

**FLAT CREEK GROUNDWATER SOURCE
INVESTIGATION REPORT**



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Montana Bureau of Mines and Geology

Prepared for:

U.S. Forest Service

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November 2018

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EXECUTIVE SUMMARY

An exploratory water well was drilled in the Flat Creek drainage in an attempt to locate an alternative water source for the town of Superior, Montana. The well was drilled at the mouth of Club Gulch just west of Flat Creek. Although an aquifer test was not conducted, the well appears to produce an ample quantity of water. However, the groundwater contains an average dissolved (filtered) antimony concentration of 8.07 µg/L, which is above the drinking water standard of 6 µg/L. Water from this location could be used for public water supply, if it is blended with water that has a lower antimony concentration. A detailed cost evaluation is necessary to determine if blending is economically advantageous at this location.

BACKGROUND

The drinking water supply for the town of Superior was developed in the late 1890s or early 1900s, and consisted of an infiltration gallery in the Flat Creek drainage that drained by gravity to a storage tank lower in the Flat Creek Valley (Duaine, 1996; MCS, 2014). The system was operated until 1997, when elevated antimony was detected in the water. Superior currently obtains potable water from wells adjacent to the Clark Fork River. Water from these wells is pumped over 1 mi to the system storage tank in the Flat Creek Valley. The U.S. Forest Service (USFS) offered to help find the town a more economical water source than current wells by drilling an exploratory water well in the Flat Creek drainage. The USFS contracted with the Montana Bureau of Mines and Geology (MBMG) in 2017 to drill this exploratory well, which is summarized in this report.

The source of antimony detected in the water collected from the infiltration gallery was likely related to historic mining activities (MCS, 2014). The Iron Mountain Mine (IMM), in the Flat Creek drainage, was the primary producer of silver, zinc, and lead in the Iron Mountain district. The mine operated episodically between 1888 and 1953 (MCS, 2014). The mining resulted in the deposition of metal-laden tailings that contained low concentrations of antimony along the Flat Creek floodplain. The Flat Creek Iron Mountain Mine Superfund site was listed on the Environmental Protection Agency's National Priorities List in 2009. During the summer of 2017 a remedial action was undertaken that removed tailings and other mine

waste along the floodplain of Flat Creek and near the former mine site (fig. 1).

Several investigations have been conducted around the Flat Creek IMM Superfund site; however, very little groundwater-quality information is available for the Flat Creek drainage. Surface-water chemistry data are limited to samples from recent Superfund studies (e.g., MCS, 2014) and samples collected by the MBMG. Samples collected by the MBMG include those from the USFS Abandoned Mine Lolo National Forest Inventory (Hargrave and others, 2003), a single sample collected in 1996, and samples collected in 2015 and 2016. Flat Creek surface-water samples from locations upstream of the mine site had antimony concentrations less than the detection limit of 0.1 µg/L (GWIC, 2018). Based on these data, the tributary drainages and the Flat Creek drainage above the mine are the most likely places to find groundwater of a quality sufficient for public water supply.

Two types of groundwater collection systems were considered for the Flat Creek drainage. The first type consists of an infiltration gallery installed in the Flat Creek alluvium upgradient of the mine site, similar to the original water collection system. This approach could potentially rely on a gravity-fed groundwater collection system, but it would require extensive piping along the bottom of the valley to connect to the existing water tank. It is therefore not a preferred solution. The second option calls for a well located in a tributary drainage. The target aquifer would likely be a bedrock formation, and well yield would depend on adequate fracture flow. Wells installed in either Club or Wood Gulches would involve less piping (<0.5 mi) to convey water to the existing water line compared to a new infiltration gallery.

WELL LOCATION

Four locations were considered for a new water supply well. The first site is in Wood Gulch upgradient from the repository (fig. 1). However, this property is owned by the State of Montana, and the Montana Department of Natural Resources and Conservation denied a request to drill at this location. Subsequently, we considered drilling on U.S. Forest Service property only. One of these sites was the Flat Creek Valley bottom above the former mine location and above private property sites that were formerly placer claims along

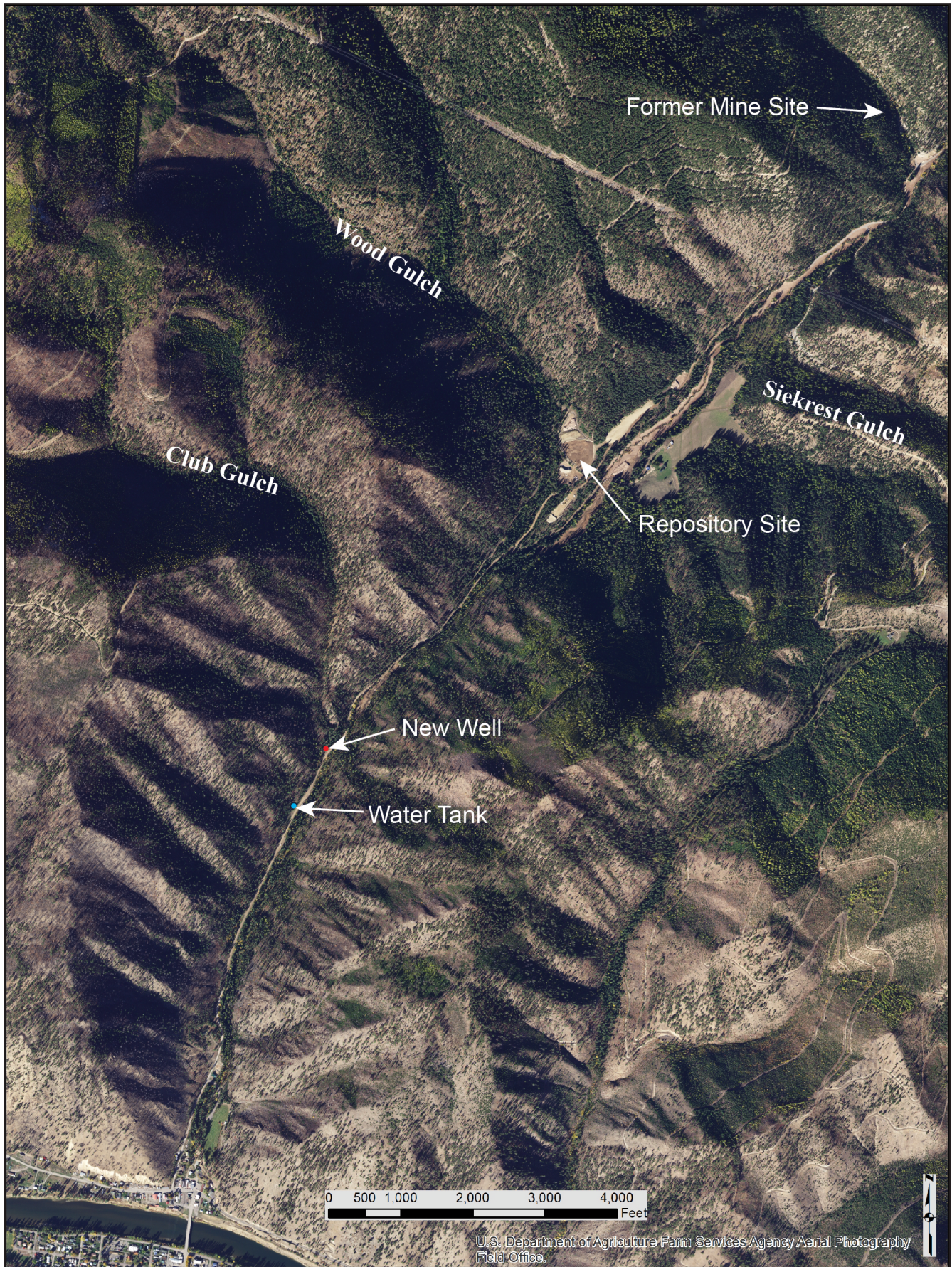


Figure 1. Location of the well drilled for this project.

the creek. However, this location would require over 3 mi of trenching to reach the existing water tank as well as acquiring easements for the water line. A location in Siekrest Gulch was also evaluated, but this site would also require extensive trenching and easements. The site selected for drilling is at the mouth of Club Gulch (latitude 47.215054, longitude -114.885074; fig. 1). The advantages of this site include proximity to the road, available electrical power, and a location about 1,000 ft from Superior's water storage tank. The disadvantage of this site is its proximity to a contaminated portion of Flat Creek, less than 200 ft away (Tetra Tech, 2015).

WELL DRILLING

Callison Well Drilling was contracted to drill the well, which was completed on July 5, 2018. The well was completed using air-rotary methods and advancing 6.6-in-diameter steel casing while drilling. The well was completed at a total depth of 90 ft below ground surface and was left as an open bottom well with casing extending to 90 ft (see appendix A).

Subsurface material encountered during drilling included alluvium to a depth of approximately 20 ft below the soil zone (appendix A). Although water was initially added to facilitate drilling, there was sufficient moisture below 20 ft that water was no longer needed. From 20 to 25 ft a dense brown clay was encountered. Gravel was encountered below the clay, and medium to coarse gravel with minor clay continued to approximately 50 ft. Fine to medium gravel was encountered from 50 to 75 ft, which consistently produced 40 to 50 gallons per minute (gpm). From 75 to 80 ft, the fine to medium gravel was mixed with rock chips. Rock chips of brown and black shale were collected from 80 to 85 ft, indicating bedrock had been encountered. From 85 to 90 ft, black shale was encountered along with an increase in flow to more than 80 gpm. The water production from this well was from the open bottom of the well; a properly constructed well with an extended screened interval would likely produce greater yields than recorded while drilling. These results suggest that much of the town's water needs could be met by this well.

WATER QUALITY

The water produced from the well was sampled for water quality at three depths while drilling (appendix B). The first sample, collected from a depth of 55 ft, contained 24.11 $\mu\text{g/L}$ of dissolved antimony, exceeding the drinking water standard of 6 $\mu\text{g/L}$. This antimony concentration is similar to the Flat Creek and infiltration gallery antimony concentrations (Duaine, 1996) and therefore may have been contaminated from the tailings along the Flat Creek drainage. There were no other exceedances of the drinking water standards (appendix B). Samples collected from depths of 75 and 90 ft contained dissolved antimony concentrations of 8.56 and 8.19 $\mu\text{g/L}$, respectively. These deeper concentrations may represent contamination from tailings along Flat Creek or naturally occurring rock-water interactions with local mineralization.

The stability of the antimony concentration was evaluated with an extended pumping experiment after the well was completed. On August 14th, approximately 12 borehole volumes (at 75 gallons per borehole volume) were purged from the well. Samples were collected after every 3 bore volumes. Dissolved antimony concentrations ranged from 7.86 to 8.32 $\mu\text{g/L}$, which is within the measurement error of the analysis (calculated as within 5 percent of the mean of the values; table 1, appendix C). The data suggest that a groundwater antimony concentration of approximately 8 $\mu\text{g/L}$ is to be expected from a well completed at this depth and location.

Table 1. Antimony concentrations collected during the extended pumping experiment.

Sample	Antimony ($\mu\text{g/L}$)
3 bore volumes purged	8.03
6 bore volumes purged	7.86
9 bore volumes purged	8.05
12 bore volumes purged	8.32

RECOMMENDATIONS

This work focused on evaluating potential water sources for the town of Superior. The current water supply system meets water-quality standards but involves pumping and transmitting water from existing wells to the water tank in the Flat Creek Valley, at a relatively high cost. Although the well drilled during this project produces water with 8 µg/L antimony, there appears to be an ample supply of water at this location, and pumping from this location would be less expensive than pumping from the existing wells. A cost savings may be realized by blending groundwater from the new location with higher-quality groundwater from the existing well field.

The Montana Department of Environmental Quality (DEQ) is responsible for evaluating public water-supply plans. The DEQ does consider blending as an acceptable approach to meeting drinking water standards. However, the regulatory requirements for blending water include extensive monitoring to ensure a safe drinking water supply (MT DEQ Emily Gillespie, oral communication September 2018). These requirements include closely controlled and monitored discharges to the storage tank and result in higher up-front and maintenance costs than a single source. A detailed analysis should be conducted to assess the potential cost savings from blending water from this location with the existing water supply.

The test well drilled for this project can be used as an observation well, if a production well is eventually drilled in this area. The well is also useful for preliminary aquifer testing to evaluate the potential long-term yield from a supply well at this location. This well could also be used to assess the long-term stability of groundwater levels in this area with the installation of a pressure transducer and data logger to monitor water levels and periodic (seasonal) sampling. If a cost-benefit analysis indicates that blending waters is not economical, this well should be properly abandoned by a licensed well installer.

REFERENCES

- Duaine, T., 1996. Draft report on Mountain Water Supply's Superior, MT spring, MBMG: Groundwater under the direct influence of surface water, Contract No. 430007—TO-26; May 1996.
- Hargrave, P.A., Kerschen, M.D., McDonald, C., Metesh, J.J., and Wintergerst, R., 2003, Abandoned-inactive mines on Lolo National Forest administered lands: Montana Bureau of Mines and Geology Open-File Report 476, 166 p.
- GWIC (MBMG Groundwater Information Center), Available online at <http://mbmggwic.mtech.edu/> [Accessed 2018]
- MCS (MCS Environmental), 2014, Final Upper Flat Creek site investigation report: Prepared for USDA Forest Service, Region 1, Missoula, Mont., 177 p.
- Tetra Tech, 2015, Engineering evaluation/cost analysis Flat Creek Iron Mountain Mine NPL site Flat Creek Tailings—OU2, Mineral County, Montana: Prepared for the Montana Department of Environmental Quality, 89 p.

APPENDIX A:
WELL LOG

<p>MONTANA WELL LOG REPORT</p> <p>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.</p>	<p>Other Options</p> <p style="text-align: right;"> Go to GWIC website Plot this site in State Library Digital Atlas Plot this site in Google Maps View hydrograph for this site View field visits for this site View water quality for this site </p>
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Site Name: US FOREST SERVICE
GWIC Id: 297671

Section 1: Well Owner(s)

1) US FOREST SERVICE (MAIL)
 26 FORT MISSOULA ROAD
 MISSOULA MT 59804 [07/05/2018]
 2) US FOREST SERVICE (WELL)
 FLAT CREEK ROAD
 SUPERIOR MT 59872 [07/05/2018]

Section 2: Location

Township	Range	Section	Quarter Sections
17N	26W	22	SE¼ SE¼
County			Geocode
MINERAL			

Latitude	Longitude	Geomethod	Datum
47.215054	-114.885074	NAV-GPS	NAD83

Ground Surface Altitude **Ground Surface Method** **Datum Date**

Addition **Block** **Lot**

Section 3: Proposed Use of Water

TEST WELL (1)

Section 4: Type of Work

Drilling Method: ROTARY
 Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, July 05, 2018

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	25	10
25	90	7.3

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
2	90	6.6	0.25	420.0	WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
2	90	6.6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	25	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 90
 Static Water Level: 39
 Water Temperature:

Air Test *

80 gpm with drill stem set at feet for hours.
 Time of recovery 1 hours.
 Recovery water level 39 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
0	5	SOIL WITH ROCK CHIPS
5	20	BROWN ALLUVIUM WITH ROCK CHIPS
20	25	BROWN CLAY
25	30	BROWN CLAY WITH MEDIUM GRAVEL
30	45	MAINLY MEDIUM GRAVEL WITH MINOR CLAY
45	50	COARSE GRAVEL WITH MINOR CLAY
50	75	FINE TO MEDIUM GRAVEL, PRODUCING 40-50 GPM
75	80	FINE TO MEDIUM GRAVEL WITH BROKEN ROCK CHIPS
80	85	BROKEN ROCK CHIPS OF BROWN AND BLACK SHALE
85	90	BLACK SHALE, WATER BEARING ZONE AT 87 FT PRODUCING >80 GPM

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.

<p style="text-align: center;"> Name: WILLIAM CALLISON Company: CALLISON WELL DRILLING License No: WWC-552 Date 7/5/2018 Completed: </p>

APPENDIX B:
WATER-QUALITY DATA
COLLECTED DURING DRILLING

Ground-Water Information Center Water Quality Report
Report Date: 7/30/2018

Site Name: US FOREST SERVICE
[Compare to Water Quality Standards](#)

Location Information

Sample Id/Site Id: 229820 / 297671	Sample Date: 7/5/2018 1:24:00 PM
Location (TRS): 17N 26W 22 DD	Agency/Sampler: MBMG / ICOPINI, GARY
Latitude/Longitude: 47° 12' 54" N 114° 53' 6" W	Field Number: FLAT CREEK WELL 55FT
Datum: NAD83	Lab Date: 7/30/2018 10:23:25 AM
Altitude:	Lab/Analyst: MBMG / TIMMER, JACKIE
County/State: MINERAL / MT	Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1
Site Type: WELL	Procedure Type: DISSOLVED
Geology:	Total Depth (ft): 90
USGS 7.5' Quad:	SWL-MP (ft): NR
PWS Id:	Depth Water Enters (ft): 2
Project: FLATCREEK_SUPERIOR	

Major Ion Results

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	36.590	1.826	Bicarbonate (HCO3)	229.910	3.768
Magnesium (Mg)	22.390	1.842	Carbonate (CO3)	0.000	0.000
Sodium (Na)	4.700	0.204	Chloride (Cl)	1.970	0.056
Potassium (K)	1.310	0.034	Sulfate (SO4)	10.460	0.218
Iron (Fe)	0.305	0.011	Nitrate (as N)	0.110	0.008
Manganese (Mn)	0.027 J	0.000	Fluoride (F)	0.080	0.004
Silica (SiO2)	11.500		Orthophosphate (as P)	<0.020 U	0.000
Total Cations		3.931	Total Anions		4.054

Trace Element Results (µg/L)

Aluminum (Al): 99.830	Cesium (Cs): <0.100 U	Molybdenum (Mo): 0.990	Strontium (Sr): 91.520
Antimony (Sb): 24.110	Chromium (Cr): 0.480 J	Nickel (Ni): <0.100 U	Thallium (Tl): <0.100 U
Arsenic (As): 0.960	Cobalt (Co): 0.270 J	Niobium (Nb): <0.100 U	Thorium (Th): <0.100 U
Barium (Ba): 49.110	Copper (Cu): 0.590 J	Neodymium (Nd): 0.270 J	Tin (Sn): <0.100 U
Beryllium (Be): <0.100 U	Gallium (Ga): 2.430	Palladium (Pd): <0.100 U	Titanium (Ti): 2.400
Boron (B): 2.810	Lanthanum (La): 0.250 J	Praseodymium (Pr): <0.100 U	Tungsten (W): <0.100 U
Bromide (Br): <10.000 U	Lead (Pb): 1.400	Rubidium (Rb): 1.120	Uranium (U): 1.560
Cadmium (Cd): <0.100 U	Lithium (Li): <10.0 U	Silver (Ag): <0.100 U	Vanadium (V): 0.330 J
Cerium (Ce): 0.610	Mercury (Hg): NR	Selenium (Se): <0.100 U	Zinc (Zn): 0.640 J
			Zirconium (Zr): <0.100 U

Field Chemistry and Other Analytical Results

**Total Dissolved Solids (mg/L): 202.38	Field Hardness as CaCO3 (mg/L): NR	Ammonia (mg/L): NR
**Sum of Diss. Constituents (mg/L): 319.08	Hardness as CaCO3: 183.52	T.P. Hydrocarbons (µg/L): NR
Field Conductivity (µmhos): 339.1	Field Alkalinity as CaCO3 (mg/L): NR	PCP (µg/L): NR
Lab Conductivity (µmhos): 357.37	Alkalinity as CaCO3 (mg/L): 188.64	Phosphorus, TD (mg/L): <0.030 U
Field pH: 7.65	Ryznar Stability Index: 7.322	Field Nitrate (mg/L): NR
Lab pH: 8	Sodium Adsorption Ratio: 0.1606	Field Dissolved O2 (mg/L): 10.150
Water Temp (°C): 12.84	Langlier Saturation Index: 0.339	Field Chloride (mg/L): NR
Air Temp (°C): NR	Nitrite (mg/L as N): <0.010 U	Field Redox (mV): 366
Nitrate + Nitrite (mg/L as N): NR	Hydroxide (mg/L as OH): 0.000	Lab, Dissolved Organic Carbon (mg/L): NR
Total Kjeldahl Nitrogen (mg/L as N): NR	Lab, Dissolved Inorganic Carbon (mg/L): NR	Lab, Total Organic Carbon (mg/L): NR
Total Nitrogen (mg/L as N): NR	Acidity to 4.5 (mg/L CaCO3): NR	Acidity to 8.3 (mg/L CaCO3): NR
As(III) (ug/L): NR	As(V) (ug/L): NR	Total Susp Solids (mg/L): NR

Sample Condition: TURBID TAN/BROWN

Field Remarks: COLLECTED DURING DRILLING WHILE CASING AT 55 FT BELOW GROUND SURFACE

Lab Remarks:

Notes

Explanation: **mg/L** = milligrams per Liter; **µg/L** = micrograms per Liter; **ft** = feet; **NR** = No Reading in GWIC

Qualifiers: **A** = Hydride atomic absorption; **E** = Estimated due to interference; **H** = Exceeded holding time; **J** = Estimated quantity above detection limit but below reporting limit; **K** = Na+K combined; **N** = Spiked sample recovery not within control limits; **P** = Preserved sample; **S** = Method of standard additions; **U** = Undetected quantity below detection limit; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

Disclaimer

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted.

Drinking water limits are based on U.S. Environmental Protection Agency primary and secondary standards for public water supplies (**view their standards**). Stock water and irrigation water recommendations are from U.S. Department of Agriculture Natural Resources Conservation Service water-quality guidelines. The guidelines are general and may vary depending on specific applications. Irrigation guidelines are based on continuous irrigation.

Sample Id	GWIC Id	Sample Date	Site Name	Location	Site Type
229820	297671	7/5/2018 1:24:00 PM	US FOREST SERVICE	17N 26W 22 DD	WELL

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	36.590 mg/L	---	---	---
Magnesium (Mg)	22.390 mg/L	---	2,000 mg/L	---
Sodium (Na)	4.700 mg/L	---	2,000 mg/L	see SAR
Potassium (K)	1.310 mg/L	---	---	---
Iron (Fe)	0.305 mg/L	0.3 mg/L [smcl]	---	---
Manganese (Mn)	0.027 J mg/L	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO ₂)	11.500 mg/L	---	---	---
Bicarbonate (HCO ₃)	229.910 mg/L	---	---	---
Carbonate (CO ₃)	0.000 mg/L	---	---	---
Chloride (Cl)	1.970 mg/L	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO ₄)	10.460 mg/L	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO ₃ as N)	0.110 mg/L	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	0.080 mg/L	4 mg/L [mcl]	2 mg/L	---
Ortho-Phosphate (as P)	<0.020 U mg/L	---	---	---
Aluminum (Al)	99.830 ug/L	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	24.110 ug/L	6 ug/L [mcl]	---	---
Arsenic (As)	0.960 ug/L	10 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	49.110 ug/L	2,000 ug/L [mcl]	---	---
Boron (B)	2.810 ug/L	---	---	---
Cadmium (Cd)	<0.100 U ug/L	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	0.480 J ug/L	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	0.270 J ug/L	---	1,000 ug/L	50 ug/L
Copper (Cu)	0.590 J ug/L	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	1.400 ug/L	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	<10.0 U ug/L	---	---	2,500 ug/L
Molybdenum (Mo)	0.990 ug/L	---	---	5 ug/L
Nickel (Ni)	<0.100 U ug/L	---	---	200 ug/L
Phosphate (P)	<0.030 U ug/L	---	---	---
Selenium (Se)	<0.100 U ug/L	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	<0.100 U ug/L	100 ug/L [smcl]	---	---
Strontium (Sr)	91.520 ug/L	---	---	---
Thallium (Tl)	<0.100 U ug/L	2.0 ug/L	---	---
Titanium (Ti)	2.400 ug/L	---	---	---
Uranium (U)	1.560 ug/L	30 ug/L	---	---
Vanadium (V)	0.330 J ug/L	---	---	---
Zinc (Zn)	0.640 J ug/L	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	<0.100 U ug/L	---	---	---

Key: **NR** = No reading in GWIC; **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; **---** = Currently no standard for this constituent; **[b]** = High concentrations of sulfate may restrict calcium uptake by crops; **[c]** = Varies with crop, generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm); **[d]** = Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR); **[mcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999; **[smcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

Ground-Water Information Center Water Quality Report
Report Date: 7/30/2018

Site Name: US FOREST SERVICE
[Compare to Water Quality Standards](#)

Location Information

Sample Id/Site Id: 229821 / 297671	Sample Date: 7/5/2018 2:10:00 PM
Location (TRS): 17N 26W 22 DD	Agency/Sampler: MBMG / ICOPINI, GARY
Latitude/Longitude: 47° 12' 54" N 114° 53' 6" W	Field Number: FLAT CREEK WELL 75FT
Datum: NAD83	Lab Date: 7/30/2018 10:23:25 AM
Altitude:	Lab/Analyst: MBMG / TIMMER, JACKIE
County/State: MINERAL / MT	Sample Method/Handling: GRAB / ru:0 ra:0 fu:1 fa:1
Site Type: WELL	Procedure Type: DISSOLVED
Geology:	Total Depth (ft): 90
USGS 7.5' Quad:	SWL-MP (ft): NR
PWS Id:	Depth Water Enters (ft): 2
Project: FLATCREEK_SUPERIOR	

Major Ion Results

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	43.200	2.156	Bicarbonate (HCO3)	NR	0.000
Magnesium (Mg)	17.360	1.429	Carbonate (CO3)	NR	0.000
Sodium (Na)	5.810	0.253	Chloride (Cl)	2.420	0.068
Potassium (K)	2.450	0.063	Sulfate (SO4)	8.040	0.167
Iron (Fe)	<0.015 U	0.000	Nitrate (as N)	0.110	0.008
Manganese (Mn)	<0.002 U	0.000	Fluoride (F)	0.100	0.005
Silica (SiO2)	10.590		Orthophosphate (as P)	<0.020 U	0.000
Total Cations		3.902	Total Anions		0.249

Trace Element Results (µg/L)

Aluminum (Al): 2.320 J	Cesium (Cs): <0.100 U	Molybdenum (Mo): 2.620	Strontium (Sr): 63.520
Antimony (Sb): 8.560	Chromium (Cr): 0.370 J	Nickel (Ni): <0.100 U	Thallium (Tl): <0.100 U
Arsenic (As): 0.670	Cobalt (Co): <0.100 U	Niobium (Nb): <0.100 U	Thorium (Th): <0.100 U
Barium (Ba): 52.210	Copper (Cu): <0.500 U	Neodymium (Nd): <0.100 U	Tin (Sn): <0.100 U
Beryllium (Be): <0.100 U	Gallium (Ga): 2.590	Palladium (Pd): <0.100 U	Titanium (Ti): <0.100 U
Boron (B): 4.550	Lanthanum (La): <0.100 U	Praseodymium (Pr): <0.100 U	Tungsten (W): <0.100 U
Bromide (Br): <10.000 U	Lead (Pb): <0.060 U	Rubidium (Rb): 1.430	Uranium (U): 0.990
Cadmium (Cd): <0.100 U	Lithium (Li): <10.0 U	Silver (Ag): <0.100 U	Vanadium (V): <0.100 U
Cerium (Ce): <0.100 U	Mercury (Hg): NR	Selenium (Se): <0.100 U	Zinc (Zn): <0.500 U
			Zirconium (Zr): <0.100 U

Field Chemistry and Other Analytical Results

**Total Dissolved Solids (mg/L): NR	Field Hardness as CaCO3 (mg/L): NR	Ammonia (mg/L): NR
**Sum of Diss. Constituents (mg/L): NR	Hardness as CaCO3: 179.32	T.P. Hydrocarbons (µg/L): NR
Field Conductivity (µmhos): 344.7	Field Alkalinity as CaCO3 (mg/L): NR	PCP (µg/L): NR
Lab Conductivity (µmhos): NR	Alkalinity as CaCO3 (mg/L): NR	Phosphorus, TD (mg/L): <0.030 U
Field pH: 7.66	Ryznar Stability Index: 19.629	Field Nitrate (mg/L): NR
Lab pH: NR	Sodium Adsorption Ratio: 0.195	Field Dissolved O2 (mg/L): 10.150
Water Temp (°C): 11.26	Langlier Saturation Index: -9.815	Field Chloride (mg/L): NR
Air Temp (°C): NR	Nitrite (mg/L as N): <0.010 U	Field Redox (mV): 362
Nitrate + Nitrite (mg/L as N) NR	Hydroxide (mg/L as OH): NR	Lab, Dissolved Organic Carbon (mg/L): NR
Total Kjeldahl Nitrogen (mg/L as N) NR	Lab, Dissolved Inorganic Carbon (mg/L): NR	Lab, Total Organic Carbon (mg/L): NR
Total Nitrogen (mg/L as N) NR	Acidity to 4.5 (mg/L CaCO3) NR	Acidity to 8.3 (mg/L CaCO3) NR
As(III) (ug/L) NR	As(V) (ug/L) NR	Total Susp Solids (mg/L) NR

Sample Condition: TURBID TAN/BROWN

Field Remarks: COLLECTED DURING DRILLING WHILE CASING AT 75 FT BELOW GROUND SURFACE, > 50 GPM

Lab Remarks:

Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: **A** = Hydride atomic absorption; **E** = Estimated due to interference; **H** = Exceeded holding time; **J** = Estimated quantity above detection limit but below reporting limit; **K** = Na+K combined; **N** = Spiked sample recovery not within control limits; **P** = Preserved sample; **S** = Method of standard additions; **U** = Undetected quantity below detection limit; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

Disclaimer

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Drinking water limits are based on U.S. Environmental Protection Agency primary and secondary standards for public water supplies (**view their standards**). Stock water and irrigation water recommendations are from U.S. Department of Agriculture Natural Resources Conservation Service water-quality guidelines. The guidelines are general and may vary depending on specific applications. Irrigation guidelines are based on continuous irrigation.

Sample Id	GWIC Id	Sample Date	Site Name	Location	Site Type
229821	297671	7/5/2018 2:10:00 PM	US FOREST SERVICE	17N 26W 22 DD	WELL

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	43.200 mg/L	---	---	---
Magnesium (Mg)	17.360 mg/L	---	2,000 mg/L	---
Sodium (Na)	5.810 mg/L	---	2,000 mg/L	see SAR
Potassium (K)	2.450 mg/L	---	---	---
Iron (Fe)	<0.015 U mg/L	0.3 mg/L [smcl]	---	---
Manganese (Mn)	<0.002 U mg/L	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO ₂)	10.590 mg/L	---	---	---
Bicarbonate (HCO ₃)	NR mg/L	---	---	---
Carbonate (CO ₃)	NR mg/L	---	---	---
Chloride (Cl)	2.420 mg/L	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO ₄)	8.040 mg/L	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO ₃ as N)	0.110 mg/L	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	0.100 mg/L	4 mg/L [mcl]	2 mg/L	---
Ortho-Phosphate (as P)	<0.020 U mg/L	---	---	---
Aluminum (Al)	2.320 J ug/L	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	8.560 ug/L	6 ug/L [mcl]	---	---
Arsenic (As)	0.670 ug/L	10 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	52.210 ug/L	2,000 ug/L [mcl]	---	---
Boron (B)	4.550 ug/L	---	---	---
Cadmium (Cd)	<0.100 U ug/L	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	0.370 J ug/L	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	<0.100 U ug/L	---	1,000 ug/L	50 ug/L
Copper (Cu)	<0.500 U ug/L	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	<0.060 U ug/L	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	<10.0 U ug/L	---	---	2,500 ug/L
Molybdenum (Mo)	2.620 ug/L	---	---	5 ug/L
Nickel (Ni)	<0.100 U ug/L	---	---	200 ug/L
Phosphate (P)	<0.030 U ug/L	---	---	---
Selenium (Se)	<0.100 U ug/L	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	<0.100 U ug/L	100 ug/L [smcl]	---	---
Strontium (Sr)	63.520 ug/L	---	---	---
Thallium (Tl)	<0.100 U ug/L	2.0 ug/L	---	---
Titanium (Ti)	<0.100 U ug/L	---	---	---
Uranium (U)	0.990 ug/L	30 ug/L	---	---
Vanadium (V)	<0.100 U ug/L	---	---	---
Zinc (Zn)	<0.500 U ug/L	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	<0.100 U ug/L	---	---	---

Key: **NR** = No reading in GWIC; **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; **---** = Currently no standard for this constituent; **[b]** = High concentrations of sulfate may restrict calcium uptake by crops; **[c]** = Varies with crop, generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm); **[d]** = Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR); **[mcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999; **[smcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

Ground-Water Information Center Water Quality Report
Report Date: 7/30/2018

Site Name: US FOREST SERVICE
[Compare to Water Quality Standards](#)

Location Information

Sample Id/Site Id: 229822 / 297671	Sample Date: 7/5/2018 3:09:00 PM
Location (TRS): 17N 26W 22 DD	Agency/Sampler: MBMG / ICOPINI, GARY
Latitude/Longitude: 47° 12' 54" N 114° 53' 6" W	Field Number: FLAT CREEK WELL 90FT
Datum: NAD83	Lab Date: 7/30/2018 10:23:25 AM
Altitude:	Lab/Analyst: MBMG / TIMMER, JACKIE
County/State: MINERAL / MT	Sample Method/Handling: GRAB / ru:0 ra:0 fu:1 fa:1
Site Type: WELL	Procedure Type: DISSOLVED
Geology:	Total Depth (ft): 90
USGS 7.5' Quad:	SWL-MP (ft): 39
PWS Id:	Depth Water Enters (ft): 2
Project: FLATCREEK_SUPERIOR	

Major Ion Results

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	44.060	2.199	Bicarbonate (HCO3)	NR	0.000
Magnesium (Mg)	17.980	1.480	Carbonate (CO3)	NR	0.000
Sodium (Na)	5.890	0.256	Chloride (Cl)	2.500	0.071
Potassium (K)	1.580	0.040	Sulfate (SO4)	8.910	0.186
Iron (Fe)	<0.015 U	0.000	Nitrate (as N)	0.110	0.008
Manganese (Mn)	0.013 J	0.000	Fluoride (F)	0.130	0.007
Silica (SiO2)	11.080		Orthophosphate (as P)	<0.020 U	0.000
Total Cations		3.976	Total Anions		0.271

Trace Element Results (µg/L)

Aluminum (Al): <2.000 U	Cesium (Cs): <0.100 U	Molybdenum (Mo): 0.720	Strontium (Sr): 63.050
Antimony (Sb): 8.190	Chromium (Cr): 0.380 J	Nickel (Ni): <0.100 U	Thallium (Tl): <0.100 U
Arsenic (As): 0.310 J	Cobalt (Co): 0.320 J	Niobium (Nb): <0.100 U	Thorium (Th): <0.100 U
Barium (Ba): 22.380	Copper (Cu): <0.500 U	Neodymium (Nd): <0.100 U	Tin (Sn): <0.100 U
Beryllium (Be): <0.100 U	Gallium (Ga): 1.060	Palladium (Pd): <0.100 U	Titanium (Ti): <0.100 U
Boron (B): 2.220	Lanthanum (La): <0.100 U	Praseodymium (Pr): <0.100 U	Tungsten (W): <0.100 U
Bromide (Br): <10.000 U	Lead (Pb): <0.060 U	Rubidium (Rb): 0.460 J	Uranium (U): 0.920
Cadmium (Cd): <0.100 U	Lithium (Li): <10.0 U	Silver (Ag): <0.100 U	Vanadium (V): <0.100 U
Cerium (Ce): <0.100 U	Mercury (Hg): NR	Selenium (Se): <0.100 U	Zinc (Zn): <0.500 U
			Zirconium (Zr): <0.100 U

Field Chemistry and Other Analytical Results

**Total Dissolved Solids (mg/L): NR	Field Hardness as CaCO3 (mg/L): NR	Ammonia (mg/L): NR
**Sum of Diss. Constituents (mg/L): NR	Hardness as CaCO3: 184.02	T.P. Hydrocarbons (µg/L): NR
Field Conductivity (µmhos): 348.1	Field Alkalinity as CaCO3 (mg/L): NR	PCP (µg/L): NR
Lab Conductivity (µmhos): NR	Alkalinity as CaCO3 (mg/L): NR	Phosphorus, TD (mg/L): <0.030 U
Field pH: 7.69	Ryznar Stability Index: 19.612	Field Nitrate (mg/L): NR
Lab pH: NR	Sodium Adsorption Ratio: 0.1925	Field Dissolved O2 (mg/L): 10.310
Water Temp (°C): 12.15	Langlier Saturation Index: -9.806	Field Chloride (mg/L): NR
Air Temp (°C): NR	Nitrite (mg/L as N): <0.010 U	Field Redox (mV): 355
Nitrate + Nitrite (mg/L as N): NR	Hydroxide (mg/L as OH): NR	Lab, Dissolved Organic Carbon (mg/L): NR
Total Kjeldahl Nitrogen (mg/L as N): NR	Lab, Dissolved Inorganic Carbon (mg/L): NR	Lab, Total Organic Carbon (mg/L): NR
Total Nitrogen (mg/L as N): NR	Acidity to 4.5 (mg/L CaCO3): NR	Acidity to 8.3 (mg/L CaCO3): NR
As(III) (ug/L): NR	As(V) (ug/L): NR	Total Susp Solids (mg/L): NR

Sample Condition: TAN CLOUDY

Field Remarks: COLLECTED DURING DRILLING WHILE CASING AT 90 FT BELOW GROUND SURFACE, > 80 GPM

Lab Remarks:

Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: **A** = Hydride atomic absorption; **E** = Estimated due to interference; **H** = Exceeded holding time; **J** = Estimated quantity above detection limit but below reporting limit; **K** = Na+K combined; **N** = Spiked sample recovery not within control limits; **P** = Preserved sample; **S** = Method of standard additions; **U** = Undetected quantity below detection limit; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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Drinking water limits are based on U.S. Environmental Protection Agency primary and secondary standards for public water supplies ([view their standards](#)). Stock water and irrigation water recommendations are from U.S. Department of Agriculture Natural Resources Conservation Service water-quality guidelines. The guidelines are general and may vary depending on specific applications. Irrigation guidelines are based on continuous irrigation.

Sample Id	GWIC Id	Sample Date	Site Name	Location	Site Type
229822	297671	7/5/2018 3:09:00 PM	US FOREST SERVICE	17N 26W 22 DD	WELL

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	44.060 mg/L	---	---	---
Magnesium (Mg)	17.980 mg/L	---	2,000 mg/L	---
Sodium (Na)	5.890 mg/L	---	2,000 mg/L	see SAR
Potassium (K)	1.580 mg/L	---	---	---
Iron (Fe)	<0.015 U mg/L	0.3 mg/L [smcl]	---	---
Manganese (Mn)	0.013 J mg/L	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO ₂)	11.080 mg/L	---	---	---
Bicarbonate (HCO ₃)	NR mg/L	---	---	---
Carbonate (CO ₃)	NR mg/L	---	---	---
Chloride (Cl)	2.500 mg/L	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO ₄)	8.910 mg/L	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO ₃ as N)	0.110 mg/L	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	0.130 mg/L	4 mg/L [mcl]	2 mg/L	---
Ortho-Phosphate (as P)	<0.020 U mg/L	---	---	---
Aluminum (Al)	<2.000 U ug/L	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	8.190 ug/L	6 ug/L [mcl]	---	---
Arsenic (As)	0.310 J ug/L	10 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	22.380 ug/L	2,000 ug/L [mcl]	---	---
Boron (B)	2.220 ug/L	---	---	---
Cadmium (Cd)	<0.100 U ug/L	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	0.380 J ug/L	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	0.320 J ug/L	---	1,000 ug/L	50 ug/L
Copper (Cu)	<0.500 U ug/L	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	<0.060 U ug/L	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	<10.0 U ug/L	---	---	2,500 ug/L
Molybdenum (Mo)	0.720 ug/L	---	---	5 ug/L
Nickel (Ni)	<0.100 U ug/L	---	---	200 ug/L
Phosphate (P)	<0.030 U ug/L	---	---	---
Selenium (Se)	<0.100 U ug/L	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	<0.100 U ug/L	100 ug/L [smcl]	---	---
Strontium (Sr)	63.050 ug/L	---	---	---
Thallium (Tl)	<0.100 U ug/L	2.0 ug/L	---	---
Titanium (Ti)	<0.100 U ug/L	---	---	---
Uranium (U)	0.920 ug/L	30 ug/L	---	---
Vanadium (V)	<0.100 U ug/L	---	---	---
Zinc (Zn)	<0.500 U ug/L	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	<0.100 U ug/L	---	---	---

Key: NR = No reading in GWIC; mg/L = milligrams per Liter; ug/L = micrograms per Liter; --- = Currently no standard for this constituent; [b] = High concentrations of sulfate may restrict calcium uptake by crops; [c] = Varies with crop, generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm); [d] = Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR); [mcl] = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999; [smcl] = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

APPENDIX C:
WATER-QUALITY DATA
COLLECTED DURING THE EXTENDED
PUMPING EXPERIMENT

Ground-Water Information Center Water Quality Report
Report Date: 9/11/2018

Site Name: US FOREST SERVICE
[Compare to Water Quality Standards](#)

Location Information

Sample Id/Site Id: 232046 / 297671	Sample Date: 8/14/2018 11:14:00 AM
Location (TRS): 17N 26W 22 DD	Agency/Sampler: MBMG / ICOPINI, GARY
Latitude/Longitude: 47° 12' 54" N 114° 53' 6" W	Field Number: FLAT CREEK WELL 3BV
Datum: NAD83	Lab Date: 9/11/2018 1:58:32 PM
Altitude:	Lab/Analyst: MBMG / TIMMER, JACKIE
County/State: MINERAL / MT	Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1
Site Type: WELL	Procedure Type: DISSOLVED
Geology:	Total Depth (ft): 90
USGS 7.5' Quad:	SWL-MP (ft): NR
PWS Id:	Depth Water Enters (ft): 2
Project: FLATCREEK_SUPERIOR	

Major Ion Results

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	43.190	2.155	Bicarbonate (HCO3)	236.630	3.878
Magnesium (Mg)	17.340	1.427	Carbonate (CO3)	0.000	0.000
Sodium (Na)	5.900	0.257	Chloride (Cl)	2.220	0.063
Potassium (K)	1.450	0.037	Sulfate (SO4)	8.430	0.176
Iron (Fe)	0.039 J	0.000	Nitrate (as N)	0.110	0.008
Manganese (Mn)	0.010 J	0.000	Fluoride (F)	0.080	0.004
Silica (SiO2)	10.900		Orthophosphate (as P)	<0.020 U	0.000
Total Cations		3.878	Total Anions		4.129

Trace Element Results (µg/L)

Aluminum (Al): <2.000 U	Cesium (Cs): <0.100 U	Molybdenum (Mo): 0.550	Strontium (Sr): 63.920
Antimony (Sb): 8.030	Chromium (Cr): <0.100 U	Nickel (Ni): <0.100 U	Thallium (Tl): <0.100 U
Arsenic (As): 0.430	Cobalt (Co): <0.100 U	Niobium (Nb): <0.100 U	Thorium (Th): <0.100 U
Barium (Ba): 24.180	Copper (Cu): <0.500 U	Neodymium (Nd): <0.100 U	Tin (Sn): <0.100 U
Beryllium (Be): <0.100 U	Gallium (Ga): 1.280	Palladium (Pd): <0.100 U	Titanium (Ti): <0.100 U
Boron (B): 3.210	Lanthanum (La): <0.100 U	Praseodymium (Pr): <0.100 U	Tungsten (W): <0.100 U
Bromide (Br): <10.000 U	Lead (Pb): <0.060 U	Rubidium (Rb): 0.460 J	Uranium (U): 1.030
Cadmium (Cd): <0.100 U	Lithium (Li): <2.000 U	Silver (Ag): <0.100 U	Vanadium (V): <0.100 U
Cerium (Ce): <0.100 U	Mercury (Hg): NR	Selenium (Se): <0.100 U	Zinc (Zn): <0.500 U
			Zirconium (Zr): <0.100 U

Field Chemistry and Other Analytical Results

**Total Dissolved Solids (mg/L): 205.28	Field Hardness as CaCO3 (mg/L): NR	Ammonia (mg/L): NR
**Sum of Diss. Constituents (mg/L): 325.53	Hardness as CaCO3: 179.22	T.P. Hydrocarbons (µg/L): NR
Field Conductivity (µmhos): 346.7	Field Alkalinity as CaCO3 (mg/L): NR	PCP (µg/L): NR
Lab Conductivity (µmhos): 346.61	Alkalinity as CaCO3 (mg/L): 194.38	Phosphorus, TD (mg/L): <0.030 U
Field pH: 7.79	Ryznar Stability Index: 7.562	Field Nitrate (mg/L): NR
Lab pH: 7.59	Sodium Adsorption Ratio: 0.195	Field Dissolved O2 (mg/L): 0.000
Water Temp (°C): 10.26	Langlier Saturation Index: 0.014	Field Chloride (mg/L): NR
Air Temp (°C): NR	Nitrite (mg/L as N): <0.010 U	Field Redox (mV): 186
Nitrate + Nitrite (mg/L as N) NR	Hydroxide (mg/L as OH): 0.000	Lab, Dissolved Organic Carbon (mg/L): NR
Total Kjeldahl Nitrogen (mg/L as N) NR	Lab, Dissolved Inorganic Carbon (mg/L): NR	Lab, Total Organic Carbon (mg/L): NR
Total Nitrogen (mg/L as N) NR	Acidity to 4.5 (mg/L CaCO3) NR	Acidity to 8.3 (mg/L CaCO3) NR
As(III) (ug/L) NR	As(V) (ug/L) NR	Total Susp Solids (mg/L) NR

Sample Condition: CLEAR

Field Remarks: 3 BORE VOLUME SAMPLE

Lab Remarks:

Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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Sample Id	GWIC Id	Sample Date	Site Name	Location	Site Type
232046	297671	8/14/2018 11:14:00 AM	US FOREST SERVICE	17N 26W 22 DD	WELL

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	43.190 mg/L	---	---	---
Magnesium (Mg)	17.340 mg/L	---	2,000 mg/L	---
Sodium (Na)	5.900 mg/L	---	2,000 mg/L	see SAR
Potassium (K)	1.450 mg/L	---	---	---
Iron (Fe)	0.039 J mg/L	0.3 mg/L [smcl]	---	---
Manganese (Mn)	0.010 J mg/L	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO ₂)	10.900 mg/L	---	---	---
Bicarbonate (HCO ₃)	236.630 mg/L	---	---	---
Carbonate (CO ₃)	0.000 mg/L	---	---	---
Chloride (Cl)	2.220 mg/L	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO ₄)	8.430 mg/L	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO ₃ as N)	0.110 mg/L	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	0.080 mg/L	4 mg/L [mcl]	2 mg/L	---
Ortho-Phosphate (as P)	<0.020 U mg/L	---	---	---
Aluminum (Al)	<2.000 U ug/L	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	8.030 ug/L	6 ug/L [mcl]	---	---
Arsenic (As)	0.430 ug/L	10 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	24.180 ug/L	2,000 ug/L [mcl]	---	---
Boron (B)	3.210 ug/L	---	---	---
Cadmium (Cd)	<0.100 U ug/L	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	<0.100 U ug/L	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	<0.100 U ug/L	---	1,000 ug/L	50 ug/L
Copper (Cu)	<0.500 U ug/L	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	<0.060 U ug/L	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	<2.000 U ug/L	---	---	2,500 ug/L
Molybdenum (Mo)	0.550 ug/L	---	---	5 ug/L
Nickel (Ni)	<0.100 U ug/L	---	---	200 ug/L
Phosphate (P)	<0.030 U ug/L	---	---	---
Selenium (Se)	<0.100 U ug/L	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	<0.100 U ug/L	100 ug/L [smcl]	---	---
Strontium (Sr)	63.920 ug/L	---	---	---
Thallium (Tl)	<0.100 U ug/L	2.0 ug/L	---	---
Titanium (Ti)	<0.100 U ug/L	---	---	---
Uranium (U)	1.030 ug/L	30 ug/L	---	---
Vanadium (V)	<0.100 U ug/L	---	---	---
Zinc (Zn)	<0.500 U ug/L	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	<0.100 U ug/L	---	---	---

Key: **NR** = No reading in GWIC; **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; **---** = Currently no standard for this constituent; **[b]** = High concentrations of sulfate may restrict calcium uptake by crops; **[c]** = Varies with crop, generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm); **[d]** = Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR); **[mcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999; **[smcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

Ground-Water Information Center Water Quality Report
Report Date: 9/11/2018

Site Name: US FOREST SERVICE
[Compare to Water Quality Standards](#)

Location Information

Sample Id/Site Id: 232047 / 297671	Sample Date: 8/14/2018 11:46:00 PM
Location (TRS): 17N 26W 22 DD	Agency/Sampler: MBMG / ICOPINI, GARY
Latitude/Longitude: 47° 12' 54" N 114° 53' 6" W	Field Number: FLAT CREEK WELL 6BV
Datum: NAD83	Lab Date: 9/11/2018 1:58:32 PM
Altitude:	Lab/Analyst: MBMG / TIMMER, JACKIE
County/State: MINERAL / MT	Sample Method/Handling: GRAB / ru:0 ra:0 fu:0 fa:1
Site Type: WELL	Procedure Type: DISSOLVED
Geology:	Total Depth (ft): 90
USGS 7.5' Quad:	SWL-MP (ft): NR
PWS Id:	Depth Water Enters (ft): 2
Project: FLATCREEK_SUPERIOR	

Major Ion Results

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	42.320	2.112	Bicarbonate (HCO3)	NR	0.000
Magnesium (Mg)	17.100	1.407	Carbonate (CO3)	NR	0.000
Sodium (Na)	5.610	0.244	Chloride (Cl)	NR	0.000
Potassium (K)	1.390	0.036	Sulfate (SO4)	NR	0.000
Iron (Fe)	0.025 J	0.000	Nitrate (as N)	NR	0.000
Manganese (Mn)	0.007 J	0.000	Fluoride (F)	NR	0.000
Silica (SiO2)	10.760		Orthophosphate (as P)	NR	0.000
Total Cations		3.800	Total Anions		0.000

Trace Element Results (µg/L)

Aluminum (Al): <2.000 U	Cesium (Cs): <0.100 U	Molybdenum (Mo): 0.520	Strontium (Sr): 64.440
Antimony (Sb): 7.860	Chromium (Cr): <0.100 U	Nickel (Ni): <0.100 U	Thallium (Tl): <0.100 U
Arsenic (As): 0.430	Cobalt (Co): <0.100 U	Niobium (Nb): <0.100 U	Thorium (Th): <0.100 U
Barium (Ba): 23.190	Copper (Cu): <0.500 U	Neodymium (Nd): <0.100 U	Tin (Sn): <0.100 U
Beryllium (Be): <0.100 U	Gallium (Ga): 1.250	Palladium (Pd): <0.100 U	Titanium (Ti): <0.100 U
Boron (B): 2.300	Lanthanum (La): <0.100 U	Praseodymium (Pr): <0.100 U	Tungsten (W): <0.100 U
Bromide (Br): NR	Lead (Pb): <0.060 U	Rubidium (Rb): 0.470 J	Uranium (U): 0.940
Cadmium (Cd): <0.100 U	Lithium (Li): <2.000 U	Silver (Ag): <0.100 U	Vanadium (V): <0.100 U
Cerium (Ce): <0.100 U	Mercury (Hg): NR	Selenium (Se): <0.100 U	Zinc (Zn): <0.500 U
			Zirconium (Zr): <0.100 U

Field Chemistry and Other Analytical Results

**Total Dissolved Solids (mg/L): NR	Field Hardness as CaCO3 (mg/L): NR	Ammonia (mg/L): NR
**Sum of Diss. Constituents (mg/L): NR	Hardness as CaCO3: 176.06	T.P. Hydrocarbons (µg/L): NR
Field Conductivity (µmhos): 346.8	Field Alkalinity as CaCO3 (mg/L): NR	PCP (µg/L): NR
Lab Conductivity (µmhos): NR	Alkalinity as CaCO3 (mg/L): NR	Phosphorus, TD (mg/L): <0.030 U
Field pH: 7.82	Ryznar Stability Index: 19.647	Field Nitrate (mg/L): NR
Lab pH: NR	Sodium Adsorption Ratio: 0.1968	Field Dissolved O2 (mg/L): 0.000
Water Temp (°C): 10.37	Langlier Saturation Index: -9.823	Field Chloride (mg/L): NR
Air Temp (°C): NR	Nitrite (mg/L as N): NR	Field Redox (mV): 184
Nitrate + Nitrite (mg/L as N) NR	Hydroxide (mg/L as OH): NR	Lab, Dissolved Organic Carbon (mg/L): NR
Total Kjeldahl Nitrogen (mg/L as N) NR	Lab, Dissolved Inorganic Carbon (mg/L): NR	Lab, Total Organic Carbon (mg/L): NR
Total Nitrogen (mg/L as N) NR	Acidity to 4.5 (mg/L CaCO3) NR	Acidity to 8.3 (mg/L CaCO3) NR
As(III) (ug/L) NR	As(V) (ug/L) NR	Total Susp Solids (mg/L) NR

Sample Condition: CLEAR

Field Remarks: 6 BORE VOLUME SAMPLE

Lab Remarks:

Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

Disclaimer

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Drinking water limits are based on U.S. Environmental Protection Agency primary and secondary standards for public water supplies ([view their standards](#)). Stock water and irrigation water recommendations are from U.S. Department of Agriculture Natural Resources Conservation Service water-quality guidelines. The guidelines are general and may vary depending on specific applications. Irrigation guidelines are based on continuous irrigation.

Sample Id	GWIC Id	Sample Date	Site Name	Location	Site Type
232047	297671	8/14/2018 11:46:00 PM	US FOREST SERVICE	17N 26W 22 DD	WELL

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	42.320 mg/L	---	---	---
Magnesium (Mg)	17.100 mg/L	---	2,000 mg/L	---
Sodium (Na)	5.610 mg/L	---	2,000 mg/L	see SAR
Potassium (K)	1.390 mg/L	---	---	---
Iron (Fe)	0.025 J mg/L	0.3 mg/L [smcl]	---	---
Manganese (Mn)	0.007 J mg/L	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO ₂)	10.760 mg/L	---	---	---
Bicarbonate (HCO ₃)	NR mg/L	---	---	---
Carbonate (CO ₃)	NR mg/L	---	---	---
Chloride (Cl)	NR mg/L	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO ₄)	NR mg/L	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO ₃ as N)	NR mg/L	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	NR mg/L	4 mg/L [mcl]	2 mg/L	---
Ortho-Phosphate (as P)	NR mg/L	---	---	---
Aluminum (Al)	<2.000 U ug/L	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	7.860 ug/L	6 ug/L [mcl]	---	---
Arsenic (As)	0.430 ug/L	10 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	23.190 ug/L	2,000 ug/L [mcl]	---	---
Boron (B)	2.300 ug/L	---	---	---
Cadmium (Cd)	<0.100 U ug/L	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	<0.100 U ug/L	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	<0.100 U ug/L	---	1,000 ug/L	50 ug/L
Copper (Cu)	<0.500 U ug/L	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	<0.060 U ug/L	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	<2.000 U ug/L	---	---	2,500 ug/L
Molybdenum (Mo)	0.520 ug/L	---	---	5 ug/L
Nickel (Ni)	<0.100 U ug/L	---	---	200 ug/L
Phosphate (P)	<0.030 U ug/L	---	---	---
Selenium (Se)	<0.100 U ug/L	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	<0.100 U ug/L	100 ug/L [smcl]	---	---
Strontium (Sr)	64.440 ug/L	---	---	---
Thallium (Tl)	<0.100 U ug/L	2.0 ug/L	---	---
Titanium (Ti)	<0.100 U ug/L	---	---	---
Uranium (U)	0.940 ug/L	30 ug/L	---	---
Vanadium (V)	<0.100 U ug/L	---	---	---
Zinc (Zn)	<0.500 U ug/L	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	<0.100 U ug/L	---	---	---

Key: NR = No reading in GWIC; **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; --- = Currently no standard for this constituent; **[b]** = High concentrations of sulfate may restrict calcium uptake by crops; **[c]** = Varies with crop, generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm); **[d]** = Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR); **[mcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999; **[smcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

Ground-Water Information Center Water Quality Report
Report Date: 9/11/2018

Site Name: US FOREST SERVICE
[Compare to Water Quality Standards](#)

Location Information

Sample Id/Site Id: 232048 / 297671	Sample Date: 8/14/2018 12:42:00 PM
Location (TRS): 17N 26W 22 DD	Agency/Sampler: MBMG / ICOPINI, GARY
Latitude/Longitude: 47° 12' 54" N 114° 53' 6" W	Field Number: FLAT CREEK WELL 9BV
Datum: NAD83	Lab Date: 9/11/2018 1:58:32 PM
Altitude:	Lab/Analyst: MBMG / TIMMER, JACKIE
County/State: MINERAL / MT	Sample Method/Handling: GRAB / ru:0 ra:0 fu:0 fa:1
Site Type: WELL	Procedure Type: DISSOLVED
Geology:	Total Depth (ft): 90
USGS 7.5' Quad:	SWL-MP (ft): NR
PWS Id:	Depth Water Enters (ft): 2
Project: FLATCREEK_SUPERIOR	

Major Ion Results

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	43.760	2.184	Bicarbonate (HCO3)	NR	0.000
Magnesium (Mg)	17.400	1.432	Carbonate (CO3)	NR	0.000
Sodium (Na)	5.680	0.247	Chloride (Cl)	NR	0.000
Potassium (K)	1.350	0.035	Sulfate (SO4)	NR	0.000
Iron (Fe)	0.026 J	0.000	Nitrate (as N)	NR	0.000
Manganese (Mn)	0.007 J	0.000	Fluoride (F)	NR	0.000
Silica (SiO2)	11.000		Orthophosphate (as P)	NR	0.000
Total Cations		3.899	Total Anions		0.000

Trace Element Results (µg/L)

Aluminum (Al): <2.000 U	Cesium (Cs): <0.100 U	Molybdenum (Mo): 0.610	Strontium (Sr): 63.630
Antimony (Sb): 8.050	Chromium (Cr): <0.100 U	Nickel (Ni): <0.100 U	Thallium (Tl): <0.100 U
Arsenic (As): 0.450	Cobalt (Co): <0.100 U	Niobium (Nb): 0.240 J	Thorium (Th): <0.100 U
Barium (Ba): 23.820	Copper (Cu): <0.500 U	Neodymium (Nd): <0.100 U	Tin (Sn): <0.100 U
Beryllium (Be): <0.100 U	Gallium (Ga): 1.260	Palladium (Pd): <0.100 U	Titanium (Ti): <0.100 U
Boron (B): 2.120	Lanthanum (La): <0.100 U	Praseodymium (Pr): <0.100 U	Tungsten (W): <0.100 U
Bromide (Br): NR	Lead (Pb): <0.060 U	Rubidium (Rb): 0.460 J	Uranium (U): 1.000
Cadmium (Cd): <0.100 U	Lithium (Li): <2.000 U	Silver (Ag): <0.100 U	Vanadium (V): <0.100 U
Cerium (Ce): <0.100 U	Mercury (Hg): NR	Selenium (Se): <0.100 U	Zinc (Zn): <0.500 U
			Zirconium (Zr): <0.100 U

Field Chemistry and Other Analytical Results

**Total Dissolved Solids (mg/L): NR	Field Hardness as CaCO3 (mg/L): NR	Ammonia (mg/L): NR
**Sum of Diss. Constituents (mg/L): NR	Hardness as CaCO3: 180.89	T.P. Hydrocarbons (µg/L): NR
Field Conductivity (µmhos): 344.4	Field Alkalinity as CaCO3 (mg/L): NR	PCP (µg/L): NR
Lab Conductivity (µmhos): NR	Alkalinity as CaCO3 (mg/L): NR	Phosphorus, TD (mg/L): <0.030 U
Field pH: 7.84	Ryznar Stability Index: 19.618	Field Nitrate (mg/L): NR
Lab pH: NR	Sodium Adsorption Ratio: 0.1941	Field Dissolved O2 (mg/L): 0.000
Water Temp (°C): 10.54	Langlier Saturation Index: -9.809	Field Chloride (mg/L): NR
Air Temp (°C): NR	Nitrite (mg/L as N): NR	Field Redox (mV): 182
Nitrate + Nitrite (mg/L as N): NR	Hydroxide (mg/L as OH): NR	Lab, Dissolved Organic Carbon (mg/L): NR
Total Kjeldahl Nitrogen (mg/L as N): NR	Lab, Dissolved Inorganic Carbon (mg/L): NR	Lab, Total Organic Carbon (mg/L): NR
Total Nitrogen (mg/L as N): NR	Acidity to 4.5 (mg/L CaCO3): NR	Acidity to 8.3 (mg/L CaCO3): NR
As(III) (ug/L): NR	As(V) (ug/L): NR	Total Susp Solids (mg/L): NR

Sample Condition: CLEAR

Field Remarks: 9 BORE VOLUME SAMPLE

Lab Remarks:

Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

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Drinking water limits are based on U.S. Environmental Protection Agency primary and secondary standards for public water supplies (**view their standards**). Stock water and irrigation water recommendations are from U.S. Department of Agriculture Natural Resources Conservation Service water-quality guidelines. The guidelines are general and may vary depending on specific applications. Irrigation guidelines are based on continuous irrigation.

Sample Id	GWIC Id	Sample Date	Site Name	Location	Site Type
232048	297671	8/14/2018 12:42:00 PM	US FOREST SERVICE	17N 26W 22 DD	WELL

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	43.760 mg/L	---	---	---
Magnesium (Mg)	17.400 mg/L	---	2,000 mg/L	---
Sodium (Na)	5.680 mg/L	---	2,000 mg/L	see SAR
Potassium (K)	1.350 mg/L	---	---	---
Iron (Fe)	0.026 J mg/L	0.3 mg/L [smcl]	---	---
Manganese (Mn)	0.007 J mg/L	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO ₂)	11.000 mg/L	---	---	---
Bicarbonate (HCO ₃)	NR mg/L	---	---	---
Carbonate (CO ₃)	NR mg/L	---	---	---
Chloride (Cl)	NR mg/L	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO ₄)	NR mg/L	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO ₃ as N)	NR mg/L	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	NR mg/L	4 mg/L [mcl]	2 mg/L	---
Ortho-Phosphate (as P)	NR mg/L	---	---	---
Aluminum (Al)	<2.000 U ug/L	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	8.050 ug/L	6 ug/L [mcl]	---	---
Arsenic (As)	0.450 ug/L	10 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	23.820 ug/L	2,000 ug/L [mcl]	---	---
Boron (B)	2.120 ug/L	---	---	---
Cadmium (Cd)	<0.100 U ug/L	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	<0.100 U ug/L	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	<0.100 U ug/L	---	1,000 ug/L	50 ug/L
Copper (Cu)	<0.500 U ug/L	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	<0.060 U ug/L	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	<2.000 U ug/L	---	---	2,500 ug/L
Molybdenum (Mo)	0.610 ug/L	---	---	5 ug/L
Nickel (Ni)	<0.100 U ug/L	---	---	200 ug/L
Phosphate (P)	<0.030 U ug/L	---	---	---
Selenium (Se)	<0.100 U ug/L	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	<0.100 U ug/L	100 ug/L [smcl]	---	---
Strontium (Sr)	63.630 ug/L	---	---	---
Thallium (Tl)	<0.100 U ug/L	2.0 ug/L	---	---
Titanium (Ti)	<0.100 U ug/L	---	---	---
Uranium (U)	1.000 ug/L	30 ug/L	---	---
Vanadium (V)	<0.100 U ug/L	---	---	---
Zinc (Zn)	<0.500 U ug/L	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	<0.100 U ug/L	---	---	---

Key: **NR** = No reading in GWIC; **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; **---** = Currently no standard for this constituent; **[b]** = High concentrations of sulfate may restrict calcium uptake by crops; **[c]** = Varies with crop, generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm); **[d]** = Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR); **[mcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999; **[smcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

Ground-Water Information Center Water Quality Report
Report Date: 9/11/2018

Site Name: US FOREST SERVICE
[Compare to Water Quality Standards](#)

Location Information

Sample Id/Site Id: 232049 / 297671	Sample Date: 8/14/2018 1:38:00 PM
Location (TRS): 17N 26W 22 DD	Agency/Sampler: MBMG / ICOPINI, GARY
Latitude/Longitude: 47° 12' 54" N 114° 53' 6" W	Field Number: FLAT CREEK WELL 12BV
Datum: NAD83	Lab Date: 9/11/2018 1:58:32 PM
Altitude:	Lab/Analyst: MBMG / TIMMER, JACKIE
County/State: MINERAL / MT	Sample Method/Handling: GRAB / ru:1 ra:0 fu:1 fa:1
Site Type: WELL	Procedure Type: DISSOLVED
Geology:	Total Depth (ft): 90
USGS 7.5' Quad:	SWL-MP (ft): 40.68
PWS Id:	Depth Water Enters (ft): 2
Project: FLATCREEK_SUPERIOR	

Major Ion Results

	mg/L	meq/L		mg/L	meq/L
Calcium (Ca)	42.600	2.126	Bicarbonate (HCO3)	237.270	3.889
Magnesium (Mg)	17.150	1.411	Carbonate (CO3)	0.000	0.000
Sodium (Na)	5.490	0.239	Chloride (Cl)	2.120	0.060
Potassium (K)	1.390	0.036	Sulfate (SO4)	8.780	0.183
Iron (Fe)	0.022 J	0.000	Nitrate (as N)	0.110	0.008
Manganese (Mn)	0.006 J	0.000	Fluoride (F)	0.050 J	0.000
Silica (SiO2)	10.840		Orthophosphate (as P)	<0.020 U	0.000
Total Cations		3.813	Total Anions		4.139

Trace Element Results (µg/L)

Aluminum (Al): <2.000 U	Cesium (Cs): <0.100 U	Molybdenum (Mo): 0.570	Strontium (Sr): 64.460
Antimony (Sb): 8.320	Chromium (Cr): 0.240 J	Nickel (Ni): <0.100 U	Thallium (Tl): <0.100 U
Arsenic (As): 0.440	Cobalt (Co): <0.100 U	Niobium (Nb): <0.100 U	Thorium (Th): <0.100 U
Barium (Ba): 23.960	Copper (Cu): <0.500 U	Neodymium (Nd): <0.100 U	Tin (Sn): <0.100 U
Beryllium (Be): <0.100 U	Gallium (Ga): 1.290	Palladium (Pd): <0.100 U	Titanium (Ti): <0.100 U
Boron (B): 2.310	Lanthanum (La): <0.100 U	Praseodymium (Pr): <0.100 U	Tungsten (W): <0.100 U
Bromide (Br): <10.000 U	Lead (Pb): <0.060 U	Rubidium (Rb): 0.450 J	Uranium (U): 0.980
Cadmium (Cd): <0.100 U	Lithium (Li): <2.000 U	Silver (Ag): <0.100 U	Vanadium (V): <0.100 U
Cerium (Ce): <0.100 U	Mercury (Hg): NR	Selenium (Se): <0.100 U	Zinc (Zn): 1.510 J
			Zirconium (Zr): <0.100 U

Field Chemistry and Other Analytical Results

**Total Dissolved Solids (mg/L): 204.5	Field Hardness as CaCO3 (mg/L): NR	Ammonia (mg/L): NR
**Sum of Diss. Constituents (mg/L): 324.75	Hardness as CaCO3: 176.96	T.P. Hydrocarbons (µg/L): NR
Field Conductivity (µmhos): 346.7	Field Alkalinity as CaCO3 (mg/L): NR	PCP (µg/L): NR
Lab Conductivity (µmhos): 352.42	Alkalinity as CaCO3 (mg/L): 194.38	Phosphorus, TD (mg/L): <0.030 U
Field pH: 7.85	Ryznar Stability Index: 7.484	Field Nitrate (mg/L): NR
Lab pH: 7.68	Sodium Adsorption Ratio: 0.1636	Field Dissolved O2 (mg/L): 0.000
Water Temp (°C): 10.61	Langlier Saturation Index: 0.098	Field Chloride (mg/L): NR
Air Temp (°C): NR	Nitrite (mg/L as N): <0.010 U	Field Redox (mV): 179
Nitrate + Nitrite (mg/L as N) NR	Hydroxide (mg/L as OH): 0.000	Lab, Dissolved Organic Carbon (mg/L): NR
Total Kjeldahl Nitrogen (mg/L as N) NR	Lab, Dissolved Inorganic Carbon (mg/L): NR	Lab, Total Organic Carbon (mg/L): NR
Total Nitrogen (mg/L as N) NR	Acidity to 4.5 (mg/L CaCO3) NR	Acidity to 8.3 (mg/L CaCO3) NR
As(III) (ug/L) NR	As(V) (ug/L) NR	Total Susp Solids (mg/L) NR

Sample Condition: CLEAR

Field Remarks: 12 BORE VOLUME SAMPLE

Lab Remarks:

Notes

Explanation: mg/L = milligrams per Liter; µg/L = micrograms per Liter; ft = feet; NR = No Reading in GWIC

Qualifiers: A = Hydride atomic absorption; E = Estimated due to interference; H = Exceeded holding time; J = Estimated quantity above detection limit but below reporting limit; K = Na+K combined; N = Spiked sample recovery not within control limits; P = Preserved sample; S = Method of standard additions; U = Undetected quantity below detection limit; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO2, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

Disclaimer

These data represent the contents of the GWIC databases at the Montana Bureau of Mines and Geology at the time and date of the retrieval. The information is considered unpublished and is subject to correction and review on a daily basis. The Bureau warrants the accurate transmission of the data to the original end user. Retransmission of the data to other users is discouraged and the Bureau claims no responsibility if the material is retransmitted.

Drinking water limits are based on U.S. Environmental Protection Agency primary and secondary standards for public water supplies (**view their standards**). Stock water and irrigation water recommendations are from U.S. Department of Agriculture Natural Resources Conservation Service water-quality guidelines. The guidelines are general and may vary depending on specific applications. Irrigation guidelines are based on continuous irrigation.

Sample Id	GWIC Id	Sample Date	Site Name	Location	Site Type
232049	297671	8/14/2018 1:38:00 PM	US FOREST SERVICE	17N 26W 22 DD	WELL

Constituent	This Sample	Drinking Water	Stock Water	Irrigation Water
Calcium (Ca)	42.600 mg/L	---	---	---
Magnesium (Mg)	17.150 mg/L	---	2,000 mg/L	---
Sodium (Na)	5.490 mg/L	---	2,000 mg/L	see SAR
Potassium (K)	1.390 mg/L	---	---	---
Iron (Fe)	0.022 J mg/L	0.3 mg/L [smcl]	---	---
Manganese (Mn)	0.006 J mg/L	0.05 mg/L [smcl]	---	2.0 mg/L
Silica (SiO ₂)	10.840 mg/L	---	---	---
Bicarbonate (HCO ₃)	237.270 mg/L	---	---	---
Carbonate (CO ₃)	0.000 mg/L	---	---	---
Chloride (Cl)	2.120 mg/L	250 mg/L [smcl]	1,500 mg/L	---
Sulfate (SO ₄)	8.780 mg/L	250 mg/L [smcl]	1,500 mg/L	[b]
Nitrate (NO ₃ as N)	0.110 mg/L	10 mg/L [mcl]	100 mg/L	---
Fluoride (F)	0.050 J mg/L	4 mg/L [mcl]	2 mg/L	---
Ortho-Phosphate (as P)	<0.020 U mg/L	---	---	---
Aluminum (Al)	<2.000 U ug/L	50-200 ug/L [smcl]	---	1,000 ug/L
Antimony (Sb)	8.320 ug/L	6 ug/L [mcl]	---	---
Arsenic (As)	0.440 ug/L	10 ug/L [mcl]	50 ug/L	100 ug/L
Barium (Ba)	23.960 ug/L	2,000 ug/L [mcl]	---	---
Boron (B)	2.310 ug/L	---	---	---
Cadmium (Cd)	<0.100 U ug/L	5 ug/L [mcl]	10 ug/L	5 ug/L
Chromium (Cr)	0.240 J ug/L	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cobalt (Co)	<0.100 U ug/L	---	1,000 ug/L	50 ug/L
Copper (Cu)	<0.500 U ug/L	1,300 ug/L [mcl]	500 ug/L	200 ug/L
Lead (Pb)	<0.060 U ug/L	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Lithium (Li)	<2.000 U ug/L	---	---	2,500 ug/L
Molybdenum (Mo)	0.570 ug/L	---	---	5 ug/L
Nickel (Ni)	<0.100 U ug/L	---	---	200 ug/L
Phosphate (P)	<0.030 U ug/L	---	---	---
Selenium (Se)	<0.100 U ug/L	50 ug/L [mcl]	50 ug/L	20 ug/L
Silver (Ag)	<0.100 U ug/L	100 ug/L [smcl]	---	---
Strontium (Sr)	64.460 ug/L	---	---	---
Thallium (Tl)	<0.100 U ug/L	2.0 ug/L	---	---
Titanium (Ti)	<0.100 U ug/L	---	---	---
Uranium (U)	0.980 ug/L	30 ug/L	---	---
Vanadium (V)	<0.100 U ug/L	---	---	---
Zinc (Zn)	1.510 J ug/L	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L
Zirconium (Zr)	<0.100 U ug/L	---	---	---

Key: NR = No reading in GWIC; **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; --- = Currently no standard for this constituent; **[b]** = High concentrations of sulfate may restrict calcium uptake by crops; **[c]** = Varies with crop, generally dissolved solids should be less than 2,000 mg/L (equivalent to specific conductance of about 2,000 to 3,000 micromhos/cm); **[d]** = Dependent upon other variables such as type of clay in soil and salt content of water. (See SAR); **[mcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999; **[smcl]** = U.S. Environmental Protection Agency maximum contaminant level or action level: revised October 13, 1999. This standard is based on aesthetic quality of water (i.e. odor, color, etc.) and is not a health standard.

