

WATER PERMIT NO. 2596-2

Name of Applicant: City of Wall

Address: Box 314, Wall SD 57790

Phone: 605 279-2563

Amount of Water Claimed: 400 AF

Total Acres: NA

Source of Water Supply: groundwater (one well)

Water to be used for: municipal

County: Pennington

Type of Waste Disposal System:

Location: 2 miles east of Wall

PRIORITY

Date Received: 7-24-06

Application/License Fee: \$325

Corrected Application Received:

Period of Annual Use: January 1 – December 31

Remarks:

Diversion Point: SW ¼ SE ¼ Sec 33-T1N-R16E

Land to be Irrigated: NA

Depth of Well: 3200 feet deep

Well Driller:

Remarks:

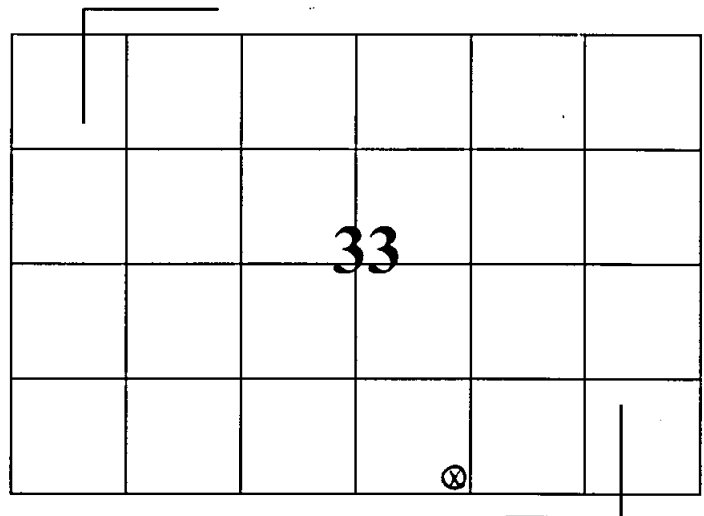
Type of Map: aerial

Prepared by: Theodore Schultz, PE

Reviewed and the Number Assigned on: 7-24-06

By: **Karen Schlaak**

Notice of Hearing - date to intervene: _____



FORM 2: Application for uses other than irrigation
(type or print)

Mail to: Water Rights Program Joe Foss Building 523 E. Capitol Pierre, SD 57501-3181 (605) 773-3352	(office use only) No. <u>2596-2</u> Hydrologic Unit <u>10140102</u>
	Basin <u>Bad River</u>
	Newspaper <u>Pennington Co. Courant, Wall</u>

RECEIVED
JUL 24 2006
WATER RIGHTS
PROGRAM

Application For Permit To Appropriate Water Within The State Of South Dakota

Check use(s) of water:

☒ Municipal ☐ Suburban Housing ☐ Recreational ☐ Institutional
☐ Rural Water System ☐ Commercial ☐ Fish & Wildlife ☐ Geothermal Heat
☐ Domestic (over 18 gpm) ☐ Industrial ☐ Other _____

Type of Application: ☒ New ☐ Vested Right (Use predates Mar 2, 1955) ☐ Future Use Reservation
(check one) ☐ Place to Beneficial Use Water Reserved by Future Use Permit No. _____
☐ Amendment/Correction to Permit No. _____

Description of amendment/correction: (i.e. change diversion point(s), add diversion point(s), change use, etc.) _____

- Name of Applicant CITY of Wall Phone 279-2563
(check one) ☒ Owner ☐ Tenant/lessee
Mailing Address Box 314 Wall SD State SD 57790-0314
(Street, RR, or Box and City) (Zip Code)
- Amount of water claimed 0.89 *CFS or 400 **GPM 400 ***AF
(*Cubic Feet per Second) (**Gallons per Minute) (***)Acre Feet - storage capacity of dam/dugout or annual use if applicable)
- Source of water supply Lakota formation
- Location of point of diversion (example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W) SW 1/4 SE 1/4: SE 1/4 SW 1/4
less N 80' of W 280' Section 33, T1N, R16E. BHM
County Pennington
- County or counties where water will be used Pennington
- Annual period during which water is to be used year round Jan 1 - Dec 31
- Give a description of the project. When available include any preliminary engineering report or other reports or information that will help explain the project. (Attach sheet if more space is needed)

Drill a water well 3200' deep for municipal use.

STATE OF SOUTH DAKOTA)

County of Pennington SS

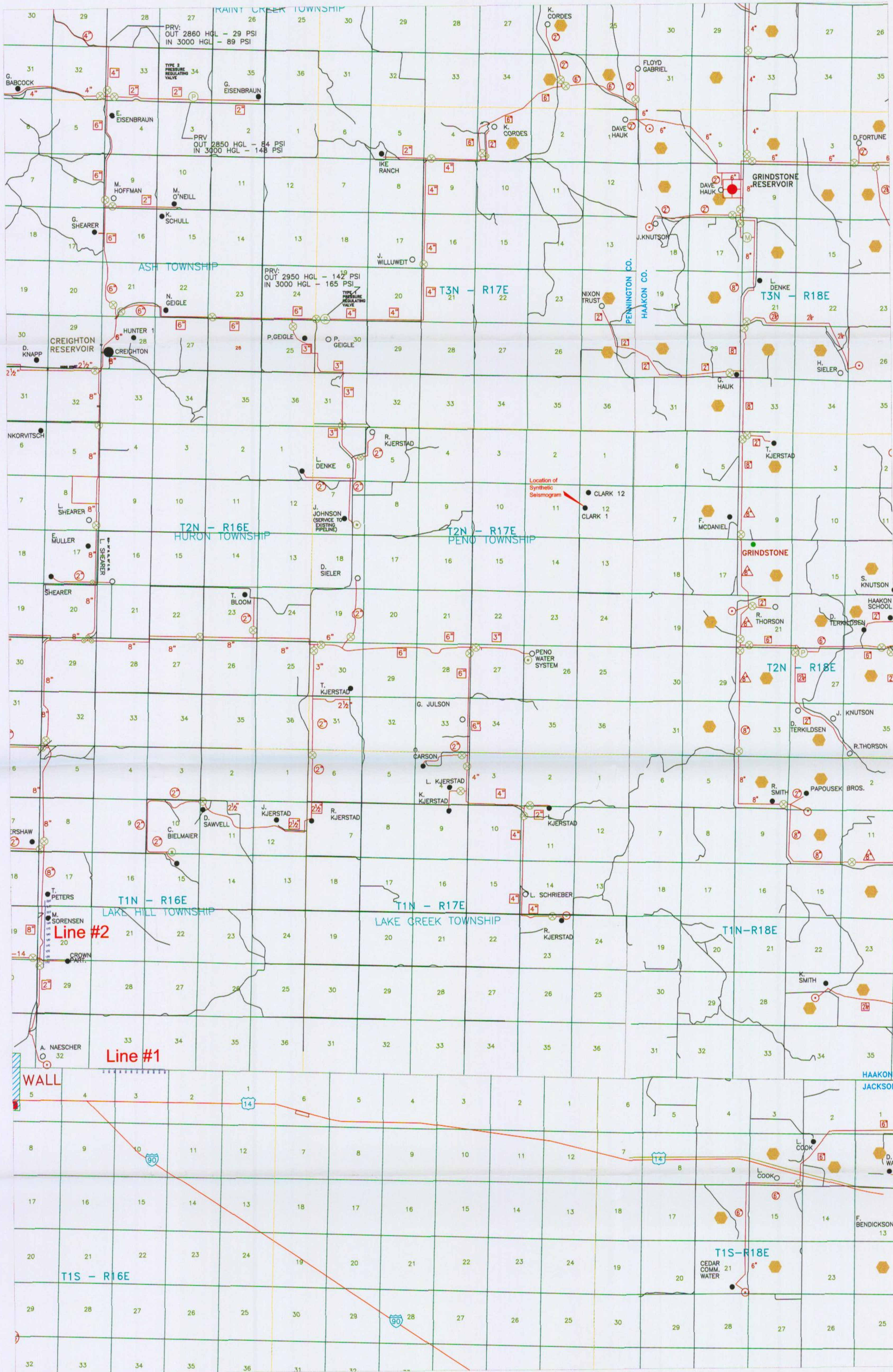
Attachments: Attach Form 2A if diversion is from a well or dugout, or if storage of water is proposed. Attach map and any other technical information. (see instructions)

I, David Hahn, the applicant, certify that I have read this application, have examined the attached map and that the matters stated are true and that I intend, and am able to complete the necessary construction.

Applicant's signature David Hahn

Subscribed and sworn to before me this 21 day of July 20 06

Jerry Patterson 12-14-10
Notary Public signature



301 Commercial Road,
Suite B
Golden, Colorado 80401

Phone: (303) 278-8700
Fax: (303) 278-8789
Web: www.blackhawkeng.com

Project No:
5062

City of Wall
South Dakota

Date:
Oct., 2006

Drawn By:
HJV

Checked By:
SH

General Location Map of
Seismic Survey Area
South Dakota

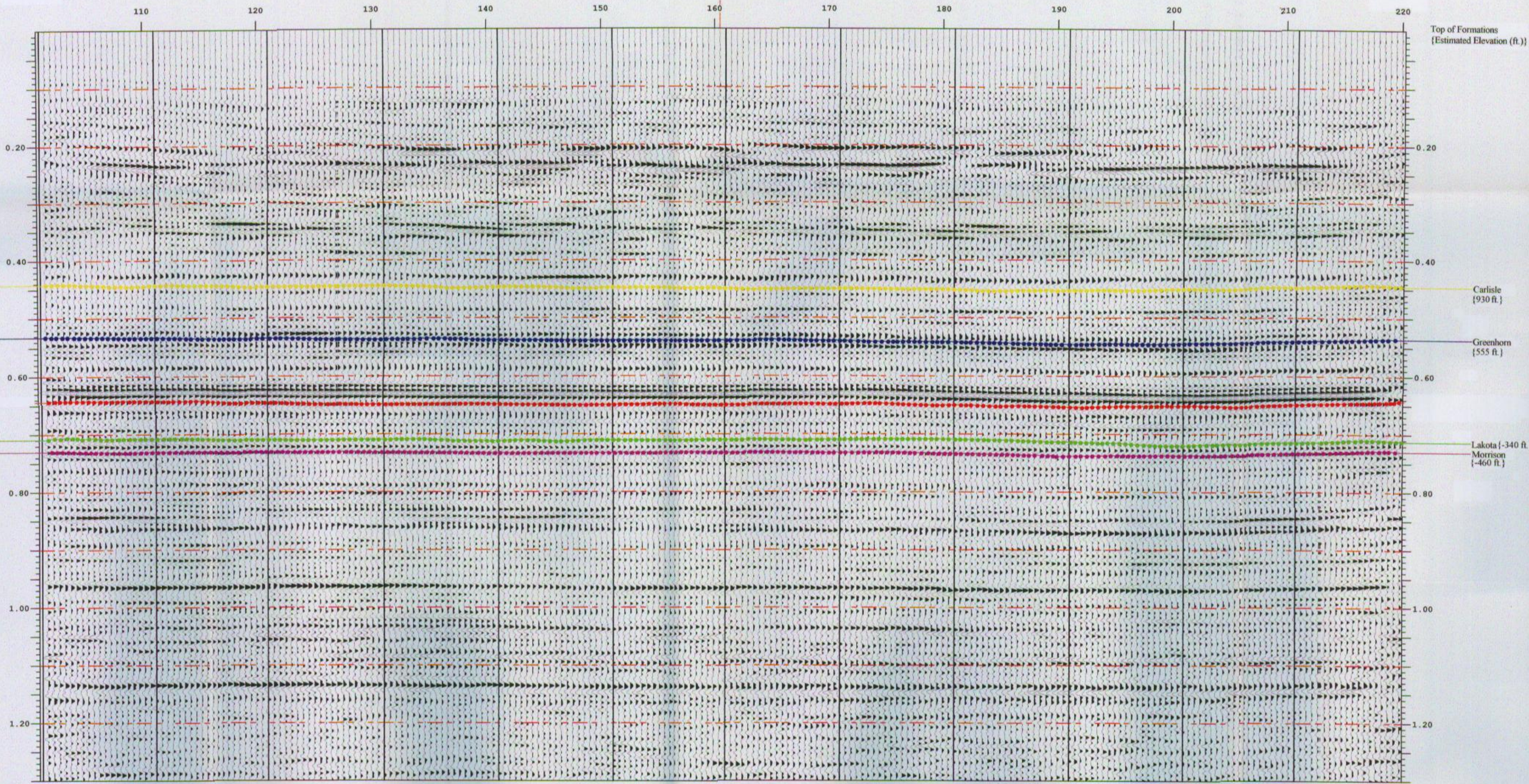
Scale:
1" = 500'

Figure:
1-1

- Carlisle
- Greenhorn
- Skull Creek
- Lakota
- Harrison

South

North



Top of Formations
(Estimated Elevation (ft.))

BHAWK-wall12_stack1-whitex 10-25-120-150 (2D Line)



301 Commercial Road, Suite B
Golden, Colorado 80401
Phone: (303) 276-8700
Fax: (303) 276-0789
Web: www.blackhawkgeo.com

City of Wall
South Dakota

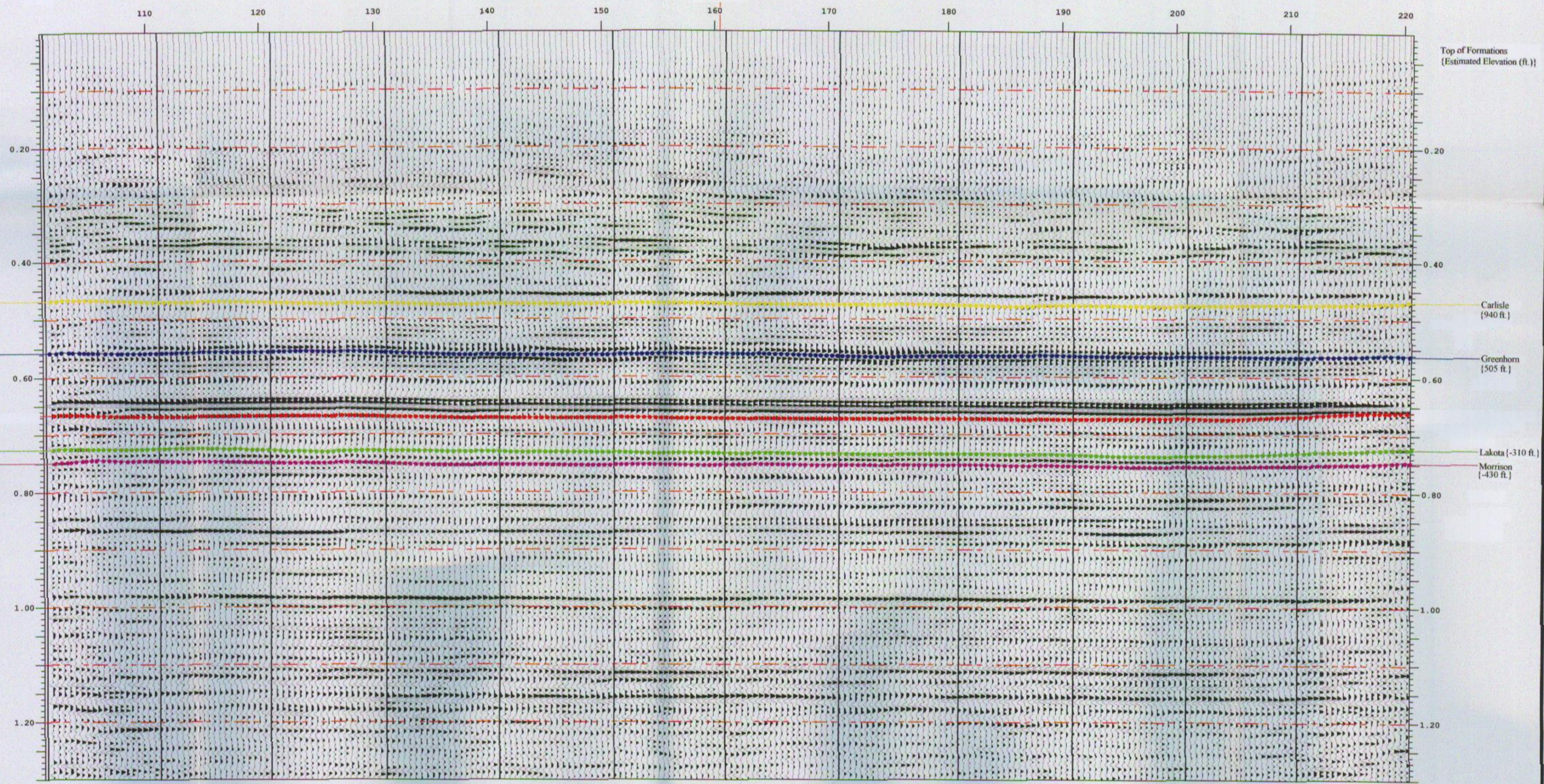
Interpreted Seismic Section
Secondary Location Line #2
Wall, South Dakota

Project No:	Date:	Drawn By:	Checked By:	Scale:	Figure:
5062	October, 2006	HJV	SH	As Shown	4-2

- Carlisle
- Greenhorn
- Skull Creek
- Lakota
- Morrison

West

East



BHAWK-wall1_stack1-whitex 10-25-120-150 (2D Line)

 BLACKHAWK A DIVISION OF ZACHRY ENGINEERING	City of Wall South Dakota		Interpreted Seismic Section Primary Location Line #1 Wall, South Dakota				
	301 Commercial Road, Suite B Golden, Colorado 80401	Phone: (303) 276-6700 Fax: (303) 276-0769 Web: www.blackhawkgeo.com	Project No: 5062	Date: October, 2006	Drawn By: HJV	Checked By: SH	Scale: As Shown

SOUTH DAKOTA
WATER PERMIT NO. 2596-2

Date of first receipt of application July 24, 2006.

The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 2596-2 to the City of Wall, Box 314, Wall SD 57790-0314 authorizing the construction of the water use system and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 2596-2 appropriates 0.89 cubic feet of water per second (400 acre-feet annually) from one well to be completed into the Inyan Kara Aquifer (approximately 3200 feet deep) located in the SW ¼ SE ¼ Section 33-T1N-R16E.
2. The water appropriated shall be used for the purpose of municipal use and may not exceed the amount of water needed for beneficial use.
3. The water is to be used during the following described annual period: January 1 – December 31.
4. The date of approval of Permit No. 2596-2 is September 11, 2006.
5. The date from which applicant may claim right is July 24, 2006.
6. One-fifth of the construction is to be completed on or before March 11, 2009.
7. All construction is to be completed on or before September 11, 2011.
8. Water is to be put to beneficial use on or before September 11, 2015.
9. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

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. 2596-2 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. The City of Wall shall report to the Chief Engineer annually the amount of water withdrawn from the Inyan Kara Aquifer.

WATER MANAGEMENT BOARD

By: Garland Erbele

Garland Erbele, Chief Engineer

Water Rights Program

Department of Environment and Natural Resources

SEP 25 2006

date



Supplemental Information

(type or print in ink)

1. Well Information - Proposed Construction

- a) Drill Hole Diameter 14" to 200'; 9" to 3200' Depth 3200'
- b) Casing Type Steel Diameter 10 3/4" to 200 7" to 3200 Thickness 3/8"
- c) Screen Type Stainless Steel Diameter 6" Thickness pipe based screen
- d) Gravel Pack NO Length of Gravel Pack NA
- e) Depth to Top of Water Bearing Material 3000' to 3200'
- f) Depth to Water (ground surface to water level) NA
- g) Distance to nearest existing domestic well: 13000'

On applicants property municipal (well) On property owned by others _____

2. Wastewater Disposal System Information

- a) Type of System (i.e. septic tank, drain field) _____
- b) System Capacity (gallons) _____ Year Constructed _____
- c) Connected to the City of _____ Sanitary System _____

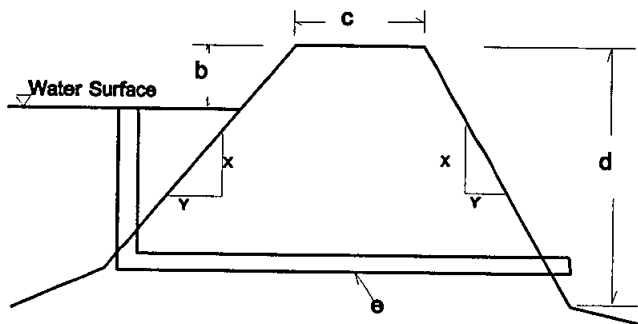
3. Dugout Information

- a) Surface Dimensions _____ Depth _____
- b) Depth to water (ground surface to water level) _____

4. Water Storage Dams

If the proposed water use system contains one or more storage dams, please furnish the information requested below for each dam. The locations of the dams need to be shown on the map submitted with the application.

- a) If a private engineering firm or government agency was involved in the design of this dam, please give their name and address:



- b) Freeboard _____
- c) Crest Width _____
Crest Length _____
- d) Height _____
- e) Primary Outlet Capacity _____
If pipe, diameter _____
- f) Secondary Spillway Capacity _____
Spillway Width _____
- g) X & Y Slope _____
Upstream _____
Downstream _____
- h) Surface Area of Impoundment _____
- i) Storage _____ Acre Feet
- j) Drainage Area Above Dam _____ Acres

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date July 24, 2006

RECEIVED OF City of Wall, PO Box 314, Wall SD 57790-0314

The following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. <u>25916-2</u> to Appropriate Water, to construct and to put water to beneficial use	275	00
Fee for Application for Permit No. _____ to Appropriate Water for Future use		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. <u>25916-2</u>	50	00
Fee for Filing Transfer Form _____		
Fee for _____		
Fee for Issuing New Well Driller's License No. _____ for C.Y. _____		
Fee for Renewal of Well Driller's License No. _____ for C.Y. _____		
Fee for Issuing Well Pump Installer's License No. _____ for C.Y. _____		
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	325.00

No.

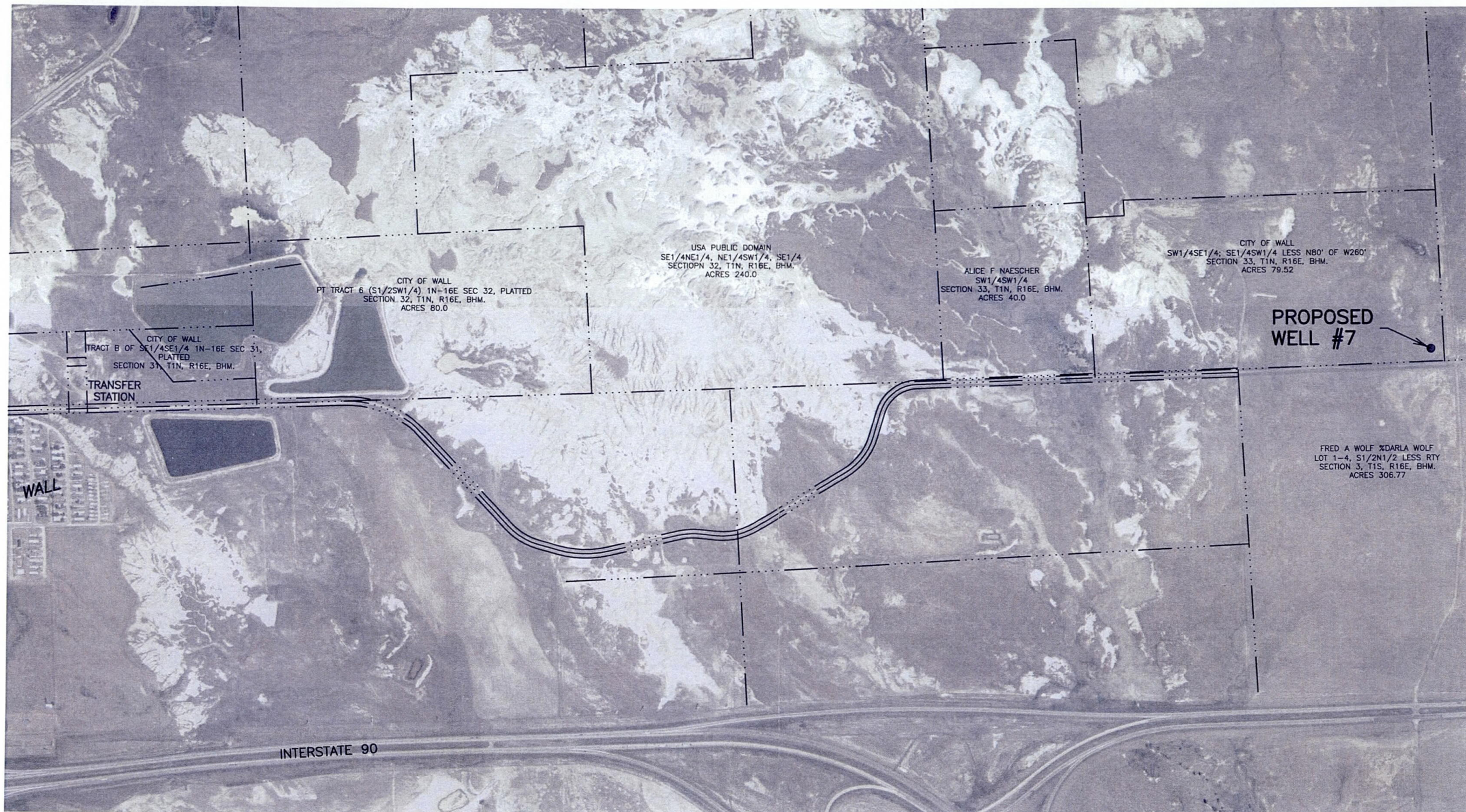
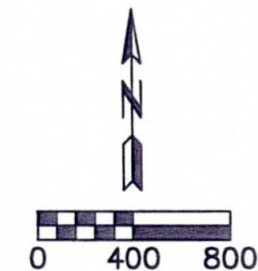
02510

By

David E. Elch

Chief Engineer

gm



PROPOSED WELL #7
CITY OF WALL

cetec
ENGINEERING SERVICES, INC.

1830 West Fulton Street
Rapid City, SD 57702
Phone: (605) 341-7800
Fax: (605) 341-7864
www.cetecengineering.com



City of Wall

501 MAIN STREET P.O. BOX 314
WALL, SOUTH DAKOTA 57790-0314

Phone 605/279-2663
Fax 605/279-2067
Email: wallcity@gwtc.net

RECEIVED
JUL 24 2006
WATER RIGHTS
PROGRAM

July 21, 2006

Water Rights Program
Joe Foss Building
523 E. Capitol
Pierre, SD 57501-3181

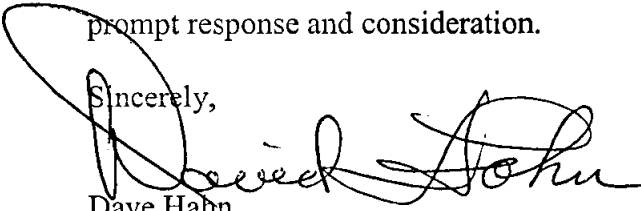
Dear Sirs:

The Wall City Council has approved proceeding with drilling a new municipal water well. A new well is needed due to the fact that some of our city wells are in excess of forty years old and one has become unusable as a result of water levels dropping. The City is also experiencing increased demands on our wells from the continuing drought.

The City of Wall respectfully requests water rights for this new municipal water well. Along with this request, we ask permission to drill a test well before water rights are approved.

In closing, the City of Wall is in urgent need of water and asks that this request be processed as quickly as possible. If you have any questions regarding this request, please don't hesitate to call me or Jeff Clark our Public Works Director. Thank you for your prompt response and consideration.

Sincerely,


Dave Hahn
Mayor

cc: Jeff Clark, Public Works Director

AGRICULTURE & TOURISM "Industries of which we are proud."



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

July 25, 2006

Dave Hahn
Mayor
City of Wall
PO. Box 314
Wall, SD 57790-0314

Dear Mayor Hahn:

As requested, pursuant to South Dakota Well Construction Standard 74:02:04:21, The City of Wall is authorized to construct a test hole prior to approval of a water permit. The test well will be completed into the Inyan Kara aquifer in the SW¼ SE¼ Sec. 33, T1N-R16E. The test well must be constructed in accordance with the SD Well Construction Standards. Any test holes that are abandoned must be plugged pursuant to the SD Well Construction Standards.

A SD Water Permit must be obtained before water from this well can be used. Approval of this test well does not assure issuance of a water permit. Following review of a Water Permit Application; and assessing the availability of water, the potential impacts to existing users, the beneficial use, and the public interest of a permit, the Chief Engineer will make a recommendation to the Water Management Board regarding the application. The recommendation to approve, deny, or defer the application will be publicly noticed and an opportunity afforded for the public to intervene. A public hearing may be required to consider the water permit.

Very truly yours,

JAMES A. GOODMAN, P.E.
Natural Resources Engineering Director
for GARLAND ERBELE, Chief Engineer
Water Rights Program
(605) 773-3352



August 24, 2006

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

The Honorable Dave Hahn
Mayor, City of Wall
PO Box 314
Wall, SD 57790-0314

Dear Mayor Hahn:

I am writing in regard to the city's request to construct a drinking water well in the southeast corner of the permitted property (SW $\frac{1}{4}$ SE $\frac{1}{4}$ and SE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 33, T1N, R16E) for the restricted use solid waste disposal facility. You have specifically requested an amendment to your solid waste permit (Permit # 06-05A) to allow for construction of the well on the permitted property. Upon further review, our office has determined that a permit amendment will not be necessary to allow for construction of the well in the location you have proposed. Even though separation distances between a solid waste facility and a drinking water well is a permitting consideration, we have determined that a variance for the well location is not necessary resulting in no need for a permit amendment. And as directed by Jeff Clark, I have voided and enclosed the city's \$250.00 check.

Even though a permit amendment isn't necessary, please remember to account for all of the design and operational requirements in your solid waste permit. Complying with your solid waste permit and implementing common sense waste management practices will ensure that future activities at the restricted use site will not expose a future well to any impacts.

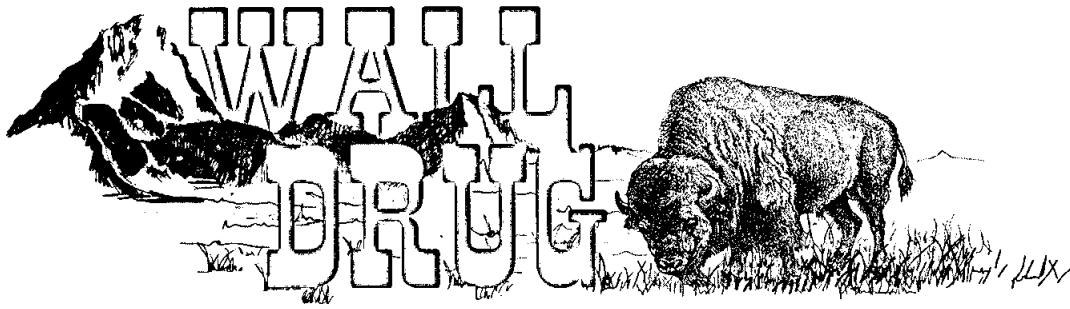
As a reminder, please ensure that you contact both the Water Rights Program and the Drinking Water Program in our department prior to constructing the well. You will need to secure the necessary permits and approvals from these programs before constructing the well. You can contact either program by calling our department's toll free number (800-438-3367).

Do not hesitate to contact our office if you have questions about this letter.

Sincerely,

Jim Wendte, P.E.
Waste Management Program
(605) 773-3153

cc: Jeff Clark, Public Works Director, City of Wall, SD
SD DENR, Drinking Water Program, Pierre, SD
SD DENR, Water Rights Program, Pierre, SD



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AUG 28 2006
WATER RIGHTS
PROGRAM

August 21, 2006

Eric Gronlund, Chief Engineer
Water Rights Program
Foss Building, 523 E. Capitol
Pierre, SD 57501

Dear Eric:

The City of Wall is facing very serious ramifications because of a dire shortage of water available to Wall. Much of our economy is based on Tourism with overnight accommodations for 2,000 guests. There are 8 restaurants in Wall, auto services and many other businesses including Wall Drug. In addition, Wall is the Headquarters for the National Grasslands, the Golden West Tele-Communications Company and the West River Electric Association. The Wall Clinic, affiliated with the Rapid City Regional Hospital, is also located here.

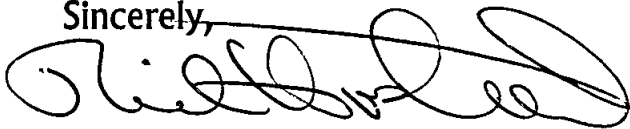
At the present time, Wall has 5 wells; two of these wells are over 40 years old and one well is 30 years old. Another well is not in use as the water level has dropped below the intake. The newest well and our best well was built in 1989 and it pumps 200 gallons per minute.

Each year, our water table drops 20 feet. At the present time, our water contract with White River Lyman Jones is for 200,000 gallons – 300,000 in an emergency and we are only getting 50,000 gallons per day which is just enough to cover the South Unit only. We have been on water restrictions this summer; however, the prospect of running out of water is devastating to our citizens and our economy.

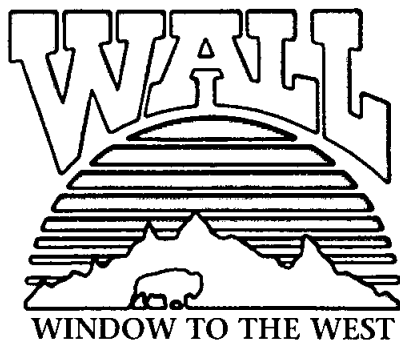
I have been on the City Council for nine years and over the years there are always some concerns about our water but at this time, our water situation is critical. With the water table continuing to drop, we are very concerned about the possibility of losing another well. If that happened it would put an unbearable amount of pressure on our 3 remaining wells. This increased demand could possibly cause one of those to go out of service. If that would happen, we would be in a catastrophic situation for our summer business. Wall Drug, the Free Ice Water Drug Store, potentially could be out of water. That would be devastating for our seasonal tourism business and the town of Wall. Also, we would most likely get a tremendous amount of negative, national publicity that would hurt the Town of Wall and our business for years to come.

I cannot stress enough how important it is for the Town of Wall to have a new Well. The present drought cycle that we are in has put enormous strain on the City of Wall's water supply.

Sincerely,

A handwritten signature in black ink, appearing to read "Rick Hustead", written over a horizontal line.

Rick Hustead, Chairman
Wall Drug Store
Wall, South Dakota 57790



City of Wall

501 MAIN STREET P.O. BOX 314
WALL, SOUTH DAKOTA 57790-0314

Phone 605/279-2663

Fax 605/279-2067

Email: wallcity@gwtc.net

August 30, 2006

Chief Engineer
Water Rights Program
Foss Building
523 East Capital
Pierre, SD 57501

RECEIVED

AUG 31 2006

WATER RIGHTS
PROGRAM

Dear Sir:

As Mayor of the City of Wall I want to express my deepest concern for the need for the proposed new "Water Well", application number 2596-2. As you most likely are aware, WATER is one of the major life-lines of our community.

Our community is host to nearly 20,000 tourists daily during the months of June, July, & August. Wall also provides numerous support services for our strong agricultural industry. Via sales tax, this is a tremendous financial impact to both the City of Wall and the State of South Dakota. Without this additional source of water both of these governmental entities will suffer financial and economic loss.

Therefore, on behalf of the Citizens of the City of Wall and our surrounding Communities, I most sincerely request your favorable understanding and need for the requested "water well".

Should there be any questions or a need for additional information, PLEASE feel free to contact me anytime at telephone number 605-279-2666.

#Thank You,

Sincerely Yours,

Dave Hahn-Mayor
City of Wall

WATER PERMIT APPLICATION NO. 2596-2
CITY OF WALL
AUGUST 1, 2006

Water Permit Application No. 2596-2 proposes to appropriate 400 acre-feet annually at a rate of 0.89 cubic feet of water per second (approximately 400 gallons per minute) from one well completed into the Inyan Kara aquifer, approximately 3,200 feet deep, located in the SW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 33, T1N-R16E, in Pennington County. The water is for municipal use.

AQUIFER: Inyan Kara (INKR)

GENERAL:

In general, the Inyan Kara aquifer consists of interbedded sandstone (thin bedded to massive), siltstone, and shale. The Inyan Kara consists of the Fall River Formation and the underlying Lakota Formation. The Fuson Shale sometimes separates these two formations, but it is often difficult to differentiate the bottom of the Fall River from the top of the Lakota. The analysis of drill cutting from Wall City Well #5 conducted by Dr. J.P. Gries does not identify the Fuson Shale or Lakota Formation (Water Rights, 1988). For all practical purposes, the Fall River Formation and the Lakota Formation can be considered a single hydrologic unit in this area.

The Inyan Kara aquifer is areally extensive, underling over 36,000 square miles of western South Dakota (Allen, 1985). The aquifer underlies 1,245,440 acres and contains an estimated 23,352,000 acre-feet of recoverable water in storage in Pennington County alone (Allen, 1985). The top of the Inyan Kara is expected to be approximately 3,000 feet below grade at this proposed well site, and the aquifer is estimated to be 200 feet thick at this site (Allen, 1985). The thickness of the Inyan Kara Aquifer does however, vary considerably within short distances. The Inyan Kara is under confined conditions in this area.

WATER AVAILABILITY:

The Water Rights Program does not monitor any observation wells completed into the Inyan Kara aquifer in this area and water level information is limited. Data does suggest that water levels in the City of Wall declined about 150 feet between 1961 and 1987 (Winter, 1994). The decline of water levels, actually localized drawdown, is probably the result of increased development and usage by the City of Wall rather than an indication of over appropriation. The water use for the City of Wall (Jeff Clark, City of Wall, personal communication with) is shown in Tables 1 and 2.

City of Wall	
Year	Average Daily Water use (gallons)
1994	181,000
1995	157,000
1996	162,000
1997	145,000
1998	153,000
1999	162,000
2000	175,000
2001	195,000
2002	225,000
2003	256,000
2004	259,000
2005	248,000

Table 1. Average Daily Water Use

City of Wall	
Year	Peak Daily Water Use (gallons)
1994	568,000
1995	481,000
1996	543,000
1997	392,000
1998	569,000
1999	597,000
2000	447,000
2001	594,000
2002	699,000
2003	847,000
2004	759,000
2005	795,000

Table 2. Peak Daily Water Use

As the city increases pumping from the aquifer the water level in the area of the wells will continue to drawdown until a dynamic equilibrium is achieved.

In addition to the increased water use by the city, a second issue affecting the water levels in the Wall area is the relative proximity of the city's wells. All of the City's wells are within about a radius of 4,000 feet. See attached map

City of Wall Wells

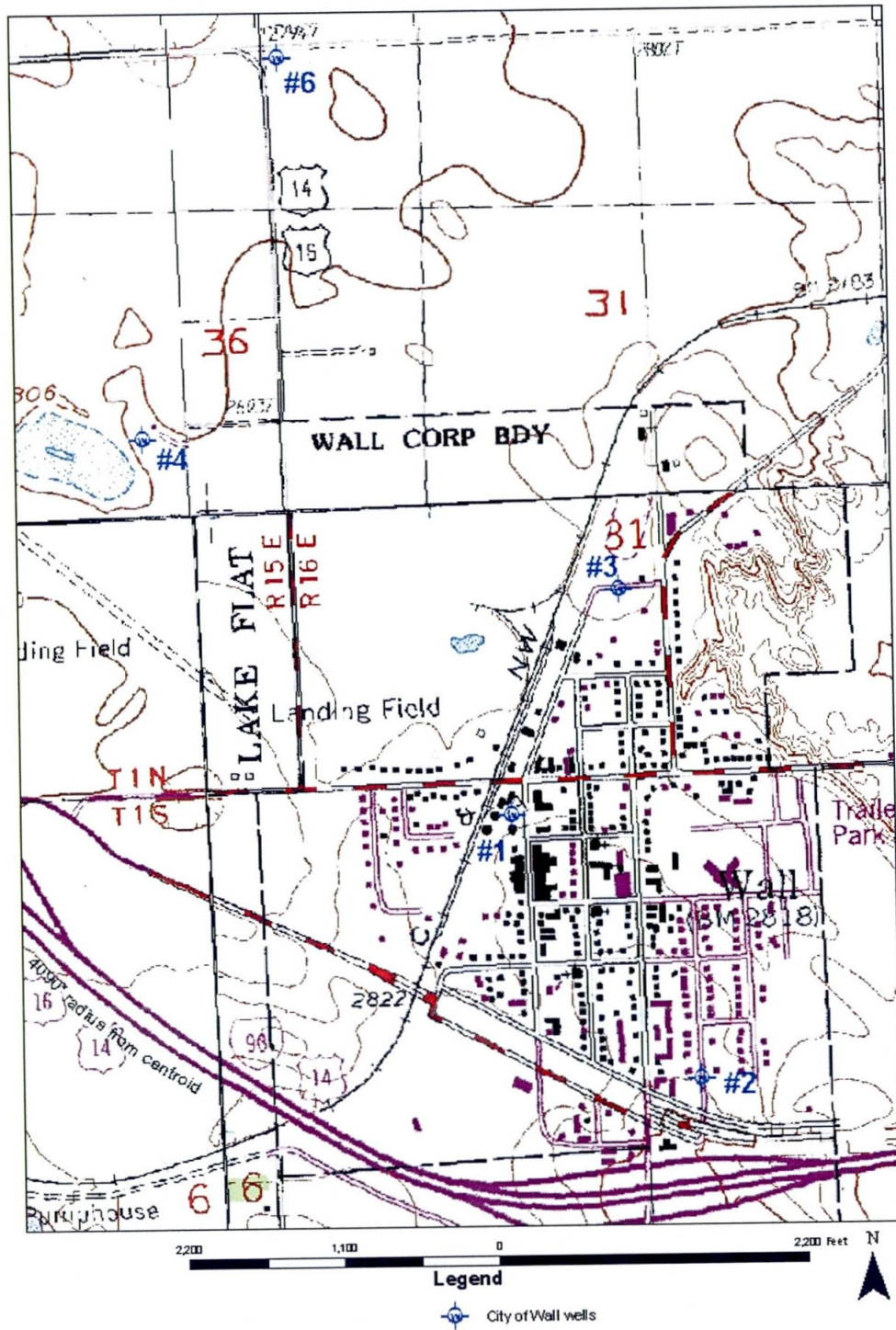


Figure 1. City of Wall Municipal Wells.

The "Report on Pump Test Conducted in the Fall River/Lakota aquifer for the City of Wall, South Dakota in November, 1985" (Rahn and other, 1986) concludes that wells should be spaced at least 2,000 feet apart to minimize interference.

EXISTING WATER RIGHTS:

There are 14 Water Rights/Permits supplied from the Inyan Kara aquifer within approximately 15 miles of the well site proposed by this application. These existing water rights include:

PERMIT NO	NAME	USE	CFS
1102-2	DONALD & ROBERT KELLY	COM	0.22
1103-2	PENO BASIN WATER SYSTEM	RWS	0.04
1361-2	CITY OF WALL	MUN	0.45
1647-2	TOWN OF QUINN	MUN	0.20
1757-2	CEDAR COMM WATER ASSOC	RWS	0.50
1834-2	GRINDSTONE RWS	RWS	0.08
2075-2	CITY OF WALL	MUN	0.41
2285A-2	WEST RIVER-LYMAN-JONES	RWS	0.56
2464-2	WEST RIVER-LYMAN-JONES	RWS	0.76
2465-2	WEST RIVER-LYMAN-JONES	RWS	1.00
639-2	CITY OF WALL	MUN	0.50
724-2	CITY OF WALL	MUN	1.00
998-2	CITY OF WALL	MUN	0.33
2552-2	KJERSTAD LIVESTOCK PARTNERSHIP	COM	0.18

Table 3. Water Rights/Permits within 15 miles of 2596-2

The well site proposed by this application is located approximately two and one-half miles from wells supplying water for the City of Wall's Water Rights. This site is located about two and one-half miles from the well that supplies Water Right No. 1102-2, Donald & Robert Kelly and about three and one-half miles from wells supplying Water Right No. 2565-2, West River-Lyman-Jones; and Water Right No. 1647-2, Town of Quinn.

The transmissivity of the Inyan Kara aquifer was estimated to be 4,400gpd/ft at a pump test conducted on the West River Lyman Jones well at Quinn (Water Rights, 2006a). The transmissivity at the West River Lyman Jones well near Creighton was estimated to be 4,200 gpm/ft (Water Rights, 2006a). An aquifer test was conducted for the Inyan Kara aquifer at the City of Wall by pumping the city well #1 for 44 hours at a rate of 120 gpm. The transmissivity of the aquifer was estimated to be 4,320 gpm/ft from the test. Projections of the Wall aquifer test data indicate a drawdown of about six feet would be expected 10,000 feet from the production well (Gries and others, 1976). If the aquifer characteristics are assumed to be similar at the site proposed by this application, the drawdown resulting 10,000 feet from a well pumping 400 gpm could be expected to be around 30 feet (figure 2).

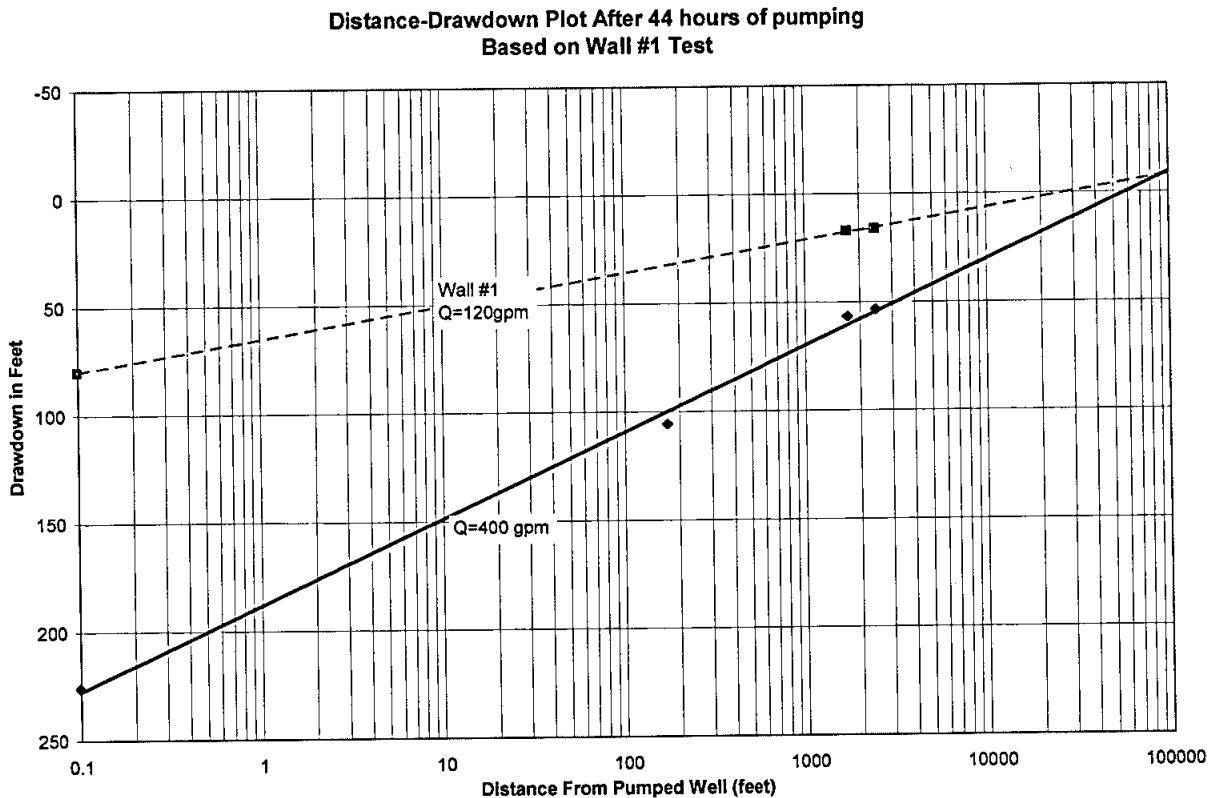
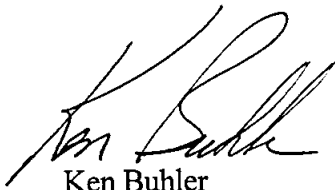


Figure 2. Distance Drawdown Plot projecting drawdown at 400 gpm based on Wall #1 pump test.

Water Management Board rules 74:02:04 and 74:02:05, which were promulgated pursuant to SDCL 46-6-6.1, provide protection for existing wells only to the degree necessary to maintain an adequate depth of water 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. In fact, in past action, the Water Management Board it has concluded that if 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. In this area, the Inyan Kara aquifer has around 2,700 feet of artesian head pressure. Therefore well interference is not likely to adversely impact existing users.

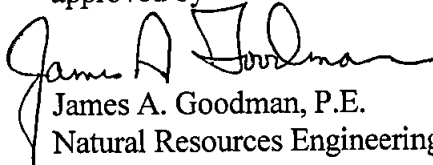
CONCLUSIONS:

1. The Inyan Kara Aquifer is a viable aquifer in this area, and water is available for this appropriation.
2. Well interference should not be a problem at this proposed well site.



Ken Buhler
Natural Resources Engineering Specialist

approved by



James A. Goodman, P.E.
Natural Resources Engineering Director

REFERENCES:

- Allen, J.C., Iles, D.L., and Petres, A.K., 1985, Analysis of Groundwater and Streamflow Data, Western Dakotas Region of South Dakota, Tasks 3A.B.C. AND 4A.B: Groundwater Resources Inventory: US Army Corps of Engineers Contract DAWC 45-82-C-0151, SD DENR- Geological Survey, Vermillion SD
- Gries, J.P., Rahyn, P.H., and Baker, R.K., 1976, A Pump Test in the Dakota Sandstone at Wall, South Dakota: South Dakota Geological Survey Circular 43, 9 p.
- Rahn, P.H., Gries, J.P, and Barari, A., 1986, Report on Pump Test Conducted in the Fall River/Lakota Aquifer for the City of Wall, South Dakota in November, 1985 (On file in Water Right No. 2465-2)
- Water Rights Program, 1988, "Water Permit File 1982-2, City of Wall," DENR-Water Rights Program, Joe Foss Building, Pierre, SD 57501
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- Winter, D.R., 1994, Water Levels through 1989 in Bedrock Aquifers in South Dakota, U.S. Geological Survey Open-File Report 94-320, Rapid City, SD



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 2596-2, City of Wall**

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. 2596-2, City of Wall, c/o Mayor David Hahn, Box 314, Wall SD 57790-0314.

The Chief Engineer is recommending APPROVAL of Application No. 2583-2 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) it is in the public interest with the following qualification:

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. 2596-2 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. The City of Wall shall report to the Chief Engineer annually the amount of water withdrawn from the Inyan Kara Aquifer.

See report on application for additional information.

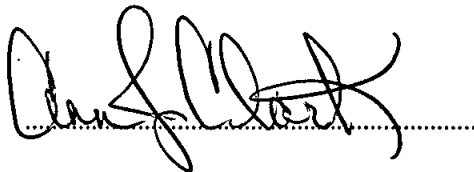
Garland Erbele, Chief Engineer
August 15, 2006

NOTICE OF
APPLICATION
NO. 2596-2

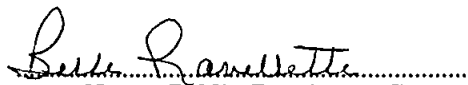
PUBLISHER'S AFFIDAVIT OF PUBLICATION

STATE OF SOUTH DAKOTA)
) ss
COUNTY OF PENNINGTON)

..... Ann Clark, of said County and State, being duly sworn, on oath says:
THE PENNINGTON COUNTY COURANT is a weekly newspaper of general circulation,
printed and published in WALL, in said County and State and has been such newspaper
during the times hereinafter mentioned; that the said PENNINGTON COUNTY
COURANT is a legal newspaper and has been in existence for more than one year
immediately preceding the first publication herein mentioned; and has more than 200
bonafide subscribers; that I, the undersigned am Legal Advertising Manager of said
newspaper, and in charge of the advertising department thereof, and have personal
knowledge of all facts stated in this affidavit; and that the advertisement headed
..... Notice of Application, a printed copy of which is hereto attached,
was printed, and published in said newspaper for two successive issues, the first
publication being on the 24th day of August, 2006 and the last publication
on the 31st day of August 2006 that \$..... 46.62 being
the full amount of the fee for publication of the annexed notice insures solely to the benefit
of the publishers of the said newspaper; that no arrangement or understanding for a
division thereof has been made with any person, and that no part thereof has been agreed
to be paid to any other person whomsoever.



Subscribed and sworn to before me this 31st day of August 2006


Notary Public, Pennington County
My Commission Expires
September 30, 2008

RECEIVED
SEP - 1 2006
WATER RIGHTS
PROGRAM

TO APPROPRIATE WATER

Notice is given that the City of Wall, c/o David Hahn, Mayor, Box 314, Wall, SD 57790-0314, has filed an application for a water permit to appropriate 0.89 cubic feet of water per second (400 acre-feet annually) from one well to be completed into the Inyan Kara Aquifer (approximately 3200 feet deep) located in the SW 1/4 SE 1/4 Section 33-T1N-R16E. The water is for municipal use.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 2596-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre, SD 57501 (605/773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by September 11, 2006.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application.

Steven M. Pirner, Secretary,
Department of Environment
and Natural Resources

Publish: August 24 & 31, 2006



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

PMB 2020
JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

August 16, 2006

Pennington Co Courant
PO Box 435
Wall SD 57790-0435

ATTENTION: Legal Public Notice

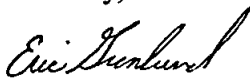
Enclosed is a Notice on Application No. 2596-2 to Appropriate Water to be published twice. Please publish the first notice on August 24, 2006 with the second publication 7 days later. The text of the notice can be e-mailed to your paper by contacting Karen Schlaak at (605) 773-3352.

Please BILL the APPLICANT for the cost of publication. The APPLICANT is City of Wall, % David Hahn Mayor, Box 314, Wall SD (Ph # 605-279-2563).

Please send the Water Rights Program the first publication immediately. The publication is checked for accuracy so any corrections can be made in the second publication. You may use the form below or fax a copy of the first publication. Any fax should be sent to the attention of Karen Schlaak at (605) 773-4068. Publication errors can invalidate the public notice.

After the second publication, **please send us an affidavit or use the enclosed Proof of Publication form.** The applicant pays the cost of publication, but the Water Rights Program records require an affidavit or Proof of Publication. Delays in receiving the affidavit can be costly to the applicant.

Sincerely,


Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

-----CUT HERE-----

No. 2596-2

TO: Eric Gronlund
Water Rights Program
Joe Foss Building
Pierre SD 57501-3181

Date _____

We are in receipt of your letter of August 16, 2006 enclosing Notice to Appropriate Water by Application No. 2596-2 which was first published in our issue of _____. **ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.**

Name

Newspaper



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

PMB 2020
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523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

**NOTE: TO BE SURE OF PUBLICATION ON
THE CORRECT DATES, CONTACT
THE NEWSPAPER RIGHT AWAY.**

August 16, 2006

City of Wall
% David Hahn Mayor
Box 314
Wall SD 57790-0314

Dear Mayor Hahn:

Water Permit Application No. 2596-2 for municipal use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice has been sent to the Publisher of the Pennington Co Courant printed at Wall, SD (Ph # 605-279-2565). You will need to contact the newspaper and authorize publication of this notice. For your information, a copy of the notice, the recommendation of the Chief Engineer and a report on the application are enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper to authorize publication of your Notice and to arrange for payment. Early contact with the paper can eliminate delays. Upon receiving authorization, the publisher has been instructed to publish your notice once each week for two consecutive weeks. The newspaper has also been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can be taken on the application.

Sincerely,

Eric Gronlund
Natural Resources Engineer
(605) 773-3352

enclosures

cc: Jeff Clark, PWD, PO Box 314, Wall SD 57790-0314

NOTE: If you plan to contest any part of the Chief Engineer's recommendation, you must file a petition pursuant to the procedures outlined in the attached notice of hearing. The Water Management Board will then consider your concerns during a hearing on the application.

Instruction to Newspaper - Publish first Notice on August 24, 2006 with the second publication 7 days later. The applicant is responsible for payment.

NOTICE OF APPLICATION NO. 2596-2 to Appropriate Water

Notice is given that the City of Wall, c/o David Hahn, Mayor, Box 314, Wall SD 57790-0314 has filed an application for a water permit to appropriate 0.89 cubic feet of water per second (400 acre-feet annually) from one well to be completed into the Inyan Kara Aquifer (approximately 3200 feet deep) located in the SW ¼ SE ¼ Section 33-T1N-R16E. The water is for municipal use.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 2596-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by September 11, 2006.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.



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www.state.sd.us/denr

SEP 25 2008

City of Wall
% David Hahn Mayor
Box 314
Wall SD 57790-0435

Dear Mayor Hahn:

Enclosed is Water Permit No. 2596-2 authorizing construction of your water diversion system and beneficial use of the water, not exceeding the limits as specified in the Water Permit.

Form 10, *Notice of Completion of Works and Application of Water to Beneficial Use*, is enclosed. Please return this completed form after you have finished the system and have put the water to beneficial use. An investigation can then be scheduled so the water license may be issued, thus completing the acquisition of a water right.

An informational sheet *Common Water Right Questions?* is also enclosed. This sheet is intended to answer some of the questions associated with obtaining and keeping a water right.

Sincerely,

Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures

2596-2

**SEISMIC REFLECTION SURVEYS
TO DELINEATE THE LAKOTA FORMATION,
WALL, SOUTH DAKOTA**

Blackhawk, a Division of ZAPATAENGINEERING
Project Number 5062

Prepared For:

CITY OF WALL
501 Main St.
P.O. Box 314
Wall, SD 57790-0314
(605) 279- 2663
Fax (605) 279- 2067

Prepared By:

BLACKHAWK A DIVISION OF ZAPATAENGINEERING
301 Commercial Road, Suite B
Golden, Colorado 80401
303-278-8700 • Fax 303-278-0789

October 11th, 2006

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4.0 INTERPRETATION	13
5.0 CONCLUSIONS AND RECOMMENDATIONS	15
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APPENDIX A – Generalized Stratigraphy and Borehole Information

FIGURE NUMBER

TITLE

1-1	General Location Map of Seismic Survey Area
1-2	Seismic Reflection Survey Line, Primary Location, Line #1
1-3	Seismic Reflection Survey Line, Secondary Location, Line #2
2-1	Seismic Raypath Geometry
4-1	Interpreted Seismic Section, Primary Location, Line #1
4-2	Interpreted Seismic Section, Secondary Location, Line #2
4-3	Correlation between Synthetic Seismogram from Clark #1 Well And Reflection Profile

TABLES

2.4.1	Nominal Seismic Reflection Acquisition Parameters
2.4.2	Summary of Line and Station Numbers
3.1	Data Processing Flow

EXECUTIVE SUMMARY

The area of investigation is located in eastern Pennington County near Wall, South Dakota. The objective of the seismic reflection profiling was to map the top and bottom of the Lakota Formation (where present) and to identify structural features within the formation. The geology of the site consists of a thick sequence of Mesozoic and Paleozoic sedimentary rocks. Groundwater in the region is present in three regional aquifers consisting of the Red River-Madison-Minnelusa aquifer, the Inyan Kara aquifer, and the Dakota-Newcastle aquifer (Case III, 1984). The target (the Lakota Formation) is part of the Inyan Kara aquifer system. This report summarizes the methods and results of the seismic acquisition, processing, and interpretation carried out in September and October, 2006.

A total of 2.5 miles of seismic reflection data were acquired along two survey sites (1.25 miles of seismic reflection data per site). An iVi Envirovibe was used as the seismic source. Source parameter testing was not necessary due to previous work conducted in the area in 2001. The production sweep used for this survey was of 8 seconds' duration, linear, and swept through 25-150 Hz. Eight sweeps were recorded and summed at each shot location. Data were recorded into an array of twelve 28Hz geophones with a group spacing of 55 feet. The data quality of the field records was good. Line 2, which was centered over the secondary well location, had a fair amount of wind noise. Noise levels, however, did not significantly degrade the signal returning from the subsurface.

The top and bottom of the Lakota Formation was interpreted for sites #1 (primary site) and site #2 (secondary site).

For Site #1, the thickness of the Lakota aquifer underneath the proposed primary well location is calculated to be about 110 feet. A slightly thicker (120-125 feet) Lakota formation can be found 2000 feet to the west, between survey shotpoints 110 and 120. Overall, any location along this line is suitable for drilling, with the zone between shotpoints 110-120 being optimal.

On Site #2, the Lakota aquifer is relatively uniform and continuous across the seismic section. The Lakota thickness at the proposed well location is predicted to be 115-120 ft. A slightly thicker Lakota section occurs between shotpoints 170 and 190, where the formation reaches an approximate thickness of 130 feet. Again, any location along this line is suitable for drilling, with the zone between shotpoints 170-190 being optimal.

1.0 INTRODUCTION

Blackhawk a Division of ZAPATAENGINEERING performed seismic reflection surveys at two sites in the vicinity of Wall, South Dakota during September 2006. The general location of the two sites is illustrated in Figure 1-1. The borehole locations for which geologic logs were available are also shown in Figure 1-1. The scope of the work, stipulated by the contract, called for seismic data collection, processing, and interpretation.

For this study, seismic reflection data was acquired along two lines. The detailed location of each line is shown in Figures 1-2 and 1-3. Key equipment used to collect the data included:

- IVi Envirovibe Vibroseis Source
- Geometrics Geode Recording System
- 28 Hz L10A Mark Product Geophones (12 elements per string)

The total field effort consisted of acquiring data for 2.5 linear miles of seismic reflection data. Production shooting began on the morning of September 29, 2006. Data acquisition proceeded quickly and smoothly, and was completed on October 1, 2006. In general, data quality was good. A single seismic line was acquired at each of the two sites. Processing was completed by Sterling Seismic Services in Denver. The processed results of the seismic survey are presented in this report, along with an interpretation of the data.

1.1 Project Objectives

Geologic Setting

The Wall area sits on a thick sedimentary basin consisting of Paleozoic and Mesozoic rocks. The target geologic unit is the Lakota Formation (Lower Cretaceous) which is part of the Inyan Kara Group. The Inyan Kara aquifer includes the Fall River Sandstone, the Fusion Member and the Lakota Formation (Case III, 1984). The Lakota is reportedly bounded on its upper and lower surfaces by erosional unconformities, which would account for variations in thickness. A generalized stratigraphic column, along with cross-correlated borehole geologic logs, and a sonic log for Clark #1 are included in Appendix A.

The objective of the seismic reflection surveys was to determine the presence or absence of the Lakota Formation, determine the layer continuity of the formation, and identify any structural features that may be present. This data would then be used to help determine a suitable water well location.

2.0 DATA ACQUISITION

2.1 General

Seismic Reflection Technique

Seismic reflection profiling is a standard technique employed by the oil and gas exploration industry. Details of the general seismic reflection method can be found in many comprehensive texts, such as Sheriff and Geldart (1995); and therefore, only a brief synopsis of the technique is included in this report.

Seismic Reflection

The basic principles of the reflection technique are illustrated in Figure 2-1. The seismic reflection method involves projecting a wave down from the surface, and then recording the returning wave back at the surface as it reflects off of formations at depth. Seismic energy will also be reflected, refracted, and diffracted at boundaries in the subsurface, in accordance with Snell's Law. The main design consideration for a successful seismic reflection survey is the ability to separate the reflected energy from the other arrivals in processing.

A seismic reflection occurs when an acoustic wavefront encounters an impedance boundary in the subsurface. Seismic impedance depends on both the density of a rock and the velocity of propagation of seismic energy through the rock. Impedance boundaries occur where these rock properties change abruptly, usually due to changes in lithology. The reflection coefficient, R , across an interface, is expressed by a function relating the acoustic impedance of adjacent layers. R determines the relative amplitude of the reflected wavelet.

$$R = \frac{\sigma_2 V_2 - \sigma_1 V_1}{\sigma_2 V_2 + \sigma_1 V_1}$$

where, R = reflection coefficient,

σ_1, σ_2 = mass density of the material on each side of the interface, and

V_1, V_2 = seismic wave velocity on each side of the interface.

The sign of the reflection coefficient determines the polarity of the reflected wave. The magnitude of the reflection coefficient is critical to obtaining usable data. The seismic reflection technique will not work if the acoustic contrast is not sufficient to produce a clear reflection, regardless of the survey parameters or processing techniques employed. The ability of the seismic reflection method to detect an individual sedimentary bed is not only a function of the acoustic impedance at the top and bottom of the bed, but also depends on the layer thickness. The minimum resolvable bed thickness is often quoted as 1/4 to 1/8 of the wavelength of the seismic reflection. Wavelength is inversely proportional to frequency.

When a reflecting boundary exists, it is important to optimize the field procedure and acquisition parameters to ensure the quality of the final processed data. Choosing the best field parameters involves determining the relative importance of several competing objectives, such as site constraints, equipment capabilities, and processing needs.

In all geophysical surveys, the objective is to extract the usable data (i.e., in this case, reflections from various lithologic boundaries) from the unwanted background information (source

generated and ambient noise). In reflection seismology, it is desirable to record high frequency, high signal-to-noise ratio reflection events from the boundary of interest. The frequency of a reflection event is largely determined by the source input frequency and the filtering effect of the ground. Often, the target reflector frequency is similar to that commonly recorded for coherent noise (in particular, the noise from ground roll), making it difficult or impossible to selectively filter out the noise. Isolation of the reflection events requires careful design of field acquisition parameters, such as the source/receiver geometry, choice of source and receiver types, as well as recording parameters, such as sampling rate and filter settings. The choice of these parameters is discussed in Section 2.2.

2.2 Design of Survey Parameters

A summary of all the acquisition parameters is provided in Section 2.5 and Table 2.5.1.

For this project, the receiver group interval was 55 feet, with an array of twelve 28 Hz geophones centered on each numbered station. Shot records contain 120 live channels (1 pilot channel and 119 data channels). With 120 receiver groups laid out, the vibrator rolled through the spread, shaking on each half station until reaching the end of the line. Data was recorded with a 1 msec sample rate, and a record length after correlation of 2000 msec.

The source parameters had been determined during Blackhawk's previous work in this area in 2001, negating the need for further source testing.

2.3 Specific Site Problems

In addition to the general requirements for seismic data acquisition described in Section 2.1, site-specific problems were known to exist or became manifest during the survey.

There were two site-specific problems experienced on some of the seismic lines:

1. Noise generated by vehicular traffic.
2. High winds.

The impacts of these problems are discussed in the following sections.

(1) Noise Generated by Vehicular Traffic

The proximity of Creighton Road to Line #2 meant some vehicular noise was inevitable. During most of the day the noise was tolerable, but some delays or reshooting of records were required when heavy truck traffic was moving along the road. A small amount of vehicular traffic occurred on the west end of Line #1 during data acquisition, causing short delays. Much of the interference from vehicle traffic on both lines was eliminated or minimized due to the long duration of the vibroseis sweep and the correlation process.

(2) High Winds

The weather was mild and pleasant during data collection with the exception of the afternoon of September 30th, when high winds were blowing during data acquisition on the north end of Line #2. The winds caused an increase in the background noise on the geophones, particularly if the phones were planted near high grass. When the wind level increases, the signal to noise ratio on the shot records decreases. There was, however, no visible signal degradation on the processed Line #2 seismic section.

2.4 Production Parameters

The production parameters for these seismic lines are summarized in Table 2.4.1 below.

TABLE 2.4.1
NOMINAL SEISMIC REFLECTION ACQUISITION PARAMETERS

Shot Spacing	55 feet, positioned on half stations
Geophone Group Interval	55 feet
Maximum CDP Fold	60
Maximum Offset	6517.5 feet
Minimum Offset	27.5 feet
Spread Geometry	120 channel Static Spread - (6545 foot total active array)
Seismographs	Geometrics Geode Seismic Recording System
Number of Channels	120
Sample Rate	1 ms
Record Length	10 seconds, 2 seconds after correlation
Field Filters	None
Seismic Source	iVi Envirovibe 25 to 150 Hz, Linear, 8 second sweep, 8 sweeps/station
Geophones	12 X 28 Hz L10A Mark Product geophones
Cables	120 pair Seislite cables with Titan II heads, 55' takeouts, 8 takeouts per cable
Rollbox	I/O Inc. RLS-240M

Table 2.4.2 lists the lines surveyed and their number of stations. The lines are also shown on the site map.

TABLE 2.4.2

SUMMARY OF LINE AND STATION NUMBERS

Line Name	First Station	Last Station	# of Stations	Line feet
Primary Site-Line #1	100	220	120	6545
Secondary Site-Line #2	101	220	120	6545

2.5 Production Procedures

Each line was chained out by Blackhawk using a tape measure. Numbered orange pinflags were placed at receiver locations and paint marks were placed at shot locations. Shot and receiver locations were then surveyed in using a Trimble 5700 Differential GPS system.

At the start of each line, the source was positioned halfway between stations 100 and 101. The source would then shake and move up at 55 foot intervals until reaching the half station between receiver groups 239 and 240. All receiver groups remained active on every shot, in a configuration known as "static spread". Approximately 170 sets of geophones and 18 cables were mobilized to the field, allowing the crew to lay out the receiver spread well in advance of the recording. The vibrator was connected to the seismograph via radio telemetry. When the operator pushed the trigger button in the recording truck, a signal was sent to the vibrator to start the sweep sequence, and the Geometrics Geode seismographs began recording. During the sweep, a synthetic pilot trace was generated by the vibrator and sent to the seismograph. This pilot sweep is recorded on channel 1 for correlation with the recorded data from the geophones. Data was recorded to the seismograph's hard drive and transferred to DVD at the end of each day.

Quality control of the seismic data included the following:

At the beginning of each day/line:

1. An uncorrelated sweep was viewed on the computer screen. This provided a check to ensure that the vibrator was operating properly, and that the seismograph was being triggered correctly.
2. Check array parameters (i.e., source location, sweep configuration, receiver spacing, etc.) and connections.
3. Check the noise monitor on the seismographs to identify any ambient noise problems and to isolate and correct any noisy or dead receiver channels.
4. Internal daily instrument tests were run on the seismograph to ensure correct operation.

3.0 DATA PROCESSING

The processing flow for this seismic data is based on a standard common mid-point (CMP) reflection processing. Each line was processed individually while keeping all area-based parameters the same for uniformity.

Table 3.1 below shows each step in the processing sequence leading to the final stacks used for interpretation.

TABLE 3.1
DATA PROCESSING FLOW

Sequence	Process Applied	Relevant Parameters
1	Data Reformat	
2	Vibroseis Correlation	
3	Geometry and Trace Edit	
4	True Amplitude Gain Recovery	
5	Apply Refraction Statics	GMG Package, Correction Velocity=7000 ft/s
6	Surface Consistent Amplitude Analysis	
7	Minimum Phase Correction	
8	Surface Consistent Deconvolution	Type: Spiking, Operator: 160 msec, Noise: 0.1%
9	Spectral Enhancement	25-150 Hz
10	Common Depth Point Gather	
11	Iteration 1, Velocity/Mute Analysis	
12	Iteration 1, NMO Corrections/Mute	
13	Iteration 1, Surface Consistent Autostatics	
14	Iteration 2, Velocity/Mute Analysis	
15	Iteration 2, NMO Corrections/Mute	
16	Iteration 2, Surface Consistent Autostatics	
17	Linear Noise Attenuation Filter	
18	Time Variant Scaling Gates	
19	Iteration 3, Velocity/Mute Analysis	
20	Iteration 3, NMO Corrections/Mute	
21	Iteration 3, Surface Consistent Autostatics	
22	CDP Consistent Trim Statics	
23	Common Depth Point Stack	
24	Final Datum Correction	Line 1=2800 ft.; Line 2=2800 ft.
25	Spectral Balancing	25-150 Hz
26	FX Predictive Deconvolution Filter	

4.0 INTERPRETATION

The processed and interpreted seismic sections are displayed in Figures 4-1 and 4-2. In general, the seismic profiles illustrate nearly flat-lying stratigraphy throughout the section. Formation tops were correlated to the seismic sections using synthetic seismograms generated from the Saga Petroleum, Clark #1 Well, located in 2N-17E-12. As an example, the tie between the synthetic seismogram and Line #2 is illustrated in Figure 4-3. The slight misties between the synthetic and seismic line #2 are due to variations in the geology between the location of the Clark #1 Well and the location of the Creighton line. In spite of this, the synthetic ties quite well in the zone from the Carlisle formation to the Minnelusa. Within the zone of interest, the strong reflector at the top of the Muddy Formation is a key marker. The top of the Lakota formation corresponds to a comparatively weak but mappable positive reflection. The base of the Lakota also corresponds to a relatively weak but mappable positive reflection.

The formation tops as derived from the synthetic seismogram are illustrated on the interpreted stacked section with colored lines (Carlisle Sh=yellow, Greenhorn Sh=purple, Lakota Fm=green, and Morrison Fm=magenta). The estimated elevations of the interpreted formation tops are noted on the right side of the seismic sections. These elevation estimates were derived through a comparison of local well logs (Appendix A), the time to depth conversions based on stacking velocities, and interval velocities derived from the sonic log synthetic (Appendix A). The estimated depth error is $\pm 10\%$.

Primary Site- Line #1

The reflection event representing the top of the Lakota formation occurs at about 740 msec (refer to Figure 4-1), which corresponds to an elevation of approximately 310 ft below sea level. This event has a lower amplitude arrival than the overlying Muddy and Skull Creek formations, both of which have high amplitude arrivals. The reflection event representing the top of the Morrison formation (base of Lakota) occurs at about 760 msec, which corresponds to approximately 430 ft below sea level. The datum elevation (at time = 0 msec) for this section is 2800 ft above sea level. The Lakota formation appears continuous across the section, with a slight thickening of the formation evident on the west end of the line (shotpoints 110 to 120), and a slight thickening on the far eastern end (sp's 210-220). Note that the thickening on the east side of the line is somewhat suspicious, as it is occurring in the low fold portion at the edge of the line, where velocity control is the weakest. On the other hand, the Quinn #1 well is about 1.5 miles further east off the end of this profile, and had a Lakota section 160 feet thick. If one assumes that the Lakota thickening seen on the east side of Line #1 is real (which we have no way of knowing with certainty), then placing a well just beyond shotpoint 220 would be risky, but could result in an excellent water producer.

Underneath the proposed primary well location (sp 160.5), the Lakota is calculated to be approximately 110 feet thick. Drilling history has shown that, although there are other factors, the thicker the Lakota section, the more productive the water well becomes. Nowhere on Line #1 does the Lakota approach the thickness observed at the Quinn location. Therefore, water production here is predicted to be less than the Quinn #1. An additional 10 to 15 feet of Lakota thickness can be achieved by shifting the proposed well location roughly 2000 feet to the west (towards town), to the zone between shotpoints 110 and 120.

Secondary Site – Line #2

The reflection event representing the top of the Lakota formation occurs at about 715 msec (refer to Figure 4-3), which corresponds to approximately 340 ft below sea level. The reflection event representing the top of the Morrison formation occurs at about 740 msec, which corresponds to approximately 460 ft below sea level. The datum elevation (at time = 0 msec) for this section is 2800 ft above sea level. The Lakota formation appears relatively uniform and continuous across this seismic section. The thickness of the Lakota under the proposed secondary well location (shotpoint 160.5) is between 115 -120 ft. A slightly thicker Lakota section is apparent between shotpoints 170 and 190, where the thickness is calculated to be approximately 130 feet. It appears that any location along this profile is suitable for drilling, with the optimal position between shotpoints 170 and 190.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of the seismic reflection survey was to assist in the identification of a suitable well location to access the Lakota Formation, which is part of the Inyan Kara aquifer of South Dakota. The objective was to confirm the presence and lateral continuity of the Lakota Formation and to estimate the thickness of this unit. Additional observations of any geologic structures and anomalies identifiable in the seismic sections may also be useful in determining the suitability of a potential well location. The conclusions are:

- 1) From the seismic data, both the Primary (Line #1) and Secondary (Line #2) locations appear to be suitable well sites. The Lakota is calculated to be 110 feet thick below the primary location, and 115-120 feet thick below the secondary location.
- 2) Thicker Lakota sections can probably be found by shifting the proposed well locations. The primary well could be shifted west towards town from shotpoint 160.5 to the zone between shotpoints 110 to 120, where the Lakota appears to be slightly thicker by 10-15 feet. The secondary well could be shifted to the zone between shotpoints 170 to 190, again because the Lakota appears to be slightly thicker in this vicinity, on the order of 10-15 feet.
- 3) A riskier well could be drilled just beyond shotpoint 220 on the east end of Line #1, where the Lakota may be arching up and thickening towards the Quinn #1 well. However, the Lakota thickening observed in the seismic is somewhat suspicious, as it is on the edge of the survey line where velocity control is the weakest, and may therefore not be an accurate representation of the geology.

REFERENCES

- Case III, H. L., 1984, Hydrology of Inyan Kara and Dakota-Newcastle aquifer system, South Dakota, Proc. of the First C.V. Theis Conferences on Geohydrology, October 1982, Lincoln, NE, p. 147-165.
- Sheriff, R.E., Geldart, L.P., 1995, Exploration Seismology, 2nd edition, Cambridge University Press.
- Steeple, Don W., and Miller, Richard D., 1986, Seismic reflection methods applied to engineering, environmental, and ground water problems, Proc. of SAGEEP, March, Golden, CO, p. 409-460.

APPENDIX A

Generalized Stratigraphy and Borehole Information

System	Geologic unit
Tertiary	Ogallala Formation
	Arikaree Formation
	White River Formation
Cretaceous	Fort Union Fm
	Tongue River Mbr
	Cannonball Mbr
	Ludlow Mbr
	Hell Creek Formation
	Fox Hills Sandstone
	Mobridge Member
	Pierre Shale
	Sharon Springs Member
Cretaceous	Ardmore Bentonite
	Niobrara Formation
	Carlisle Shale
	Greenhorn Formation
	Belle Fourche Shale
	Mowry Shale
	Newcastle Sandstone
	Skull Creek Shale
Cretaceous	Basal silt
	Fall River Ss
Jurassic	Inyan Kara Gp
	Fuson Mbr
	Lakota Fm
Jurassic	?
	Morrison Formation
	Sundance Formation
	Gypsum Spring Formation
Triassic	
	Speartfish Formation
	Minnekahta Limestone
	Opeche Formation
Permian	
Pennsylvanian	Minnekusa Formation
Mississippian	
	Madison Limestone
	or
	Pahasapa Limestone
	Englewood Formation
Devonian	
Silurian	
Ordovician	
	Red River Formation
	or
	Whitewood Dolomite
	Winnipeg Formation
Cambrian	
	Deadwood Formation
Precambrian	

Generalized Stratigraphic Column of South Dakota

(modified from L.O. Anna, Anna Geosciences Inc.
written communication 1982, and Peterson 1979)

**LITHOLOGIC LOG FOR WEST RIVER/LYMAN JONES RURAL WATER SYSTEM
(QUINN #1)**

**PENNINGTON COUNTY, SOUTH DAKOTA
NW SE SEC 1, T1S, R16E**

DEPTH	GENERAL LITHOLOGY	SAMPLE DESCRIPTION	COMMENTS
PIERRE FORMATION			
0-80	Silty clay	multicolored silty calcareous clay - chips of pale and grayish yellow green silty clay with sand streaks. Yellowish gray to dusky yellow sandy clay with minor chips of v.f. grained dusky yellow sandstone	
80-650	Shale	Hard, platy olive black shale interbedded with siltstone. Minor chalky white calcareous clay-sized material	
650-850	Siltstone	olive black siltstone containing abundant sand and clayey (Marl) interlayers.	
850-1120	Sandy Siltstone	siltstone containing v.f. sand, interbedded with marl. Abundant dusky yellow sand streaks: scarce dusky yellow siltstone.	
1120-1150	Fossiliferous Shale	Olive gray shale with abundant shell fragments.	
1150-1310	Shale	Olive black chips with olive gray siltstone calcareous, v.f. sand and poorly indurated siltstone with white shell fragments and streaks of fine sand.	
1310-1330	Chalk and sandy shale	olive black, calcareous shale with silt and fine sand Interbedded with dark yellowish orange silty clay, minor iron staining some white chalk with yellowish gray non-calcareous shale	
1330-1535	Shale	Olive black shale, occasionally iron stained with interbedded olive black marl, yellowish gray non-calcareous shale and light gray to yellowish gray calcareous siltstone	
TOP OF NIOBRARA FORMATION			
1535-1690	Chalk and shale	Calcareous light gray shale. Abundant chalk	
TOP OF CARLILE FORMATION			
1690-1725	Shale	Dusky blue, fissile, non calcareous shale with biotite flakes, pale-dark yellowish brown noncalcareous shale, streaks of v.f. sand; fine angular calcareous sand	
1725-1745	Limestone/Sandstone	Blocky limestone interbedded with Iron stained calcareous sand, soft, silty blueish white v.f. non-calcareous sandstone and olive black shale.	
1745-1860	Shale	Grayish black non-calcareous shale with minor v.f. sand on	

bedding planes, small shell fragments and brownish black shale interbedded with pale brownish yellow limestone

1860-2115 Interbedded shale, sandstone, limestone

Shale and limestone interbedded with gray marl. olive gray calcareous sandstone with shows of dark yellowish orange sandstone and iron staining

TOP OF GREENHORN LIMESTONE

2115-2165 Limestone

Dark gray with rounded white calcareous grains. light gray sandy limestone with fine yellowish gray lime mudstone.

TOP OF BELLE FOURCHE SHALE

2165-2330 Shale

Brownish black, slightly fissile shale; abundant bentonite and minor yellowish brown calcareous shale

TOP OF MOWRY SHALE

2330-2435 Shale

Brownish black, fossiliferous shale, pyrite and oxidized iron stains; interbedded with white arkosic/calcareous sandstone, calcite veining and yellowish brown micaceous shale.

2435-2495 Interbedded shale and sandstone

Brownish black shale containing dolomite concretions, pyrite, calcite veining. Finely laminated brownish black and light olive gray shale with bentonite and calcite cemented v.f. sandstone

TOP OF DAKOTA SANDSTONE

2495-2700 Interbedded sandstone and shale

Fine grained, calcite cemented, light olive gray sandstone, with non-calcareous dark gray shale and olive black shale with iron staining in lower shales. Calcite cemented med sand size grains intermingled with pyrite.

TOP OF FUSON SHALE

2700-2905 Shale interbedded

Dark gray calcareous-non-calcareous shale, with minor amounts of yellowish brown siltstone pyrite sand and light gray fine grained sandstone, intermingled with reddish and yellowish sandstone

TOP OF LAKOTA SANDSTONE

2905-3065 Sandstone

Light olive gray v.f. to med. grained sub-angular to subrounded quartz sandstone. silica cemented sand friable. Minor white clay with black streaks. Coarser grained material 3030-3050

TOP OF MORRISON FORMATION

3065-3101 Shale

olive gray to light greenish waxy shale, white bentonite clay

Well Name Clark12 Sonic Logged
Location 6 miles SSW of Grindstone
Datum 2620

<u>Lithology</u>	<u>Depth to top</u>	<u>Elevation</u>	<u>Thickness</u>
Niobrara	1630	990	180
Carlile	1810	810	390
Greenhorn Fm	2200	420	148
Belle Fourche	2348	272	168
Mowry	2516	104	122
Muddy	2638	-18	131
Skull Creek Sh	2769	-149	201
Lakota Fm	2970	-350	130
Morrison Fm	3100	-480	46
Sundance Fm	3146	-526	310
Spearfish? Fm	3456	-836	204
Minnelusa Fm	3660	-1040	753
Madison Ls	4413	-1793	552
Red River Fm	4965	-2345	276
Winnipeg Fm	5241	-2621	214
Total Depth	5455	-2835	

Clark #12-4 1

DEUTRA Plotted On 29 March, 2001

Sample Rate: 1.00 Milliseconds

Zero Time at Start of Log

Well Information:

Well Name: SAGA PETROLEUM U.S., INC. NO. 1 CLARK

Location: NW/4 12-2N-17E

Title: PENNINGTONSOUTH DAKOTAUSA

Date Drilled: ***

Kelly Bushing: 2620.00 - DATA

Reflection Coefficients Calculated from Sonic values only. Integrated by Windows

Program: Converted from LAS Format

Seismic Information:

Trace Scale: 18.00 traces/inch

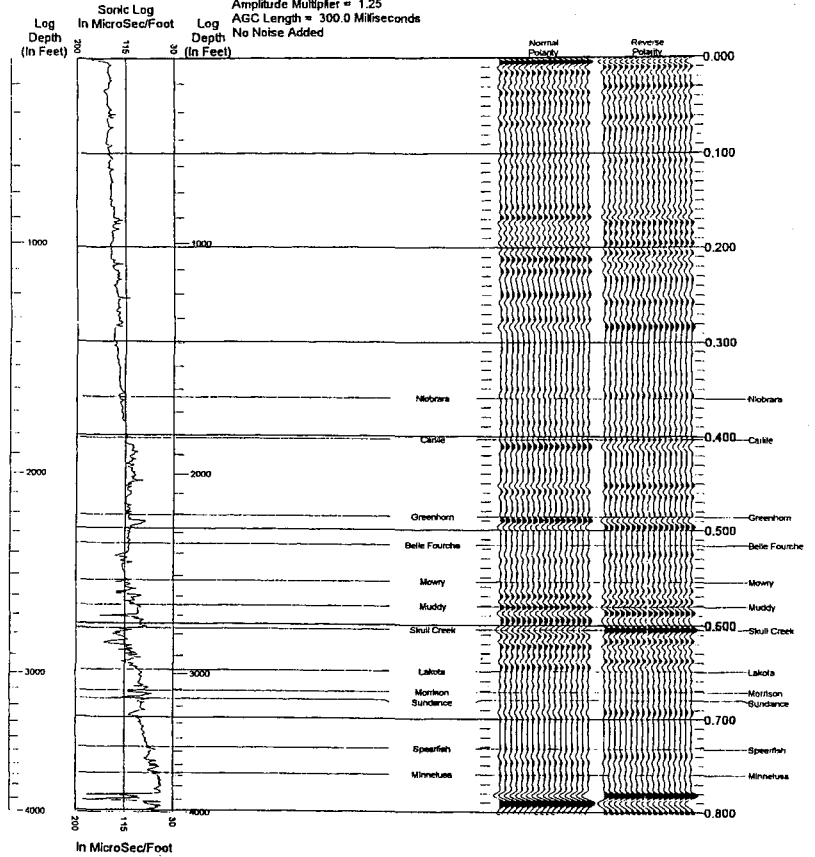
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Datum Not Used

Amplitude Multiplier = 1.25

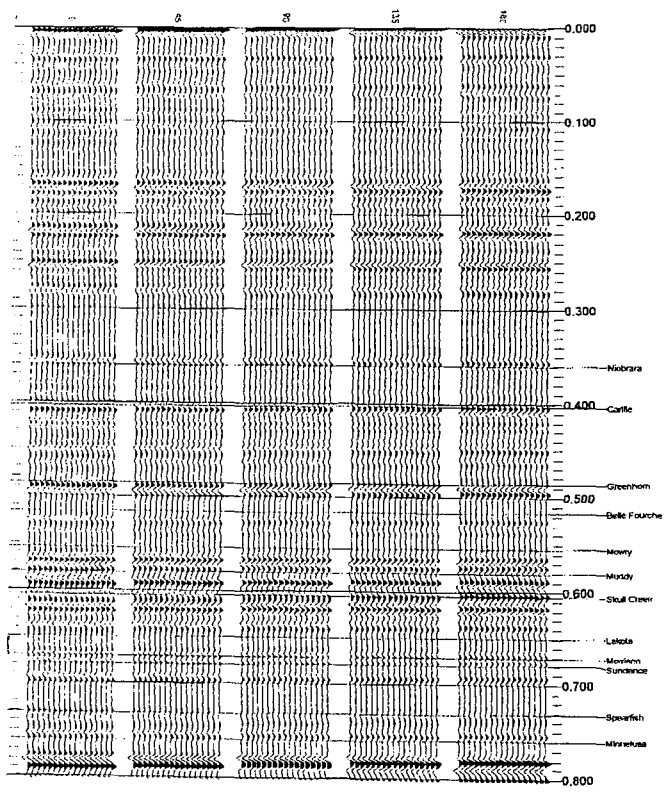
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No Noise Added





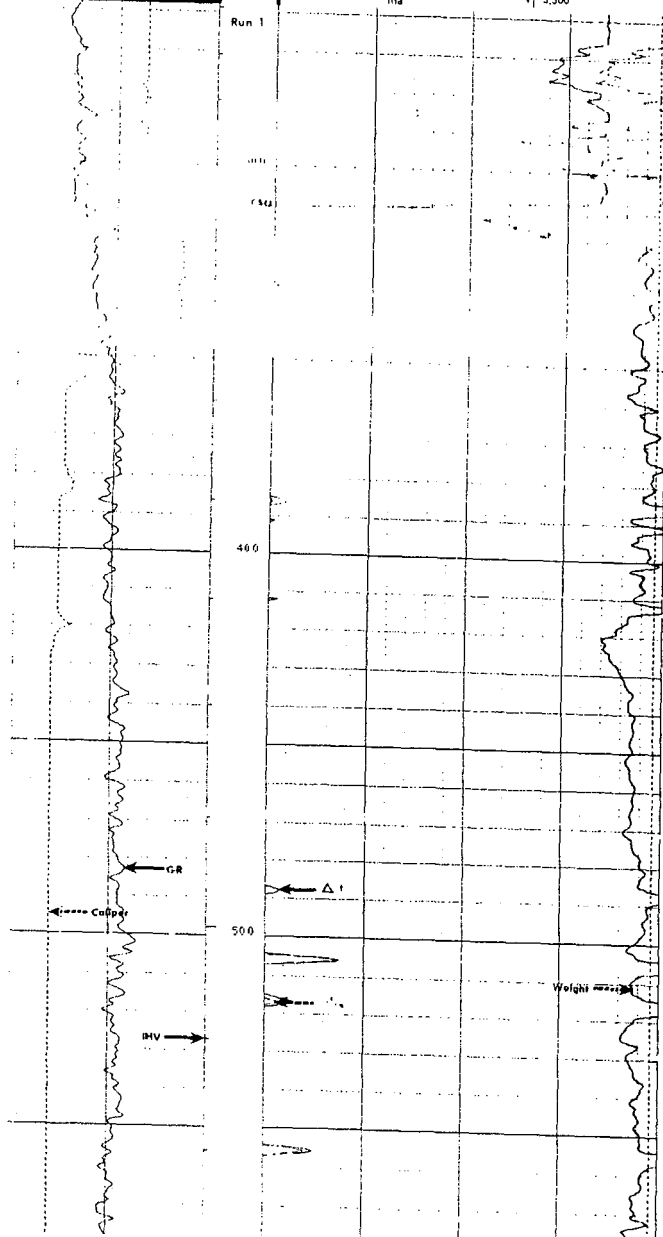
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2970
MOR 130N
3100

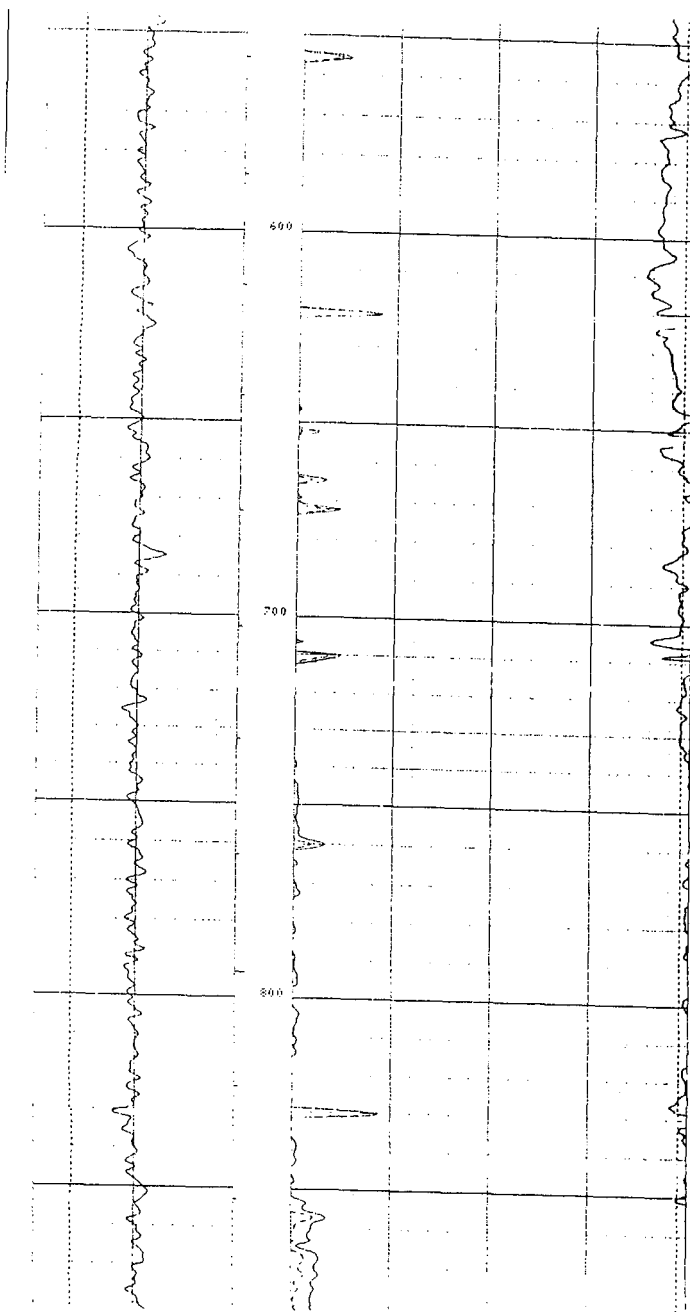


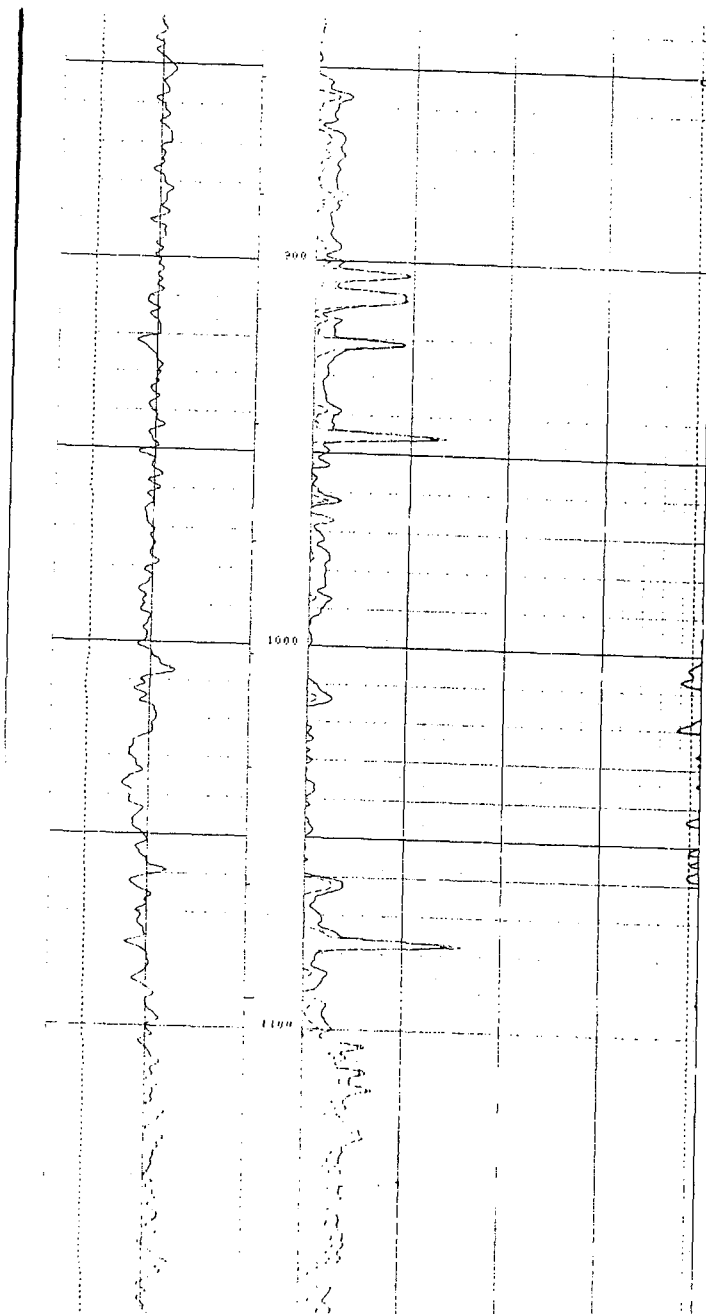
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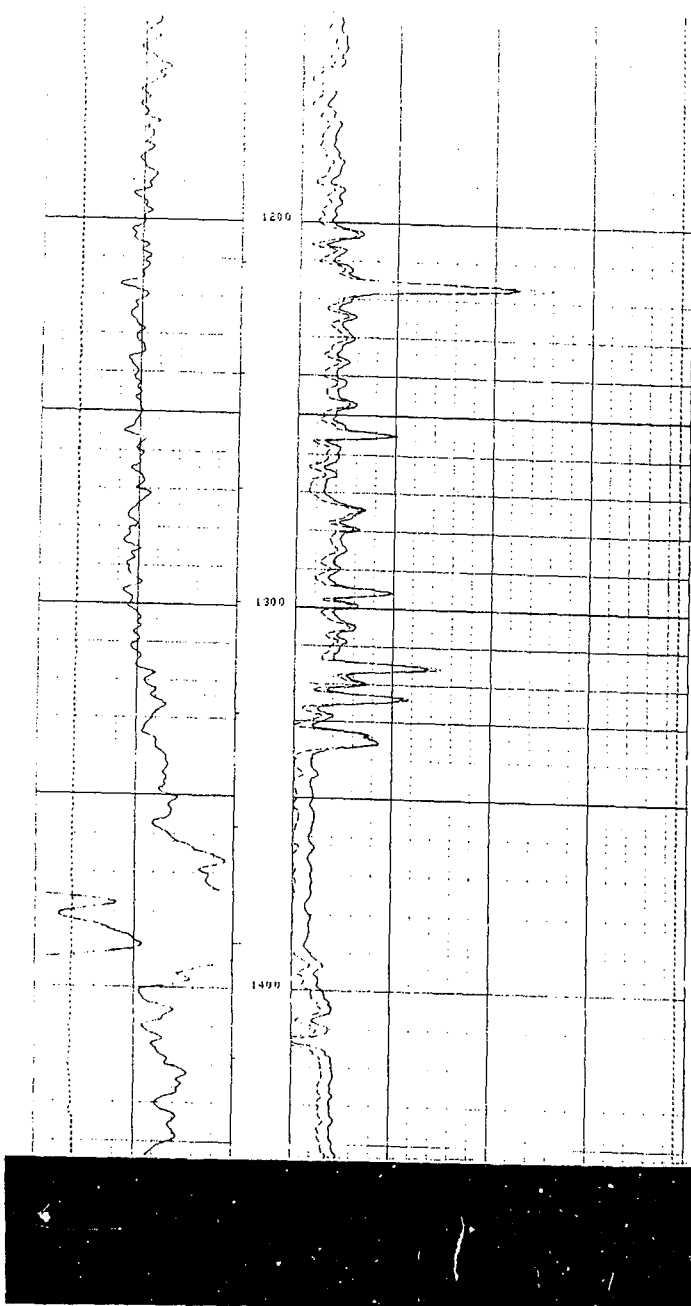
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200 400

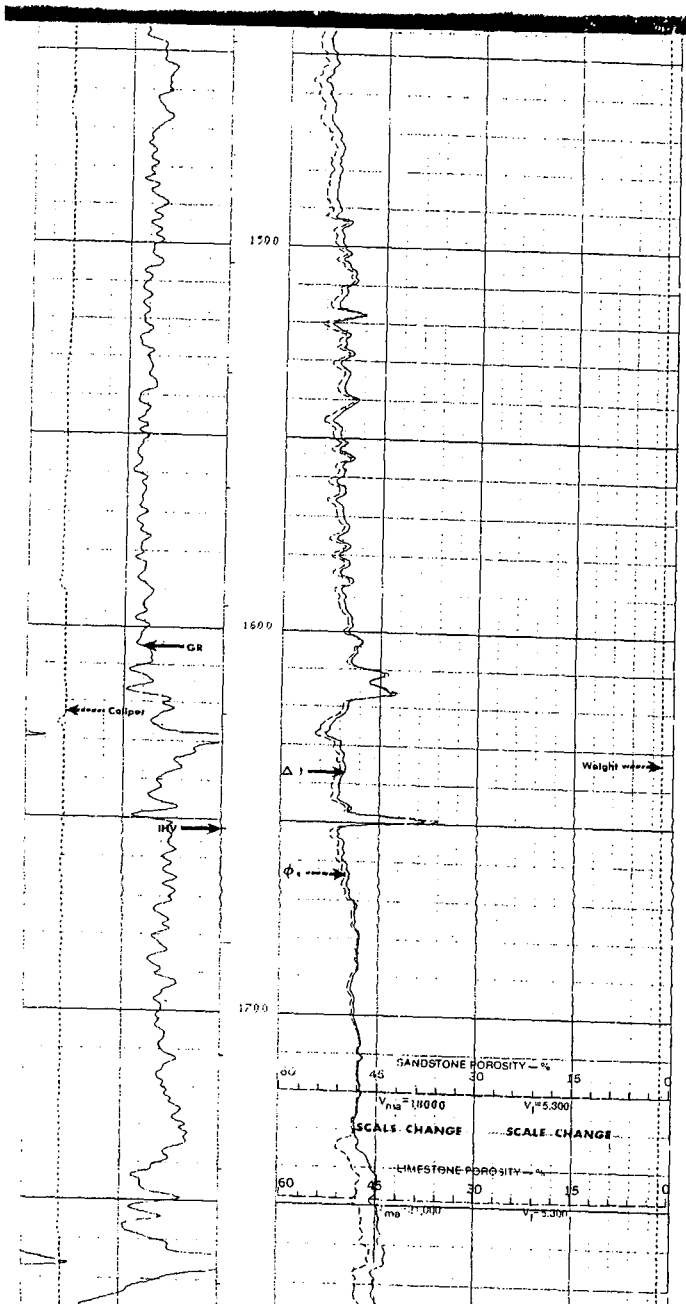
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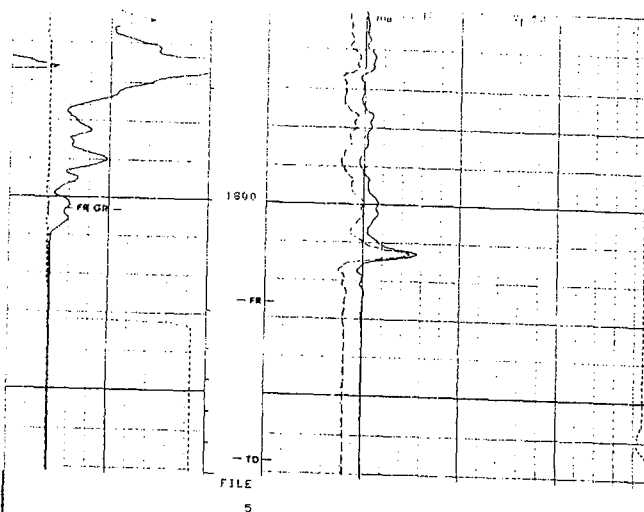










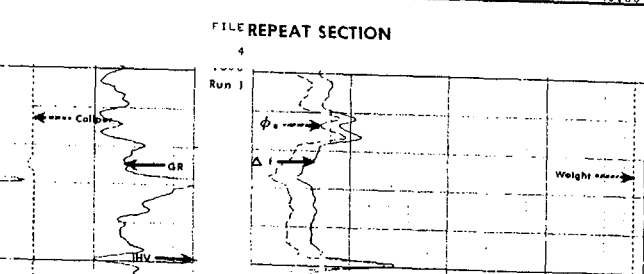


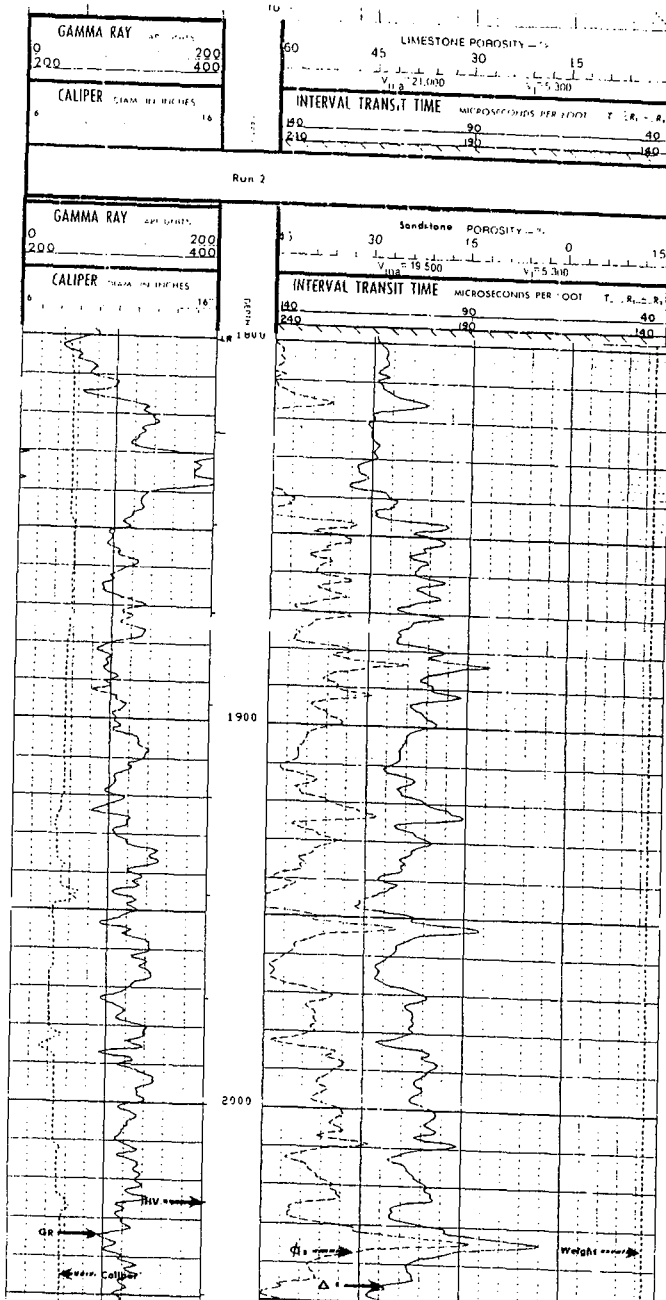
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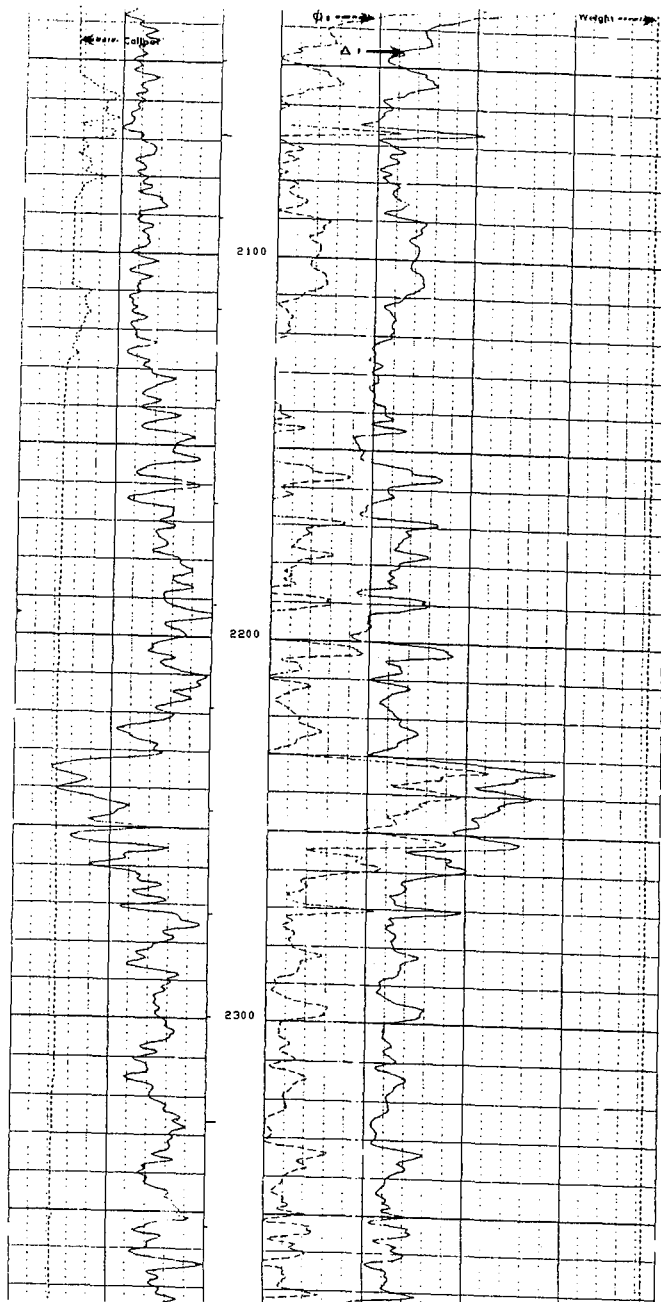
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PAT	38.9 FEET	CTL	41.4 FEET
UP	61.6 FEET	TT	41.4 FEET
ILD	6.9 FEET	CHLI	29.3 FEET
ILM	3.3 FEET	SPL	2.9 FEET
SPAR	.0 FEET	SP	.0 FEET
HTS	33.2 FEET	TENS	.0 FEET

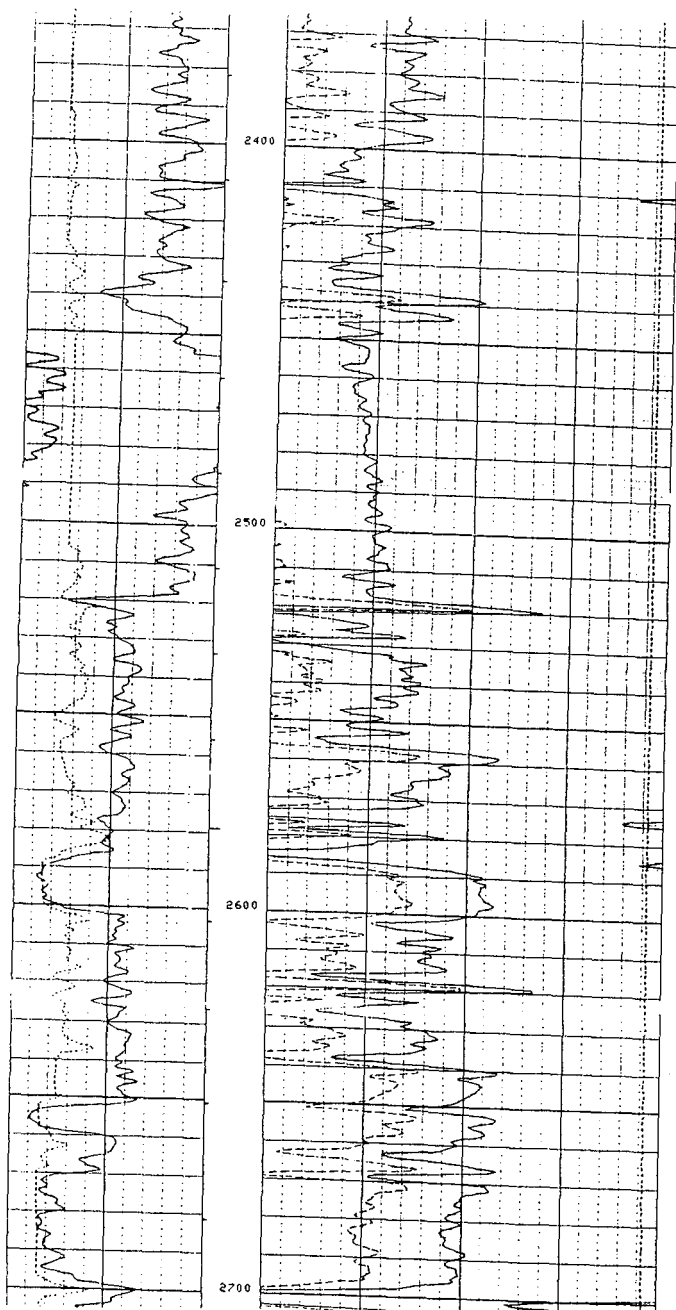
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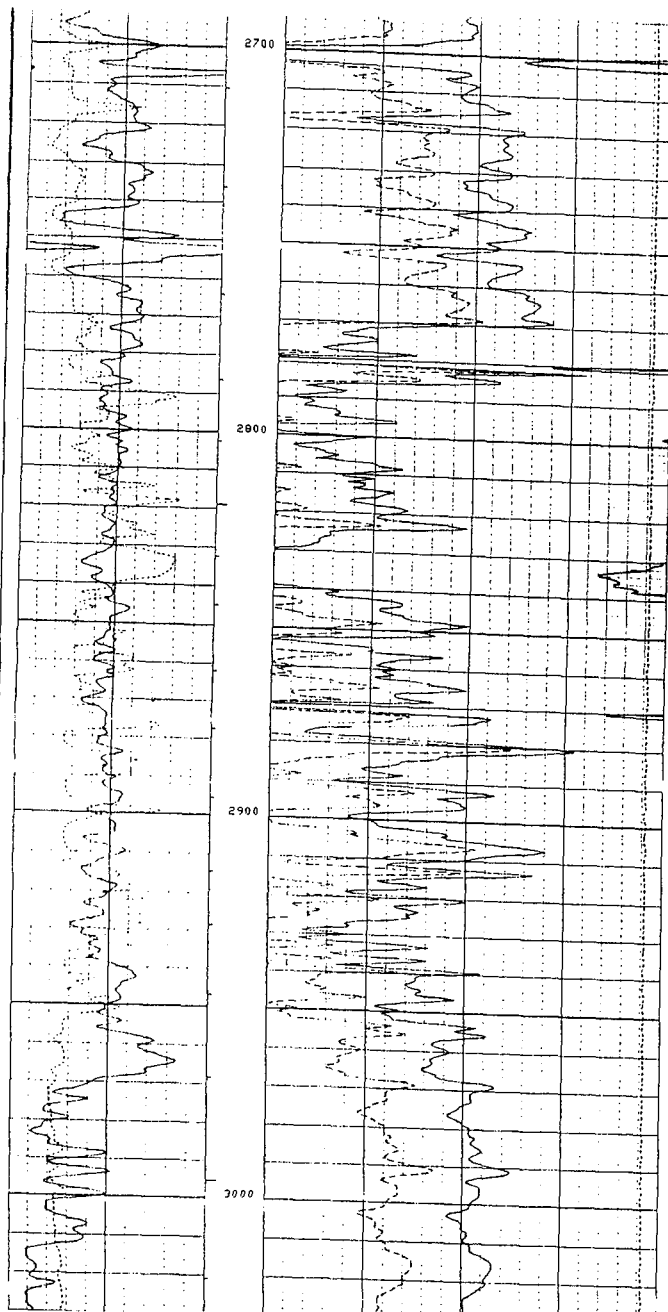
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			140.0				

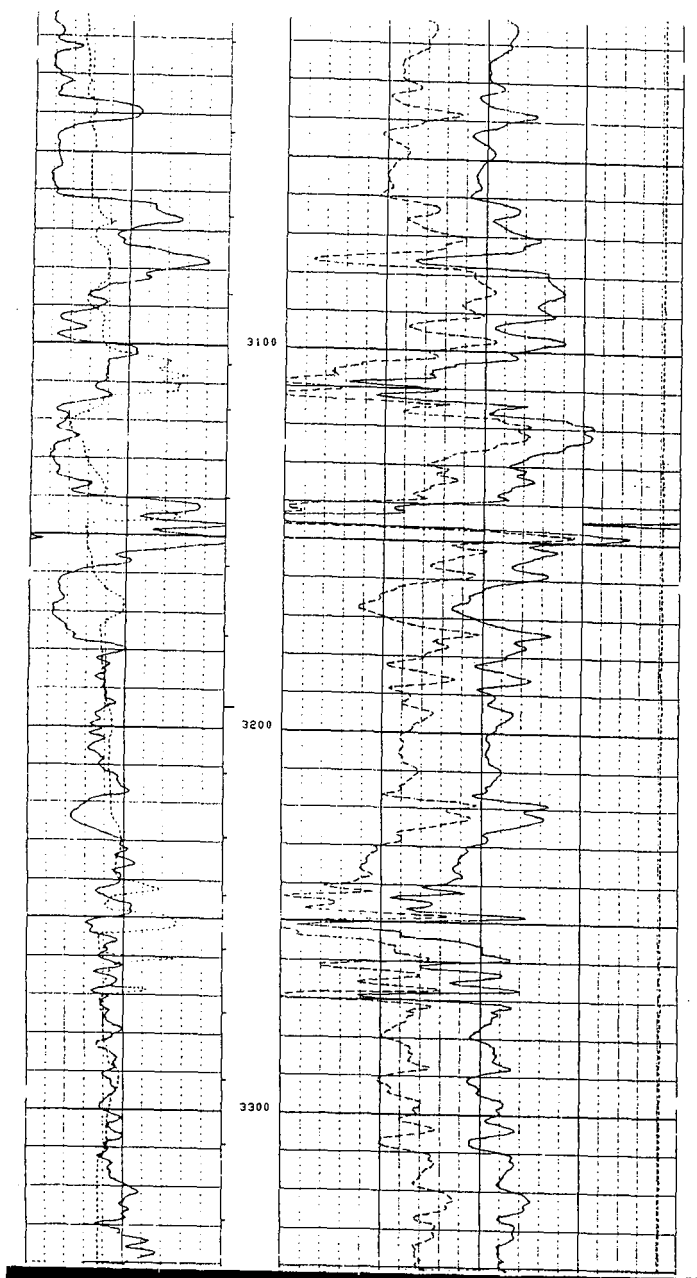


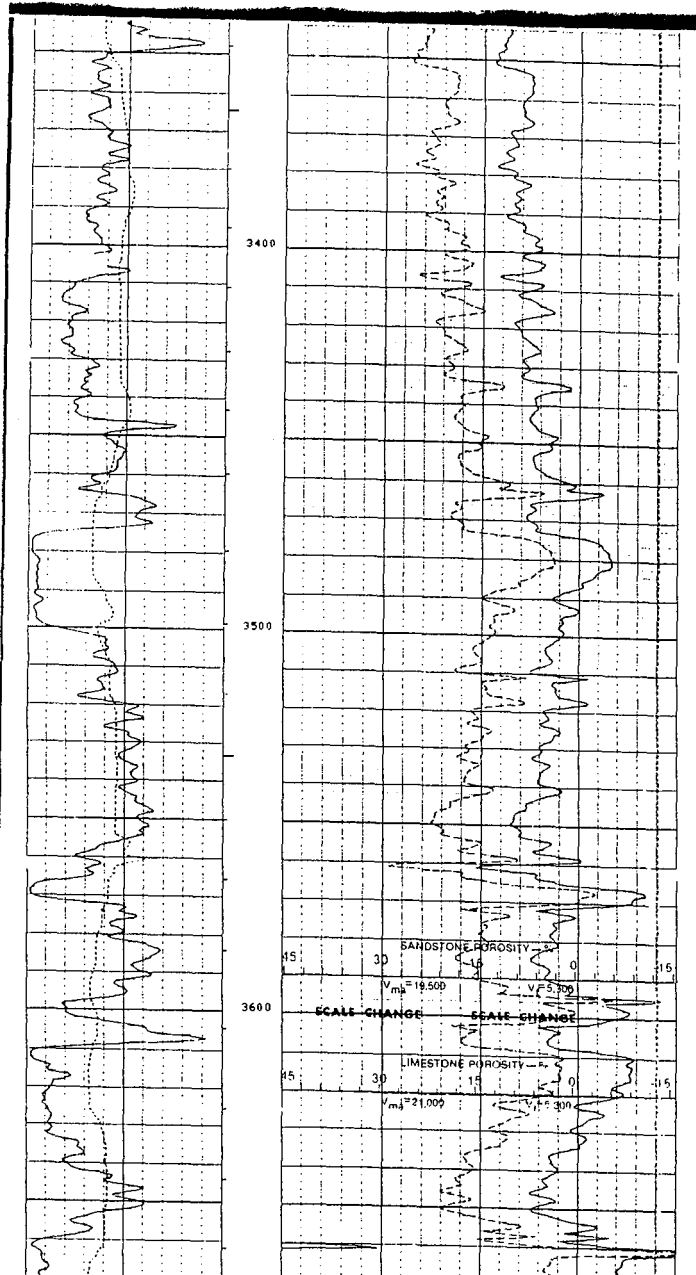


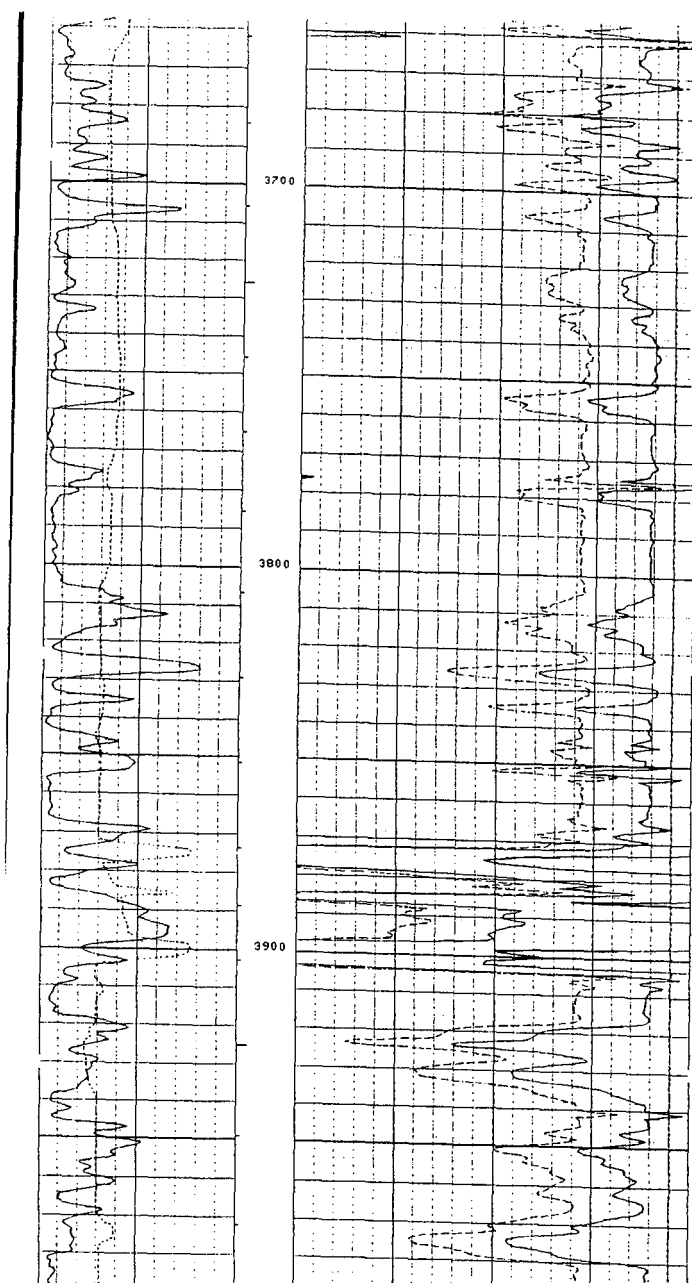


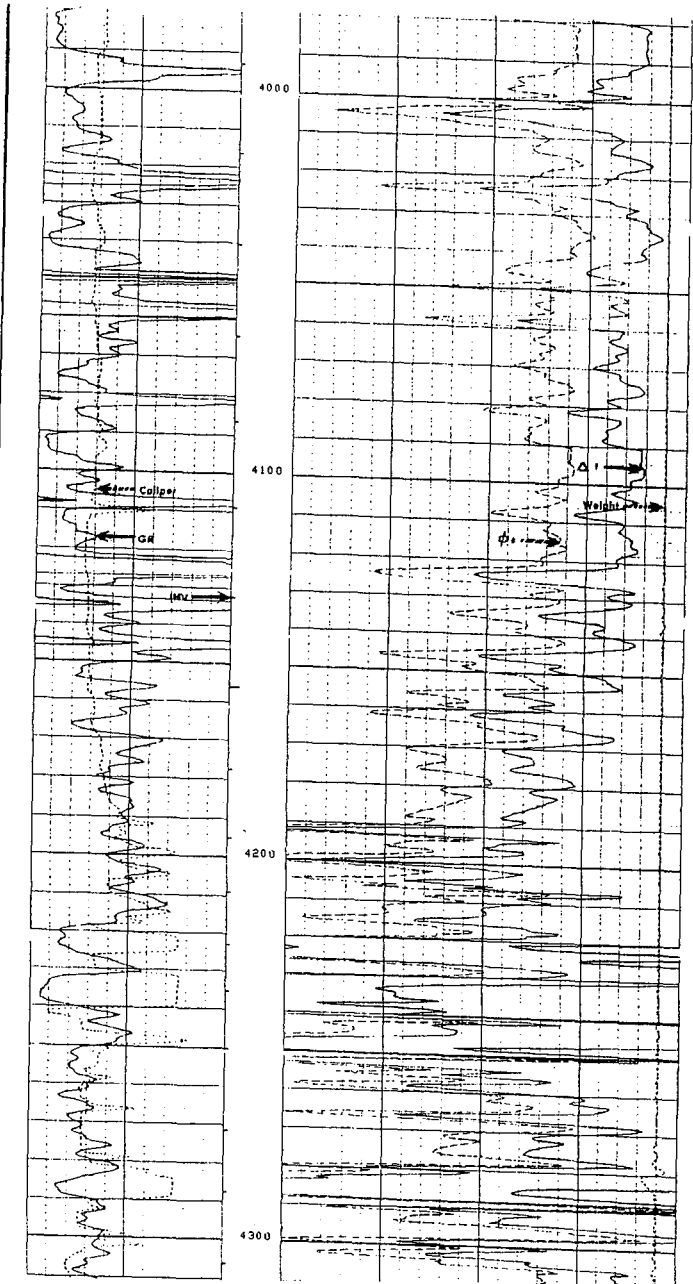


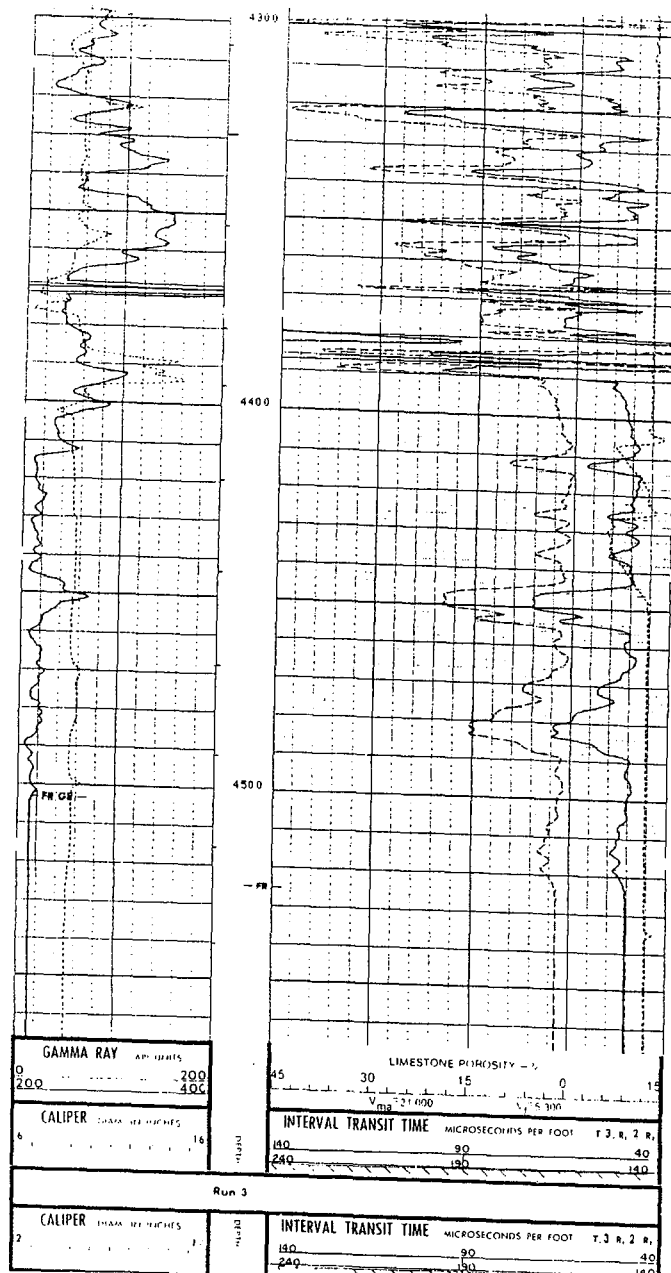




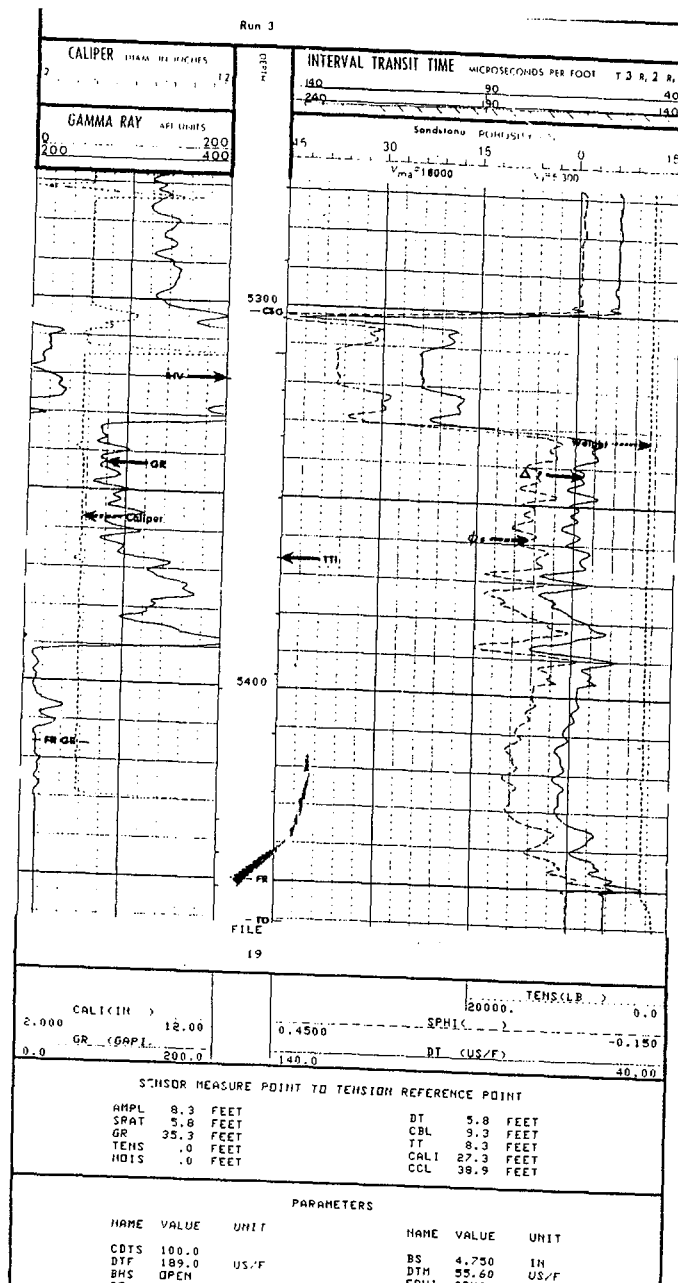


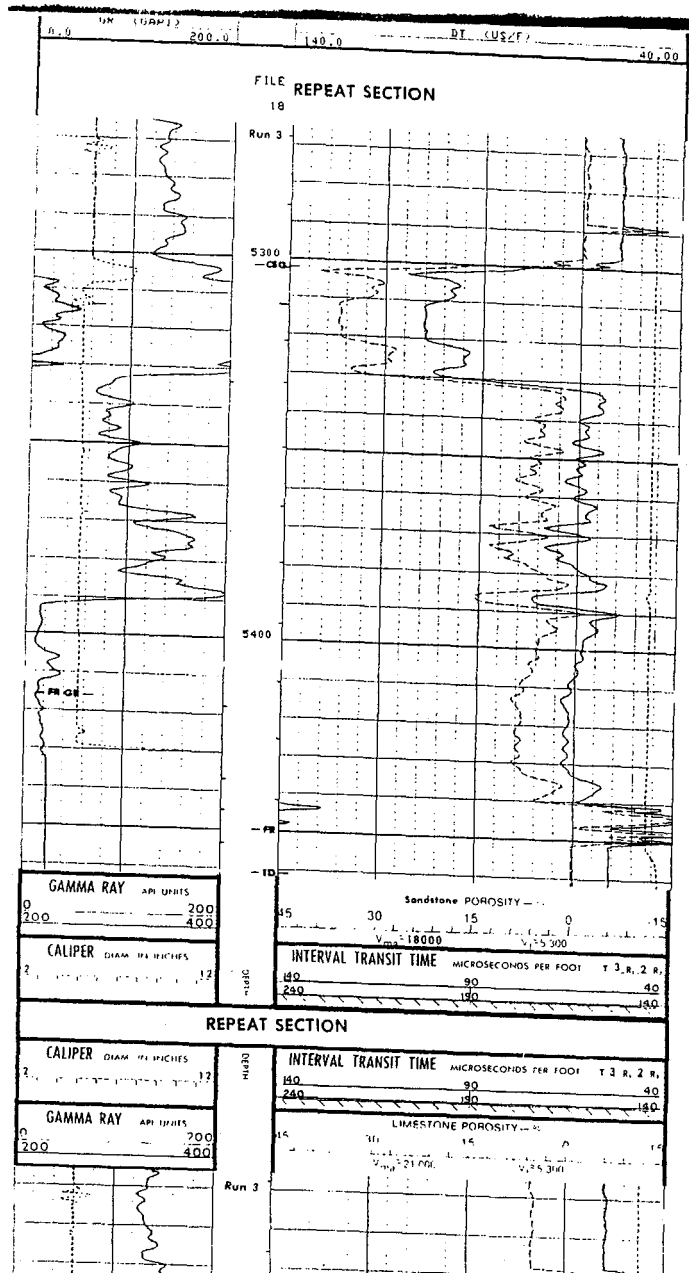


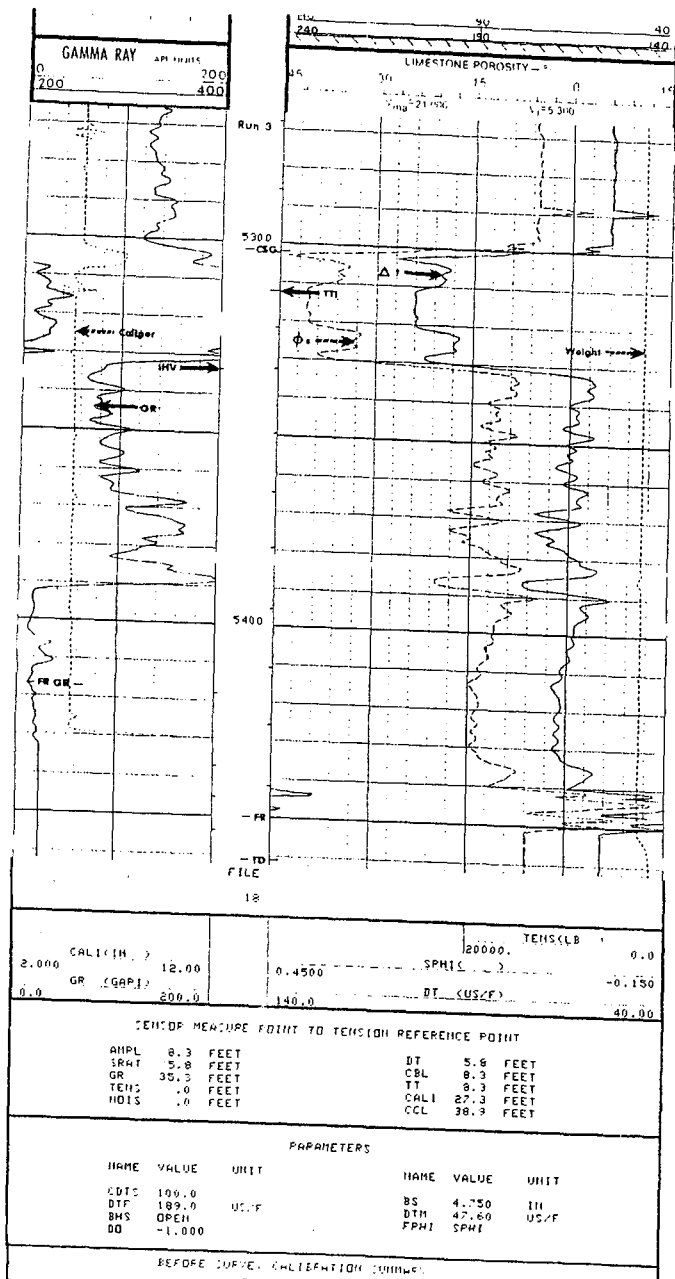




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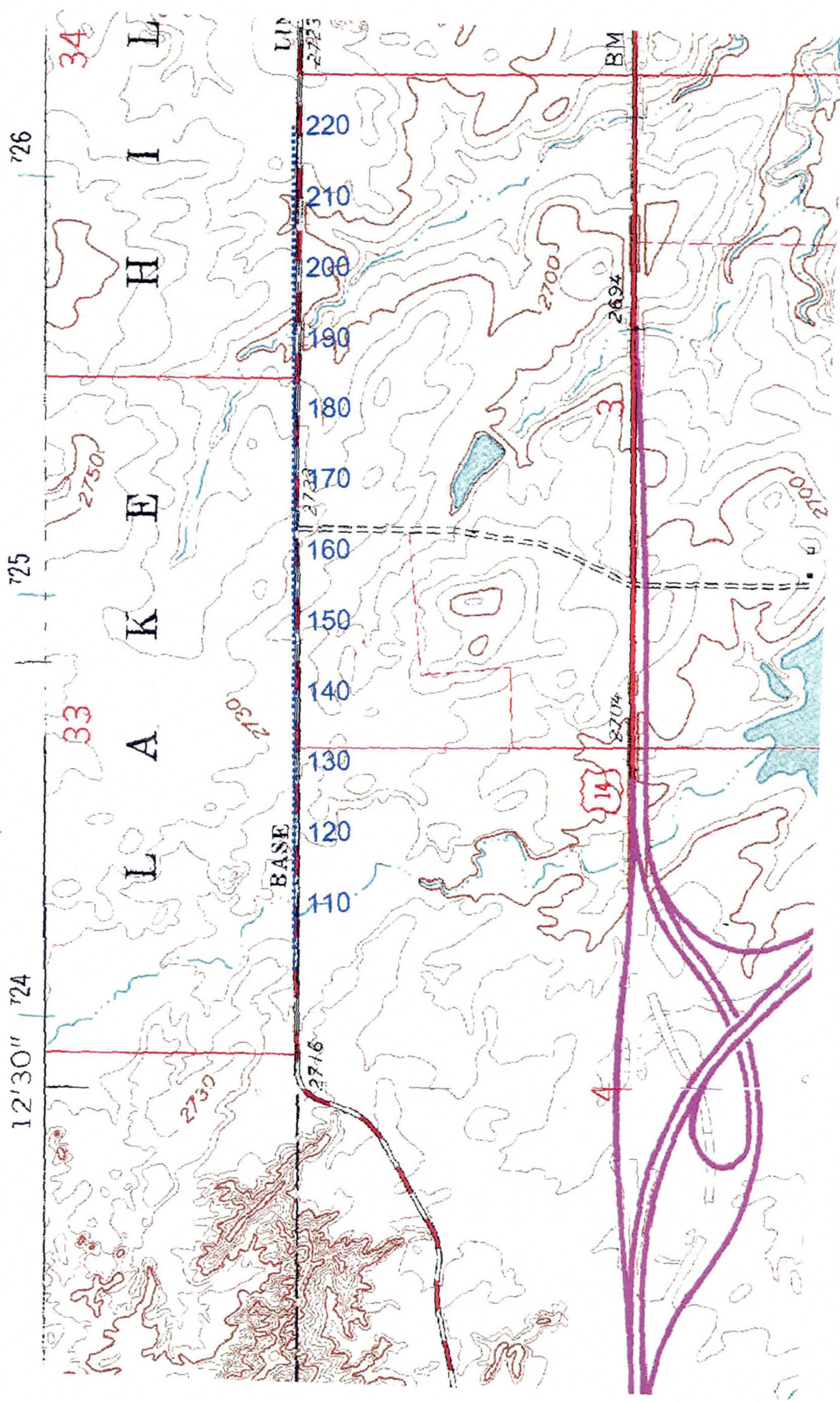


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	MEASURED				CALIBRATED				
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ILM	0.0	554.8			0.0	500.0		MMHO	
SFL	0.0	564.5			0.0	500.0		MMHO	
ILD	SONDE ERROR CORRECTION :				3.6	MMHO			
ILM	SONDE ERROR CORRECTION :				3.9	MMHO			
SGTE DETECTOR CALIBRATION SUMMARY									
	MEASURED				CALIBRATED				
GR	BKGD	JIG						UNITS	
	42	135			165			GAPI	
MCDB CALIPER CALIBRATION SUMMARY									
	MEASURED				CALIBRATED				
	SMALL	LARGE			SMALL	LARGE		UNITS	
CALI	7.4	11.3			8.0	12.0		IN	
	FILE								
2									
BEFORE SURVEY CALIBRATION SUMMARY									
Run 2									
PERFORMED: 81/09/24									
PROGRAM FILE: ISS (VERSION 20.2 00/00/00)									
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	ZERO	PLUS			ZERO	PLUS		UNITS	
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ILM	4.5	536.2			0.0	500.0		MMHO	
SFL	0.1	506.0				500.0		MMHO	
ILD	SONDE ERROR CORRECTION :				5.5	MMHO			
ILM	SONDE ERROR CORRECTION :				5.9	MMHO			
SGTE DETECTOR CALIBRATION SUMMARY									
	MEASURED				CALIBRATED				
GR	BKGD	JIG						UNITS	
	51	137			165			GAPI	
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	MEASURED				CALIBRATED				
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	FILE								
9									
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	MEASURED				CALIBRATED				
GR	BKGD	JIG						UNITS	
	44	191			165			GAPI	
MCDB CALIPER CALIBRATION SUMMARY									
	MEASURED				CALIBRATED				
	SMALL	LARGE			SMALL	LARGE		UNITS	
CALI	7.2	11.2			8.0	12.0		IN	
	FILE								
0									

CALIBRATION RECORD

CALIBRATION RECORD

COMPANY	DATE	SCHL. FR.
WELL	TIME	SCHL. TO
FIELD	DRIR	ID.
COUNTY	STATE	Elev. KB
		DF.
		GI.



0 2000 4000
Scale in Feet



301 Commercial Road,
Suite B
Golden, Colorado 80401
Phone: (303) 278-8700
Fax: (303) 278-0789
Web: www.blackhawkgeo.com

Project No:
5062

Date:
October, 2006

Drawn By:
HJV

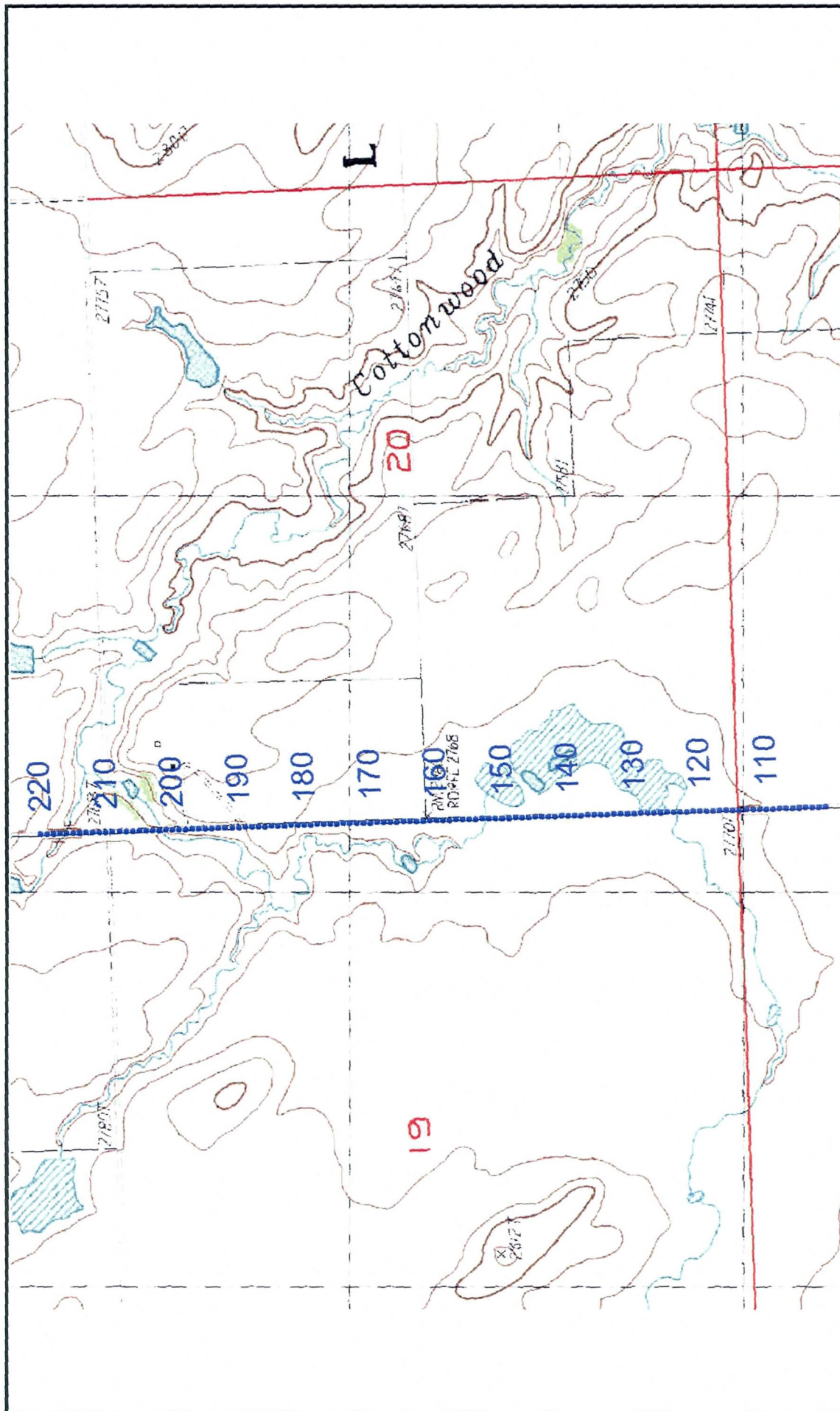
Checked By:
SH

Scale:
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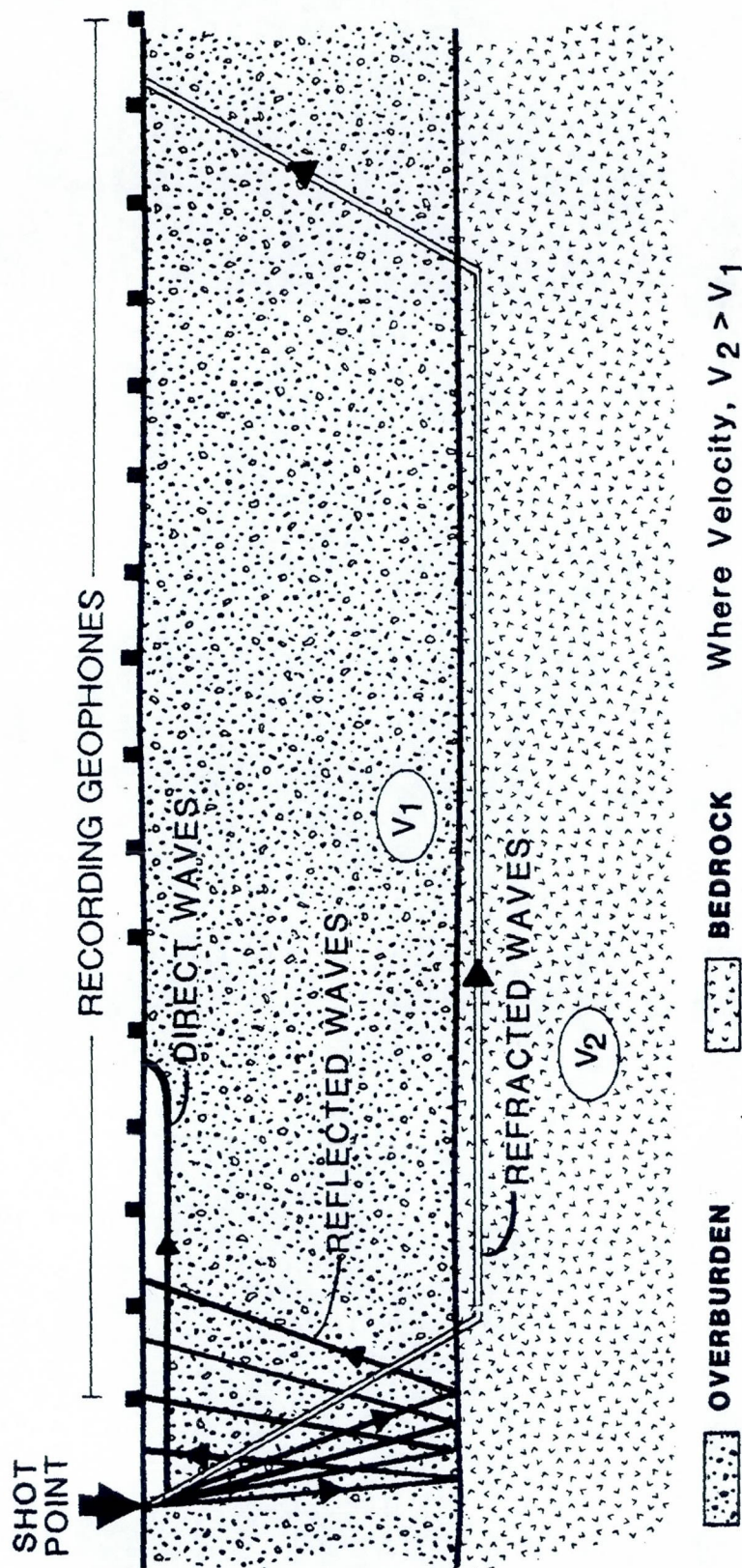
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1-2

Seismic Reflection Survey
Primary Location Line #1
Wall, South Dakota

City of Wall
South Dakota

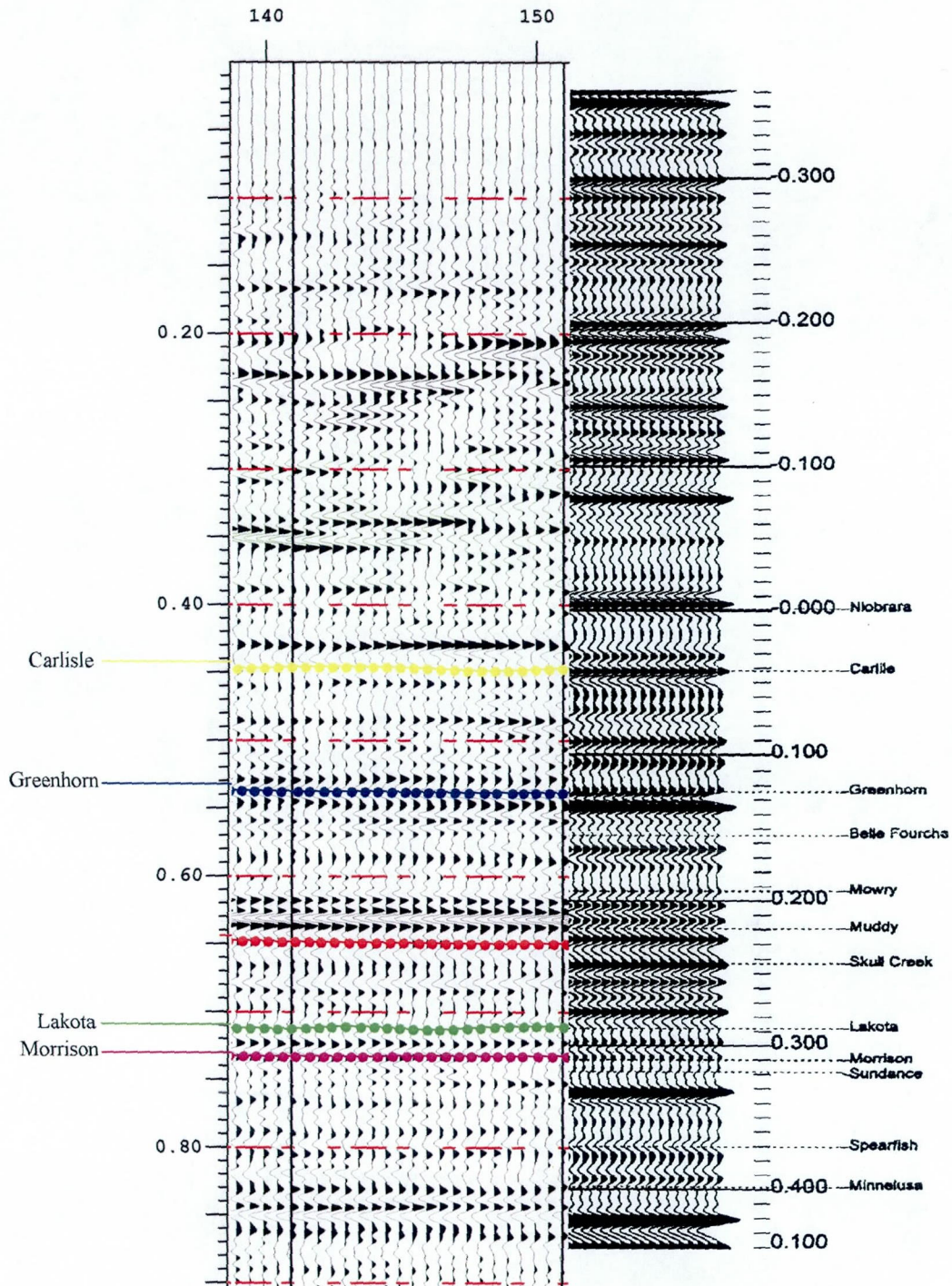


 BLACKHAWK A DIVISION OF ZAPATA ENGINEERING	City of Wall South Dakota	Seismic Reflection Survey Secondary Location Line #2 Wall, South Dakota
Project No: 5062	Date: October, 2006	Checked By: SH
301 Commercial Road, Suite B Golden, Colorado 80401	Phone: (303) 278-8700 Fax: (303) 278-0789 Web: www.blackhawkgeo.com	Scale: 1"=2000'
		Figure: 1-3



 BLACKHAWK A DIVISION OF ZAPATA ENGINEERING	City of Wall South Dakota			Seismic Raypath Geometry		
301 Commercial Road, Suite B Golden, Colorado 80401 Phone: (303) 278-8700 Fax: (303) 278-0789 Web: www.blackhawkgeo.com	Project No: 5062	Date: October, 2006	Drawn By: HJV	Checked By: SH	Scale: No Scale	Figure: 2-1

Line #2



City of Wall
South Dakota

Correlation between Synthetic
Seismogram from Clark #1
Well and Reflection Profile

301 Commercial Road,
Suite B
Golden, Colorado 80401
Phone: (303) 278-8700
Fax: (303) 278-0789
Web: www.blackhawkgeo.com

Project No:

5062

Date:

October, 2006

Drawn By:

HJV

Checked By:

SH

Scale:

No Scale

Figure:

4-3

SOUTH DAKOTA WATER WELL COMPLETION REPORT

2596-2
11-02

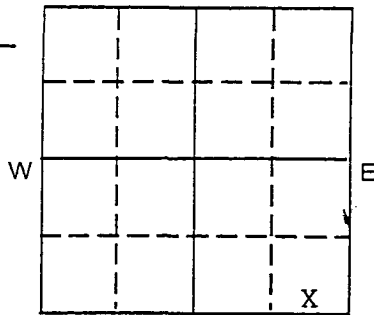
Location SE 1/4 SE 1/4 Sec 33 Twp 1N Rg 16E

County

Pennington

North

Please mark well location with an "X"



Well Completion Date

Dec. 19, 2007

1 Mile

Distance to nearest potential pollution source (Septic tank, abandoned well, feed lot, etc.)

? ft. from unknown (identify source)

PROPOSED USE:

☐ Domestic/Stock ☒ Municipal ☐ Business ☐ Test Holes
☐ Irrigation ☐ Industrial ☐ Institutional ☐ Monitoring well

METHOD OF DRILLING:

Rotary Mud

CASING DATA: ☒ Steel ☐ Plastic ☐ Other

If other describe

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
62.58 LB/FT	16 IN	0 FT	40 FT	20 IN
40.5 LB/FT	10 3/4 IN	0 FT	1810 FT	14 3/4 IN
23 LB/FT	7 IN	1762 FT	3224 FT	9 1/2 IN

GROUTING DATA:

Grout Type	No. of Sacks	Grout Weight	From	To
Lite	720	12.7 Lb/gal	1810 Ft	0 Ft
Class G	330	15.8 Lb/gal	" Ft	" Ft
Describe grouting procedure Pressure grouted by Basic				
Lite	300	12.7	3006	1762
Class G	100	15.8	"	"

SCREEN:

☐ Perforated pipe ☒ Manufactured

Diameter 7 Inches Length 100 Feet

Material stainless steel

Slot Size 0.015 Set From 3030 Feet to 3096 Feet

Other information 3168 3202

WAS A PACKER OR SEAL USED? ☒ Yes ☐ No

If so, what material? Neoprene rubber

Describe packer(s) and location

3006, 3010, 3030, 3168

DISINFECTION: Was well disinfected upon completion?

☒ Yes, How? Calcium

Lab sample sent to for water quality analysis ☐ No, Why Not? hypochloride

Energy Labs

Well Owner: City of Wall

Business Name:

Address: PO Box 314

City, State, Zip: Wall, South Dakota 57793

WELL LOG:

DEPTH

FORMATION

FROM

TO

STATIC WATER LEVEL

540

FEET

If flowing: closed in pressure

PSI

GPM flow

through

Inch pipe

Controlled by ☐ Valve

☐ Reducers

☐ Other

Reduced flow rate

GPM

Can well be completely shut in?

WELL TEST DATA:

☒ Pumped Describe:

☐ Bailed

☐ Other

Pumping Level Below Land Surface

918

Ft. After 48

Hrs. pumped

250

GPM

Ft. After

Hrs. pumped

GPM

If pump installed, pump rate:

GPM

REMARKS

RECEIVED

FEB - 4 2008

WATER RIGHTS
PROGRAM

This well was drilled under license # 604

And this report is true and accurate.

Drilling firm: Weston Engineering, Inc.

Signature of License Representative:

Signature of Well Owner or Equitable Property Holder:

Date:

**LITHOLOGIC LOG FOR TOWN OF WALL
(WALL #)
PENNINGTON COUNTY, SOUTH DAKOTA
SE SE SEC 33, T1N, R16E**

DEPTH	GENERAL LITHOLOGY	SAMPLE DESCRIPTION	COMMENTS
0-2	Top Soil	Dark Brown to Black	
WHITE RIVER FORMATION			
2-55	Clay, siltstone Sandy siltstone	multicolored clay and siltstone brown sandy siltstone and sand	
PIERRE FORMATION			
55-170	Silty clay	multicolored silty calcareous clay - chips of pale and grayish yellow green silty clay with sand streaks. Yellowish gray to dusky yellow sandy clay with minor chips of v.f. grained dusky yellow sandstone	
170-850	Shale	Hard, platy olive black shale interbedded with siltstone. Minor chalky white calcareous clay-sized material	
850-1060	Siltstone	olive black siltstone containing abundant sand and clayey (Marl) interlayers.	
1060-1210	Sandy Siltstone	siltstone containing v.f. sand, interbedded with marl. Abundant dusky yellow sand streaks: scarce dusky yellow siltstone.	
1210-1792	Shale	Olive black shale, occasionally iron stained with interbedded olive black marl, yellowish gray non-calcareous shale and light gray to yellowish gray calcareous siltstone	
TOP OF NIOBRARA FORMATION			
1792-1826	Chalk and shale	Calcareous light gray shale. Abundant chalk	
TOP OF CARLILE FORMATION			
1826-2058	Shale	Dusky blue, fissile, non calcareous shale with biotite flakes, pale-dark yellowish brown noncalcareous shale, streaks of v.f. sand; fine angular calcareous sand	
2058-2152	Limestone/Sandstone	Blocky limestone interbedded with iron stained calcareous sand, soft, silty blueish white v.f. non-calcareous sandstone and olive black shale.	
2152-2242	Shale	Grayish black non-calcareous shale with minor v.f. sand on bedding planes, small shell fragments and brownish black shale interbedded with pale brownish yellow limestone	

TOP OF GREENHORN LIMESTONE

2242-2270	Limestone	Dark gray with rounded white calcareous grains. light gray sandy limestone with fine yellowish gray lime mudstone.
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TOP OF BELLE FOURCHE SHALE

2270-2450	Shale	Brownish black, slightly fissile shale; abundant bentonite and minor yellowish brown calcareous shale
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TOP OF MOWRY SHALE

2450-2590	Shale	Brownish black, fossiliferous shale, pyrite and oxidized iron stains; interbedded with white arkosic/calcareous sandstone, calcite veining and yellowish brown micaceous shale.
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TOP OF MUDDY FORMATION

2590-2662	Interbedded shale and sandstone	Brownish black shale containing dolomite concretions, pyrite, calcite veining. Finely laminated brownish black and light olive gray shale with bentonite and calcite cemented v.f. sandstone
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2662-2674	Sandstone	Fine grained, light olive gray v.f. to med. grained sub-angular to subrounded quartz sandstone. silica cemented sand friable.
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2674-2710	Interbedded shale and sandstone	Brownish black shale containing dolomite concretions, pyrite, calcite veining. Finely laminated brownish black and light olive gray shale with bentonite and calcite cemented v.f. sandstone
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TOP OF DAKOTA SANDSTONE

2710-2782	Interbedded sandstone and shale	Fine grained, calcite cemented, light olive gray sandstone, with non-calcareous dark gray shale and olive black shale with iron staining in lower shales. Calcite cemented med sand size grains intermingled with pyrite.
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2782 - 2796	Sandstone	Fine grained, light olive gray v.f. to med. grained sub-angular to subrounded quartz sandstone. silica cemented sand friable.
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2796 - 2810	Shale	Brownish black, fossiliferous shale, pyrite and oxidized iron stains; interbedded with white arkosic/calcareous sandstone, calcite veining and yellowish brown micaceous shale.
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2810 - 2862	Sandstone	Light olive gray v.f. to med. grained sub-angular to subrounded quartz sandstone. silica cemented sand friable.
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TOP OF FUSON SHALE

2862 - 3032	Shale interbedded	Dark gray calcareous-non-calcareous shale, with minor amounts of yellowish brown siltstone pyrite sand and light gray fine grained sandstone, intermingled with reddish and yellowish sandstone
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TOP OF LAKOTA SANDSTONE

3032 - 3094	Sandstone	Light olive gray v.f. to med. grained sub-angular to subrounded quartz sandstone. silica cemented sand friable.
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3094 - 3170	Shale interbedded	Dark gray calcareous-non-calcareous shale, light gray fine grained sandstone, intermingled with white clay with black streaks
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3170 - 3194	Sandstone	Light olive gray v.f. to med. grained sub-angular to subrounded quartz sandstone. silica cemented sand friable. Minor white clay with black streaks.
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TOP OF MORRISON FORMATION

3194 - 3225 Shale

olive gray to light greenish waxy shale, white bentonite clay

LABORATORY ANALYTICAL REPORT**CLIENT:** Weston Engineering-Upton**Project:** Wall WSW 7**Report Date:** 06/08/07**Lab ID:** R07060125-001 **Matrix:** DRINKING WATER**Collection Date:** 06/07/07 09:40**Client Sample ID:** Orifice Discharge**Received Date:** 06/07/07 11:30**Sampled By:** Not Given

Analyses	Result	Units	Safe/Unsafe	Qual	Method	Analysis Date / By
MICROBIOLOGICAL						
Bacteria, Total Coliform	Absent	P/A	SAFE		A9223 B	06/07/07 12:00 / JM
Bacteria, E-Coli Coliform	Absent	P/A			A9223 B	06/07/07 12:00 / JM

Comments: The notation "SAFE" indicates that the water was bacteriologically SAFE when sampled.

The notation "UNSAFE" indicates that the water was bacteriologically UNSAFE when sampled.

Method Reference: E - EPA / MCAWW Methodology A - Standard Methods 19th Ed.



ENERGY LABORATORIES, INC. * 2821 Plant Street * Rapid City, SD 57702-0335
Toll Free 888.672.1225 * 605.342.1225 * FAX 605.342.1397 * rapid_city@energylab.com

LABORATORY ANALYTICAL REPORT

Client: Weston Engineering-Upton
Project: Wall WSW 7
Lab ID: R07050175-001
Client Sample ID: Well #7

Report Date: 05/17/07
Collection Date: 05/10/07 09:00
Date Received: 05/10/07
Matrix: AQUEOUS

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
PHYSICAL PARAMETERS								
Conductivity @ 25 C	2350	umhos/cm		5		1	A2510 B	05/16/07 15:43/CH
pH	8.36	s.u.		0.010		1	A4500-H B	05/14/07 12:01/CH
INORGANIC PARAMETERS								
Calcium	7.3	mg/L		1.0		2	E200.7	05/16/07 18:07/eli-b
Magnesium	ND	mg/L		1.0		2	E200.7	05/16/07 18:07/eli-b
Sodium	573	mg/L		1.0		2	E200.7	05/16/07 18:07/eli-b
NUTRIENT PARAMETERS								
Nitrogen, Nitrate as N	ND	mg/L		0.10		1	E300.0	05/15/07 22:37/JMH
TOTAL METALS ANALYSES								
Iron	2.6	mg/L		0.03		2	E200.7	05/16/07 18:45/eli-b
Manganese	0.07	mg/L		0.01		2	E200.7	05/16/07 18:45/eli-b

Report Definitions: RL - Analyte reporting limit.
QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

Page 1 of 1



LABORATORY ANALYTICAL REPORT

Client: Weston Engineering-Upton
Project: Wall WSW 7
Lab ID: R07060151-001
Client Sample ID: Wall WSW 7

Report Date: 07/18/07
Collection Date: 06/08/07 08:00
Date Received: 06/08/07
Matrix: DRINKING
WATER

Analyses	Result	Units	Qual	MCL/			Method	Analysis Date / By
				RL	QCL	DF		
PHYSICAL PARAMETERS								
Alkalinity, Total as CaCO3	440	mg/L		5		1	A2320 B	06/12/07 16:27/SN
Bicarbonate as HCO3	530	mg/L		5		1	A2320 B	06/12/07 16:27/SN
Carbonate as CO3	ND	mg/L		5		1	A2320 B	06/12/07 16:27/SN
Color	ND	c.u.		5		1	A2120 B	06/13/07 13:50/eli-b
Conductivity @ 25 C	1350	umhos/cm		5		1	A2510 B	06/13/07 14:26/JMH
pH	8.56	s.u.		0.010		1	A4500-H B	06/13/07 14:20/JMH
Solids, Total Dissolved TDS @ 180 C	820	mg/L		5		1	A2540 C	06/11/07 00:00/JS
Turbidity	0.81	NTU		0.10		1	A2130 B	06/12/07 00:00/JMH
Odor	ND					1	A2150 B	06/13/07 13:50/eli-b
INORGANIC PARAMETERS								
Calcium	2.6	mg/L		1.0		2	E200.7	06/15/07 04:03/eli-b
Chloride	19	mg/L		0.50		1	E300.0	06/09/07 16:43/JMH
Fluoride	3.1	mg/L		0.10		1	E300.0	06/09/07 16:43/JMH
Magnesium	ND	mg/L		1.0		2	E200.7	06/15/07 04:03/eli-b
Potassium	2.5	mg/L		1.0		2	E200.7	06/15/07 04:03/eli-b
Sodium	342	mg/L		1.0		2	E200.7	06/15/07 04:03/eli-b
Sulfate	229	mg/L	D	3.6		5	E300.0	06/14/07 02:24/JMH
Hardness as CaCO3	8	mg/L		1		1	A2340 B	06/25/07 17:20/ADM
Cyanide, Total	ND	mg/L		0.005	0.2	1	E335.4	06/15/07 12:33/eli-b
Hardness as CaCO3 - Grains	0.49	grains/gal		0.06		1	A2340 B	06/25/07 17:20/ADM
NUTRIENT PARAMETERS								
Nitrogen, Nitrate as N	ND	mg/L		0.10		1	E300.0	06/09/07 16:43/JMH
Nitrogen, Nitrite as N	ND	mg/L		0.10		1	E300.0	06/09/07 16:43/JMH
RADIONUCLIDES - TOTAL								
Gross Alpha	6.8	pCi/L		1.0	15	1	E900.0	06/18/07 21:24/eli-c
Gross Alpha precision (±)	0.8	pCi/L				1	E900.0	06/18/07 21:24/eli-c
Radium 226	1.7	pCi/L		1.0	5	1	E903.0	06/26/07 11:26/eli-c
Radium 226 precision (±)	0.50	pCi/L				1	E903.0	06/26/07 11:26/eli-c
Radium 228	ND	pCi/L		1	5	1	RA-05	06/21/07 11:29/eli-c
Uranium	ND	mg/L		0.0010	0.03	1	E200.8	06/16/07 13:01/eli-c
Uranium, Activity	ND	pCi/L		0.67	20	1	E200.8	06/16/07 13:01/eli-c
DRINKING WATER METALS ANALYSES								
Antimony	ND	mg/L		0.003	0.006	1	E200.8	06/16/07 14:07/eli-b
Arsenic	ND	mg/L		0.005	0.01	1	E200.8	06/16/07 14:07/eli-b

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Weston Engineering-Upton

Project: Wall WSW 7

Lab ID: R07060151-001

Client Sample ID: Wall WSW 7

Report Date: 07/18/07

Collection Date: 06/08/07 08:00

Date Received: 06/08/07

Matrix: DRINKING
WATER

Analyses	Result	Units	Qual	RL	MCL/		Method	Analysis Date / By
					QCL	DF		
DRINKING WATER METALS ANALYSES								
Barium	ND	mg/L		0.05	2	2	E200.7	06/15/07 01:57/eli-b
Beryllium	ND	mg/L		0.002	0.004	2	E200.7	06/15/07 01:57/eli-b
Cadmium	ND	mg/L		0.001	0.005	1	E200.8	06/16/07 14:07/eli-b
Chromium	ND	mg/L		0.01	0.1	2	E200.7	06/15/07 01:57/eli-b
Copper	ND	mg/L		0.01		2	E200.7	06/15/07 01:57/eli-b
Iron	0.19	mg/L	D	0.06		2	E200.7	06/15/07 01:57/eli-b
Lead	ND	mg/L		0.001	0.015	1	E200.8	06/16/07 14:07/eli-b
Manganese	ND	mg/L		0.01		2	E200.7	06/15/07 01:57/eli-b
Mercury	ND	mg/L		0.0002	0.002	1	E200.8	06/22/07 14:45/eli-b
Nickel	ND	mg/L		0.01	0.1	2	E200.7	06/15/07 01:57/eli-b
Selenium	ND	mg/L		0.005	0.05	1	E200.8	06/16/07 14:07/eli-b
Thallium	ND	mg/L		0.001	0.002	1	E200.8	06/16/07 14:07/eli-b
Zinc	ND	mg/L		0.01		2	E200.7	06/15/07 01:57/eli-b

SEMI-VOLATILE ORGANIC COMPOUNDS

Alachlor	ND	ug/L		0.10	2	1	E525.2	06/22/07 01:09/eli-b
Aldrin	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b
Aroclor 1016	ND	ug/L		0.080		1	E525.2	06/22/07 01:09/eli-b
Aroclor 1221	ND	ug/L		2.0		1	E525.2	06/22/07 01:09/eli-b
Aroclor 1232	ND	ug/L		0.50		1	E525.2	06/22/07 01:09/eli-b
Aroclor 1242	ND	ug/L		0.30		1	E525.2	06/22/07 01:09/eli-b
Aroclor 1248	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b
Aroclor 1254	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b
Aroclor 1260	ND	ug/L		0.20		1	E525.2	06/22/07 01:09/eli-b
Atrazine	ND	ug/L		0.10	3	1	E525.2	06/22/07 01:09/eli-b
Benzo(a)pyrene	ND	ug/L		0.10	0.2	1	E525.2	06/22/07 01:09/eli-b
Butachlor	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b
Chlordane	ND	ug/L		1.0	2	1	E525.2	06/22/07 01:09/eli-b
Dieldrin	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b
Endrin	ND	ug/L		0.10	2	1	E525.2	06/22/07 01:09/eli-b
gamma-BHC (Lindane)	ND	ug/L		0.10	0.2	1	E525.2	06/22/07 01:09/eli-b
Heptachlor	ND	ug/L		0.10	0.4	1	E525.2	06/22/07 01:09/eli-b
Heptachlor epoxide	ND	ug/L		0.10	0.2	1	E525.2	06/22/07 01:09/eli-b
Hexachlorobenzene	ND	ug/L		0.10	1	1	E525.2	06/22/07 01:09/eli-b
Hexachlorocyclopentadiene	ND	ug/L		0.10	50	1	E525.2	06/22/07 01:09/eli-b
Methoxychlor	ND	ug/L		0.10	40	1	E525.2	06/22/07 01:09/eli-b
Metolachlor	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b
Metribuzin	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b

Report RL - Analyte reporting limit.

Definitions: QCL - Quality control limit.

D - RL increased due to sample matrix interference.

MCL - Maximum contaminant level.

ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Weston Engineering-Upton
Project: Wall WSW 7
Lab ID: R07060151-001
Client Sample ID: Wall WSW 7

Report Date: 07/18/07
Collection Date: 06/08/07 08:00
Date Received: 06/08/07
Matrix: DRINKING
WATER

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
SEMI-VOLATILE ORGANIC COMPOUNDS								
Propachlor	ND	ug/L		0.10		1	E525.2	06/22/07 01:09/eli-b
Simazine	ND	ug/L		0.10	4	1	E525.2	06/22/07 01:09/eli-b
Toxaphene	ND	ug/L		2.0	3	1	E525.2	06/22/07 01:09/eli-b
Surr: 1,3-Dimethyl-2-nitrobenzene	84.0	%REC			70-130		E525.2	06/22/07 01:09/eli-b
Surr: Perylene-d12	80.0	%REC			70-130		E525.2	06/22/07 01:09/eli-b
Surr: Pyrene-d10	107	%REC			70-130		E525.2	06/22/07 01:09/eli-b
Surr: Triphenylphosphate	105	%REC			70-130		E525.2	06/22/07 01:09/eli-b

- Note: The federal MCL for total PCB's is 0.5 ug/L as Decachlorobiphenyl (DCB). PCB screening at the reporting limits given for the individual Aroclors meets or exceeds federal and state requirements for "Total PCB" monitoring if Aroclors are not detected.

DRINKING WATER VOLATILE ORGANIC COMPOUNDS

Benzene	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
Bromobenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Bromochloromethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Bromodichloromethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Bromoform	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Bromomethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
n-Butylbenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
sec-Butylbenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
tert-Butylbenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Carbon tetrachloride	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
1,2-Dichloroethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Chlorobenzene	ND	ug/L		0.50	100	1	E524.2	06/19/07 19:05/SN
Chlorodibromomethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Chloroethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Chloroform	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Chloromethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
2-Chlorotoluene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
4-Chlorotoluene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,2-Dibromo-3-chloropropane	ND	ug/L		1.0		1	E524.2	06/19/07 19:05/SN
Dibromomethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,2-Dichlorobenzene	ND	ug/L		0.50	600	1	E524.2	06/19/07 19:05/SN
1,3-Dichlorobenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,4-Dichlorobenzene	ND	ug/L		0.50	75	1	E524.2	06/19/07 19:05/SN
Dichlorodifluoromethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,1-Dichloroethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,2-Dibromoethane	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
1,1-Dichloroethene	ND	ug/L		0.50	7	1	E524.2	06/19/07 19:05/SN
cis-1,2-Dichloroethene	ND	ug/L		0.50	70	1	E524.2	06/19/07 19:05/SN

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Weston Engineering-Upton
Project: Wall WSW 7
Lab ID: R07060151-001
Client Sample ID: Wall WSW 7

Report Date: 07/18/07
Collection Date: 06/08/07 08:00
Date Received: 06/08/07
Matrix: DRINKING WATER

Analyses	Result	Units	Qual	MCL/			Method	Analysis Date / By
				RL	QCL	DF		
DRINKING WATER VOLATILE ORGANIC COMPOUNDS								
trans-1,2-Dichloroethene	ND	ug/L		0.50	100	1	E524.2	06/19/07 19:05/SN
1,2-Dichloropropane	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
1,3-Dichloropropane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
2,2-Dichloropropane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,1-Dichloropropene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
cis-1,3-Dichloropropene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
trans-1,3-Dichloropropene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Ethylbenzene	ND	ug/L		0.50	700	1	E524.2	06/19/07 19:05/SN
Hexachlorobutadiene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Isopropylbenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
p-Isopropyltoluene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Methylene chloride	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
Naphthalene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
n-Propylbenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Styrene	ND	ug/L		0.50	100	1	E524.2	06/19/07 19:05/SN
1,1,1,2-Tetrachloroethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,1,2,2-Tetrachloroethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Tetrachloroethene	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
Toluene	ND	ug/L		0.50	1000	1	E524.2	06/19/07 19:05/SN
1,2,3-Trichlorobenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,2,4-Trichlorobenzene	ND	ug/L		0.50	70	1	E524.2	06/19/07 19:05/SN
1,1,1-Trichloroethane	ND	ug/L		0.50	200	1	E524.2	06/19/07 19:05/SN
1,1,2-Trichloroethane	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
Trichloroethene	ND	ug/L		0.50	5	1	E524.2	06/19/07 19:05/SN
Trichlorofluoromethane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,2,3-Trichloropropane	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Trihalomethanes, Total	ND	ug/L		0.50	80	1	E524.2	06/19/07 19:05/SN
1,2,4-Trimethylbenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
1,3,5-Trimethylbenzene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Vinyl chloride	ND	ug/L		0.50	2	1	E524.2	06/19/07 19:05/SN
m+p-Xylenes	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
o-Xylene	ND	ug/L		0.50		1	E524.2	06/19/07 19:05/SN
Xylenes, Total	ND	ug/L		0.50	10000	1	E524.2	06/19/07 19:05/SN
Surr: p-Bromofluorobenzene	106	%REC			75-130		E524.2	06/19/07 19:05/SN
Surr: 1,2-Dichloroethane-d4	109	%REC			75-130		E524.2	06/19/07 19:05/SN
Surr: Toluene-d8	95.0	%REC			75-130		E524.2	06/19/07 19:05/SN

DRINKING WATER HERBICIDE PARAMETERS

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

LABORATORY ANALYTICAL REPORT

Client: Weston Engineering-Upton

Project: Wall WSW 7

Lab ID: R07060151-001

Client Sample ID: Wall WSW 7

Report Date: 07/18/07

Collection Date: 06/08/07 08:00

Date Received: 06/08/07

Matrix: DRINKING
WATER

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
DRINKING WATER HERBICIDE PARAMETERS								
2,4-D	ND	ug/L		1	70	1	E515.1	06/30/07 06:30/eli-b
2,4-DB	ND	ug/L		2		1	E515.1	06/30/07 06:30/eli-b
Dalapon	ND	ug/L		2	200	1	E515.1	06/30/07 06:30/eli-b
Dicamba	ND	ug/L		0.2		1	E515.1	06/30/07 06:30/eli-b
Dichlorprop	ND	ug/L		1		1	E515.1	06/30/07 06:30/eli-b
Dinoseb	ND	ug/L		1	7	1	E515.1	06/30/07 06:30/eli-b
Pentachlorophenol	ND	ug/L		0.04	1	1	E515.1	06/30/07 06:30/eli-b
Picloram	ND	ug/L		0.5	500	1	E515.1	06/30/07 06:30/eli-b
2,4,5-TP (Silvex)	ND	ug/L		0.2	50	1	E515.1	06/30/07 06:30/eli-b
Surr: DCAA	77.0	%REC			70-130		E515.1	06/30/07 06:30/eli-b
DRINKING WATER ENDOTHAAL ANALYSIS								
Endothall	ND	ug/L		8	100	1	E548.1	06/16/07 18:24/eli-b
Surr: 2,4-Dichlorophenylacetic acid	115	%REC			70-130		E548.1	06/16/07 18:24/eli-b
DRINKING WATER GLYPHOSATE ANALYSIS								
Glyphosate	ND	ug/L		5	700	1	E547	06/21/07 10:59/eli-ca
DRINKING WATER DIQUAT ANALYSIS								
Diquat	ND	ug/L		0.4	20	1	E549.2	06/20/07 09:36/eli-ca
DRINKING WATER EDB AND DBCP PARAMETERS								
1,2,3-Trichloropropane	ND	ug/L		0.05		1	E504.1	06/17/07 13:28/eli-c
1,2-Dibromo-3-chloropropane	ND	ug/L		0.02	0.2	1	E504.1	06/17/07 13:28/eli-c
1,2-Dibromoethane	ND	ug/L		0.01	0.05	1	E504.1	06/17/07 13:28/eli-c
Surr: 1,1,1,2-Tetrachloroethane	113	%REC			70-130		E504.1	06/17/07 13:28/eli-c
DRINKING WATER CARBAMATE PARAMETERS								
Aldicarb	ND	ug/L		0.4	3	1	E531.1	06/15/07 01:56/eli-ca
Aldicarb sulfone	ND	ug/L		0.4	2	1	E531.1	06/15/07 01:56/eli-ca
Aldicarb sulfoxide	ND	ug/L		0.4	4	1	E531.1	06/15/07 01:56/eli-ca
Carbaryl	ND	ug/L		0.4		1	E531.1	06/15/07 01:56/eli-ca
Carbofuran	ND	ug/L		0.4	40	1	E531.1	06/15/07 01:56/eli-ca
3-Hydroxycarbofuran	ND	ug/L		0.4		1	E531.1	06/15/07 01:56/eli-ca
Methiocarb	ND	ug/L		0.4		1	E531.1	06/15/07 01:56/eli-ca
Methomyl	ND	ug/L		0.4		1	E531.1	06/15/07 01:56/eli-ca
Oxamyl	ND	ug/L		0.4	200	1	E531.1	06/15/07 01:56/eli-ca
Baygon	ND	ug/L		0.4		1	E531.1	06/15/07 01:56/eli-ca

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

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LABORATORY ANALYTICAL REPORT

Client: Weston Engineering-Upton

Project: Wall WSW 7

Lab ID: R07060151-001

Client Sample ID: Wall WSW 7

Report Date: 07/18/07

Collection Date: 06/08/07 08:00

Date Received: 06/08/07

Matrix: DRINKING
WATER

Analyses	Result	Units	Qual	RL	MCL/ QCL	DF	Method	Analysis Date / By
DRINKING WATER CARBAMATE PARAMETERS								
Surr: BDMC	112	%REC			70-130		E531.1	06/15/07 01:56/eli-ca

Report RL - Analyte reporting limit.
Definitions: QCL - Quality control limit.

MCL - Maximum contaminant level.
ND - Not detected at the reporting limit.

Permit No. 2596-2
Upper Cheyenne River - Water District

Report of Examination of Works and/or Application of Water to Beneficial Use

TO: Chief Engineer, Water Rights Program, DENR, Foss Bldg., Pierre, SD 57501

I have on this day, 6/5/2012 thorough examination of the water use system constructed by City of Wall, 307 Norris Street, PO Box 314, Wall, SD 57790 holder of Permit No. 2596-2, bearing the priority date of July 24, 2006. Permit No. 2596-2 is authorized to appropriate a total of 0.89 cfs (400 gpm) from one groundwater well (Inyan Kara Aquifer) for municipal purposes, in Pennington County.

Inspection contact and relationship to
permit holder, if applicable:

Jeff Clark,
Public Works Director

A. Works used to divert the water:

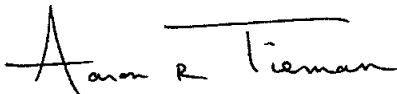
Centrilift submersible pump 272 gpm.

B. Works used to transport water to place of use:

Municipal distribution lines.

The system is in the following condition good. The point of diversion (well) is located specifically at Lat/Lon – N43.995161/W-102.192820 which is the approximately 250 feet north and 1350 feet west of the SE corner of Section 33, T1N-R16E. The works are capable of diverting 0.60 cfs which is to be used for municipal purposes. The license should be issued for 0.60 cfs.

All structures, wells and lands on map Y
Exceptions to compliance are: none.



Aaron Tieman
Natural Resources Engineer II
DENR, Water Rights Program

Date report completed: June 24, 2015

FIELD INVESTIGATION REPORT FOR PERMIT NO. 2596-2

DATE OF INVESTIGATION:	June 5, 2012
NAME & ADDRESS OF PERMIT HOLDER	City of Wall 307 Norris Street PO Box 314 Wall, SD 57790-0314
INVESTIGATION CONTACT/ RELATIONSHIP TO PERMIT HOLDER, IF APPLICABLE	Jeff Clark (Public Works Director)
DIVERSION POINT LEGAL LOCATION	SW¼ SE¼ Section 33, T1N-R16E
WATER SUPPLY SOURCE	Ground water, Inyan Kara Aquifer

Other permit(s) associated with the project:

WELL INFORMATION:

- 1) Well Drilling Firm: **Weston Engineering, Inc.**
- 2) No. of Wells **One**
- 3) Depth(s) **3194** feet
- 4) Well log is available **yes**
- 5) Comment:

Casing:

- | | | |
|--------------------------------------|------------------------------------|----------------------------------|
| 1) Diameter: <u>16</u> inches | Diameter: <u>10¾</u> inches | Diameter: <u>7</u> inches |
| 2) Length: <u>40</u> feet | Length: <u>1810</u> feet | Length: <u>1462</u> feet |
| 3) Type: <u>Steel</u> | Type: <u>Steel</u> | Type: <u>Steel</u> |

Screen:

- 1) Type: **Manufactured**
- 2) Length: **100** feet
- 3) Static water level: **540** feet

Pump:

- 1) Make: **Centrilift**
- 2) Model: **538 PMSND P75-32**
- 3) Capacity: **272** GPM

Motor:

- 1) Make: **Centrilift**
- 2) Model: **KMH**
- 3) Horsepower rating: **114** hp

DISTRIBUTION LINES OR CANALS:

- 1) Type: **Municipal distribution lines.**

PERMIT QUALIFICATIONS:

- 1) Special qualifications to permit being abided by **Yes**
- 2) All structures, wells and lands on map **Yes**

COMMENTS:

FILE ATTACHMENT TO INSPECTION REPORT

Water Permit No. 2596-2 was issued with a diversion rate of 0.89 cfs (400 acre-feet annually). This figure was arrived at by taking 60 percent of what 0.89 cfs pumped continuously would be.

The inspection of the water use system found the system capable of 0.60 cfs (272 gpm). Using the same calculation, 60 percent of 0.6 cfs run continuously would be approximately 261 acre feet.

A review of the past water use reports submitted by the City of Wall for use of water from the Inyan Kara Aquifer reflect the following:

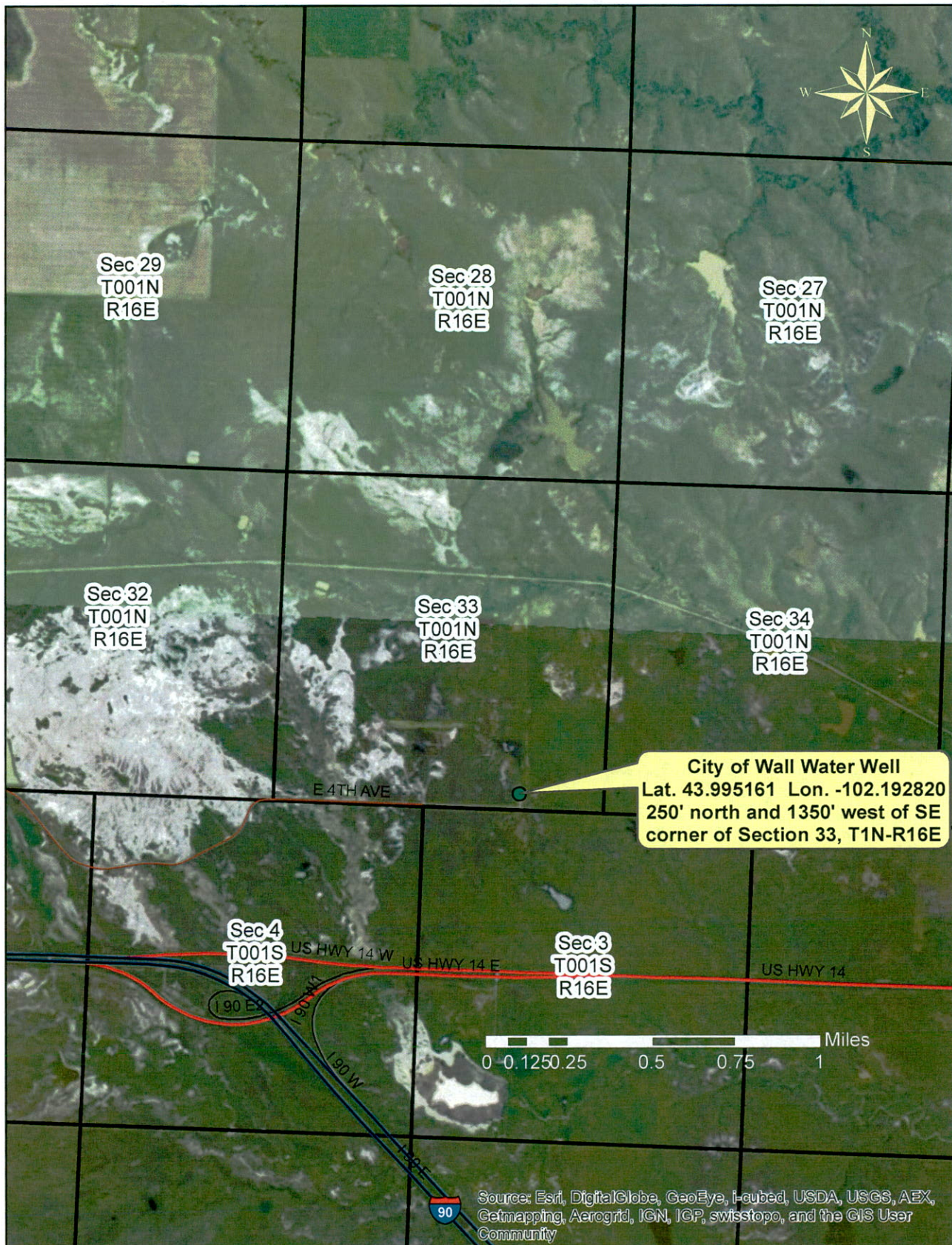
- 2006 252 AF
- 2007 185 AF
- 2008 44 AF
- 2009 55 AF
- 2010 61 AF
- 2011 45 AF
- 2012 43 AF
- 2013 230 AF
- 2014 160 AF

Based on the pump rate developed, and using the conversion factor of 60 percent, the water license will be issued to reflect a total of 261 acre feet annually. The water use reports submitted by the City reflect they have not needed to use over 261 acre feet annually.



Genny McMath
Water Rights Program
July 1, 2015

Water Right 2596-2
City of Wall
June 5, 2012



Aaron R. Tieman

Aaron Tieman
Natural Resources Engineer II
DENR Water Rights Program





DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3182
<http://denr.sd.gov>

AUG 27 2015

2596-2

Carolynn Anderson, Finance Officer
City of Wall
PO Box 314
Wall SD 57790

Dear Ms. Anderson:

Enclosed is Water License No. 2596-2. This is the final water right document completing the city's process of obtaining a Water Right. Included with the license is a map prepared by the staff engineer who conducted the field investigation.

For your information SDCL 46-6-27 requires that if the owner of an existing well, such as the well authorized by Water Right No. 2596-2, constructs a replacement well and does not plan to use the old well, the old well is considered abandoned and must be plugged. Also, any well that is being used or is not considered abandoned must be valved and controlled, if flowing, or sealed and capped so that no leaking occurs either underground or at the surface.

As long as you use the water beneficially, as stated in the Water License, the State Water Laws provide that you have a continuing right to use the water. If you have any questions, please contact our office.

Sincerely,

Jeanne Goodman, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures

**STATE OF SOUTH DAKOTA
WATER LICENSE NO. 2596-2**

(1) City of Wall, PO Box 314, Wall SD 57790 made Application No. 2596-2, July 24, 2006 for a water permit to divert 0.89 cubic feet of water per second (400 acre-feet annually) from ground water (one well – Inyan Kara Aquifer), Pennington County, South Dakota for municipal purposes. Permit No. 2596-2, with a priority date of July 24, 2006 was approved September 11, 2006 and issued to the applicant for diversion of water with construction of the described water supply system to be completed on or before September 11, 2011 and for the application to beneficial use of said water on or before September 11, 2015.

(2) It is certified that the permit holder has complied with the provisions of South Dakota State Law relating to completion of the water supply system and is entitled to divert 0.60 cubic feet of water per second (261 acre-feet annually) for beneficial use.

The location of the diversion point is approximately 250 feet north and 1,350 feet west of the SE corner of Section 33, T1N, R16E (SW ¼ SE ¼).

(3) The permit holder has complied with the provisions of South Dakota State Law relating to the application of water to beneficial use.

(4) Pursuant to South Dakota Water Law 46-5-30.1 the City of Wall, PO Box 314, Wall SD 57790 the holder and/or owner of Water Right No. 2596-2 is issued a license to appropriate water, the right to use 0.60 cubic feet of water per second (261 acre-feet annually) from ground water (one well – Inyan Kara Formation) with a priority date of July 24, 2006 from the location specified in (2) of this license for municipal purposes.

This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Right No. 2596-2 and subject to the following qualifications:

- 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.
- The well authorized by Permit No. 2596-2 shall be constructed by a licensed well driller and construction of the well and installation of the pump shall comply with the 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. *The well was drilled in 2007 by Weston Engineering. A copy of the log is on file with the Water Rights Program.*
- The City of Wall shall report to the Chief Engineer annually the amount of water withdrawn from the Inyan Kara Aquifer.



Jeanne Goodman, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

AUG 27 2015

date

