilities, state of Montana cleanup sites, leaking underground storage tank sites, and existing underground storage tanks is also provided in Appendix A.

#### Stevensville

Inventory data for Stevensville are provided on Figures 3-1 through 3-7, and Table 3-1. There are a limited number of potential contaminant sources present in the Stevensville area, due primarily to the small level of development and also the Town's location away from the valley center. The majority of the land use (Figure 3-1) in the Inventory Region is agricultural[9]. The city center land is primarily residential, and only small areas exist that are considered urban (commercial, industrial, "built-up" areas).

Agricultural land use occupies the largest area in both the well inventory regions (Figure 3-1) and also the Filter Plant spill response region (Figure 3-6). Depending on the actual usage, agricultural practices can pose a threat to ground- and surface-waters. Land applied chemicals can be dissolved in runoff and washed downward into the soil penetrating to groundwater. Chemical spills can occur at mixing stations. Best Management Practices (BMPs) exist for land application of chemicals and also the mixing of chemicals for agriculture. Implementation of these BMPs will reduce the risk of water contamination.

A total of 19 potential contaminant sources (Figure 3-2) were identified directly inside of or near to the Inventory Region (Well Nos. 1, 2, & 3). Additional information on these potential sources is annotated onto Figure 3-2 and provided in Table 3-1. The potential contaminant sources included a mixture of facilities with no major type dominant. Two gas stations and one dry cleaner were present. One of the gas stations, CENEX, is under investigation for leaking underground storage tanks. Two machine shops were present. No unusually large or uncommon industries were present. One feed lot exists, but it is located to the north of the Well No. 1 Inventory Region. There were no confined animal feeding areas within the Acute Contaminants Inventory Region for the wells and the hazard posed by septic systems is considered low (Figure 3-5).

Well No. 1 is generally protected from point sources in the area due to the depth at which it extracts groundwater (362 – 370 feet). A concern for deep wells, however, is the existence of neighboring wells that can act as conduits for contaminants to move deeply in the groundwater system. The circular Confined Aquifer Inventory Region identified for Well No. 1 was used as a focus area for identifying other existing wells that may pose this threat. A well inventory list was obtained from the Groundwater Information Center (Montana Bureau of Mines and Geology) for this area and is presented in Appendix B. There were 18 wells identified from the inventory list that could possibly be located within the Confined Aquifer Inventory Region. Twelve of these wells may actually occur outside of the region, as the location provided indicated only the section number. Six wells appear to be located in the same quarter section as Well No. 1. These six wells range in depth from 5 to 65 feet. They were installed from 1957 to 1984 (one well was undated). Because the wells are shallow, they are not considered to pose a significant threat to Well No. 1. However, it is noteworthy that in all likelihood these wells are not constructed with proper surface seals. If any of these wells are no longer in use, the owners should be requested to properly abandon the well.

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[9] Land Use data were obtained in a computerized mapping file, and were originally developed by the U.S. Geological Survey. These data represent actual land use, which is not to be confused with zoning. The method of preparing the Land Use maps is not known, but is likely based on part on processing of satellite images.

Septic systems (Figure 3-3) are used for sewage treatment in the areas outside of the city and are known sources of nitrate contamination in groundwater. The City wastewater is collected by a sewer system and treated at a lagoon treatment plant to the northwest of town (a map of the sewer collection system is provided in Appendix B). All development outside of the city utilizes septic systems. Based on evaluation of septic hazard, Well Nos. 1, 2 and 3 appear to be at a moderate risk level for contamination from septic systems[10]. The higher density development is occurring along the Eastside Highway, in a pattern that is elongated from north to south. In contrast, the Inventory Regions extend up the Burnt Fork Creek drainage, and are elongated in the east to west direction. Consequently, little of the Inventory Region is considered presently (1990) at risk from septic system discharges. This condition could change in the future as a result of growth in the area.

Infrastructure for stormwater management in Stevensville is limited to a collection system that runs north along the East Side Highway, through the downtown area. This system is owned and operated by the state of Montana. Inlets collect stormwater that then enters a pipeline and is routed to a surface water discharge approximately 1,000 feet northwest of Well No. 1. If a spill were to occur in the downtown area, this stormwater system would be protective of groundwater, assuming the pipeline is not prone to leaking. Stormwater in the Stevensville area that is not collected by this system flows along roadsides from east to west, following the main gradient of the land surface. Discharge that does not collect in depressions within the town area will ultimately be discharged on the west side of town into a wetland/surface water area, adjacent to the Bitterroot River. There are no dry wells used to dispose of stormwater in the Stevensville area.

Major transportation corridors in the Stevensville area include only the railroad (Figure 3-4). Most truck traffic passing through the area will use US Highway 93 located about 1.5 miles west of Stevensville. The Northern Pacific railroad spur exists in proximity to the well sources and poses a significant potential risk when bulk chemicals are transported. A greater risk exists for Well Nos. 2 and 3 than for Well No. 1.

There are no known point sources or discharges to surface water in the Spill Response Region for the Filtration Treatment Plant (Figures 3-6 and 3-7). The most significant threat to water quality at the Filter Plant is related to agricultural land uses in the area. Where chemicals are applied or mixed and where animal wastes become concentrated, it is possible for impacts to occur to the water quality feeding the plant. Otherwise, the location of this plant is favorable in terms of source water protection, as it is upstream from most development. The Burnt Fork watershed has limited forestry activity and the rocks do not provide mineral resources for mining. The only potential sources of contamination known to exist in this area are septic systems, which occur sparsely, and the agricultural lands as mentioned above. The hazard posed by septic systems (Figure 3-7) is considered low. Most of the lower watershed is within agricultural lands (Figure 3-5), primarily pasture used for growing hay and grazing livestock. There are no known concentrated animal feeding areas within the Spill Response Region or the Watershed. There is also no major transportation routes, although county roads exist. There are also no railroad crossings above the Filter Plant.

[10]Septic hazard is based on the population density in unsewered areas, and an assumption of 2.6 persons per septic system. Population density data were obtained from the 1990 census. A low hazard has less than 50 septic systems per square mile. Moderate hazard has between 50 and 130 septic systems per square mile. High hazard has greater than 130 septic systems per square mile.

TABLE 3-1
STEVENSVILLE FIELD SURVEY DATA

| Well No. | SWPA Region | Map ID | Facility Name | Facility Street Address | Source Type (Database Listing) |
|---|---|---|---|---|---|
| 1 | 1 Yr | S-001 | Cenex Gas Station | 107 Main Street | Gas Stations (UST)(LUST)(**F**) |
| 1 | 1 - 3 Yr | S-002 | Ace Hardware & Fertilizer | 4054 Eastside Hwy | Hardware/Lumber/Parts Stores |
| 1 | 1 - 3 Yr | S-003 | Omega II | 4072 Eastside Hwy | (EPA)(**F**) |
| 1 | 1 - 3 Yr (outside) | S-004 | Western Montana Millwork & Mfg. | 4071 Eastside Hwy | Wood Products |
| 1 | 1 - 3 Yr | S-005 | Kenyon Machine Shop | 931 East 2nd Street | Machine Shops (**F**) |
| 1 | 1 - 3 Yr | S-006 | Montana Power Sub Station | 938 East 2nd Street | Electrical |
| 1 | 1 Yr | S-007 | Montana Power Sub Station | 3700 Eastside Hwy | Electrical |
| 1 | 1 - 3 Yr | S-008 | Cenex Fertilizer Plant | 215 East 3rd Street | Fertilizer (**F**) |
| 1 | Outside | S-009 | Ellison Feed Lot | 4161 Eastside Hwy | Animal Feeding |
| 1 | 1 - 3 Yr (outside) | S-010 | Pollard Machine Shop | 3753 Eastside Hwy | Machine Shops |
| 1 | Outside | S-011 | The Works Conoco Gas Station | 324 Main Street | Gas Stations (UST) |
| 1 | >3 Yr | S-012 | Stevensville Water Plant | Middle Burnt Fork Rd. | Water Treatment |
| 2-3 | 1 Yr | S-013 | IGA Grocery Store | 601 Main Street | |
| 2-3 | 1 Yr | S-014 | Alpine Dry Cleaners | 201 Barbara Street | Dry Cleaning (**F**) |
| 2-3 | 1 Yr | S-015 | Maple Wood Cemetary | | Graveyards |
| 2-3 | 1 Yr | S-016 | Car Wash | 604 Main Street | |
| 2-3 | 1 Yr (outside) | S-017 | Montana Saw Shop | 183 Middle Burnt Fork | Wood Products |
| 2-3 | 1 - 3 Yr | S-018 | United Auto Wrecking Yard | 208 Middle Burnt Fork | Salvage Yards (**F**) |
| 2-3 | Outside | S-019 | Stevi Feed & Farm Supply | 407 Main Street | Pesticide/Fertilizer |

Notes: UST indicates site listed in state of Montana underground storage tanks database; LUST indicates site listed in state of Montana active leaking underground storage tanks database; EPA indicates site listed in EPA-regulated database; **F** indicates a detailed inventory form exists for the source in Appendix B.

### 3.2 Susceptibility of Potential Contaminant Sources

The state of Montana has developed a method to assign significant potential contaminant sources into a category of susceptibility. The categories are identified as very-low, low, moderate, high, and very-high. Potential contaminant sources put into the low category are considered to pose a low risk of contaminating a source of water supply. In contrast, those sources put into the very high category are considered to pose the greatest risk of contamination to the water supply.

Susceptibility assignments are made to significant potential contaminant source identified in the source inventory, including point and non-point sources. There are two steps to determining susceptibility. First, the source is assigned a hazard level, based simply on its occurrence within a source water protection area. Hazard levels are categorized as low, moderate, and high. Those sources that are nearest to a source of water supply (or occupy a large land area) will have a higher hazard classification than sources that are farther away (or occupy a small land area).

In step two, the contaminant source is evaluated for the occurrence of barriers, either natural or engineered, that may protect the water source from contamination. If there are no barriers then little protection exists to prevent contamination in the event of a spill or leak. In these cases, the susceptibility assignment would be into a higher level, reflecting the absence of barriers. On the other hand, if multiple barriers are present, a spill or leak is likely to be captured or impeded. The presence of one or more barriers will tend to reduce the susceptibility level assigned to the potential contaminant source. Once the hazard level and number of barriers has been determined for each potential contaminant source, it is put into a susceptibility category. Table 3-5 summarizes the susceptibility categories with respect to the hazard level and the existence of barriers.

TABLE 3-5
SUSCEPTIBILITY CATEGORIES

| Presence of Barriers | Hazard Level | | |
|---|---|---|---|
| | High | Moderate | Low |
| No Barriers | Very High | High | Moderate |
| One Barrier | High | Moderate | Low |
| Two or more Barriers | Moderate | Low | Very Low |

#### 3.2.1 Stevensville

Table 3-6 presents the susceptibility assignments for significant potential contaminant sources inventoried in the Stevensville Source Water Protection Areas. With respect to barriers, one barrier could be credited to those sources occurring within the Inventory Region of Well No. 1. This well has an intake greater than 50-feet below the static water level, which provides for a barrier due to the well construction. A barrier could also be credited to gas stations, as all tanks in Ravalli County comply with the 1998 regulations, which include provisions for leak detection. Note that a barrier was not credited to a site which has a known leaking tank (LUST site). Barriers may exist for other potential contaminant sources, however, at present there is insufficient information to make this determination. Therefore, the susceptibility levels will have a tendency to be conservatively high.

The results of susceptibility assignments for Stevensville are summarized as follows:

- **Point Sources** There were seven point sources included in the susceptibility assessment. The CENEX station (Source S-001) due to its proximity to Well No. 1 and its leaking underground tank status (LUST) is scored as Very High. The Alpine Dry Cleaners is also scored Very High due to its proximity to Well Nos. 2 and 3. The other point sources were scored Moderate and Low.

- **Class V Injection Wells** At present, there is no inventory for these types of sources. The US EPA will be conducting an inventory of Class V Injection Wells in Ravalli County in the near future. When this information becomes available, the town of Stevensville should incorporate it into their source inventory.

- **Cropped Agricultural Land** Based on the assumption that all of the agricultural land was cropped, this source type was scored to have Very High susceptibility. The basis for this score is that over 50% of the inventory areas are cropped agricultural land, and that there are no barriers in place, such as BMPs. Additional information on agricultural land in the source water protection areas can be used to reassess the susceptibility level for this source type.

- **Septic Systems** The hazard level for septic systems is low, but an absence of barriers results in a Moderate susceptibility. Stevensville will need to evaluate this source type as new growth occurs, as the hazard level and the susceptibility will both be likely to increase.

- **Sanitary Sewers** Leaking sewers, due to proximity to the well sources and location within the 1-year time-of-travel zone, present a High hazard and Very High susceptibility. There is a history for public water wells to be impacted by sewer failures. One of these cases occurred in Missoula several years ago. Stevensville should consider this susceptibility level when considering upgrades and maintenance of the sanitary sewer system.

- **Stormwater Discharge** There are no known concentrated discharges of stormwater within the source water protection areas for the Stevensville water sources. There is no assignment of susceptibility made for this source type. Whenever stormwater management decisions are made by the town or which affect the town, however, consideration should be given to the source water protection areas for the water supply.

- **Highways/Railroads/Pipelines** The railroad passes through Stevensville in proximity to Well Nos. 1, 2, and 3. It is assigned a High hazard because it passes through the 1-year time-of-travel zone (barely). Due to an absence of barriers for Well Nos. 2 and 3, it receives a Very High susceptibility assignment. Transportation of hazardous chemicals by rail poses a significant risk to the wells, particularly Well Nos. 2 and 3.

### 3.2.2 Hamilton

Table 3-7 presents the susceptibility assignments for potential contaminant sources in the Hamilton Source Water Protection Areas. As all of the Hamilton wells draw groundwater from less than 50-feet (with the exception of Well No. 5), no barrier existed for well construction. Only underground storage tanks could be assigned one barrier, as all the tanks that exist meet the 1998 regulations, requiring leak detection ability. However, leaking underground tanks (LUST sites) where not credited with a barrier.

TABLE 3-6
STEVENSVILLE SUSCEPTIBILITY

| Map ID | Facility Name | Potential Contaminants | Contaminant Origin | Hazard Rating | Barriers | Susceptibility |
|---|---|---|---|---|---|---|
| S-001 | Cenex Gas Station | VOCs | Leaking UST | High | 1 (LUST) | High |
| S-003 | Omega II | VOCs | Spill | Moderate | 1 | Moderate |
| S-005 | Kenyon Machine Shop | VOCs | Spill | Moderate | 1 | Moderate |
| S-008 | CENEX Fertilizer Plant | Nitrogen | Spill | Moderate | 1 | Moderate |
| S-010 | Pollard Machine Shop | VOCs | Spill | Low | 1 | Low |
| S-011 | The Works Conoco Gas Station | VOCs | Leaking UST | High | 2 | Low |
| S-014 | Alpine Dry Cleaners | VOCs | Spill | High | 0 | Very High |
| NA | Class V Injection Wells* | VOCs,SOCs,IOCs | Spill | Unknown | Unknown | Unknown |
| NA | Cropped Agricultural Land** | SOCs, Nitrate, pathogens | Spill, Runoff | High | 0 | Very High |
| NA | Septic Systems | Nitrate, pathogens | Infiltration Recharge | Low | 0 | Moderate |
| NA | Sanitary Sewers | Nitrate, pathogens | Leaking Sewer | High | 0 | Very High |
| NA | Stormwater Drainage | SOCs, IOCs | Infiltration Recharge | None | 0 | None |
| NA | Highways/Railroads/Pipelines | VOCs, SOCs, IOCs | Spill | High (RR) | 0 | Very High |

Notes:
VOCs = volatile organic compounds; SOCs = synthetic organic compounds; IOCs = inorganic compounds; UST = underground storage tank; AST = above ground storage tank; NA = not applicable; * Data are not presently available; ** It has been conservatively assumed that all agricultural lands are cropped.

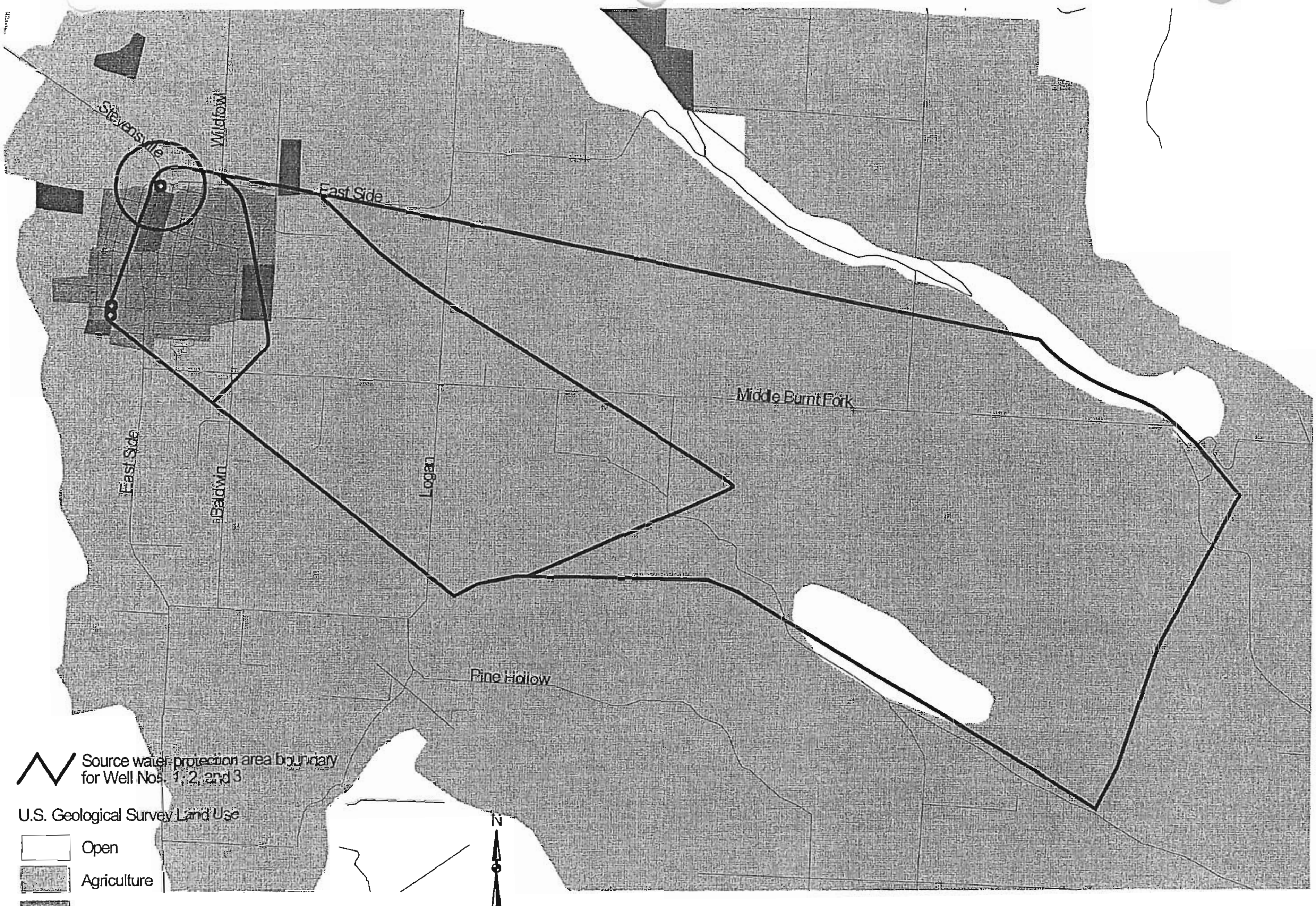
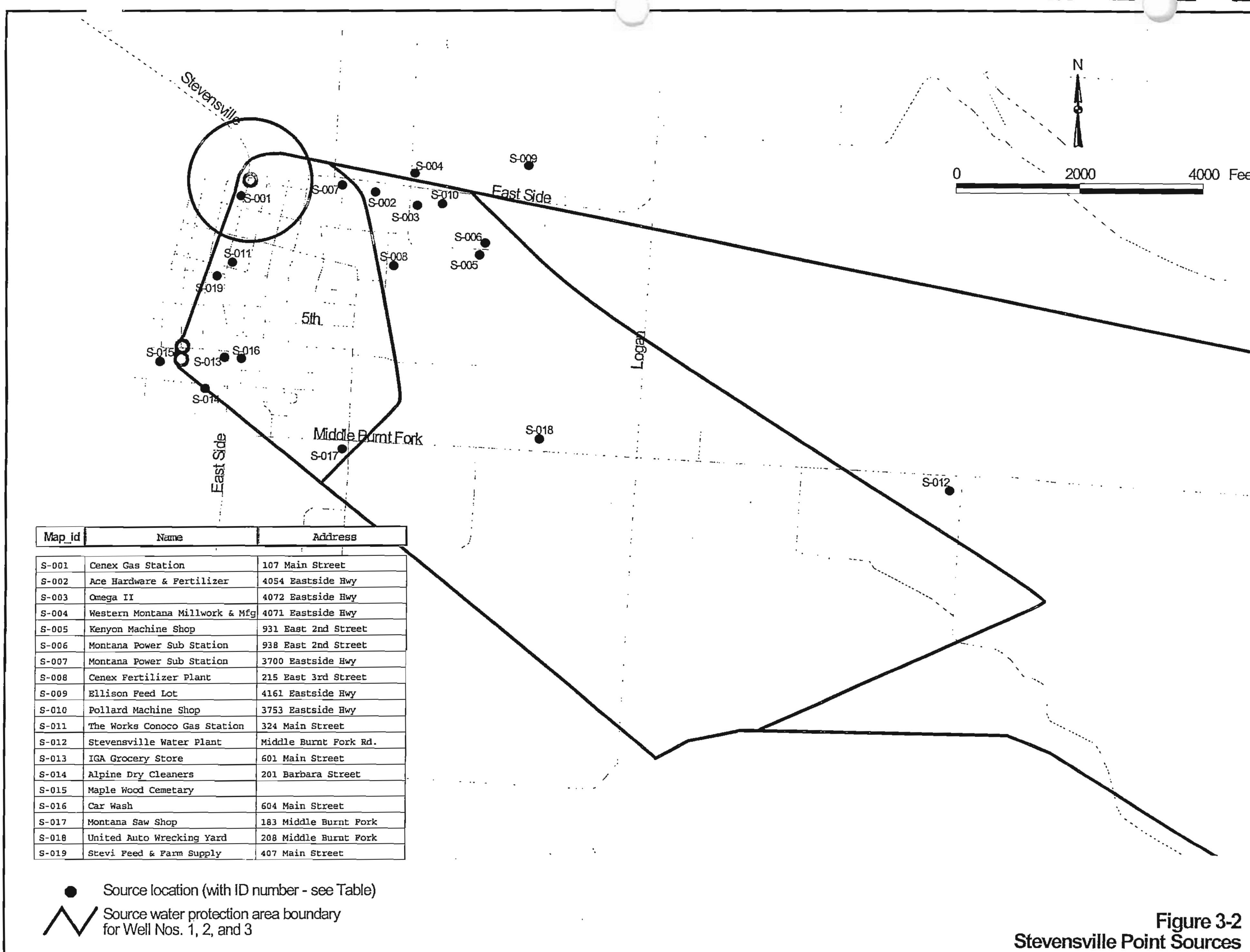



**Figure 3-1**
**Stevensville Area Land Use**
**Well Nos. 1, 2, and 3**

Western Groundwater Services




| Map_id | Name | Address |
|---|---|---|
| S-001 | Cenex Gas Station | 107 Main Street |
| S-002 | Ace Hardware & Fertilizer | 4054 Eastside Hwy |
| S-003 | Omega II | 4072 Eastside Hwy |
| S-004 | Western Montana Millwork & Mfg | 4071 Eastside Hwy |
| S-005 | Kenyon Machine Shop | 931 East 2nd Street |
| S-006 | Montana Power Sub Station | 938 East 2nd Street |
| S-007 | Montana Power Sub Station | 3700 Eastside Hwy |
| S-008 | Cenex Fertilizer Plant | 215 East 3rd Street |
| S-009 | Ellison Feed Lot | 4161 Eastside Hwy |
| S-010 | Pollard Machine Shop | 3753 Eastside Hwy |
| S-011 | The Works Conoco Gas Station | 324 Main Street |
| S-012 | Stevensville Water Plant | Middle Burnt Fork Rd. |
| S-013 | IGA Grocery Store | 601 Main Street |
| S-014 | Alpine Dry Cleaners | 201 Barbara Street |
| S-015 | Maple Wood Cemetary | |
| S-016 | Car Wash | 604 Main Street |
| S-017 | Montana Saw Shop | 183 Middle Burnt Fork |
| S-018 | United Auto Wrecking Yard | 208 Middle Burnt Fork |
| S-019 | Stevi Feed & Farm Supply | 407 Main Street |

Figure 3-2
Stevensville Point Sources

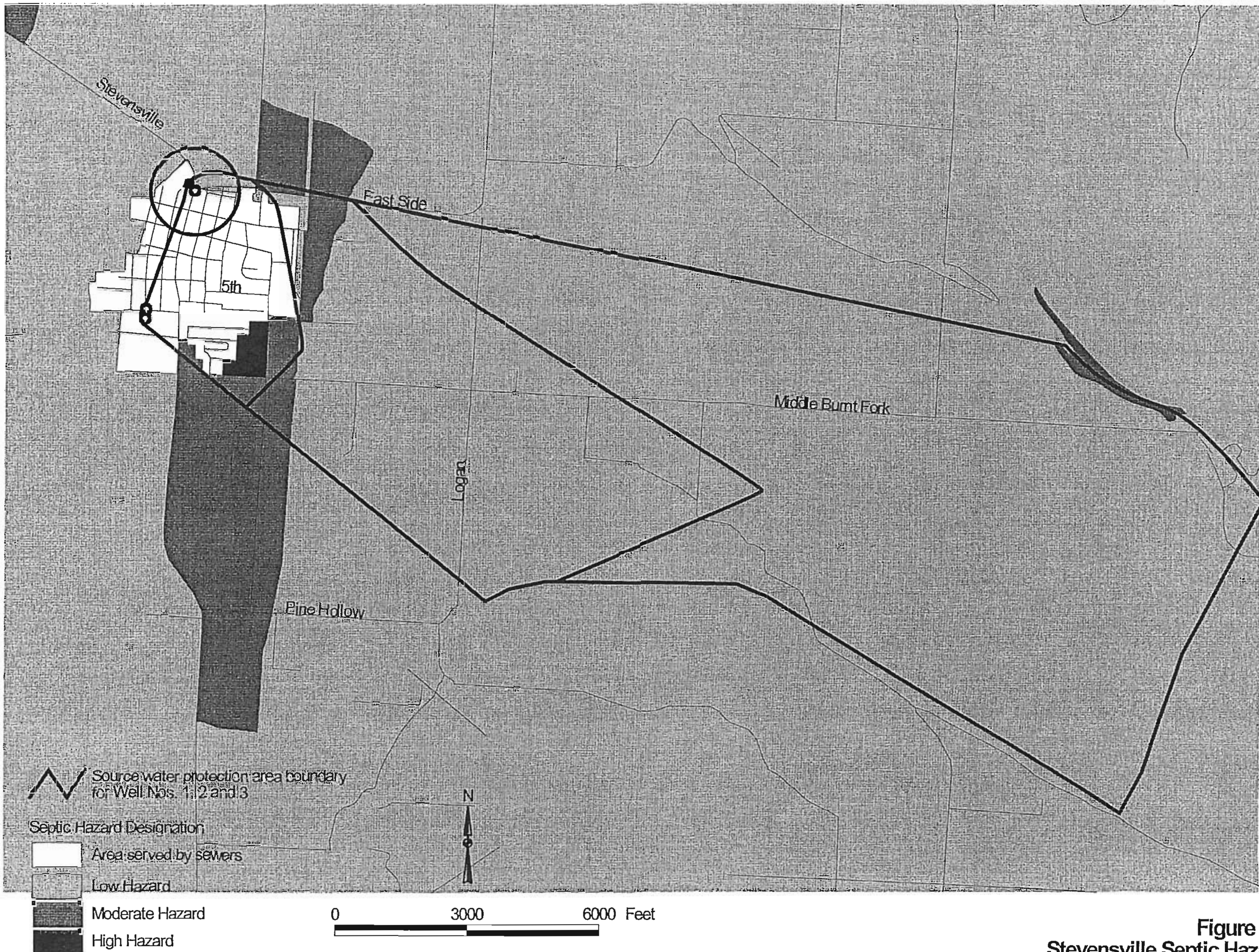



**Figure 3-3**
**Stevensville Septic Hazard**

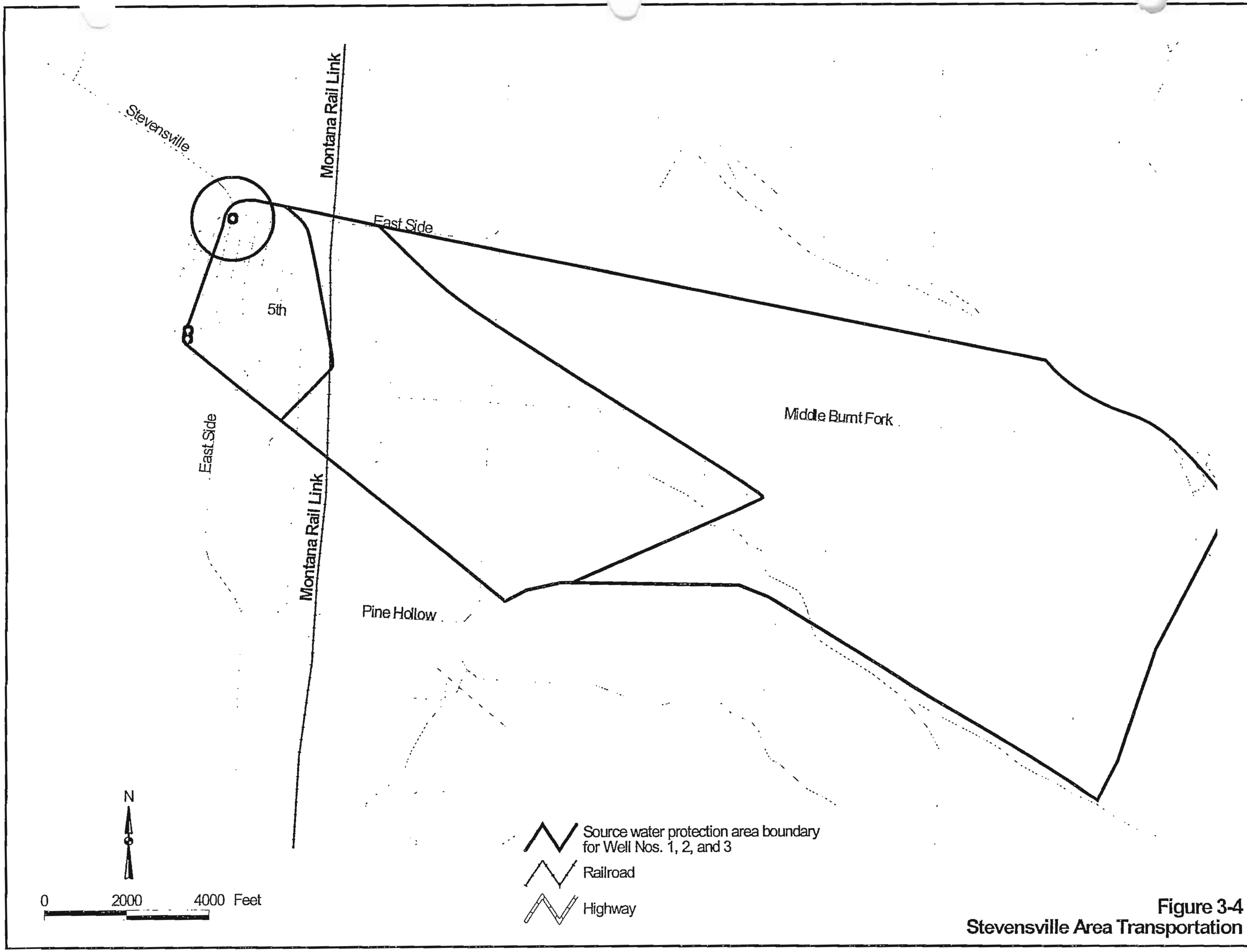



**Figure 3-4**
**Stevensville Area Transportation**

**Western Groundwater Services**

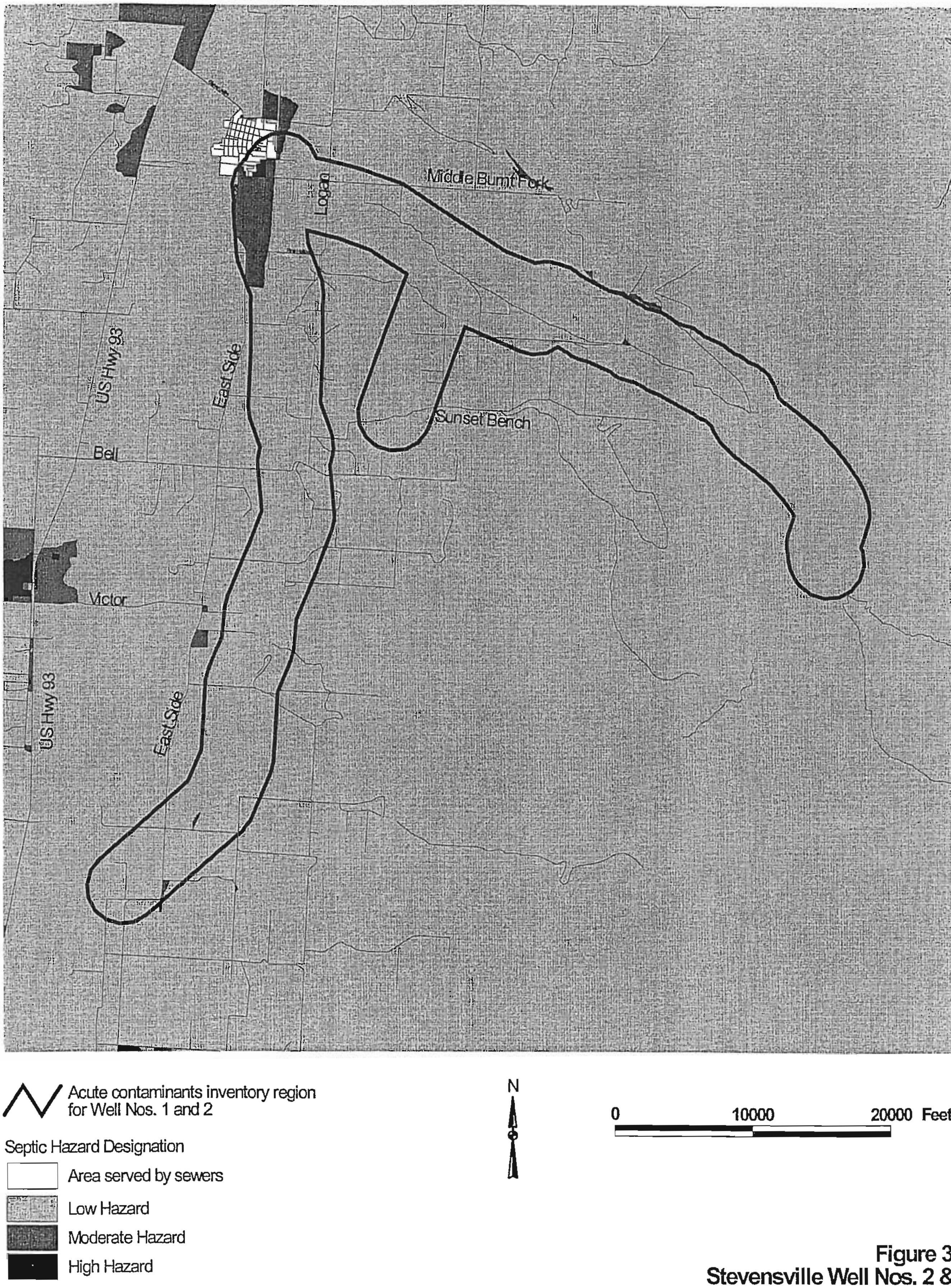



**Figure 3-5**
**Stevensville Well Nos. 2 & 3**
**Acute Contaminants Inventory Region**
**Septic Hazard**

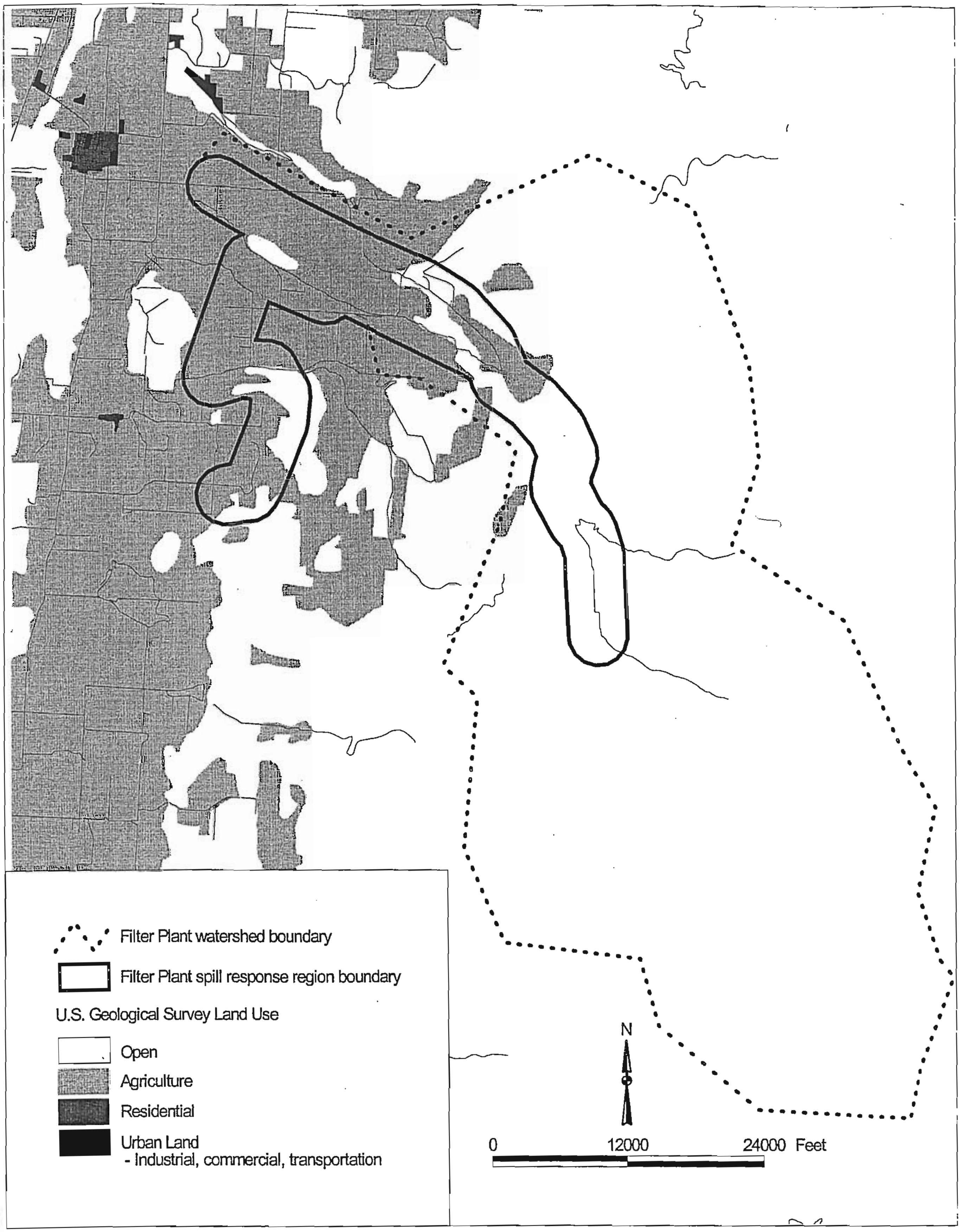



**Figure 3-6**
**Stevensville Area Land Use**
**for Filter Plant**

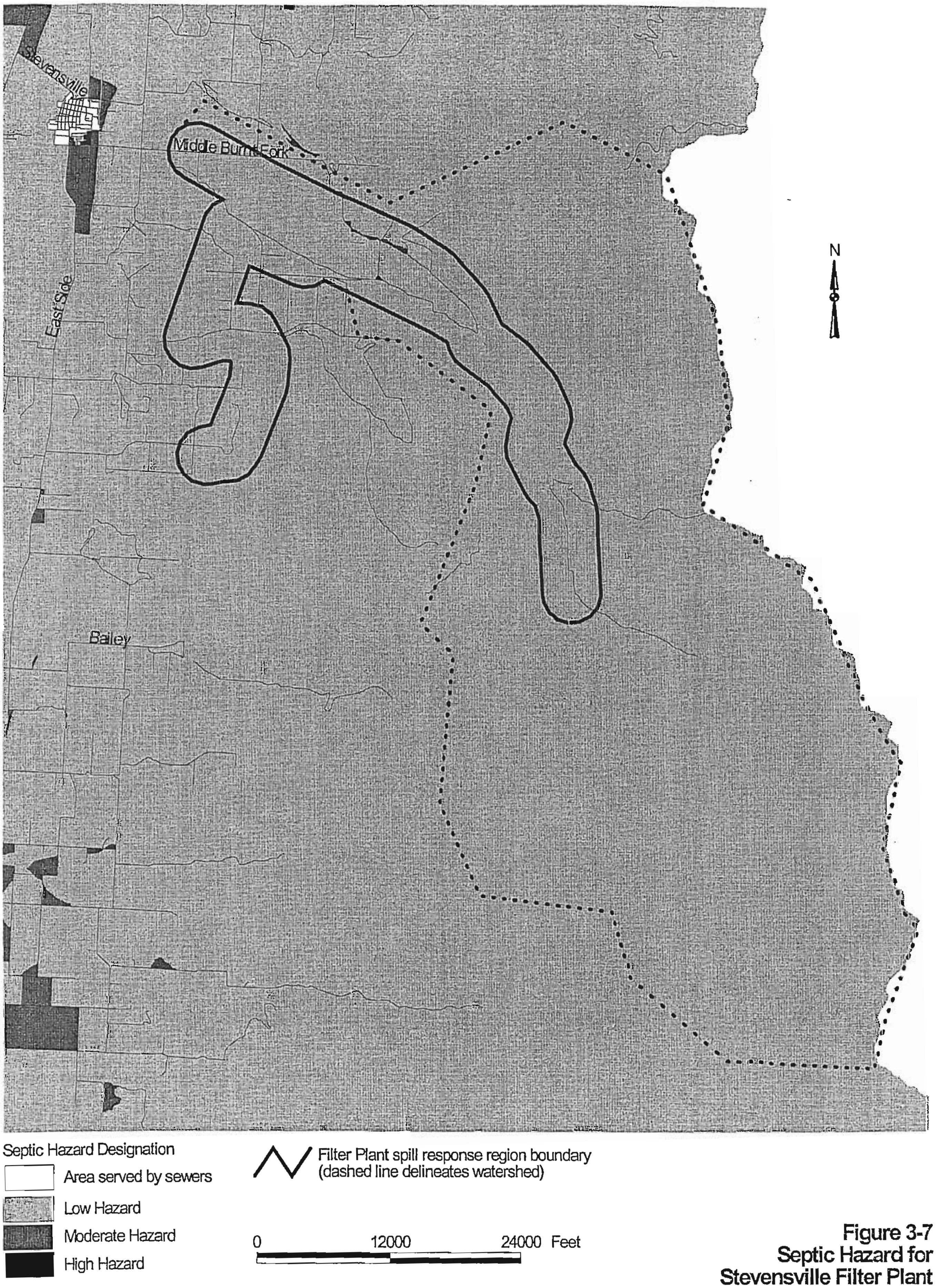



**Figure 3-7**
**Septic Hazard for Stevensville Filter Plant**

# 5 ALTERNATIVE WATER SOURCES

This section of the SWPP provides information that can be used during a project to develop an alternative or replacement water supply. It is assumed that for the communities involved in this SWPP that any new source development will consist of vertical wells installed into the local aquifers.

Development of new wells or wellfields is normally done in a phased manner. Initially, the need for water and the use of vertical wells (versus horizontal wells or surface water) will be identified in a Water Facility Plan. This Plan undergoes state review and approval, and is required to obtain state or federal funding for water improvement projects. The Water Facility Plan should include or identify the need for a groundwater evaluation to locate candidate well sites. Candidate wells sites should be subject to a ranking process considering groundwater quantity and quality, water right issues, source water protection, and infrastructure needs, including property acquisition. Influence of surface water on the groundwater quality at the site should also be carefully reviewed. The highest ranking sites are selected for new well development.

Selected sites for well development are first tested by drilling one or more test wells. For small capacity wells (<300 gpm) and shallow well depths (<100 ft), it will normally be cost-effective to immediately drill a production-size well. For larger or deeper wells, it will normally be more cost-effective to first drill a 6-inch or 8-inch diameter test well. Under favorable conditions, a full-size production well would be installed afterwards.

Production wells installed into unconsolidated sand and gravel aquifers should be completed with high-quality stainless steel well screens. A sanitary surface seal should be grouted into an oversize borehole to a depth of at least 18-feet[12]. Where the well is vulnerable to surface contamination, such as in water table aquifers, it can be beneficial to install a grouted seal to within 15-feet of the top of the well screen. In these cases, the surface seal may extend to depths of 30- to 50-feet (or more) below ground surface. Figure 5-1 diagrams a properly constructed well installed into an unconsolidated sand and gravel aquifer.

## 5.1 Stevensville

A general area for consideration of new well development for the town of Stevensville is shown on Figure 5-2 (please refer to Section 2 for a discussion of geology and map symbols). The area shown is located south and southeast from town, along Middle Burnt Fork Rd. The target aquifer for new wells in this area will be the alluvial fan deposits (map symbol Qafy) or the older sand and gravels (map symbol Tbg), which underlie the alluvial fan. Based on the existing wells, it appears more cost-effective for Stevensville to develop wells in the alluvial fan deposits (well depth 45- to 65-feet), assuming that capacity and quality requirements can be met. New wells installed into the alluvial fan deposits may have similar production capacity as Well Nos. 2 and 3.

The area shown on Figure 5-2 has several favorable properties that suggest it may be useful for new well development. These include: 1) it is generally up gradient from point sources; 2) it overlies the alluvial fan aquifer and the older sand and gravel aquifer occurring at depth; 3) for wells installed in the east-half of the hatched area, connection to the water system may be facilitated by the pipeline from the Filter Plant

[12] The state of Montana allows the sanitary surface seal to be constructed by "trickling" powdered bentonite into the borehole annulus during drilling. This type of seal provides little protection from surface contamination and does not conform to American Water Works Association standards. A proper seal is constructed by installing under pressure a neat cement grout or bentonite slurry grout into a borehole at least 4-inches larger in diameter than the well casing.

that runs along Middle Burnt Fork Rd.; and 4) connection to the water system for wells installed in the west-half should be reasonably feasible by pipeline extension from the town center area. It is noteworthy, that if groundwater capacity and quality are acceptable, the east-half of the area is preferable for new wells in comparison to the west-half.

### 5.2 Hamilton

Potential areas for development of new wells in the Hamilton area are shown on Figure 5-3. Two hatched areas are identified. One is a relatively large area extending from Fairgrounds Rd. to Golf Course Rd. The other is a small area located due south of the city center area. Both of these areas overlie the water table aquifer that is tapped by the other existing city wells.

The favorable aspects of the hatched areas shown on Figure 5-3 include the following: 1) the south and east locations place wells up-gradient from most point sources; 2) the alluvial aquifer is anticipated to be productive in either location, with potential for successful municipal wells; and 3) the locations are generally in proximity to existing waterlines, facilitating connection to the water system. It is undesirable, however, that the large area on the east side of town will undergo substantial development in the near future. Septic hazard will increase up until the time when the city extends sewer service into this area.

### 5.3 Darby

Areas that may be considered for new well development by the town of Darby are shown on Figure 5-4. Two areas were identified. One of these areas exists within the downtown area, extending from Well No. 2 to Well No. 4. The other area is south of town. Both areas are anticipated to overlie the water table aquifer system that is tapped by the Town's existing wells.

The smaller hatched area located south of town appears to be the most favorable for new well sites. It is up-gradient from the developed area and at least 500 feet from surface water. New wells would be installed into a shallow alluvial aquifer that may be highly productive. Unfortunately, at a minimum, 2,500- to 3,000-feet of new waterline would be required to develop the site. Flooding from the Bitterroot River and Tin Cup Creek may also occur in this area.

The larger hatched area spanning the town center should accommodate up to two new wells, assuming about a 1,000-foot spacing. It is necessary to make well hydraulics calculations in order to predict the most appropriate spacing for locating new wells in this area. The area is subject to growth and is therefore more vulnerable to contamination than the small hatched area to the south. However, new wells would be central to the water system and could be connected relatively easily.

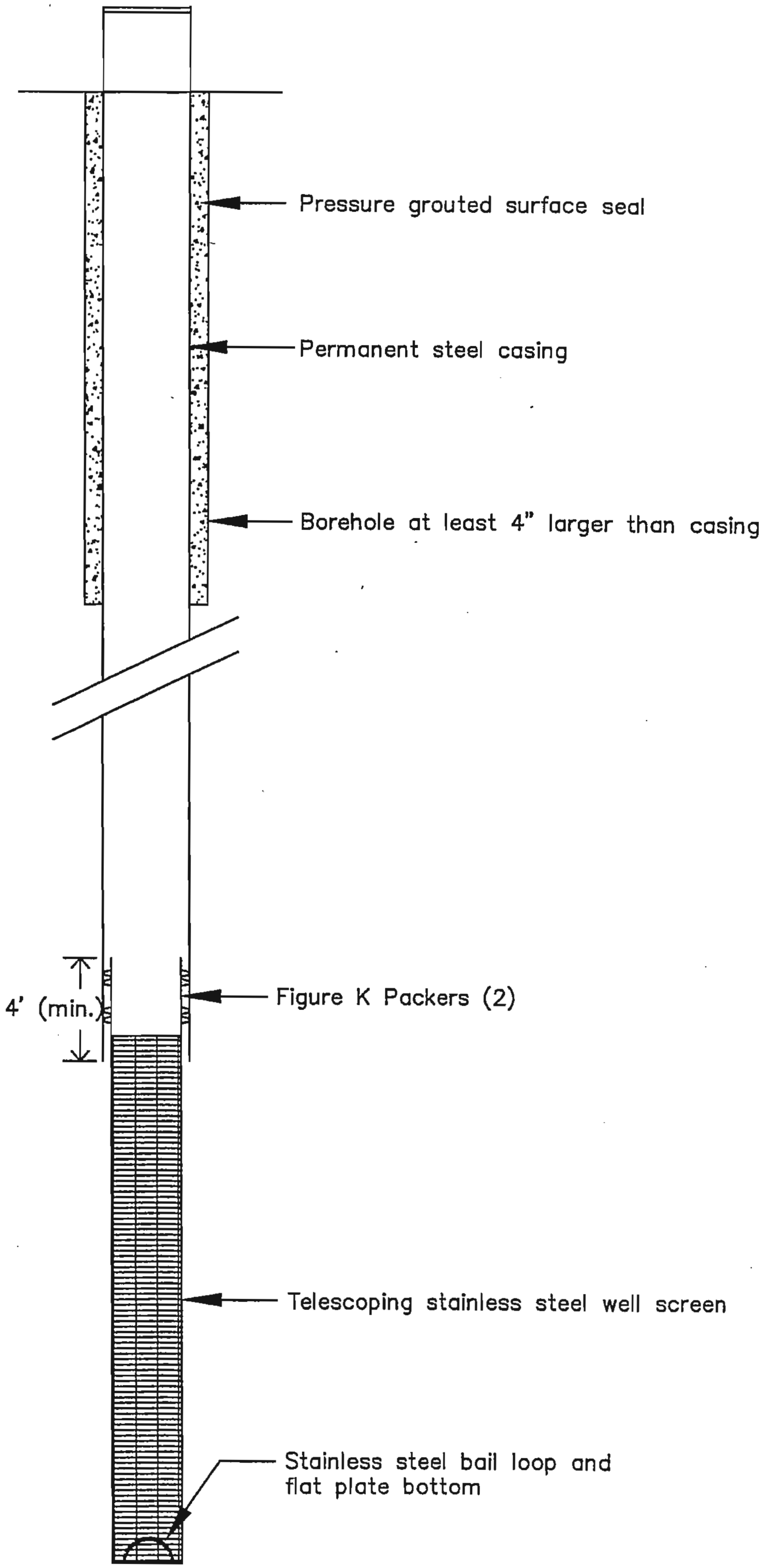



**Figure 5-1**
**Typical Well Construction**

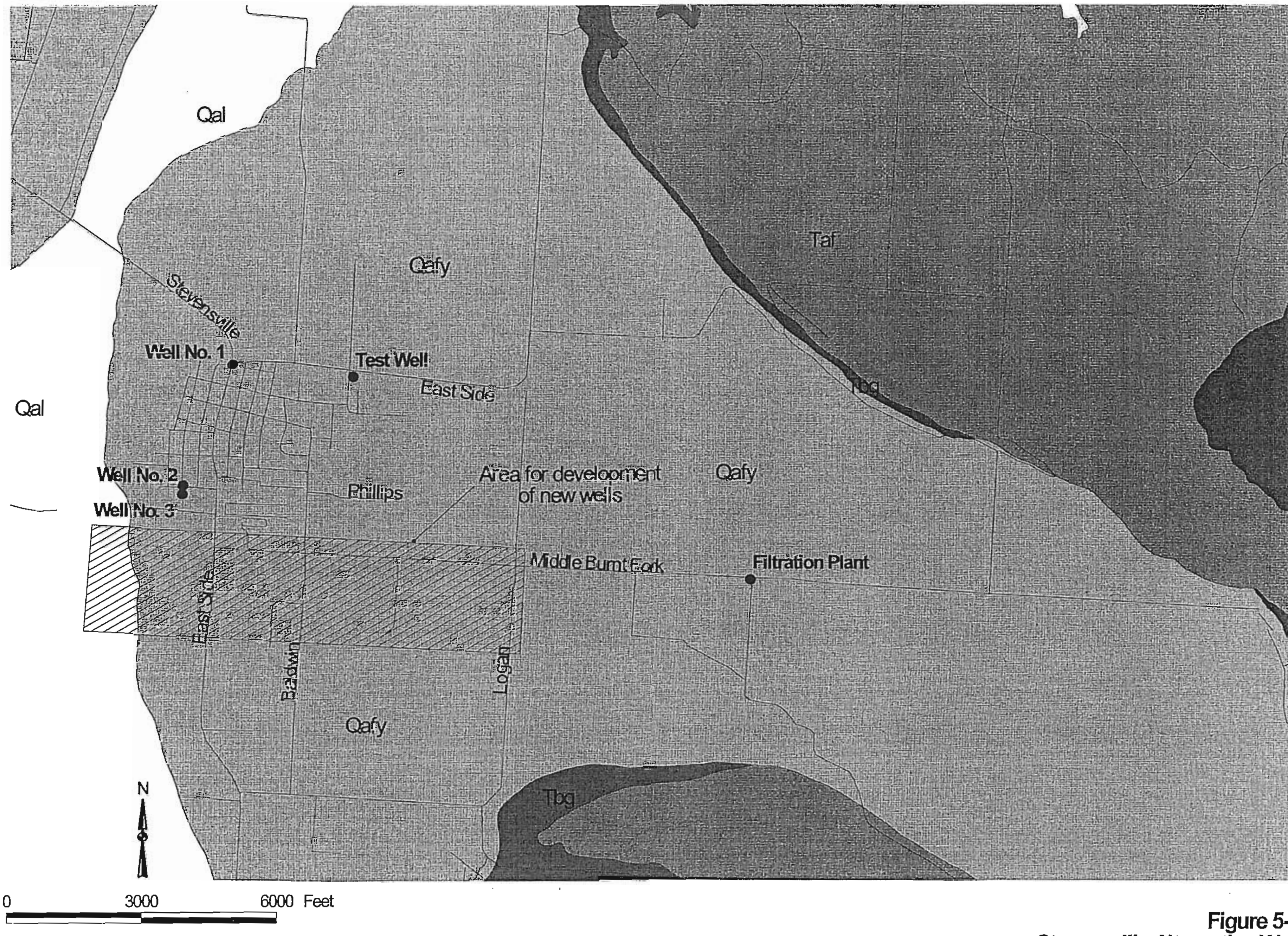



**Figure 5-2**
**Stevensville Alternative Well**
**Development Area**

Western Groundwater Services

RESOLUTION NO. 138 '39

A RESOLUTION ADOPTING INFRASTRUCTURE ACCESS FEES TO BE PAID BY APPLICANTS FOR WATER AND SEWER SERVICE THAT ARE LOCATED WITHIN THE CORPORATE CITY LIMITS.

**WHEREAS**, the Stevensville Water and Sewer systems have been constructed over the years, and funded from revenue fees and bond issues; and,

**WHEREAS**, the revenue fees are not sufficient to continue to maintain the water and sewer facilities and also accomplish the needed expansion due to increased use; and,

**WHEREAS**, new users will be having the use of the existing facilities paid for by the present and past users; and,

**WHEREAS**, it is essential to the public health, welfare and safety of the residents of the Town of Stevensville to provide an adequate water and sewer system and to provide sufficient funding to meet the cost of expanding the same.

**NOW THEREFORE, BE IT RESOLVED** that every new water and sewer user shall pay an Infrastructure Access fee according to the annexed tables which have been prepared to provide proper adjustment for the investment of present users in the existing system. These fees shall be paid at the time application is made for water and sewer service and shall be deposited into a capital improvement fund, specifically for the expansion and improvement of the water and sewer systems and will be in addition to hookup fees.

**BE IT FURTHER RESOLVED** that a waterline devoted exclusively to providing fire protection services is a fire line and shall be exempt from water and sewer system development fees, but a monthly water use fee may be charged.

**BE IT FURTHER RESOLVED** that whenever a user shall request an upgrade in Water service that necessitates the installation of a meter or a larger meter, the user shall pay the incremental Infrastructure Access fee in accordance with the increase in use, and this shall be in addition to the cost of the meter and other connection fees.

This resolution shall become effective upon final approval and filing with the Public Service Commission.

PASSED THE 8th DAY OF January 1996.

APPROVED THE 8th DAY OF January 1996.

William D. Meisner
MAYOR

ATTEST:
Nancy L. Sowell

TOWN OF STEVENSVILLE

# Infrastructure Access Fee (IAF)

Preliminary Discussion

*November 15, 1995*

## BACKGROUND

As the demand for growth is accelerating in western Montana, we are seeing communities begin to consider the concept of "development fees". The concept is that projects requiring service to other areas or to users not previously participating in the funding of the facilities, should be required to "buy-in" to the existing system capacity through a "development" fee or "capacity" charge. Such fees, along with a portion of everyone's monthly water and sewer charges, should go into specific funds for replacement and capital improvements.

Fees are known by several different names: "sewer development fee", "infrastructure access fee", "plant investment fee", or simply "connection charge". A good discussion of the basic concept is included in the "Utility Financing Handbook" prepared for the State of Wyoming and the Wyoming Association of Municipalities, May, 1982, by James M. Montgomery, Inc. A professional paper by Bruce Bender, December, 1982, titled "Municipal Connection Charge: Financing Utility Expansion" has the same general concepts and was used by the City of Helena in developing their connection charge.

I prefer to call the fee an "Infrastructure Access Fee" or IAF and recommend to the Town of Stevensville that it adopt such a fee as part of their overall water and sewer rate structure. The definition of an IAF is as follows:

*Infrastructure Access Fees are in addition to connection charges and other service charges and are assessed to any new developments to help defray the cost of excess water and sewer system capacity. The charge represents the proportionate capacity of the "general benefit" facilities required by the new development. Revenues collected from the IAF's are used to retire any debt encountered in constructing the general benefit facilities, or in contributions to the system capital improvement fund.*

CALCULATION FOR STEVENSVILLE

In Stevensville's case, there is no debt on the sewer system, and only a small amount remains on a water Revenue bond. The Bond is about $20,000 and can be paid off anytime, but I will use that debt for illustrative purposes.

Projects requiring service to other areas or to users not previously participating in the funding of the facilities, should be required to "buy-in" to the existing system capacity through the "Infrastructure Access fee". Such fees, along with a portion of everyone's monthly water and sewer charges, should go towards funds for replacement and capital improvements

The IAF is based on the size of the water service required for the proposed development and the general equation is:

$$\text{IAF} = \frac{\text{General Benefit Facility value - debt}}{\text{Total Capacity Units}}$$

The "general benefit" facilities are considered as those improvements required and used by everyone on the system. The value is the current replacement value of the following facilities:

WATER SYSTEM: Wells, pumps, controls, supply lines, storage tanks, infiltration gallery and treatment plant.

SEWER SYSTEM: Lagoons, treatment plant, and short gravity main used by all.

A " capacity unit" is considered as the typical amount of water used, or wastewater discharged by a single family residence with a 5/8" water meter. Uses other than single family residences, can be proportioned against the 5/8" meter for a multiplier to the IAF. A review of Stevensville's water and sewer system's capacity results in the following estimated total capacity units:

WATER SYSTEM: Existing storage volume and water supply limits the system to 1,000 single family residences (capacity units).

SEWER SYSTEM: The treatment plant was designed to 300,000 gpd, or approximately 1,000 single family residences.

For the sake of simplicity, I will assume that both the Stevensville water and sewer systems have a "total capacity" of <u>1,000</u> single family residences.

## Calculation of Water and Sewer IAF

**WATER SYSTEM:** Consists of three (3) wells producing 800 gpm with a 650 gpm filtration plant, infiltration gallery and 430,000 gallon storage tank.

1995 Replacement Values

| Item | Description | Replacement Value |
|---|---|---|
| 1. | Filtration Plant | $850,000.00 |
| 2. | Infiltration Gallery | $30,000.00 |
| 3. | Concrete Storage Reservoir, 430,000 gallons | $325,000.00 |
| 4. | Backwash decant chamber | $50,000.00 |
| 5. | Plant yard piping & valving | $75,000.00 |
| 6. | Diversion box & Parshall flume | $30,000.00 |
| 7. | Plant perimeter chain link fencing | $9,000.00 |
| 8. | 8" Transmission main, 10,000 lf | $200,000.00 |
| 9. | 10" Transmission main, 10,000 l f | $250,000.00 |
| 10. | Well No. 1, 16" casing, 320' depth, 50 hp turbine | $98,000.00 |
| 11. | Well No. 2, 8" casing, 78' depth, 20 hp submersible | $20,000.00 |
| 12. | Well No. 3, 8" casing, 77' depth, 20 hp submersible | $20,000.00 |
| 13. | Well Control system | $10,000.00 |
| 14. | Land Acquisition | $50,000.00 |
| 15. | Water Rights | $50,000.00 |
| 16. | Engineering & Construction contingencies | $333,000.00 |
| 17. | TOTAL REPLACEMENT VALUE | $2,400,000.00 |

The water system has been constructed over the years from Town water system funds, grants, and revenue bonds. No General Obligation funds have been used in the water system, therefore, only the present and past water users have funded the system. All new developments should be required to "buy-in" to the existing system capacity in the following manner:

$$\text{IAF (Water system)} = \frac{2{,}400{,}000 - 20{,}000\text{(debt)}}{1000 \text{ cu}} = \$\ 2{,}380 / \text{cu}$$

**Use $ 2,400 for the 1995 water system IAF.**

**SEWER SYSTEM:** Consists of oxidation ditch, clarifier, digester and groundwater discharge cells.

| Item | Description | Replacement Value |
|---|---|---|
| 1. | Maintenance building | $60,000.00 |
| 2. | Sludge truck garage | $40,000.00 |
| 3. | Sludge Truck | $50,000.00 |
| 4. | Oxidation Ditch | $250,000.00 |
| 5. | Circular clarifier | $60,000.00 |
| 6. | Aerobic digester | $75,000.00 |
| 7. | Inlet structure, with comminuter | $37,000.00 |
| 8. | Control building with Lab & blower | $70,000.00 |
| 9. | Yard piping & valves | $70,000.00 |
| 10. | Sludge drying beds | $35,000.00 |
| 11. | Pump / sludge room with pumps | $40,000.00 |
| 12. | Groundwater recharge cells (2) | $25,000.00 |
| 13. | Sewage lift station (Riverside) | $40,000.00 |
| 14. | Plant perimeter fencing | $30,000.00 |
| 15. | Engineering & Construction contingencies | $148,000.00 |
| 16. | TOTAL REPLACEMENT VALUE | $1,030,000.00 |

The sewer system funding has been more complex with two (2) General Obligation Bonds over the years to help fund the system. Developments on properties previously contributing to the G.O. bonds should receive credit for their participation to date. The original sewer collection system was partially funded by a $150,000 G.O. bond in 1960. The treatment plant was installed and other upgrades made in 1978 with a $125,000 G.O. bond . Each bond was financed over a different area as shown on the attached Town Map entitled "SEWER IAF ZONES".

he current (1995) value of the G.O. Bond contributions are assumed to be as follows:

| G.O. Bond Issue | Original Value | 1995 Value |
|---|---|---|
| 1960 | $ 150,000 | $ 422,000(3% for 35 years) |
| 1978 | $ 125,000 | $ 243,000 (4% for 17 years) |

The Map indicates the following three (3) zone classifications:

**ZONE A:** Encompasses the Town limits used in financing the 1960 G.O. Bond issue. This area also helped finance the 1978 G.O. Bond issue and will benefit from contributing to both bond issues:

$$\text{IAF (Sewer system)} = \frac{\underline{\$1{,}030{,}000 - \$422{,}000 - \$243{,}000}}{1000 \text{ cu}} = \$365/\text{cu}$$

**Use $365 for the 1995 Zone A sewer system IAF.**

**ZONE B:** Encompasses the Town limits used in financing the 1978 G.O. Bond issue.

$$\text{IAF (Sewer system)} = \frac{\underline{\$1{,}030{,}000 - \$243{,}000}}{1000 \text{ cu}} = \$787/\text{cu}$$

**Use $790 for the 1995 Zone B sewer system IAF.**

**ZONE C:** Are all areas outside of Zone A or Zone B:

$$\text{IAF (Sewer system)} = \frac{\underline{\$1{,}030{,}000 - \$0}}{1000 \text{ cu}} = \$1{,}030/\text{cu}$$

**Use $1,000 for the 1995 Zone C sewer system IAF.**

For the Town of Stevensville then, the 1995 cost of connecting to the water and sewer systems would depend on which Zone the development were in, and may be summarized:

Table 1

| Zone | Water IAF | Sewer IAF | **TOTAL IAF** |
|---|---|---|---|
| A | $2,400 | $ 365 | **$ 2,765** |
| B | $2,400 | $ 790 | **$ 3,190** |
| C | $2,400 | $1,000 | **$ 3,400** |

For structures other than single family residences, the appropriate water service would be sized in accordance with principals laid out in the AWWA Manual M22 (Sizing Water Service Lines and Meters", published by the American Water Works Association). The flow through a 3/4" (or smaller) water meter is assumed to serve capacity unit of "1" and larger meters are proportioned to their recommended maximum design capacity per AWWA C700.

The multiplier and the total IAF costs for other sizes of service lines becomes:

Table 2

| Size of Water Service | No. of Capacity Units | Zone A IAF | Zone B IAF | Zone C IAF |
|---|---|---|---|---|
| 5/8" or 3/4" | 1 | $2,765 | $3,190 | $3,400 |
| 1.0" | 1.7 | $4,700 | $5,423 | $5,780 |
| 1.5" | 3.3 | $9,125 | $10,527 | $11,220 |
| 2.0" | 5.3 | $14,655 | $16,907 | $18,020 |
| 3.0" | 10.0 | $27,650 | $31,900 | $34,000 |

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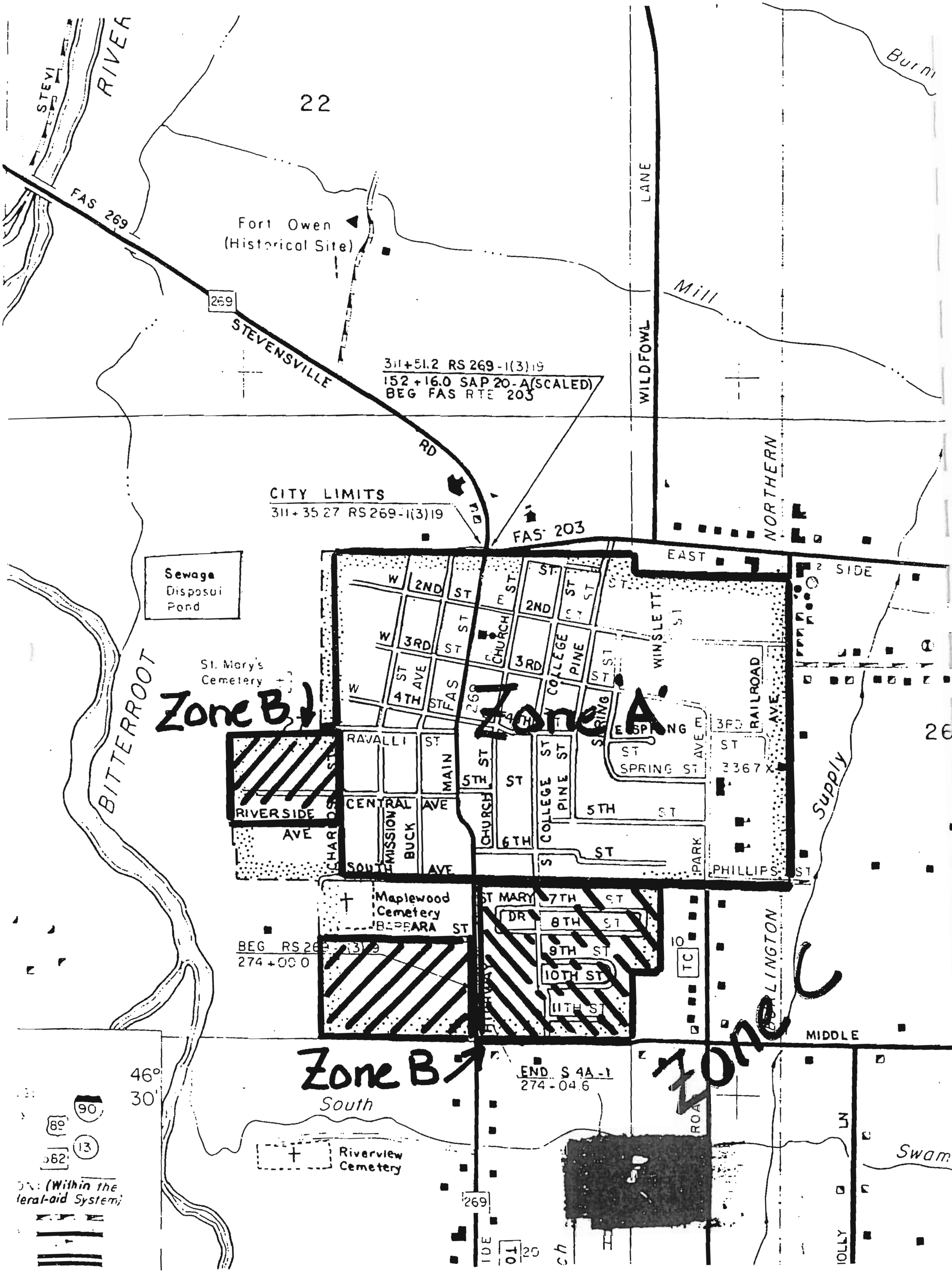


RIVER
22
Burn
FAS 269
Fort Owen
(Historical Site)
269
STEVENSVILLE RD
WILDFOWL LANE
Mill
311+51.2 RS 269-1(3)19
152+16.0 SAP 20-A(SCALED)
BEG FAS RTE 203
NORTHERN
CITY LIMITS
311+35.27 RS 269-1(3)19
FAS 203
EAST SIDE
Sewage
Disposal
Pond
W 2ND ST
E 2ND ST
W 3RD ST
3RD
CHURCH
COLLEGE
PINE
WINSLETT ST
RAILROAD AVE
St. Mary's
Cemetery
BITTERROOT
W 4TH ST
FAS 269
Zone B
Zone A
SPRING
E SPRING
3RD ST
26
RAVALLI ST
MAIN
5TH ST
SPRING ST
3367X
Supply
RIVERSIDE AVE
CENTRAL AVE
MISSION
BUCK
5TH ST
6TH ST
PARK
SOUTH AVE
PHILLIPS ST
Maplewood
Cemetery
BARBARA ST
ST MARY DR
7TH ST
8TH ST
9TH ST
10TH ST
11TH ST
10
TC
ALLINGTON
BEG RS 269-1(3)19
274+00.0
Zone C
MIDDLE
46°
30'
Zone B
END S 4A-1
274-04.6
South
90
89
13
Riverview
Cemetery
Swamp
(Within the
Federal-aid System)
269

Passed
5-29-07

CERTIFICATE AS TO RESOLUTION AND ADOPTING VOTE

I, the undersigned, being the duly qualified and acting recording officer of the Town of Stevensville, Ravalli County, Montana (the "Town"), hereby certify that the attached resolution is a true copy of a Resolution entitled: "RESOLUTION OF THE TOWN OF STEVENSVILLE, MONTANA TO INCREASE THE RATES FOR THE USERS OF THE MUNICIPAL WATER SYSTEM" (the "Resolution"), on file in the original records of the Town in my legal custody; that the Resolution was duly adopted by the Town Council of the Town at a regular meeting on May 29, 2007, and that the meeting was duly held by the Town Council and was attended throughout by a quorum, pursuant to call and notice of such meeting given as required by law; and that the Resolution has not as of the date hereof been amended or repealed.

I further certify that, upon vote being taken on the Resolution at said meeting, the following Council Members voted in favor thereof: Paul Ludington, Bob Summers, Susan Evans & Tom Brown; voted against the same: ________; abstained from voting thereon: ________; or were absent: ________.

WITNESS my hand officially this 29 day of May, 2007.

Nancy Lowell

Nancy Lowell
Town Clerk

RESOLUTION NO. 234

RESOLUTION OF THE TOWN OF STEVENSVILLE, MONTANA TO INCREASE THE RATES FOR THE USERS OF THE MUNICIPAL WATER SYSTEM

RECITALS

WHEREAS, the Town pursuant to authority conferred by Montana Code Annotated (M.C.A.), Title 7, Chapter 13, Parts 43 and 44, as amended (the "Act"), and other laws of the State of Montana, has established and presently owns and operates a municipal water system (the "System"); and

WHEREAS, pursuant to Section 7-13-4307, M.C.A., the rates and charges established for the services and facilities afforded by the System shall be sufficient in each year to provide income and revenues adequate for the payment of reasonable expense and operation and maintenance and for payment of the sums required to be paid into the sinking fund and for the accumulation of such reserves and the making of such expenditures for depreciation and replacement of the System; and

WHEREAS, the Town has determined that the current rates and charges for the services and facilities afforded by the System are inadequate to meet the requirements of Section 7-13-4307, M.C.A.; and

WHEREAS, pursuant to Sections 7-13-4308 and 69-7-101, M.C.A., the Town has the power and authority to regulate, establish, and change, as it considers proper, rates, charges, and classifications imposed for utility services to its inhabitants and other persons served by the municipal systems. Rates, charges, and classifications must be reasonable and just; and

WHEREAS, the Town in consultation with its engineer and the Montana Rural Water Users Association has determined it to be in the best interest of the Town and the users of the System to increase the rates and charges for the services provided by the System in order to collect sufficient revenues to meet the requirements of Section 7-13-4307, M.C.A.;

WHEREAS, a notice of public hearing was mailed to all users of the Town's System notifying them that pursuant to Resolution No. 233, adopted April 23, 2007, it was the intention of the Town to increase the rates and charges for water service and notice of public hearing was published as required by Section 69-7-111, M.C.A. A public hearing was held on May 29, 2007 at 6:30 p.m. at the Chambers of the Town Council, Town Hall, 206 Buck Street, Stevensville, Montana, for the purpose of hearing comments from the public on the water rate increase; and

WHEREAS, all persons appearing were given an opportunity to speak at the public hearing.

NOW, THEREFORE, BE IT RESOLVED by the Town Council (the "Council") of the Town as follows:

Section 1. Determination of Annual Budget for System. Each year the Council of the Town shall determine the amount of money needed to pay the costs of the System including but not limited to: (a) the payment of the reasonable expense of operation and maintenance of the System; (b) administration of the System; (c) the payment of principal and interest on any bonded or other indebtedness of the System; and (d) the establishment or maintenance of any required reserves, including reserves needed for expenditures for depreciation and replacement of facilities, as may be determined necessary from time to time by the Council or as covenanted in the ordinance or resolution authorizing any outstanding bonds of the System. Based on the annual needs of the System, the Council will establish quarterly charges for the use of the System.

Section 2. Equivalent Dwelling Unit and Water Usage. The Town utilizes an equivalent dwelling unit methodology for imposing rates and charges, which is based on the size of the meter servicing each connection. A ¾ inch service, which is the standard service for single family residential users, is 1 Equivalent Dwelling Unit (EDU). The following table shows the number of EDUs for each size of service:

| Water Line/Meter Size | Connections | Multiplier | EDUs |
|---|---|---|---|
| ¾ inch | 725 | 1.00 | 725.00 |
| 1 inch | 25 | 1.79 | 44.75 |
| 1½ inch | 17 | 4.00 | 68.00 |
| 2 inch | 4 | 7.14 | 28.56 |
| Total | | | 866.31 |

There are currently 866 EDUs in the Town.

Section 3. Current Charges. The Town currently charges users of the System a base rate charge (the "Quarterly Charge") of $25.75 per EDU for metered properties plus a rate of $0.55 for every 1,000 gallons of water used over 10,000 gallons (the "Usage Charge"). Out-of-town properties are charged a Quarterly Charge of $39.80 per EDU, and unmetered in-town properties are charged a Quarterly Charge of $33.10 per EDU.

Section 4. Fixing of Rates. The Town hereby increases the Quarterly Charge per EDU to $43.96 for metered properties, $58.01 for out-of-town properties, and $51.31 for unmetered in-town properties, effective as of the July 1, 2007 water billing.

As of April 23, 2007, there are 866 EDUs as shown in Section 2 above. Effective as of July 1, 2007, the Quarterly Charge for customers shall be as follows:

| Water Line/ Meter Size | Multiplier | Monthly Water Charge | Metered | Out-of-Town | Unmetered |
|---|---|---|---|---|---|
| ¾ inch | 1.00 | | $43.96 | $58.01 | $51.31 |
| 1 inch | 1.79 | | $78.69 | $103.84 | $91.84 |
| 1½ inch | 4.00 | | $175.84 | $232.04 | $205.24 |
| 2 inch | 7.14 | | $313.87 | $414.19 | $366.35 |

Section 5. Further Rate Increases. Subsequent adjustments to the Quarterly Charge will be made by resolution of the Town Council duly adopted after a public hearing with notice thereof given as provided by law.

Section 6. Effective Date of Resolution. This resolution shall be immediately filed with the Town Clerk and shall become effective upon passage. This resolution shall also be filed with the Public Service Commission.

Passed and approved this 29th day of May, 2007.

Mayor

ATTEST:

Nancy Lowell
Town Clerk

NOTICE OF RATE INCREASE AND PUBLIC HEARING

NOTICE IS HEREBY GIVEN that on April 23, 2007, the Town Council (the "Council") of the Town of Stevensville, Montana (the "Town"), adopted a Resolution of Intention to Increase the Rates for the Users of the Municipal Water System.

The Town has determined that the rates and charges established for the services and facilities afforded by the municipal water system (the "System") are insufficient to provide income and revenues adequate for the payment of reasonable expense and operation and maintenance and for payment of the sums required to be paid into the sinking fund and for the accumulation of such reserves and the making of such expenditures for depreciation and replacement of the System. The Town in consultation with its engineer and the Montana Rural Water Users Association has determined it to be in the best interest of the Town and the users of the System to increase the rates and charges for the services provided by the System in order to collect sufficient revenues.

The Town utilizes an equivalent dwelling unit methodology for imposing rates and charges, which is based on the size of the water line or meter servicing each connection. A ¾ inch service, which is the standard service for single family residential users, is 1 Equivalent Dwelling Unit (EDU). The following table shows the number of EDUs for each size of service:

| Water Line/Meter Size | Connections | Multiplier | EDUs |
|---|---|---|---|
| ¾ inch | 725 | 1.00 | 725.00 |
| 1 inch | 25 | 1.79 | 44.75 |
| 1½ inch | 17 | 4.00 | 68.00 |
| 2 inch | 4 | 7.14 | 28.56 |
| Total | | | 866.31 |

The Town currently charges users of the System a base rate charge (the "Quarterly Charge") of $25.75 per EDU for metered properties plus a rate of $0.55 for every 1,000 gallons of water used over 10,000 gallons (the "Usage Charge"). Out-of-town properties are charged a Quarterly Charge of $39.80 per EDU and unmetered in-town properties are charged a Quarterly Charge of $33.10 per EDU. The Town intends to increase the Quarterly Charge by $18.21 effective as of the July 1, 2007 water billing.

As of April 23, 2007, there are 866 EDUs. Effective as of July 1, 2007, the Quarterly Charge for each type of service shall be as follows:

| Water Line/ Meter Size | Multiplier | Monthly Water Charge | Metered | Out-of-Town | Unmetered |
|---|---|---|---|---|---|
| ¾ inch | 1.00 | | $43.96 | $58.01 | $51.31 |
| 1 inch | 1.79 | | $78.68 | $103.84 | $91.84 |
| 1½ inch | 4.00 | | $174.76 | $232.04 | $205.24 |
| 2 inch | 7.14 | | $313.87 | $414.19 | $366.35 |

This proposed rate increase represents an average increase in the Quarterly Charge of approximately 71% over the existing rates for metered properties, 46% for out-of-town properties, and 55% for unmetered in-town properties.

On Tuesday, May 29, 2007 at 6:30 p.m., at Chambers of the Town Council, Town Hall, 206 Buck Street, Stevensville, Montana., the Council will conduct a public hearing and pass upon all protests against the proposed water rate increase. Written comments will be accepted at the address below until 3:00 p.m., Friday, May 25, 2007.

Further information about the proposed rate increases may be obtained by contacting Nancy Lowell, Town Clerk, Town Hall, 206 Buck Street, Stevensville, Montana 59870, phone: (406) 777-5271.

Done by Order of the Council of the Town of Stevensville, Montana, this 23rd day of April, 2007.

Nancy Lowell

Nancy Lowell
Town Clerk

THE EDU SYSTEM FOR WATER & SEWER SYSTEMS

SYSTEM NAME **STEVENSVILLE** Apr-07

| Current Budget | Less-Budget Itens | Current 2006&2007 Budget |
|---|---|---|
| $356,600 | $151,000 | $205,600 |

INVENTORY OF CONNECTIONS BY LINE OR METER SIZE

| SIZE | NO. OF CONNECTIONS | MULTIPLIER | EDU'S |
|---|---|---|---|
| 3/4 INCH | 725 | 1.00 | 725 |
| 1 INCH | 25 | 1.79 | 44.75 |
| 1-1/2INCH | 17 | 4.00 | 68 |
| 2 INCH | 4 | 7.14 | 28.56 |
| 3 INCH | | 16.00 | 0 |
| 4 INCH | | 28.57 | 0 |
| TOTAL | | | 866.31 |

| | | | | |
|---|---|---|---|---|
| NEW DEBT SERVICE | | | MOI | MONTH |
| EXISTING DEBT | | YEAR | | MONTH |
| RESERVE | | YEAR | | MONTH |
| DEPRECIATION | | YEAR | | MONTH |
| OTHER O&M | $208,000 | YEAR | | MONTH |
| | | YEAR | | MONTH |
| TOTAL COST | 208000 | YEAR | | MONTH |

| | | Year | Month |
|---|---|---|---|
| TOTAL BASE COST | 208000 | | |
| EDU'S | 866.31 | $ 240.10 | $ 20.01 |
| EXISTING RATE | | | $ 13.94 |
| INCREASE | | | $ 6.07 |

TE COST PER EDU'S

| SIZE | EDU-COST | MULTIPLIER | TOTAL COST |
|---|---|---|---|
| 3/4 INCH | 20.01 | 1 | $ 20.01 |
| 1 INCH | 20.01 | 1.79 | $ 35.81 |
| 1-1/2INCH | 20.01 | 4 | $ 80.03 |
| 2 INCH | 20.01 | 7.14 | $ 142.86 |
| 3 INCH | 20.01 | 16 | $ 320.13 |
| 4 INCH | 20.01 | 28.57 | $ 571.64 |

**Note:**

| Existing Water Rate | New Water Rate | Increase Water Rate | |
|---|---|---|---|
| $ 13.94 | $ 20.01 | $ 6.07 | Monthly charge |

Target Rate:
Water & Sewer $49.29

Sewer & Water
$35.09 $20.01 $55.10

Over target rate $5.81

# Town of Stevensville

HISTORIC STEVENSVILLE Where Montana Began

*Presentation of the Water and Sewer Revenue Requirements*

October 26, 2009

HDR

***Presented by:***
***Craig Caprara***
***Herta Fairbanks***

# Overview of The Rate Setting Process

- **HDR has developed the results of the water and sewer revenue requirements analysis**

- **Draft results have been reviewed by Staff**

- **Purpose of the presentation is to present the results to the Town Council**

# Comprehensive Rate Setting Process

**Revenue Requirement**

**Compares the revenues of each utility to its expenses to determine the overall level of rate adjustment**

**Cost of Service**

**Equitably allocates the revenue requirements between the various customer classes of service**

**Rate Design**

**Designs rates for each class of service to meet the revenue needs of each utility, along with any other rate design goals and objectives**

# Overview of the Development of Revenue Requirements

- **Revenue Requirements:**
  - **Compares the sources of funds (revenues) with the applications of funds (expenses)**
  - **Reviews a test period**
    - ***for Stevensville, we reviewed 2010 – 2014 (5 years)***
  - **Uses a "Generally Accepted" method to accumulate costs - "Cash Basis"**

# Detail of the "Cash Basis" Approach

+ O&M Expenses
+ Taxes/Transfer Payments
+ Debt Service (P&I)
+ Capital Projects Funded from Rates

= Total Revenue Requirements

\- Miscellaneous Revenues

= Balance Required from Rates

*(i + Term)*

+ Total Capital Projects

\- Revenue Bonds

\- Grants

\- Customer Contributions (e.g. SDC's)

= Capital Projects Funded from Rates

# Financial Planning Considerations

**Reserve levels**

- **Operating Reserve**
- **Debt Reserve**
- **Capital Reserve**
- **Rate Stabilization Reserve**

**Meet *typical* rate covenants associated with outstanding debt/bonds**

- **Debt service coverage ratios**

# Key Assumptions of the District's Revenue Requirements

- **Began with 2009 budget**
- **Projected 2010 through 2014**
- **Assumed inflationary levels for O&M expenses (approximately 3%/year)**
- **Calculated revenues independent of the Town's budget**
- **Assumed customer growth of 2.00% per year for water and sewer**

# Key Inputs in the Town's Revenue Requirements

- **O&M**
  - **Water - $251,000 in 2010**
  - **Sewer - $271,000 in 2010**
- **Capital**
  - **Water**
    - **$3.3 million for Phase 3 – Supply Wells & Storage in 2011**
    - **Capital funded through rates in the amount of $45,000 average per year**
    - **Minimal connection charge revenue**
    - **Balance funded through rates and grants/debt**
  - **Sewer**
    - **$1.2 million in 2010 for Phase 1 – UV Disinfection**
    - **$1.7 million in 2014 for Phase 2 – Headworks Improvements**
    - **Capital funded through rates in the amount of $100,000 average per year**
    - **Balance funded through reserves and grants/debt**
- **Debt Service**
  - **Water – approximately $829,000 during the test period**
  - **Sewer – approximately $887,000 during the test period**

# Summary of the Water Capital Improvement Plan

| CAPITAL IMPROVEMENT PROJECTS | Budget 2009 | Projected 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Water Administration:** | | | | | | |
| **Water Utilities** | | | | | | |
| Repair & Maintenance Supplies | $15,000 | $0 | $0 | $0 | $0 | $0 |
| Phase 3 - Supply Wells & Storage | 0 | 0 | 3,297,747 | 0 | 0 | 0 |
| **Purification & Treatment** | | | | | | |
| Operating Supplies | 389 | 0 | 0 | 0 | 0 | 0 |
| **Transmission & Distribution** | | | | | | |
| Phase 2 - MBFR & Meters | 1,914,299 | 0 | 0 | 0 | 0 | 0 |
| To Reserves | 25,000 | 43,000 | 45,000 | 45,000 | 46,000 | 47,000 |
| | ------------ | ------------ | ------------ | ------------ | ------------ | ------------ |
| **TOTAL WATER FUND** | $1,954,688 | $43,000 | $3,342,747 | $45,000 | $46,000 | $47,000 |
| Unidentified Capital Projects/Transmission Projects | $0 | $0 | $0 | $0 | $0 | $0 |
| **TOTAL CAPITAL IMPROVEMENT PROJECTS** | **$1,954,688** | **$43,000** | **$3,342,747** | **$45,000** | **$46,000** | **$47,000** |

# Summary of the Sewer Capital Improvement Plan

| CAPITAL IMPROVEMENT PROJECTS | Budget 2009 | Projected 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Wastewater Treatment Plant** | | | | | | |
| Phase 1 - UV Disinfection, Emergency Power, Permitting/Decommis: | $0 | $1,238,050 | $0 | $0 | $0 | $0 |
| Phase 2 - Headworks Improvements | 0 | 0 | 0 | 0 | 0 | 1,733,749 |
| Phase 3 - Secondary Biological Treatment Improvements | 0 | 0 | 0 | 0 | 0 | 0 |
| | ------------ | ------------ | ------------ | ------------ | ------------ | ------------ |
| **TOTAL SEWER FUND** | $0 | $1,238,050 | $0 | $0 | $0 | $1,733,749 |
| Unidentified Capital Projects/Transmission Projects | $0 | $0 | $100,278 | $102,284 | $104,329 | $0 |
| **TOTAL CAPITAL IMPROVEMENT PROJECTS** | **$0** | **$1,238,050** | **$100,278** | **$102,284** | **$104,329** | **$1,733,749** |

# Summary of the Water Revenue Requirements

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Sources of Funds** | | | | | | |
| Rate Revenues | $230,094 | $234,696 | $237,993 | $242,753 | $247,608 | $252,560 |
| Non-Operating Revenues | 27,300 | 21,516 | 22,095 | 22,022 | 22,185 | 22,593 |
| **Total Sources of Funds** | **$257,394** | **$256,212** | **$260,088** | **$264,775** | **$269,793** | **$275,154** |
| **Applications of Funds** | | | | | | |
| O&M Expense | $244,075 | $251,190 | $258,932 | $268,162 | $277,732 | $287,655 |
| CIP from Rates | 15,389 | 17,500 | 18,990 | 18,470 | 18,939 | 19,398 |
| Net Debt Service | 60,912 | 60,912 | 192,183 | 192,183 | 192,183 | 192,183 |
| Operating Transfers | 0 | 20,488 | (14,863) | (1,728) | 11,422 | 25,640 |
| **Total Operations & Maintenance** | **$320,376** | **$350,090** | **$455,242** | **$477,087** | **$500,276** | **$524,875** |
| **Balance/(Deficiency) of Funds** | **($62,982)** | **($93,878)** | **($195,154)** | **($212,312)** | **($230,483)** | **($249,722)** |
| **Balance as a % of Rate Rev.** | **27.4%** | **40.0%** | **82.0%** | **87.5%** | **93.1%** | **98.9%** |
| **Proposed Rate Adjustment** | **0.0%** | **40.0%** | **30.0%** | **3.0%** | **3.0%** | **3.0%** |
| **Additional Revenue from Rate Adjustment** | **$0** | **$93,878** | **$195,154** | **$212,312** | **$230,483** | **$249,722** |
| **Balance/Deficiency of Funds after Proposed Rate** | **($62,982)** | **$0** | **$0** | **($0)** | **($0)** | **$0** |

# Summary of the Sewer Revenue Requirements

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Sources of Funds** | | | | | | |
| Operating Revenues | $225,612 | $230,125 | $234,727 | $239,422 | $244,210 | $249,094 |
| Non Operating Revenues | 31,650 | 24,283 | 25,563 | 26,632 | 28,203 | 30,140 |
| **Total Sources of Funds** | $257,262 | $254,408 | $260,290 | $266,054 | $272,413 | $279,234 |
| | | | | | | |
| **Applications of Funds** | | | | | | |
| O&M Expenses | $263,478 | $271,224 | $279,642 | $289,770 | $300,275 | $311,171 |
| CIP from Rates | 0 | 78,050 | 100,278 | 102,284 | 104,329 | 108,749 |
| Net Debt Service | (92,643) | (45,146) | (49,310) | (53,556) | (57,888) | 9,698 |
| Operating Transfers | 96,643 | 53,837 | 50,623 | 67,243 | 79,779 | 18,967 |
| **Total Revenue Requirements** | $267,478 | $357,965 | $381,233 | $405,741 | $426,495 | $448,585 |
| | | | | | | |
| **Balance/(Deficiency) of Funds** | ($10,216) | ($103,557) | ($120,943) | ($139,687) | ($154,082) | ($169,351) |
| | | | | | | |
| **Balance as a % of Rate Revenues** | **4.5%** | **45.0%** | **51.5%** | **58.3%** | **63.1%** | **68.0%** |
| | | | | | | |
| **Proposed Rate Adjustment** | **0.0%** | **45.0%** | **4.5%** | **4.5%** | **3.0%** | **3.0%** |
| | | | | | | |
| **Additional Revenue from Adjustment** | $0 | $103,556 | $120,943 | $139,687 | $154,082 | $169,351 |
| | | | | | | |
| **Total Balance/(Deficiency) of Funds** | ($10,216) | ($0) | $0 | ($0) | $0 | $0 |

# Conclusions of the Revenue Requirements

- **Water rates are projected to be insufficient for the five-year period**
  - **Deficient 40% in 2010**
  - **Approximately 99% by 2014***

- **Sewer rates are projected to be insufficient for the five-year period**
  - **Deficient 45% in 2010**
  - **Approximately 68% by 2014***

- **Adjustments in initial years will reduce the deficiency in the following years**

- **Deficiencies are a combination of O&M expenses and capital programs**

** Rate Deficiencies are cumulative*

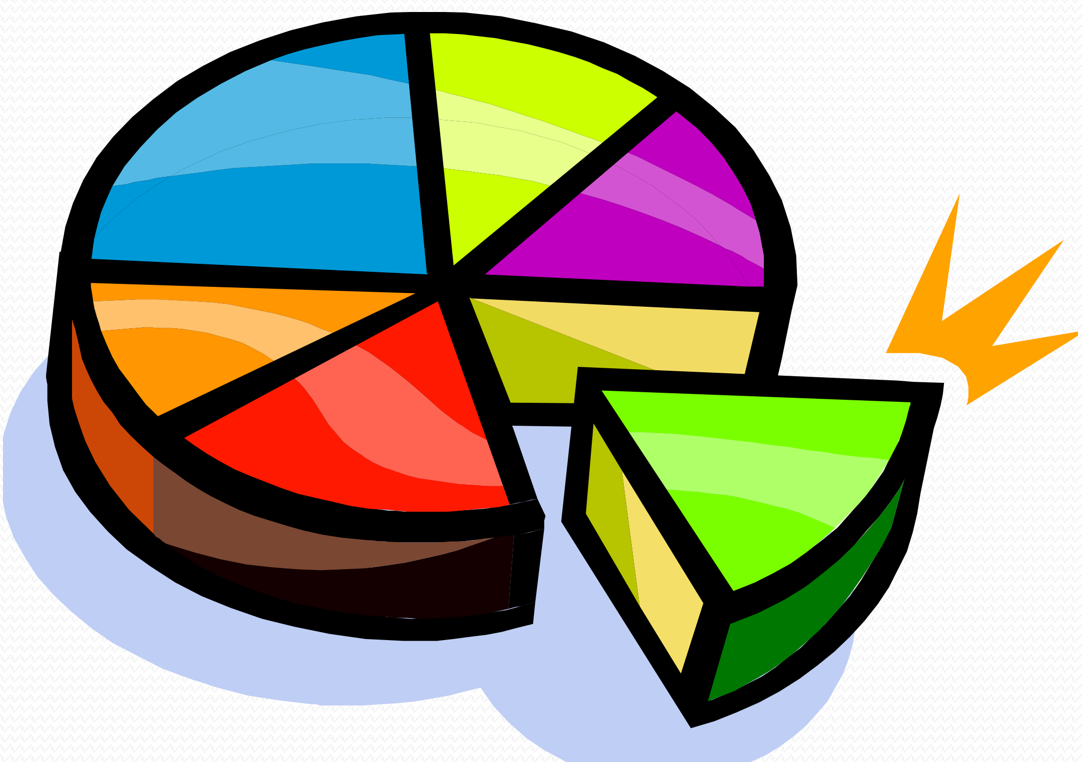
# Recommendations from the Revenue Requirements

- **Water rates should be phased-in over 3-year period**
  - **40% adjustment in 2010**
  - **30% adjustment in 2011**
  - **3% adjustments in 2012-14**
  - **Review rates after those adjustments in 2014**

- **Sewer rates should be phased-in over 3-year period**
  - **45% adjustment in 2010**
  - **4.5% adjustment in 2011-12**
  - **3% adjustment in 2013-14**
  - **Review rates after those adjustments in 2014**

- **Capital Reserves are funded and Sewer draws upon its capital reserve to levelize rate impact of capital programs**

# What's next?



***"Splitting the Pie"***

# ERUs

- Need to put all customers on an even playing field ("equivalent")
- Options:
  - Actual consumption/flow data
  - Design criteria
  - Comparative analysis

# Overview of What the Cost of Service Analyses Do

- **Method to equitably allocate costs between customer classes of service**
- **Considers the reason that costs are incurred**
- **Uses a "generally accepted" approach to allocate costs**
- **Provides unit cost information for eventual rate design**

# Moving Forward

- The revenue requirements portion of the cost of service study for both utilities is complete
- Both water and sewer will need to adjust rates if all planned expenditures are to be covered
- Additional data collection will be needed to develop an accurate cost of service in the future

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 1**
**ESCALATION FACTORS**

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Revenues: | | | | | | |
| Customer Growth | Calculated | 2.00% | 2.00% | 2.00% | 2.00% | 2.00% |
| Miscellaneous Revenues | Budget | 1.00% | 1.00% | 1.00% | 1.00% | 1.00% |
| Expenses: | | | | | | |
| Labor | Budget | 3.00% | 3.00% | 4.00% | 4.00% | 4.00% |
| Supplies & Materials | Budget | 3.00% | 3.00% | 3.00% | 3.00% | 3.00% |
| Equipment | Budget | 3.00% | 3.00% | 3.00% | 3.00% | 3.00% |
| Miscellaneous | Budget | 2.00% | 2.00% | 2.00% | 2.00% | 2.00% |
| Utilities | Budget | 3.00% | 4.00% | 4.00% | 4.00% | 4.00% |
| Interest: | 1.9% | 1.9% | 1.9% | 1.9% | 1.9% | 1.9% |
| Revenue Bond | | | | | | |
| Term in Years | 40 | 40 | 40 | 40 | 40 | 40 |
| Rate | 3.8% | 3.8% | 3.8% | 4.5% | 4.5% | 4.5% |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
SUMMARY OF THE REVENUE REQUIREMENTS
EXHIBIT 2B

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Sources of Funds** | | | | | | |
| Rate Revenues | $230,094 | $234,696 | $237,983 | $242,753 | $247,608 | $252,560 |
| Non-Operating Revenues | 27,300 | 21,516 | 22,095 | 22,022 | 22,185 | 22,593 |
| **Total Sources of Funds** | $257,394 | $256,212 | $260,088 | $264,775 | $269,793 | $275,154 |
| **Applications of Funds** | | | | | | |
| O&M Expense | $244,075 | $251,190 | $258,932 | $268,162 | $277,732 | $287,655 |
| CIP from Rates | 15,369 | 17,500 | 18,990 | 18,470 | 18,939 | 19,398 |
| Net Debt Service | 60,912 | 60,912 | 192,183 | 192,183 | 192,183 | 192,183 |
| Operating Transfers | 0 | 20,488 | (14,863) | (1,728) | 11,422 | 25,640 |
| **Total Operations & Maintenance** | $320,376 | $350,090 | $455,242 | $477,087 | $500,276 | $524,875 |
| **Balance/(Deficiency) of Funds** | ($62,982) | ($93,878) | ($195,154) | ($212,312) | ($230,483) | ($249,722) |
| **Balance as a % of Rate Rev.** | 27.4% | 40.0% | 82.0% | 87.5% | 93.1% | 98.9% |
| **Proposed Rate Adjustment** | 0.0% | 40.0% | 30.0% | 3.0% | 3.0% | 3.0% |
| **Additional Revenue from Rate Adjustment** | $0 | $93,878 | $195,154 | $212,312 | $230,483 | $249,722 |
| **Balance/Deficiency of Funds after Proposed Rate** | ($62,982) | $0 | $0 | ($0) | ($0) | $0 |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 2
SOURCES AND APPLICATIONS OF FUNDS PROJECTED 2009 - 2014



| | Budget | Projected | | | | | |
|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | Notes: |
| SOURCES OF FUNDS | | | | | | | |
| Operating Revenues | | | | | | | |
| Residential | $188,560 | $192,332 | $194,762 | $198,677 | $202,651 | $206,704 | As Customer Growth |
| Commercial | 41,533 | 42,364 | 43,211 | 44,076 | 44,957 | 45,856 | As Customer Growth |
| Total Operating Revenues | $230,094 | $234,696 | $237,993 | $242,753 | $247,608 | $252,560 | |
| Non-Operating Revenues | | | | | | | |
| Investment Earnings (Interest) | $6,000 | 50 | $361 | $67 | $7 | $191 | Calc'd on Oper. Balance |
| Water Revenues | 300 | 306 | 312 | 318 | 325 | 331 | As Customer Growth |
| Sales of Water Materials & Supplies | 3,000 | 3,030 | 3,060 | 3,091 | 3,122 | 3,153 | As Miscellaneous Revenues |
| Water Permits | 200 | 202 | 204 | 206 | 208 | 210 | As Miscellaneous Revenues |
| Miscellaneous Water Revenue | 3,300 | 3,333 | 3,366 | 3,400 | 3,434 | 3,468 | As Miscellaneous Revenues |
| Other Miscellaneous Revenue | 11,000 | 11,110 | 11,221 | 11,333 | 11,447 | 11,561 | As Miscellaneous Revenues |
| Other Financing Sources | 3,500 | 3,535 | 3,570 | 3,606 | 3,642 | 3,679 | As Miscellaneous Revenues |
| Total Non-Operating Revenues | $27,300 | $21,516 | $22,095 | $22,022 | $22,185 | $22,593 | |
| TOTAL SOURCES OF FUNDS | $257,394 | $256,212 | $260,088 | $264,775 | $269,793 | $275,154 | |
| APPLICATION OF FUNDS | | | | | | | |
| Operations & Maintenance | | | | | | | |
| Administration | | | | | | | |
| Salaries & Wages | $70,306 | $72,415 | $74,588 | $77,571 | $80,674 | $83,901 | As Labor |
| Employer Contributions | 24,381 | 25,112 | 25,866 | 26,900 | 27,976 | 29,096 | As Labor |
| Office Supplies & Materials | 500 | 515 | 530 | 546 | 563 | 580 | As Supplies & Materials |
| Operating Supplies | 500 | 515 | 530 | 546 | 563 | 580 | As Supplies & Materials |
| Repair & Maintenance Supplies | 2,000 | 2,060 | 2,122 | 2,185 | 2,251 | 2,319 | As Supplies & Materials |
| Gas, Oil, Diesel Fuel, Grease, etc. | 1,500 | 1,545 | 1,591 | 1,639 | 1,688 | 1,739 | As Equipment |
| Other Repair & Maintenance Supplies | 500 | 515 | 530 | 546 | 563 | 580 | As Supplies & Materials |
| Supplies for Resale | 4,500 | 4,635 | 4,774 | 4,917 | 5,065 | 5,217 | As Supplies & Materials |
| Purchased Services | 1,942 | 2,000 | 2,060 | 2,122 | 2,186 | 2,251 | As Supplies & Materials |
| Communication & Transportation | 0 | 0 | 0 | 0 | 0 | 0 | As Equipment |
| Postage, Box Rent, etc. | 225 | 230 | 234 | 239 | 244 | 248 | As Miscellaneous |
| Publicity, Subscriptions & Dues | 700 | 714 | 728 | 743 | 758 | 773 | As Miscellaneous |
| Membership & Registration Fees | 3,600 | 3,672 | 3,745 | 3,820 | 3,897 | 3,975 | As Miscellaneous |
| Utility Services | 450 | 464 | 482 | 501 | 521 | 542 | As Utilities |
| Professional Services | 3,000 | 3,090 | 3,183 | 3,310 | 3,442 | 3,580 | As Labor |
| Legal Services | 10,000 | 10,300 | 10,609 | 11,033 | 11,475 | 11,934 | As Labor |
| Repair & Maintenance Services | 800 | 824 | 849 | 874 | 900 | 927 | As Supplies & Materials |
| Travel | 1,000 | 1,020 | 1,040 | 1,061 | 1,082 | 1,104 | As Miscellaneous |
| Training Services | 1,500 | 1,530 | 1,561 | 1,592 | 1,624 | 1,656 | As Miscellaneous |
| Other Purchased Services | 2,500 | 2,550 | 2,601 | 2,653 | 2,706 | 2,760 | As Miscellaneous |
| Insurance | 9,500 | 9,690 | 9,884 | 10,081 | 10,283 | 10,489 | As Miscellaneous |
| Machinery & Equipment | 1,500 | 1,545 | 1,591 | 1,639 | 1,688 | 1,739 | As Equipment |
| Total Administration | $140,904 | $144,841 | $149,100 | $154,522 | $160,149 | $165,988 | |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 2
SOURCES AND APPLICATIONS OF FUNDS PROJECTED 2009 - 2014



| | Budget 2009 | Projected 2010 | 2011 | 2012 | 2013 | 2014 | Notes: |
|---|---|---|---|---|---|---|---|
| Source of Supply & Pumping | | | | | | | |
| Repair & Maintenance Supplies | $6,500 | $6,695 | $6,896 | $7,103 | $7,316 | $7,535 | As Supplies & Materials |
| Utility Services | 20,000 | 20,600 | 21,424 | 22,281 | 23,172 | 24,099 | As Utilities |
| Professional Services | 3,500 | 3,605 | 3,713 | 3,862 | 4,016 | 4,177 | As Labor |
| Total Source of Supply & Pumping | $30,000 | $30,900 | $32,033 | $33,245 | $34,504 | $35,811 | |
| Purification & Treatment | | | | | | | |
| Operating Supplies | $16,000 | $16,480 | $16,974 | $17,484 | $18,008 | $18,548 | As Supplies & Materials |
| Repair & Maintenance Supplies | 18,000 | 18,540 | 19,096 | 19,669 | 20,259 | 20,867 | As Supplies & Materials |
| Gas, Oil, Diesel Fuel, Grease, Etc. | 349 | 359 | 370 | 381 | 393 | 405 | As Equipment |
| Other Repair & Maintenance Supplies | 2,500 | 2,575 | 2,652 | 2,732 | 2,814 | 2,898 | As Supplies & Materials |
| Publicity, Subscriptions & Dues | 700 | 714 | 728 | 743 | 758 | 773 | As Miscellaneous |
| Utility Services | 20,000 | 20,600 | 21,424 | 22,281 | 23,172 | 24,099 | As Utilities |
| Professional Services | 6,000 | 6,180 | 6,365 | 6,620 | 6,885 | 7,160 | As Labor |
| Other Purchased Services | 1,000 | 1,020 | 1,040 | 1,061 | 1,082 | 1,104 | As Miscellaneous |
| Total Purification & Treatment | $64,549 | $66,468 | $68,651 | $70,971 | $73,371 | $75,854 | |
| Transmission & Distribution | | | | | | | |
| Repair & Maintenance Supplies | $8,500 | $8,755 | $9,018 | $9,288 | $9,567 | $9,854 | As Supplies & Materials |
| Supplies for Resale | 0 | 0 | 0 | 0 | 0 | 0 | As Supplies & Materials |
| Utility Services | 122 | 126 | 131 | 136 | 141 | 147 | As Utilities |
| Total Transmission & Distribution | $8,622 | $8,881 | $9,148 | $9,424 | $9,708 | $10,001 | |
| TOTAL OPERATIONS & MAINTENANCE | $244,075 | $251,190 | $258,932 | $268,162 | $277,732 | $287,655 | |
| NET CIP FROM RATES | $15,389 | $17,500 | $18,990 | $18,470 | $18,939 | $19,398 | Depreciation = $17,205 EOY 2006 |
| Debt Service | | | | | | | |
| Existing | $0 | $0 | $0 | $0 | $0 | $0 | From Debt Schedule |
| New Revenue Bond | 60,912 | 60,912 | 192,183 | 192,183 | 192,183 | 192,183 | Assumed 40 Years |
| Total Debt Service | $60,912 | $60,912 | $192,183 | $192,183 | $192,183 | $192,183 | |
| Less: Debt Related Revenue | $0 | $0 | $0 | $0 | $0 | $0 | |
| Net Debt Service | $60,912 | $60,912 | $192,183 | $192,183 | $192,183 | $192,183 | |
| Operating Transfers | | | | | | | |
| Water Construction Fund | $0 | $0 | $0 | $0 | $0 | $0 | |
| Water Operating Fund | 0 | 19,488 | (15,863) | (3,228) | 9,922 | 24,140 | |
| To Rate Stabilization Fund | 0 | 1,000 | 1,000 | 1,500 | 1,500 | 1,500 | |
| To Debt Reserve Fund | 0 | 0 | 0 | 0 | 0 | 0 | |
| Total Operating Transfers | $0 | $20,488 | ($14,863) | ($1,728) | $11,422 | $25,640 | |

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 2**
**SOURCES AND APPLICATIONS OF FUNDS PROJECTED 2009 - 2014**



| | Budget | Projected | | | | | |
|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | Notes: |
| TOTAL REVENUE REQUIREMENTS | $320,376 | $350,090 | $455,242 | $477,087 | $500,276 | $524,875 | |
| **Balance/(Deficiency) of Funds** | ($62,982) | ($93,878) | ($195,154) | ($212,312) | ($230,483) | ($249,722) | |
| **Balance as a % of Rate Rev.** | 27.4% | 40.0% | 82.0% | 87.5% | 93.1% | 98.9% | |
| Proposed Rate Adjustment | 0.0% | 40.0% | 30.0% | 3.0% | 3.0% | 3.0% | Minimum Adjustment = Inflation |
| Additional Revenue from Rate Adjustment | $0 | $93,878 | $195,154 | $212,312 | $230,483 | $249,722 | |
| Balance/Deficiency of Funds after Proposed Rate | ($62,982) | $0 | $0 | ($0) | ($0) | $0 | |
| Residential Quarterly Average Rate | | | | | | | |
| Before Proposed Rate Adjustment | $51.31 | | | | | | |
| After Proposed Rate Adjustment | $51.31 | $71.83 | $93.38 | $96.19 | $99.07 | $102.04 | |
| Debt Service Coverage Ratio | | | | | | | |
| Before Rate Adjustment | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | |
| After Proposed Rate Adjustment | 0.00 | 1.27 | 0.91 | 0.97 | 1.04 | 1.12 | |
| Operating Reserve Fund | | | | | | | |
| Beginning Balance | $0 | $0 | $19,488 | $3,625 | $397 | $10,319 | |
| Plus: To Operating Reserves | 0 | 19,488 | (15,863) | (3,228) | 9,922 | 24,140 | |
| Less: Uses of Funds | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ending Balance | $0 | $19,488 | $3,625 | $397 | $10,319 | $34,459 | |
| 120 days O&M Minimum | 80,244 | 82,583 | 85,128 | 88,163 | 91,309 | 94,571 | |
| Capital Reserves | | | | | | | |
| Beginning Balance | $312,017 | $343,021 | $392,764 | $445,447 | $499,104 | $554,763 | 2009 balance reflects 2008 EOY balance |
| Plus: Interest | 6,004 | 6,744 | 7,682 | 8,657 | 9,659 | 10,698 | |
| Plus: To Reserves | 25,000 | 43,000 | 45,000 | 45,000 | 46,000 | 47,000 | |
| Less: Uses of Funds | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ending Balance | $343,021 | $392,764 | $445,447 | $499,104 | $554,763 | $612,460 | |
| Target = average annual CIP: $ | $56,299 | $56,299 | $122,254 | $122,254 | $122,254 | $122,254 | |
| Rate Stabilization/Emergency Reserve | | | | | | | |
| Beginning Balance | $0 | $0 | $1,000 | $2,019 | $3,557 | $5,123 | |
| Plus: Interest | 0 | 0 | 19 | 38 | 66 | 95 | |
| Plus: To Reserves | 0 | 1,000 | 1,000 | 1,500 | 1,500 | 1,500 | |
| Less: Uses of Funds | 0 | 0 | 0 | 0 | 0 | 0 | |
| Ending Balance | $0 | $1,000 | $2,019 | $3,557 | $5,123 | $6,719 | |
| Target = 3% Operating Revenue | $7,000 | $7,000 | $7,000 | $7,000 | $7,000 | $8,000 | |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 3
CAPITAL IMPROVEMENT FUNDING

| | Budget | Projected | | | | | |
|---|---|---|---|---|---|---|---|
| CAPITAL IMPROVEMENT PROJECTS | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | Notes: |
| **Water Administration:** | | | | | | | |
| **Water Utilities** | | | | | | | |
| Repair & Maintenance Supplies | $15,000 | $0 | $0 | $0 | $0 | $0 | |
| Phase 3 - Supply Wells & Storage | 0 | 0 | 3,297,747 | 0 | 0 | 0 | |
| **Purification & Treatment** | | | | | | | |
| Operating Supplies | 389 | 0 | 0 | 0 | 0 | 0 | |
| **Transmission & Distribution** | | | | | | | |
| Phase 2 - MBFR & Meters | 1,914,299 | 0 | 0 | 0 | 0 | 0 | |
| To Reserves | 25,000 | 43,000 | 45,000 | 45,000 | 46,000 | 47,000 | |
| **TOTAL WATER FUND** | $1,954,688 | $43,000 | $3,342,747 | $45,000 | $46,000 | $47,000 | |
| Unidentified Capital Projects/Transmission Projects | $0 | $0 | $0 | $0 | $0 | $0 | |
| TOTAL CAPITAL IMPROVEMENT PROJECTS | $1,954,688 | $43,000 | $3,342,747 | $45,000 | $46,000 | $47,000 | |
| **LESS: OUTSIDE FUNDING** | | | | | | | |
| Water System Development Fees | $25,000 | $25,500 | $26,010 | $26,530 | $27,061 | $27,602 | Infrastructure Revenue |
| Operating Cash | 0 | 0 | 0 | 0 | 0 | 0 | |
| Capital Reserves | 0 | 0 | 0 | 0 | 0 | 0 | |
| Grant Funding | 662,500 | 0 | 600,000 | 0 | 0 | 0 | |
| Anticipated New Debt | 1,251,799 | 0 | 2,697,747 | 0 | 0 | 0 | |
| Unanticipated New Debt | 0 | 0 | 0 | 0 | 0 | 0 | |
| **TOTAL OUTSIDE FUNDING** | $1,939,299 | $25,500 | $3,323,757 | $26,530 | $27,061 | $27,602 | |
| **TOTAL CAPITAL IMPROVEMENTS FUNDED THROUGH RATES** | $15,389 | $17,500 | $18,990 | $18,470 | $18,939 | $19,398 | |
| Target CIP Through Rates | $55,799 | $55,799 | $121,754 | $121,754 | $121,754 | $121,754 | Depreciation = $17,205 EOY 2006 |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 4
DEVELOPMENT OF REVENUES AT *PRESENT* RATES FOR TEST YEAR CY 2008

| | | Jan-08 | Feb-08 | Mar-08 | Apr-08 | May-08 | Jun-08 | Jul-08 | Aug-08 | Sep-08 | Oct-08 | Nov-08 | Dec-08 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Residential-Metered** | | | | | | | | | | | | | | |
| 3/4" - in | $43.96 | | | 430 | | | 430 | | | 430 | | | 430 | 430 |
| 1" - In | $78.68 | | | 36 | | | 35 | | | 36 | | | 36 | 36 |
| 1.5" - In | $174.76 | | | 14 | | | 14 | | | 14 | | | 14 | 14 |
| 2" - In | $313.87 | | | 3 | | | 3 | | | 3 | | | 3 | 3 |
| 3/4" - out | $39.80 | | | 3 | | | 3 | | | 3 | | | 3 | 3 |
| 1" - out | $103.84 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| 1.5" - out | $232.04 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| 2" - out | $414.19 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| Total Number of Customers | | | | 486 | | | 488 | | | 485 | | | 486 | 486 |
| Total Monthly Charge | | | | $25,243 | | | $25,243 | | | $25,243 | | | $25,243 | $100,972 |
| **Residential Consumption (1,000 gal)** | | | | | | | | | | | | | | |
| Consumption Over 10,000 gal | 0.55 | | | 1,667,430 | | | 13,250,120 | 56,400 | 72,200 | 28,506,530 | 4,100 | 2,400 | 5,643,100 | 49,202,280 |
| Total Consumption | | | | 1,667,430 | | | 13,250,120 | 56,400 | 72,200 | 28,506,530 | 4,100 | 2,400 | 5,643,100 | 49,202,280 |
| Water Consumption Charge | | | | $917 | | | $7,288 | | | $15,679 | | | $3,104 | $26,987 |
| DEQ Dept of Environmental Quality | 2.00 | | | $860 | | | | | | | | | | $860 |
| **Total Residential Metered** | | | | $27,020 | | | $32,530 | | | $40,922 | | | $28,347 | $128,819 |
| **Residential-Non-metered** | | | | | | | | | | | | | | |
| Flat - 3/4" in | $51.31 | | | 214 | | | 214 | | | 214 | | | 214 | 214 |
| Flat - 1" in | $51.31 | | | 1 | | | 1 | | | 1 | | | 1 | 1 |
| Flat - 3/4" out | $51.31 | | | 24 | | | 24 | | | 24 | | | 24 | 24 |
| Total Number of Customers | | | | 239 | | | 239 | | | 239 | | | 239 | 239 |
| Total Monthly Charge | | | | $12,263 | | | $12,263 | | | $12,263 | | | $12,263 | $49,052 |
| DEQ Dept of Environmental Quality | 2.00 | | | $478 | | | | | | | | | | $478 |
| Irrigation | $16.45 | | | | | | 198 | | | 198 | | | | 198 |
| Total Irrigation Charge | | | | | | | $3,257 | | | $3,257 | | | | $6,514 |
| **Total Residential Non-metered** | | | | $12,741 | | | $15,520 | | | $15,520 | | | $12,263 | $56,045 |
| **Commercial** | | | | | | | | | | | | | | |
| **metered** | | | | | | | | | | | | | | |
| 3/4" - in | $43.96 | | | 40 | | | 40 | | | 40 | | | 40 | 40 |
| 1" - in | $78.68 | | | 18 | | | 18 | | | 18 | | | 18 | 18 |
| 1.5" - In | $174.76 | | | 12 | | | 12 | | | 12 | | | 12 | 12 |
| 2" - in | $313.87 | | | 3 | | | 3 | | | 3 | | | 3 | 3 |
| 3/4" - out | $39.80 | | | 1 | | | 1 | | | 1 | | | 1 | 1 |
| 1" - out | $103.84 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| 1.5" - out | $232.04 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| 2" - out | $414.19 | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| flat | | | | 0 | | | 0 | | | 0 | | | 0 | 0 |
| 3/4" - in | $43.96 | | | 22 | | | 22 | | | 22 | | | 22 | 22 |
| 1.5" - in | $174.76 | | | 1 | | | 1 | | | 1 | | | 1 | 1 |
| 3/4 - out | $39.80 | | | 1 | | | 1 | | | 1 | | | 1 | 1 |
| Total Number of Customers | | | | 98 | | | 98 | | | 98 | | | 98 | 98 |
| Total Monthly Charge | | | | $7,435 | | | $7,435 | | | $7,435 | | | $7,435 | $29,739 |
| **Non-Residential Consumption (1,000 gal)** | | | | | | | | | | | | | | |
| Consumption Over 10 000 gal | $0.55 | | | 2,891,480 | | | 4,686,530 | | | 7,703,310 | | | 4,083,340 | 19,364,660 |
| Total Consumption | | | | 2,891,480 | | | 4,686,530 | | | 7,703,310 | | | 4,083,340 | 19,364,660 |
| Water Consumption Charge | | | | $1,590 | | | $2,578 | | | $4,237 | | | $2,246 | $10,651 |
| Irrigation | $16.45 | | | | | | 10 | | | 10 | | | | 10 |
| Total Irrigation Charge | | | | | | | $165 | | | $165 | | | | $329 |
| **Total Commercial** | | | | $9,025 | | | $10,177 | | | $11,836 | | | $9,681 | $40,390 |
| **TOTAL REVENUE** | | | | | | | | | | | | | | $225,253 |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 4B
CALCULATION OF 2011 EQUIVALENT RESIDENTIAL METERED REVENUE
FOR EXISTING NON-METERED CUSTOMERS

| | Average Metered Bill | # Of Non-metered Customers | 2011 Converted Revenue |
|---|---|---|---|
| 3/4" in | $57.84 | 214 | $52,543 |
| 1" | $92.56 | 1 | $381 |
| 3/4" out | $53.68 | 24 | $5,153 |
| | | | $58,078 |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 5
DEVELOPMENT OF THE COMMODITY ALLOCATION FACTOR

| | 2008 Consumption in 1,000 gal | 40.00% Losses [1] | Total Water Delivered (Cons. + Losses) | Consumption (MGD) [2] | % of Total |
|---|---|---|---|---|---|
| Residential | 102,398 | 40,959 | 143,358 | 0.39 | 81.5% |
| Commercial | 23,285 | 9,314 | 32,599 | 0.09 | 18.5% |
| Total Consumption | 125,683 | 50,273 | 175,956 | 0.48 | 100.0% |
| | | *Total Production [3]* | 290,140,500 | *0.79* | |
| Allocation Factor | | | | | (COMM) |

Notes: [1] PCI provided losses of 40%, however total production less total measured consumption shows closer to 60% non-revenue water
[2] Total Consumption in 1,000 gal/365/1,000
[3] From Town Data - 2008 total production

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 6**
**DEVELOPMENT OF THE CAPACITY ALLOCATION FACTOR**

| | Average Consumption (MGD) | Peaking Factors [1] | Peak Day Use (MGD) | % of Total |
|---|---|---|---|---|
| Residential | 0.39 | 2.33 | 0.91 | 86.5% |
| Commercial | 0.09 | 1.59 | 0.14 | 13.5% |
| Total | 0.48 | 2.19 | 1.06 | 100.0% |
| Allocation Factor | | | | (CAP) |

Note: [1] Peak flow per ERU of 1,275 gpd / average flow per ERU of 675 gpd

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 7
DEVELOPMENT OF THE CUSTOMER ALLOCATION FACTOR

| | Actual Customer | | Customer Service & Accounting | | | Meters & Services | | |
|---|---|---|---|---|---|---|---|---|
| | Number of Meters | % of Total | Weighting Factor | Weighted Customer | % of Total | Weighting Factor | Weighted Customer | % of Total |
| Residential | 725 | 88.1% | 1.00 | 725 | 88.1% | $197 | 142,825 | 88.1% |
| Commercial | 98 | 11.9% | 1.00 | 98 | 11.9% | 197 | 19,306 | 11.9% |
| Total | 823 | 100.0% | | 823 | 100.0% | | $162,131 | 100.0% |
| Allocation Factor | | (AC) | | | (WCA) | | | (WCMS) |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 8
DEVELOPMENT OF THE PUBLIC FIRE PROTECTION ALLOCATION FACTOR

| | Number of Meters | Fire Protection Requirements (gals/min) [1] | Duration (minutes) [1] | Total FP Requirements (1,000 g/min) | % of Total |
|---|---|---|---|---|---|
| Residential | 725 | 2,000 | 120 | 174,000 | 73.8% |
| Commercial | 98 | 3,500 | 180 | 61,740 | 26.2% |
| Total | 823 | | | 235,740 | 100.0% |
| Allocation Factor | | | | | (FP) |

Note: [1] Town provided flow and duration requirements

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 9
DEVELOPMENT OF THE REVENUE RELATED ALLOCATION FACTOR

| | Projected 2010 | % of Total |
|---|---|---|
| Residential | $192,332 | 81.9% |
| Commercial | 42,364 | 18.1% |
| Total Rate Revenues | $234,696 | 100.0% |
| Allocation Factor | | (RR) |

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 10**
**FUNCTIONALIZATION AND CLASSIFICATION OF RATE BASE**

| | | | | Customer Related | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Weighted for: | | | | | | |
| | 2007 | Commodity (COMM) | Capacity (CAP) | Actual Customer (AC) | Cust. Acctg (WCA) | Meters & Services (WCMS) | Public Fire Protection (FP) | Revenue Related (RR) | Direct Assign. (DA) | Pumping Zones (PZ) | *Basis of Classification* |
| **Water Treatment** | | | | | | | | | | | |
| Water Treatment Building | $32,824 | $15,099 | $17,725 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | 45.0% Comm 54.0% Cap |
| Blower Building | 55,271 | 25,425 | 29,846 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46.0% Comm 54.0% Cap |
| Water Treatment Plant | 562,852 | 258,912 | 303,940 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46.0% Comm 54.0% Cap |
| Total - Treatment | $650,947 | $299,436 | $351,511 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| **Transmission & Distribution** | | | | | | | | | | | |
| Equipment Shop #2 | $28,613 | $28,613 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | 100.0% Comm |
| Total - Distribution/Transmission | $28,613 | $28,613 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| **Pumping and Storage** | | | | | | | | | | | |
| WTP Reservoir | $84,754 | $0 | $34,852 | $0 | $0 | $0 | $49,902 | $0 | $0 | $0 | 41.1% Cap 58.9% Fire |
| Water Pump | 18,900 | 0 | 7,772 | 0 | 0 | 0 | 11,128 | 0 | 0 | 0 | 41.1% Cap 58.9% Fire |
| Total - Pumping and Storage | $103,654 | $0 | $42,624 | $0 | $0 | $0 | $61,030 | $0 | $0 | $0 | |
| **Plant Before General Plant** | $783,214 | $328,049 | $394,135 | $0 | $0 | $0 | $61,030 | $0 | $0 | $0 | |
| Percent Plant Before General Plant | 100.0% | 41.9% | 50.3% | 0.0% | 0.0% | 0.0% | 7.8% | 0.0% | 0.0% | 0.0% | Factor PBG |
| **General Plant** | | | | | | | | | | | |
| Hose Lot 1.75" | $7,140 | $2,991 | $3,593 | $0 | $0 | $0 | $556 | $0 | $0 | $0 | As PBG |
| Hose Lot 5" | 10,432 | 4,369 | 5,250 | 0 | 0 | 0 | 813 | 0 | 0 | 0 | As PBG |
| Lawn Mower | 17,624 | 7,382 | 8,569 | 0 | 0 | 0 | 1,373 | 0 | 0 | 0 | As PBG |
| Total General Plant | $35,196 | $14,742 | $17,712 | $0 | $0 | $0 | $2,743 | $0 | $0 | $0 | |
| **Total Plant** | **$818,410** | **$342,790** | **$411,847** | **$0** | **$0** | **$0** | **$63,772** | **$0** | **$0** | **$0** | |
| Less Accumulated Depreciation | | | | | | | | | | | |
| Treatment | $374,298 | $172,177 | $202,121 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | As Treatment |
| Transmission & Distribution | 17,608 | 17,608 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | As Transmission & Distribution |
| Pumping & Storage | 100,264 | 0 | 41,230 | 0 | 0 | 0 | 59,034 | 0 | 0 | 0 | As Pumping & Storage |
| General Plant | 35,196 | 14,742 | 17,712 | 0 | 0 | 0 | 2,743 | 0 | 0 | 0 | As General Plant |
| Total Accumulated Depreciation | $527,355 | $204,527 | $261,063 | $0 | $0 | $0 | $61,776 | $0 | $0 | $0 | |
| Less Developer Contribution | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | As Total Plant |
| **Rate Base** | **$291,044** | **$138,284** | **$150,786** | **$0** | **$0** | **$0** | **$1,896** | **$0** | **$0** | **$0** | |

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 11**
**DIRECT ASSIGNMENT OF RATE BASE**

| | Total | Residential | Commercial | Notes: |
|---|---|---|---|---|
| **Water Treatment** | | | | |
| Water Treatment Building | $0 | $0 | $0 | |
| Blower Building | 0 | 0 | 0 | |
| Water Treatment Plant | 0 | 0 | 0 | |
| Total - Treatment | $0 | $0 | $0 | |
| Transmission & Distribution | | | | |
| Equipment Shop #2 | $0 | $0 | $0 | |
| Total - Distribution/Transmission | $0 | $0 | $0 | |
| Pumping and Storage | | | | |
| WTP Reservoir | $0 | $0 | $0 | |
| Water Pump | 0 | 0 | 0 | |
| Total - Pumping and Storage | 0 | 0 | 0 | |
| Plant Before General Plant | $0 | $0 | $0 | |
| Percent Plant Before General Plant | 0.0% | 0.0% | 0.0% | |
| General Plant | $0 | $0 | $0 | |
| Hose Lot 1.75" | 0 | 0 | 0 | |
| Hose Lot 5" | 0 | 0 | 0 | |
| Lawn Mower | 0 | 0 | 0 | |
| Total General Plant | $0 | $0 | $0 | |
| **Total Plant** | $0 | $0 | $0 | |
| Less: Accumulated Depreciation | | | | |
| Treatment | $0 | $0 | $0 | |
| Transmission & Distribution | 0 | 0 | 0 | |
| Pumping & Storage | 0 | 0 | 0 | |
| General Plant | 0 | 0 | 0 | |
| Total Accumulated Depreciation | $0 | $0 | $0 | |
| Less: Developer Contribution | $0 | $0 | $0 | |
| **Rate Base** | $0 | $0 | $0 | |

TOWN OF STEVENSVILLE
WATER EXHIBIT 12
DISTRIBUTION STORAGE

**Fire Protection**

| | hrs | mg | Total |
|---|---|---|---|
| Fire Flow Requirements | 3 | 3,500 | 630,000 |
| Total Required Storage Capacity [1] | | | 1,070,000 |
| % Public Fire Protection | | | 58.9% |
| % Capacity | | | 41.1% |

Note: [1] The Town is currently undersized for storage capacity, therefore recommended capacity is used.

**Source of Supply**

Capacity/Commodity

| | | | |
|---|---|---|---|
| Average Day | 0.48 | COMM | 46.0% |
| Peak Day | 1.08 | (1-COMM)=Cap | 54.0% |

**Distribution Main Analysis**

| Main Size | Length (ft) | Replcmt $ | Total |
|---|---|---|---|
| 0.8 | | $83.00 | $0 |
| 1 | | 83.00 | 0 |
| 1.3 | | 83.00 | 0 |
| 1.5 | | 83.00 | 0 |
| 2 | | 83.00 | 0 |
| 3 | | 83.00 | 0 |
| 4 | | 83.00 | 0 |
| 6 | | 83.00 | 0 |
| 8 | | 83.00 | 0 |
| 10 | | 108.00 | 0 |
| 12 | | 108.00 | 0 |
| 14 | | 130.00 | 0 |
| 16 | | 130.00 | 0 |
| 18 | | 130.00 | 0 |
| 20 | | 179.00 | 0 |
| 24 | | 179.00 | 0 |
| 30 | | 200.00 | 0 |
| 36 | | 200.00 | 0 |
| 42 | | 200.00 | 0 |
| | 0 | | 0 |

| | | | Adjusted |
|---|---|---|---|
| **Customer%** | | | |
| (1) Total @ 2" Equiv | | $0 | |
| /Total Cost | #DIV/0! | | 25.0% |
| **Capacity** | | | |
| (2) Cost for 2-10" | | $0 | |
| (3) Equiv 10" for larger | | 0 | |
| 1+2-3/4 | #DIV/0! | | 65.0% |
| **Fire Protection** | | | |
| 1-comm-cap | #DIV/0! | | 10.0% |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 13
FUNCTIONALIZATION AND CLASSIFICATION OF REVENUE REQUIREMENTS



| | 2010 | Commodity (Comm) | Capacity (Cap) | Customer Related: Actual Customer (AC) | Customer Related: Weighted for: Cust. Acctg. (WCA) | Customer Related: Weighted for: Meters & Services (WCMS) | Public Fire Protection (FP) | Revenue Related (RR) | Direct Assign. (DA) | *Basis of Classification* |
|---|---|---|---|---|---|---|---|---|---|---|
| Administration | | | | | | | | | | |
| Salaries & Wages | $72,415 | $0 | $0 | $72,415 | $0 | $0 | $0 | $0 | $0 | As AC |
| Employer Contributions | 25,112 | 0 | 0 | 25,112 | 0 | 0 | 0 | 0 | 0 | As AC |
| Office Supplies & Materials | 515 | 0 | 0 | 515 | 0 | 0 | 0 | 0 | 0 | As AC |
| Operating Supplies | 515 | 0 | 0 | 515 | 0 | 0 | 0 | 0 | 0 | As AC |
| Repair & Maintenance Supplies | 2,060 | 863 | 1,037 | 0 | 0 | 0 | 161 | 0 | 0 | As PBG |
| Gas, Oil, Diesel Fuel, Grease, etc. | 1,545 | 0 | 0 | 1,545 | 0 | 0 | 0 | 0 | 0 | As AC |
| Other Repair & Maintenance Supplies | 515 | 216 | 259 | 0 | 0 | 0 | 40 | 0 | 0 | As PBG |
| Supplies for Resale | 4,635 | 0 | 0 | 4,635 | 0 | 0 | 0 | 0 | 0 | As AC |
| Purchased Services | 2,000 | 0 | 0 | 2,000 | 0 | 0 | 0 | 0 | 0 | As AC |
| Communication & Transportation | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | As AC |
| Postage, Box Rent, etc. | 230 | 0 | 0 | 230 | 0 | 0 | 0 | 0 | 0 | As AC |
| Publicity, Subscriptions & Dues | 714 | 0 | 0 | 714 | 0 | 0 | 0 | 0 | 0 | As AC |
| Membership & Registration Fees | 3,672 | 0 | 0 | 3,672 | 0 | 0 | 0 | 0 | 0 | As AC |
| Utility Services | 464 | 0 | 0 | 464 | 0 | 0 | 0 | 0 | 0 | As AC |
| Professional Services | 3,090 | 0 | 0 | 3,090 | 0 | 0 | 0 | 0 | 0 | As AC |
| Legal Services | 10,300 | 0 | 0 | 10,300 | 0 | 0 | 0 | 0 | 0 | As AC |
| Repair & Maintenance Services | 824 | 345 | 415 | 0 | 0 | 0 | 64 | 0 | 0 | As PBG |
| Travel | 1,020 | 0 | 0 | 1,020 | 0 | 0 | 0 | 0 | 0 | As AC |
| Training Services | 1,530 | 0 | 0 | 1,530 | 0 | 0 | 0 | 0 | 0 | As AC |
| Other Purchased Services | 2,550 | 0 | 0 | 2,550 | 0 | 0 | 0 | 0 | 0 | As AC |
| Insurance | 9,690 | 0 | 0 | 9,690 | 0 | 0 | 0 | 0 | 0 | As AC |
| Machinery & Equipment | 1,545 | 647 | 777 | 0 | 0 | 0 | 120 | 0 | 0 | As PBG |
| Total Administration | $144,941 | $2,071 | $2,488 | $139,997 | $0 | $0 | $385 | $0 | $0 | |
| Source of Supply & Pumping | | | | | | | | | | |
| Repair & Maintenance Supplies | $6,695 | $0 | $2,753 | $0 | $0 | $0 | $3,942 | $0 | $0 | As Pumping & Storage |
| Utility Services | 20,600 | 0 | 8,471 | 0 | 0 | 0 | 12,129 | 0 | 0 | As Pumping & Storage |
| Professional Services | 3,605 | 0 | 1,482 | 0 | 0 | 0 | 2,123 | 0 | 0 | As Pumping & Storage |
| Total Source of Supply & Pumping | $30,900 | $0 | $12,707 | $0 | $0 | $0 | $18,193 | $0 | $0 | |
| Purification & Treatment | | | | | | | | | | |
| Operating Supplies | $16,480 | $7,581 | $8,899 | $0 | $0 | $0 | $0 | $0 | $0 | As Treatment |
| Repair & Maintenance Supplies | 18,540 | 8,528 | 10,012 | 0 | 0 | 0 | 0 | 0 | 0 | As Treatment |
| Gas, Oil, Diesel Fuel, Grease, Etc. | 359 | 165 | 194 | 0 | 0 | 0 | 0 | 0 | 0 | As Treatment |
| Other Repair & Maintenance Supplies | 2,575 | 1,185 | 1,391 | 0 | 0 | 0 | 0 | 0 | 0 | As Treatment |
| Publicity, Subscriptions & Dues | 714 | 328 | 386 | 0 | 0 | 0 | 0 | 0 | 0 | As Treatment |
| Utility Services | 20,600 | 9,476 | 11,124 | 0 | 0 | 0 | 0 | 0 | 0 | As Treatment |
| Professional Services | 6,180 | 2,843 | 3,337 | 0 | 0 | 0 | 0 | 0 | 0 | As Treatment |
| Other Purchased Services | 1,020 | 469 | 551 | 0 | 0 | 0 | 0 | 0 | 0 | As Treatment |
| Total Purification & Treatment | $68,468 | $30,575 | $35,893 | $0 | $0 | $0 | $0 | $0 | $0 | |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 13
FUNCTIONALIZATION AND CLASSIFICATION OF REVENUE REQUIREMENTS

| | 2010 | Commodity (Comm) | Capacity (Cap) | Customer Related: Actual Customer (AC) | Customer Related: Weighted for: Cust. Acctg. (WCA) | Customer Related: Weighted for: Meters & Services (WCMS) | Public Fire Protection (FP) | Revenue Related (RR) | Direct Assign. (DA) | *Basis of Classification* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Transmission & Distribution** | | | | | | | | | | |
| Repair & Maintenance Supplies | $8,755 | $8,755 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | As Transmission & Distribution |
| Supplies for Resale | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | As Transmission & Distribution |
| Utility Services | 126 | 126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | As Transmission & Distribution |
| **Total Transmission & Distribution** | $8,881 | $8,881 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| **TOTAL OPERATIONS & MAINTENANCE** | $251,190 | $41,527 | $51,087 | $139,997 | $0 | $0 | $18,579 | $0 | $0 | |
| **NET CIP FROM RATES** | $17,500 | $7,330 | $8,808 | $0 | $0 | $0 | $1,364 | $0 | $0 | As Plant Before General Plant |
| Debt Service | | | | | | | | | | |
| Existing | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| New Revenue Bond | 60,912 | 60,912 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | As Transmission & Distribution |
| Total Debt Service | $60,912 | $60,912 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| Less: Debt Related Revenue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | As Transmission & Distribution |
| **Net Debt Service** | $60,912 | $60,912 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| **Operating Transfers** | | | | | | | | | | |
| Water Construction Fund | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | As Plant Before General Plant |
| Water Operating Fund | 19,488 | 3,222 | 3,964 | 10,861 | 0 | 0 | 1,441 | 0 | 0 | As Total Operations & Maintenance |
| To Rate Stabilization Fund | 1,000 | 165 | 203 | 557 | 0 | 0 | 74 | 0 | 0 | As Total Operations & Maintenance |
| To Debt Reserve Fund | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | As Net Debt Service |
| **Total Operating Transfers** | $20,488 | $3,387 | $4,167 | $11,419 | $0 | $0 | $1,515 | $0 | $0 | |
| **TOTAL REVENUE REQUIREMENTS** | $350,090 | $113,156 | $64,061 | $151,416 | $0 | $0 | $21,458 | $0 | $0 | |
| **Less: Miscellaneous Revenues** | | | | | | | | | | |
| Investment Earnings (Interest) | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | As Total RR |
| Water Revenues | 306 | 99 | 56 | 132 | 0 | 0 | 19 | 0 | 0 | As Total RR |
| Sales of Water Materials & Supplies | 3,030 | 979 | 554 | 1,310 | 0 | 0 | 186 | 0 | 0 | As Total RR |
| Water Permits | 202 | 65 | 37 | 87 | 0 | 0 | 12 | 0 | 0 | As Total RR |
| Miscellaneous Water Revenue | 3,333 | 1,077 | 610 | 1,442 | 0 | 0 | 204 | 0 | 0 | As Total RR |
| Other Miscellaneous Revenue | 11,110 | 3,591 | 2,033 | 4,805 | 0 | 0 | 681 | 0 | 0 | As Total RR |
| Other Financing Sources | 3,535 | 1,143 | 647 | 1,529 | 0 | 0 | 217 | 0 | 0 | As Total RR |
| **Total Miscellaneous Revenues** | $21,516 | $6,954 | $3,937 | $9,306 | $0 | $0 | $1,319 | $0 | $0 | |
| **NET REVENUE REQUIREMENTS** | $328,574 | $106,201 | $60,124 | $142,110 | $0 | $0 | $20,139 | $0 | $0 | |

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 14**
**DIRECT ASSIGNMENT OF EXPENSES**



| | Total | Residential | Commercial | Notes: |
|---|---|---|---|---|
| **Administration** | | | | |
| Salaries & Wages | $0 | $0 | $0 | |
| Employer Contributions | 0 | 0 | 0 | |
| Office Supplies & Materials | 0 | 0 | 0 | |
| Operating Supplies | 0 | 0 | 0 | |
| Repair & Maintenance Supplies | 0 | 0 | 0 | |
| Gas, Oil, Diesel Fuel, Grease, etc. | 0 | 0 | 0 | |
| Other Repair & Maintenance Supplies | 0 | 0 | 0 | |
| Supplies for Resale | 0 | 0 | 0 | |
| Purchased Services | 0 | 0 | 0 | |
| Communication & Transportation | 0 | 0 | 0 | |
| Postage, Box Rent, etc. | 0 | 0 | 0 | |
| Publicity, Subscriptions & Dues | 0 | 0 | 0 | |
| Membership & Registration Fees | 0 | 0 | 0 | |
| Utility Services | 0 | 0 | 0 | |
| Professional Services | 0 | 0 | 0 | |
| Legal Services | 0 | 0 | 0 | |
| Repair & Maintenance Services | 0 | 0 | 0 | |
| Travel | 0 | 0 | 0 | |
| Training Services | 0 | 0 | 0 | |
| Other Purchased Services | 0 | 0 | 0 | |
| Insurance | 0 | 0 | 0 | |
| Machinery & Equipment | 0 | 0 | 0 | |
| **Total Administration** | $0 | $0 | $0 | |
| **Source of Supply & Pumping** | | | | |
| Repair & Maintenance Supplies | $0 | $0 | $0 | |
| Utility Services | 0 | 0 | 0 | |
| Professional Services | 0 | 0 | 0 | |
| **Total Source of Supply & Pumping** | $0 | $0 | $0 | |
| **Purification & Treatment** | | | | |
| Operating Supplies | $0 | $0 | $0 | |
| Repair & Maintenance Supplies | 0 | 0 | 0 | |
| Gas, Oil, Diesel Fuel, Grease, Etc. | 0 | 0 | 0 | |
| Other Repair & Maintenance Supplies | 0 | 0 | 0 | |
| Publicity, Subscriptions & Dues | 0 | 0 | 0 | |
| Utility Services | 0 | 0 | 0 | |
| Professional Services | 0 | 0 | 0 | |
| Other Purchased Services | 0 | 0 | 0 | |
| **Total Purification & Treatment** | $0 | $0 | $0 | |

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 14**
**DIRECT ASSIGNMENT OF EXPENSES**



| | Total | Residential | Commercial | Notes: |
|---|---|---|---|---|
| Transmission & Distribution | | | | |
| Repair & Maintenance Supplies | $0 | $0 | $0 | |
| Supplies for Resale | 0 | 0 | 0 | |
| Utility Services | 0 | 0 | 0 | |
| Total Transmission & Distribution | $0 | $0 | $0 | |
| TOTAL OPERATIONS & MAINTENANCE | $0 | $0 | $0 | |
| NET CIP FROM RATES | $0 | $0 | $0 | |
| Debt Service | | | | |
| Existing | $0 | $0 | $0 | |
| New Revenue Bond | 0 | 0 | 0 | |
| Total Debt Service | $0 | $0 | $0 | |
| Less: Debt Related Revenue | 0 | 0 | 0 | |
| Net Debt Service | | | | |
| Operating Transfers | | | | |
| Water Construction Fund | $0 | $0 | $0 | |
| Water Operating Fund | 0 | 0 | 0 | |
| To Rate Stabilization Fund | 0 | 0 | 0 | |
| To Debt Reserve Fund | 0 | 0 | 0 | |
| Total Operating Transfers | $0 | $0 | $0 | |
| TOTAL REVENUE REQUIREMENTS | $0 | $0 | $0 | |
| Less: Miscellaneous Revenues | | | | |
| Investment Earnings (Interest) | $0 | $0 | $0 | |
| Sales of Water Materials & Supplies | 0 | 0 | 0 | |
| Water Permits | 0 | 0 | 0 | |
| Miscellaneous Water Revenue | 0 | 0 | 0 | |
| Other Miscellaneous Revenue | 0 | 0 | 0 | |
| Other Financing Sources | 0 | 0 | 0 | |
| Total Miscellaneous Revenues | $0 | $0 | $0 | |
| NET REVENUE REQUIREMENTS | $0 | $0 | $0 | |

TOWN OF STEVENSVILLE
WATER REVENUE REQUIREMENTS STUDY
EXHIBIT 15
ALLOCATION OF REVENUE REQUIREMENTS

| Classification Components | Net Revenue Requirement | Residential | Commercial | Allocation Factor |
|---|---|---|---|---|
| Commodity | $106,201 | $86,526 | $19,675 | (COMM) |
| Capacity | $60,124 | $52,036 | $8,088 | (CAP) |
| Customer Related | | | | |
| -Actual Customer | $142,110 | $125,188 | $16,922 | (AC) |
| -Weighted for Cust. Acctg. | 0 | 0 | 0 | (WCA) |
| -Weighted for Meters & Services | 0 | 0 | 0 | (WCMS) |
| Total Customer Related | $142,110 | $125,188 | $16,922 | |
| Public Fire Protection Related | $20,139 | $14,865 | $5,274 | (FP) |
| Revenue Related | $0 | $0 | $0 | (RR) |
| Direct Assignment | $0 | $0 | $0 | (DA) |
| NET REVENUE REQUIREMENT | $328,574 | $278,614 | $49,960 | |

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 16**
**SUMMARY OF THE COST OF SERVICE ANALYSIS**

| | 2010 Expenses | Residential | Commercial |
|---|---|---|---|
| Revenues at Present Rates | $234,696 | $192,332 | $42,364 |
| Allocated Revenue Requirement | $328,574 | $278,614 | $49,960 |
| Balance/(Deficiency) of Funds | ($93,878) | ($86,283) | ($7,596) |
| Required % Change in Rates | 40.0% | 44.9% | 17.9% |

**TOWN OF STEVENSVILLE**
**WATER REVENUE REQUIREMENTS STUDY**
**EXHIBIT 17**
**AVERAGE UNIT COSTS**

| | Total | Residential | Commercial |
|---|---|---|---|
| Commodity $/1,000 Gal | $0.84 | $0.84 | $0.84 |
| Capacity $/1,000 Gal | $0.48 | $0.51 | $0.35 |
| Fire/Revenue/Direct $/1,000 Gal | $0.16 | $0.15 | $0.23 |
| Total $/1,000 Gal | $1.48 | $1.50 | $1.42 |
| Customer Costs - $/account/month | $14.39 | $14.39 | $14.39 |
| Pumped Zones | $0.00 | $0.00 | $0.00 |
| Average Total Cost $/1,000 Gal | $2.61 | $2.72 | $2.15 |
| Current Unit Revenue $/1,000 Gal | $1.87 | $1.88 | $1.82 |
| Basic Data: | | | |
| Annual Water Consumption(/1,000 Gal) | 125,683 | 102,398 | 23,285 |
| Number of Accounts | 823 | 725 | 98 |

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 7286-00 PROVISIONAL PERMIT
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE

**Owners:** STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** JANUARY 23, 1976 at 02:07 P.M.
**Enforceable Priority Date:** JANUARY 23, 1976 at 02:07 P.M.

**Purpose (use):** MUNICIPAL
**Maximum Flow Rate:** 240.00 GPM
**Maximum Volume:** 40.00 AC-FT

**Source:**
**Source Name:** GROUNDWATER
**Source Type:** GROUNDWATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | SWNWSE | 27 | 9N | 20W | RAVALLI |

**Diversion Means:** WELL
**Well Depth:** 56.00 FEET
**Static Water Level:** 30.00 FEET
**Casing Diameter:** 6.00 INCHES

**Period of Diversion:** JANUARY 1 to DECEMBER 31

**Purpose (Use):** MUNICIPAL
**Volume:** 40.00 AC-FT
**Period of Use:** JANUARY 1 to DECEMBER 31
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | | | W2 | 26 | 9N | 20W | RAVALLI |
| 2 | | | E2 | 27 | 9N | 20W | RAVALLI |

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**Remarks:**

**LAND DESCRIPTION CLARIFICATION**
USE FOR TOWN OF STEVENSVILLE

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 214147-00 STATEMENT OF CLAIM
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE
**Late Claim:** B

**Owners:** STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** JUNE 1, 1875
**Enforceable Priority Date:** JUNE 30, 1973

**Type of Historical Right:** DECREED

CLAIM FILED LATE 05/23/90 . AS MANDATED BY SECTION 85-2-221(3), MCA, THIS CLAIM IS SUBORDINATE, AND THEREFORE JUNIOR, TO ALL FEDERAL AND INDIAN RESERVED WATER RIGHTS AND ALL VALID TIMELY FILED CLAIMS BASED ON STATE LAW.

**Purpose (use):** MUNICIPAL
**Maximum Flow Rate:** 2.50 CFS
**Maximum Volume:** 1,120.00 AC-FT

**Source:**
**Source Name:** MILL FORK CREEK
**Source Type:** SURFACE WATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | NWSENE | 31 | 9N | 19W | RAVALLI |

**Diversion Means:** HEADGATE

**Period of Diversion:** JANUARY 1 to DECEMBER 31

**Purpose (Use):** MUNICIPAL
**Volume:** 1,120.00 AC-FT
**Period of Use:** JANUARY 1 to DECEMBER 31
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | | | W2 | 26 | 9N | 20W | RAVALLI |
| 2 | | | | 27 | 9N | 20W | RAVALLI |

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**Remarks:**

THE FOLLOWING ELEMENTS WERE AMENDED BY THE CLAIMANT ON 07/16/90: SOURCE, POINT OF DIVERSION, FLOW RATE, VOLUME, PERIOD OF USE, PLACE OF USE, MEANS OF DIVERSION.

THE WATER RIGHTS LISTED FOLLOWING THIS STATEMENT ARE ASSOCIATED. THEY ARE PART OF A MANIFOLD SYSTEM WHICH SUPPLIES MUNICIPAL WATER TO THE TOWN OF STEVENSVILLE.

CLAIM FILED LATE 05/23/90 . THIS CLAIM MAY BE SUBORDINATE, AND THEREFORE JUNIOR, TO CERTAIN PERMITS AND RESERVATIONS OF WATER. SEE SECTION 85-2-221(3), MCA.

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 89376-00 PROVISIONAL PERMIT
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE

**Owners:** STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** MARCH 28, 1994 at 09:42 A.M.
**Enforceable Priority Date:** MARCH 28, 1994 at 09:42 A.M.

**Purpose (use):** MUNICIPAL
**Maximum Flow Rate:** 500.00 GPM
**Maximum Volume:** 919.86 AC-FT

**Source:**
**Source Name:** GROUNDWATER
**Source Type:** GROUNDWATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | SWNENE | 27 | 9N | 20W | RAVALLI |

**Diversion Means:** WELL
**Well Depth:** 460.00 FEET
**Static Water Level:** 30.00 FEET
**Casing Diameter:** 10.00 INCHES

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 2 | | SWNWSE | 27 | 9N | 20W | RAVALLI |

**Diversion Means:** WELL
**Well Depth:** 56.00 FEET
**Static Water Level:** 30.00 FEET
**Casing Diameter:** 0.67 INCH

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 3 | | NWSWSE | 27 | 9N | 20W | RAVALLI |

**Diversion Means:** WELL
**Well Depth:** 75.00 FEET
**Static Water Level:** 28.00 FEET
**Casing Diameter:** 0.67 INCH

**Period of Diversion:** JANUARY 1 to DECEMBER 31

**Purpose (Use):** MUNICIPAL
**Volume:** 919.86 AC-FT
**Period of Use:** JANUARY 1 to DECEMBER 31
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | | | W2 | 26 | 9N | 20W | RAVALLI |
| 2 | | | E2 | 27 | 9N | 20W | RAVALLI |

TOWN OF STEVENSVILLE

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**Remarks:**

**ASSOCIATED RIGHT**

THIS PERMIT AND WATER RIGHT NOS. 76H-P007286-00 AND 76H-P009186-00 ARE MANIFOLD TOGETHER. THE COMBINED DIVERSION FROM THE MANIFOLD SYSTEM IS 960 GPM UP TO 1299.86 ACRE-FEET PER YEAR.

**ASSOCIATED RIGHT**

THIS PERMIT IS ALSO ASSOCIATED TO WATER RIGHT NOS. 76H-W214147-00, 76H-W214148-00 AND 76H-W214149-00. THE WATER IS USED FOR THE TOWN OF STEVENSVILLE.

**ASSOCIATED RIGHT**

THIS PERMIT IS TO ADD A WELL AND TO INCREASE THE VOLUME DIVERTED FROM THE MANIFOLD SYSTEM

**IMPORTANT INFORMATION**

IF AT ANY TIME AFTER THIS PERMIT IS ISSUED, THE DEPARTMENT RECEIVES WRITTEN COMPLAINTS ALLEGING THAT DIVERTING FROM THIS SOURCE IS RESULTING IN ADVERSE IMPACTS TO EXISTING WATER RIGHTS, THE DEPARTMENT MAY MAKE A FIELD INVESTIGATION OF THE PROJECT. THE PERMITTEE MAY, AT THIS TIME, BE REQUIRED TO MEASURE HYDROSTATIC PRESSURE OF THE AQUIFER AND KEEP A WRITTEN RECORD OF MEASUREMENTS WHICH SHALL BE SUBMITTED TO THE DEPARTMENT

**Remarks:**

BY NOVEMBER 30 OF EACH YEAR AND/OR UPON REQUEST.

**WATER MEASUREMENT-WATER USE MEASURING DEVICE**

THIS RIGHT IS SUBJECT TO THE CONDITION THAT THE APPROPRIATOR SHALL INSTALL AN ADEQUATE FLOW METERING DEVICE TO ALLOW THE FLOW RATE AND VOLUME OF WATER DIVERTED TO BE RECORDED. THE APPROPRIATOR SHALL KEEP A WRITTEN RECORD OF THE FLOW RATE AND VOLUME OF ALL WATERS DIVERTED, INCLUDING THE PERIOD OF TIME, AND SHALL SUBMIT SAID RECORDS BY NOVEMBER 30TH OF EACH YEAR AND/OR UPON REQUEST TO THE WATER RESOURCES REGIONAL OFFICE AT THE ADDRESS LISTED BELOW. TOWN & COUNTRY SHOPPING CENTER, 1610 S 3RD ST W, SUITE 103, PO BOX 5004, MISSOULA, MT 59806-5004 PH: 406-721-4284

**OBJECTION INFORMATION**

OBJ LOG 94-081

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 88532-00 PROVISIONAL PERMIT
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE

**Owners:** STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** FEBRUARY 25, 1994 at 03:16 P.M.
**Enforceable Priority Date:** FEBRUARY 25, 1994 at 03:16 P.M.

**Purpose (use):** MUNICIPAL
**Maximum Flow Rate:** 345.30 GPM
**Maximum Volume:** 556.97 AC-FT

**Source:**
**Source Name:** GROUNDWATER
**Source Type:** GROUNDWATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | N2 | 31 | 9N | 19W | RAVALLI |

**Diversion Means:** WELL
**Well Depth:** 14.00 FEET
**Casing Diameter:** 10.00 INCHES
HORIZONTAL WELLS

**Period of Diversion:** JANUARY 1 to DECEMBER 31

**Purpose (Use):** MUNICIPAL
**Volume:** 556.97 AC-FT
**Period of Use:** JANUARY 1 to DECEMBER 31
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | | | W2 | 26 | 9N | 20W | RAVALLI |
| 2 | | | E2 | 27 | 9N | 20W | RAVALLI |

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**Remarks:**

**ASSOCIATED RIGHT**

THIS RIGHT IS ASSOCIATED TO WATER RIGHT NUMBERS 76H- P-007236, P-009186, P-076760, W-214147, W-214148 AND W-214149. THEY ARE PART OF A MANIFOLD SYSTEM.

**IMPORTANT INFORMATION**

THIS SYSTEM WAS ORIGINALLY INSTALLED IN THE EARLY 1900S. THIS SYSTEM IS MANIFOLD WITH OTHER SURFACE AND GROUNDWATER RIGHTS THAT SERVE THE TOWN OF STEVENSVILLE. WATER IS STORED IN A 480,000 GALLON STORAGE TANK LOCATED IN THE NENENE, SEC 36, TWP 09N, RGE 20W, RAVALLI CO.

**WATER MEASUREMENT-WATER USE MEASURING DEVICE**

THIS RIGHT IS SUBJECT TO THE CONDITION THAT THE APPROPRIATOR SHALL INSTALL AN ADEQUATE FLOW MEASURING DEVICE TO ALLOW THE FLOW RATE AND VOLUME OF WATER DIVERTED TO BE RECORDED. THE APPROPRIATOR SHALL KEEP A WRITTEN RECORD OF THE FLOW RATE AND VOLUME OF ALL WATERS DIVERTED, INCLUDING THE PERIOD OF TIME, AND SHALL SUBMIT SAID RECORDS BY NOVEMBER 30TH OF EACH YEAR AND/OR UPON REQUEST TO THE WATER RESOURCES REGIONAL OFFICE AT THE ADDRESS LISTED BELOW. TOWN & COUNTRY SHOPPING CENTER, 1610 S 3RD ST W, SUITE 103, PO BOX 5004, MISSOULA, MT 59806-5004 PH: 406-721-4284

**POSSIBLE COMPLAINT RECEIVED**

IF AT ANY TIME AFTER THIS RIGHT IS ISSUED, A WRITTEN COMPLAINT IS RECEIVED BY THE DEPARTMENT ALLEGING THAT DIVERTING FROM THIS SOURCE IS ADVERSELY AFFECTING A PRIOR WATER RIGHT, THE DEPARTMENT MAY MAKE A FIELD INVESTIGATION OF THE PROJECT. IF DURING THE FIELD INVESTIGATION THE DEPARTMENT FINDS SUFFICIENT EVIDENCE SUPPORTING THE ALLEGATION, IT MAY CONDUCT A HEARING IN THE MATTER ALLOWING THE APPROPRIATOR TO SHOW CAUSE WHY THE RIGHT SHOULD NOT BE MODIFIED OR REVOKED. THE DEPARTMENT MAY THEN MODIFY OR REVOKE THIS RIGHT TO PROTECT EXISTING RIGHTS OR LEAVE THIS RIGHT UNCHANGED IF THE HEARING OFFICER DETERMINES NO EXISTING WATER RIGHTS ARE BEING ADVERSELY AFFECTED.

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 76760-00 PROVISIONAL PERMIT
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE

**Owners:** STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** DECEMBER 28, 1990 at 11:30 A.M.
**Enforceable Priority Date:** DECEMBER 28, 1990 at 11:30 A.M.

**Purpose (use):** MUNICIPAL
**Maximum Flow Rate:** 337.50 GPM
**Maximum Volume:** 272.20 AC-FT

**Source:**
**Source Name:** NORTH SWAMP CREEK
**Source Type:** SURFACE WATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | NWNWNW | 31 | 9N | 19W | RAVALLI |

**Diversion Means:** OTHER DIVERSION
DROP INLET STRUCTURE

**Period of Diversion:** OCTOBER 15 to APRIL 15

**Reservoir:** OFF STREAM

| Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|
| | NENENE | 36 | 9N | 20W | RAVALLI |

**Current Capacity:** 1.40 ACRE-FEET

**Purpose (Use):** MUNICIPAL
**Volume:** 272.20 AC-FT
**Period of Use:** OCTOBER 15 to APRIL 15
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | | | W2 | 26 | 9N | 20W | RAVALLI |
| 2 | | | | 27 | 9N | 20W | RAVALLI |

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**Remarks:**

**ASSOCIATED RIGHT**

THIS RIGHT IS ASSOCIATED TO WATER RIGHT NUMBERS 76H- P-007286, P-009186, W-214147, W-214148, W-214149 AND P-088532. THEY ARE PART OF A MANIFOLD SYSTEM.

**IMPORTANT INFORMATION**

THIS PERMIT IS SUBJECT TO EXHIBIT A AND THE STIPULATION AND WITHDRAWAL OF OBJECTIONS. EXHIBIT A CONTAINS CONDITIONS ABOUT POSSIBLE COMPLAINTS AND SHOW CAUSE HEARING. ALSO THE EXHIBIT INCLUDES INFORMATION ABOUT MEASURING DEVICE REQUIREMENTS. THE TOWN PRESENTLY MEASURES ALL WATER ENTERING THE WATER TREATMENT PLANT AND THERE IS A RATINGS TABLE FOR THE DROP INLET STRUCTURE. WHEN THE NORTH SWAMP CREEK WATER IS IN USE, THE PLANT OPERATORS WILL MONITOR THE GAGE ASSOCIATED WITH THIS DIVERSION AND SUBMIT RECORDS.

**REISSUED RIGHT**

THIS PERMIT WAS REISSUED 06/01/98 IN LIEU OF THE RIGHT ISSUED 02/28/96. THE APPROPRIATION AND USE PERIOD WAS CORRECTED AND A DIVERSION MEANS WAS ADDED.

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 43251-00 STATEMENT OF CLAIM
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE

**Owners:**
VICTORIA SHORTER-HOWELL
609 MIDDLE BURNT FORK RD
STEVENSVILLE, MT 59870

STEVE PECKINPAUGH
PO BOX 305
STEVENSVILLE, MT 59870

NORM COHEN
PO BOX 213
STEVENSVILLE, MT 59870

MICHAEL HOWELL
609 MIDDLE BURNT FORK RD
STEVENSVILLE, MT 59870

STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** JUNE 1, 1866
**Enforceable Priority Date:** JUNE 1, 1866
**Type of Historical Right:** DECREED
**Purpose (use):** IRRIGATION
**Maximum Flow Rate:** 1.75 CFS
**Maximum Volume:**
**Maximum Acres:** 80.00

**Source:**
**Source Name:** NORTH SWAMP CREEK
**Source Type:** SURFACE WATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | NWSWNE | 31 | 9N | 19W | RAVALLI |
| **Diversion Means:** | HEADGATE | | | | | |
| 2 | | SWSENE | 31 | 9N | 19W | RAVALLI |
| **Diversion Means:** | HEADGATE | | | | | |
| 3 | | NWSENW | 31 | 9N | 19W | RAVALLI |
| **Diversion Means:** | HEADGATE | | | | | |

DIVERSION 1 IS HEADGATE #69 INTO THE BAKER 1 DITCH. DIVERSION 2 IS HEADGATE #66 INTO THE FARLIN DITCH. DIVERSION 3 IS HEADGATE #71 INTO THE BAKER 2 DITCH.

**Period of Diversion:** APRIL 1 to NOVEMBER 4

**Purpose (Use):** IRRIGATION
**Irrigation Type:** FLOOD
**Climatic Area:** 3 - MODERATE
**Period of Use:** APRIL 1 to NOVEMBER 4
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | 80.00 | | N2NW | 31 | 9N | 19W | RAVALLI |
| **Total:** | 80.00 | | | | | | |

1.417 ACRES IN THE CLAIMED PLACE OF USE WAS SEVERED FROM THIS WATER RIGHT. SEE CLAIM FILE FOR INFORMATION.

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**Remarks:**

NOTICE OF WATER RIGHT TRANSFER RECEIVED 08/01/90.

NOTICE OF WATER RIGHT TRANSFER RECEIVED 08/01/90.

NOTICE OF WATER RIGHT TRANSFER RECEIVED 01/23/92.

NOTICE OF WATER RIGHT TRANSFER RECEIVED 11/05/92.

NOTICE OF WATER RIGHT TRANSFER RECEIVED 10/14/98.

**Remarks:**

WATER RIGHT OWNERSHIP UPDATE RECEIVED 04/26/01.

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 9186-00 PROVISIONAL PERMIT
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE

**Owners:** STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** AUGUST 13, 1976 at 09:00 A.M.
**Enforceable Priority Date:** AUGUST 13, 1976 at 09:00 A.M.

**Purpose (use):** MUNICIPAL
**Maximum Flow Rate:** 220.00 GPM
**Maximum Volume:** 340.00 AC-FT

**Source:**
**Source Name:** GROUNDWATER
**Source Type:** GROUNDWATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | NWSWSE | 27 | 9N | 20W | RAVALLI |

**Diversion Means:** WELL
**Well Depth:** 75.00 FEET
**Static Water Level:** 44.00 FEET
**Casing Diameter:** 8.00 INCHES
**Pump Size:** 20.00 HP

**Period of Diversion:** JANUARY 1 to DECEMBER 31

**Purpose (Use):** MUNICIPAL
**Volume:** 340.00 AC-FT
**Period of Use:** JANUARY 1 to DECEMBER 31
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | | | W2 | 26 | 9N | 20W | RAVALLI |
| 2 | | | E2 | 27 | 9N | 20W | RAVALLI |

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**Remarks:**

**ASSOCIATED RIGHT**

THIS CERTIFICATE IS ASSOCIATED WITH WATER RIGHT 007286-G76H AND 089376-76H. THEY HAVE OVERLAPPING PLACES OF USE.

**ASSOCIATED RIGHT**

THE WATER RIGHTS LISTED FOLLOWING THIS STATEMENT ARE ASSOCIATED. THEY ARE PART OF A MANIFOLD SYSTEM WHICH SUPPLIES MUNICIPAL WATER TO THE TOWN OF STEVENSVILLE.

STATE OF MONTANA
DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
1424 9TH AVENUE P.O.BOX 201601 HELENA, MONTANA 59620-1601

# GENERAL ABSTRACT

**Water Right Number:** 76H 214149-00 STATEMENT OF CLAIM
**Version:** 1 -- ORIGINAL RIGHT
**Status:** ACTIVE
**Late Claim:** B

**Owners:** STEVENSVILLE, TOWN OF
PO BOX 30
STEVENSVILLE, MT 59870

**Priority Date:** JULY 31, 1852

**Enforceable Priority Date:** JUNE 30, 1973

**Type of Historical Right:** DECREED

CLAIM FILED LATE 05/23/90 . AS MANDATED BY SECTION 85-2-221(3), MCA, THIS CLAIM IS SUBORDINATE, AND THEREFORE JUNIOR, TO ALL FEDERAL AND INDIAN RESERVED WATER RIGHTS AND ALL VALID TIMELY FILED CLAIMS BASED ON STATE LAW.

**Purpose (use):** MUNICIPAL

**Maximum Flow Rate:** 1.25 CFS

**Maximum Volume:** 900.00 AC-FT

**Source:**

**Source Name:** MILL FORK CREEK

**Source Type:** SURFACE WATER

**Point of Diversion and Means of Diversion:**

| ID | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|
| 1 | | NWSENE | 31 | 9N | 19W | RAVALLI |

**Diversion Means:** HEADGATE

**Period of Diversion:** JANUARY 1 to DECEMBER 31

**Purpose (Use):** MUNICIPAL
**Volume:** 900.00 AC-FT
**Period of Use:** JANUARY 1 to DECEMBER 31
**Place of Use:**

| ID | Acres | Govt Lot | Qtr Sec | Sec | Twp | Rge | County |
|---|---|---|---|---|---|---|---|
| 1 | | | W2 | 26 | 9N | 20W | RAVALLI |
| 2 | | | | 27 | 9N | 20W | RAVALLI |

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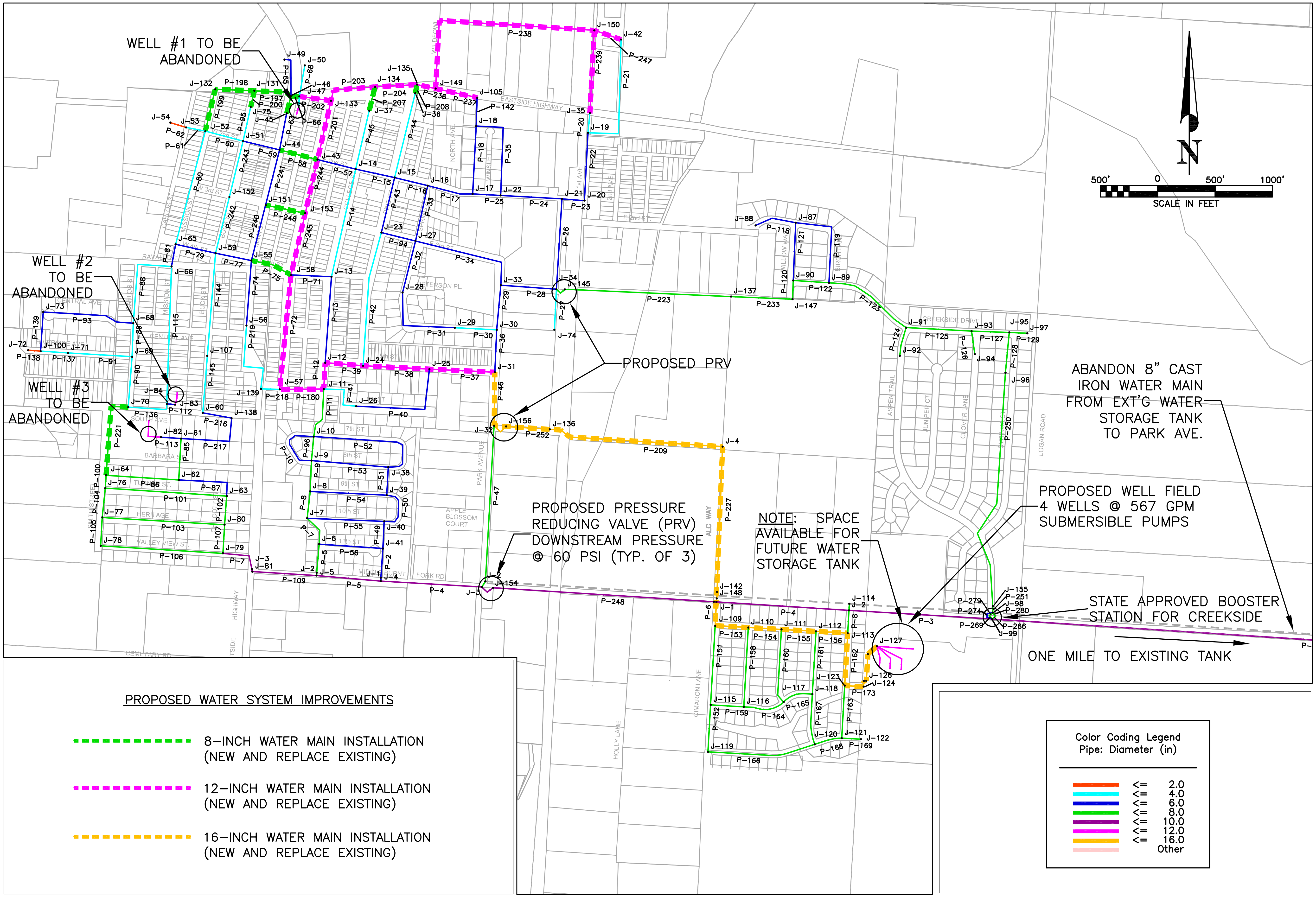
**Remarks:**

THE FOLLOWING ELEMENTS WERE AMENDED BY THE CLAIMANT ON 07/16/90: SOURCE, POINT OF DIVERSION, FLOW RATE, VOLUME, PERIOD OF USE, PLACE OF USE, MEANS OF DIVERSION.

THE WATER RIGHTS LISTED FOLLOWING THIS STATEMENT ARE ASSOCIATED. THEY ARE PART OF A MANIFOLD SYSTEM WHICH SUPPLIES MUNICIPAL WATER TO THE TOWN OF STEVENSVILLE.

CLAIM FILED LATE 05/23/90 . THIS CLAIM MAY BE SUBORDINATE, AND THEREFORE JUNIOR, TO CERTAIN PERMITS AND RESERVATIONS OF WATER. SEE SECTION 85-2-221(3), MCA.

F:\2004\7252-Town of Stevensville\PER 2009 Update\WaterCAD for AutoCAD exhibits\Future Water System\Future Water System II.dwg; 11/4/09




# 2030 WATER SYSTEM
TOWN OF STEVENSVILLE

Professional Consultants Inc.
Engineers, Surveyors, Planners, Mappers
3115 RUSSELL ST. PO BOX 1750
MISSOULA, MONTANA 59801
PHONE 406-728-1880
FAX 406-728-0276
1713 NORTH FIRST STREET
HAMILTON, MONTANA 59840
PHONE 406-363-1201
FAX 406-363-1215

PROJECT NO. 7252-04
DRAWN: MEW
CHECKED:
DATE: 10/30/2009
REVISION: 11/04/2009
REVISION:
REVISION:

2

SHEET 1 OF 1

# PHASE II IMPROVEMENTS

| II.1. METER IMPROVEMENTS | | | | | |
|---|---|---|---|---|---|
| A. Install meters on all un-metered services | | Quantity | Units | Unit Cost | Total |
| 1 | Install meters in home / plumbing & fitting | 189 | EA | $ 250.00 | $ 47,250 |
| 2 | Town supplied meter setter | 189 | EA | $ 35.00 | $ 6,615 |
| 3 | Install curbside meter pits | 59 | EA | $ 1,000.00 | $ 59,000 |
| 4 | 3/4" meters with remote radio read head | 248 | EA | $ 160.00 | $ 39,680 |
| 5 | Mobe / demobe / General Conditions | 1 | LS | $ 0.05 | $ 7,627 |
| Subtotal, Meter Installation | | | | | $ 160,172 |
| Contingency (10%) | | | | | $ 16,017 |
| Engineering & Contract Administration (15%) | | | | | $ 24,026 |
| Subtotal, complete metering all services | | | | | $ 200,215 |
| B. Radio-read heads & meter reading system | | Quantity | Units | Unit Cost | Total |
| 1 | Materials - Radio-read heads for existing meters | 460 | EA | $ 115.00 | $ 52,900 |
| 2 | Read system, software & accounting package | 1 | EA | $ 30,000.00 | $ 30,000 |
| Subtotal, Meter read system | | | | | $ 82,900 |
| Contingency (10%) | | | | | $ 8,290 |
| Subtotal, install radio-read system | | | | | $ 91,190 |
| TOTAL METER IMPROVEMENTS | | | | | $ 291,405 |

| II.2. NEW SUPPLY TRANSMISSION MAIN (Route 2 - ALC Way to 5th Street) | | | | | |
|---|---|---|---|---|---|
| A. Water Transmission Main | | Quantity | Units | Unit Cost | Total |
| 1 | 16" ductile iron pipe, PC 350 DI, or C905 PVC - DR-18 | 6000 | LF | $ 90.00 | $ 540,000 |
| 2 | 16" butterfly valves | 16 | EA | $ 3,500.00 | $ 56,000 |
| 3 | 16" fittings & bends | 10 | EA | $ 2,500.00 | $ 25,000 |
| 4 | culvert crossings | 3 | EA | $ 250.00 | $ 750 |
| 5 | Supply Ditch Bridge & RR bore & 30" sleeve (2 Bores) | 150 | LF | $ 425.00 | $ 63,750 |
| 6 | Install 16" Main in sleeve, chocks & seals | 150 | LF | $ 100.00 | $ 15,000 |
| 7 | Fire Hydrants | 4 | EA | $ 5,000.00 | $ 20,000 |
| 8 | Tie in at well field | 1 | EA | $ 4,000.00 | $ 4,000 |
| 9 | Tie in at Park & 5th | 2 | EA | $ 4,000.00 | $ 8,000 |
| 10 | Tie in at Middle Burnt Fork Road | 1 | EA | $ 8,000.00 | $ 8,000 |
| 11 | Temporary Water Service | 1 | LS | $ 5,000.00 | $ 5,000 |
| 12 | Testing & acceptance | 1 | LS | $ 5,000.00 | $ 5,000 |
| 13 | Re-connect water services | 5 | EA | $ 500.00 | $ 2,500 |
| 14 | Abandon 8" Cast Iron Main | 1 | LS | $ 7,500.00 | $ 7,500 |
| 15 | Construction De-watering | 1 | LS | $ 20,000.00 | $ 20,000 |
| 16 | Haul off Excess Material | 3625 | CY | $ 6.00 | $ 21,750 |
| 17 | Traffic control | 1 | LS | $ 10,000.00 | $ 10,000 |
| 18 | Mobe / demobe / General Conditions | 1 | LS | $ 0.05 | $ 40,613 |
| Subtotal, Water Transmission Main | | | | | $ 852,863 |
| Contingency (10%) | | | | | $ 85,286 |
| Engineering & Contract Administration (15%) | | | | | $ 127,929 |
| Subtotal, New Supply Transmission Main | | | | | $ 1,066,078 |
| B. Road Repair - 6,150 lf of roadway | | Quantity | Units | Unit Cost | Total |
| 100 | Mobilization/Demobilization (5%) | 1 | LS | $ 5,080.50 | $ 5,081 |
| 110 | SWPPP | 1 | LS | $ 2,000.00 | $ 2,000 |
| 120 | Erosion Control Measures (Silt Fence, Straw Bales) | 1 | LS | $ 5,000.00 | $ 5,000 |
| 130 | Traffic Control | 1 | LS | $ 5,000.00 | $ 5,000 |
| 140 | Asphalt Concrete - Sawcut, Remove & Replace | 1450 | SY | $ 25.00 | $ 36,250 |
| 150 | Strip, Stockpile & Replace Sub-Base Gravel (12") | 490 | CY | $ 35.00 | $ 17,150 |
| 160 | Geotextile Fabric | 100 | SY | $ 1.25 | $ 125 |
| 170 | 3/4" Minus Crushed Base/Gravel Travel Course (4") | 915 | CY | $ 35.00 | $ 32,025 |
| 180 | Painting and Markings | 1 | LS | $ 2,500.00 | $ 2,500 |
| 190 | Drill/Hydro Seeding | 15600 | SF | $ 0.10 | $ 1,560 |
| 200 | Payment and Performance Bonds | 1 | LS | $ 2,032.20 | $ 2,032 |
| Subtotal, Road Repair | | | | | $ 108,723 |
| Contingency (10%) | | | | | $ 10,872 |
| Engineering & Contract Administration (15%) | | | | | $ 16,308 |
| Subtotal, Road Repair | | | | | $ 135,903 |
| TOTAL, TRANSMISSION MAIN & ROAD REPAIR | | | | | $ 1,201,982 |

| PHASE II IMPROVEMENT SUMMARY | | |
|---|---|---|
| II.1 | METER IMPROVEMENTS | $ 291,405 |
| II.2.A | NEW SUPPLY TRANSMISSION MAIN | $ 1,066,078 |
| II.2.B | ROAD REPAIR | $ 135,903 |
| | TOTAL PHASE II IMPROVEMENTS | $ 1,493,387 |

# PHASE III IMPROVEMENTS

| III.1. NEW PRODUCTION WELLS (4 @ 570 gpm) | | | | | |
|---|---|---|---|---|---|
| A. Land Acquisition | | Quantity | Units | Unit Cost | Total |
| 1 | Surveys & legal | 1 | LS | $ 5,000.00 | $ 5,000 |
| 2 | Purchase land | 8 | ACRES | $ - | $ - |
| Subtotal, land acquisition | | | | | $ 5,000 |
| B. Production Wells (570 gpm ea) | | Quantity | Units | Unit Cost | Total |
| 1 | 10" Production well. Drilled & cased & grouted | 450 | LF | $ 80.00 | $ 36,000 |
| 2 | Well development, 24 hrs | 24 | Hrs | $ 500.00 | $ 12,000 |
| 3 | Well screen | 30 | FT | $ 300.00 | $ 9,000 |
| 4 | Submersible turbine pump, Drop Pipe & Pitless, 75 HP | 1 | EA | $ 35,000.00 | $ 35,000 |
| 5 | Pump Control Panel / Soft Start / Wiring | 1 | LS | $ 6,000.00 | $ 6,000 |
| 6 | 6" PVC or DI piping to Pump House | 300 | LF | $ 65.00 | $ 19,500 |
| Subtotal, Production Well | | | | | $ 117,500 |
| Subtotal, Three Production Wells | | 3 | EA | $ 117,500.00 | $ 352,500 |
| 1 | Submersible turbine pump (Twin Creeks Well) | 1 | EA | $ 15,000.00 | $ 15,000 |
| 2 | Abandon Existing Wells | 3 | EA | $ 2,500.00 | $ 7,500 |
| C. Well pump house & Treatment with back-up generator | | Quantity | Units | Unit Cost | Total |
| 1 | Access road and Site Pad | 1 | LS | $ 20,000.00 | $20,000 |
| 2 | Pump house / Treatment building (1250 SF @ $125/SF) | 1 | LS | $ 156,250.00 | $156,250 |
| 3 | Well House plumbing and valves | 1 | LS | $ 30,000.00 | $30,000 |
| 4 | 350 kW Backup Power Generation | 1 | LS | $ 90,000.00 | $90,000 |
| 5 | Disinfection & corrosion control system | 1 | LS | $ 25,000.00 | $25,000 |
| 6 | Electrical service connection | 1 | LS | $ 15,000.00 | $15,000 |
| 7 | Fencing and Security | 1 | LS | $ 15,000.00 | $15,000 |
| 8 | Telemetry & Controls For Existing Tank | 1 | LS | $ 45,000.00 | $45,000 |
| Subtotal, Pump House, Electrical & Controls | | | | | $396,250 |
| SUBTOTAL, PRODUCTION WELLS, PUMPHOUSE & TREATMENT | | | | | $776,250 |
| Contingency (10%) | | | | | $77,625 |
| Engineering (15%) | | | | | $116,438 |
| TOTAL NEW WATER SUPPLY WELLS, PUMPHOUSE & TREATMENT | | | | | $970,313 |

| III.2. DE-COMMISSION INFILTRATION GALLERY & TREATMENT PLANT | | | | | |
|---|---|---|---|---|---|
| Item | Description | Quantity | Units | Unit Cost | Total |
| 1 | Cut & Cap Infiltration Gallery | 1 | LS | $ 5,000.00 | $ 5,000 |
| 2 | Remove equipment & piping | 1 | LS | $ 10,000.00 | $ 10,000 |
| 3 | Re-roof existing tank | 1 | LS | $ 25,000.00 | $ 25,000 |
| 4 | Install concrete floor, convert to storage building | 1 | LS | $ 30,000.00 | $ 30,000 |
| Subtotal, estimated de-commission cost | | | | | $ 70,000 |
| Construction contingency (10%) | | | | | $ 7,000 |
| Engineering & Contract Administration (15%) | | | | | $ 10,500 |
| TOTAL DE-COMMISSION INFILTRATION GALLERY & TREATMENT PLANT | | | | | $ 87,500 |

| III.3 DISTRIBUTION SYSTEM IMPROVEMENTS | | | | | |
|---|---|---|---|---|---|
| Water Main - See System Schematic, Attachment C | | | | | |
| Pipe | Description | Quantity | Units | Unit Cost | Total |
| 37 | 12" Pipe | 570 | LF | $ 70.00 | $ 39,900 |
| | 12" Valves & Fittings | 4 | EA | $ 1,800.00 | $ 7,200 |
| | Services | 10 | EA | $ 500.00 | $ 5,000 |
| | Asphalt Repair | 570 | LF | $ 20.00 | $ 11,400 |
| | SUBTOTAL | | | | $ 63,500 |
| 38 | 12" Pipe | 575 | LF | $ 70.00 | $ 40,250 |
| | 12" Valves & Fittings | 4 | EA | $ 1,800.00 | $ 7,200 |
| | Services | 20 | EA | $ 500.00 | $ 10,000 |
| | Asphalt Repair | 575 | LF | $ 20.00 | $ 11,500 |
| | SUBTOTAL | | | | $ 68,950 |
| 39 | 12" Pipe | 330 | LF | $ 70.00 | $ 23,100 |
| | 12" Valves & Fittings | 4 | EA | $ 1,800.00 | $ 7,200 |
| | Services | 5 | EA | $ 500.00 | $ 2,500 |
| | Asphalt Repair | 330 | LF | $ 20.00 | $ 6,600 |
| | SUBTOTAL | | | | $ 39,400 |
| 12 | 12" Pipe | 230 | LF | $ 70.00 | $ 16,100 |
| | 12" Valves & Fittings | 5 | EA | $ 1,800.00 | $ 9,000 |
| | Services | 4 | EA | $ 500.00 | $ 2,000 |
| | Asphalt Repair | 230 | LF | $ 20.00 | $ 4,600 |
| | SUBTOTAL | | | | $ 31,700 |
| 180 | 12" Pipe | 380 | LF | $ 70.00 | $ 26,600 |
| | 12" Valves & Fittings | 4 | EA | $ 1,800.00 | $ 7,200 |
| | Services | 6 | EA | $ 500.00 | $ 3,000 |
| | Asphalt Repair | 380 | LF | $ 20.00 | $ 7,600 |
| | SUBTOTAL | | | | $ 44,400 |
| 72 | 12" Pipe | 1000 | LF | $ 70.00 | $ 70,000 |
| | 12" Valves & Fittings | 4 | EA | $ 1,800.00 | $ 7,200 |
| | Services | 23 | EA | $ 500.00 | $ 11,500 |
| | Asphalt Repair | 1000 | LF | $ 20.00 | $ 20,000 |
| | SUBTOTAL | | | | $ 108,700 |
| 245 | 12" Pipe | 540 | LF | $ 70.00 | $ 37,800 |
| | 12" Valves & Fittings | 3 | EA | $ 1,800.00 | $ 5,400 |
| | Services | 10 | EA | $ 500.00 | $ 5,000 |
| | Asphalt Repair | 540 | LF | $ 20.00 | $ 10,800 |
| | SUBTOTAL | | | | $ 59,000 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 244 | 12" Pipe | 500 | LF | $ | 70.00 | $ | 35,000 |
| | 12" Valves & Fittings | 3 | EA | $ | 1,800.00 | $ | 5,400 |
| | Services | 10 | EA | $ | 500.00 | $ | 5,000 |
| | Asphalt Repair | 500 | LF | $ | 20.00 | $ | 10,000 |
| SUBTOTAL | | | | | | $ | 55,400 |
| 201 | 12" Pipe | 525 | LF | $ | 70.00 | $ | 36,750 |
| | 12" Valves & Fittings | 3 | EA | $ | 1,800.00 | $ | 5,400 |
| | Services | 12 | EA | $ | 500.00 | $ | 6,000 |
| | Asphalt Repair | 525 | LF | $ | 20.00 | $ | 10,500 |
| SUBTOTAL | | | | | | $ | 58,650 |
| 202 | 12" Pipe | 280 | LF | $ | 70.00 | $ | 19,600 |
| | 12" Valves & Fittings | 3 | EA | $ | 1,800.00 | $ | 5,400 |
| | Services | 2 | EA | $ | 500.00 | $ | 1,000 |
| | Asphalt Repair | 280 | LF | $ | 20.00 | $ | 5,600 |
| SUBTOTAL | | | | | | $ | 31,600 |
| 203 | 12" Pipe | 450 | LF | $ | 70.00 | $ | 31,500 |
| | 12" Valves & Fittings | 3 | EA | $ | 1,800.00 | $ | 5,400 |
| | Services | 1 | EA | $ | 500.00 | $ | 500 |
| | Asphalt Repair | 450 | LF | $ | 20.00 | $ | 9,000 |
| SUBTOTAL | | | | | | $ | 46,400 |
| 204 | 12" Pipe | 365 | LF | $ | 70.00 | $ | 25,550 |
| | 12" Valves & Fittings | 3 | EA | $ | 1,800.00 | $ | 5,400 |
| | Services | 0 | EA | $ | 500.00 | $ | - |
| | Asphalt Repair | 365 | LF | $ | 20.00 | $ | 7,300 |
| SUBTOTAL | | | | | | $ | 38,250 |
| 236 | 12" Pipe | 165 | LF | $ | 70.00 | $ | 11,550 |
| | 12" Valves & Fittings | 3 | EA | $ | 1,800.00 | $ | 5,400 |
| | Services | 2 | EA | $ | 500.00 | $ | 1,000 |
| | Asphalt Repair | 165 | LF | $ | 20.00 | $ | 3,300 |
| SUBTOTAL | | | | | | $ | 21,250 |
| 237 | 12" Pipe | 370 | LF | $ | 70.00 | $ | 25,900 |
| | 12" Valves & Fittings | 4 | EA | $ | 1,800.00 | $ | 7,200 |
| | Services | 2 | EA | $ | 500.00 | $ | 1,000 |
| | Asphalt Repair | 370 | LF | $ | 20.00 | $ | 7,400 |
| SUBTOTAL | | | | | | $ | 41,500 |
| 238 | 12" Pipe | 1960 | LF | $ | 70.00 | $ | 137,200 |
| | 12" Valves & Fittings | 6 | EA | $ | 1,800.00 | $ | 10,800 |
| | Services | 2 | EA | $ | 500.00 | $ | 1,000 |
| | MDT Crossing | 1 | LS | $ | 2,000.00 | $ | 2,000 |
| | MRL Crossing | 1 | LS | $ | 25,000.00 | $ | 25,000 |
| | Asphalt Repair | 1960 | LF | $ | 20.00 | $ | 39,200 |
| SUBTOTAL | | | | | | $ | 215,200 |
| 247 | 12" Pipe | 235 | LF | $ | 70.00 | $ | 16,450 |
| | 12" Valves & Fittings | 4 | EA | $ | 1,800.00 | $ | 7,200 |
| | Services | 1 | EA | $ | 500.00 | $ | 500 |
| | Asphalt Repair | 235 | LF | $ | 20.00 | $ | 4,700 |
| SUBTOTAL | | | | | | $ | 28,850 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 239 | 12" Pipe | 700 | LF | $ | 70.00 | $ | 49,000 |
| | 12" Valves & Fittings | 3 | EA | $ | 1,800.00 | $ | 5,400 |
| | Services | 0 | EA | $ | 500.00 | $ | - |
| | MDT Crossing | 1 | LS | $ | 2,000.00 | $ | 2,000 |
| | Asphalt Repair | 700 | LF | $ | 20.00 | $ | 14,000 |
| SUBTOTAL | | | | | | $ | 70,400 |
| 75 | 8" Pipe | 365 | LF | $ | 45.00 | $ | 16,425 |
| | 8" Valves & Fittings | 4 | EA | $ | 1,000.00 | $ | 4,000 |
| | Services | 4 | EA | $ | 500.00 | $ | 2,000 |
| | Fire Hydrant | 1 | EA | $ | 5,000.00 | $ | 5,000 |
| | Asphalt Repair | 365 | LF | $ | 20.00 | $ | 7,300 |
| SUBTOTAL | | | | | | $ | 34,725 |
| 246 | 8" Pipe | 350 | LF | $ | 45.00 | $ | 15,750 |
| | 8" Valves & Fittings | 4 | EA | $ | 1,000.00 | $ | 4,000 |
| | Services | 3 | EA | $ | 500.00 | $ | 1,500 |
| | Fire Hydrant | 1 | EA | $ | 5,000.00 | $ | 5,000 |
| | Asphalt Repair | 350 | LF | $ | 20.00 | $ | 7,000 |
| SUBTOTAL | | | | | | $ | 33,250 |
| 58 | 8" Pipe | 350 | LF | $ | 45.00 | $ | 15,750 |
| | 8" Valves & Fittings | 4 | EA | $ | 1,000.00 | $ | 4,000 |
| | Services | 4 | EA | $ | 500.00 | $ | 2,000 |
| | Fire Hydrant | 1 | EA | $ | 5,000.00 | $ | 5,000 |
| | Asphalt Repair | 350 | LF | $ | 20.00 | $ | 7,000 |
| SUBTOTAL | | | | | | $ | 33,750 |
| 199 | 8" Pipe | 372 | LF | $ | 45.00 | $ | 16,740 |
| | 8" Valves & Fittings | 3 | EA | $ | 1,000.00 | $ | 3,000 |
| | Services | 8 | EA | $ | 500.00 | $ | 4,000 |
| | Asphalt Repair | 372 | LF | $ | 20.00 | $ | 7,440 |
| SUBTOTAL | | | | | | $ | 31,180 |
| 198 | 8" Pipe | 340 | LF | $ | 45.00 | $ | 15,300 |
| | 8" Valves & Fittings | 3 | EA | $ | 1,000.00 | $ | 3,000 |
| | Services | 10 | EA | $ | 500.00 | $ | 5,000 |
| | Asphalt Repair | 340 | LF | $ | 20.00 | $ | 6,800 |
| SUBTOTAL | | | | | | $ | 30,100 |
| 200 | 8" Pipe | 144 | LF | $ | 45.00 | $ | 6,480 |
| | 8" Valves & Fittings | 3 | EA | $ | 1,000.00 | $ | 3,000 |
| | Services | 4 | EA | $ | 500.00 | $ | 2,000 |
| | Asphalt Repair | 144 | LF | $ | 20.00 | $ | 2,880 |
| SUBTOTAL | | | | | | $ | 14,360 |

| | | | | | |
|---|---|---|---|---|---|
| 197 | 8" Pipe | 325 | LF | $ 45.00 | $ 14,625 |
| | 8" Valves & Fittings | 3 | EA | $ 1,000.00 | $ 3,000 |
| | Services | 4 | EA | $ 500.00 | $ 2,000 |
| | MDT Crossing | 1 | LS | $ 2,000.00 | $ 2,000 |
| | Asphalt Repair | 325 | LF | $ 20.00 | $ 6,500 |
| SUBTOTAL | | | | | $ 28,125 |
| 66 | 8" Pipe | 75 | LF | $ 45.00 | $ 3,375 |
| | 8" Valves & Fittings | 3 | EA | $ 1,000.00 | $ 3,000 |
| | Services | 2 | EA | $ 500.00 | $ 1,000 |
| | Asphalt Repair | 75 | LF | $ 20.00 | $ 1,500 |
| SUBTOTAL | | | | | $ 8,875 |
| 64 | 8" Pipe | 150 | LF | $ 45.00 | $ 6,750 |
| | 8" Valves & Fittings | 4 | EA | $ 1,000.00 | $ 4,000 |
| | Services | 6 | EA | $ 500.00 | $ 3,000 |
| | Asphalt Repair | 150 | LF | $ 20.00 | $ 3,000 |
| SUBTOTAL | | | | | $ 16,750 |
| 207 | 8" Pipe | 215 | LF | $ 45.00 | $ 9,675 |
| | 8" Valves & Fittings | 3 | EA | $ 1,000.00 | $ 3,000 |
| | Services | 4 | EA | $ 500.00 | $ 2,000 |
| | Asphalt Repair | 215 | LF | $ 20.00 | $ 4,300 |
| SUBTOTAL | | | | | $ 18,975 |
| 208 | 8" Pipe | 75 | LF | $ 45.00 | $ 3,375 |
| | 8" Valves & Fittings | 3 | EA | $ 1,000.00 | $ 3,000 |
| | Services | 0 | EA | $ 500.00 | $ - |
| | Asphalt Repair | 75 | LF | $ 20.00 | $ 1,500 |
| SUBTOTAL | | | | | $ 7,875 |
| 221 | 8" Pipe | 750 | LF | $ 45.00 | $ 33,750 |
| | 8" Valves & Fittings | 8 | EA | $ 1,000.00 | $ 8,000 |
| | Services | 1 | EA | $ 500.00 | $ 500 |
| | Asphalt Repair | 750 | LF | $ 20.00 | $ 15,000 |
| SUBTOTAL | | | | | $ 57,250 |
| Subtotal, Main Replacement Costs | | | | | $ 1,338,365 |
| Construction Services | | Quantity | Units | Unit Cost | Total |
| 1 | Temporary Water Service | 1 | LS | $ 25,000.00 | $ 25,000 |
| 2 | Construction De-watering | 1 | LS | $ 25,000.00 | $ 25,000 |
| 3 | Haul of Excess Material off-site | 6150 | CY | $ 6.00 | $ 36,900 |
| 4 | Coordination with Dry Utilities | 1 | LS | $ 10,000.00 | $ 10,000 |
| 5 | Traffic Control | 1 | LS | $ 20,000.00 | $ 20,000 |
| 6 | Water Main Testing | 1 | LS | $ 15,000.00 | $ 15,000 |
| 7 | Mobe / demobe / General Conditions @ 5% | 1 | LS | 5% | $ 66,918 |
| Subtotal, Construction Services | | | | | $ 198,818 |
| Construction contingency (10%) | | | | | $ 153,718 |
| Engineering Costs (15%) | | | | | $ 230,577 |
| TOTAL DISTRIBUTION SYSTEM IMPROVEMENTS | | | | | $ 1,921,479 |

| III.4. PRESSURE REDUCING VALVES & BOOSTER STATION | | | | | |
|---|---|---|---|---|---|
| A. Easement & Survey | | Quantity | Units | Unit Cost | Total |
| 1 | Surveys & legal | 1 | LS | $ 5,000.00 | $ 5,000 |
| Subtotal, Easement & Survey | | | | | $ 5,000 |
| B. Pressure Reducing Valves | | Quantity | Units | Unit Cost | Total |
| 1 | Pressure Reducing/Pressure Sustaining Valve | 1 | EA | $ 18,000.00 | $ 18,000 |
| 2 | Valve Vault | 1 | EA | $ 5,000.00 | $ 5,000 |
| 3 | Piping and Installation | 1 | LS | $ 2,000.00 | $ 2,000 |
| Subtotal, Pressure Reducing Valves & Vaults | | | | | $ 25,000 |
| 3 Pressure Reducing Valves and Vaults | | 3 | EA | $ 25,000.00 | $ 75,000 |
| C. 300 gpm Booster Station | | Quantity | Units | Unit Cost | Total |
| 1 | Booster Station capable of 300 gpm | 1 | LS | $ 30,000.00 | $30,000 |
| 2 | Booster Station Piping and valves | 1 | LS | $ 25,000.00 | $25,000 |
| 3 | Electrical service connection | 1 | LS | $ 5,000.00 | $5,000 |
| 4 | Booster Station Enclosure | 1 | LS | $ 25,000.00 | $25,000 |
| Subtotal, 300 gpm Booster Station | | | | | $85,000 |
| Subtotal, Pressure Reducing Valves & Booster Station | | | | | $165,000 |
| Contingency (10%) | | | | | $16,500 |
| Engineering (15%) | | | | | $12,750 |
| TOTAL PRESSURE REDUCING VALVES & BOOSTER STATION | | | | | $194,250 |

| PHASE III IMPROVEMENT SUMMARY | | |
|---|---|---|
| III.1 | NEW PRODUCTION WELLS (3 @ 570 gpm) | $ 970,313 |
| III.2 | DE-COMMISSION INFILTRATION GALLERY & TREATMENT PLANT | $ 87,500 |
| III.3 | DISTRIBUTION SYSTEM IMPROVEMENTS | $ 1,921,479 |
| III.4 | PRESSURE REDUCING VALVES AND BOOSTER STATION | $ 194,250 |
| | TOTAL PHASE III IMPROVEMENTS | $ 3,173,542 |

| PROJECT SUMMARY | | |
|---|---|---|
| II.1 | METER IMPROVEMENTS | $ 291,405 |
| II.2.A | NEW SUPPLY TRANSMISSION MAIN | $ 1,066,078 |
| II.2.B | ROAD REPAIR | $ 135,903 |
| | SUBTOTAL PHASE II IMPROVEMENTS | $ 1,493,387 |
| III.1 | NEW PRODUCTION WELLS (3 @ 570 gpm) | $ 970,313 |
| III.2 | DE-COMMISSION INFILTRATION GALLERY & TREATMENT PLANT | $ 87,500 |
| III.3 | DISTRIBUTION SYSTEM IMPROVEMENTS | $ 1,921,479 |
| III.4 | PRESSURE REDUCING VALVES AND BOOSTER STATION | $ 194,250 |
| | SUBTOTAL PHASE III IMPROVEMENTS | $ 3,173,542 |
| | ESTIMATED TOTAL PROJECT COST | $ 4,666,928 |

| II.2.a NEW SUPPLY TRANSMISSION MAIN & BURNT FORK RECONSTRUCTION | | | | | |
|---|---|---|---|---|---|
| **A. Water Transmission Main** | | Quantity | Units | Unit Cost | Total |
| $ 1 | 16" ductile iron pipe, PC 350, or PVC | $ 5,450 | LF | $ 90.00 | $ 490,500 |
| $ 2 | 16" butterfly valves | $ 13 | EA | $ 3,500.00 | $ 45,500 |
| $ 3 | 16" fittings & bends | $ 8 | EA | $ 2,500.00 | $ 20,000 |
| $ 4 | culvert crossings | $ 15 | EA | $ 250.00 | $ 3,750 |
| $ 5 | Supply Ditch Bridge & RR bore & 36" sleeve | $ 100 | LF | $ 425.00 | $ 42,500 |
| $ 6 | Install 16" DIP in sleeve, chocks & seals | $ 100 | LF | $ 100.00 | $ 10,000 |
| $ 7 | Tie in at Well Field | $ 1 | EA | $ 4,000.00 | $ 4,000 |
| $ 9 | Tie in at Park Street | $ 1 | EA | $ 4,000.00 | $ 4,000 |
| $ 10 | Tie in at Eastside Highway | $ 1 | EA | $ 8,000.00 | $ 8,000 |
| $ 11 | Testing & acceptance | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 12 | Re-connect 1" water services / new service line & meter pit | $ 10 | EA | $ 3,000.00 | $ 30,000 |
| $ 15 | Construction De-watering | $ 1 | LS | $ 20,000.00 | $ 20,000 |
| $ 16 | Haul off Excess Material | $ 3,280 | CY | $ 6.00 | $ 19,680 |
| $ 13 | Traffic control | $ 1 | LS | $ 20,000.00 | $ 20,000 |
| $ 14 | Mobe / demobe / General Conditions | $ 1 | LS | 5.00% | $ 36,147 |
| Subtotal, water supply line | | | | | $ 759,077 |
| Contingency (10%) | | | | | $ 75,908 |
| Engineering & Contract Administration (15%) | | | | | $ 113,861 |
| Subtotal, New Supply Transmission Main | | | | | $ 948,846 |
| **B. Burnt Fork Repair - 6635 lf of roadway (1/2 Road Patch)** | | Quantity | Units | Unit Cost | Total |
| $ 100 | Mobilization/Demobilization (5%) | $ 1 | LS | $ 16,709.13 | $ 16,709 |
| $ 110 | SWPPP | $ 1 | LS | $ 2,000.00 | $ 2,000 |
| $ 120 | Erosion Control Measures (Silt Fence, Straw Bales) | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 130 | Traffic Control | $ 1 | LS | $ 15,000.00 | $ 15,000 |
| $ 140 | Asphalt Concrete Mill, Haul & Dispose | $ 8,850 | SY | $ 6.00 | $ 53,100 |
| $ 150 | Strip, Stockpile & Replace Sub-Base Gravel (12") | $ 2,950 | SY | $ 12.00 | $ 35,400 |
| $ 160 | Geotextile Fabric | $ 8,850 | SY | $ 1.25 | $ 11,063 |
| $ 170 | 1-1/2" Minus Crushed Base Course (4") | $ 985 | CY | $ 32.00 | $ 31,520 |
| $ 180 | 12' Wide Asphalt Concrete Pavement (4") Two 2" Lifts | $ 1,970 | TN | $ 85.00 | $ 167,450 |
| $ 190 | Painting and Markings | $ 1 | LS | $ 11,000.00 | $ 11,000 |
| $ 200 | Drill/Hydro Seeding | $ 53,000 | SF | $ 0.05 | $ 2,650 |
| $ 210 | Payment and Performance Bonds | $ 1 | LS | $ 6,683.65 | $ 6,684 |
| Subtotal, Road Reconstruction | | | | | $ 357,575 |
| Contingency (10%) | | | | | $ 35,758 |
| Engineering & Contract Administration (15%) | | | | | $ 53,636 |
| Subtotal, Middle Burnt Fork Re-construction | | | | | $ 446,969 |
| TOTAL, TRANSMISSION MAIN & BURNT FORK RE-CONSTRUCTION | | | | | $ 1,395,815 |

| II.2.b NEW SUPPLY TRANSMISSION MAIN (Route 3 - Park Street) | | | | | |
|---|---|---|---|---|---|
| **A. Water Transmission Main** | | Quantity | Units | Unit Cost | Total |
| $ 1 | 16" ductile iron pipe, PC 350, or PVC | $ 7,000 | LF | $ 90.00 | $ 630,000 |
| $ 2 | 16" butterfly valves | $ 16 | EA | $ 3,500.00 | $ 56,000 |
| $ 3 | 16" fittings & bends | $ 10 | EA | $ 2,500.00 | $ 25,000 |
| $ 4 | culvert crossings | $ 15 | EA | $ 250.00 | $ 3,750 |
| $ 5 | Supply Ditch Bridge & RR bore & 36" sleeve | $ 100 | LF | $ 425.00 | $ 42,500 |
| $ 6 | Install 16" DIP in sleeve, chocks & seals | $ 100 | LF | $ 100.00 | $ 10,000 |
| $ 7 | Tie in at Well Field | $ 1 | EA | $ 4,000.00 | $ 4,000 |
| $ 9 | Tie in at Park, Pine, College, 6th | $ 4 | EA | $ 4,000.00 | $ 16,000 |
| $ 11 | Testing & acceptance | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 12 | Re-connect water services | $ 25 | EA | $ 1,000.00 | $ 25,000 |
| $ 15 | Construction De-watering | $ 1 | LS | $ 20,000.00 | $ 20,000 |
| $ 16 | Haul off Excess Material | $ 4,212 | CY | $ 6.00 | $ 25,272 |
| $ 13 | Traffic control | $ 1 | LS | $ 20,000.00 | $ 20,000 |
| $ 14 | Mobe / demobe / General Conditions | $ 1 | LS | 5.00% | $ 44,126 |
| Subtotal, water supply line | | | | | $ 926,648 |
| Contingency (10%) | | | | | $ 92,665 |
| Engineering & Contract Administration (15%) | | | | | $ 138,997 |
| Subtotal, New Supply Transmission Main | | | | | $ 1,158,310 |
| **B. Road Repair - 7000 lf of roadway** | | Quantity | Units | Unit Cost | Total |
| $ 100 | Mobilization/Demobilization (5%) | $ 1 | LS | $ 11,163.94 | $ 11,164 |
| $ 110 | SWPPP | $ 1 | LS | $ 2,000.00 | $ 2,000 |
| $ 120 | Erosion Control Measures (Silt Fence, Straw Bales) | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 130 | Traffic Control | $ 1 | LS | $ 7,500.00 | $ 7,500 |
| $ 140 | Asphalt Concrete Mill, Haul & Dispose | $ 5,555 | SY | $ 6.00 | $ 33,330 |
| $ 150 | Strip, Stockpile & Replace Sub-Base Gravel (12") | $ 1,855 | CY | $ 35.00 | $ 64,925 |
| $ 160 | Geotextile Fabric | $ 5,555 | SY | $ 1.25 | $ 6,944 |
| $ 170 | 1-1/2" Minus Crushed Base Course (4") | $ 620 | CY | $ 32.00 | $ 19,840 |
| $ 180 | 12' Wide Asphalt Concrete Pavement (4") Two 2" Lifts | $ 926 | TN | $ 85.00 | $ 78,710 |
| $ 190 | Painting and Markings | $ 1 | LS | $ 3,000.00 | $ 3,000 |
| $ 200 | Drill/Hydro Seeding | $ 40,600 | SF | $ 0.05 | $ 2,030 |
| $ 210 | Payment and Performance Bonds | $ 1 | LS | $ 4,465.58 | $ 4,466 |
| Subtotal, Road Reconstruction | | | | | $ 238,908 |
| Contingency (10%) | | | | | $ 23,891 |
| Engineering & Contract Administration (15%) | | | | | $ 35,836 |
| Subtotal, Road Repair | | | | | $ 298,635 |
| TOTAL, TRANSMISSION MAIN & ROAD REPAIR | | | | | $ 1,456,945 |

| II.2.c NEW SUPPLY TRANSMISSION MAIN (Route 2 - ALC Way to 5th Street) | | | | | |
|---|---|---|---|---|---|
| **A. Water Transmission Main** | | Quantity | Units | Unit Cost | Total |
| $ 1 | 16" ductile iron pipe, PC 350 DI, or C905 PVC - DR-18 | $ 6,000 | LF | $ 90.00 | $ 540,000 |
| $ 2 | 16" butterfly valves | $ 16 | EA | $ 3,500.00 | $ 56,000 |
| $ 3 | 16" fittings & bends | $ 10 | EA | $ 2,500.00 | $ 25,000 |
| $ 4 | culvert crossings | $ 3 | EA | $ 250.00 | $ 750 |
| $ 5 | Supply Ditch Bridge & RR bore & 30" sleeve (2 Bores) | $ 150 | LF | $ 425.00 | $ 63,750 |
| $ 6 | Install 16" Main in sleeve, chocks & seals | $ 150 | LF | $ 100.00 | $ 15,000 |
| $ 7 | Fire Hydrants | $ 4 | EA | $ 5,000.00 | $ 20,000 |
| $ 8 | Tie in at well field | $ 1 | EA | $ 4,000.00 | $ 4,000 |
| $ 9 | Tie in at Park & 5th | $ 2 | EA | $ 4,000.00 | $ 8,000 |
| $ 10 | Tie in at Middle Burnt Fork Road | $ 1 | EA | $ 8,000.00 | $ 8,000 |
| $ 11 | Temporary Water Service | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 12 | Testing & acceptance | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 13 | Re-connect water services | $ 5 | EA | $ 500.00 | $ 2,500 |
| $ 14 | Abandon 8" Cast Iron Main | $ 1 | LS | $ 7,500.00 | $ 7,500 |
| $ 15 | Construction De-watering | $ 1 | LS | $ 20,000.00 | $ 20,000 |
| $ 16 | Haul off Excess Material | $ 3,625 | CY | $ 6.00 | $ 21,750 |
| $ 17 | Traffic control | $ 1 | LS | $ 10,000.00 | $ 10,000 |
| $ 18 | Mobe / demobe / General Conditions | $ 1 | LS | $ 0.05 | $ 40,613 |
| Subtotal, Water Transmission Main | | | | | $ 852,863 |
| Contingency (10%) | | | | | $ 85,286 |
| Engineering & Contract Administration (15%) | | | | | $ 127,929 |
| Subtotal, New Supply Transmission Main | | | | | $ 1,066,078 |
| **B. Road Repair - 6,150 lf of roadway** | | Quantity | Units | Unit Cost | Total |
| $ 100 | Mobilization/Demobilization (5%) | $ 1 | LS | $ 5,080.50 | $ 5,081 |
| $ 110 | SWPPP | $ 1 | LS | $ 2,000.00 | $ 2,000 |
| $ 120 | Erosion Control Measures (Silt Fence, Straw Bales) | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 130 | Traffic Control | $ 1 | LS | $ 5,000.00 | $ 5,000 |
| $ 140 | Asphalt Concrete - Sawcut, Remove & Replace | $ 1,450 | SY | $ 25.00 | $ 36,250 |
| $ 150 | Strip, Stockpile & Replace Sub-Base Gravel (12") | $ 490 | CY | $ 35.00 | $ 17,150 |
| $ 160 | Geotextile Fabric | $ 100 | SY | $ 1.25 | $ 125 |
| $ 170 | 3/4" Minus Crushed Base/Gravel Travel Course (4") | $ 915 | CY | $ 35.00 | $ 32,025 |
| $ 200 | Painting and Markings | $ 1 | LS | $ 2,500.00 | $ 2,500 |
| $ 210 | Drill/Hydro Seeding | $ 15,600 | SF | $ 0.10 | $ 1,560 |
| $ 220 | Payment and Performance Bonds | $ 1 | LS | $ 2,032.20 | $ 2,032 |
| Subtotal, Road Repair | | | | | $ 108,723 |
| Contingency (10%) | | | | | $ 10,872 |
| Engineering & Contract Administration (15%) | | | | | $ 16,308 |
| Subtotal, Road Repair | | | | | $ 135,903 |
| TOTAL, TRANSMISSION MAIN & ROAD REPAIR | | | | | $ 1,201,982 |

# SHORT LIVED ASSETS

***(TOTAL BUDGET FOR 1-15 YEAR PERIOD)***

| | AMOUNT |
|---|---|
| 1 - 5 YEARS | $1,440 |
| 5 - 10 YEARS | $4,896 |
| 10-15 YEARS | $3,533 |
| | |
| | |
| **TOTAL ANNUAL CONTRIBUTIONS** | $9,869 |

# SHORT LIVED ASSETS

*(ONE TO FIVE YEARS)*

| 1 - 5 YEARS | TOTAL CONTRIBUTIONS |
|---|---|
| | |
| | |
| billing software updates | 2,500 |
| Lawnmower | 2,000 |
| 100 gallon plastic tank "CL2" | 300 |
| LMI dosing pump "CL2" | 2,200 |
| LMI rebuild kits | 200 |
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| TOTAL 1 - 5 YEARS | 7,200 |
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| LESS CASH ON HAND | |
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| TOTAL BUDGET NEEDS | 7,200 |
| | |
| ANNUAL CONTRIBUTION (TOTAL NEEDS DIVIDED BY 5) | $1,440 |

# SHORT LIVED ASSETS

***(FIVE TO TEN YEARS)***

| 5 - 10 YEARS | TOTAL CONTRIBUTIONS |
|---|---|
| | |
| meters 100 @ $160 | 16,000 |
| computer for billing (prorated share with ww) | 1,000 |
| tank inspection and cleaning | 5,000 |
| Jet Pump "CL2" | 500 |
| Bobcat (prorated with sewer) | 16,000 |
| PRV Rebuild (3 PRV's) | 5,000 |
| CL17 Chlorine Analyzer | 2,000 |
| CL2 pocket meter | 705 |
| Phosphate Pocket Meter | 370 |
| LMI Dosing Pumps "Phosphate" | 1,500 |
| 150 gallong plastic tank "Phosphate" | 385 |
| 250 gallon plastic tank "Phosphate" | 500 |
| | |
| TOTAL 5 - 10 YEARS | 48,960 |
| | |
| LESS CASH ON HAND | |
| | |
| TOTAL BUDGET NEEDS | 48,960 |
| | |
| ANNUAL CONTRIBUTION (TOTAL NEEDS DIVIDED BY 10) | $4,896 |

# SHORT LIVED ASSETS

***(TEN TO FIFTEEN YEARS)***

| 10 - 15 YEARS | TOTAL CONTRIBUTIONS |
|---|---|
| | |
| Well #1 pump service | 7,000 |
| Well #2 pump service | 7,000 |
| Well #3 pump service | 7,000 |
| Well #4 pump service | 7,000 |
| Data Recorders & Telemetry | 5,000 |
| Control System Upgrades | 5,000 |
| Booster Station Pumps | 15,000 |
| | |
| TOTAL 10 - 15 YEARS | 53,000 |
| | |
| LESS CASH ON HAND | |
| | |
| TOTAL BUDGET NEEDS | 53,000 |
| | |
| ANNUAL CONTRIBUTION (TOTAL NEEDS DIVIDED BY 15) | $3,533 |

Ravalli County

*Ravalli County Economic Development Authority*

October 12, 2009

Town of Stevensville
PO Box 30
Stevensville, MT 59870

RE: Support – Town of Stevensville Water Improvement Project

Dear Mayor Evans and Town Council,

It is Ravalli County Economic Development Authority's (RCEDA) pleasure to provide a letter of support for the Town of Stevensville Water Improvement Project

The Town of Stevensville is one of the fastest growing in the State. Keeping up with infrastructure needs is an extreme challenge. Although the potential for economic development to occur in the Town is great the lack of infrastructure is a barrier.

Stevensville has the desire and many of the assets needed to grow their tax base and become more self-sufficient in sharing in the cost of capital improvements. Selway Manufacturing, an existing company with over 120 employees is an example of the opportunity. This company requires infrastructure, both for the company and so their employees can count on safe drinking water in the homes of their families.

The Town is seeking grant assistance to upgrade their water systems at the same time they are proactively working on economic development projects, such as a Tax Increment Finance District, to keep the tax base they have (Selway) and create opportunities for new tax base growth to occur. This company and a few others will have to decide where they need to be to expand their business. They will not make a decision to remain in an area that can not provide adequate and safe water supply.

The Town's citizens are predominately low or moderate income. Good paying jobs are a necessity and many jobs are currently supplied by the companies that are prevented from expanding because of inadequate infrastructure. Your agencies support of the requested water improvement project will provide the mechanism for the Town of Stevensville to meet the incredible challenges described briefly herein.

Sincerely,

Julie Foster

Julie Foster
Executive Director, RCEDA

Voice: (406) 375-9416 • Fax (406) 363-2402
105 East Main, Hamilton, MT 59840

**Stevensville Public Schools**

Superintendent
Kent Kultgen
Ext. 136

300 Park Avenue
Stevensville, MT 59870
Phone: 406-777-5481
Fax: 406-777-1381

Business Manager
Bill Schiele
Ext. 139

October 8, 2009

Susan Evans, Mayor
Town of Stevensville
P.O. Box 30
Stevensville, MT 59870

Dear Mayor Evans:

This letter is in reference to the Stevensville Town Council's diligence in identifying the city's water issues. Having basic services is a foundation for any community and these utilities greatly enhance all patrons, businesses and schools. As Superintendent of schools I understand this as we serve the taxpayers of the community. Without these basic necessities we would not be able to open our doors. In my career as an administrative educator I have had to close school due to emergency water and sewer disruptions. It is for this reason that the Stevensville Public Schools support the Town Council in their endeavor to secure funds for our community.

Currently Stevensville Schools is proposing a building project to replace two facilities constructed in the early 1900s. We know firsthand the expense of maintaining antiquated infrastructure. The proposed educational improvements along with city utility updates will provide a higher quality of living for all our citizens.

Thank you very much for your time and consideration. It is my hope that the Stevensville Town Council's request will be successful.

Sincerely,

Kent Kultgen
Superintendent
Stevensville Schools

MAX BAUCUS
MONTANA

# United States Senate

WASHINGTON, DC 20510–2602

WASHINGTON, DC
(202) 224–2651

MONTANA TOLL FREE NUMBER
1–800–332–6106

INTERNET:
max@baucus.senate.gov
http://www.senate.gov/~baucus

March 19, 2008

To Whom It May Concern:

I am honored to have the opportunity to express my strong support to the Town of Stevensville as they apply for funding to provide critical upgrades to their water treatment and wastewater treatment plants.

These city systems are outdated and in need of repair. Both systems are in violation with the state due to safety and environmental concerns. The Town of Stevensville must raise the funds to provide the necessary upgrades to these two systems.

Again, I offer my full support to the Town of Stevensville, and I hope you will consider their application favorably. Please feel free to contact my office if I can provide any additional information. I also would greatly appreciate if you kept my office informed about the status of this request.

With best personal regards, I am

Sincerely,

Max Baucus

MSB/jj

COUNTY OF RAVALLI

STATE OF MONTANA

The Bitterroot Valley

Hamilton, Montana 59840

February 12, 2008

Bill Meisner, Mayor
Town of Stevensville
P.O. Box 30
Stevensville, MT. 59870

**RE: Water Improvement Project**

Dear Mayor Meisner;

On behalf of the Ravalli County Commissioners, I would like to offer our full support for the Town's proposed Water Improvement Project. We appreciate that the Town is taking a proactive approach to reducing water losses that are estimated at over 300,000 gallons per day (100 million gallons annual). In addition, the Town plans to increase water production which has proven marginal for peak summer use, and to replace the existing rapid sand filter (which cannot meet EPA requirements for safe drinking water), with a safe and adequate groundwater supply. Other system improvements needed include upgrades and replacements to provide fire flows and adequate capacity for maximum day use. Given the broad scope and urgent needs of this Project, it is helpful that the Town of Stevensville is taking positive steps to do their part in improving the existing water supply and distribution system.

As you well know, Ravalli County has experienced record growth for the past 20 years and the Town of Stevensville has experienced over 23% growth in population from 2000 to 2006. The anticipated Water Improvement Project is necessary for the heath and safety of the Stevensville residents and also benefits the entire County with safe and dependable drinking water.

We enthusiastically lend our support for any grants and funding opportunities that the Town may pursue to carry out this essential work, and thank you for your efforts in this matter.

Sincerely,

Carlotta Grandstaff

Carlotta Grandstaff, Chairperson
Ravalli County Commissioners

***Stevensville Main Street Association***

**P.O. BOX 18**
**Stevensville, MT, 59870**

**Telephone: 406-777-3773**

02/11/08

Re: Grant Fund Request—Town of Stevensville
Water System Project
Waste Water Project

To Whom It May Concern:

This letter is from the Stevensville Main Street Association on behalf of the Town of Stevensville and their request for grant funds for the Water System Project and the Waste Water Project needed for the Town of Stevensville.

We hope that you will consider favorably their request for grant funds to support these two projects.

The Stevensville area is rapidly growing; and the need for additional services plus the existing services required, adds to the urgent need for funding for these projects.

Thank you for your consideration.

Sincerely,

Joan Prather
Executive Director

EDA Ravalli County Economic Development Authority

*Ravalli County Economic Development Authority*

March 11, 2008

PCI
1713 North 1st St.
Hamilton, Montana 59840

RE: Town of Stevensville TSEP Application

To Whom It May Concern:

Ravalli County Economic Development Authority supports the Town of Stevensville in their effort to obtain financial assistance that will help upgrade the water system.

Ravalli County Economic Development Authority (RCEDA) is concerned with the general welfare of our citizens and the economic vitality of our community. Sewer and water infrastructure is a prerequisite for economic development to occur. Local businesses, both existing and start-up are held back from developing to their full potential when sewer and water infrastructure are not available.

The average home price in Stevensville has increased from $155,242 in 2000 to $286,856 in 2007; an increase of over 80%. The median household income by comparison has risen 30% during the same time period going from $27,803 in 2000 to $36,040 in 2007.

Stevensville, like the rest of the Bitterroot Valley, is growing rapidly compared with other areas in the state. In order to keep up with infrastructure needs and costs commercial development must occur and this requires infrastructure.

In Stevensville there are several growing manufacturing companies that are paying wages ranging from $18 to $25 per hour; some include benefits. It is imperative that quality, reliable, water services be available to support these businesses.

As more citizens move to this growing area, the impact on sewer and water infrastructure will impact the Town's systems. It is an increasing concern that businesses and homes in the area around the Town will not have adequate water for fire flows and will be connected to systems that will not meet EPA requirements. With the current system the Town is unable to properly bill customers further impacting their ability to cover costs of provisioned services.

This project is essential to the well being of the Town of Stevensville and its' citizens. Ravalli County Economic Development Authority would like to offer our full support for the proposed Town of Stevensville Water Project.

Respectfully,

Robert A. Thomas

Robert A. Thomas,
Treasurer, Ravalli County Economic Development Authority

Voice: (406) 375-9416 • Email: bdavis@RCEDA.org • Fax (406) 363-2402
105 East Main, Hamilton, MT 59840

## RESOLUTION No. 031808-3

*In support of the Town of Stevensville's application to the Montana Community Development Block Grant Program and the Treasure State Endowment Program for a public facilities project involving improvements to the Town's water system..*

WHEREAS, the Montana Department of Commerce (DOC) has designated the Missoula Area Economic Development Corporation (MAEDC) to be the Certified Regional Development Corporation (CRDC) for Missoula and Ravalli Counties; and

WHEREAS, the CRDC Program requires participation from at least two counties and a majority of the incorporated municipalities in the region to be served; and

WHEREAS, MAEDC has received letters of support from the Missoula and Ravalli County Boards of Commissioners, as well as from the municipalities of Darby, Hamilton and Stevensville, and the City of Missoula is an active member of MAEDC; and

WHEREAS, the Town of Stevensville, based on a needs assessment process and two public hearings, and a preliminary engineering report, has determined that a public facilities project involving improvements to the Town's water supply and distribution systems, is in the public interest and has authorized applications to the Montana Department of Commerce for financial assistance from the Community Development Block Grant and Treasure State Endowment Programs; and

WHEREAS, the Comprehensive Economic Development Strategy prepared by the Bitter Root Economic Development District has identified deficiencies in the Town of Stevensville's water system as a priority for the District.

NOW, THEREFORE, BE IT RESOLVED by the Board of Directors of the Missoula Area Economic Development Corporation that:

1. As the governance entity for the Certified Regional Development Corporation for the Missoula/Ravalli Region, the Board of Directors has determined that the applications to be submitted by the Town of Stevensville for assistance from the Montana Community Development Block Grant and the Treasure State Endowment Programs, in the approximate amounts of $450,000 and $750,000 respectively, address priority needs for the CRDC Region and merit full support.

PASSED AND ADOPTED this 18th day of March 2008.

Diane Beck

Diane Beck, Chair

ATTEST:

Craig Burns

Craig Burns, Secretary