

STATE OF SOUTH DAKOTA



**OFFICE OF ATTORNEY GENERAL**

1302 East Highway 14, Suite 1  
Pierre, South Dakota 57501-8501

Phone (605) 773-3215

Fax (605) 773-4106

TTY (605) 773-6585

<http://atg.sd.gov/>

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**JUN - 1 2015**

**WATER RIGHTS  
PROGRAM**

**MARTY J. JACKLEY**  
ATTORNEY GENERAL

**CHARLES D. McGUIGAN**  
CHIEF DEPUTY ATTORNEY GENERAL

June 1, 2015

**All Parties of Record Noted in Certificate of Service Mailing List**

Re: *In the Matter of Water Application No. 2730-2, United Order of South Dakota*

To Whom It May Concern:

Enclosed please find true and correct copies of DENR's Disclosure of Experts including copies of said attachments, and an accompanying Certificate of Service. The originals of these pleadings are being sent to the Department.

Sincerely,

Ann Mines Bailey  
Assistant Attorney General

AFM/jm  
Enclosures

STATE OF SOUTH DAKOTA  
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES  
WATER MANAGEMENT BOARD

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IN THE MATTER OF WATER	)	DENR'S
APPLICATION NO. 2730-2, UNITED	)	DISCLOSURE OF EXPERTS
ORDER OF SOUTH DAKOTA	)	
	)	

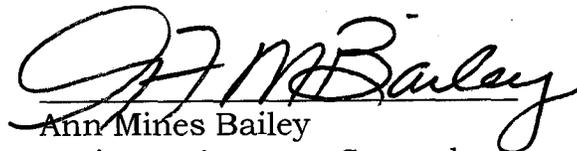
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Pursuant to the Procedural and Scheduling Order dated May 18, 2015,  
DENR hereby provides the names of its expert witnesses:

1. Ken Buhler, Engineer, South Dakota Department of Environment and Natural Resources, Water Rights Program. A copy of his initial report and the supplemental report regarding the application and upon which the Chief Engineer's recommendation is based is attached herewith.

2. Jeanne Goodman, Chief Engineer, South Dakota Department of Environment and Natural Resources, Water Rights Program. The Chief Engineer's initial recommendation and revised recommendation are attached hereto.

Dated this 19 day of June, 2015



Ann Mines Bailey  
Assistant Attorney General  
1302 East Highway 14, Suite 1  
Pierre, SD 57501-8501  
Telephone: (605)773-3215

*Counsel for Water Rights Program, DENR*

STATE OF SOUTH DAKOTA  
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

WATER MANAGEMENT BOARD

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IN THE MATTER WATER )  
APPLICATION No. 2730-2, UNITED ) CERTIFICATE OF SERVICE  
ORDER OF SOUTH DAKOTA )  
)

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The undersigned hereby certifies that a true and correct copy of the DENR's Disclosure of Experts in the above-entitled matter were served upon each of the following by enclosing the same in envelopes with first class postage prepaid and affixed thereto, and depositing said envelopes in the United States mail at Pierre, South Dakota on this 1st day of June, 2015:

Jeff Connolly  
Gunderson, Palmer, Nelson & Ashmore  
P.O. Box 8045  
Rapid City, SD 57709

William R Hansen, Chief  
Water Rights Branch  
National Park Service  
1201 Oak Ridge Drive Ste 250  
Ft. Collins, CO 80525

Karl R and Suzanne K Von Rump  
11560 Farmer Road  
Custer, SD 57730

Toni Martin  
4141 Villa Ridge Ct #122  
Rapid City, SD 57701

Mr & Mrs David Albrecht  
High Lonesome Ranch  
26541 Stagecoach Springs Rd  
Custer, SD 57730-9109

Michael M Hickey  
Bangs McCullen Law Firm  
P.O. Box 2670  
Rapid City, SD 57709-2670

Douglas L Leshner, Acting Manager  
Stone Meadow Ranch  
26699 Remington Rd  
Custer, SD 57730

Craig Bobzien, Forest Supervisor  
Black Hills National Forest  
1019 N 5th Street  
Custer, SD 57730

Rick Fox  
P.O. Box 35  
Hermosa, SD 57744

Dean and Delia Johnson  
14585 E French Creek Road  
Fairburn, SD 57738

Cheryl Schrempp Dupris  
Assistant U.S. Attorney  
P.O. Box 7240  
Pierre, SD 57501

Lois Witte  
Office of the General Counsel  
Mountain Region  
740 Simms St, Room 309  
Golden, CO 80401-4720

Peter Fahmy  
National Park Service  
12795 W Alameda Parkway, Ste 198  
Lakewood, CO 80228

And on the same date, the original was filed with Jeanne Goodman, Chief Engineer, DENR Water Rights Program, Joe Foss Building, 523 E. Capitol Avenue, Pierre, SD 57501.

A handwritten signature in black ink, appearing to read "Ann F. Mines-Bailey", written over a horizontal line.

Ann F. Mines-Bailey  
Assistant Attorney General  
1302 East Highway 14, Suite 1  
Pierre, SD 57501-8501  
Telephone: (605) 773-3215

# KEN BUHLER

## EDUCATION

B.S. Geological Engineering, South Dakota School of Mines and Technology, 1981

## CAREER EXPERIENCE

Engineer III - SD Dept of Environment and Natural Resources, Water Rights Program: Responsibilities: Conducting ground water investigations and investigating complaints, managing the Observation Well Network, compiling water well data, preparing and reviewing reports for new ground water permit applications, providing technical assistance to the Chief Engineer and providing expert testimony to the Water Management Board on contested water permit applications. Responsible for the management of the state's water well construction program, including licensure and regulation of well drillers operating in South Dakota and administration of the SD Well Construction Standards. Monitor water use, investigate violation complaints and conduct water permit reviews for licensing. Provide technical assistance to the Water Management Board through evaluating ground water permit applications and through interpretation of data from the statewide observation well network.

District Field Engineer – Western Company of North America: Designed oil well stimulation and cementing programs and ensured QA/QC for the District's services.

## SPECIAL PROJECTS

Provided technical assistance to the Steering committees for the Black Hills Hydrology Study and the Black Hills Water Management Study.

Provided technical assistance and expert testimony before the South Dakota Water Management Board for Well Construction Rules promulgation, well construction enforcement and well driller licensing issues since 1985.

## TESTIMONY

Testified as an expert witness before the South Dakota Water Management Board since 1985. Cases since March 7, 1990 include:

- Water Permit Applications from the Tulare: Western Spink Hitchcock Aquifer: Nos. 7858-3 and 7859-3-Brad Peterson; No. 7860-3-Oscar Inc; No. 7894-3-Van Buskirk Farms
- Water Permit Applications from the Tulare: East James Aquifer: Nos. 7875-3, 7876-3 and 7877-3- Lenny Peterson; Nos. 7878-3, 78779-3, 7880-3, 7881-3, 7882-3 and 7884-3- Oscar Inc.
- Water Permit Application No. 8032-3, Arthur Olsen
- Water Permit Application No. 2078A-3, Riverside Hutterian Brethren
- Water Permit Application Nos. 7369A-3, 7369B-3 and 7369C-3, Huron Hutterian Brethren
- Water Permit Application No. 8068-3, Thunder Ridge RE LLC
- Consideration of Water Permit Application No. 8013-3, Riverside Hutterian Brethren
- Consideration of Water Permit Application No. 4134-3, Bixler Farms
- Consideration of Deferred Applications from Upper Vermillion: Missouri aquifer Application

- No. 7725-3, Lenny Peterson; Nos. 7752-3, 7755-3, 7756-3, 7757-3, Lenny Peterson; Nos. 7726-3, 7727-3, 7753-3, 7754-3, 7759-3, Oscar Inc.; Nos. 7733-3, 7734-3, 7735-3, 7736-3, Van Buskirk Farms LLP
- Renewal of South Dakota Well Driller License No. 740, Brechtel & Sons Drilling
- South Dakota Well Driller License Application for RCS Construction
- South Dakota Well Pump Installer License Application for Babby Solar Pump Co.
- Well Driller License No. 473, Babby Well Drilling
- Application No. 7685-3, Michael Watson; No. 7716-3 Denis and Craig Slepikas; Nos. 7717-3, 7718-3, 7720-3, 7721-3, Terry Wieting; No. 7719-3, Marshall Brothers; Nos. 7722-3, 7723-3, 7724-3, Bren/Leland Kleinssaser; Nos. 7725-3, 7752-3, 7755-3, 7756-3, 7757-3, Lenny Peterson; Nos. 7726-3, 7727-3, 7753-3, 7754-3, 7759-3, Oscar Inc.; Nos. 7733-3, 7734-3, 7735-3, 7736-3, Van Buskirk Farms LLP
- Application No. 7747-3 Gordie Hofer
- Application No. 7551-3, Wayne Binger, Nos. 7570-3, 7571-3, 7572-3, 7574-3, 7575-3, 7637-3, 7638-3, 7639-3, 7640-3, Gary Marshall; No. 7620-3, Oscar, Inc.
- Application No. 7441-3, Gary or Julie Peterson; No. 7442-3, Gary or Julie Peterson; No. 7452-3, Jerome Hult; No. 7466-3, Bethel Hagen Trust; No. 7535-3, Donald D Benson; No. 7467-3, Cleland Hagen Trust; No. 7468-3, Cleland Hagen Trust; No. 7558-3, Cleland Hagen Trust; No. 7587-3, Paul Petersen; No. 7588-3, Paul Petersen; No. 7600-3, Michael D Stevens; No. 7601-3, Michael D Stevens; No. 7602-3, Michael D Stevens; No. 7603-3, Michael D Stevens; No. 7623-3, Darrell Osborn; No. 7633-3, Brad Farrar; No. 7653-3, Jeremiah Welsh
- Application No. 7386-3, Brian Gatzke; No. 7537-3, Bret Flihs; No. 7541-3 Roger Schuelke; No. 7555-3 Craig Bass
- Application No. 7373-3, Terry Wieting; No. 7620-3, Oscar, Inc
- Application No. 7649-3, POET
- Application No. 7295-3, William St. Clair; No. 7348-3, Wipf Acres LP; No. 7365-3, Huron Colony; No. 7366-3, Huron Colony; No. 7367-3, Huron Colony; No. 7368-3, Huron Colony; No. 7369-3, Huron Colony; No. 7370-3, Huron Colony
- Application No. 7345-3, Jack Schmidt
- Application No. 7289-3, Bixler Farms; Nos. 7290-3 and 7291-3, Lee Gatzke; No. 7293-3, Jefferey Gatzke and No. 7292-3, Allen Gatzke
- Well Driller License No. 722, Stretch's Well Service
- Consider Application to renew SD Well Driller's License No. 672, Millbrook Industries
- Consider Application for a SD Well Driller's License, Ekern HomeEquipment Co. Inc
- Application No. 7165-3, Paul Buckneberg
- Appeal of Chief Engineer's Decision in the matter of a pond along Spring Creek
- Consider Application for a SD Well Driller's License, Aaron Marshall
- Application No. 2629-2, Fall River Water User District
- Application No. 2633-2, Southern Black Hills Water System
- Application No. 5156-3, Lincoln County Rural Water System, Inc.
- Application No. 2623-2, Colonial Pine Hills Sanitary District
- Application No. 6823-3, TM Rural Water District
- Application No. 1883-1, Pro Eco Energy
- Application No. 2610-2, United Land Management
- Application Nos. 2560A-2 & 2615-2, Fall River Water User District
- Application No. 6846-3, Otter Tail Corporation
- Application No. 1872-1, City of Spearfish
- Application No. 1864-1, Hay Creek Ranch
- Application No. 1858-1, Glencoe Camp Resort
- Application No. 1865-1, Jay Allen

- Application Nos. 2580-2 & 2585-2, Southern Black Hills Water System
- Application No. 2591-2, Larry and Geri Gustafson
- Application No. 1707E-1, Frawley Ranches
- Application No. 2560-2, Fall River Water Users District
- Application No. 2559-2, John Markus
- Application No. 2549-2, City of Custer
- Application No. 2544-2, Timmerman Brothers Ranch Co.
- Application No. 1707D-1, City of Spearfish
- Application No. 1803-1, Albert & Ryett Harty
- Application No. 1789-1, Sturgis Water Department
- Application No. 1779-1, City of Spearfish
- Application No. 1775-1, Alben, Inc
- Application No. 1769-1, DuWayne Mahlen
- Application No. 1772-1, Fisher Sand and Gravel Company
- Application No. 1758-1, No Name City RV & Cabins
- Application No. 2475-2, City of Rapid City
- Application No. 1756-1, Frawley Ranches, Inc
- Application No. 2466-2, Black Hills Generation
- Application No. 2461-2, Colonial Pine Hills Sanitary District
- Application No. 2459-2, Anita Cregut
- Application No. 2458-2, Red Rock Development
- Application No. 6245-2, Shamrock Colony
- Application No. 1707-1, Frawley Ranches
- Application No. 1733-1, Frawley Ranches
- Application No. 6070-3, Spencer Quarries
- Application No. 2427-2, Daniel and Gary Velder
- Application No. 6166-3, Oscar Inc.
- Application No. 1689-1, Jack Marler
- Application No. 6121-3, John Swanson
- Application No. 2418-2, Fall River RWS
- Application No. 1676-1, Stagebarn Subdivision
- Application No. 1674-1, Black Hawk Water User District
- Application No. 6094-3, Dan Christensen
- Application No. 6007-3, Bob's Resort, Inc.
- Application No. 6091-3, Brentwood Colony
- Application No. 2396-2, Flintstone Bedrock City
- Application No. 1670-1, Lyndon & Jane Kok
- Application No. 1666-1, Golden Reward
- Application No. 2400-2, Karlen Family Partnership
- Application No. 2395-2, Roy Alexander
- Application No. 6027-3, City of Brandon
- Application No. 2386-2, Town of Keystone
- Application No. 5996-3, Myrl & Roy's Paving
- Application No. 1650-1, Melvin Delzer
- Application No. 2385-2, Roger Robbins
- Application Nos. 5966-3 & 5967-3, Michael Williams
- Application No. 5965-3, Rodney Hofer
- Application No. 2313-2, Coca Cola bottling of the Black Hills
- Application No. 5797-3, Heartland Pork
- Application No. 2299-2, Custer School District 16-1

- Application No. 2235-2, The Fort
- Application No. 2204-2, Flintstone Bedrock City
- Application No. 5521-3, City of Sioux Falls
- Application No. 5522-3, City of Sioux Falls
- Application No. 5533-3, City of Sioux Falls
- Application No. 5556-3, City of Sioux Falls
- Application No. 2137-2, Frank Simpson
- Application Nos. 2155-2 & 2156-2, City of Rapid City
- Application No. 1478-1 Pete Lien & Sons, Inc
- Consideration of Alleged Seepage Problems with Hawthorne Ditch

Testified as an expert witness before the Sixth Circuit Court in the matter of Stretch's Well Service, Inc./Chuck Ross (Scattergun Lodge) well.

Testified as an expert witness before the Pierre City Council in the matter of flooding related groundwater issues

**JEANNE GOODMAN, P.E.**  
**CHIEF ENGINEER**

**EDUCATION**

Bachelor of Science Degree in Geological Engineering, South Dakota School of Mines and Technology 1979

**REGISTRATIONS, PROFESSIONAL SOCIETIES, AND AWARDS**

1. South Dakota Registered Professional Engineer
2. South Dakota Engineering Society
3. Central Chapter SD Engineering Society Outstanding Engineer of 1995
4. Central Chapter SD Engineering Society Young Engineer of the Year 1986

**CAREER EXPERIENCE**

**April 2013 – present – Chief Engineer**, Water Rights Program, DENR. Administer the Program, which coordinates the appropriation of water resources in South Dakota to protect the public welfare and interest in the development of the water resources and determine in what way the water of the state should be developed for the greatest public benefit.

**2000 – 2013 - Natural Resources Administrator**, Surface Water Quality Program, DENR. Administer the Surface Water Quality program, which coordinates the prevention, reduction, measurement, and control of water pollutants to maintain water quality that is protective of the public's health and safety and the beneficial uses of the state's lakes and streams.

**1997 – 2000 - Natural Resources Administrator**, Air Quality Program, DENR. Administer the Air Quality program, which coordinates the prevention, reduction, measurement, and control of air pollutants to maintain air quality that is protective of the public's health and safety.

**1987 – 1997 – Natural Resources Engineer IV**, Ground Water Quality Program, DENR. Team Leader for ground-water discharge plans and enforcement of ground-water quality standards, Underground Injection Control, pesticides in Ground Water, and Wellhead Protection staff. Review storage tank plans and specifications. Supervise special water quality studies and the review of numerous regulated substance release assessments and remediations.

**1981 – 1987 – Natural Resources Engineer/Hydrologist**, Ground Water Quality Program, DWNR. Participated in writing Rural Clean Water Program/Comprehensive Monitoring and Evaluation proposal and workplan; reviewed mineral exploration permits for impacts to ground water; identified aquifers and compiled well data for Corps studies. Supervised staff and participated in ground water studies and investigations by installing and sampling monitoring wells; contributed sections to the Big Sioux Aquifer Water Quality study; prepared all contracts for Comprehensive Monitoring and Evaluation project, and assisted in installation of monitoring systems.

**1979 – 1980 – Natural Resources Engineer I**, Water Rights Program, DWNR. Investigated water rights complaints; reviewed water right applications; supervised installation of observation wells; prepared a report on flowing artesian wells.

## TESTIMONY

Board of Water Management – In various capacities and responsibilities with DENR, provided testimony regarding permit application review and water use, water quality, and water monitoring relative to water right permit applications, General Water Pollution Control Permits for Concentrated Animal Feeding Operations, and ground water discharge plan applications, and proposed and modifications to Administrative Rules of South Dakota for ground water and surface water quality standards, beneficial use classifications for water bodies in South Dakota, and ground water and surface water discharge permits.

Board of Minerals and Environment – In various capacities and responsibilities with DENR, provided testimony regarding water use, water quality, and water monitoring relative to mineral and oil and gas exploration and development permits.

Court matters since 2008 - In re: *Veblen West Dairy, LLP, Chapter 11, Debtor. Bankr. No. 10-10071*. United States Bankruptcy Court, D. South Dakota (court testimony).  
*Storbeck, et. al. v. State of South Dakota*, Third Judicial Circuit, Kingsbury County Civ. No. 07-69 (deposition).

## MAJOR PUBLICATIONS

1. "South Dakota Ground-Water Quality" w/ Koch and Lawrence -USGS  
USGS Open-file Report 87-0752, Goodman and Pirner - SDDWNR
2. "Agricultural Sources of Nitrate Contamination in a Shallow Sand and Gravel Aquifer in Eastern South Dakota", in Perspectives on Nonpoint Source Pollution, EPA 440/5-85-001.
3. "Non-Point Source Pesticide Contamination of Shallow Ground Water', ASTM Paper No. 892529, St. Joseph, Missouri, Kimball and Goodman.
4. "Nitrate and Pesticide Occurrence in Shallow Groundwater During the Oakwood Lakes-Poinsett RCWP Project", in The National Rural Clean Water Program Symposium, EPA/625/R-92/006.
5. "Coordination is the Project Cornerstone", in The National Rural Clean Water Program Symposium, EPA/625/R-92/006, Kuck and Goodman.
6. "Ground Water Monitoring – A Guide to Monitoring for Agricultural Nonpoint Source Pollution Projects", USDA-FSA, Huron, SD. Goodman, German, and Bischoff, January 1996.



DEPARTMENT OF ENVIRONMENT  
and NATURAL RESOURCES

JOE FOSS BUILDING  
523 EAST CAPITOL  
PIERRE, SOUTH DAKOTA 57501-3182  
denr.sd.gov



**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT  
APPLICATION NO. 2730-2, United Order of South Dakota**

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. 2730-2, United Order of South Dakota, c/o Seth Jeffs, 11571 Farmer Rd, Pringle SD 57773.

The Chief Engineer is recommending Approval of Application No. 2730-2 with a 20 year term pursuant to SDCL 46-1-14 and 46-2A-20 because 1) evidence is not available to justify issuing this permit without a 20 year term limitation, 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. In accordance with SDCL 46-1-14 and 46-2A-20, Permit No. 2730-2 is issued for a twenty year term. Pursuant to SDCL 46-2A-21, the twenty year term may be deleted at any time during the twenty year period or following its expiration. If the twenty year term is not deleted at the end of the term, the permit may either be cancelled or amended with a new term limitation of up to twenty years. Permit No. 2730-2 may also be cancelled for non-construction, forfeiture, abandonment or three permit violations pursuant to SDCL 46-1-12, 46-5-37.1 and ARSD 74:02:01:37.
2. The new 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.
3. The new well authorized by Permit No. 2730-2 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.
4. The Water Permit Holder shall report to the Chief Engineer annually the amount of water withdrawn from the Madison aquifer that is authorized by Water Permit Nos. 2610-2 and 2730-2.

See report on application for additional information.

Jeanne Goodman, Chief Engineer  
December 5, 2014

WATER PERMIT APPLICATION NO. 2730-2  
UNITED ORDER OF SOUTH DAKOTA  
NOVEMBER 12, 2014

Water Permit Application No. 2730-2 proposes to appropriate water from the Madison aquifer at a maximum diversion rate of 0.46 cubic feet of water per second (cfs). Water is to be diverted from two existing wells which were authorized by Water Permit No. 2610-2, and a proposed well. Water Permit No. 2610-2 authorizes diversions of up to 0.21 cfs from two wells located in the NW¼ SE¼ of Section 10, T6S-R3E, Custer County. This application proposes to authorize the construction of a third well, also located in the NW¼ SE¼ of Section 10, T6S-R3E, and authorize a total maximum diversion from the three wells of 0.67 cfs. The water will be used in the United Order of South Dakota's water system.

**AQUIFER:** Madison aquifer (MDSN)

**Aquifer Characteristics:**

The Madison aquifer is a regionally extensive aquifer contained within the Madison Limestone, locally known as the Pahasapa Limestone, and the Englewood Limestone. The aquifer underlies portions of North Dakota, South Dakota, Montana, Wyoming, Saskatchewan, Manitoba and Alberta. The Madison aquifer underlies most of western South Dakota and parts of Eastern South Dakota (Figure 1). The Madison aquifer contains an estimated 644,827,200 acre-feet of recoverable water in storage in Western South Dakota (Allen and others, 1985) and 51,512,300 acre-feet of recoverable water in storage in Eastern South Dakota (Hedges and others, 1982).

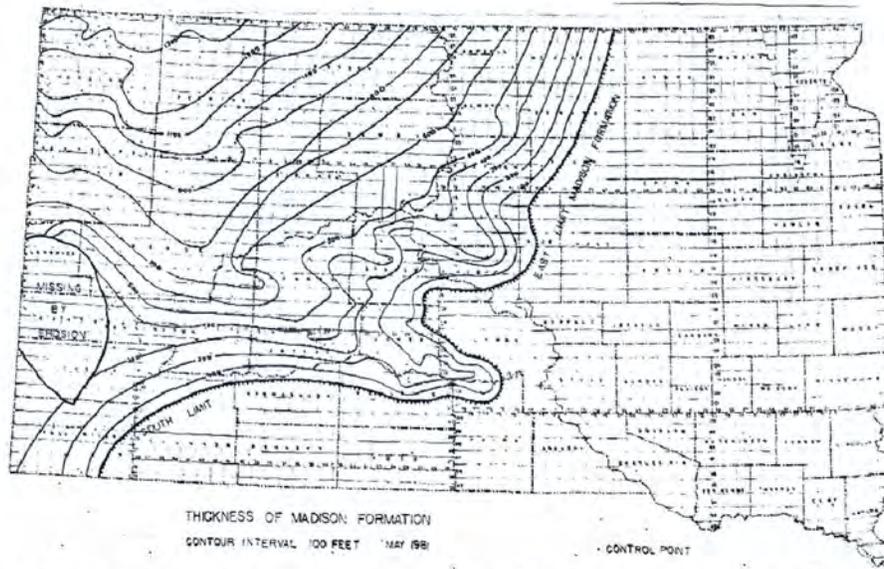


Figure 1. Areal Extent of the Madison Formation in South Dakota: modified from (Gries, 1981).

The Madison aquifer is considered a “mature karst aquifer” (Long and others, 2012) and is composed of a fine to medium crystalline, cavernous limestone and dolomite. The Madison is expected to be approximately 300 feet thick in this area (Carter and Redden, 1999a); and (Carter and Redden, 1999b). The upper portion of the Madison Limestone is karstic, therefore it contains randomly distributed zones of secondary porosity and permeability formed by weathering of

exposed surfaces, groundwater solution and fracturing. The lower part of the Madison Limestone and the Englewood Limestone generally have lower permeability than the upper part of the Madison aquifer in the Black Hill (Greene, 1993). The average porosity of the Madison is estimated to be 11%, and the effective porosity from which recoverable water can be obtained by wells is assumed to be 5% (Rahn, 1979).

The well site proposed by this application is located approximately five miles southwest of the Madison Limestone outcrop (Strobel and others, 1999). In this area, the Madison Limestone dips to the southwest at approximately 240 feet per mile (approximately three degrees) (Carter and Redden, 1999a). The DENR-Water Rights Program has record of three existing wells constructed for the United Order of South Dakota. The top of the Madison was reported to be 785 feet below grade in one well log, 715 feet below grade in a second well log and is inferred to be 719 feet below grade in the third log (Water Rights, 2014c). The static water level of the wells was reported to be 650' (06/05/2005), approximately 800' (10/20/2010) and approximately 800' (10/15/2007) respectively.

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

Pursuant to SDCL 46-2A-9, a permit to appropriate water may be issued only if there is 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.

#### **Water Availability:**

The availability of unappropriated water 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." The statute provides that "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. 2730-2 proposes to appropriate water from the Madison aquifer, a water source that is older than the Greenhorn Formation, and the water is to be used by a water distribution system. Therefore, the Board need not consider the recharge versus withdrawal issue.

#### **Existing Rights:**

This applicant has been utilizing wells completed into the Madison aquifer that were authorized by Water Permit No. 2610-2 since 2007 with no significant impact. The additional diversion rate proposed by this application is relatively low and will not likely have a noticeable effect to the Madison aquifer. There are 64 completion reports on file with the DENR-Water Rights Program within approximately five miles of the wells that are to be used to supply this appropriation (Water Rights, 2014c). The majority of these domestic wells appear to be completed into the Minnelusa aquifer and at least two are completed into the Deadwood aquifer. Wells completed into aquifers that are either stratigraphically above or below the Madison aquifer (i.e. Minnelusa and Deadwood respectively) are not expected to be affected by this proposed appropriation since the lower Minnelusa formation can be considered a confining bed that isolates the Madison hydraulically from shallower aquifers, and the bottom portion of the Madison isolates the Madison from lower

aquifers. Only three of the domestic wells on file appear to be completed into the Madison aquifer. Based on the legal location provided on the completion reports, the Madison aquifer wells are all located over three and three quarter miles from the site(s) of Application No. 2730-2.

The diversion point locations for existing water rights and future use permits appropriating water from the Madison aquifer in this area are shown in Figure 2 and identified in Tables 1 and 2.

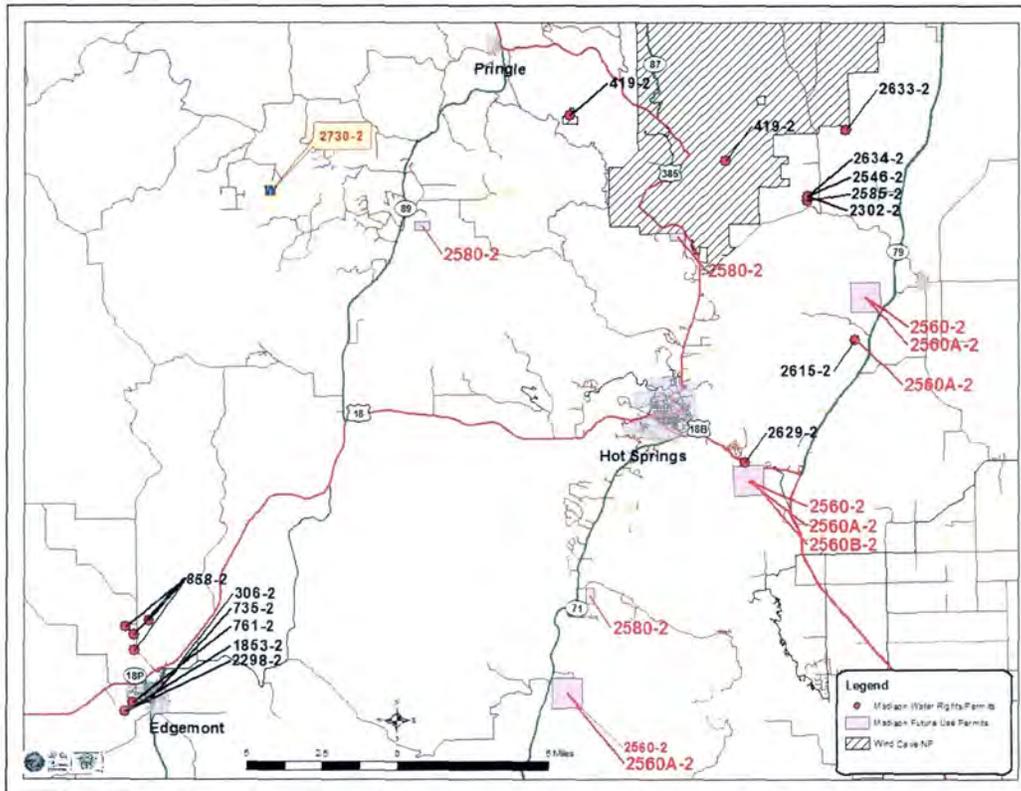


Figure 2. Location of the diversion point(s) proposed by Water Permit Application No. 2730-3, diversion points for existing Madison aquifer water rights/permits, and areas of Madison aquifer future use permits in the vicinity (Water Rights, 2014b).

Table 1. Water Rights/Permits appropriating water from the Madison aquifer in the vicinity of the diversion points proposed by Application No. 2730-2(Water Rights, 2014b).

PERMIT NO	NAME	PRIORITY DATE	STATUS	USE	CFS	ACRES	AC-FT /YR
306-2	CITY OF EDGEMONT	12/14/1945	LC	MUN	0.31		
419-2	WIND CAVE NATIONAL PARK	12/29/1955	LC	COM/IRR	0.15		
735-2	TENNESSEE VALLEY AUTHORITY	12/26/1961	LC	IND	0.66		
761-2	CITY OF EDGEMONT	04/09/1962	LC	MUN	0.41		
858-2	WYOMING DAKOTA RAILROAD PROPERTIES INC	02/05/1965	LC	IRR	9.36	655.75	
1853-2	CITY OF EDGEMONT	08/23/1983	IL	MUN			
2298-2	CITY OF EDGEMONT	08/28/1993	LC	REC/MUN	1		
2302-2	EBEN W STREETER	02/07/1994	LC	RWS	0.033		
2546-2	EBEN STREETER	01/03/2005	PE	RWS	0.21		
2615-2	FALL RIVER WATER USERS DISTRICT	05/16/2005	PE	RWS	0.67		
2629-2	FALL RIVER WATER USERS DISTRICT	05/16/2005	PE	RWS	1		
2585-2	SOUTHERN BLACK HILLS WATER SYS	05/08/2006	DF	RWS	2.67		1600
2610-2	UNITED ORDER OF SOUTH DAKOTA	02/09/2007	PE	SHD	0.21		
2633-2	SOUTHERN BLACK HILLS WATER SYSTEM	06/20/2008	PE	RWS	0.67		
2634-2	STREETER FAMILY LIMITED PARTNERSHIP	07/17/2008	PE	RWS	0		

LC= Water License, IL= Incorporated, PE= Water Permit, DF= Deferred, MUN= municipal, COM= Commercial, IRR= Irrigation, IND= Industrial, REC= Recreational, RWS= Rural Water System, SHD= Suburban Housing Development

Table 2. Future Use Permits reserving water from the Madison aquifer in the vicinity of the diversion points proposed by Application No. 2730-2(Water Rights, 2014b).

FUTURE USE PERMIT NO.	NAME	ORIGINAL RESERVATION (AC-FT/YR)	REMAINING RESERVATION (AC-FT/YR)
2560-2	FALL RIVER WATER USERS DISTRICT	750	0
2580-2	SOUTHERN BLACK HILLS WATER SYSTEM	1474	1474
2560A-2	FALL RIVER WATER USERS DISTRICT	*	0
2560B-2	FALL RIVER WATER USERS DISTRICT	*	0

\* FUTURE USE PERMIT NOS. 2560A-2 AND 2560B-2 AMEND FUTURE USE PERMIT NO. 2560-2 TO EXPAND THE FUTURE USE AREA AND DO NOT RESERVE ADDITIONAL WATER

Since the Madison is under artesian conditions in this area, drawdown from pumping a well may extend over a fairly large area. The transmissivity of the aquifer is very heterogeneous with values that range over several orders of magnitude (Putnam and Long, 2007). In addition, the aquifer characteristics of the Madison can vary considerably within a short distance (Greene, 1993).

Carter and others (2001) developed hydrologic budgets for the Madison and Minnelusa aquifers combined, using nine subareas to cover the Black Hills. The subareas were identified on the basis

of hypothetical flow paths and were selected with the intent of minimizing flow across the boundaries. The well(s) that is/are to be used to supply this appropriation is/are located in Carter and others' (2001) subarea 8. Carter and others (2001) estimated the transmissivity of the Madison aquifer on the border of the subarea near the well site at 1,463 feet squared per day ( $\text{ft}^2/\text{d}$ ). Applying this estimated transmissivity and assuming a storage coefficient of  $S= 2 \times 10^{-4}$ , the drawdown 1,000 feet from a well pumping 0.46 cfs would be less than 19 feet after one year of continuous pumping based on the Theis Equation (see Figure 3) ("Theis Equation Calculator").

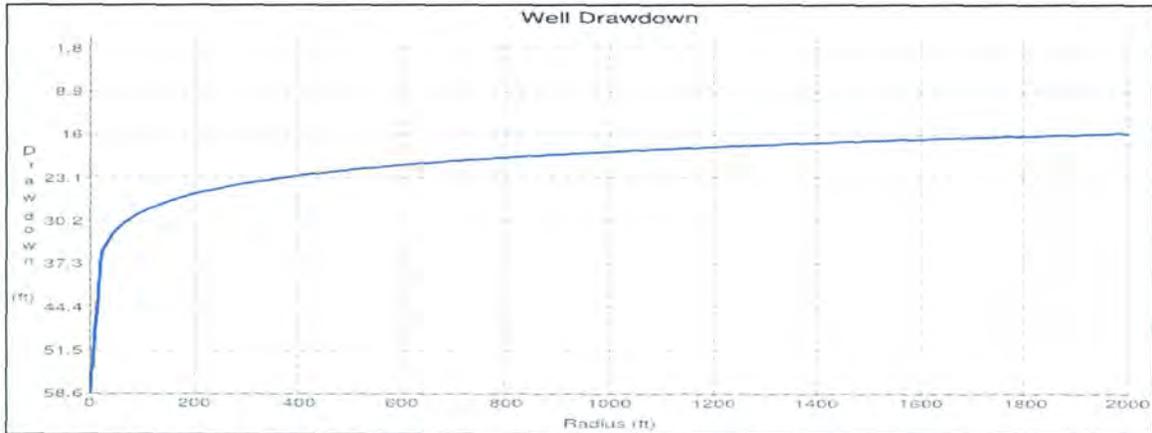


Figure 3. Drawdown predicted from a well pumping 0.46 cfs from the Madison aquifer, continuously for one year, assuming  $T= 1,463 \text{ ft}^2/\text{d}$ ,  $S= 2 \times 10^{-4}$ . (modified from ("Theis Equation Calculator"))

Assuming the combined diversion rates of Water Permit No. 2610-2 and Water Permit No. 2730-2 (if approved) are pumped from a single well, a transmissivity of 1,463  $\text{ft}^2/\text{d}$  and a storage coefficient of  $S= 2 \times 10^{-4}$ , the drawdown 1,000 feet from a well pumping 0.67 cfs would be less than 28 feet after one year of continuous pumping based on the Theis Equation (see Figure 4) ("Theis Equation Calculator").

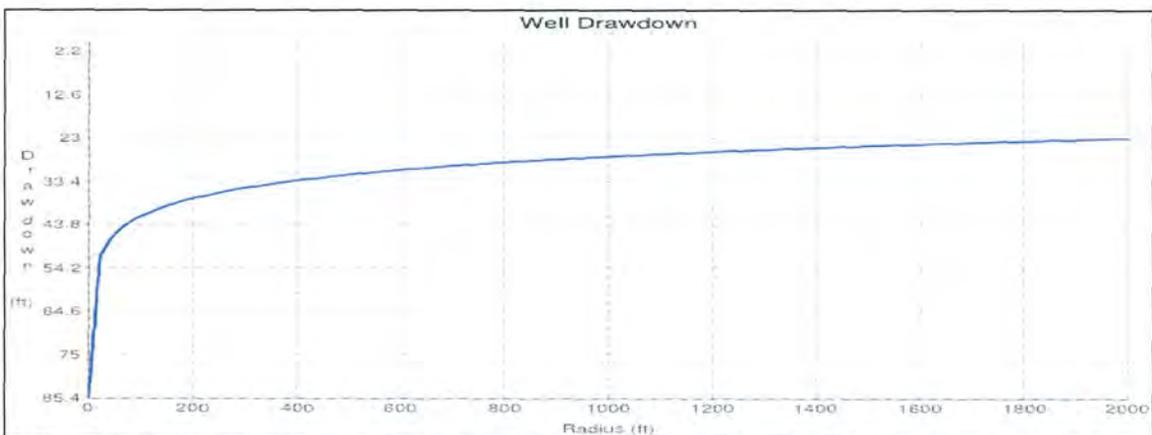


Figure 4. Drawdown predicted from a well pumping 0.67 cfs from the Madison aquifer, continuously for one year, assuming  $T= 1,463 \text{ ft}^2/\text{d}$ ,  $S= 2 \times 10^{-4}$ . (modified from ("Theis Equation Calculator"))

The Theis equation requires a number of simplifying assumptions, some of which may not apply in this case; however, the solution is still useful to show that drawdown should not be significant.

Wells supplying existing Water Rights/Permits and domestic uses are protected from adverse impacts per Water Management Board rules 74:02:04 and 74:02:05, which were promulgated pursuant to SDCL 46-6-6.1. These rules provide for the regulation of large capacity wells to the degree necessary to maintain an adequate depth of water for a prior appropriator in wells that have the ability to produce water **independent of artesian pressure**. Simply put, the pump placement in a prior appropriator's well is not necessarily protected.

If the water levels in the Madison aquifer were to decline, owners of existing wells bear the responsibility of lowering the pump inlet in the well to the top of the aquifer, if necessary. Increased lift would decrease the pump discharge; or require a larger pump or a different type of a pump to maintain the same output.

An increase in operating expenses that may result from interference between wells is not necessarily an adverse impact. The Water Management Board considered this situation in the matter of Water Permit Application 2313-2, Coca-Cola Bottling Company of the Black Hills (Water Rights, 1995). The Board adopted findings of fact and conclusions of law that basically state that if the increased cost or decreased production is considered an adverse impact, it could be in conflict with SDCL 46-1-4, which requires South Dakota's water resources to be put to beneficial use to the fullest extent of which they are capable.

It should be noted however, that well interference (drawdown) measured at Water Rights' observation wells located near high capacity municipal wells in Spearfish, Sturgis and Rapid City has never been significant (i.e. drawdown of only a few feet or tens of feet) (Water Rights, 2014a).

Given the distance between the well(s) that is/are to supply this appropriation and existing Madison wells well interference is not expected to be adverse.

The well sites proposed by this application are located approximately five miles west of the "Argyle" well site proposed by Future Use Permit No. 2580-2. Approval of this application should not hinder development of the future use permit due to the distance involved.

**Beneficial Use:**

Pursuant to SDCL 46-1-6 (3) beneficial use is defined as:

“any use of water within or outside the state, that is reasonable and useful and beneficial to the appropriator, and at the same time is consistent with the interests of the public of this state in the best utilization of water supplies;

The applicant has the burden of proof in establishing that an application is a beneficial use of water.

**Public Interest Issues:**

In the past, there have been two “public interest” issues raised that could potentially be obstacles to developing the Madison aquifer in the Southern Black Hills: the possibility of affecting artesian spring discharge; and the possibility of affecting the water resources at Wind Cave National Park.

### Artesian Springs:

The water at a number of springs in the southern Black Hills area contains geochemical and isotopic characteristics of the Madison aquifer (Whalen, 1994). These springs are classified as Type 2 springs by Rahn and Gries (1973), meaning “The springs do not dry up and serve as points of permanent discharge from the carbonate aquifer” (Rahn and Gries, 1973). Major springs in the area identified by Naus and others (2001) are shown in Figure 5.

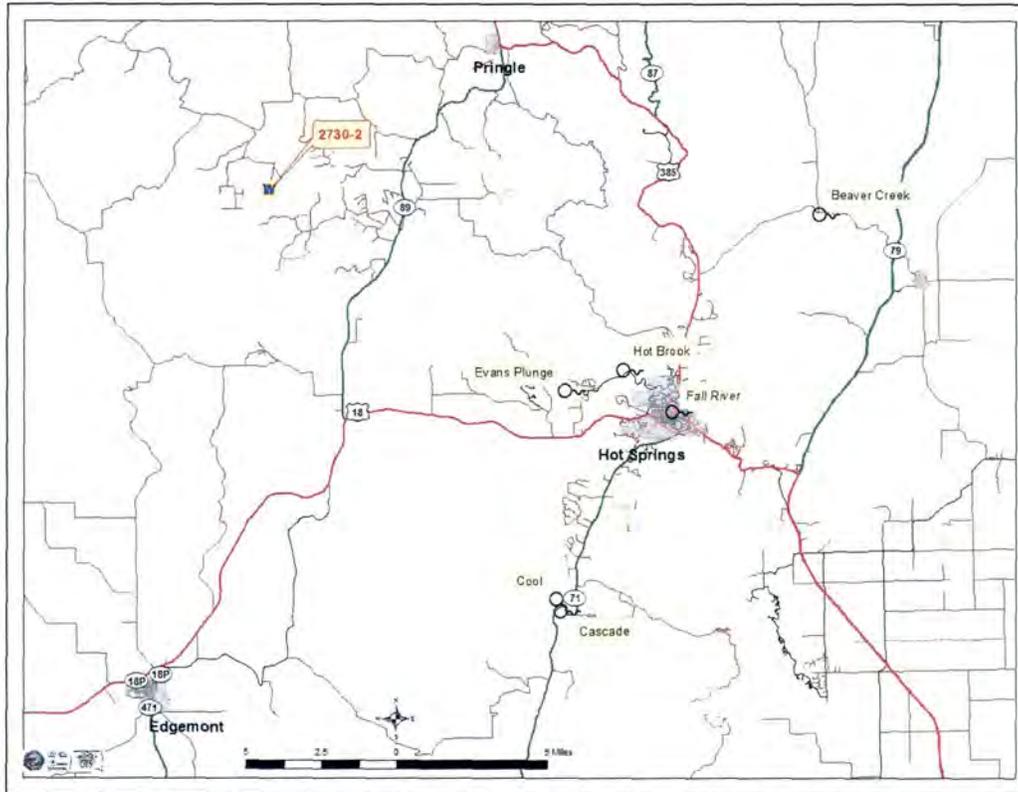


Figure 5. Location of the diversion point(s) proposed by Water Permit Application No. 2730-2, and the location of major springs in the vicinity.

The discharge of one of these springs, Beaver Creek Spring, is measured by National Park Service personnel. The spring is located approximately two and one-quarter miles east of SD DENR-Water Rights' Observation Well CU-91A. A comparison of the discharge of Beaver Creek Springs and the potentiometric surface of the Madison aquifer suggests a relationship may exist between the two (see Figure 6). At this time it is not possible to determine if a cause and effect relationship exists between the Madison aquifer potentiometric surface and the spring flow or if the two have similar responses to the same hydrologic conditions. If a cause and effect relationship exists between the Madison aquifer potentiometric surface and the spring discharge, a decline of the potentiometric surface in the vicinity of the springs could decrease spring discharge.

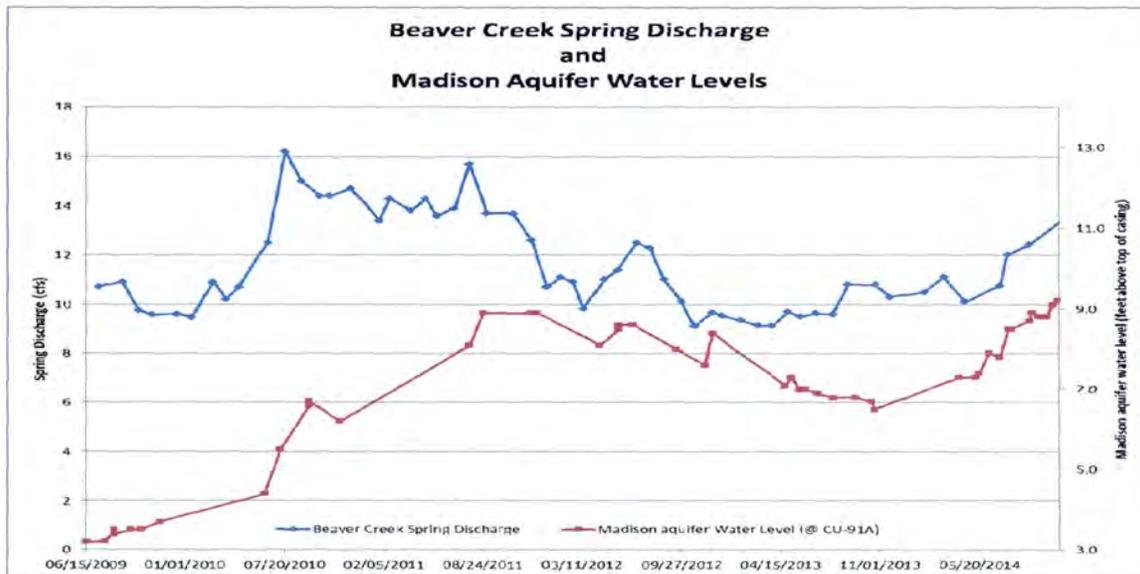


Figure 6. Beaver Creek Spring Discharge compared to Madison aquifer potentiometric surface measured at observation well CU-91A (“Aquarius Web Data Portal.”; Water Rights 2014a)

When considering Future Use Permit No. 2560-2 for Fall River Water User District, the Water Management Board accepted that SD Water Law does not protect artesian head pressure as a means of diversion and determined that well interference resulting in decreased discharge from these “artesian” springs could probably not be considered an adverse impact. The Board did however recognize the “public interest” issues of decreased base flows in area streams that could result from decreased spring discharge as the result of well interference. Approval of Future Use Permit No. 2560-2 included the following qualification:

“At such time as definite plans are made to construct works and put the water reserved by this permit to beneficial use, specific application for all or any part of the reserved water must be submitted and approved prior to construction of facilities pursuant to SDCL 46-5-38.1 with particular attention given to the flows of Beaver Spring, Cascade Springs and Hot Springs.” (Water Rights, 2014b)

Subsequently, when considering the deferral of Water Permit Application No. 2585-2, Southern Black Hills Water System, the Water Management Board adopted a conclusion of law (No. 11) which states in part “The only protection South Dakota law provides when considering an application for an underground water permit for flow from an artesian spring is under the public interest criteria.”

The well site(s) proposed by this application is/are located over eleven miles from the nearest major spring (Evens Plunge). A fairly large change in the hydraulic gradient in the vicinity of the springs would be necessary to significantly affect the groundwater flow rates and consequently the spring’s discharge. Given the distance involved and the relatively low diversion rate proposed by this application, (0.67 cfs maximum), it is unlikely that drawdown from this well would have a measurable impact on spring discharge.

### Wind Cave National Park:

The National Park Service (NPS) has intervened in matters of water permit applications from the Madison aquifer in the past. In 2007, the NPS filed a petition to intervene in the matter of Water Permit Application No. 2610-2. The NPS was concerned that “the Application No. 2610-2, over time and in combination with senior water right applications ... will adversely impact Wind Cave National Park (Wind Cave NP) senior water rights and water-dependent resources.” The water-related resources cited by the NPS include: lakes and pools in the lower reaches of Wind Cave, three perennial streams (Cold Springs, Beaver, and Highland Creeks), many intermittent and ephemeral stream courses, and over 95 seeps and springs. The NPS later withdrew their opposition to granting the water permit but restated its concerns about the potential impacts of appropriations from the Madison aquifer.

### *Lakes and Pools:*

The lakes and pools in Wind Cave National Park are in hydraulic connection with the Madison aquifer and the water table of the Madison aquifer is accessible at the deepest part of the cave (Long and others, 2012) . The stages of the lakes fluctuate in response to climatic conditions similar to fluctuations in the Madison potentiometric surface measured in DENR-Water Rights’ Observation Well CU-91A, (see Figure 7).

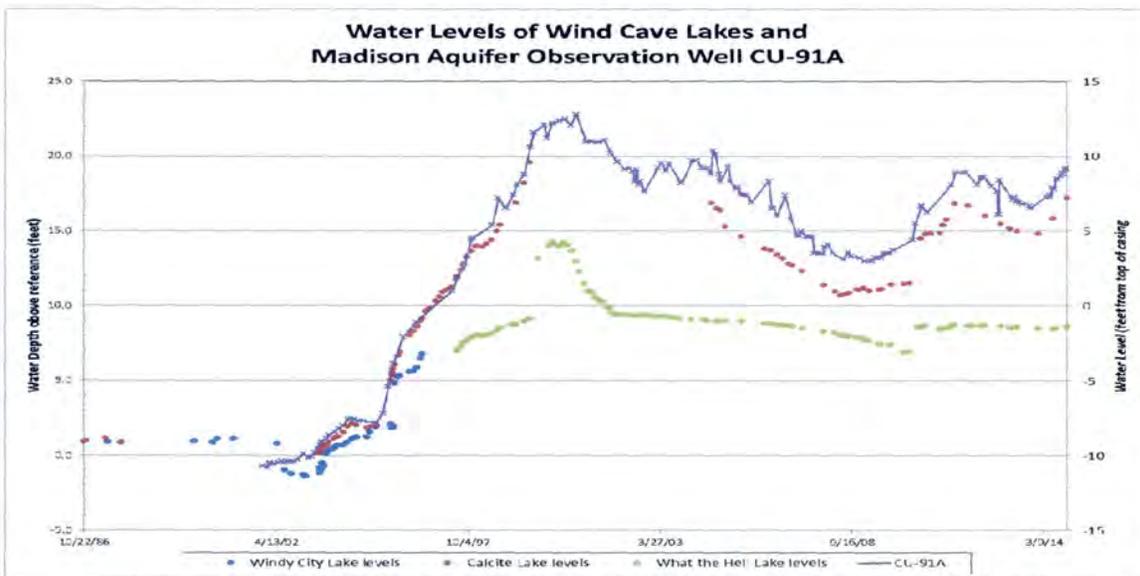


Figure 7. Water Levels of Wind Cave National Park Lakes compared to Madison aquifer potentiometric surface measured at observation well CU-91A (Hughes; Water Rights 2014a)

The lakes and pools in Wind Cave are located approximately thirteen miles east of the well site(s) proposed by this application (see Figure 8).

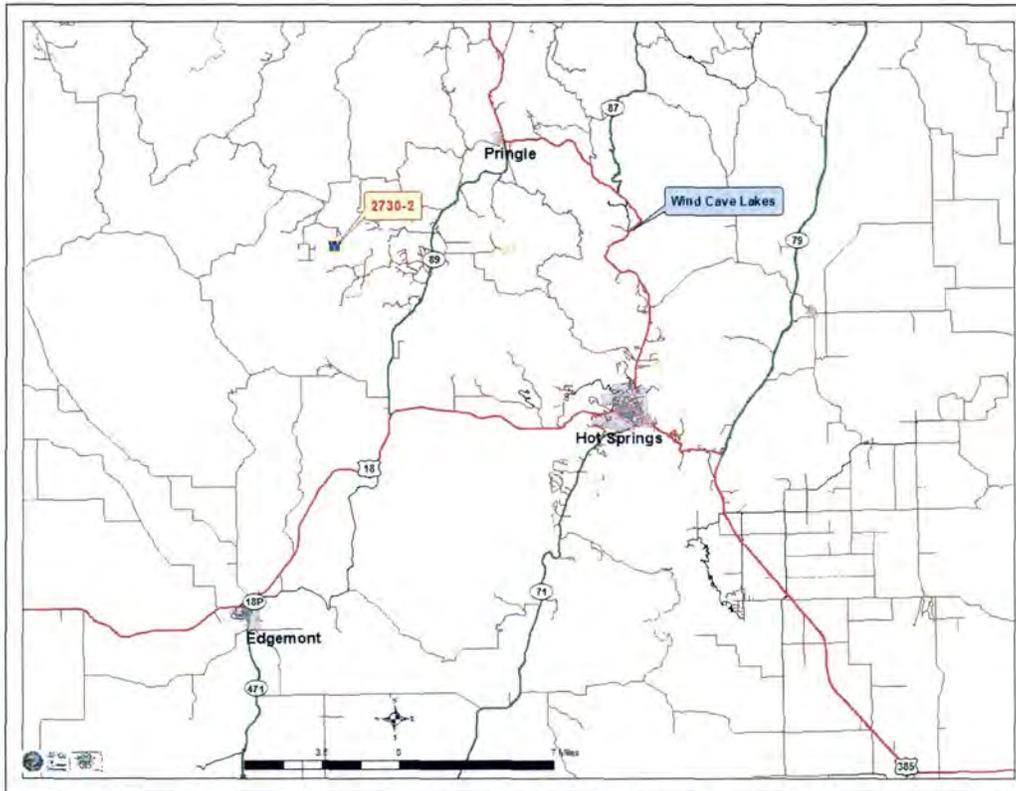


Figure 8. Location of the diversion point(s) proposed by Water Permit Application No. 2730-3, and the location of lakes and pools in Wind Cave National Park.

The impacts of pumping the well proposed by this application is expected to be negligible on the Wind Cave Lakes, especially when compared with the natural fluctuations because of the distances involved (>5 miles) and the relatively small diversion rate proposed (0.67 cfs maximum).

*Streams (Perennial and Ephemeral):*

The NPS identified three perennial streams (Cold Spring, Beaver and Highland Creeks) as “water resources of high value at Wind Cave NP”. The entire length of Cold Spring Creek is located on formations that are geologically lower than the Madison and therefore are not expected to be influenced by Madison aquifer withdrawals. Beaver and Highland Creeks are typically dry in their reaches downstream from the loss zone (Madison, Minnelusa and Minnehahata aquifer outcrops) because the upstream flow is usually insufficient to meet or exceed the streams’ loss thresholds. Since loss thresholds are assumed to be generally constant (Hortness and Driscoll, 1998), any fluctuations of the groundwater levels caused by pumping will not affect the frequency that the reaches of Beaver Creek and Highland Creek downstream of the loss zones are dry.

*Seeps and springs:*

The majority of the seeps and springs identified by the NPS are obviously not related to the Madison aquifer. They either surface in geologic formations hydrologically isolated from the Madison at elevations hundreds of feet higher than the water level of the Madison, or in geologic formations older than (below) the Madison. The few seeps or springs identified by the NPS that are actually situated on the Madison outcrop are likely expressions of localized perched conditions that would not be impacted by any changes in water level of the regional system.

**TERM LIMITATION:**

SDCL 46-2A-20 requires that "... no water permit for construction of works to withdraw water from the Madison formation in Butte, Fall River, Custer, Lawrence, Meade and Pennington counties may be issued for a term of more than twenty years, unless the water management board determines, based upon the evidence presented at the hearing that:

- (1) Sufficient information is available to determine whether any significant adverse hydrologic effects on the supply of water in the Madison formation would result if the proposed withdrawal were approved; and
- (2) The information, whether provided by the applicant or by other means, show that there is a reasonable probability that issuance of the proposed permit would not have a significant adverse effect on nearby Madison formation wells and springs."

Evidence is not available to justify issuing this permit without a term limitation of 20 years.

**Conclusions:**

1. The Madison aquifer is a viable aquifer in this area.
2. This diversion will not adversely impair existing water rights.
3. Information is not available to approve this application without a 20 year term limit



Ken Buhler  
SD DENR-Water Rights Program

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DEPARTMENT of ENVIRONMENT  
and NATURAL RESOURCES

JOE FOSS BUILDING  
523 EAST CAPITOL  
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

**REVISED RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT  
APPLICATION NO. 2730-2, United Order of South Dakota**

Pursuant to SDCL 46-2A-2, the following is the revised recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 2730-2, United Order of South Dakota, c/o Seth Jeffs, 11571 Farmer Rd, Pringle SD 57773.

The Chief Engineer is recommending APPROVAL of Application No. 2730-2 with a 20 year term pursuant to SDCL 46-1-14 and 46-2A-20 because 1) evidence is not available to justify issuing this permit without a 20 year term limitation, 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. In accordance with SDCL 46-1-14 and 46-2A-20, Permit No. 2730-2 is issued for a twenty year term. Pursuant to SDCL 46-2A-21, the twenty year term may be deleted at any time during the twenty year period or following its expiration. If the twenty year term is not deleted at the end of the term, the permit may either be cancelled or amended with a new term limitation of up to twenty years. Permit No. 2730-2 may also be cancelled for non-construction, forfeiture, abandonment or three permit violations pursuant to SDCL 46-1-12, 46-5-37.1 and ARSD 74:02:01:37.
2. The wells approved under Permit Nos. 2610-2 and 2730-2 will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under these Permits 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.
3. The new well authorized by Permit No. 2730-2 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.
4. Water Permit Nos. 2610-2 and 2730-2, combined, are limited to an annual volume of 60 acre feet of water at a maximum diversion rate of 0.446 cubic feet of water per second.
5. A water meter shall be installed and maintained at the well sites authorized by Water Permit Nos. 2610-2 and 2730-2. The Water Permit Holder shall report to the Chief Engineer annually the amount of water withdrawn from the Madison aquifer. The report shall be submitted each January and provide a month by month breakdown of water withdrawn for the previous calendar year.

See report on application for additional information.

Jeanne Goodman, Chief Engineer

June 1, 2015

SUPPLEMENTAL REPORT TO THE CHIEF ENGINEER  
ON  
WATER PERMIT APPLICATION NO. 2730-2  
UNITED ORDER OF SOUTH DAKOTA C/O SETH JEFFS  
MAY 14, 2015

Water Permit Application No. 2730-2 was received by the Department of Environment and Natural Resources-Water Rights Program (DENR-WR) on October 14, 2014. The application proposed authorization to complete a new well into the Madison aquifer (approximately 1100 feet deep) in the NW¼ SE¼ of Section 10, T6S-R3E, in Custer County. The application proposed to divert water from the new well and from two existing wells, authorized by Water Permit No. 2610-2, at a combined maximum diversion rate of 0.67 cfs (approximately 300 gallons per minute (gpm)). Water Permit No. 2610-2 currently authorizes diversions of up to a maximum rate of 0.21 cfs (approximately 94 gpm) from two wells located in the NW¼ SE¼ of Section 10, T6S-R3E, Custer County. Therefore, Application No. 2730-2 proposed an increased diversion rate from the Madison aquifer of 0.46 cfs (approximately 206 gpm). The water is to be used in the United Order of South Dakota's water system.

Water Permit Application No. 2730-2 was public noticed and several interveners filed petitions in opposition to granting the permit. On February 18, 2015, the Water Rights Program received a request from the applicant to modify Application No. 2730-2 to a reduced diversion rate. Application No. 2730-2, as revised, proposes to appropriate water from the Madison aquifer at an additional maximum diversion rate of 0.236 cfs (approximately 105.9 gpm) and authorize a total maximum diversion rate from a new well and the two existing wells of 0.446 cfs (approximately 200 gpm).

**CURRENT WATER USAGE:**

Water Permit No. 2610-2 was approved August 1, 2007, and included a qualification (No. 4) that requires the applicant to report to the Chief Engineer annually the amount of water withdrawn from the Madison aquifer. A summary of the United Order of South Dakota's reported water use is shown in Table 1.

Table 1. Annual water usage associated with Water Permit No. 2610-2, as reported to the Chief Engineer (Water Rights, 2015).

<b>Water Use Reported by United Order of South Dakota</b>		
<b>Year</b>	<b>Gallons (Reported)</b>	<b>Acre-feet (Converted)</b>
2007	150,500	0.46
2008	2,813,000	8.63
2009	6,207,000	19.05
2010	8,600,900	26.40
2011	13,205,800	40.53
2012	10,635,920	32.64
2013	3,447,480	10.58
2014	8,323,600	25.54

Water Permit No. 2610-2 authorizes the use of water for the purpose of “suburban housing development” and may not exceed the amount of water needed for beneficial use. Suburban housing development use typically includes water for drinking, washing, sanitary and culinary purposes, in addition to incidental irrigation. In a February 18, 2015, letter addressed to the Chief Engineer, The National Park Service Water Resources Division and The Black Hills National Forest, Mr. Seth S. Jeffs, the United Order of South Dakota water operator, indicated the community’s beneficial use of water includes “watering gardens, orchards, landscape, and feeding animals during the spring and summer months”.

**Drinking, washing, sanitary and culinary uses:**

*2014 Drinking Water Survey*

An on-site evaluation at the United Order of South Dakota public water system was conducted by the Department of Environment and Natural Resources-Drinking Water Program on June 11, 2014. The evaluation report identified the system as a “Community Water System” with a total population served of 75. The on-site evaluation reported that well No.1, which was constructed in 2007, was the only well connected to the water system, and it was capable of diverting 80 gpm. The on-site evaluation reported the system was capable of supplying 95 gpm (Holan, 2014).

**Watering Gardens, Orchards, Landscape, and Feeding Animals:**

The areas within the United Order of South Dakota’s development that appear to be cultivated or landscaped were identified by evaluating June 29, 2014, imagery available through Google Earth 7.1.2.2014. The areas, shown as polygons outlined in dark green in Figure 1, digitized using Esri® ArcGIS 10.2, total approximately seven acres. Assuming an application rate of two acre-feet per acre per year, the total annual water use at the development for watering gardens, orchards and landscape is estimated to be less than 14 acre-feet per year. Livestock watering uses cannot be estimated at this time.



Figure 1. Gardens, orchards and landscaping apparent from Google Earth

**FUTURE NEEDS:**

In his February 18, 2015 letter, Mr. Jeffs stated that “the number of gardens and orchards will increase as the community is able to bring more of the land into cultivation”; “the needs for animals in the future will increase the demand for water”; and “the need for fire protection is also a great concern.”

**Drinking, washing, sanitary and culinary uses:**

*Onsite Wastewater System Approvals*

The DENR has approved four onsite wastewater systems for the United Order of South Dakota community. The specifics for these systems are shown in Table 2. The wastewater systems are limited to capacities approved; therefore the total maximum daily flow (MDF) for the four systems is limited to 7,560 gallons per day (gpd). Assuming 7,560 gpd for 365 days equates to total volume of 8.47 acre-feet per year.

Table 2. Onsite wastewater systems approved by DENR for the United Order of South Dakota compound. (Hipple)

ESTABLISHMENT	APPROVAL DATE	REMARKS
United Land Management	09/14/2005	Basic system, 2,160 MDF, 18-bedroom residence
United Land Management	06/28/2007	Basic system, 1,560 MDF, 13-bedroom residence
United Land Management	09/10/2007	Basic drainfield for two duplexes, total of 14 bedrooms, 1,600 MDF
United Order of SD (United Land Management)	03/03/2010	Basic system, 2160 MDF, 18-bedroom residence
MDF=maximum daily flow		

The designed wastewater flow rate used in the review of United Land Management’s residential septic systems was based on 60 gallons a person per day and a maximum of 2 persons per bedroom (Hipple, 2015). Based on the onsite wastewater systems approved for the community, (i.e. maximum daily flow of 7,560 gpd, and 63 bedrooms), the onsite wastewater system capacity is 126 people.

The total future system residential demand based on a population limited by the community’s onsite wastewater system capacity (126) and a per capita demand for residential use of a maximum of 130 gallons per capita per day (Lindeburg, 2012) is estimated to be 18 ac-ft/yr.

**Watering Gardens, Orchards, Landscape, and Animal needs:**

Increased acreage of gardens, orchards and landscape areas is difficult to predict. However, two areas, totaling approximately 14 acres, (identified in yellow in Figure 2.) were considered potentially irrigable lands based on topography and groundcover. The addition of 14 acres of gardens, orchards and landscaping, would result in a tripling of the acreage currently estimated for that use. Assuming 21 acres of gardens, orchards and landscaping, irrigated at a rate of two acre-feet per acre per year results in an estimated “irrigation” use of 42 acre-feet per year. Future animal needs cannot be estimated with the information currently available.



Figure 2. Gardens, orchards and landscaping apparent from Google Earth (shown in dark green polygons) and potentially irrigable acreage (shown in yellow polygons).

**Fire Protection**

“Based on United Order of South Dakota’s Water Right Application stating that they will be constructing at least a 250,000 gal storage tank and the Insurance Service Office (ISO) minimum requirements for fire suppression of 1000gpm at 20psi for 2hours; the 250,000 gal storage will supply adequate domestic and fire suppression storage. The ISO required fire suppression storage should not affect annual drawdown” (Dreis, 2015).

**Projected Total Future Water Use:**

Future water use at the United Order of South Dakota community is estimated on an average per capita water use of 130 gallons per person per day for the maximum population capacity of the onsite wastewater systems (126), plus the irrigation of 21 acres at a maximum rate of two acre-feet per acre. This total demand is estimated to be less than 60 ac-ft/yr.

**ESTIMATED IMPACTS:**

In the report to the Chief Engineer titled “Water Permit Application No. 2730-2, United Order of South Dakota, November 12, 2014” (Buhler, 2014), the Theis Equation was used to compare the theoretical impact of an increase in the total pumping rate at the community of 0.67 cfs compared to 0.46 cfs. Drawdown 1000 feet from a pumped well would have increased with the increased diversion rate on the order of nine feet. The assumption of continuous pumping at the

maximum diversion rate, for one year, with no recharge, is an unrealistic assumption. As stated in the report, "The Theis equation requires a number of simplifying assumptions, some of which may not apply in this case; however, the solution is still useful to show that drawdown should not be significant."

The instantaneous diversion rate proposed by this application has been revised and the drawdown that would result would be less. The impact of this application's proposed withdrawals was evaluated considering well withdrawals more likely for this community. Drawdown was evaluated at a distance of 1000 feet from a production well after one year, assuming: A. a transmissivity of 10,943.2 GPD/F; B. a Storativity of 0.0002; and C. a difference between 40.53 acre-feet per year (maximum reported pumping) and 60 acre-feet per year (projected pumping). With the assumptions above and again, assuming no recharge, drawdown can be expected to be in the vicinity of 1.1 feet ("Theis Equation Calculator").



Ken Buhler  
SD DENR-Water Rights Program

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