



**DEPARTMENT OF ENVIRONMENT
and NATURAL RESOURCES**

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**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 6937A-3, Dean R Morman**

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. 6937A-3, Dean R Morman, 44742 302nd Street, Volin SD 57072.

The Chief Engineer is recommending APPROVAL of Application No. 6937A-3 because there is reasonable probability that there is unappropriated water available for the applicant's proposed use 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. 6937A-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.
4. Approval of Water Permit No. 6937A-3 cancels Water Permit No. 6937-3.

See report on application for additional information.

Jeanne Goodman, Chief Engineer
September 30, 2014

**REPORT TO THE CHIEF ENGINEER
WATER PERMIT APPLICATION NO. 6937A-3
DEAN R MORMAN
SEPTEMBER 19, 2014**

Water Permit Application No. 6937A-3 is a reinstatement of Water Permit No. 6937A-3 which had a priority date of March 3, 2008, with a required completion date of March 3, 2013. The system was not completed within the five year completion date of the original permit. Water Permit No. 6937-3 was approved for the appropriation of water at a maximum diversion rate of 1.78 cubic feet per second (cfs) from a single well completed into the Lower James: Missouri aquifer in the center of the SW ¼ of Section 6, T94N-R54W at an expected depth of approximately 180 feet. The water will be used to irrigate 135 acres in the SE ¼ SW ¼ (35 acres), NE ¼ SW ¼ (35 acres), NW ¼ SW ¼ (35 acres), SW ¼ SW ¼ (30 acres) all in Section 6, T94N-R54W in Yankton County.

AQUIFER: Lower James Missouri aquifer (LJM)

GEOLOGY AND AQUIFER CHARACTERISTICS:

The Lower James Missouri aquifer is a buried outwash (sand and gravel) aquifer that is generally found under artesian conditions in Yankton County. Stonesifer (2013) constructed a composite map based on delineations of the Lower James Missouri aquifer produced from Bugliosi (1986), Lindgren and Hansen (1990), Hansen (1983), and Hedges and others (1982). Small portions of the aquifer were delineated in McCook and Clay Counties based on lithologic logs (SD Geological Survey, 2014). The Lower James Missouri aquifer underlies approximately 191,700 acres and contains an estimated 2,795,400 acre-feet (ac-ft) of recoverable water in storage (Hedges et al., 1982). The aquifer extends into Hutchinson County to the north and is hydraulically connected to the Missouri Elk Point aquifer to the south as well as the Lower James Missouri Scotland aquifer to the west. The aquifer shows evidence of being connected to the James River in Yankton County. Bugliosi (1986) divided the Lower James Missouri aquifer into northern and southern areas which Hedges (1982) defines as the Lower James Missouri and Missouri Elk Point aquifers. Bugliosi (1986) goes on to say that wells from the aquifer can generally be expected to yield at least 500 gallons per minute (gpm). In addition, Hansen (1983) defined a glacial aquifer in southern Hansen County as the Plum Creek aquifer which is also included in Stonesifer's (2013) composite map and is assumed to be connected to the Lower James Missouri aquifer in this report.

No test well records were submitted with this application or with the original application for Water Permit No. 6937-3. Bugliosi (1986) indicates that the aquifer is present in this area. A lithologic record provided by the South Dakota Geologic Survey and located approximately 1,800 feet to the southwest shows the bottom of the formation at 189 feet below the ground surface. Although no test hole log was provided with this application, and estimated well depth of 180 feet was proposed. This is consistent with the SDGS lithologic record.

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 the effects on existing water rights completed into this portion of the Lower James: Missouri aquifer.

WATER AVAILABILITY:

This application proposes to appropriate water from the Lower James Missouri aquifer. The probability of unappropriated water available from the 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. In this case, the aquifer is not older or lower than the Greenhorn Formation and the applicant is not a public water system.

Recharge:

Recharge to the Lower James Missouri aquifer occurs through infiltration of precipitation where the aquifer is at or near land surface in the James River flood plain, upward leakage from the bedrock aquifers, inflow from surface water, and inflow from the surrounding glacial aquifers (Bugliosi, 1986; Hansen, 1983; Lindgren and Hansen, 1990).

Hedges and others (1985) estimated recharge rate of the Lower James Missouri aquifer through regional flow-net analysis to be 1.5 inches per year (in/yr). In applying this total recharge rate estimate to the total area of the aquifer (191,700 acres (Hedges et al., 1982)) recharge is estimated to be approximately 24,000 ac-ft/yr.

The recharge rate to unconfined portions of the aquifer was estimated to be 3.9 inches per year (in/yr) from observation well analysis (Hedges and others, 1985). The unconfined portion of the aquifer was determined from lithologic logs, observation wells, and ArcMap 10.2 mapping software and was determined to be 82,200 acres (Stonesifer, 2014). Applying Hedges and others (1985) recharge rate, recharge is estimated to be approximately 26,700 ac-ft/yr in the unconfined portion of the aquifer.

Figure 1 shows historic water levels in the Missouri River (USGS, 1984-2014) and DENR Water Rights Observation Well YA-78J (Water Rights, 2014a). The Observation well is located between the proposed well site and the Missouri River at distances of approximately 6.5 miles and 2.9 miles, respectively. Given the high degree of correlation in the two hydrographs, it is likely that an increase in pumping from the aquifer would induce a greater recharge rate from the river. Ultimately, it is likely the potential for induced recharge is much greater than Hedges (1985) estimate of 24,000 ac-ft/yr and Stonesifer’s (2013) estimate of 26,700 ac-ft/yr.

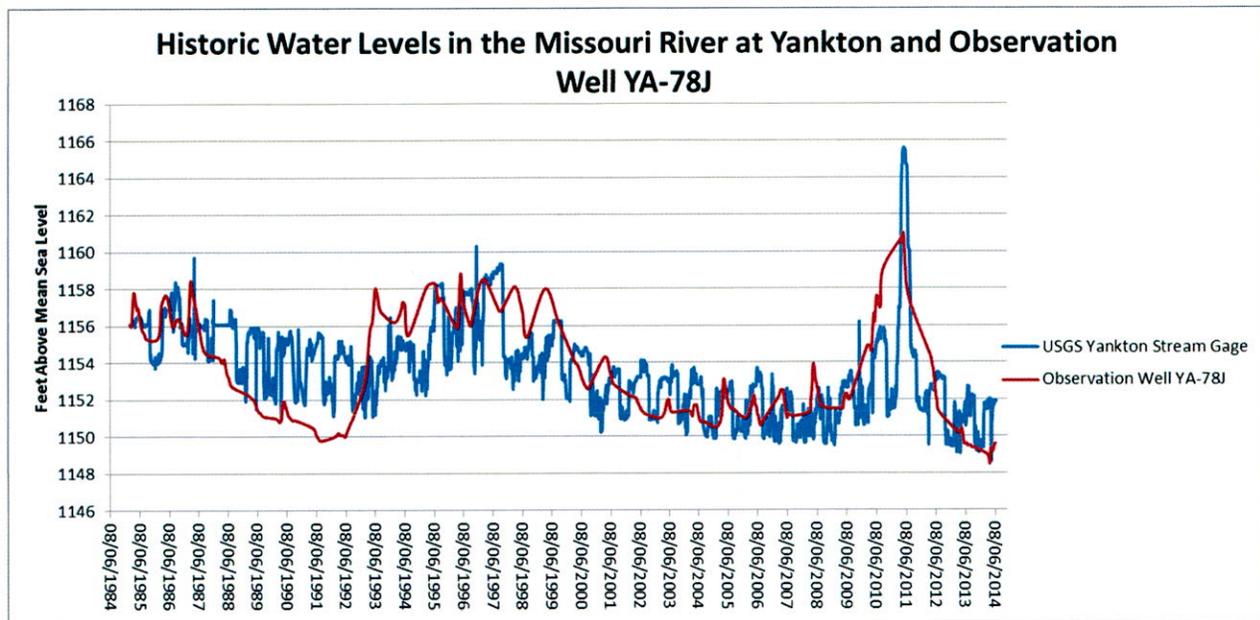


Figure 1: Historic Water Levels in the Missouri River (USGS, 1984-2014) at Yankton and Observation Well YA-78J.

Discharge:

Discharge from the Lower James Missouri aquifer occurs through evapotranspiration in areas where the aquifer is at or near land surface, seepage to surface waters, and well withdrawals (Bugliosi, 1986; Hansen, 1983; Lindgren and Hansen, 1990). Currently there are 152 water rights/permits appropriating water from the Lower James Missouri aquifer and one water right appropriating water from the Plum Creek aquifer (Water Rights, 2014b).

While there are many domestic wells on file, many are no longer used as primary sources since rural water systems have been introduced in the area. Considering this, and the relatively small withdrawal of domestic wells, the annual quantity of water withdrawn due to domestic wells is assumed to be negligible compared to the overall hydrologic budget of the aquifer (Water Rights, 2014c).

The amount of water that can be expected to be withdrawn by non-irrigation water rights/permits at the current appropriation amount, which are all limited by diversion rate, can be estimated by assuming these water rights/permits pump at the maximum authorized diversion rate 60 percent of the time. This amounts to 1,323 ac-ft/yr pumped from the Lower James Missouri aquifer. There are no non-irrigation water rights/permits authorized from the Plum Creek aquifer (Water Rights, 2014b).

The historic irrigation water use from water rights/permits authorized from the Lower James Missouri aquifer together with the Plum Creek aquifer is shown in Figure 2. The average irrigation pumpage over the period of record from Lower James Missouri aquifer water rights/permits is 2,680 ac-ft/yr. When also including water rights/permits from the Plum Creek aquifer, average irrigation pumpage is 2,766 ac-ft/yr. The expected use of irrigation water rights/permits is estimated to be the average pumpage reported over the entire period of record for water rights/permits authorized prior to 2014.

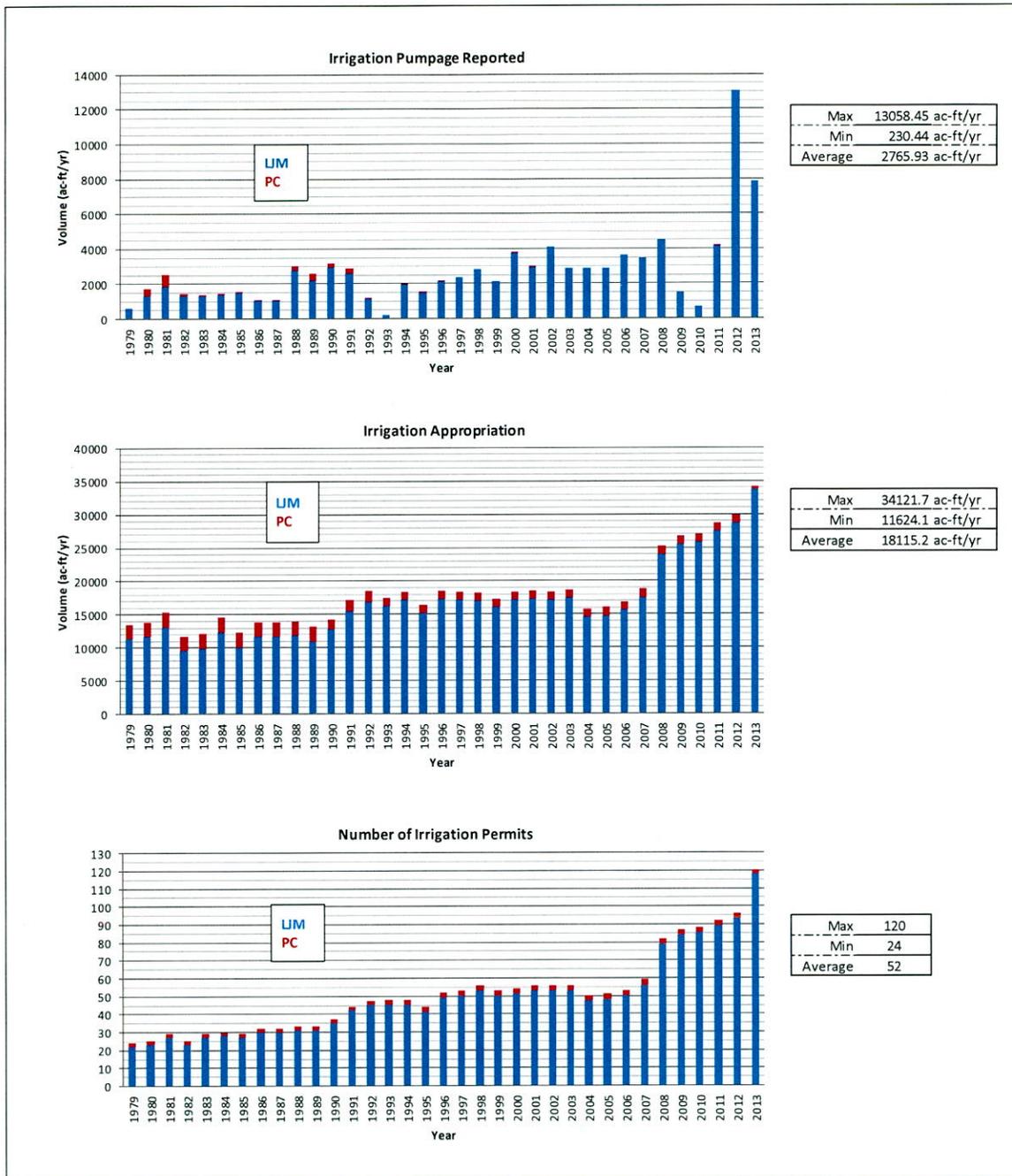


Figure 2: Historic irrigation water use from the Lower James Missouri aquifer including the Plum Creek aquifer (Water Rights, 1980-2014)

Hydrologic Budget:

The average total withdrawal from the Lower James Missouri aquifer is estimated to be 4,089 ac-ft/yr. Hedges and others’ (1985) flow net analysis determined a recharge estimate of 24,000 ac-ft/yr. Applying Hedges and others (1985) unconfined recharge rate to the determined unconfined area yields a recharge estimate of 26,700 ac-ft/yr to the unconfined portion of the aquifer with an unknown and likely negligible recharge from the remaining confined portions of the aquifer. Both recharge estimates are much greater than withdrawals. Therefore, there is a reasonable

probability that unappropriated water is available from the Lower James Missouri aquifer to support the proposed appropriation.

Observation Well Data:

Administrative Rule of South Dakota (ARSD) 74:02:05:07 states the Board will rely on the record of observation well measurements to determine that the annual withdrawals from the aquifer does not exceed the estimated average annual recharge.

The nearest observation wells to the proposed well site in this application and which are completed into the Lower James Missouri aquifer, YA-80FA and YA-78E, are located approximately 1.4 miles to the northwest and 1.75 miles southwest of the well site, respectively. The hydrographs for these observation wells are shown in Figures 4 and 5. These hydrographs are typical of many observation wells recording water levels in the Lower James Missouri aquifer. Observation well data documents cyclic yet somewhat linear water levels. Temporal well withdrawal is visible but is generally masked by climatic conditions, indicating that natural discharge is available for capture. Most Lower James Missouri aquifer observation wells record increasing trends in water levels, indicating that withdrawals have not exceeded recharge. Observation wells with declining water level trend lines are generally thought to be a result of recent increases in local pumping and not overall declining aquifer levels. Therefore, there is a reasonable probability that unappropriated water is available from the Lower James Missouri aquifer for the proposed appropriation.

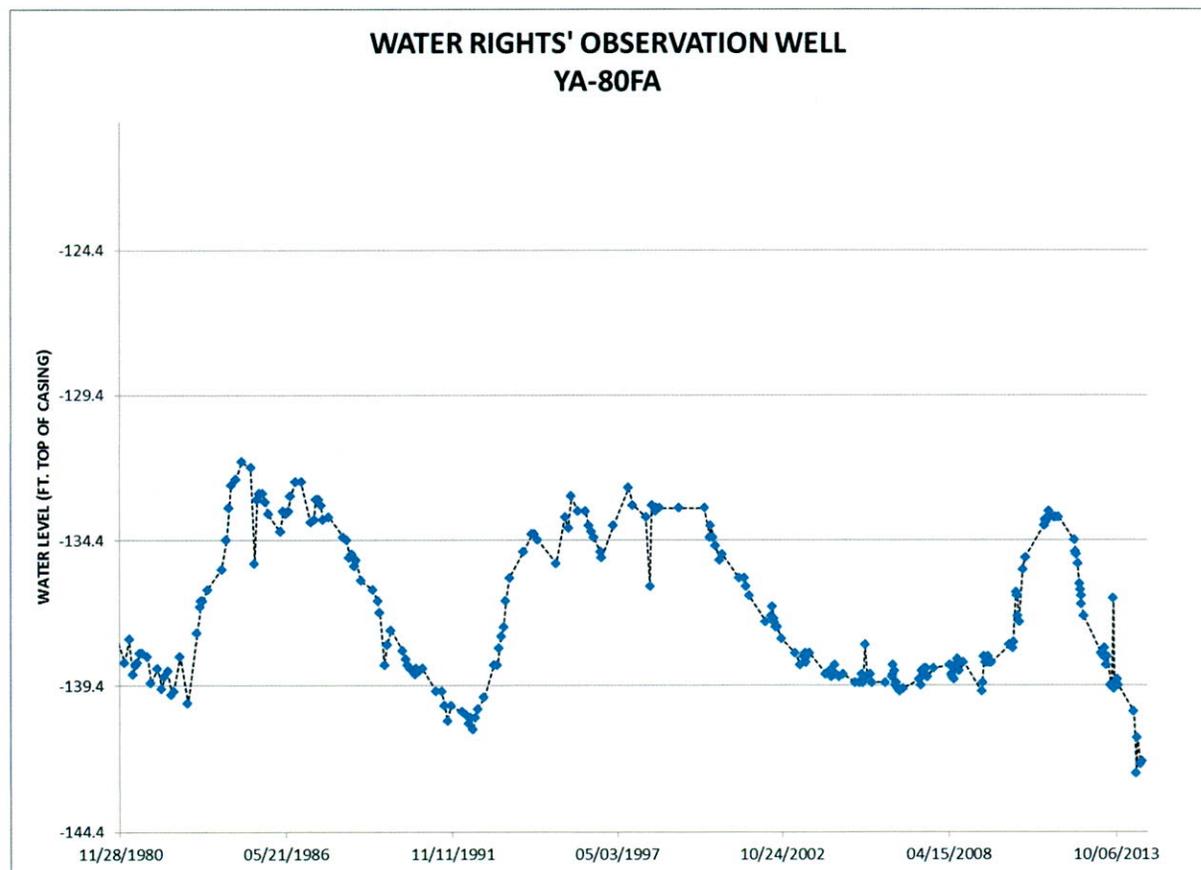


Figure 3: Historic water levels in Observation Well YA-80FA (Water Rights, 2014a)

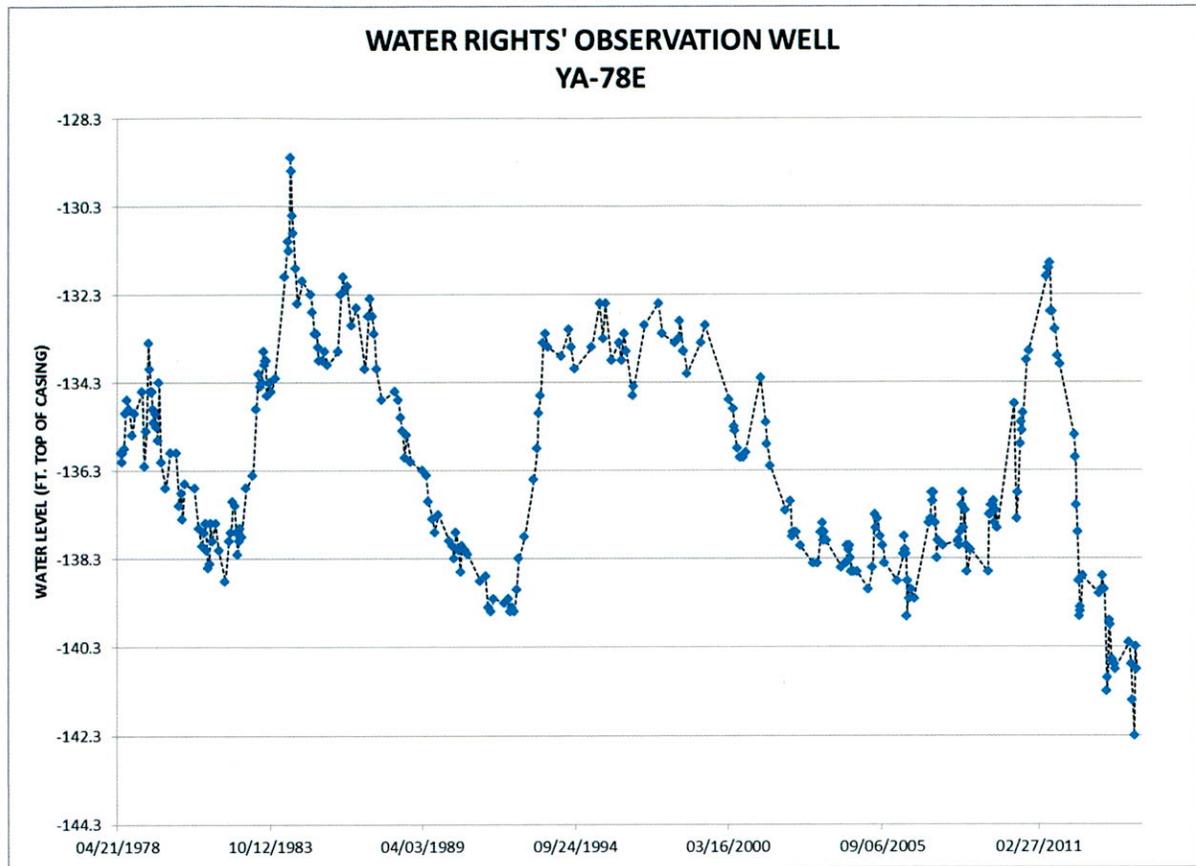


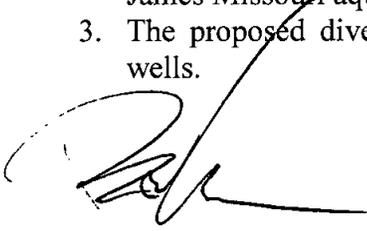
Figure 4: Historic water levels in Observation Well YA-78E (Water Rights, 2014a)

EXISTING WATER RIGHTS:

In evaluating this application, the water rights database was reviewed for the nearest water rights/permits and domestic wells on file. Because of the interconnectedness of the Lower James Missouri and Missouri: Elk Point aquifers, water rights and domestic wells in both formations were considered in terms of potential interference. The nearest water right/permit to the proposed diversion site (6974-3) is located approximately 0.5 miles to the east of the proposed well site. At the time of construction in June 2008, static water levels in the aquifer were approximately 20 feet above the actual water bearing formation. Historic and current water levels in the two nearest observation wells (shown in Figure 3 and 4) show that the static water level is approximately four feet lower than in 2008 due to drier climatic conditions. The predominately confined conditions of the aquifer at the well site dictate some drawdown due to pumping is expected (Water Rights, 2014a). The Water Management Board has consistently recognized that to place water to maximum beneficial use a certain amount of drawdown may occur. In addition, SDCL 46-6-6.1 does not require protection of artesian head pressure as a means of groundwater delivery. Approval of this permit is not expected to result in depletion of the artesian head to the top of the aquifer and is therefore not expected to result in unlawful impairment of nearby water rights/permits or adequately constructed domestic wells.

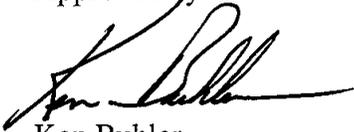
CONCLUSIONS:

1. Water Permit Application No. 6937A-3 proposes to appropriate groundwater at a maximum diversion rate of 1.78 cfs from one well to be completed into the Lower James Missouri aquifer for the irrigation of 135 acres.
2. There is a reasonable probability that unappropriated water is available from the Lower James Missouri aquifer to supply the proposed appropriation.
3. The proposed diversion is not expected to adversely impact existing nearby adequate wells.



Bracken Capen
SD DENR-Water Rights Program

Approved by



Ken Buhler
SD DENR-Water Rights Program

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