DEPARTMENT of AGRICULTURE and NATURAL RESOURCES
JOE FOSS BUILDING
523 E. CAPITOL AVE
PIERRE SD 57501-3182
danr.sd.gov

RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT APPLICATION NO. 8770-3, Sioux River Dairy, Inc

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Agriculture and Natural Resources concerning Water Permit Application No. 8770-3, Sioux River Dairy, Inc, c/o Jim Czech, 45767 177th Street, Watertown SD 57201.

The Chief Engineer is recommending APPROVAL of Application No. 8770-3 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 domestic water uses and water rights, 3) the proposed use is a beneficial use and 4) it is in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board with the following qualifications:

1. The wells approved under this Permit and Water Permit No. 7012-3 are located near domestic wells and other wells which may obtain water from the same aquifer. The well owner, under these Permits shall control withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.

2. Water Permit No. 8770-3 is subject to compliance with requirements of the Department's Water Pollution Control Permit issued pursuant to SDCL 34A-2-36 or 34A-2-36.2 or 34A-2-112 for concentrated animal feeding operations.

3. Water Permit No. 8770-3 is subject to compliance with all existing and applicable Water Management Board Rules including but not limited to:

   a) Chapter 74:54:01 Ground Water Quality Standards,
   b) Chapter 74:54:02 Ground Water Discharge Permit,
   c) Chapter 74:51:01 Surface Water Quality Standards,
   d) Chapter 74:51:02 Uses Assigned to Lakes,
   e) Chapter 74:51:03 Uses Assigned to Streams, and
   f) Chapter 74:52:01 through 74:52:11 Surface Water Discharge Provisions

(continued)

4. The Permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Big Sioux:North aquifer.

5. This Permit and Water Permit No. 7012-3, combined, authorize a total annual diversion of up to 56 acre-feet of water.

See report on application for additional information.

Eric Gronlund

Eric Gronlund, Chief Engineer
August 1, 2023

Report to the Chief Engineer

Water Permit Application No. 8770-3

Sioux River Dairy, Inc., c/o Jim Czech

July 21, 2023

Water Permit Application No. 8770-3 proposes to divert water at a maximum instantaneous diversion rate of 0.19 cubic feet of water per second (cfs) from two additional existing wells located in the NW ¼ NE ¼ Section 34-T116N-R52W in addition to two existing wells authorized by Water Permit No. 7012-3 completed into the Big Sioux: North aquifer for commercial use in a dairy operation. Water Permit No. 7012-3 authorizes a diversion rate of 0.089 cfs from two wells completed into the Big Sioux: North aquifer located in the NW ¼ NE ¼ Section 34-T116N-R52W. If approved, Application No. 8770-3 and Water Permit No. 7012-3 will collectively authorize a combined total of up to 56 acre-feet of water annually at a maximum instantaneous diversion rate of 0.278 cfs from a total of four wells, all located in NW ¼ NE ¼ of Section 34, T116N-R52W. This site is located in Codington County, approximately 5 miles south of Watertown, South Dakota.

AQUIFER: Big Sioux: North (BS: N)

HYDROGEOLOGY:

The Big Sioux aquifer is a glacial outwash that underlies the flood plain of the Big Sioux River and its tributaries (Hansen, 1990). The northernmost management unit is called the Big Sioux: North aquifer with the city of Castlewood, SD located near the southernmost end of the management unit. The aquifer underlies portions of Codington, Hamlin, Grant, and Roberts Counties (Hedges et al., 1982). Aquifer materials consist of poorly sorted medium sand and gravel and are generally underlain by glacial till (Hansen, 1990; Putnam and Thompson, 1996), with some confined portions of the aquifer being overlaid with 3 to 5 feet of till (Hansen, 1990). The aquifer is primarily unconfined, with the average thickness of aquifer materials approximately 22 to 24 feet but can range from 2 to 54 feet (Hansen, 1994; Putnam and Thompson, 1996).

As outlined in Water Permit No. 7857-3, the areal extent of the Big Sioux: North aquifer is estimated to be 111,700 acres after Stonesifer (2013) reevaluated delineations by Hedges et al. (1982). This areal extent should be considered a likely minimum as discussed by Kilts (2017) there may be a buried, narrow outwash extending off the west of the main body of the aquifer that could be interpreted as portions of the Big Sioux: North aquifer. Observation wells CK-78S and CD-78A may be within this extended region not shown in the Stonesifer (2013) delineation (Figure 1).

Each of the existing wells on site have well completion reports on file (Water Rights, 2023c and 2023d). Static water levels range from 6 to 12 feet below surface, depth to top of aquifer ranges from 0 to 2 feet below the surface, and saturated aquifer thickness ranges from 7 to 14 feet. The wells at this site have been moved and/or replaced numerous times due to low production (Water Rights, 2023d). The site is under water-table conditions which means minimal drawdown; however, well production may be limited due to the thin saturated thickness of the aquifer.

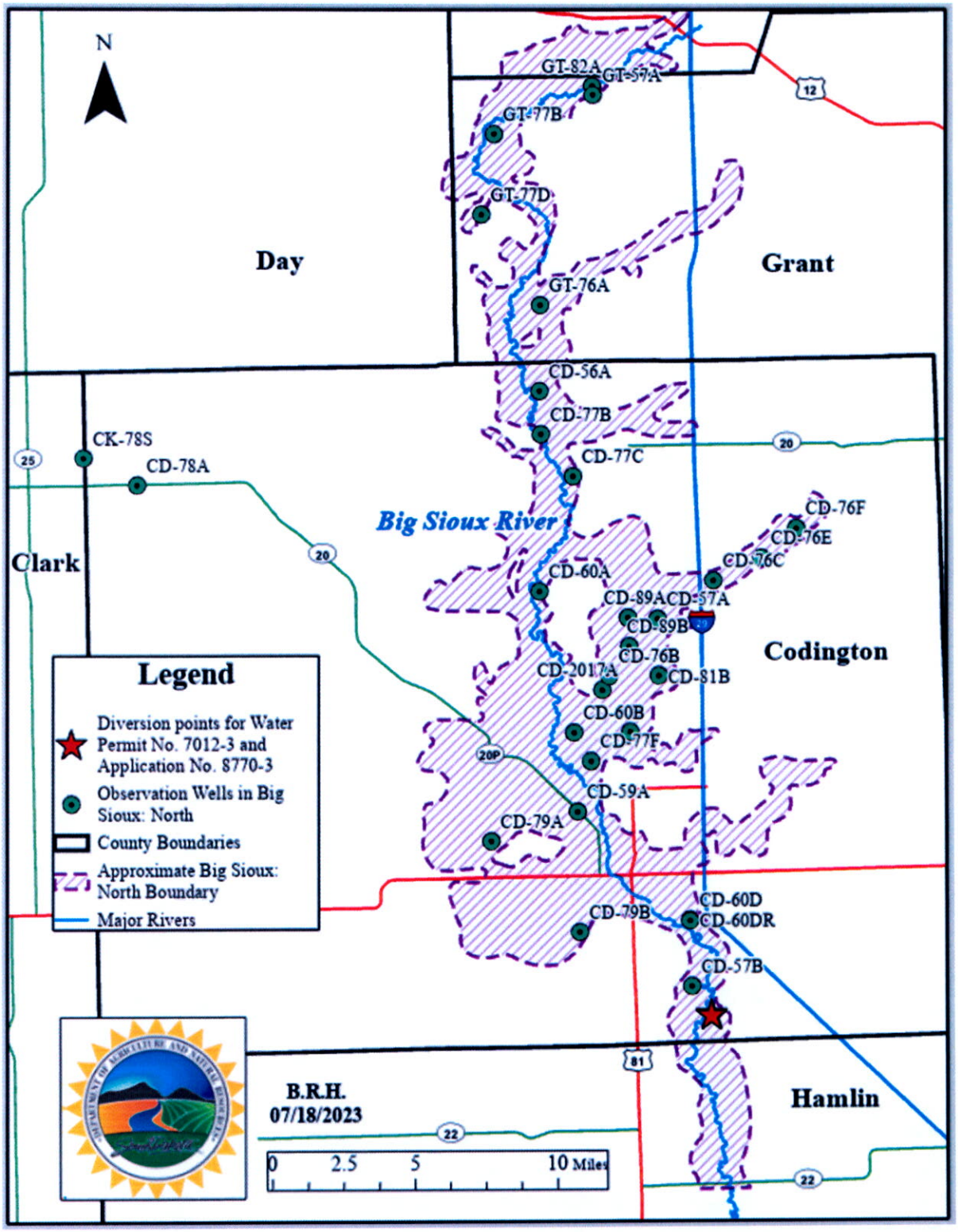

Figure 1: Map of the approximate Big Sioux: North aquifer areal extent (Stonesifer, 2013), the location of four wells on site for Application No. 8770-3, and observation wells in the Big Sioux: North aquifer (Water Rights, 2023b and 2023c).

APPLICABLE SOUTH DAKOTA CODIFIED LAW (SDCL):

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 diversion point can be developed without unlawful impairment of existing domestic water uses and water rights, and that the proposed use is a beneficial use and in the public interest as it pertains to matters of public interest within the regulatory authority of the Water Management Board as defined by SDCL 46-2-9 and 46-2-11." This report will address the availability of unappropriated water and the potential for unlawful impairment of existing domestic water uses and water rights within the Big Sioux: North aquifer.

Water Availability

Water Permit Application No. 8770-3 proposes to appropriate water from the Big Sioux: North aquifer. The probability of unappropriated water being available from the aquifer can be evaluated by considering SDCL 46-6-3.1, which requires that:

"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. An application may be approved, however, for withdrawals of groundwater from any groundwater formation older than or stratigraphically lower than the Greenhorn formation in excess of the average estimated annual recharge for use by water distribution systems."

Water Permit Application No. 8770-3 does not involve a public water system as defined by SDCL 46-1-6 (17) and the aquifer is above the Greenhorn formation (Fahrenbach et al., 2010). Therefore, recharge and withdrawal must be considered. The methods of assessment are a hydrologic budget with quantified values of recharge and withdrawal, and observation well analysis.

HYDROLOGIC BUDGET:

Recharge

Recharge to the Big Sioux: North aquifer in Codington and Grant Counties is primarily by infiltration of precipitation and seepage from surface water features when potentiometric levels are higher than those in the aquifer, especially lakes Kampeska and Pelican (Hansen, 1990; Putnam and Thompson, 1996). Water levels in the Big Sioux: North aquifer tend to fluctuate in response to the Big Sioux River and may gain water from the river (Putnam and Thompson, 1996; Thompson, 2001).

Hedges et al. (1985) used observation well analysis to estimate the recharge rates to unconfined, unburied aquifers, and the rate for Big Sioux: North aquifer was estimated to be 3.2 inches/year. The recharge rates for the entire Big Sioux aquifer using observation well analysis ranged from 2.7 to 5.6 inches/year (Hedges et al., 1985). Hansen (1990) estimated the recharge rate to the Big Sioux aquifer to range from 4 to 10 inches/year using similar methods. Using observation well analysis, Putnam and Thompson (1996) estimated recharge rates of 2.9 to 5.8 inches/year. The recharge range 2.9 to 5.8 inches/year will be used in this scenario due to the emphasis of the Big Sioux: North aquifer in

Codington and Grant Counties. This gives a volumetric recharge rate range of approximately 27,000 to 54,000 acre-feet/year, using the areal extent of the Big Sioux: North aquifer estimated by Stonesifer (2013).

Discharge

Discharge from the Big Sioux: North aquifer is primarily from base flow south to the Big Sioux River, evapotranspiration, and pumping from wells (Thompson, 2001). There may be outflow to adjacent lakes (Kampeska, Still, Pelican) depending on the relative stages of the lakes and aquifer (Putnam and Thompson, 1996).

Currently, there are 105 established water rights/permits (irrigation and non-irrigation use) that are authorized to appropriate water from the Big Sioux: North aquifer (Water Rights, 2023c). Additionally, Water Right No. 8336-3 is authorized to divert water from both the Big Sioux: North and Prairie Coteau aquifers, with a specific volume limitation authorized for each aquifer. For the purpose of estimating average annual withdrawals, Water Right No. 8336-3 is assumed to withdraw their full specified volume permitted only from their Big Sioux: North aquifer well. Water Right No. 5158-3 for Sioux Rural Water System has not been used since 1998. The well field has "basically been abandoned" because of water quality issues (Mathiowetz, 2014; Water Rights, 2023c) and the appropriated volume for this water right has not been included in the hydrologic budget.

Table 1 summarizes the 41 non-irrigation water rights/permits, including three future use permits that are authorized to appropriate water from the Big Sioux: North aquifer with the estimated annual use for each water right/permit as determined by their permitted maximum diversion rate or volume. Historically, average water use by non-irrigation appropriations limited by an instantaneous diversion rate have been assumed to be pumping 60% of full time at the respective permitted diversion rate. Water rights/permits limited by an annual volume are assumed to withdraw their entire respective annual volume limitation. For non-irrigation permits that report annual pumping to the Chief Engineer and have at least 10 years of data (Water Rights, 2023f), the average of the reported withdrawal rates was used to estimate annual use. These are standard methods used by the DANR-Water Rights Program for estimating annual withdrawals by non-irrigation appropriations from an aquifer (Water Rights, 2023c).

Overall, the estimated average annual withdrawal rate from the Big Sioux: North aquifer by the non-irrigation water rights/permits (including future use water permits) is approximately 13,469 acre-feet/year (Table 1) (Water Rights, 2023c).

Table 1: Estimated annual use for the non-irrigation water rights/permits authorized to divert water from the Big Sioux: North aquifer (Water Rights, 2023c).

Permit No.	Name	Priority Date	County	Status	Use	Authorized Diversion Rate (cfs)	Permitted Volume (acre-feet)	Estimated Volume (acre-feet/year)
1218-3	City of Watertown	12/03/1956	CD	FU	MUN	N/A	2,709	2,709
2107-3		08/26/1974	CD	FU	MUN	N/A	N/A	0
5862-3		04/06/1995	CD	FU	MUN	N/A	760	760
1716-3		12/03/1956	CD	LC	MUN	0.8	N/A	347.5
2239-3		09/02/1965	CD	LC	MUN	2.23	N/A	968.7
2757-3		09/02/1965	CD	LC	MUN	1.45	N/A	629.9
3022-3		09/02/1965	CD	LC	MUN	1.31	N/A	569.1
349-3		01/01/1933	CD	LC	MUN	0.33	N/A	143.4
350-3		01/01/1933	CD	LC	MUN	0.8	N/A	347.5
351-3		01/01/1934	CD	LC	MUN	1.12	N/A	486.5
352-3		12/03/1956	CD	LC	MUN	1.12	N/A	486.5
6500-3		06/14/2004	CD	LC	MUN	0.11	N/A	47.8
6208-3		05/15/2000	CD	LC	MUN	0.1	N/A	43.4
5233-3		09/02/1965	CD	LC	MUN	2	N/A	868.8
5683-3		09/02/1965	CD	LC	MUN	2.67	1160	1,160
348A-3	Watertown Municipal Utilities Dept.	08/01/1932	CD	LC	MUN	0.33	N/A	143.4
4183A-3	Pelican Plaza	10/27/1977	CD	LC	SHD	0.08	N/A	34.8
4932-3	Northern Con-Agg Inc.	10/27/1982	CD	LC	IND	3.12	N/A	1,355.3
494-3	Watertown Mall Assoc.	08/06/1957	CD	LC	COM	0.11	N/A	47.8
496-3	Medical Center	08/15/1957	CD	LC	COM	0.08	N/A	34.8
5157-3	Magellan Pipeline Co. LLC	10/08/1987	CD	LC	IND	0.19	N/A	82.5
5318-3	Consolidated Ready Mix	04/11/1989	CD	LC	COM	0.1	N/A	43.4
5636-3	Stanley Schmitt	01/01/1949	CD	LC	COM	0.033	N/A	14.3
1402-3	FJ McLaughlin Co	04/26/1967	CD	LC	COM	1	N/A	434.4
5690-3	BJ's Food & Spirits	07/22/1992	CD	LC	COM	0.07	N/A	30.4
5696-3	Rauville Café	08/03/1992	CD	LC	COM	0.022	N/A	9.6
5954-3	Lakeland Nurseries	09/09/1996	CD	LC	COM	0.022	N/A	9.6
6043-3	Dakota Finishing Inc.	01/23/1998	CD	PE	IND	0.155	N/A	67.3
6270-3	Dakota Plastics Company	07/17/2001	CD	LC	IND	0.214	N/A	93.0
6457-3	Big Sioux Nursury Inc.	12/30/2003	CD	LC	COM	0.04	N/A	17.4
6514-3	Concrete Dakota Redi-Mix Inc.	05/24/2004	CD	LC	IND	0.134	N/A	58.2
6595-3	Clark RWS Inc.	01/26/2005	CD	LC	RWS	0.44	404	135.9*
6750-3	Big Sioux Nursury Inc.	08/16/2006	CD	LC	COM	0.055	N/A	23.9
6856-3	Watertown Municipal Utilities	09/02/1965	CD	LC	MUN	2.14	927	19*
7055-3		04/06/1995	CD	LC	MUN	8	4,500	2,621.3*
7012-3	Sioux River Dairy Inc.	04/10/2008	CD	PE	COM	0.089	N/A	38.7
7969-3	Bronson Custom Farms Inc.	02/13/2014	GT	LC	COM	0.2	N/A	86.9
8027-3	Wilbur Ellis	06/13/2014	GT	LC	COM	0.09	N/A	39.1
8297-3	Valley View Farms Inc.	06/16/2017	CD	LC	COM	0.08	35	35
8336-3	Everist Inc.	03/12/2018	RB	LC	COM	0.044	2.75	2.75
8341-3		03/26/2018	RB	LC	IND	6.67	1,199	1,199
CD= Codington; GT= Grant; RB= Roberts; FU= Future Use; LC= Water Right; PE= Water Permit; MUN= Municipal; COM= Commercial; SHD= Surburban Housing Development; IND= Industrial; RWS= Rural Water System; *Average annual pumping (with at least 10 years of data) as reported by the Chief Engineer (Water Rights, 2023f)							**Total**	**13,469**

Irrigation water rights/permits have been required to report their annual usage on an irrigation questionnaire since 1979. The average annual withdrawal rate for the Big Sioux: North aquifer from 1979 through 2021 is approximately 2,442 acre-feet/year (Table 2) (Water Rights, 2023a). To reflect the current development of irrigation water rights/permits more accurately, the average annual withdrawal rate for irrigation appropriations from 2012 through 2021 is approximately 3,782 acre-feet/year (Table 2) (Water Rights, 2023a).

Currently, there are 64 irrigation water rights/permits authorized to appropriate water from the Big Sioux: North aquifer (Water Rights, 2023c). Table 2 lists 61 water rights/permits as per the 2021 irrigation questionnaire (IQ) survey, and permit applications approved for irrigation use since then include Permit Nos. 8554-3, 8622-3, and 8728-3, authorizing the irrigation of 368 acres (Water Rights, 2023a and 2023c). Generally, irrigators in eastern South Dakota apply less than one foot of water per acre per year. To account for the fluctuation in wet and dry cycles from year to year, one foot of water per acre per year is used to overestimate the annual withdrawal rate for the irrigation water permits not listed on Table 2, thus the estimated appropriation for the three water permits not listed on Table 2 is 368 acre-feet/year (Water Rights, 2023a and 2023c). The collective estimated annual withdrawal rate for irrigation water rights/permits in the Big Sioux: North aquifer is approximately 4,150 acre-feet/year (average from 2012 to 2021: 3,782 acre-feet/year, plus the estimated average annual withdrawal rate for the irrigation water permits approved after the 2021 IQ survey: 368 acre-feet/year) (Water Rights, 2023a and 2023c).

Table 2: Reported historic irrigation use from the Big Sioux: North aquifer and summary statistics from 1979 to 2021 (Water Rights, 2023a).

Year	No. of Permits Reporting	Pumpage Reported (acre-feet/year)
1979	39	912
1980	39	888
1981	37	1,067
1982	32	1,384
1983	34	1,110
1984	36	1,685
1985	36	1,420
1986	35	1,079
1987	35	1,929
1988	35	2,740
1989	40	2,687
1990	44	2,520
1991	38	1,659
1992	33	1,326
1993	34	865
1994	33	1,193
1995	32	1,187
1996	30	1,498
1997	31	1,656
1998	35	1,703
1999	35	2,593
2000	36	3,013
2001	36	2,559
2002	37	2,835
2003	37	3,662
2004	38	2,449
2005	40	2,887
2006	38	4,286
2007	38	3,309
2008	41	2,744
2009	45	1,774
2010	46	2,421
2011	46	2,148
2012	50	4,970
2013	56	4,943
2014	61	3,269
2015	61	3,603
2016	63	4,436
2017	63	4,276
2018	64	3,894
2019	62	1,189
2020	60	2,966
2021	61	4,274
MIN	64	865
MAX	30	4970
Average (1979-2021)	42	2,442
Average (2012-2021)	60	3,782

There are domestic wells completed into the Big Sioux: North aquifer that do not require a water right/permit, so the withdrawal amount from those wells is unknown (Water Rights, 2023d). Due to their relatively low diversion rates, withdrawals from domestic wells are generally not considered to be a significant portion of the hydrologic budget. Additionally, rural water systems have been developed in areas where the Big Sioux: North aquifer is the uppermost aquifer available, and it is likely that some domestic users have transitioned to rural water. Therefore, the quantity of water withdrawn by domestic wells is estimated to be negligible to the hydrologic budget for the aquifer.

Hydrologic Budget Summary

The estimated average annual recharge rate to the Big Sioux: North aquifer is approximately 27,000 to 54,000 acre-feet/year. The estimated average annual withdrawal rate from the Big Sioux: North aquifer is approximately 17,675 acre-feet per year (non-irrigation: 13,469 acre-feet/year; irrigation: 4,150 acre-feet/year; Water Permit Application No. 8770-3 (if approved, assuming to pump entire annual volume limitation): 56 acre-feet/year). Based on the hydrologic budget, there is a reasonable probability that unappropriated water is available from the Big Sioux: North aquifer for the proposed appropriation.

OBSERVATION WELL DATA:

Administrative Rule of South Dakota (ARSD) 74:02:05:07 requires that the Water Management Board shall rely upon the record of observation well measurements in addition to other data to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated average annual recharge of the aquifer.

Observation wells provide data on how the aquifer responds to regional climatic conditions and local pumping. The DANR-Water Rights Program monitors 29 observation wells completed into the Big Sioux: North aquifer (Water Rights, 2023b). The four closest observation wells to the diversion points for Application No. 8770-3 with a longer period of record (as shown in Figure 1) are CD-57B (approximately 1.2 miles northwest), CD-60D and CD-60DR (approximately 3.4 miles north), CD-79B (approximately 5.5 miles northwest), and CD-79A (approximately 10 miles northwest) (Water Rights, 2023b). These observation wells are representative of the hydrographs for other observation wells completed into the Big Sioux: North aquifer. Observation well CD-60D has a large downward spike and may not be functioning properly due to slow recovery after air development of the well (Mathiowetz, 2023). The period of record for observation well CD-60DR is still too short to draw conclusions. Hydrographs of observation wells are constructed by measuring the static water level from the top of the well casing over a period of record. The hydrographs of these nearest observation wells are displayed in Figures 2 to 6 (Water Rights, 2023b).

The overall trend for the hydrographs of the nearest observation wells to the existing diversion points display stable to increasing water levels. This indicates that the Big Sioux: North aquifer responds well to climatic conditions because water levels are rising during wetter periods and declining to a stable water level during drier periods. Additionally, the water levels in the observation wells display that the aquifer returns to pre-pumped conditions between irrigation seasons. Aquifer recovery indicates that climatic conditions, and therefore, recharge to and natural discharge from the aquifer govern the long-term fluctuations of water levels in the aquifer rather than the impacts of pumping from the Big Sioux:

North aquifer. Natural discharge can also be captured for pumping. Therefore, observation well hydrographs demonstrate that unappropriated water is available for the proposed appropriation.

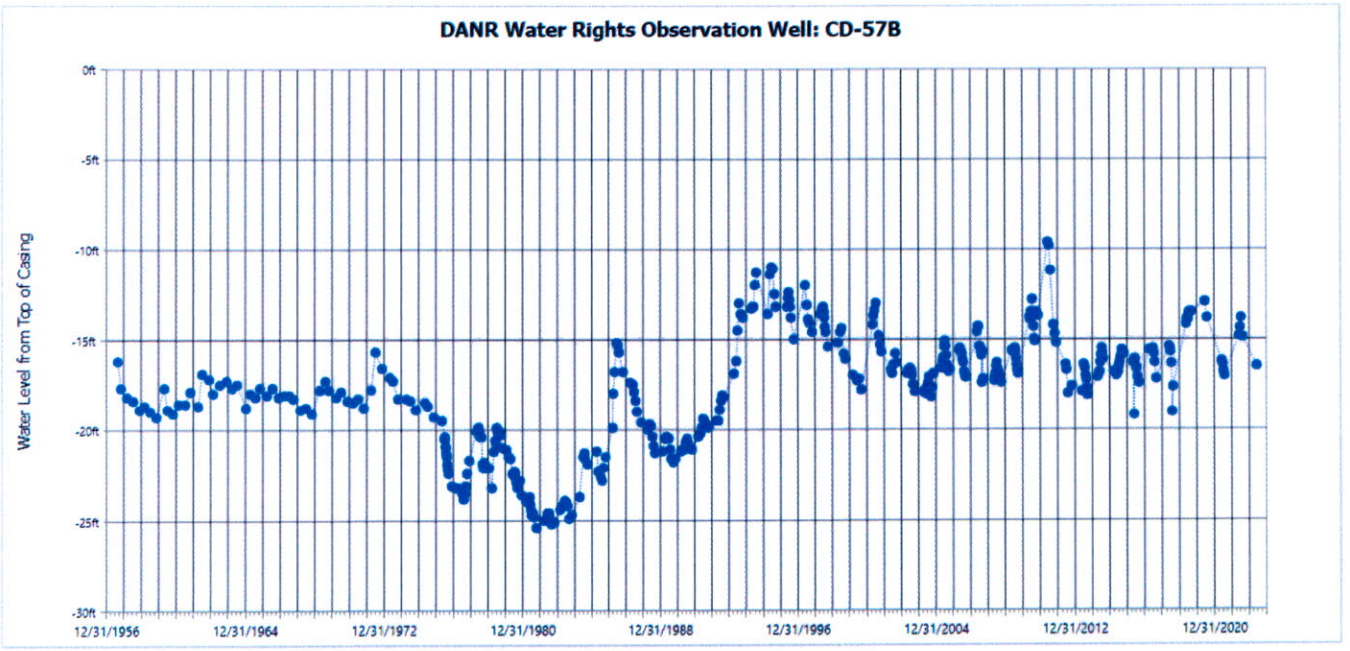

Figure 2: Hydrograph for observation well CD-57B (Water Rights, 2023b).

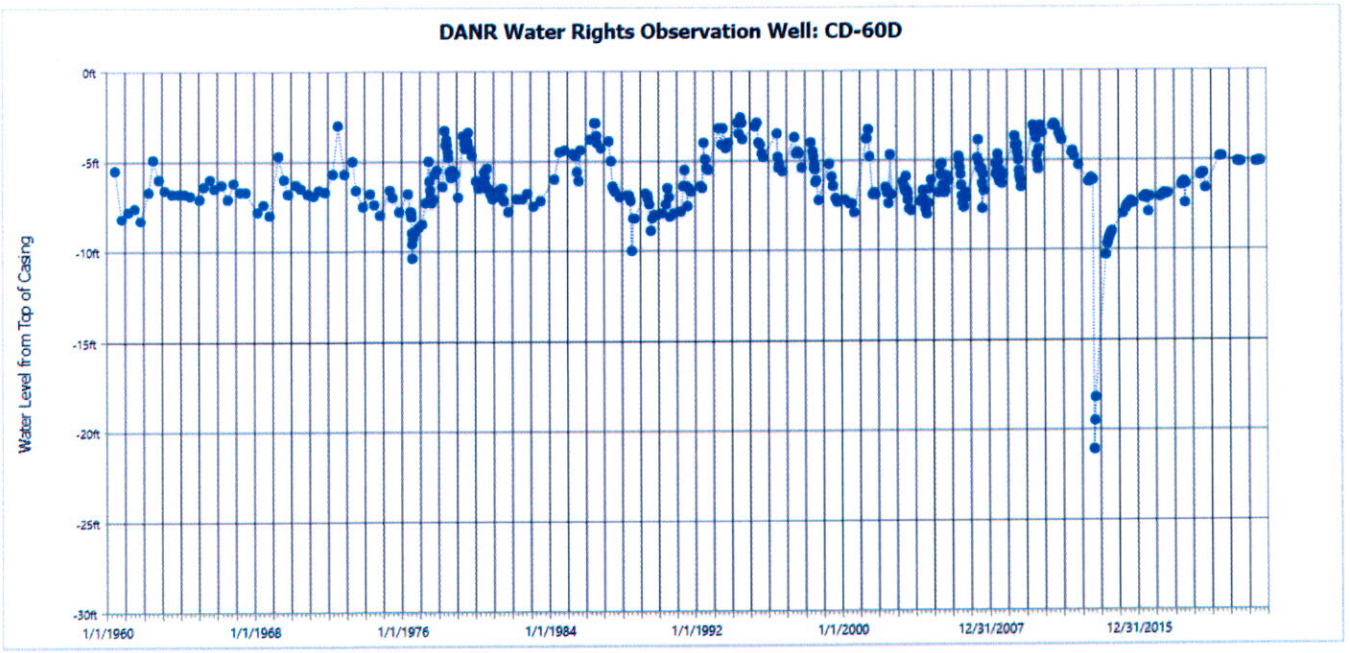

Figure 3: Hydrograph for observation well CD-60D (Water Rights, 2023b).

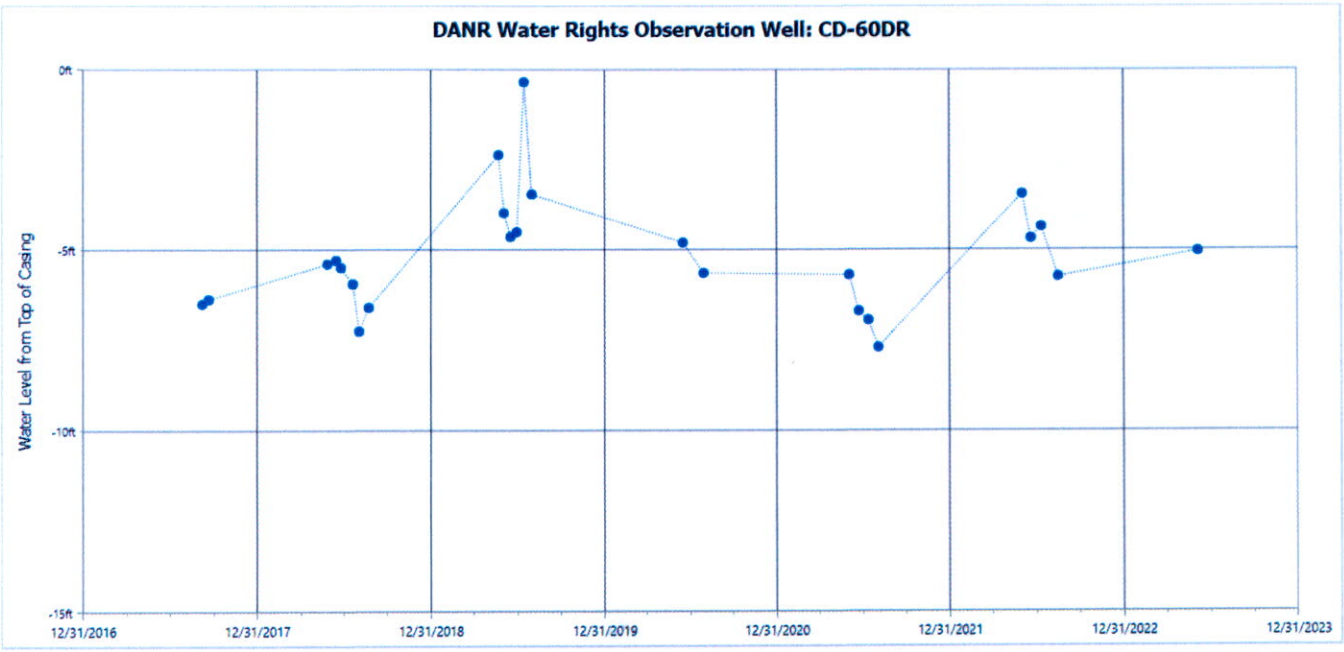

Figure 4: Hydrograph for observation well CD-60DR (Water Rights, 2023d).

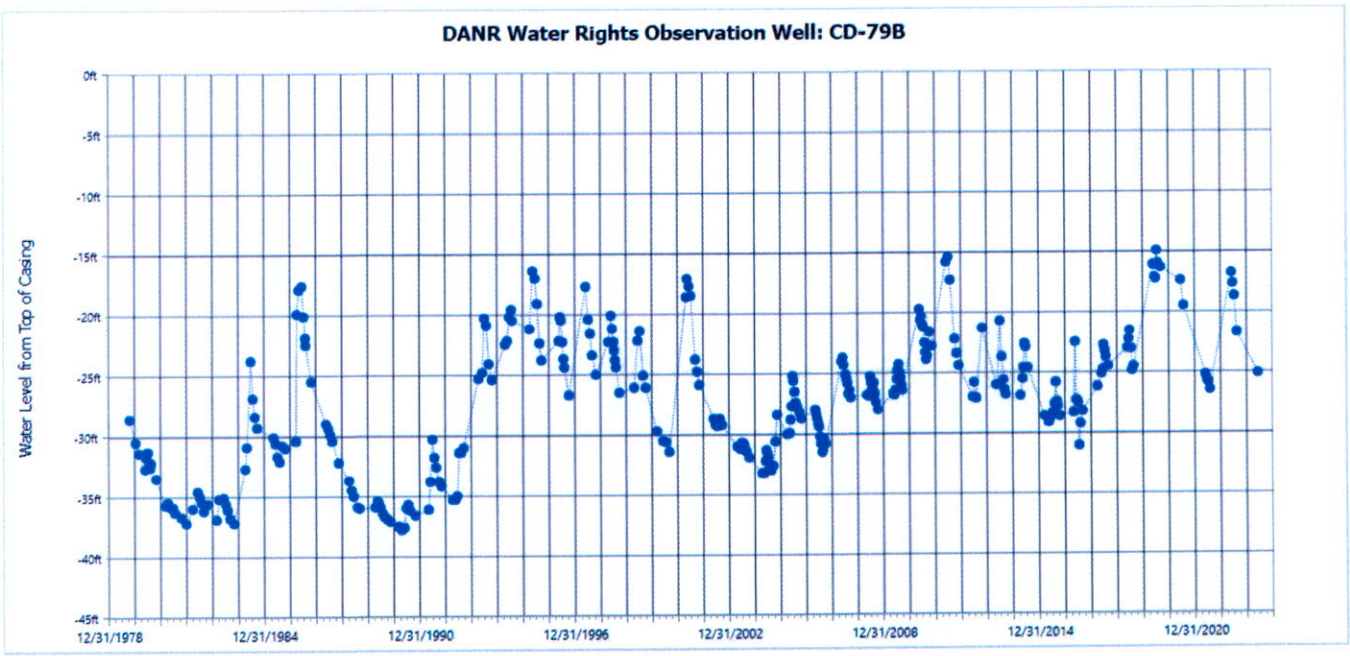

Figure 5: Hydrograph for observation well CD-79B (Water Rights, 2023b).

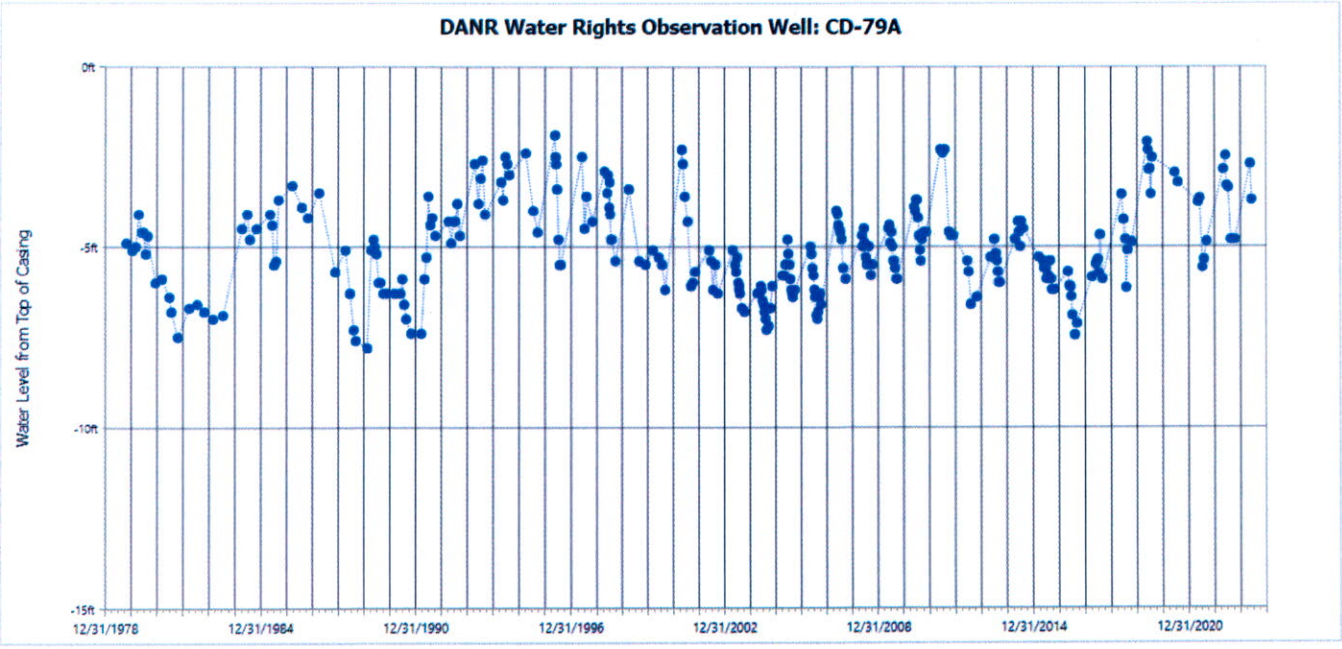

Figure 6: Hydrograph for observation well CD-79A (Water Rights, 2023b).

POTENTIAL FOR UNLAWFUL IMPAIRMENT OF EXISTING WATER RIGHTS:

Currently, there are 105 water rights/permits authorized to appropriate water from the Big Sioux: North aquifer (Water Rights, 2023c). Table 3 lists the nearest water rights/permits to the proposed diversion points shown in Figure 7. The closest water right/permit to the proposed diversion point is Water Right No. 8297-3, which is held by Valley View Farms Inc. The diversion point for Water Right No. 8297-3 is located approximately 0.25 miles northeast of the diversion points for this application (Table 3) (Figure 7) (Water Rights, 2023c).

There are domestic wells on file with the DANR-Water Rights Program that are completed into the Big Sioux: North aquifer, with the closest domestic well on file (not held by the applicant) approximately 0.4 miles northeast of the proposed diversion point (Water Rights, 2023d). There could potentially be other domestic wells completed into the Big Sioux: North aquifer near the diversion points for this application that are not on file with the DANR-Water Rights Program. The location of the domestic wells is based on the location provided at the time of completion by the well driller.

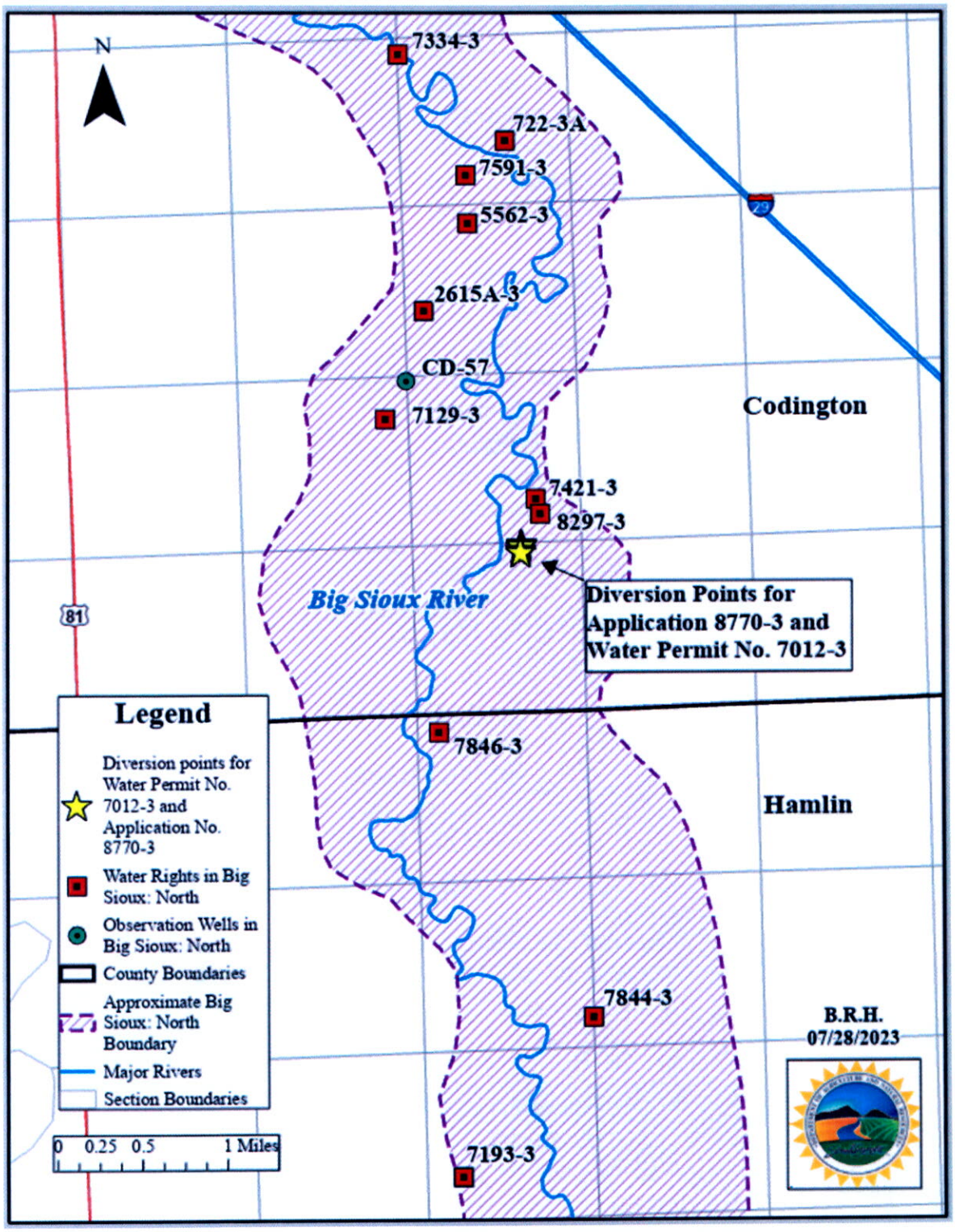

Figure 7: Map of the approximate Big Sioux: North aquifer boundary (Stonesifer, 2013) showing nearby existing water rights/permits within approximately four miles of the existing wells at the site of Application No. 8770-3 (Water Rights, 2023c).

Table 3: List of existing Big Sioux: North aquifer water rights/permits within four miles of the proposed diversion point as shown in Figure 7 (Water Rights, 2023c).

Permit No.	Name	Priority	Status	Use	Authorized Diversion Rate (cfs)	Acres (If Irrigation)
7334-3	Nick & Matt Kranz Inc.	03/19/2012	LC	IRR	1.72	120.7
722-3A	Scott Simon	06/10/1960	LC	IRR	0.64	45
7591-3	Robert Raml	12/26/2012	LC	IRR	0.84	59.1
5562-3	Robert Endres	07/02/1991	LC	IRR	1.66	136
2615A-3	Robert Endres	03/01/1976	LC	IRR	1.67	136
7129-3	Gordon Little	04/21/2009	LC	IRR	1.67	129.4
7421-3	Valley View Farms Inc.	08/29/2012	LC	IRR	2	156
8297-3		06/16/2017	LC	COM	0.08	N/A
7846-3	Marvin Czech	05/23/2013	PE	IRR	1.33	120
7844-3	Craig Bass	05/23/2013	LC	IRR	1.44	167
7193-3	Claremont Httrn Brth	03/30/2010	LC	IRR	1.33	130

At the existing well site, the Big Sioux: North aquifer has a saturated thickness ranging from approximately 7 to 14 feet (Water Rights, 2023c and 2023d). However, well completion reports on file for Big Sioux: North aquifer wells within one mile of the existing well site, indicate a saturated thickness ranging from approximately 25 to 35 feet (Water Rights, 2023d).

The Water Management Board recognizes that an "adequate well" is defined in ARSD 74:02:04:20(6) as:

> "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 to the bottom of the aquifer as is practical if the aquifer thickness is less than 20 feet."

The saturated thickness in this area may limit production during dry seasons due to lower water levels, but the wells at this site have the capacity to produce water at the applicant's requested rate due to the reported pump test rate of 50 gallons per minute or 0.11 cfs (Water Rights, 2023d).

The aquifer is under water-table conditions at the existing well site (Water Rights, 2023d). Drawdown created by pumping a well generally does not extend far from the pumped well in an unconfined aquifer. The hydrograph for observation well CD-57B completed in the Big Sioux: North aquifer shows no signs of being significantly impacted by drawdown caused by pumping, despite being located within three miles of several high yield wells (assumed to be a well with an authorized diversion rate greater than 0.2 cfs) (Figure 6) (Water Rights, 2023b and 2023c). For Codington and Hamlin County, there are no complaints on file with the DANR Water Rights Program regarding well interference for adequate wells completed into the Big Sioux: North aquifer (Water Rights, 2023e).

Considering the statutes, SDCL 46-2A-9, 46-6-3.1 and ARSD 74:02:04:20(7), the generally unconfined nature of the aquifer, reported pumping rates that the wells are capable of, the lack of well interference complaints for adequate wells completed into the Big Sioux: North aquifer as well as lack of complaints from the existing wells for Water Permit No. 7012-3 which appropriate water from the Big Sioux: North (Water Rights, 2023b, 2023c, 2023e), there is a reasonable probability that any interference from the proposed appropriation will not impose unlawful impairments on water rights/permits or domestic uses from adequate wells.

CONCLUSIONS:

1. Application No. 8770-3 proposes to divert water from the Big Sioux: North aquifer at a maximum instantaneous diversion rate of 0.19 cfs from two additional existing wells located in the NW ¼ NE ¼ of Section 34 in T116N-R52W.

2. Existing Water Permit No. 7012-3 appropriates water at a maximum instantaneous diversion rate of 0.089 cfs from two wells completed into the Big Sioux: North aquifer located in the NW ¼ NE ¼ of Section 34 in T116N-R52W.

3. If approved, Application No. 8770-3 and Water Permit No. 7012-3 will collectively authorize up to 56 acre-feet of water annually at a maximum instantaneous diversion rate of 0.278 cfs from four wells for the commercial use in a dairy operation. This site is located in Codington County, approximately 5 miles south of Watertown, South Dakota.

4. Based on observation well data and the hydrologic budget, there is a reasonable probability that unappropriated water is available from the Big Sioux: North aquifer to supply the proposed appropriation.

5. There is a reasonable probability that the proposed diversion by Application No. 8770-3 will not unlawfully impair adequate wells for existing water rights/permits and domestic uses.

6. Based on the thin saturated thickness at the proposed site of Application No. 8770-3 and Water Permit No. 7012-3, there may be limited production due to fluctuating water levels for shallow aquifers during dry seasons.

Brittan Hullinger
Natural Resources Engineer I
SD DANR - Water Rights Program

Reviewed by:

Adam Mathiowetz, PE
Natural Resources Engineer IV
SD DANR -Water Rights Program

References

Fahrenbach, M.D., Steece, F.V., Sawyer, J.F., et al. 2010. South Dakota Stratigraphic Correlation Chart. Oil and Gas Investigations 3. SD DANR-Geological Survey. Vermillion, SD.

Hansen, D.S. 1990. Water Resources of Codington and Grant Counties, South Dakota. U.S. Geological Survey. Water-Resources Investigations Report 89-4147. Huron, SD.

Hansen, D.S. 1994. Major Aquifers in Codington and Grant Counties, South Dakota. U.S. Geological Survey. Information Pamphlet No. 47. Vermillion, SD.

Hedges, L.S., Allen, J., Holly, D.E., 1985. Evaluation of Ground-Water Resources Eastern South Dakota and Upper Big Sioux River, South Dakota and Iowa, Task 7: Ground Water Recharge; United States Army Corps of Engineers Contract DACW 45-80-C-0185.

Hedges, L.S., Burch, S.L., Iles, D.L. et al. 1982. Evaluation of Ground-Water Resources Eastern South Dakota and Upper Big Sioux River, South Dakota and Iowa. Task 1: Bedrock Topography and Distribution, Task 2: Extent of Aquifers, Task 3: Ground-Water Storage, Task 4: Computerized Data Base, Final Report. U.S. Army Corps of Engineers Contract DACW 45-80-C-0185.

Kilts, W. 2017. Report on Water Permit Application No. 8315-3. DANR- Water Rights Program. Joe Foss Building. Pierre, SD.

Mathiowetz, A.W. 2023. Report on Water Permit Application No. 8728-3. DANR-Water Rights Program. Joe Foss Building. Pierre, SD.

Mathiowetz, A.W. 2014. Report on Water Permit Application No. 7943-3. DANR-Water Rights Program. Joe Foss Building. Pierre, SD.

Putnam, L.D. and Thompson, R.C. 1996. Appraisal of the Water Resources of the Big Sioux Aquifer, Codington and Grant Counties, South Dakota. U.S. Geological Survey. Water-Resources Investigations Report 96-4275. Rapid City, SD.

SDGS, 2023. South Dakota Geological Survey Lithologic Logs Database. SD DANR Geological Survey Program. Accessed July 18, 2023. http://cf.sddanr.net/lithdb/.

Stonesifer, J.R. 2013. Report on Water Permit Application No. 7857-3. DANR- Water Rights Program. Joe Foss Building. Pierre, SD.

Thompson, R.C. 2001. Water Resources of the Lake Traverse Reservation, South and North Dakota, and Roberts County, South Dakota. U.S. Geological Survey. Water-Resources Investigation Report 01-4219. Rapid City, SD.

Water Rights, 2023a. "1979-2021 Irrigation Summaries by Aquifer", SD DANR-Water Rights Program. Joe Foss Building. Pierre, SD.

Water Rights, 2023b. Observation Well Data. SD DANR-Water Rights Program. Joe Foss Building. Pierre, SD.

Water Rights, 2023c. Water Right/Permit Files. SD DANR-Water Rights Program. Joe Foss Building. Pierre, SD.

Water Rights, 2023d. Well Completion Reports. SD DANR-Water Rights Program. Joe Foss Building. Pierre, SD.

Water Rights, 2023e. County Files. SD DANR-Water Rights Program. Joe Foss Building. Pierre, SD.

Water Rights, 2023f. Non-Irrigation Yearly Reports. SD DANR- Water Rights Program. Joe Foss Building. Pierre, SD.