REPORT TO THE CHIEF ENGINEER
ON
WATER PERMIT APPLICATION NO. 2685-2
POWERTECH (USA) INC.
November 2, 2012

Madison

Powertech (USA) proposes to recover uranium by a method known as in-situ recovery, or ISR, in which groundwater from the formation containing uranium (the Inyan Kara Group) is pumped to the surface from a field of wells, fortified with oxygen and carbon dioxide, and recirculated through the formation. The oxidized groundwater changes the uranium to a soluble form and is pumped to the surface, where uranium is removed from the solution. ISR circulates water through the uranium ore zone. Only a small fraction of the water is a net withdrawal because most water is recirculated back through the ore zone. A portion of the water extracted from the Inyan Kara Aquifer will be "bled off" to maintain a cone of depression so native groundwater continually flows toward the center of the production zone. Production bleed rates may vary in the range of 0.5 to 3 percent over the life of the project. If necessary, a bleed of up to 17 percent will be used briefly during aquifer restoration. The ISR process is repeated until the economic reserves of uranium are fully removed from that particular well field. The process moves to another well field, and the uranium depleted well field is restored by continuing to circulate clean water through the wells until the water is similar in quality to the water that existed in the formation prior to the ISR operations. Most of the water removed from the Inyan Kara Aquifer during the ISR process is recirculated and re-injected through the well field, resulting in the net consumptive use of water being a small portion of the gross withdrawal rate. Most of the water used in the ISR operations will be obtained from the Inyan Kara Group. However, Powertech (USA) plans to use water from the Madison Aquifer to make up for water that is not provided from the ISR process. The amount of "make-up" from the Madison Aquifer will depend upon the water disposal method which is either deep disposal well or land application. The use of water from these two formations necessitates obtaining water permits from each source. The eastern portion of the project area is known as the Burdock area. It will include a series of ISR well fields and a central processing plant. The western portion of the project areas is the Dewey area which will include ISR well fields and a satellite processing plant.

Water Permit Application No. 2685-2 proposes to appropriate up to 888.8 acre-feet of water annually at an instantaneous peak diversion rate of 1.228 cubic feet of water per second (cfs) (551 gallons per minute (gpm)), from two wells 2,700 – 3,400 feet deep, completed into the Madison aquifer. The wells are to be located in the NW¼ NW¼ Section 32, T6S, R1E and the NW¼ NE¼ Section 11, T7S, R1E. The water is to be used primarily for aquifer restoration following in-situ recovery (ISR) mining but may also be used to supply the facility including the central processing plant, satellite plant and for domestic and livestock use for area landowners inside and near the project area. The amount of water that will be diverted from the Madison aquifer for this project depends on the water disposal method that will be used as part of the ISR process. The disposal method has not been determined but will be either through deep disposal wells or land application. The use of land application disposal will require a diversion rate of 551 gpm, and using deep disposal wells will require a diversion rate of 160 gpm from the Madison aquifer.

AQUIFER: MADISON (MDSN)

GEOLOGY AND AQUIFER CHARACTERISTICS:
The Madison aquifer is a major regional aquifer that underlies parts of Montana, North Dakota, South Dakota, Wyoming and Canada. The aquifer underlies most of western South Dakota and a small part 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).

The Madison aquifer occurs within the Mississippian aged Madison Limestone which is locally known as the Pahasapa Limestone. The Madison Limestone is a massive limestone and dolomite with relatively low primary permeability and porosity. Extensive secondary porosity and permeability occur within the Madison in the form of fractures and solution openings. The upper portion of the Madison Limestone in particular is karstic with caves, solution collapse features and enlarged conduits. A number of high yield wells have been developed in the Madison aquifer where these enhanced porosity and permeability features are favorable. 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 Madison Limestone is estimated to be between 300 feet thick (Carter and Redden, 1999a; and Carter and Redden, 1999b) and 400 feet in this area (Gries, 1981). The Madison dips to the southwest in this area at approximately 200 feet per mile (Carter and Redden, 1999a). The top of the Madison is estimated to be approximately 3,130 feet below ground surface at the "Dewey" well site and approximately 2,715 feet below grade at the "Burdock" well site (Carter and Redden, 1999a).

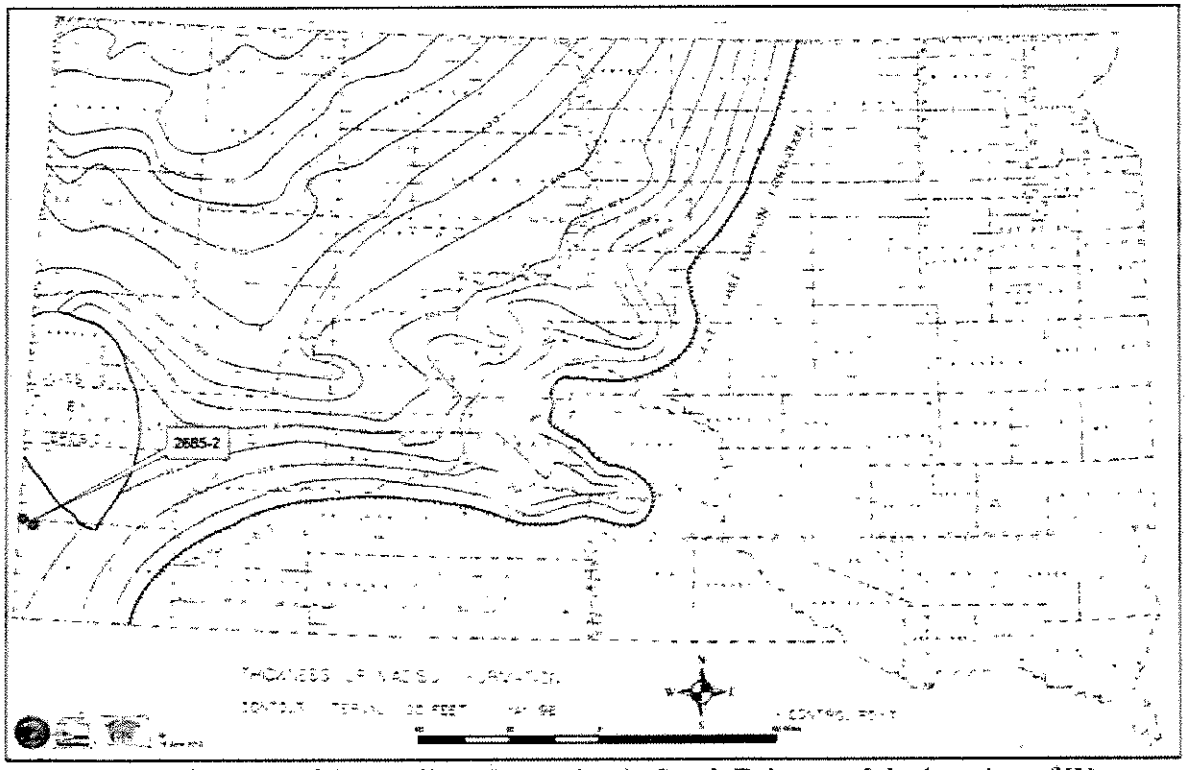


Figure 1. Areal Extent of the Madison Formation in South Dakota and the location of Water Permit Application No. 2685-2: (modified from Gries, 1981)

The well sites, "Dewey" and "Burdock" proposed by this application are located approximately two and one-half, and five and three-fourths miles south, respectively of the Dewey Fault and Structural Zone (DeWitt and others, 1989; and Brobst, 1961). Directly north of the proposed "Dewey" well, the Madison has been displaced approximately 300 feet vertically by the fault and north of the "Burdock" well site the vertical displacement at the fault is approximately 500 feet (Carter and Redden, 1999a). Southwest trending folding (an anticline and syncline) has been identified approximately five miles east-northeast of the proposed well sites and the north-south trending Sheep Canyon monocline is located approximately 11 miles east of "Burdock" well site (Strobel and others, 1999). A generalized stratigraphic column for this area is shown in Figure 2.

The Madison is generally considered an excellent aquifer in terms of its potential to supply good quality water to relatively productive wells, especially near the outcrop (recharge area). The well sites proposed by this application are located 18-20 miles southwest of the Madison outcrop (Strobel and others, 1999).

| ABBREVIATION FOR STRATIGRAPHIC INTERVAL | GEOLOGIC UNIT | |
|---|---|---|
| Kds | GRANEROS | MOWRY SHALE |
| | | MUDDY SANDSTONE / NEWCASTLE SANDSTONE |
| | | SKULL CREEK SHALE |
| Ksk | INYAN KARA GROUP | FALL RIVER FORMATION |
| | | LAKOTA FORMATION |
| Jsu | | MORRISON FORMATION |
| | | SUNDANCE FORMATION |
| | | GYPSUM SPRING FORMATION |
| TRPs | | SPEARFISH FORMATION |
| Pmk | | MINNEKAHTA LIMESTONE |
| Pd | | OPEOKE SHALE |
| PIPm | | MINNELUSA FORMATION |
| MDma | | MADISON (PAHASAPA) LIMESTONE |
| | | ENGLEWOOD FORMATION |
| Ocd | | DEADWOOD FORMATION |
| pCu | | UNDIFFERENTIATED IGNEOUS AND METAMORPHIC ROCKS |

Figure 2. Generalized stratigraphic column for this area (modified from Carter and others, 2003)

The lower portion of the Madison and the underlying Englewood Formation form a lower confining zone (Strobel and others, 1999). The Minnelusa Formation unconformably overlies the Madison aquifer and generally serves as an upper confining layer. However, "The hydraulic connection between the Madison Limestone and Minnelusa Formation is spatially variable and may result from faults, fractures, and breccia pipes. Collapse features … may be pathways for vertical movement of water between these two units." (Putnam and Long, 2007). The water levels of DENR-Water Rights' observation wells in the area indicate very distinct potentiometric surfaces in the Minnelusa and Madison, and suggest the aquifers are hydraulically separated.

**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 probability of unappropriated water available for appropriation 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."

**Water Balance:**
Recharge to the Madison aquifer occurs through streamflow losses and direct infiltration of precipitation at the outcrop area. "Precipitation recharge [in the Black Hills] is consistently larger than streamflow recharge; however, the relative proportion of streamflow recharge increases as combined recharge decreases" (Carter and others, 2001a). Recharge to the Madison aquifer in South Dakota has been estimated to range from 140,000 to 400,000 acre-feet per year (Woodward-Clyde, 1981). Woodward-Clyde however, essentially defined the Madison aquifer as everything between the Precambrian and the Cretaceous shales. As part of the Black Hills Hydrology Study, the average annual recharge to the Madison aquifer from 1931-1998 was estimated to be approximately 137,000 ac-ft/yr (Carter and others, 2001a).

The high cost of Madison wells, except very near the outcrop, and the availability of groundwater from shallower sources, has limited domestic development from the aquifer. Carter and others, (2001b) estimate "Self-supply Domestic" and "Livestock Watering" only account for approximately 2.25% of the water use from the Madison aquifer. In general, well withdrawals from the Madison are for uses which require water rights/permits. The majority of the water rights/permits from the aquifer are from Butte, Lawrence, Meade, Pennington and Fall River Counties. The Madison supplies water for irrigation, geothermal, industrial, and commercial uses. However, by far the major use of the aquifer is for water distribution systems (suburban housing development and municipal use). The cities of Spearfish, Belle Fourche, Sturgis, Rapid City, Box Elder, and Edgemont all depend on water from wells completed into the Madison aquifer.

There have been a total of 213 applications made for appropriations from the Madison; the statuses of these applications are shown in table 1.

| STATUS | NUMBER |
|---|---|
| Approved and licensed | 94 |
| Approved and not licensed | 63 |
| Future Use reservation | 7 |
| Incorporated into a license | 28 |
| Cancelled | 17 |
| Denied | 1 |
| Deferred | 1 |
| Withdrawn | 2 |

Table 1. Water permit applications from the Madison aquifer in South Dakota

There are currently a total of 164 appropriations plus one deferred application from the Madison aquifer in South Dakota. Assuming that: (1) future use permits will be fully developed; (2) appropriations with a specified annual volume limitation will divert to their maximum limit; and (3) appropriations limited by diversion rate only, will be used at 60 percent of full time usage at their maximum diversion rate; the appropriations represent a potential maximum annual withdrawal from the Madison aquifer of approximately 55,000 ac-ft/yr. The assumptions used to estimate the potential maximum withdrawal from the aquifer are extremely conservative and represent a "worst case scenario."

Almost all of the water use from the Madison aquifer in South Dakota is from the Black Hills area. The withdrawals from all wells completed into the Madison aquifer in the Black Hills of

South Dakota and Wyoming, were estimated to average 12,310 acre-feet annually from 1987-1996 (Carter and others, 2001b). The "potential maximum annual withdrawal" from the aquifer for 1996, using the assumptions given above for the appropriations in 1996 is 35,831 ac-ft/yr. Applying the 1996 "potential maximum annual withdrawal" to the estimated average annual use ratio, the average annual withdrawal corresponding with a potential maximum annual withdrawal of 55,000 ac-ft/yr would be less than 20,000 ac-ft/yr.

The quantities of both the average annual recharge and the average annual use for the Madison aquifer are both small percentages of the amount of water stored in the Madison aquifer so the aquifer can actually withstand several years of drought conditions with only minimal impact to wells or springs. Comparison of average annual recharge and average annual withdrawal estimates for the Madison aquifer indicate that unappropriated water is available from the Madison aquifer. The simple water budget comparing the estimated average annual recharge and the potential withdrawal by existing wells and current appropriations is not intended to suggest that all of the water that is in storage in the Madison or that all of the recharge to the aquifer is available for this appropriation, merely to demonstrate that in general the Madison aquifer is an immense resource that is relatively untapped.

**Localized Hydrologic Budget:**

Carter and others (2001b) developed a hydrologic budget for the Madison and Minnelusa aquifers combined, for a subarea based on the hydrogeology, which includes this project area. The hydrologic budget for this subarea balanced from 1987-1996, by estimating that water enters the subarea through streamflow recharge, precipitation recharge and groundwater inflow from the northwest and from the west. Water was assumed to exit this subarea through groundwater outflow to the east, artesian springflow and well withdrawals (see table 2).

| Stream-flow recharge | Precipita-tion recharge | Minnelusa ground-water inflow | Madison ground-water inflow | Minnelusa ground-water outflow | Madison ground-water outflow | Artesian spring-flow | Well with-drawals |
|---|---|---|---|---|---|---|---|
| 4.4 cfs | 6.1 cfs | 24.5cfs | 23.2cfs | 8 cfs | 4 cfs | 44.3 cfs | 1.8 cfs |

Table 2. Hydrologic budget for the subarea that includes the project area proposed by Application No. 2685-2 for Water Years 1987-1996. Modified from (Carter and others, 2001b).

It is clear that in this subarea most of the recharge to the Madison aquifer is through groundwater inflow, and water leaves this subarea primarily through artesian springflow and groundwater outflow. There are only 27 wells on file with the DENR-Water Rights Program that appear to be completed into the Madison aquifer in the subarea that includes this proposed project (Water Rights, 2012c) and as shown in table 2, well withdrawals are a minor component. Springflow, groundwater inflow and groundwater outflow are all dependent on the groundwater gradient at the subarea boundaries or near the springs. As the aquifer is stressed by changing one or more of the variables in the hydrologic budget, the other interdependent variables adjust until the system equilibrates. Obviously, a new hydrologic budget can balance for this subarea (i.e. a new condition of dynamic equilibrium) with an increase of well withdrawals through a decrease of the natural discharge from the aquifer or an increase of groundwater inflow from adjacent subareas. It can be assumed that with a very subtle change in the hydraulic gradient at either the

inflow zone or the outflow zone, a new dynamic equilibrium would be established in this area with virtually immeasurable impacts to the amount of water in transient storage. Therefore, there is a reasonable probability that unappropriated water is available from this subarea for this proposed use.

**Observation Well Data:**
Administrative Rule of South Dakota Section 74:02:05:07 requires that "the Water Management Board shall rely upon the record of observation well measurements to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated average annual recharge to the aquifer."

The Water Rights Program monitors 26 observation wells completed into the Madison aquifer in the Black Hills area (Water Rights, 2012a). This project area is located within approximately 15 miles of two Water Rights' Observations completed into the Madison aquifer. Hydrographs for the wells show the aquifer's response to climatic conditions and clearly demonstrate the system is recharged, (see figures 3 and 4).

The analysis of the DENR-Water Rights Program observation well data provides a qualitative means of assessing the aquifer and provides the best information reasonably available to evaluate the hydrologic budget for the Madison aquifer. Observation well data showing a steady, continual decline of the aquifer's water level or artesian pressure could indicate that withdrawals from the aquifer were exceeding recharge. In addition, water level fluctuations in an aquifer dominated by the influences of well withdrawals, or a change in the gradient of the potentiometric surface could indicate that well pumping is a significant component in the system relative to recharge and/or natural withdrawals.

Observation well data for the Madison aquifer documents: 1) upward trending water levels; 2) that at the current level of development, climatic conditions greatly mask any temporal effects of well withdrawals thus the combined recharge to and natural discharge from the Madison aquifer significantly exceeds long term well withdrawals; and 3) the potentiometric surface of the aquifer has been relatively unchanged over time. Therefore, the observation well data shows that unappropriated water is available from the Madison aquifer.

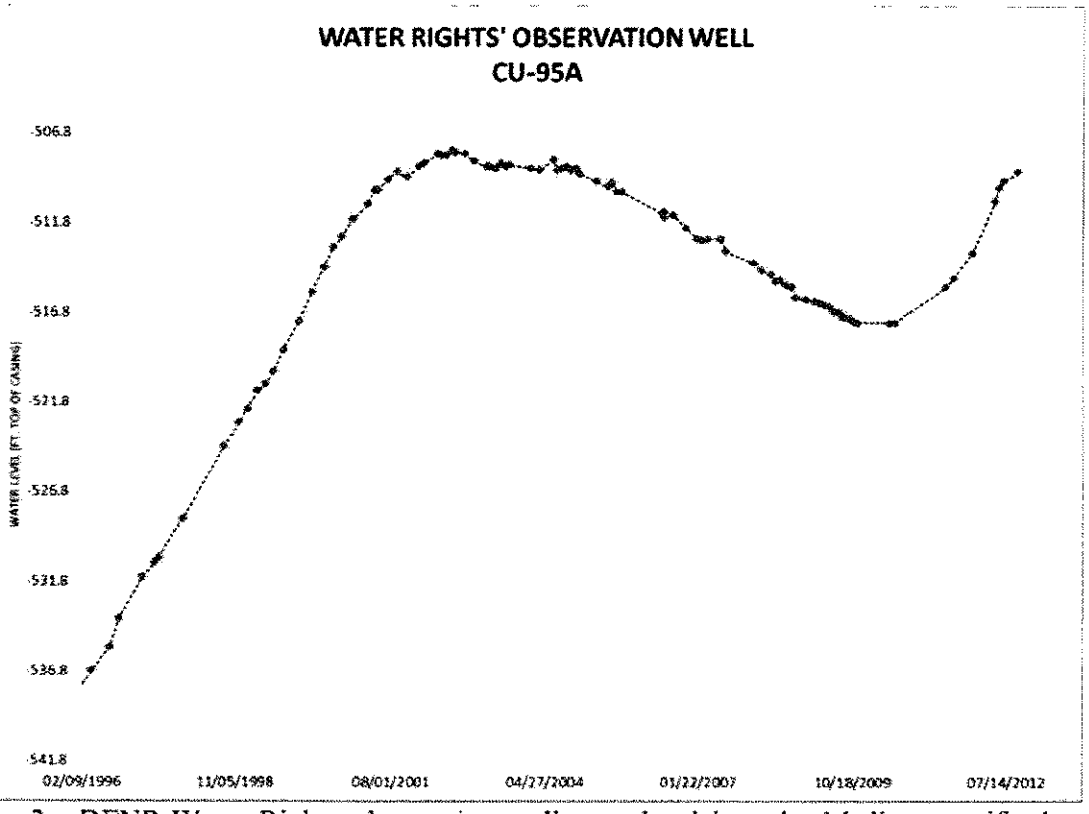


Figure 3. DENR-Water Rights observation well completed into the Madison aquifer located approximately 10 miles northeast of the project area proposed by Application No. 2685-2.

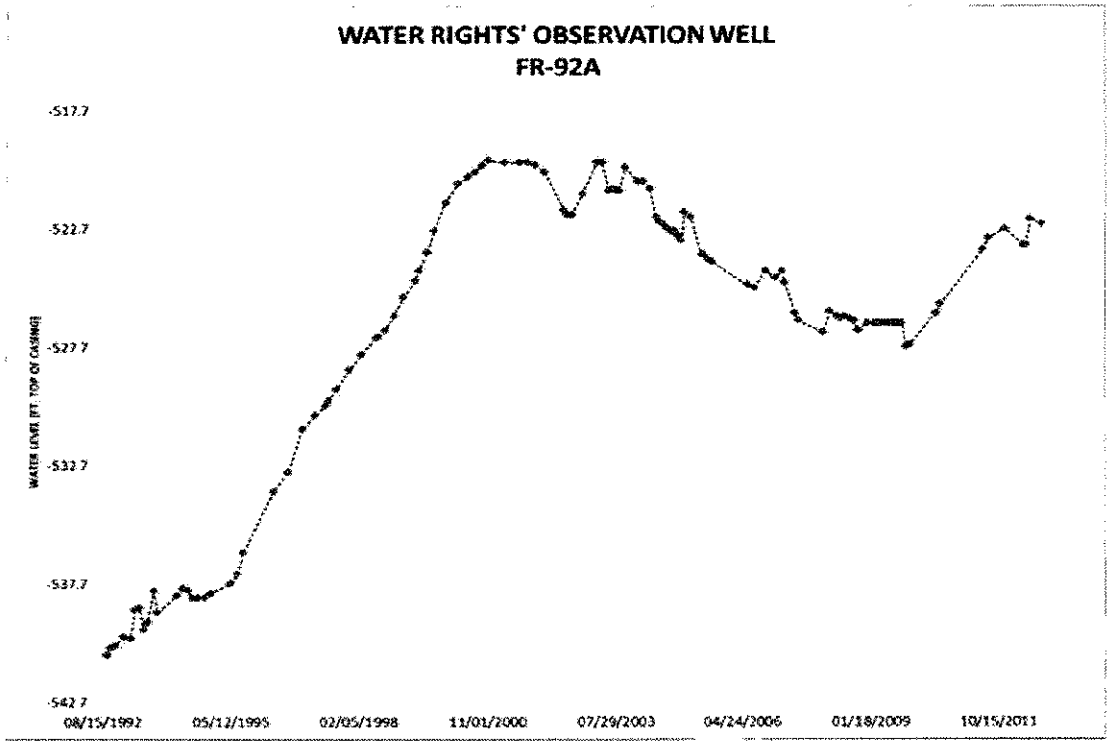


Figure 3. DENR-Water Rights observation well completed into the Madison aquifer located approximately 15 miles east of the project area proposed by Application No. 2685-2.

**AFFECTS ON EXISTING RIGHTS:**

Water Rights/Permits supplied by wells completed into aquifers that are stratigraphically above or below the Madison are not expected to be affected by Madison aquifer withdrawals since the lower Minnelusa Formation and the lower Madison Limestone generally serve as upper and lower confining units for the Madison aquifer. The displacement of the Madison Limestone caused by the Dewey Fault likely provides a north-south groundwater barrier for most of the length of the fault and drawdown from wells south of the fault is not expected to extend to the north of the fault.

It is difficult to precisely estimate the amount and extent of drawdown that will result from pumping a well completed into the Madison aquifer since the well conditions are site specific. The transmissivity of the aquifer is very heterogenous 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). The transmissivity of the Madison at flow zones into and out of this subarea was estimated at between 732 and 7,393 feet squared per day ($ft^2/d$) (Carter and others, 2001b). The hydraulic gradient of the Madison aquifer in this area appears to be very low which generally indicates high transmissivity (Water Rights, 2012a; Water Rights, 2012b and Water Rights, 2012c). The transmissivity for this subarea is expected to be as high as 7,393 $ft^2/d$ in this area (Carter and others, 2001b) therefore drawdown could be even less than predicted by the Theis equation.

Applying the transmissivity and storage coefficient (i.e. T= 3,000 $ft^2/d$; and S= $2x10^{-4}$) estimated for the Madison aquifer in this area (Woodward-Clyde Consultants, 1980), the drawdown 1,000 feet

from a well pumping 551 gpm would be less than 35 feet after twenty years of continuous pumping based on the Theis Equation (see Figure 4) ("Theis Equation Calculator"). Since the transmissivity for this area is likely higher than 3,000 $ft^2/d$, drawdown would be less than predicted by the Theis Equation. The Theis equation requires a number of simplifying assumptions, some of which may not apply in this case however, the solution is still useful.

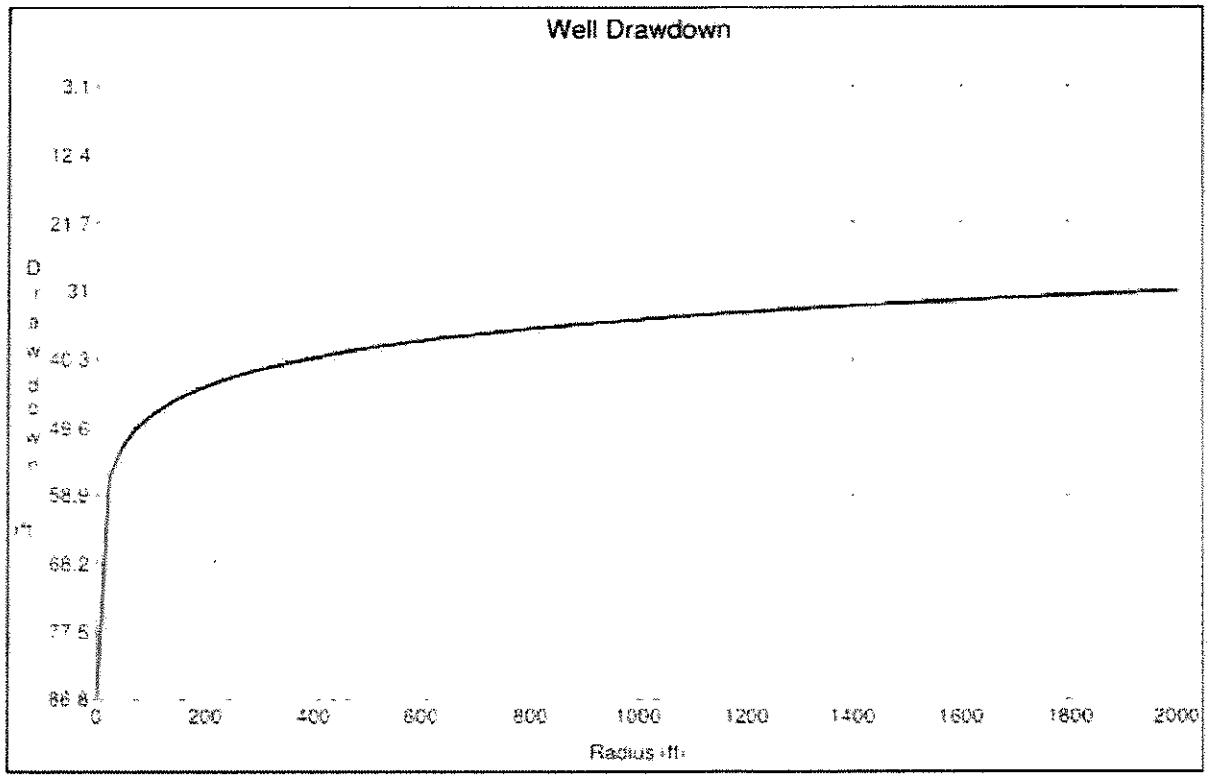


Figure 5. Drawdown predicted from a well pumping 551 gallons per minute from the Madison aquifer, continuously for one year, assuming T= 3,000 ft2/d, S= 2x10-4, t=20 yrs. (modified from ("Theis Equation Calculator"))

There are only 16 wells on file with the DENR-Water Rights Program that appear to be completed into the Madison aquifer within approximately 16 miles of this project area. Only one of these wells, a domestic well for Steve Casters, located in the SE¼ SW¼ Section 14, T5S-R1E (i.e. approximately nine miles north-northeast of the "Dewey" well proposed by this application), is within 10 miles of this project area. If this application is approved, drawdown from either or both wells is not expected to be significant to existing wells. Well interference is not expected to be significant.

If this application is approved, the drawdown caused by pumping a well or wells at a rate of 551 gallons per minute is not expected to adversely impact domestic wells or wells supplying prior appropriation. This is especially the case when considering the Madison is under artesian conditions with several hundred feet of head pressure at the documented natural fluctuation in this area (see figure 3 and 4). 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, 2012a).

Given the distance between the well that is to supply this appropriation and existing Madison wells, well interference is not expected to be adverse.

**BENEFICIAL USE OF WATER**:
In the past, the Water Management Board has determined that the use of water for mining purposes is a beneficial use of water. The Water Management Board has not yet considered if in situ recovery is a beneficial use of water.

**PUBLIC INTEREST:**
Historically, "public interest issues" have been raised by the public during Water Management Board hearings. However, the Chief Engineer has raised the question of whether the Board should consider a large decrease in spring output as a public interest issue if such a decrease would occur. 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 likely could not be considered an adverse impact. The Board concluded that "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" (Water Management Board Findings dated 19 March 2007 (Paragraph 11)). Consequently, the Board has conditioned a number of recent water permits appropriating water from the Madison aquifer with a qualification such as:

> "The Permit Holder shall control withdrawals from the well so there is not a significant adverse effect on the water flow from area springs or a significant adverse effect on the water quality and character in area springs."

Rahn and Gries, (1973) identify four springs in the subarea defined by Carter and others (2001b) in which this proposed project is to be located. The springs are shown in Table 3.

| SPRING | DISCHARGE (cfs) * | APPROXIMATE DISTANCE FROM 2685-3 (miles) | LIKELY SOURCE |
|---|---|---|---|
| Cold Brook | 0.66 | ≈23 miles | Partly evolved Minnelusa** |
| Hot Brook | 1.98 | ≈24 miles | Distinct Madison** |
| Fall River | 22.92 | ≈25 miles | Madison and Partly evolved Minnelusa** |
| Cascade | 23.65 | ≈21 miles | Madison*** |
| * (Rahn and Gries,1973) **(Whalen,1994) ***(Hayes,1999) | | | |

Table 3. Springs located within the subarea defined by Carter and Driscoll (2001) in which 2685-2 is located.

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, (551 gpm maximum), it is unlikely that drawdown from this well would have a measurable impact on the spring discharge.

During the public hearing to consider Water Permit Application No. 2585-2, the National Park Service contended that the possibility of an impact on the park may exist if the water levels in the underground caves were lowered. Geochemical data indicates that water at Wind Cave sites has contributions from recharge that occurred on the western outcrop of the Madison aquifer (Long). Again, since a fairly large change in the hydraulic gradient in the vicinity of Wind Cave National Park would be required to affect the water levels in the park, it is unlikely that drawdown from this proposed appropriation would be measurable at Wind Cave National Park due to the distance involved.

**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."

Pursuant to SDCL 46-2A-21, "at the end of the twenty-year limitation, the board may cancel a permit or amend the permit with a new term limitation of up to twenty years, if the board is unable to make a finding after notice and hearing that sufficient information is available to delete the term limitation."

Although the criteria for approval of a water permit established by SDCL 46-2A-9 are met, (i.e., there is a reasonable probability that unappropriated water is available for the applicant's proposed use, and this proposed diversion can be developed without unlawful impairment of existing rights); evidence is not available to justify issuing this permit without a term limitation of 20 years.

**CONCLUSIONS:**

1. The Madison aquifer is a major regional aquifer and a viable source of water for this proposed appropriation.
2. This application proposes to appropriate 1.228 cubic feet of water per second. There is no limit to the annual volume of water that can be diverted other than the physical constraints of the maximum diversion rate.
3. There is a reasonable probability that unappropriated water is available in the Madison aquifer to supply this appropriation.
4. Approval of this application will not result in average annual withdrawals from the Madison aquifer to exceed the average annual recharge to the aquifer.
5. There is a reasonable probability this appropriation can be made without adversely impacting existing water rights including domestic users.
6. Information is not available to justify issuing these permits without a term limitation of 20 years.
7. Following notice and a public hearing, the Water Management Board may cancel this permit or amend it with a new term limitation after twenty years.

Ken Buhler
Natural Resources Engineer

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**DEPARTMENT of ENVIRONMENT and NATURAL RESOURCES**

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**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT APPLICATION NO. 2685-2, Powertech (USA) Inc.**

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. 2685-2, Powertech (USA) Inc., c/o Richard Blubaugh, 5575 DTC Parkway, Suite #140, Greenwood Village CO 80111.

The Chief Engineer is recommending Approval of Application No. 2685-2 for a 20 year term pursuant to SDCL 46-1-14 and 46-2A-20 because 1) although evidence is not available to justify issuing this permit without a 20 year term limitation, there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use, and 4) it is in the public interest with the following qualifications:

1. The permit holder shall report to the Chief Engineer annually, the amount of water withdrawn from the Madison Aquifer. This annual reporting shall report separately the amount of water use for the insitu mining operation and water supplied for domestic/livestock use in the area.

2. The wells 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 wells authorized by Permit No. 2685-2 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. In accordance with SDCL 46-1-14 and 46-2A-20, Permit No. 2685-2 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. 2685-2 may also be cancelled for nonconstruction, forfeiture, abandonment or three permit violations pursuant to SDCL 46-1-12, 46-5-37.1 and ARSD 74:02:01:37.

5. The Permit holder under this permit shall control withdrawals from the wells so there is not a significant adverse effect on the water flow from area springs or a significant adverse effect on the water quality and character in area springs.

See report on application for additional information.

Garland Erbele, Chief Engineer
November 6, 2012

NOTE: In addition to obtaining water right permits, Powertech (USA) is subject to compliance with all other state of South Dakota and federal government regulations relating to water use and insitu mining.