

VII. WELL AND SPRING INVENTORY, AND GROUND-WATER USE

Pertinent 30CFR¹ Sections:

- Ground-water information
- Cross sections, maps, and plans.
- Protection of hydrologic balance.

One of the requirements of the regulations is the determination of current ground-water uses in the vicinity of a proposed permit area. The objective of this requirement is to define the premining ground-water uses and any potential responses of the aquifer system(s) to the ground-water withdrawals. The uses could be withdrawals from wells, springs, and from excavation-related dewatering operations.

The applicant can obtain information on well and springs from State agencies, such as State Geological Surveys, Departments of Natural Resources, and State Engineer's Offices, and from Federal agencies such as Soil Conservation Service and U.S. Geological Survey. Not all privately drilled wells are recorded, however, and changes in well construction or location are often not officially recorded. The applicant can also obtain well information from local well drillers.

All active wells in the permit area and adjacent area that are withdrawing ground water should be inventoried. When all premining withdrawals are defined and documented, the effects of active mining on the aquifer(s) can be compared with other discharging and recharging effects on the aquifer(s).

Types of information needed for water-well inventories are listed in table VII-1. An example of a water-well inventory at the surface-mine near Decker, Mont., is presented in table VII-2. The location map of inventoried wells within and adjacent to the proposed permit area is shown in figure VII-1. As noted in table VII-2, minimum ground-water-quality information was obtained through specific conductance measurements and selected chemical analyses. Results of these analyses are presented in table VII-3.

Types of information needed for spring inventory are presented in table VII-4. An example of the records of springs and mine discharges is presented in table VII-5. Attention must be paid to the time or period of measurement; for example, no-flow conditions of springs are commonly related to seasonally dry conditions. Routine monitoring of spring discharges in the adjacent and general area, throughout the year, will indicate to the applicant and spring owner the nature of spring flow. This flow could be affected by seasonal variations as well as by mining operations.

¹CFR= Code of Federal regulations

Table VII-1.— Types of information needed for well inventory
(Example of well inventory data is given in Table VII-2.)

1. Location of well on a planimetric map, such as necessary for the proposed mine-permit application, or on a U.S. Geological Survey 7½-minute topographic map.
 2. Well owner's name and address.
 3. Use of well water (stock, domestic, irrigation, commercial, industrial, not in use, or abandoned).
 4. Quantity of ground-water pumped (monthly, annually)
 5. Depth of well below land surface, with the recorded source of information, such as well owner, driller, or hydrologist.
 6. Date well was drilled
 7. Land surface elevation or altitude (from topographic map).
 8. Water-level information:
 - depth to water below land surface,
 - date of water-level measurement,
 - name of measurer,
 - description of measuring point,
 - the record of historic water-level measurement data.
 9. Diameter and type of casing.
 10. Depth to which the well is cased.
 11. Sealing or grouting of casing, if any.
 12. Depth range(s) of perforated casing or screen, if any.
 13. Depth setting for pump intake, if applicable.
 14. Specific capacity of well as measured by driller or hydrologist, if performed.
 15. Size and type of pump.
 16. "Normal" yield or discharge, not necessarily as reported by driller,
 17. Aquifer designation; or aquifers pumped from if more than one.
 18. Other available information:
 - driller's log,
 - chemical analysis and sampling date
 - specific conductance measurement(s) and dates
 - aquifer-test results, including discharge, date, static water level, length of test, and method of analysis.
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Table VII-2.— Example of water-well data for the Decker mine area, Montana.
(From VanVoast and Hedges, 1975, p. 11)

[Location: Township, Range, Section with quarter-quarter-quarter subdivision.
(refer to referenced report for well location details)
Altitude: Land surface elevation at well estimated from U.S.G.S. 7½-minute quadrangle topographic maps, accurate to 10 ft.
Aquifer: Interpretations by Montana Bureau of Mines and, Geology.
Coded sources D-1 Cl = D-1
Clinker: Sub D-2 = unspecified aquifers below mineable coal beds.
Depth to water: Depths to nearest 0.1 foot measured; depths to nearest 1.0 foot reported; + indicates flowing well.
Discharge: gal/min, gallons per minute to nearest 0.1 measured; gal/min to nearest 1.0 reported.
Drawdown: Drawdown (at indicated discharge) to nearest 0.1 foot, measured; drawdown to nearest 1.0 foot, reported.
Specific Conductance: Field electrical conductance of water, in micronhos per centimeter at 25° C; L indicates laboratory conductance.
Data source: MBMG, Montana Bureau of Mines and Geology; USGS, U.S. Geological Survey.
Water analyses: refer to water quality table in referenced report.]

Location	Water use	Altitude (feet)	Well Depth (feet)	Aquifer	Depth to water (feet)	Dis-charge (gal/min)	Draw-down (feet)	Specific conductance (umho/cm)	Data source	Water analysis
9S 39E 14DCBB	Unused	3,647	391	Sub D-2	160.9	-	-	4,000	USGS	
9S 39E 24DCDC	Unused	3,610	244	D-1 & D-2 Coal	106	10	-	-	MEMG	
9S 39E 24ACDA	Unused	3,590	235	D-1 & D-2 Coal	88	10	-	-	MEMG	
9S 39E 25DDC	Stock	-	150	D-1 Overburden	-	10	-	-	USGS	
9S 40E 01CCA	Stock	3,445	125	D-2 Coal	26.4	-	-	1,900	USGS	
9S 40E 03ACAB	Stock	3,424	200	Sub D-2	+	33	-	1,380	MEMG	yes
9S 40E 03DCA	Stock	3,440	462	Sub D-2	3	4	44	-	USGS	
9S 40E 04CDAB	Stock	3,542	-	D-2 Coal	95	10	-	3,980	MEMG	
9S 40E 05BACC	Stock	3,580	260	Sub D-2	70	6	-	2,000	MEMG	
9S 40E 07CCAB	Stock	3,720	274	D-1 Coal & Overburden	138	50	-	-	MEMG	
9S 40E 10CDDD	Industr'	1,3,465	498	Sub D-2	29	60	88.5	-	MEMG	
9S 40E 10DDBA	Industr'	1,3,452	160	D-2 Coal & Sub D-2	23	20	6	1,714L	MEMG	yes
9S 40E 11ADA	Stock	3,430	32	D-1 Lower Coal	17.5	-	-	1,750	USGS	
9S 40E 13CAAA	Stock	3,500	108	D-1 Upper Coal	63.4	-	-	2,400	USGS	
9S 40E 13DCCD	Stock	3,520	75	D-1 Overburden	31.2	-	-	925	USGS	
9S 40E 21CACD	Domestic	3,554	110	D-1 Overburden	-	-	-	5,010	MEMG	yes
9S 40E 21CCDB	Unused	3,642	200	D-1 Overburden	131.6	-	-	-	MEMG	
9S 40E 21CDAC	Unused	3,565	280	D-1 Coal	123	-	-	2,700	MEMG	
9S 40E 21CDBB	Domestic	3,578	-	Unknown	-	-	-	-	MEMG	
9S 40E 21CDBD	Commerc'	1,3,574	227	D-1 Coal	117	5	73	1,570	MEMG	yes
9S 40E 21DDBA	Stock	3,502	171	Sandstone	26	20	39	4,500	MEMG	
9S 40E 22DAAD	Stock	3,455	269	D-1 Coal	40.7	5	-	2,500	USGS	yes
9S 40E 22DADA	Domestic	3,460	170	D-1 Coal	41	-	-	2,340	MEMG	yes
9S 40E 24ABBB	Stock	3,520	140	D-1 Upper Coal	82	5	48	-	USGS	
9S 40E 26BADD	Stock	3,490	40	Above mineable beds	15	36	15	2,200	MEMG	

Table VII-3.— Example of chemical analyses of waters from wells in the Decker area southeastern Montana.
(From Van Voast and Hodges, 1975, table 3.)

[Concentrations in milligrams per liter; analyses by Montana Bureau of Mines and Geology water laboratory, Butte, MT.
Collecting agency: MBMG, Montana Bureau of Mines and Geology; USGS, U. S. Geological Survey.
Aquifer: Interpretation by MBMG. Coded Sources— Al, Alluvium; D-1 0, D-1 Overburden; D-1 C, D-1 Coal;
D-1 Cl, D-1 Clinker; D-2 C, D-2 Coal; Sub D-2, Unspecified aquifers below the mineable beds.]

Location	Well depth (feet)	Date of collection	Silica (SiO ₂)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Hydroxide (OH)	Alkalinity as CaCO ₃	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Dissolved solids (calculated)	Carbonate	Noncarbonate	Sodium adsorption ratio	Specific Conductance (micromhos per centimeter at 25°C)	pH (Laboratory)	Temperature (°C)	Collecting agency	Aquifer
88.39E.12ACB1	141	07-18-74	12.0	0.00	0.01	31	23	261	7.5	426	9	0	381	367	5.3	2.2	1.5	1,146.0	173	0	8.6	1,419	8.46	12.5	USGS	Sub D-2
88.39E.12ACB2	370	07-18-74	9.3	.00	.00	7.8	3.6	460	4.3	455	33	0	482	553	6.5	4.0	5.6	1,541.5	34	0	34.3	2,041	8.74	12.0	USGS	Sub D-2
88.39E.13BEC	348	07-29-74	15.4	.00	.12	156	198	542	13.8	859	0	0	705	1,523	15.3	.8	58.6	3,362.5	705	507	6.8	3,690	7.44	10.0	USGS	D-1&D-2C
88.39E.14CBB	-	10-13-73	14.2	.05	.04	89	70	112	7.5	507	0	0	416	327	6.5	.3	1.5	1,135.1	416	97	2.2	1,190	7.88	12.0	USGS	unknown
88.40E.11CAA	14	07-17-74	21.3	.00	.00	85	57	36	8.1	420	0	0	344	176	6.8	1.0	1.3	812.1	344	102	.7	920	7.64	13.5	USGS	Al
88.40E.33ACB	-	10-11-73	13.2	.03	.05	130	72	178	12.4	347	0	0	285	703	5.7	.3	6.0	1,468.6	285	336	3.1	1,610	7.74	10.5	USGS	D-2 C
88.40E.34BDA	53	10-11-73	27.8	.02	.02	40	65	75	8.9	198	0	0	183	347	4.4	.5	5.5	773.0	183	210	1.7	927	7.76	12.0	USGS	D-1 Cl
88.41E.21CAB	99	10-17-73	32.6	.00	.00	24	32	60	5.6	215	0	0	176	142	7.4	1.8	5.9	526.3	176	17	1.9	638	8.21	15.0	USGS	D-1 Cl
98.39E.14EDAD	185+	10-17-73	8.8	.00	.00	2.6	0.8	354	4.0	870	28	0	808	10	3.5	2.8	4.4	1,289.4	10	0	48.7	1,370	8.82	14.0	USGS	D-1&D-2C
98.40E.03ACAB	200	05-02-75	9.1	.01	.00	2	0.6	350	3.2	933	0	0	765	1	3.9	4	.3	1,306.7	7	0	55.8	1,340	8.03	12.0	MEMG	Sub D-2
98.40E.10DDBA	160	11-17-71	4.0	.04	.00	5.7	0.4	443	6.6	1,190	0	0	976	4	7.1	3.6	0.1	1,666.0	16	0	48.5	1,714	8.09	10.5	MEMG	D-2 C
98.40E.17ACAC	180	07-14-72	9.0	4.00	.02	3.8	1.6	500	4.1	953	18	0	843	273	5.1	2.9	6.4	1,870.0	16	0	54.4	1,870	8.69	12.0	MEMG	D-1 C
98.40E.21CABD	110	10-14-72	8.6	.02	.03	31	13	1,355	9.4	996	19	0	1,701	1,320	16.4	.4	32.0	4,801.4	132	0	51.3	5,060	8.40	15.0	MEMG	D-1 C
98.40E.21CBB	227	07-14-72	9.0	.09	.00	6	0.4	450	3.7	1,139	23	0	1,012	8	16.2	2.6	.0	1,658.8	17	0	47.8	1,660	8.52	13.0	MEMG	D-1 C
98.40E.22DAD	169	10-18-73	9.4	.00	.01	17.7	.22	710	7.8	1,578	51	0	1,466	275	35.0	.9	8.8	2,716.4	135	0	26.7	2,840	8.43	10.0	USGS	D-1 C
98.40E.22DADA	170	08-17-72	7.6	.00	.00	5.9	8.4	616	5.4	1,416	127	0	1,586	8	13.2	1.9	10.0	2,219.4	50	0	38.2	2,340	8.10	10.0	MEMG	D-1 C
98.40E.29CCAD	153	07-27-72	8.0	.00	.00	3.2	1.6	455	3.7	985	102	0	1,147	22	14.4	2.2	.0	1,596.2	14	0	52.2	1,740	9.50	10.9	MEMG	D-1 C
98.41E.09ACBC	29	10-14-73	27.0	.01	.01	86	185	350	11.5	626	0	0	514	1,152	11.0	.3	7.5	2,457.2	514	447	4.9	2,620	7.88	10.5	USGS	Al

Table VII-4.– Types of information needed for a spring-inventory

1. Location of spring on a planimetric map, such as necessary for the proposed mine-permit application, or on a U.S. Geological Survey 7½-minute topographic map.
 2. Spring owner's name and address.
 3. Use of spring water (stock, domestic, unused).
 4. Quantity of spring water used, and time distribution of useage.
Does it stop flowing? what month? or, Is it perennial?
 5. Spring discharge measurement and date of measurement; range of discharge by month over the year.
 6. Chemical analyses and date of water sampling; specific conductance measurement and date of measurement.
 7. Type of spring (perched, contact, fracture).
 8. Aquifer designation (for example, Dakota sandstone, Ogallala Formation, Quaternary alluvium)
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Table VII-5 – Records of springs and mine discharges in Clarion River and Redbank Creek Basins, Northwestern Pennsylvania.
(From Buckwalter and others, 1979, table 2.)

[Spring or mine-discharge number: AR, Armstrong County; CR, Clarion County; CF, Clearfield County; EK, Elk County; JE, Jefferson County; SP, spring; MD, mine discharge.

Location: Lat.-long., latitude and longitude in degrees and minutes of the southeast corner of a one-minute quadrangle within which the? spring or mine discharge is located.

Use: H, household; P, public supply; R, recreation — swimming; S, stock; U, unused. Altitude of land surface: Estimated from topographic maps feet above sea level; ft, feet. Discharge: gal/min (gallons per minute).

Temperature: °C, degrees Celsius.

Hardness: gr/gal, grains per gallon; (conversion factor - 17.1 milligrams per liter for each grain per gallon) Specific conductance: umho/cm, micromhos per centimeter at 25°C.

Iron dissolved: mg/L (milligrams per liter)

Aquifer: QAL, Alluvium; QCL, Colluvium; PCG, Glenshaw Formation of the Conemaugh Group; PA, Allegheny Group; PP, Pottsville Group; ML, Lower Mississippian Series; DO, Oswayo Formation.]

Spring or mine-discharge number	Location latitude-longitude	Owner or name	Use	Altitude of land surface (ft)	Aquifer	Yield		Temperature (°C)	Hardness (gr/gal)	Specific conductance (umho/cm)	pH	Iron dissolved (mg/L)
						Discharge (gal/min)	date					
AR-SP- 2	4059-7920	Seneca Trail	P	1,220	PA	6	4-14-72	8.3	17	558	5.7	0.04
CR-SP- 1	4105-7940	(unknown)	H	950	PA	2	-	-	-	-	-	-
2	4118-7923	Huefner	P	1,300	QAL	43	4- 5-72	7.5	1	50	5.1	0
3	4119-7914	Mars Gas Co.	P	1,300	ML	53	4- 5-72	8.5	1	95	4.9	0
6	4113-7923	Lions Club	U	1,150	ML	8	4-25-72	9.8	21	610	4.2	.09
9	4111-7914	Lemonade	U	1,565	QCL	247	1-26-72	9.8	24	1,240	3.6	.50
33	4115-7921	State Game Land	U	1,360	PP	2	7- 2-73	21.0	290	7,000	3.0	141
34	4115-7922	do.	U	1,290	PP	10	7- 2-73	15.3	34	1,350	3.6	4.3
35	4116-7922	do.	U	1,370	PP	15	7-14-73	10.2	69	2,950	3.7	5.0
36	4119-7921	Lutz, Winfield	S	1,580	PA	4	3-13-75	6.7	-	135	3.9	.29
MD- 1	4104-7903	(unknown)	-	1,240	PA	<11	4-10-73	-	-	-	3.4	1.0
2	4104-7930	do.	-	1,235	PA	144	2-21-75	10.5	21	850	5.0	29
7	4105-7930	do.	-	1,250	PA	800	2-21-75	11.0	31	1,000	3.3	15
8	4102-7917	do.	-	1,280	PA	14	4-27-73	-	-	2,400	5.7	52
9	4105-7916	do.	-	1,390	PA	-	-	-	-	8,000	1.8	2,100
CF-SP- 1	4111-7942	Treasure Lake	U	1,850	PP	285	5-16-73	12.8	1	50	4.5	.26
2	4111-7942	do.	U	1,865	PP	124	5-16-73	7.0	1	40	6.7	.10
3	4111-7942	do.	U	1,875	PP	36	5-16-73	7.0	1	40	7.4	.10
EK-SP- 2	4131-7837	Bendigo State Pk.	R	1,740	PP	27	8-30-74	10.0	1	60	6.4	.03
JE-SP- 1	4105-7852	Reynoldsville Bor.	P	1,410	PA	100	10-11-29	7.2	2	-	-	.18
3	4108-7910	Carrier Homesite	U	1,430	PA	64	6- 5-73	-	-	-	-	-
MD- 1	4107-7857	(unknown)	U	1,800	PA	40	2- 6- 74	-	17	620	-	4.4

- EXPLANATION**
- Water well in use
 - Unused well
 - ⊙ Industrial/Commercial well
 - Domestic well
- 2040 Specific conductance of water

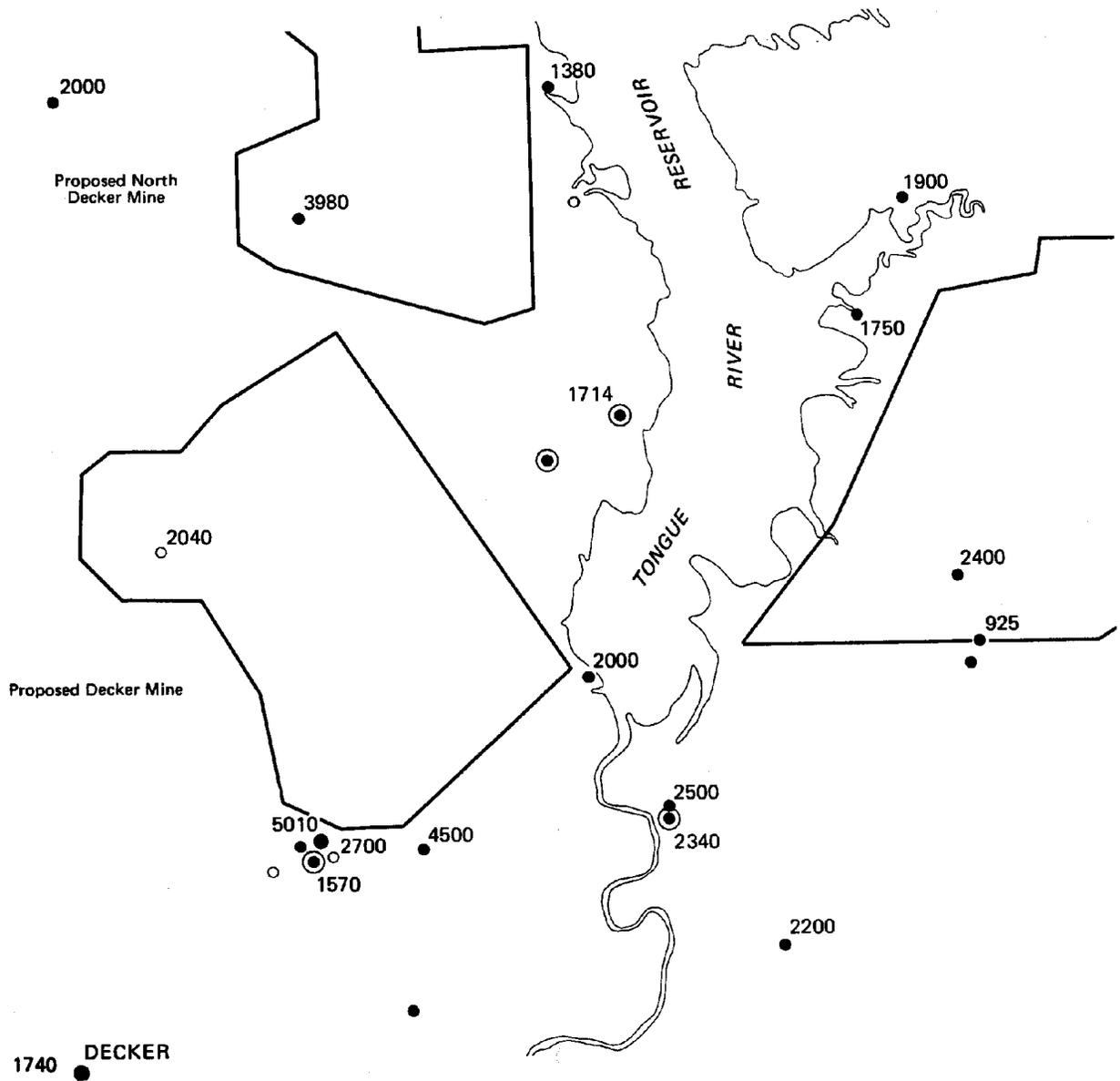
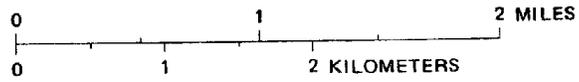


Figure VII-1.— Example map showing inventory of ground-water uses in permit area. (Modified from U.S. Geological Survey and Montana Department of State Lands, 1977, fig. 43)