



**DEPARTMENT of ENVIRONMENT  
and NATURAL RESOURCES**

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PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT  
APPLICATION NO. 2745-2, Croell Redi Mix**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 2745-2, Croell Redi Mix, c/o Kyle Frisinger, Aggregate Manager, PO Box 1352, Sundance WY 82729.

The Chief Engineer is recommending APPROVAL of Application No. 2745-2 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use, 4) it is in the public interest with the following qualifications:

1. The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
2. The well authorized by Permit No. 2745-2 shall be constructed by a licensed well driller and construction shall comply with Water Management Board Well Construction Rules, Chapter 74:02:04 with the well casing pressure grouted (bottom to top) pursuant to Section 74:02:04:28.
3. The Permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Deadwood Aquifer.
4. Water Permit No. 2745-2 authorizes a total annual diversion of 19.6 acre feet of water.

See report on application for additional information.

Joanne Goodman, Chief Engineer  
March 24, 2016

**REPORT TO THE CHIEF ENGINEER ON  
WATER PERMIT APPLICATION NO. 2745-2  
CROELL REDI MIX  
FEBRUARY 2, 2016**

Water Permit Application No. 2745-2 proposes to appropriate up to 19.6 acre-feet annually from the Deadwood aquifer. This application proposes to divert water from one well at a maximum diversion rate of 0.33 cubic feet of water per second (cfs). Water is to be used for industrial use in a limestone crushing plant operation and for domestic use, including livestock watering. The proposed well is to be located in the NE $\frac{1}{4}$  SW $\frac{1}{4}$  Sec. 9, T1S-R7E, and is expected to be approximately 1150 feet deep. If approved, this permit will authorize water use in portions of the S $\frac{1}{2}$  NE $\frac{1}{4}$ , SE $\frac{1}{4}$  NW $\frac{1}{4}$ , that portion of the NE $\frac{1}{4}$  SW $\frac{1}{4}$  lying north of Highway 16, and that portion of the SE $\frac{1}{4}$  lying north of US Highway 16 in Sec.9, T1S-R7E; and that portion of S  $\frac{1}{2}$  NW $\frac{1}{4}$  lying west of US Highway 16, and the portion of the SW $\frac{1}{4}$  lying north and west of Highway 16 in Sec.10, T1S-R7E.

**AQUIFER: DEADWOOD FORMATION**

**GEOLOGY AND AQUIFER CHARACTERISTICS:**

The Deadwood aquifer occurs within the porous and permeable portions of the Deadwood Formation. The Early Ordovician and Late Cambrian aged Deadwood Formation consists of sandstone, siltstone, shale and shaley limestone, as much as 450 feet thick at the outcrops around the Black Hills and as much as 600 feet thick in northern South Dakota (Gries,1981). The Deadwood aquifer is a regional aquifer that underlies most of western South Dakota and extends into North Dakota, Montana, Wyoming and Nebraska (Downey, 1986). The aquifer underlies an estimated 1,492,480 acres of Pennington County alone and contains an estimated 14,924,800 acre-feet of recoverable water in storage within that county (Hedges and others, 1985). In the area of this proposed well, the maximum thickness of the formation is estimated to be 245 feet (Lester and Rahn, 2001). In general, the Deadwood Formation dips from west to east on the east flank of the Black Hills. The regional dip of the sedimentary beds, including the Deadwood Formation, is 8-10 degrees east in this area. However, locally the attitude of the beds may be affected by folding. In this area, the Englewood Limestone disconformably overlies the Deadwood Formation which unconformably overlies the Precambrian. The upper contact of the Deadwood Formation occurs at ground surface, at an elevation of approximately 4,400 feet above mean sea level elevation (fmsl), approximately two and one half miles west of this proposed well site (Lester and Rahn, 2001), and the top of the formation is estimated to be approximately 3,180 fmsl (880 feet below grade) at this proposed well site (Carter and Redden, 1999).

Except for a narrow area at or near the outcrop, the Deadwood aquifer is generally under confined conditions. At the well site proposed by this application, the Deadwood aquifer is under confined conditions and the potentiometric surface of the aquifer is expected to be approximately 3,600 fmsl (460 feet below grade). In this area, groundwater flows from west to east with a gradient of 200 to 300 feet per mile (Strobel and others, 1999). Wells completed into the Deadwood aquifer rarely yield more than 50 gallons per minute, however, exceptions include wells supplying Water Right No.1450-2, Bear Country (Bear Country well); Water Right No. 2056-2, Countryside Homeowners

(Countryside well); and Water Right No. 2295-2, Colonial Pine Hills Sanitary District (Colonial Pine Hills well).

### **SDCL 46-2A-9**

Pursuant to SDCL 46-2A-9, a permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant's proposed use, that the proposed diversion can be developed without unlawful impairment of existing rights and that the proposed use is a beneficial use and in the public interest. This report will address the availability of unappropriated water from the aquifer and the potential for impairment of existing rights.

### **WATER AVAILABILITY:**

Water Permit Application No. 2745-2 proposes to appropriate water for industrial use in a limestone crushing plant operation and for domestic use, including livestock watering. The applicant proposes to place a maximum of 19.6 acre-feet of water to beneficial use annually. The probability of unappropriated water available from an aquifer can be evaluated by considering SDCL 46-6-3.1, which requires "No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source." If the source of the water is older or lower than the Greenhorn Formation and a water distribution system has applied for a permit, the Board need not consider the recharge/withdrawal issue. Here, although the Deadwood aquifer is older than the Greenhorn Formation, a water distribution system is not involved, therefore withdrawal/recharge issue must be considered.

### **Recharge versus Discharge:**

Recharge to the Deadwood aquifer in the Black Hills Area, which occurs through direct infiltration of precipitation at the outcrop area and to a minor extent streamflow losses, has been estimated to be 14,500 acre-feet per year (Driscoll and Carter, 2001). In this area, recharge is from precipitation on the outcrop, groundwater inflow from surrounding areas, and possibly streamflow losses along Spring Creek.

Discharge from the Deadwood aquifer occurs through well withdrawals, groundwater outflow and spring discharge. Relatively few wells have been completed into the Deadwood aquifer and the water use from the aquifer is fairly low. Although individual domestic use wells are completed into the Deadwood aquifer, the water use by these wells is not significant to a hydrologic budget for the aquifer. Development of the Deadwood aquifer has generally been limited to a fairly narrow band in or near the outcrop area due to the fact that most of the aquifer is overlain by productive aquifers. There are 35 water rights/permits appropriating water from the Deadwood aquifer in South Dakota (see Table 1). The locations of these water rights/permits are shown in Figure 1.

The withdrawals associated with water rights/permits shown in Table 1 are limited only by instantaneous diversion rates. The total diversion rate authorized by the appropriations shown in Table 1 is 4.974 cfs (Water Rights, 2016b). Historically, water use by non-irrigation appropriations has been less than 60% of full time pumping at the permitted maximum authorized diversion rate.

Assuming the total diversion rate authorized is pumped 60 percent of the time, annual withdrawals from appropriative rights would equal approximately 2,160 acre-feet.

A simple comparison between estimated average annual recharge (14,500 ac-ft/yr) and estimated annual withdrawals (2,160 ac-ft/yr) indicates that unappropriated water is available from the Deadwood aquifer to supply the 19.6 ac-ft/yr appropriation proposed by this application.

Table 1. Water Rights/Permits appropriating water from the Deadwood aquifer in South Dakota  
(Water Rights, 2016b)

PERMIT NO	NAME	PRIORITY DATE	STATUS	USE	CFS
1174-1	WHARF RESOURCES (USA) INC	01/01/1900	LC	COM/MUN	0.67
608-2	UNITED NATIONAL BANK	05/19/1960	LC	COM	0.02
1450-2	BEAR COUNTRY USA INC	09/24/1976	LC	DOM	0.2
1705-2	S CANYON COUNTRY ESTATES	02/29/1980	LC	SHD	0.27
1819-2	STRATO-RIM ESTATES INC	06/10/1982	LC	SHD	0.5
1864-2	HIGH MEADOWS WATER INC	01/12/1984	LC	SHD	0.06
1899-2	OLD HOME CAMPGROUND	10/05/1984	PE	COM	0.03
522A-2	JEWEL CAVE NATL MONUMENT	03/20/1985	LC	COM	0.04
1933-2	RUTH SAUNDERS	05/22/1985	PE	COM	0.02
1989-2	RUSHMORE CAVE	08/18/1986	LC	COM	0.055
1406A-1	TERRY VALLEY TROJAN WATER PROJECT	07/29/1987	LC	SHD	0.178
2045-2	WHISPERING PINES WATER	11/06/1987	LC	SHD	0.08
2056-2	COUNTRYSIDE HOMEOWNERS	05/20/1988	LC	SHD	0.3
1458-1	LEAD COUNTRY CLUB	02/09/1989	LC	IRR	0.18
1525-1	SPEARFISH CANYON RESORTS LLC	06/27/1991	LC	COM	0.038
1532-1	SHRINE OF THE NATIVITY	12/02/1991	PE	INS	0.02
1551-1	TRAILSHEAD LODGE INC	06/03/1992	LC	COM	0.033
1560-1	RICHARD D SLEEP	09/14/1992	LC	COM	0.078
2253-2	HIGHMEADOWS RANCHETTES	09/17/1992	LC	SHD	0.044
2288-2	BLACK HILLS RESORTS INC	07/02/1993	LC	COM	0.03
2295-2	COLONIAL PINE HILLS SANITARY DISTRICT	10/08/1993	LC	SHD	0.289
1596-1	RADIO TOWER HOMEOWNER'S	01/03/1994	LC	SHD	0.09
2305-2	SPRING CANYON WATER CO	02/25/1994	LC	SHD	0.044
1605-1	WOODLAND HILLS COMM ASSOC	08/15/1994	LC	RWS	0.197
1608-1	SPEARFISH CANYON RESORTS LLC	09/08/1994	LC	COM	0.34
1623-1	OAK MOUNTAIN COUNTRY ESTATES	06/26/1995	LC	SHD	0.035
2384-2	JOE THEBERGE	03/14/1997	PE	COM/IRR	0.12
2389-2	SITTING BULL CRYSTAL CAVE	06/16/1997	LC	COM	0.022
2424-2	S CANYON COUNTRY ESTATES	05/27/1999	PE	SHD	0.29
1725-1	ASPEN VIEW SUBDIVISION	05/25/2000	LC	SHD	0.02
2449-2	OAKS WATER USERS ASSOC	09/22/2000	PE	SHD	0.39
2507-2	HANI SHAFAI	05/28/2003	LC	SHD	0.067
2600-2	GARY KLUTHE	08/18/2006	LC	SHD	0.044
2628-2	BRANDON POWLES	02/26/2008	PE	SHD	0.08
1900-1	CITY OF DEADWOOD	10/30/2008	LC	MUN	0.1

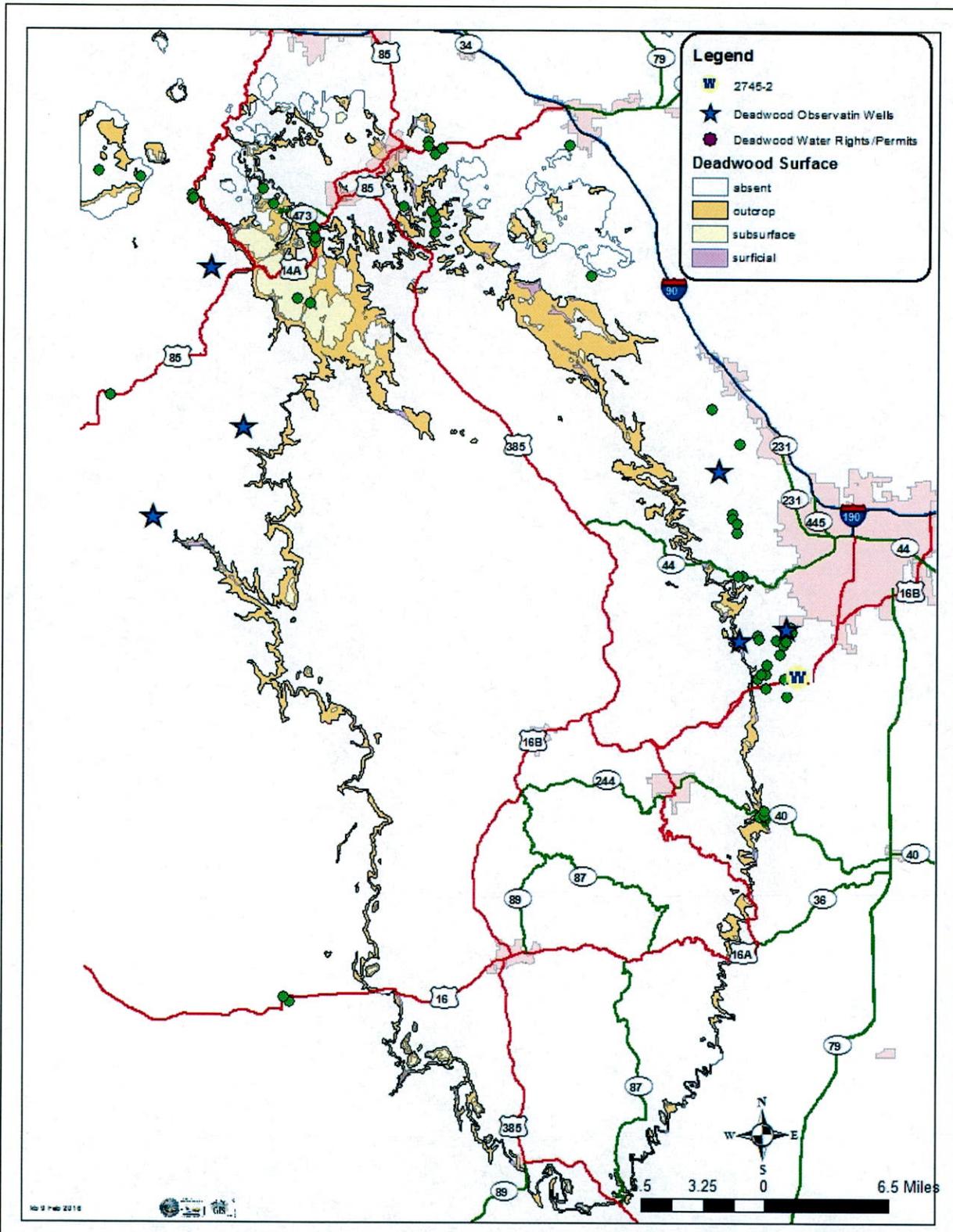


Figure 1. Locations of water rights/permits appropriating water from the Deadwood aquifer in South Dakota and DENR-Water Rights' Observation wells completed into the Deadwood aquifer (modified from Williamson and others, 2000), (Water Rights, 2016b).

**Observation well data:**

The Water Rights Program monitors five observation wells completed into the Deadwood Aquifer in the Black Hills (Water Rights, 2016a). The nearest of these wells is located approximately 2.7 miles north of this proposed well site. The hydrograph of the observation well is shown in Figure 2. The hydrograph shows that the water levels have fluctuated about 65 feet in response to climatic conditions over the period of record.

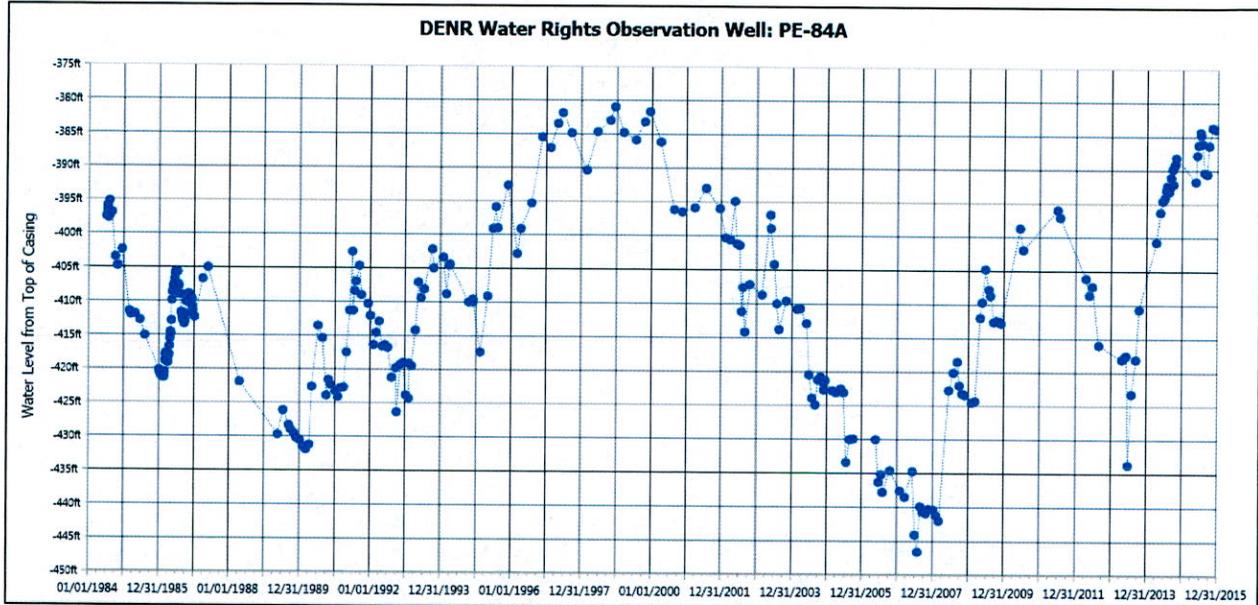


Figure 2. Hydrograph of a Deadwood aquifer observation well located approximately 2.7 miles north of the well site proposed by Water Permit Application No.2745-2. (Water Rights, 2016a)

Data from observation wells indicates the potentiometric surface of the Deadwood aquifer fluctuates seasonally in response to recharge events, with the highest water level occurring in late spring-early summer and the lowest water level occurring in late winter-early spring. The water levels are generally higher in “wet” years and are generally lower in “dry” years. Observation well data suggest that at the existing level of development, natural influences dominate the water levels of the aquifer, and the effects of pumping are not obvious. The observation well data indicates that water is available for this appropriation.

**EXISTING WATER RIGHTS:**

There are 129 Water Well Completion Reports on file with the DENR-Water Rights Program for wells located within approximately two and one-half miles of the well site proposed by this application. Thirty four of these wells appear to be completed into the Deadwood aquifer (Water Rights, 2016c). Wells supplied by aquifers either stratigraphically above or below the Deadwood aquifer are not expected to be affected by withdrawals from the Deadwood because leakage between aquifers is expected to be minimal. The preponderance of appropriations from the Deadwood aquifer are from an area immediately north and west of this proposed well site (see Figures 1 and 3). All of the water rights/permits shown in Figure 3 are diverting from wells completed in confined portions of the Deadwood aquifer.

The nearest well supplying a Deadwood aquifer appropriation is the well that supplies Water Right No. 1450-2, Bear Country USA, Inc. (Bear Country well). Application No. 2745-2 reports the Bear Country well is located 1,742 feet west of the well site proposed by the application. Although the water right is licensed for 0.20 cfs, the Bear Country well reportedly is capable of producing in excess of 160 gpm (Kim Taylor, personal communication. 12 February 2016). The top of the Deadwood Formation was reported to be 780 feet below grade, and the static water level of the well was reported at 420 feet below grade in March 1976. Currently, the well pump is set 660 feet below grade (i.e. 120 feet above the top of the Deadwood aquifer). The specific capacity of the Bear Country well has been estimated to be approximately two gallons per minute per foot of drawdown, (Kim Taylor, Taylor Drilling, personal communication. 12 February 2016).

Water Permit Application No. 2745-2 proposes to divert up to 19.6 acre-feet of water annually at a maximum rate of 0.33 cfs (approximately 150 gallons per minute (gpm)). At the proposed instantaneous diversion rate of 150 gpm, water could be diverted 116.6 minutes per day on average. A rate of 19.6 acre-feet annually (17,500 gallons per day) is equivalent to a continuous discharge of about 12 gpm. Considering the substantial artesian head pressure at the Bear Country well, and the distance to other wells supplying Deadwood water rights/permits, the equivalent of 12 gpm pumped continuously is not expected to adversely impact existing water rights or adequate domestic wells. (Domestic use wells can pump up to 18 gpm without a Water Right).

The nearest domestic use well on file with the DENR-Water Rights Program (Gary Mallams well) is located approximately three fourths of a mile west of the well site proposed by this application. The top of the Deadwood Formation in the Mallams well is estimated to be 740 feet below grade based on the completion report filed for the well, and the static water level of the well was reported to be 400 feet below grade (Water Rights, 2016c). The Deadwood aquifer is under confined conditions with over 300 feet of artesian head pressure in this area. Drawdown caused by individual well withdrawals from artesian aquifers can extend over a fairly large area. However, well interference is not expected to be measurable due to the distance between wells and the low pumping rate. Furthermore, ARSD 74:02:04:20(7) states that for a domestic well to be considered "adversely impacted", the well's pump intake must be set at least 20 feet below the top of the aquifer, and the water level of the aquifer must have declined to a level that the pump will no longer deliver sufficient water for the well owner's needs. This rule, in keeping with SDCL 46-6-6.1, provides protection to domestic wells without the necessity of requiring maintenance of artesian head pressure in the domestic use well.

Considering the aquifer characteristics that can be inferred from the nearby Bear Country well, it can be predicted that the drawdown that would result from a withdrawal of 12 gpm will be minimal.

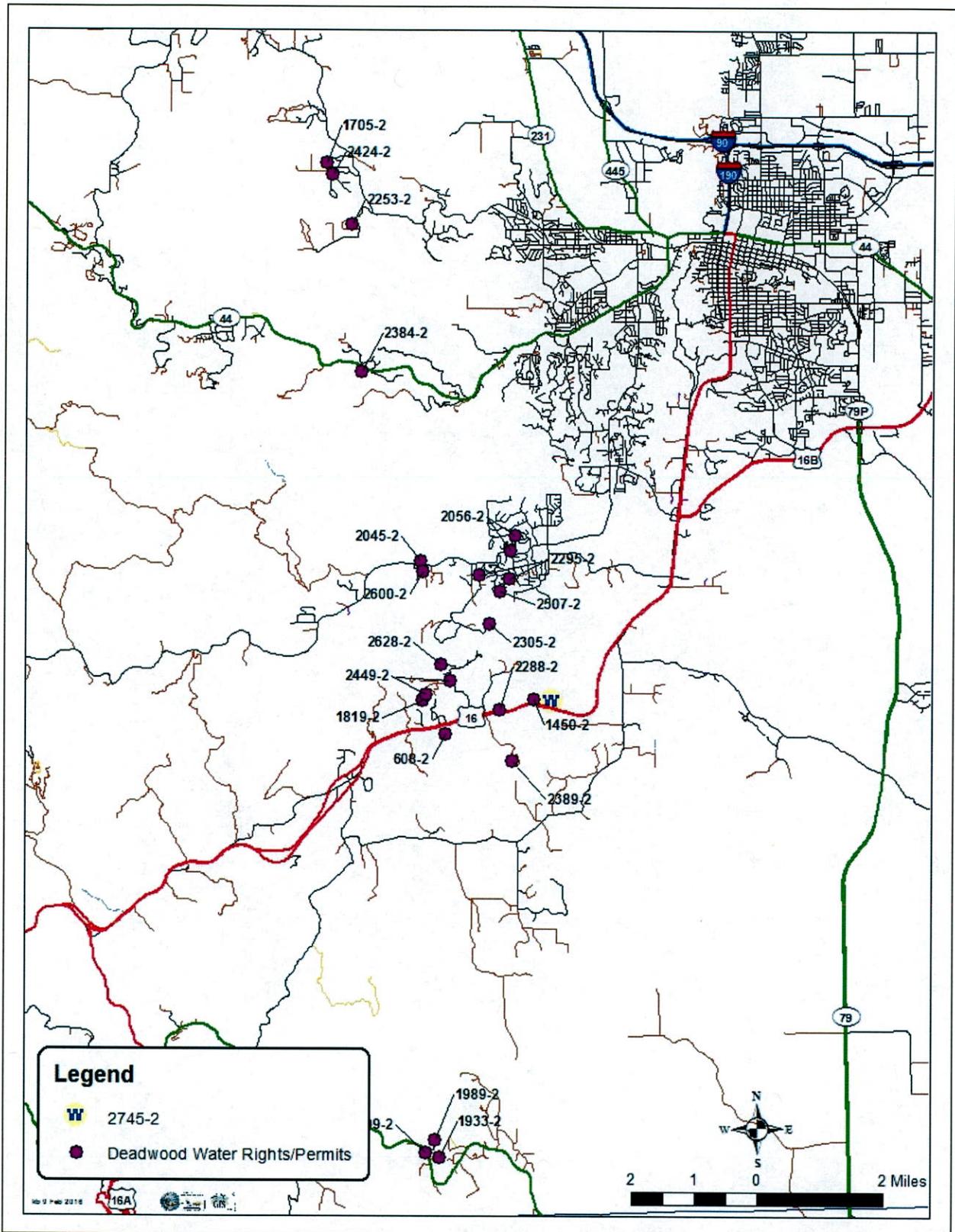


Figure 3. Locations of water rights/permits appropriating water from the Deadwood aquifer in the vicinity of the well site proposed by Water Permit Application No. 2745-2 (Water Rights, 2016b).

## CONCLUSIONS:

1. This application proposes to appropriate a maximum of 19.6 acre-feet annually from the Deadwood aquifer.
2. This application proposes to divert water from a single well at a maximum diversion rate of 0.33 cfs.
3. Withdrawals at the maximum diversion rate would average less than two hours per day to achieve an annual diversion rate of 19.6 acre-feet annually.
4. An annual diversion rate of 19.6 acre-feet annually is equivalent to a continuous diversion of about 12 gpm.
5. The Deadwood aquifer is a significant aquifer on a regional scale. There is a reasonable probability unappropriated water is available to satisfy this appropriation.
6. The Deadwood aquifer is under confined conditions in this area, and there is an estimated 420 feet of artesian pressure in the aquifer at this proposed well site.
7. There is a reasonable probability that this appropriation would not adversely impact existing water rights or domestic use wells.



Ken Buhler  
DENR-Water Rights Program

## REFERENCES:

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