**DEPARTMENT of ENVIRONMENT and NATURAL RESOURCES**

JOE FOSS BUILDING
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denr.sd.gov

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT APPLICATION NO. 8092-3, Roy Grismer**

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. 8092-3, Roy Grismer, 12525 328th Avenue, Bowdle SD 57428.

The Chief Engineer is recommending APPROVAL of Application No. 8092-3 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 and 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. 8092-3 shall be constructed by a licensed well driller and construction of the well and installation of the pump 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. This Permit is approved subject to the irrigation water use questionnaire being submitted each year.

See report on application for additional information.

Jeanne Goodman

Jeanne Goodman, Chief Engineer
March 27, 2015

NOTE: The Grand Aquifer may have a high salinity hazard and a medium sodium hazard. DENR encourages you to have a soil water compatibility analysis performed to insure the water is suitable for irrigation. The Water Resources Institute at SDSU or other qualified soil scientist can assist you in making a soil water compatibility determination and recommend if there are water management techniques to implement to optimize crop production and protect the soil structure.

**Report to the Chief Engineer**

**Application No. 8091-3 and No. 8092-3**
**Roy Grismer**
**March 6, 2015**

Water Permit Application Number 8091-3 proposes to appropriate water from the Grand aquifer at a maximum diversion rate of 2.67 cfs. The water is to be used for the irrigation of 240 acres located in the SE ¼, S ½ NE ¼ Section 8 in T125N-R72W. The proposed well location is the NE ¼ SE ¼ Section 8 in T125N-R72W and estimated depth is to be about 280 feet deep.

Water Permit Application Number 8092-3 proposes to appropriate water from the Grand aquifer at a maximum diversion rate of 2.67 cfs. The water is to be used for the irrigation of 240 acres located in the S. ½, S ½ NE ¼ Section 13 in T125N-R73W. The proposed well location is the NW ¼ SW ¼ Section 13 in T125N-R73W and estimated depth is to be about 330 feet deep.

**Aquifer: Grand aquifer (G)**

**Aquifer Characteristics and Hydrogeology**

The Grand aquifer underlies approximately 405,100 acres of Campbell, Edmunds, Faulk, Hand, McPherson, and Walworth counties and contains about 3,637,000 acre-feet of recoverable water (Hedges, 1982). Approximately 44,200 acres of that area underlies McPherson county. The Grand aquifer lies in a bedrock valley formed by erosion caused by the preglacial ancient Grand River (Christensen, 1977 and Hamilton, 1982). The aquifer is composed of stratified sand, gravel, and silt from the outwash and alluvium of the preglacial Grand River and can contain thin beds of silty clay (Hamilton, 1982 and Koch, 1970). The Grand aquifer sharply increases in thickness from its margins to the deepest part of the bedrock channel in which it lies, with its greatest thicknesses occurring in the deepest areas of the bedrock channel (Hamilton, 1982). Hamilton (1982) documents an average thickness for the aquifer of 50 feet in McPherson, Edmunds, and Faulk counties with a maximum thickness of 175 feet occurring in southwestern McPherson county near the deepest area of the bedrock channel in which the aquifer lies.

Water movement varies locally within the aquifer (Hamilton, 1982). Major discharge areas for the aquifer are southeastern and northeastern Faulk county, southeastern Edmunds county, and areas where the aquifer underlies the Missouri River (Hamilton, 1982 and Koch, 1970). This aquifer is primarily under artesian conditions (Water Rights, 2015a). Water in some areas of the Grand aquifer has medium sodium hazard and a high salinity, which would indicate the potential need for special management when utilizing the Grand for irrigation purposes (Koch, 1970; Hamilton, 1982; and Water Rights, 2015b).

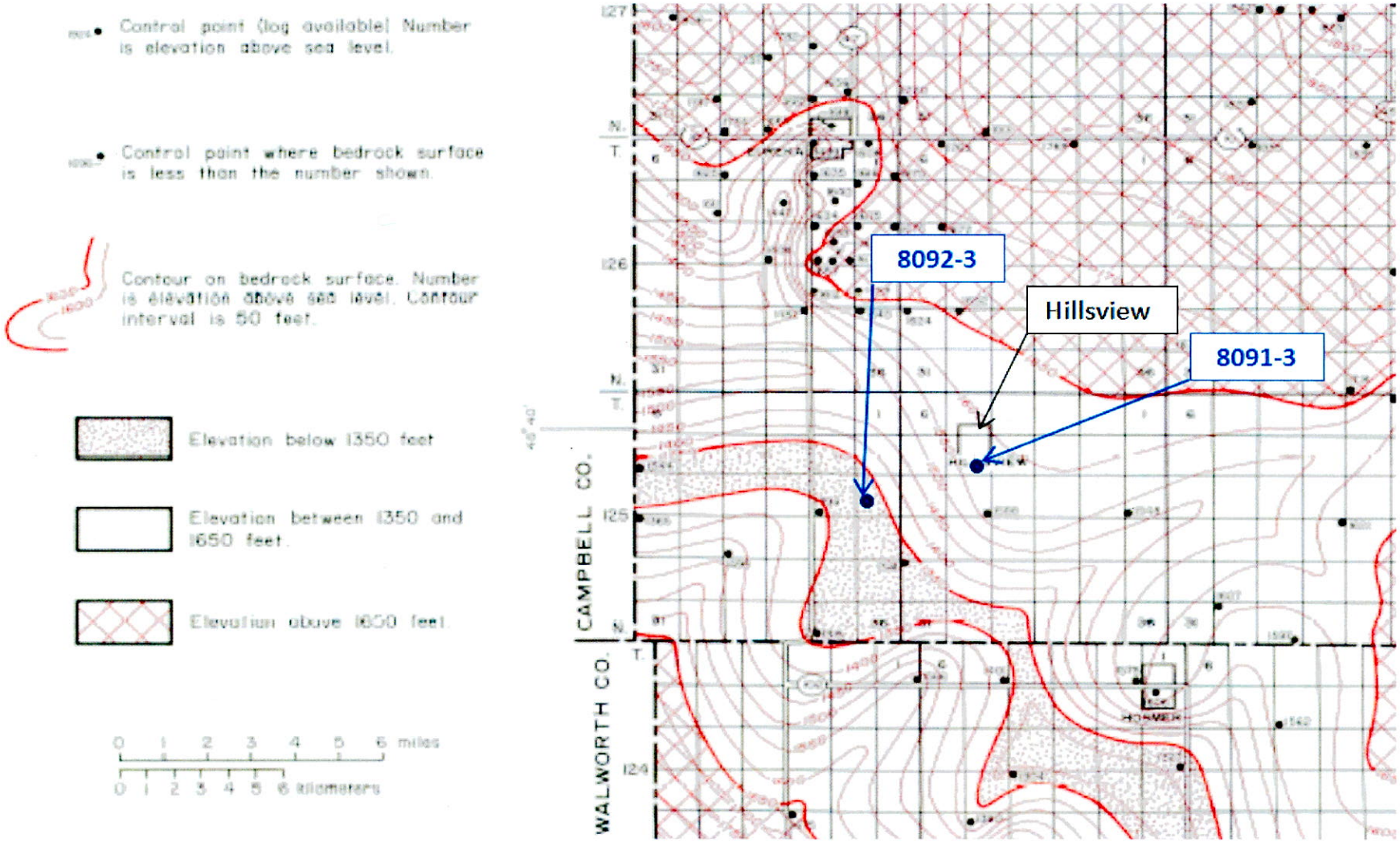


Figure 1: Approximate well locations of Application No. 8091-3 and 8092-3 in relation to area bedrock surface elevations. Areas with elevations below 1350 feet would indicate the deepest part of the bedrock channel (modified from Christensen, 1971).

Based on the test hole information submitted with Application No. 8091-3, the expected well depth of this application is 280 feet below grade. The static water level at the time of test hole drilling (12/17/2014) was 46 feet below grade. Aquifer materials were from 30 to 275 feet below grade, with a layer of sandy clay at 175 to 185 feet below grade. Shale was encountered at 278 feet below grade.

Based on the test hole information submitted with Application No. 8092-3, the expected well depth of this application is 330 feet below grade. The static water level at the time of test hole drilling (12/17/2014) was 56 feet below grade. Aquifer materials were from 137 to 330 feet below grade. The test hole information indicates that the aquifer is under artesian conditions at this location.

The proposed well location of Application No. 8092-3 is approximately 2.7 miles southwest of the proposed well location for Application No. 8091-3. Comparison of the proposed well depths of these applications to bedrock elevations and area aquifers indicates that the applicant is requesting to divert water from the Grand aquifer (Christensen, 1977 and Hedges et al, 1982). In considering the test hole information for Application No. 8091-3 in relation to the test hole information provided for the nearby Application No. 8096-3, it is thought the aquifer materials reported in the data for Application No. 8091-3 are from two different aquifers: the basal Grand aquifer and potentially the surface system Selby aquifer, or some of the area well completion reports suggest that there is possibly a thin layer of intermediate sand and gravel that if present in the area of Application No. 8091-3 that could be contributing to the reported thickness of aquifer materials (Hamilton, 1982 and Water Rights, 2015c). Care will need to be taken in the construction of the well for Application No. 8091-3 to ensure that Administrative Rules of South Dakota (ARSD) 74:02:04:34.01 is complied with. ARSD 74:02:04:34.01 states that, "No well may be constructed to allow production from more than one aquifer unless approved by the chief engineer or the water management board."

**South Dakota Codified Law (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 and existing rights from the aquifer that are pertinent to this application.

**Water Availability**

Water Permit Applications No. 8091-3 and No. 8092-3 propose to appropriate water from the Grand aquifer. 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 that 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 public water system has applied for a permit, the Board need not consider the recharge/withdrawal issue. Here, a public water system is not involved and the Grand aquifer is not older or lower than the Greenhorn Formation, therefore the withdrawal/recharge issue must be considered.

In applying SDCL 46-6-3.1, the Sixth Judicial Circuit Court ruled in 2005 that if the Water Management Board uses average annual recharge, then it should also use average annual withdrawals to determine if unappropriated water is available from the aquifer (*Hines v. South Dakota Dept. of Environ. and Nat'l. Resources, Hughes County 04-37*) (Memorandum Decision, April 29, 2005).

A 2012 First Judicial Circuit Court's rulings basically stated that data must be presented to show it is probable the average annual recharge exceeds the average annual discharge by at least the amount requested by the water permit application being considered (*Hanson County Dairy v. Robert Bender and Stace Nelson*) (Memorandum Decision, April 11, 2012).

Later in 2012, the First Judicial Circuit Court stated that in deciding whether or not it is probable that the quantity of water withdrawn will exceed the quantity of the average estimated annual recharge is to be based according to the best information reasonably available, and that nothing in South Dakota law requires a recharge study (*Longview Farms, LLP v. South Dakota Dept. of Environ. and Nat'l. Resources*) (Memorandum Decision, May 17, 2012).

**Hydraulic Budget**

*Recharge*

Recharge to the aquifer is from infiltration of water through overlying sediments (Koch, 1970). Based on observation well analysis Hedges et al. (1985) estimated recharge to unconfined portions of the Grand aquifer at approximately 4.0 inches per year, however there is not enough data to estimate the area for which this aquifer is unconfined. For confined aquifers, Hedges et al. (1985) recommends utilizing a range of recharge rate from 0.15 to 0.60 inches per year for management and development programs to estimate recharge. By applying this rate to the area of the aquifer, recharge to the aquifer can be estimated to be between 5,064 to 20,255 acre feet per year of which about 552 to 2,210 acre feet per year is in McPherson county. However, due to the general nature of this estimate, the importance of utilizing the observation well data in considering water availability for this application is emphasized.

*Withdrawal*

Withdrawals from the aquifer are the result of natural discharge and pumping from wells (Hamilton, 1982). Withdrawals due to wells can be split into irrigation and non-irrigation uses. Withdrawals from domestic wells are not considered a significant portion of the hydraulic budget for the aquifer. Currently there are 49 water rights/permits authorizing wells to withdraw water from the Grand aquifer; of these none are located in McPherson county (Water Rights, 2015b). Of those 16 water rights/permits are for non-irrigation use, and 33 are for irrigation.

Non-irrigation uses in the Grand aquifer include commercial (4), industrial (2), and municipal (10). For non-irrigation use, average annual use can be estimated by assuming that pumping will occur at the maximum diversion rate 60% of the time for water rights/permits limited by rate only. For water rights/permits limited to an annual volume, full use of that volume is assumed for estimation of average annual withdrawal. The municipalities of Hosmer, Onaka, Faulkton, Glenham, Mound City, Pollock, and Herreid are connected to WEB Rural Water and maintain their own systems for emergency use (Friedeman, 2015). The City of Roscoe obtains their water from both WEB Rural Water and a Grand aquifer well with the majority of their water coming from WEB Rural Water. Annual water use estimated by user is shown in Table 1. Water use for Herreid Concrete Inc. for 2013 was seven acre-feet and for 2014 was 27 acre-feet, indicating that average annual use for this Permit No. 7841-3 will likely be less than the annual limit (Water Rights, 2014-2015). Taking this into consideration average annual withdrawal due to non-irrigation use can be estimated at less than 985 acre-feet per year.

Table 1: Non-irrigation Use for the Grand Aquifer (Water Rights, 2015b and Friedeman, 2015)

| Permit No. | Name | Use | Status | Rate (cfs) | Annual Limit (acre-feet) | Estimated Average Annual Use (acre-feet) |
|---|---|---|---|---|---|---|
| 6012-3 | Jensen's W. Pollock Resort | COM | LC | 0.035 | | 15.2 |
| 6111-3 | Blumengard Colony | COM/DOM/LCO | LC | 0.45 | | 195.5 |
| 6185-3 | Blumengard Colony | COM/DOM/LCO | LC | 0.667 | | 289.7 |
| 6629-3 | Bret & Raechel Fliehs | COM/LCO | LC | 0.4 | | 173.8 |
| 7184-3 | Jensen Rock & Sand Inc. | IND | PE | 0.67 | 20 | 20.0 |
| 7841-3 | Herreid Concrete Inc. | IND | PE | 1.56 | 282 | 282.0 |
| 1705-3* | City of Hosmer | MUN | LC | 0.27 | | |
| 2769-3* | Town of Onaka | MUN | LC | 0.13 | | |
| 3947A-3* | City of Faulkton | MUN | LC | 0.27 | | |
| 3947B-3* | City of Faulkton | MUN | LC | 0.73 | | |
| 3998-3* | Town of Glenham | MUN | LC | 0.12 | | |
| 4144-3* | Town of Mound City | MUN | LC | 0.22 | | |
| 4914-3* | City of Roscoe | MUN | LC | 0.5 | | 9.2 |
| 5366-3* | Town of Pollock | MUN | LC | 0.78 | | |
| 5417-3* | City of Herreid | MUN | LC | 1.17 | | |
| 778-3* | Town of Pollock | MUN | LC | 0.56 | | |
| **Total** | | | | | | **985** |

*Connected to WEB Rural Water
COM=commercial, DOM=domestic, LCO=livestock confinement operation IND=industrial, MUN=municipal, LC=license, PE=permit

Information for water rights/permits for irrigation use in the aquifer over the period of record (1979-2013) is summarized in Table 2. The average number of water rights/permits over the period of record is 20, the minimum is 15, and the maximum is 30 (Water Rights, 1980-2014). The average reported pumping rate over the period of record is approximately 2,171 acre-feet per year (Water Rights, 1980-2014). During the period of record the maximum reported pumpage was in 2013 at about 3,983 acre-feet, and the minimum occurred in 1993 at about 727 acre-feet (Water Rights, 1980-2014). In examining Table 2, it can be observed that the number of irrigation water rights/permits has been increasing in recent years for the Grand aquifer, therefore using average reported pumpage to estimate irrigation water use would not be reflective of average annual water use due to irrigation. To account for this, the average ratio of pumpage to

appropriation over the period of record can be applied to the current level of appropriations. The average ratio of pumpage to appropriation over the period of record is 15.3%, with values ranging from 5.3% in 1993 to 33.4% in 2006. In considering the period of record both wet and dry years as well as both high and low economic conditions are present with in the period of record, thus the average ratio of pumpage to appropriation is reflective of these different conditions. When this percentage is applied to the current level of appropriation (18,927.4 acre-feet which includes the addition of the appropriations for Water Permit Nos. 7320-3, 7321-3, and 7924-3), average annual water use due to irrigation can be estimated at 2,896 acre-feet.

Table 2: Irrigation Water Right/Permit Data for the Grand Aquifer (Water Rights, 1979-2014)

| Year | Permit | Pumpage (acre-feet) | Appropriation (acre-feet) | Percentage of Appropriation Pumped |
|---|---|---|---|---|
| 1979 | 22 | 1339.0 | 18382.0 | 7.3% |
| 1980 | 21 | 2334.0 | 17902.0 | 13.0% |
| 1981 | 28 | 2204.0 | 20782.0 | 10.6% |
| 1982 | 22 | 2956.4 | 16223.6 | 18.2% |
| 1983 | 22 | 3067.6 | 17681.6 | 17.3% |
| 1984 | 25 | 3407.0 | 19401.6 | 17.6% |
| 1985 | 23 | 3082.0 | 18441.6 | 16.7% |
| 1986 | 22 | 2333.0 | 18121.6 | 12.9% |
| 1987 | 22 | 2272.0 | 18121.6 | 12.5% |
| 1988 | 20 | 2845.9 | 16645.6 | 17.1% |
| 1989 | 20 | 2042.1 | 16645.6 | 12.3% |
| 1990 | 20 | 2335.0 | 16645.6 | 14.0% |
| 1991 | 20 | 1853.0 | 16645.6 | 11.1% |
| 1992 | 19 | 1205.0 | 15632.6 | 7.7% |
| 1993 | 18 | 727.0 | 13760.6 | 5.3% |
| 1994 | 17 | 1695.4 | 13370.6 | 12.7% |
| 1995 | 16 | 1092.6 | 12890.6 | 8.5% |
| 1996 | 15 | 1172.6 | 11394.6 | 10.3% |
| 1997 | 15 | 1422.0 | 11394.6 | 12.5% |
| 1998 | 15 | 1245.1 | 11394.6 | 10.9% |
| 1999 | 15 | 1162.7 | 11394.6 | 10.2% |
| 2000 | 16 | 1317.8 | 10797.6 | 12.2% |
| 2001 | 16 | 1220.1 | 10797.6 | 11.3% |
| 2002 | 17 | 2646.0 | 11061.6 | 23.9% |
| 2003 | 17 | 1784.7 | 11061.6 | 16.1% |
| 2004 | 17 | 1621.8 | 11061.6 | 14.7% |
| 2005 | 18 | 1842.9 | 11701.6 | 15.7% |
| 2006 | 18 | 3892.6 | 11653.6 | 33.4% |
| 2007 | 19 | 2352.0 | 12163.4 | 19.3% |
| 2008 | 19 | 2660.4 | 12163.4 | 21.9% |
| 2009 | 19 | 2334.9 | 12163.4 | 19.2% |
| 2010 | 19 | 2903.8 | 12163.4 | 23.9% |
| 2011 | 21 | 2428.5 | 13219.4 | 18.4% |
| 2012 | 23 | 3206.3 | 13755.4 | 23.3% |
| 2013 | 30 | 3983.2 | 17107.4 | 23.3% |
| **Average** | **20** | **2171.1** | **14392.7** | **15.3%** |
| **Minimum** | **15** | **727.0** | **10797.6** | **5.3%** |
| **Maximum** | **30** | **3983.2** | **20782.0** | **33.4%** |
| **Standard Deviation** | **3.5** | **833.4** | **3053.1** | **5.84%** |

Combining irrigation and non-irrigation uses results in an estimated average annual withdrawal of 3,881 acre-feet. Applying average ratio of pumpage to appropriation of 15.3% to the appropriations that would be associated with these permits, if approved, would result in an average annual water use of 147 acre-feet for a total estimated average annual withdrawal of 4,028 acre-feet. This estimate falls below the range of estimated recharge (5,064 to 20,255 acre feet per year) for the aquifer. Therefore there is a reasonable probability that there is water available to support these applications.

**Observation Wells**

In determining the availability of unappropriated water for a permit application Administrative Rule 74:02:05:07 requires the Water Management Board to rely on the record of observation well measurements, in addition to other data, to determine that average annual withdrawals from the aquifer do not exceed the estimated annual recharge. Observation well data offers a picture of conditions in the aquifer over the period of record.

The Water Rights Program monitors 36 observation wells in the Grand aquifer. These observation wells generally show steady of increasing water levels in the aquifer (Water Rights, 2015a). Some observation wells near irrigation water rights/permits can show the effects of pumping; however water levels recover after irrigation has ceased. The exception to this is observation well CA-80A in western Campbell county and ED-2000A in southern Edmonds county, which show declining water levels (Water Rights, 2015a). For CA-80A this appears to be due to localized pumping. In the case of ED-2000A water levels decreased from 2000 to 2008 and have been relatively stable since 2008. In comparing ED-2000A with the nearby observation wells of FA-80A and FA-2000A, a notable difference in the potentiometric surface occurs (Water Rights, 2015a). This is due to FA-80A and FA-2000A being completed into a small discontinuous portion of the Grand aquifer separate from the portion of the aquifer into which ED-2000A is completed (Rich, 2008; Rich, 2010; and Rich, 2015). MP-80I is located about 1.7 miles southwest of the location of Application No. 8092-3 and 4.4 miles southwest of the location of Application No. 8091-3. The hydrograph for observation well MP-80I is shown in Figure 2, and the hydrograph for observation well ED-80A is shown in Figure 3. These observation wells are under artesian conditions.

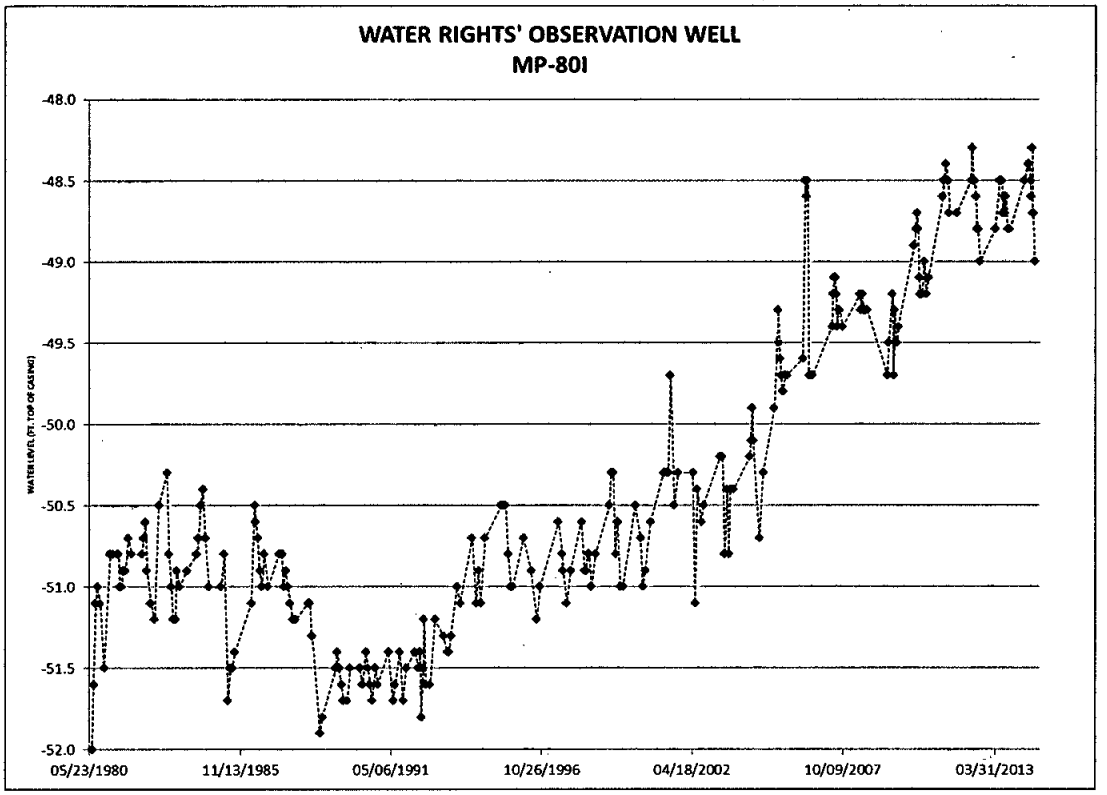


Figure 2: Hydrograph of observation well MP-80I (Water Rights. 2015a)

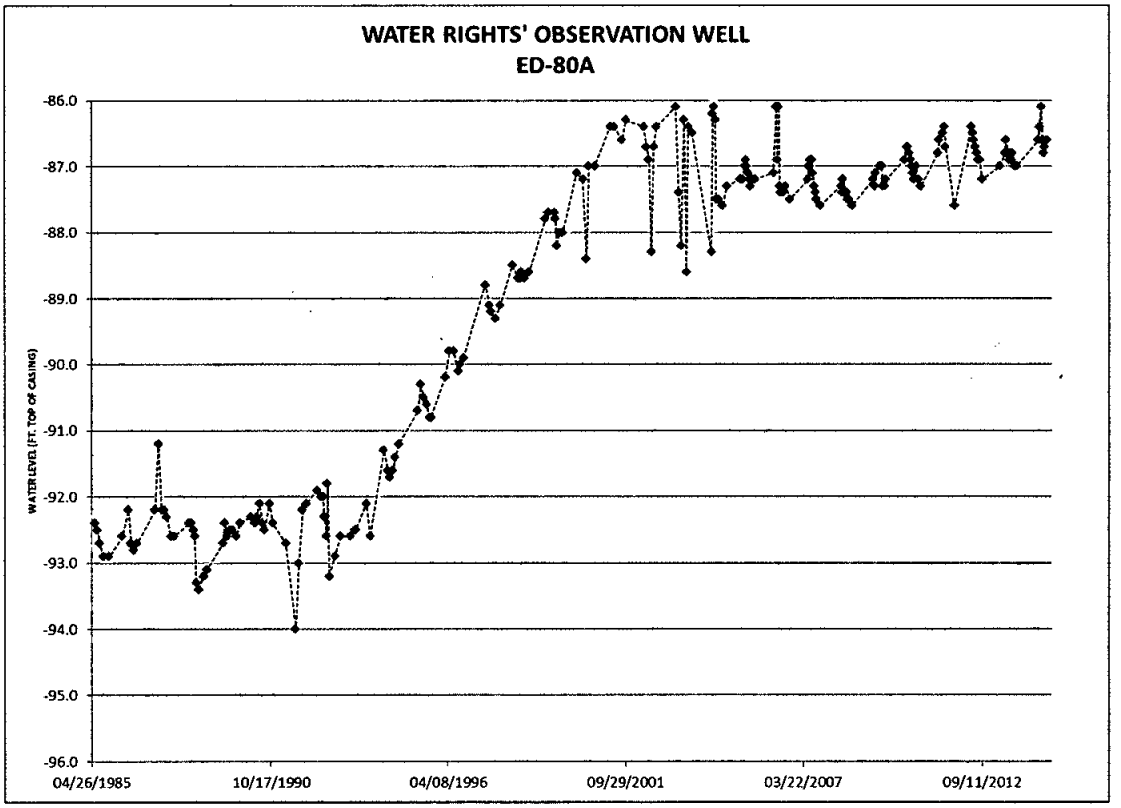


Figure 3: Hydrograph of observation well ED-80A (Water Rights. 2015a)

The observation well hydrographs show cyclic patterns based on the effect of climatic conditions on the aquifer. Increases in water levels occur during wetter periods (recharge), and decreases in water levels occur during drier periods. In examining the hydrographs for these observation wells it is evident that natural conditions dominate, indicating that there is a reasonable probability that water is available for capture. As a result there is a reasonable probability that water is available to support the needs of this application.

**Existing Water Rights**

There are currently no water rights/permits for the Grand aquifer in McPherson county. The nearest water right/permit completed into the Grand aquifer is Water Right No. 1705-3 shown in Figure 4. Water Right No. 1705-3 is held by the City of Hosmer located 6.6 miles southeast from the proposed well location of Application No. 8091-3 and 7.7 miles southeast from the proposed well location of Application No. 8092-3. Due to the distances involved these applications are not expected to impact existing water rights/permits. Additionally of note in the area of Application No. 8091-3 is a pending application for the Grand aquifer, Water Permit Application No. 8096-3, with a proposed well location of the SE ¼ NW ¼ Section 8 of T125N-R72W.

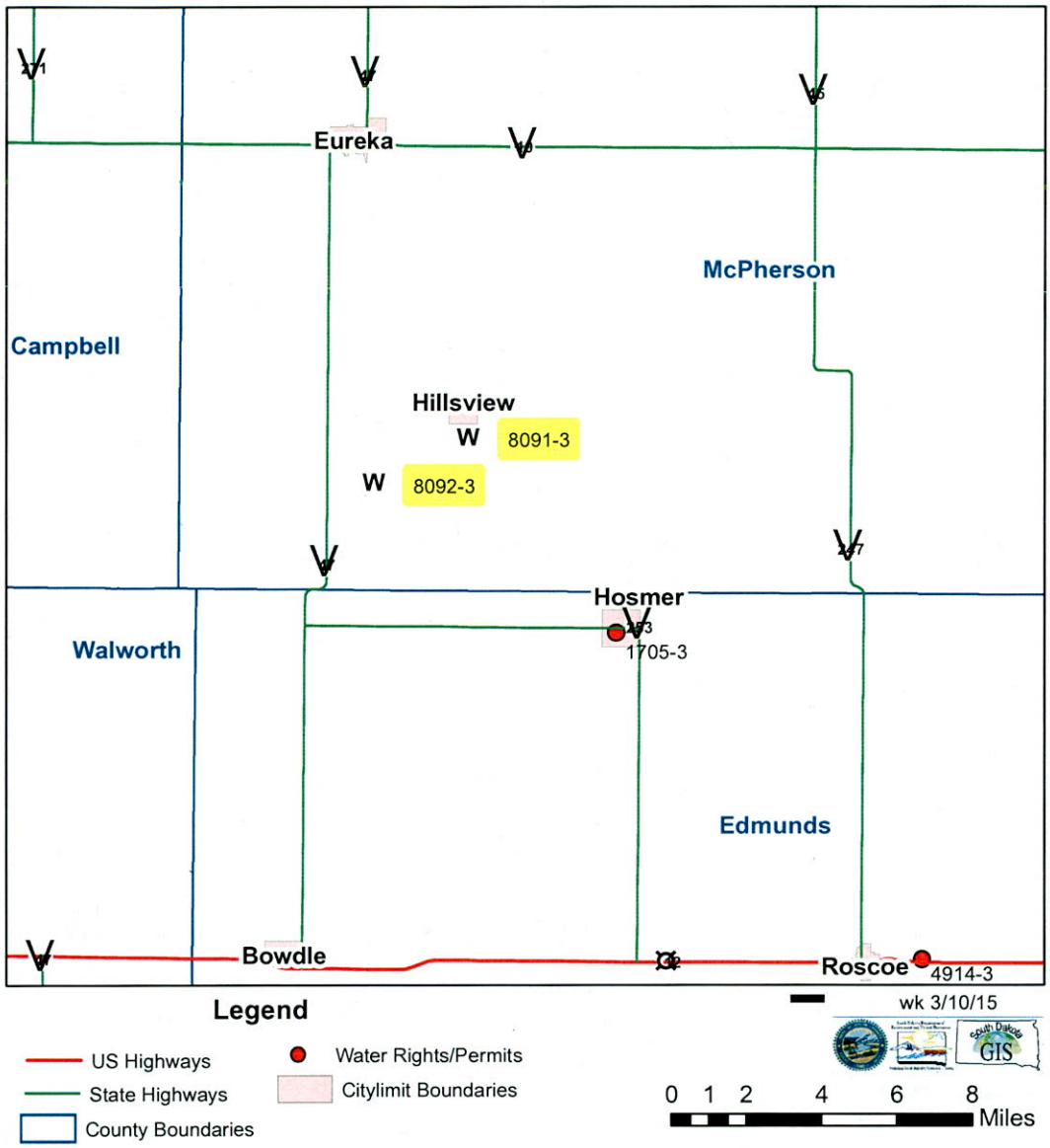


Figure 4: Approximate diversion point locations for water rights/permits in the area of Application No. 8091-3 and No. 8092-3 (Water Rights, 2015b)

There are several domestic wells on file with the SDDENR-Water Rights Program within two miles of the proposed well locations for these applications that could be completed into this aquifer. Since the aquifer is under confined conditions, drawdown as a result of pumping is likely. However, the precise amount and radius of drawdown cannot be quantified without aquifer testing. Based on the available data (Hamilton, 1982 and Koch, 1970) these applications, if approved, would not be expected to adversely impact nearby adequate wells. An adequate well as defined by South Dakota Administrative Rules is "a well constructed or rehabilitated to allow various withdrawal methods to be used, to allow the inlet to the pump to be placed not less than 20 feet into the saturated aquifer or formation material when the well is constructed, or to allow the pump to be placed as near as possible to the bottom of the aquifer as is practical if the aquifer

thickness is less than 20 feet." In the past the Water Management Board has recognized that to place water to maximum beneficial use a certain amount of drawdown may occur. In the case Water Permit Application No. 2313-2 Coke Cola Bottling Company of the Black Hills the Water Management Board adopted findings that noted that if the increased costs or decreased production as a result of the impacts of legitimate users on artesian head pressure could be considered an adverse impact it would conflict with SDCL 46-1-4 (Water Rights, 1995). SDCL 46-1-4 requires the water resources of the state be put to beneficial use to the maximum extent of which they are capable (Water Rights, 1995). Additionally pursuant to SDCL 46-6-6.1 artesian head pressure is not protected as a means of groundwater delivery. However, in the case of irrigation since reasonable domestic use must be insured first, the Water Management Board does need to give consideration to artesian head pressure.

**Conclusions**

1. Water Permit Application Number 8091-3 proposes to appropriate water from the Grand aquifer at a maximum diversion rate of 2.67 cfs for the irrigation of 240 acres located in the SE ¼, S ½ NE ¼ Section 8 in T125N-R72W.

2. Water Permit Application Number 8092-3 proposes to appropriate water from the Grand aquifer at a maximum diversion rate of 2.67 cfs for the irrigation of 240 acres located in the S ½, S ½ NE ¼ Section 13 in T125N-R73W.

3. The is a reasonable probability that water is available to meet the request of these applications.

4. The is a reasonable probability that these application will not significantly impact nearby adequate wells.

Whitney Kilts

Whitney Kilts
SDDENR-Water Rights Program

Approved by

Ken Buhler
SDDENR-Water Rights Program

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