



Coal Combustion Residuals Landfill

Groundwater Monitoring System Certification

Antelope Valley Station Landfill

Prepared for
Basin Electric Power Cooperative

March 2022

Coal Combustion Residuals Landfill
Groundwater Monitoring System Certification
Antelope Valley Station Landfill

March 2022

Contents

1	Introduction and Site Hydrogeologic Setting	1
2	CCR Groundwater Monitoring System.....	2
3	References	3

Figure

Figure 1 CCR Groundwater Monitoring System

Appendix

Appendix A Boring Logs

Certification

I hereby certify that I have examined the facility and, being familiar with the provisions of 40 CFR 257 Subpart D and NDAC Chapter 33.1-20, attest that this Groundwater Monitoring System Certification has been prepared in accordance with good engineering practice, including consideration of relevant industry standards and the requirements of 40 CFR § 257.91 and NDAC 33.1-20-08. I further certify that I am a duly Licensed Professional Engineer under the laws of the State of North Dakota and that I have professional experience with groundwater monitoring at landfills.

Paul T. Swenson, PE
PE-7636

March 24, 2022
Date

1 Introduction and Site Hydrogeologic Setting

Basin Electric Power Cooperative (BEPC) owns and operates Antelope Valley Station (AVS), an electrical power generating unit, and is preparing a permit modification application for a lateral expansion of the AVS special waste landfill for disposal of coal combustion residuals (CCR). The landfill CCR unit includes the existing landfill and the proposed lateral expansion. The purpose of this document is twofold:

1. Provide certification from a qualified professional engineer that the CCR unit groundwater monitoring system has been designed and constructed to meet the requirements of 40 Code of Federal Regulations (CFR) § 257.91 and North Dakota Administrative Code (NDAC) 33.1-20-08-06.
2. Document the design, installation, and development of the monitoring wells for the CCR unit.

The Landfill Expansion Preapplication (BEPC, 2019) states that the existing landfill and the proposed expansion areas are located in part of a former surface mine used to extract Beulah Bed lignite. The landfill is underlain by clay-rich soil (mine spoil material) about 120-feet to 160-feet thick, with hydraulic conductivity values of around 1×10^{-7} cm/sec as documented in the Site Characterization Report (Barr, 2021).

The Spaer Bed is stratigraphically lower and is separated from the Beulah Bed by a silty clay unit approximately 60- to 70-feet thick that is part of the Sentinel Butte Formation as described in the Landfill Expansion Preapplication (BEPC, 2019). The Spaer Bed, 7- to 9-feet thick below the CCR unit, is not considered a regional water supply aquifer, but it is typically saturated and is the uppermost aquifer as documented in the Site Characterization Report. The groundwater flow directions range from west – east to west – northeast at average linear groundwater flow rates less than 1 foot per year based on information presented in the Site Characterization Report (Barr, 2021).

2 CCR Groundwater Monitoring System

Figure 1 shows the groundwater monitoring system for the CCR unit. It consists of the following ten wells:

- Upgradient wells:
 - MW-18(S)
 - MW-19(S)
 - MW-21(S)
- Downgradient wells:
 - MW-15(S)
 - MW-16(S)
 - MW-17(S)
 - MW-20(S)
 - MW-22(S)
 - MW-23(S)
 - MW-24(S)

Logs for each well are in Appendix A. The CCR Groundwater System Report (AECOM, 2017) provides documentation on the design, installation, and development of wells MW-15(S) through MW-20(S). The Site Characterization Report (Barr, 2021) provides similar documentation for wells MW-21(S) through MW-24(S).

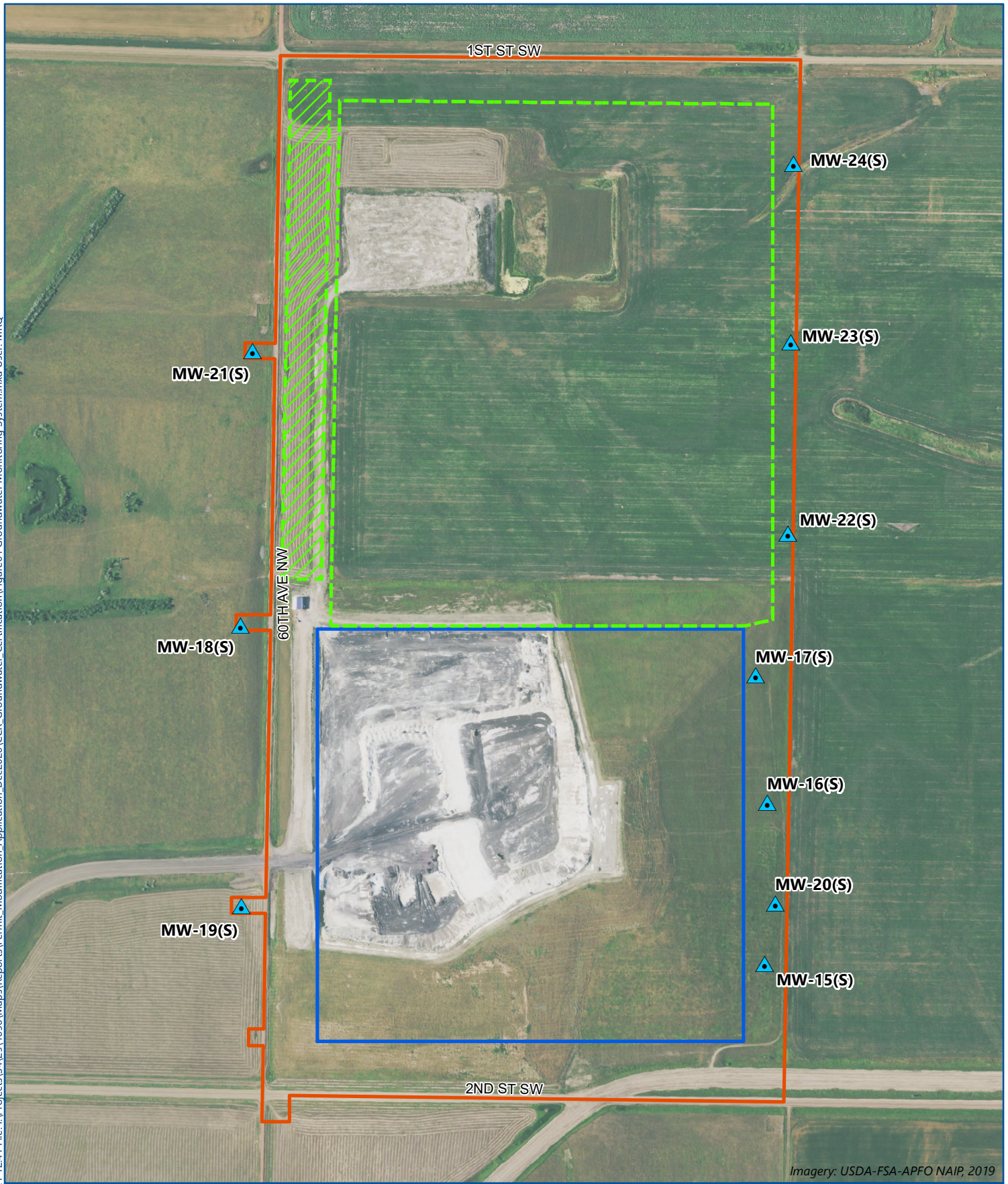
3 References

AECOM, 2017. CCR Groundwater System Report, Antelope Valley Station, Beulah, North Dakota, BEPC, October 17, 2017.






Barr Engineering Co., 2021. Site Characterization Report, Antelope Valley Station Landfill Expansion Area, April 2021.

Basin Electric Power Cooperative, 2019. Antelope Valley Station (AVS) 0160 Landfill Expansion Preapplication, March 8, 2019.

Figure



Imagery: USDA-FSA-APFO NAIP, 2019

-  CCR Groundwater Monitoring System Well
-  Permit Boundary
-  Existing Landfill Limits
-  Landfill Limits Expansion
-  Leachate Management Area



**CCR GROUNDWATER
MONITORING SYSTEM**
Basin Electric Power Cooperative
Antelope Valley Station Landfill
Mercer County, North Dakota

FIGURE 1

Appendix A

CLIENT Basin Electric **PROJECT NAME** Antelope Valley
PROJECT NUMBER 60495311 **PROJECT LOCATION** Beulah, ND
DATE STARTED 5/23/2016 **COMPLETED** 5/24/2016 **GROUND ELEVATION** 2102.89 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**
DRILLING METHOD Rotary Sonic **AT TIME OF DRILLING** ---
LOGGED BY Ryan Klutes **CHECKED BY** A. Lanning **AT END OF DRILLING** ---
COORDINATES 630410.64 N 1675007.24 E **▼ AFTER DRILLING** 221.70 ft / Elev 1881.19 ft from BTOC

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0							Casing Top Elev. 2 (ft) Casing Type: 2" PVC Pipe
0						CLAY, with gravel; brown (Mine Spoils)	Top of Casing (estimated 2' ags)
10	SONIC	100					
20	SONIC	100					Grout (0' - 232' bgs) PVC Pipe (2' ags - 250' bgs)
26.0	SONIC	100				S.A.A., gray	
32.0	SONIC	100		CL		S.A.A., brown clay mixed with gray clay	
40.0	SONIC	100				S.A.A., no gray coloring	
50	SONIC	100					
60	SONIC	100				S.A.A., brown and gray clay	
64.0	SONIC	100				S.A.A., trace lignite, no gravel	
70							

AVS SOIL-WELL LOG.GDT - 7/13/17 13:16 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
70						S.A.A., trace lignite, no gravel	
80	SONIC	100				S.A.A., with gravel, no lignite	← Grout (0' - 232' bgs) PVC Pipe (2' ags - 250' bgs)
90	SONIC	100				S.A.A., no gravel	
100	SONIC	100				S.A.A., very hard	
110	SONIC	100		CL		S.A.A., silty clay; gray	
120	SONIC	100				S.A.A., no silt	
130	SONIC	100					
140	SONIC	100					
150	SONIC	100					


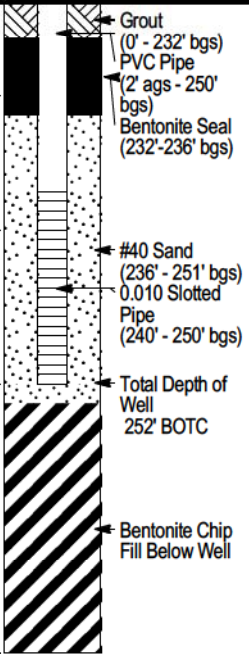


AVS SOIL-WELL LOG.GDT - 7/13/17 13:17 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
150						S.A.A., with gravel; brown and gray	
160	SONIC	100		CL			
170	SONIC	100		CL			
168.0					COAL	LIGNITE (6" lense)	
168.5						CLAY, trace silt; gray	
1934.9							
1934.4							
180	SONIC	100					
180.0						S.A.A., trace sand	
1922.9							
190	SONIC	100		CL			
191.0						S.A.A., sandy clay	
1911.9							
196.0						S.A.A., with shale, no sand, very hard	
1906.9							
200	SONIC	100					
210	SONIC	100					
211.0					COAL	LIGNITE (1' lense); brown	
212.0						CLAY, very hard; gray	
1891.9							
1890.9							
220	SONIC	100		CL			
225.0					SHALE	SHALE (1' lense); gray	
226.0						CLAY, very hard; gray	
1877.9							
1876.9							
230	SONIC	100		CL			

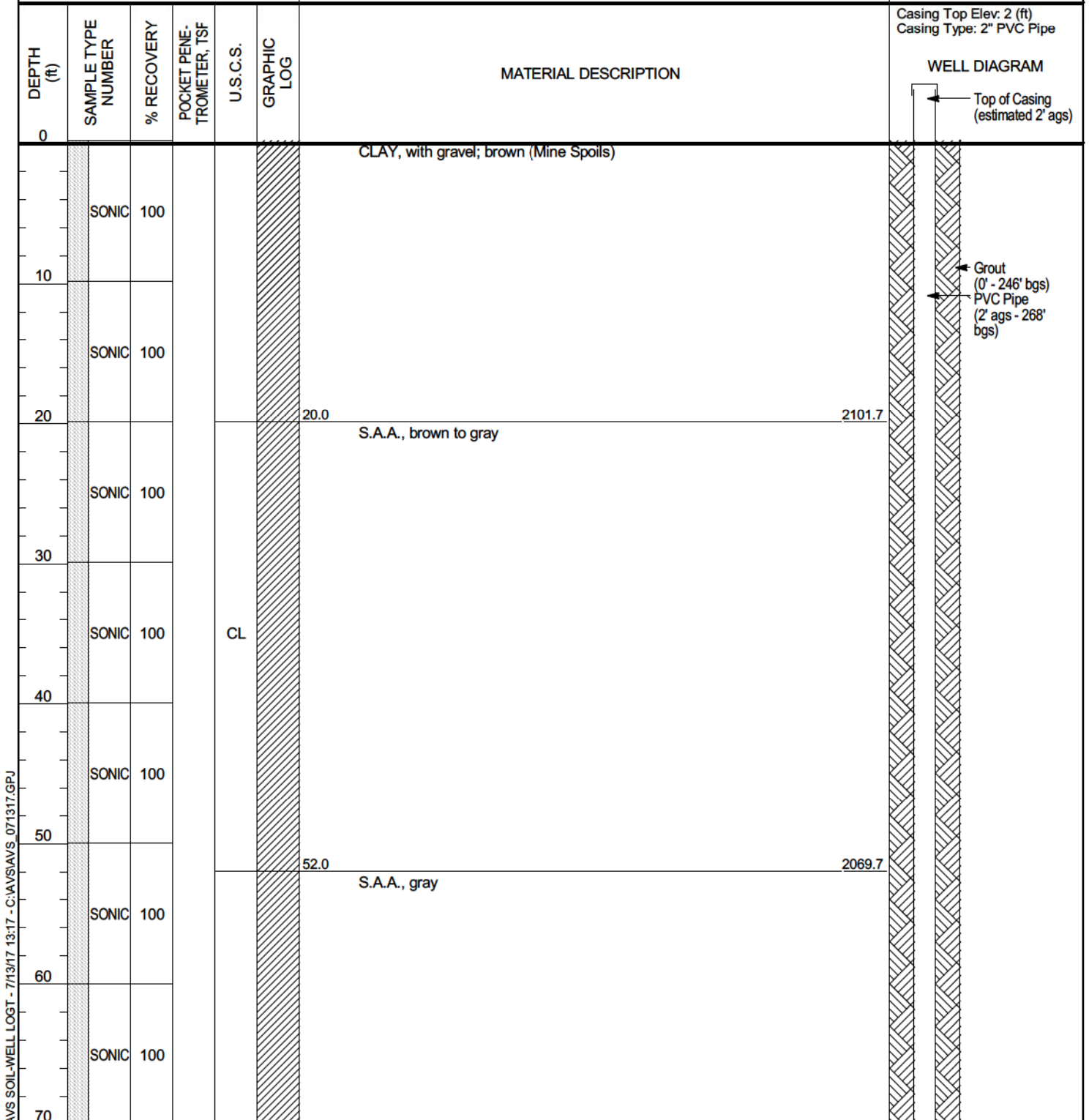
AVS SOIL-WELL LOG.GDT - 7/13/17 13:17 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
230							
	SONIC	100		CL		CLAY, very hard; gray	 <p>Grout (0' - 232' bgs) PVC Pipe (2' ags - 250' bgs) Bentonite Seal (232'-236' bgs) #40 Sand (236' - 251' bgs) 0.010 Slotted Pipe (240' - 250' bgs) Total Depth of Well 252' BOTC Bentonite Chip Fill Below Well</p>
						S.A.A., crumbly	
240							
	SONIC	100		COAL		LIGNITE; brown	
250							
	SONIC	100		CL		CLAY, very hard; gray	
260							
	SONIC	100					

Bottom of borehole at 264.0 feet.

CLIENT Basin Electric **PROJECT NAME** Antelope Valley
PROJECT NUMBER 60495311 **PROJECT LOCATION** Beulah, ND
DATE STARTED 5/25/2016 **COMPLETED** 6/1/2016 **GROUND ELEVATION** 2121.7 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**
DRILLING METHOD Rotary Sonic **AT TIME OF DRILLING** ---
LOGGED BY Ryan Klutes **CHECKED BY** A. Lanning **AT END OF DRILLING** ---
COORDINATES 631224.67 N 1675017.86 E **▼ AFTER DRILLING** 249.60 ft / Elev 1872.10 ft from BTOC



AVS SOIL-WELL LOGT - 7/13/17 13:17 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
70							
80	SONIC	100				S.A.A., gray	
85.0					80.0	S.A.A., brown to gray	
85.0	SONIC	100			85.0	S.A.A., very hard; gray	
90							
100	SONIC	100					
106.0					106.0	S.A.A., brown to gray	
110	SONIC	100		CL			
120							
130	SONIC	100			131.0	S.A.A., gray	
131.0					131.0	S.A.A., gray	
140	SONIC	100					
150							

AVS SOIL-WELL LOG.GDT - 7/13/17 13:17 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
150						S.A.A., gray	
	SONIC	100				156.0 S.A.A., brown to gray 1965.7	
160							
	SONIC	100					
170				CL			
	SONIC	100					
180							
	SONIC	100					
190							
	SONIC	100				194.0 LIGNITE; brown 1927.7	
				COAL		198.0 CLAY, hard; gray 1923.7	
200				CL			
	SONIC	100				203.0 LIGNITE; brown 1918.7	
				COAL		206.0 CLAY, crumbly; brown 1915.7	
210						210.0 S.A.A., trace silt; gray 1911.7	
	SONIC	100		CL		215.0 S.A.A., no silt, very hard 1906.7	
220							
	SONIC	100				222.0 LIGNITE; brown 1899.7	
				COAL		224.0 CLAY, very hard; brown 1897.7	
				CL		227.0 S.A.A., trace sand, very hard; light brown 1894.7	
230							

AVS SOIL-WELL LOG.GDT - 7/13/17 13:17 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
230						S.A.A., trace sand, very hard; light brown	<p>Grout (0' - 246' bgs) PVC Pipe (2' ags - 268' bgs) Bentonite Seal (246'-254.5' bgs) #40 Sand (254.5' - 268' bgs) 0.010 Slotted Pipe (258' - 268' bgs) Total Depth of Well 270' BOTC Native Clay Below Well - Natural Collapse</p>
237.0	SONIC	100				S.A.A., very hard, crumbly; gray	
240				CL			
246	SONIC	100					
250							
255.0	SONIC	100				S.A.A., light brown to gray	
258.0						LIGNITE; brown	
260				COAL			
267.0	SONIC	100				CLAY, very hard; gray	
270				CL			
276.0	SONIC	100					

Bottom of borehole at 276.0 feet.

CLIENT Basin Electric **PROJECT NAME** Antelope Valley
PROJECT NUMBER 60495311 **PROJECT LOCATION** Beulah, ND
DATE STARTED 6/2/2016 **COMPLETED** 6/3/2016 **GROUND ELEVATION** 2123.06 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**
DRILLING METHOD Rotary Sonic **AT TIME OF DRILLING** ---
LOGGED BY Ryan Klutes **CHECKED BY** A. Lanning **AT END OF DRILLING** ---
COORDINATES 631865.98 N 1674961.19 E **AFTER DRILLING** 238.40 ft / Elev 1884.66 ft from BTOC

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0							Casing Top Elev: 1.8 (ft) Casing Type: 2" PVC Pipe
0 - 10	SONIC 100	100				CLAY, trace sand; brown to orange (Mine Spoils)	Top of Casing (estimated 1.8' ags)
10 - 20	SONIC 100	100					Grout (0' - 244' bgs) PVC Pipe (1.8' ags - 266' bgs)
20					20.0	S.A.A., brown to light brown	2103.1
20 - 30	SONIC 100	100					
30					31.0	S.A.A., with gravel, no sand; brown	2092.1
30 - 40	SONIC 100	100		CL			
40 - 50	SONIC 100	100					
50					51.0	S.A.A., very sticky	2072.1
50 - 60	SONIC 100	100					
60 - 70	SONIC 100	100					

AVS SOIL-WELL LOG.GDT - 7/13/17 13:18 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
70							
71.0						2052.1 S.A.A., hard; brown to gray	
80	SONIC	100				2033.1	
90						2028.1	
95.0	SONIC	100				2023.1	
100						2016.1	
107.0						2007.1	
110	SONIC	100		CL		1998.1	
116.0						1988.1	
125.0	SONIC	100				1983.1	
130							
135.0	SONIC	100					
140							
140.0	SONIC	100					
150							

AVS SOIL-WELL LOG.GDT - 7/13/17 13:18 - C:\AVS\AVS_071317.GPJ

(Continued Next Page)

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

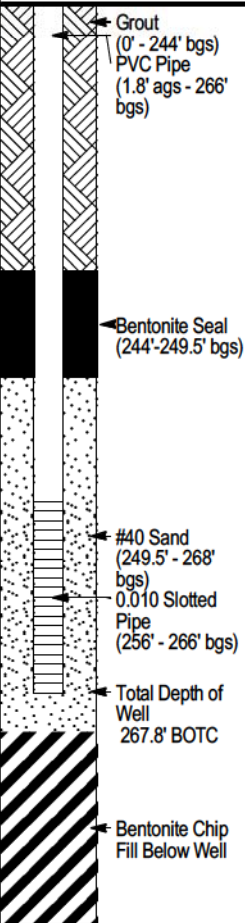
DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
150						S.A.A., trace gravel	
	SONIC	100					
160						S.A.A., increasing gravel	
	SONIC	100					
170				CL		S.A.A., no gravel; gray	
	SONIC	100					
180						S.A.A., with gravel, trace brown clay	
	SONIC	100					
190						S.A.A., trace sand, no gravel	
	SONIC	100					
191.0				COAL		LIGNITE (less than 1' in thickness); brown	
192.0						CLAY, trace sand; gray	
	SONIC	100					
200							
	SONIC	100		CL			
210							
	SONIC	100					
220						S.A.A., dark gray	
	SONIC	100					
226.0				SC		SANDY CLAY, crumbly; gray	
	SONIC	100					
230				CL		CLAY, crumbly; gray with yellow sand lenses	

AVS SOIL-WELL LOG.GDT - 7/13/17 13:18 - C:\AVS\AVS_071317.GPJ

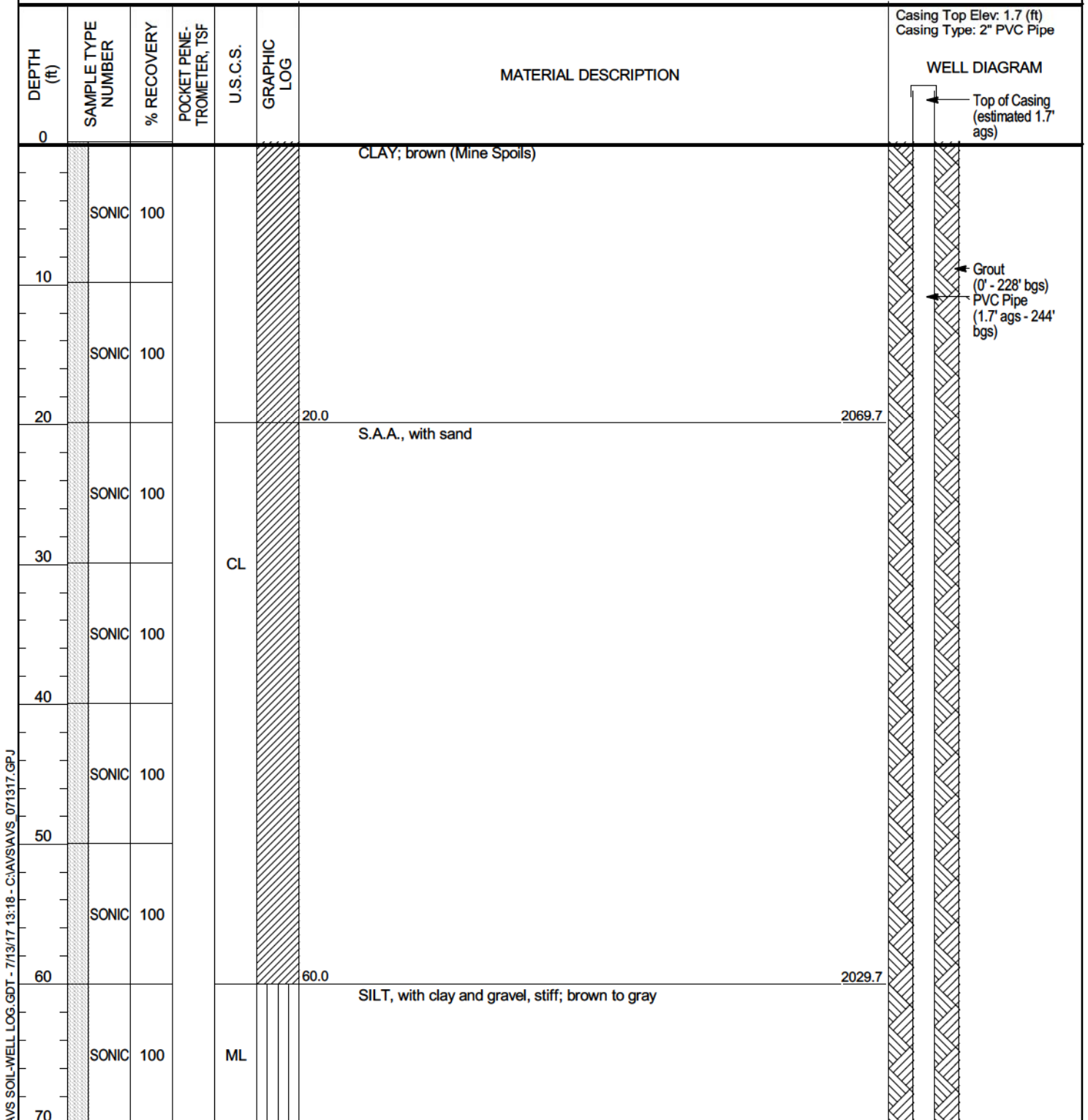
CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
230							
232.0						1891.1 S.A.A., no yellow sand lenses	
240	SONIC	100				240.0 S.A.A., trace sand	
250	SONIC	100		CL		1883.1	
258.0	SONIC	100				1865.1	
260						LIGNITE, very crumbly; dry, brown to black	
265.0	SONIC	100		COAL		1858.1	
270						CLAY, very hard; gray	
278.0	SONIC	100		CL		1845.1	

Bottom of borehole at 278.0 feet.



CLIENT Basin Electric **PROJECT NAME** Antelope Valley
PROJECT NUMBER 60495311 **PROJECT LOCATION** Beulah, ND
DATE STARTED 5/17/2016 **COMPLETED** 5/18/2016 **GROUND ELEVATION** 2089.7 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**
DRILLING METHOD Rotary Sonic **AT TIME OF DRILLING** ---
LOGGED BY Ryan Klutes **CHECKED BY** A. Lanning **AT END OF DRILLING** ---
COORDINATES 632117.57 N 1672362.93 E **▼ AFTER DRILLING** 198.75 ft / Elev 1890.95 ft from BTOC



AVS SOIL-WELL LOG.GDT - 7/13/17 13:18 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
70						SILT, with clay and gravel, stiff; brown to gray	<p>Grout (0' - 228' bgs) PVC Pipe (1.7' - 244' bgs)</p>
76.0	SONIC 100	100		ML	S.A.A., trace sand, no gravel, crumbly; gray		
86.0	SONIC 100	100		CL	CLAY with silt and gravel, very hard; brown		
100.0	SONIC 100	100		ML	SILT, with brown clay, trace gravel, trace coarse sand, crumbly; gray		
123.0	SONIC 100	100		CL	CLAY, trace silt, very stiff; brown		
129.0	SONIC 100	100		ML	SILT, trace sand, crumbly; gray		
136.0	SONIC 100	100		CL	CLAY, trace sand and gravel, firm; brown		
140.0	SONIC 100	100		CL	S.A.A., very stiff		
147.0	SONIC 100	100		SP	SAND, medium-grained, trace brown clay; orange		
1942.7							
1989.7							
2003.7							
2013.7							

AVS SOIL-WELL LOG.GDT - 7/13/17 13:19 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
150							
	SONIC	100		SP		SAND, medium-grained, trace brown clay; orange	<p>Grout (0' - 228' bgs) PVC Pipe (1.7' ags - 244' bgs)</p>
				ML		SILT, trace brown clay, very stiff, crumbly; gray	
160						CLAY, trace gravel, very stiff; brown	
	SONIC	100				S.A.A., with small lenses of medium-grained sand and gravel	
170						S.A.A., no sand or gravel lenses	
	SONIC	100				S.A.A., very hard	
180						S.A.A., with some gravel (possible slough)	
	SONIC	100				S.A.A., no gravel	
190							
	SONIC	100					
200							
	SONIC	100					
210							
	SONIC	100					
220							
	SONIC	100					
230							Bentonite Seal

AVS SOIL-WELL LOG.GDT - 7/13/17 13:19 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
230							
	SONIC	100		CL		S.A.A., no gravel	
						LIGNITE, with peat; very dry, brown	
240	SONIC	100		COAL		236.0 1853.7	
						CLAY, very hard; gray	
250	SONIC	100		CL		245.0 1844.7	
260	SONIC	100		CL		262.0 1827.7	

Bottom of borehole at 262.0 feet.

CLIENT Basin Electric **PROJECT NAME** Antelope Valley
PROJECT NUMBER 60495311 **PROJECT LOCATION** Beulah, ND
DATE STARTED 5/19/2016 **COMPLETED** 5/20/2016 **GROUND ELEVATION** 2040.68 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**
DRILLING METHOD Rotary Sonic **AT TIME OF DRILLING** ---
LOGGED BY Ryan Klutes **CHECKED BY** A. Lanning **AT END OF DRILLING** ---
COORDINATES 630703.79 N 1672368.4 E **AFTER DRILLING** 149.50 ft / Elev 1891.18 ft from BTOC

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0							Casing Top Elev: 3 (ft) Casing Type: 2" PVC Pipe
0 - 10	SONIC 100	100				CLAY, with medium-grained gravel; dark brown (Mine Spoils)	Top of Casing (estimated 3' ags)
10 - 20	SONIC 100	100					Grout (0' - 172' bgs) PVC Pipe (3' ags - 186' bgs)
20					20.0	S.A.A., grades moist; dark brown to light brown	2020.7
20 - 30	SONIC 100	100					
30 - 40	SONIC 100	100		CL			
40					40.0	S.A.A., trace, gravel; brown with light brown horizons	2000.7
40 - 50	SONIC 100	100					
50 - 60	SONIC 100	100					
60					58.0	S.A.A., trace poorly cemented sandstone fragments; brown	1982.7
60 - 70	SONIC 100	100					

AVS SOIL-WELL LOG.GDT - 7/13/17 13:19 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

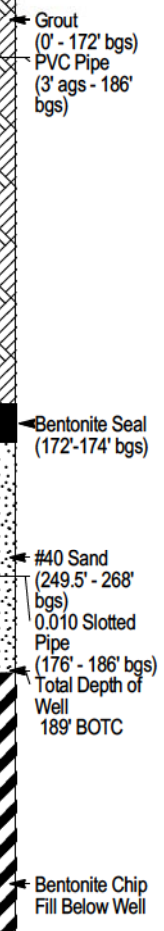
DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
70							
80	SONIC	100				S.A.A., trace poorly cemented sandstone fragments; brown	<p>Grout (0' - 172' bgs) PVC Pipe (3' - 186' bgs)</p>
80.0					1960.7	S.A.A., sandy clay, dry, crumbly	
90	SONIC	100		CL			
100	SONIC	100					
100.0					1940.7	S.A.A., grades moist	
106.0	SONIC	100			1934.7	S.A.A., moist; gray with small brown inclusions	
110	SONIC	100					
116.0	SONIC	100			1924.7	SILT, trace clay, very hard, very compacted; gray	
120					1920.7	S.A.A., CLAYEY SILT	
130	SONIC	100		ML			
139.0					1901.7	CLAY, with chert, some shale, very hard, crumbly; gray	
140	SONIC	100					
143.0					1897.7	S.A.A., grades without chert and shale	
150	SONIC	100		CL			

AVS SOIL-WELL LOG.GDT - 7/13/17 13:19 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
150							
152.0	SONIC	100			[Hatched Pattern]	S.A.A., mottled black and brown	1888.7
160	SONIC	100		CL	[Hatched Pattern]	S.A.A., grades gray	1879.7
174.0	SONIC	100			[Hatched Pattern]	S.A.A., grades with silt	1866.7
178.0				COAL	[Solid Black]	LIGNITE, very crumbly; black to brown	1862.7
186.0	SONIC	100			[Hatched Pattern]	CLAY, very hard; gray	1854.7
190	SONIC	100		CL	[Hatched Pattern]		
200	SONIC	100			[Hatched Pattern]		
208.0					[Hatched Pattern]		1832.7

Bottom of borehole at 208.0 feet.



CLIENT Basin Electric **PROJECT NAME** Antelope Valley
PROJECT NUMBER 60495311 **PROJECT LOCATION** Beulah, ND
DATE STARTED 11/7/2016 **COMPLETED** 11/16/2016 **GROUND ELEVATION** 2105.695 ft **HAMMER TYPE** Not Applicable
DRILLING CONTRACTOR Cascade Drilling **GROUND WATER LEVELS:**
DRILLING METHOD Rotary Sonic **AT TIME OF DRILLING** ---
LOGGED BY Ryan Klutes **CHECKED BY** A. Lanning **AT END OF DRILLING** ---
COORDINATES 630733.344 N 1675082.654 E **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0							Casing Top Elev. 1.43 (ft) Casing Type: 4" PVC Pipe
0						CLAY, reworked; brown	Top of Casing (estimated 1.43' ags)
10	SONIC	100					Grout (0' - 230' bgs) PVC Pipe (1.43' ags - 251' bgs)
20	SONIC	100					
30	SONIC	100					
40	SONIC	100		CL			
50	SONIC	100					
60	SONIC	100					
70	SONIC	100					

AVS SOIL-WELL LOG.GDT - 7/13/17 13:20 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
70							
80	SONIC	100				CLAY, reworked; brown	
90	SONIC	100					
100	SONIC	100					
110	SONIC	100		CL			
120	SONIC	100					
130	SONIC	100					
140	SONIC	100					
140.0						140.0	1965.7
						SILTY CLAY, very hard, reworked material; gray	
149.0						149.0	1956.7
150							

AVS SOIL-WELL LOG.GDT - 7/13/17 13:20 - C:\AVS\AVS_071317.GPJ


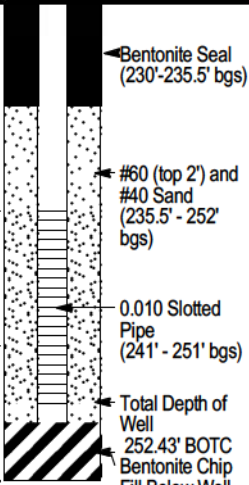


(Continued Next Page)

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
150						CLAY, reworked; brown	<p>Grout (0' - 230' bgs) PVC Pipe (1.43' bgs - 251' bgs)</p>
160	SONIC	100		CL			
170	SONIC	100		CL			
172.0						1933.7	
	SONIC	100		CL		CLAY/SILT, lignite fragments, native material; gray	
180						1925.7	
180.0				COAL		LIGNITE, clay; gray	
185.0	SONIC	70				1920.7	
						LIGNITE (<1")	
						CLAY; gray very hard drilling	
190	SONIC	100					
	SONIC	100					
200	SONIC	100					
	SONIC	100		CL			
210	SONIC	100					
	SONIC	100					
220	SONIC	100					
	SONIC	100					
230	SONIC	100					

AVS SOIL-WELL LOG.GDT - 7/13/17 13:20 - C:\AVS\AVS_071317.GPJ

CLIENT Basin Electric PROJECT NAME Antelope Valley
 PROJECT NUMBER 60495311 PROJECT LOCATION Beulah, ND

DEPTH (ft)	SAMPLE TYPE NUMBER	% RECOVERY	POCKET PENE-TROMETER, TSF	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
230							
	SONIC	100		CL		CLAY; gray very hard drilling	 <ul style="list-style-type: none"> Bentonite Seal (230'-235.5' bgs) #60 (top 2') and #40 Sand (235.5' - 252' bgs) 0.010 Slotted Pipe (241' - 251' bgs) Total Depth of Well 252.43' BOTC Bentonite Chip Fill Below Well
240	SONIC	100				LIGNITE	
	SONIC	100		COAL			
	SONIC	100				CLAY; gray	
250	SONIC	100		CL			
	SONIC	100				Bottom of borehole at 255.0 feet.	



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 1 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILLWORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0					TOPSOIL: brown; moist; few roots, trace fine gravel.			
1		1			LEAN CLAY WITH SAND (CL): fine grained; yellowish brown to gray 10YR 5/4 - 5/1; moist; trace fine gravel, trace lignite inclusions.		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2090
2		2	CL				RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4'	
5					LEAN TO FAT CLAY WITH SAND (CL-CH): fine grained; dark gray to brown 10YR 4/1 - 4/3; moist; firm to hard; medium to high plasticity; 15% sand, 85% fines.		GROUT Type: Neat Cement Interval: 0-230' bgs	2085
10		3	CL-CH				SEAL Type: Bentonite Interval: 230-238' bgs	2080
15					LEAN TO FAT CLAY (CL-CH): dark gray to brown 10YR 4/1 - 4/3; moist; hard; few lignite inclusions; medium to high plasticity.	Mine Spoils	SANDPACK Type: 35-45 10WS Interval: 238-256' bgs	2075
20		4	CL-CH				SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	2070
25					LEAN TO FAT CLAY (CL-CH): gray 10YR 5/1; moist; hard; trace orange oxidized staining; medium to high plasticity; 1" fine sandstone band at 28'.			2065
30		5	CL-CH					2060

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 2 OF 8

P:\BISMARCK\34_ND\29\34291096_BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
35			CL-CH		LEAN TO FAT CLAY (CL-CH): gray 10YR 5/1; moist; hard; trace orange oxidized staining; medium to high plasticity; 1" fine sandstone band at 28'. (continued)		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2055
40		6			FAT CLAY (CH): dark gray 10YR 4/1; moist; firm to hard; few lignite inclusions, trace orange oxidized staining; high plasticity.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4'	2050
45			CH				GROUT Type: Neat Cement Interval: 0-230' bgs	2045
50		7					SEAL Type: Bentonite Interval: 230-238' bgs	2040
55							SANDPACK Type: 35-45 10WS Interval: 238-256' bgs	2035
60		8			MUDSTONE: gray 10YR 5/1; fractured.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	2030
61-66		9	CL-CH		LEAN TO FAT CLAY WITH SAND (CL-CH): fine grained; dark gray to brown; moist; hard; trace orange oxidized staining; 20% sand, 80% fines.			
61-66					61-66' - no recovery during drilling, soft.			

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 3 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
65					61-66' - no recovery during drilling, soft. (continued)			
68		10	CH		FAT CLAY WITH GRAVEL (CH): fine grained; dark brown 10YR 3/3; moist; hard; fractured, few orange oxidized staining; high plasticity; 20% gravel, 80% fines.	Mine Spoils	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4' GROUT Type: Neat Cement Interval: 0-230' bgs SEAL Type: Bentonite Interval: 230-238' bgs SANDPACK Type: 35-45 10WS Interval: 238-256' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	2025
70			CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; fractured, trace lignite inclusions; high plasticity.			2020
75			CH		FAT CLAY WITH SAND/SILT (CH): very fine to fine grained; dark brown 10YR 3/3; moist; hard; high plasticity; 20% sand, 80% fines.			2015
80		11	CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; high plasticity.			2010
85			CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; high plasticity.			2005
90		12	CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; high plasticity.			2000
95			CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; fine sand/silt lenses throughout; high plasticity.			1995

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 4 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILLWORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
100		13	CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; fine sand/silt lenses throughout; high plasticity. <i>(continued)</i>		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1990
105					LEAN TO FAT CLAY (CL-CH): dark gray 10YR 4/1; moist; hard; trace lignite inclusions; medium to high plasticity.	Mine Spoils	RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4'	1985
110		14	CL-CH				GROUT Type: Neat Cement Interval: 0-230' bgs	1980
115							SEAL Type: Bentonite Interval: 230-238' bgs	1975
120		15					SANDPACK Type: 35-45 10WS Interval: 238-256' bgs	1970
125					FAT CLAY (CH): dark gray to brown 10YR 4/1 - 4/3; moist; hard; few fine gravel and coarse sand, trace orange oxidized staining; high plasticity.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	1965
130			CH					

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 5 OF 8

P:\BISMARCK\34.ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet	
130		16	CH		FAT CLAY (CH): dark gray to brown 10YR 4/1 - 4/3; moist; hard; few fine gravel and coarse sand, trace orange oxidized staining; high plasticity. (continued)		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4' GROUT Type: Neat Cement Interval: 0-230' bgs SEAL Type: Bentonite Interval: 230-238' bgs SANDPACK Type: 35-45 10WS Interval: 238-256' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	1960	
			SM		SILTY SAND (SM): fine to medium grained; light yellowish brown 10YR 6/4; moist; angular to subangular; trace lignite inclusions, loose; 70% sand, 30% fines.				
135					FAT CLAY (CH): dark gray to brown 10YR 4/1 - 4/3; moist; hard; few fine gravel and coarse sand, trace orange oxidized staining.				1955
140		17	CH						1950
145									1945
150		18	CL-CH		LEAN TO FAT CLAY (CL-CH): dark gray to brown 10YR 4/1 - 4/3; moist; firm to hard; few fine gravel and fine sand lenses throughout, few lignite inclusion, few orange oxidized staining; medium to high plasticity.	Mine Spoils		1940	
155								1935	
160		19	CH		END OF MINE SPOILS - FAT CLAY (CH): very dark gray 10YR 3/1; dry to moist; hard; fractured; high plasticity; 1" lignite bands at 161', 163', and 164'.			1930	

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 6 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
165			CH		END OF MINE SPOILS - FAT CLAY (CH): very dark gray 10YR 3/1; dry to moist; hard; fractured; high plasticity; 1" lignite bands at 161', 163', and 164'. (continued)	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4' GROUT Type: Neat Cement Interval: 0-230' bgs SEAL Type: Bentonite Interval: 230-238' bgs SANDPACK Type: 35-45 10WS Interval: 238-256' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	1925
			CH		FAT CLAY (CH): greenish gray GLEY1 5/1; dry to moist; hard; fractured; high plasticity.			1920
170		20			FAT CLAY (CH): dark gray to very dark gray 10YR 4/1 - 3/1; dry to moist; hard; fractured, silt lenses throughout; high plasticity.			1915
175			CH					1910
180		21			SILTY SAND (SM): fine grained; gray 10YR 5/1; moist; hard; 70% sand, 30% fines.			1905
185			CH		FAT CLAY (CH): dark gray to very dark gray 10YR 4/1 - 3/1; moist; hard; fractured; high plasticity.			1900
			CH		FAT CLAY (CH): greenish gray GLEY1 5/1; moist; hard; fractured, thin fine sand/silt lenses throughout; high plasticity.			
190		22			FAT CLAY (CH): dark gray to very dark gray 10YR 4/1 - 3/1; moist; hard; fractured; high plasticity.			
			CH		FAT CLAY (CH): greenish gray GLEY1 5/1; moist; hard; fractured, thin fine sand/silt lenses throughout; high plasticity.			
195			CH					

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 7 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
195			CH		FAT CLAY (CH): dark gray to very dark gray 10YR 4/1 - 3/1; moist; hard; fractured; high plasticity.	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1895
200		23	CH		FAT CLAY (CH): greenish gray GLEY1 5/1; moist; hard; fractured, thin fine sand/silt lenses throughout; high plasticity.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4'	1890
205			CH		SHALE: greenish gray GLEY1 5/1; very hard.		GROUT Type: Neat Cement Interval: 0-230' bgs	1885
210		24	CL-ML		LEAN CLAY TO SILT (CL-ML): gray 10YR 5/1; moist; hard; indistinguishable fines.		SEAL Type: Bentonite Interval: 230-238' bgs	1880
215		25	CH		FAT CLAY (CH): dark gray to very dark gray 10YR 4/1 - 3/1; moist; hard; fractured; high plasticity; 1" lignite band at 214'.		SANDPACK Type: 35-45 10WS Interval: 238-256' bgs	1875
220		26	ML		SILT (ML): gray to dark gray 10YR 5/1 - 4/1; hard; fractured.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	1870
225		27	CL-ML		LEAN CLAY TO SILT (CL-ML): gray 10YR 4/1; moist; firm to hard; fractured; indistinguishable fines.			1865
			CL-CH		LEAN TO FAT CLAY (CL-CH): very dark gray 10YR 3/1; moist; hard; fractured; medium to high plasticity.			

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-21(S)

SHEET 8 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2092.5 ft	Top of Casing Elev.:	2095.1 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,504.3 ft E 1,672,423.9 ft	Completion Depth:	256.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
230		28			LEAN TO FAT CLAY (CL-CH): very dark gray 10YR 3/1; moist; hard; fractured; medium to high plasticity. (continued)	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1860
235		29	CL-CH				RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 241' to surface + 2.4'	1855
240		30					GROUT Type: Neat Cement Interval: 0-230' bgs	
245		31			LIGNITE: Spaer Bed; black to dark brown 10YR 2/1 - 3/3; dry; fractured, crumbly, few thin bands appearing wet.	Spaer Bed Lignite	SEAL Type: Bentonite Interval: 230-238' bgs	1850
250		32			SANDY LEAN CLAY TO SANDY SILT (CL-ML): fine grained; gray 10YR 5/1; moist; hard; fractured, trace carbonaceous staining at fracture planes; non-plastic plasticity.	Native Sentinel Butte Formation	SANDPACK Type: 35-45 10WS Interval: 238-256' bgs	1845
255			CL-ML				SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 241-251' bgs	1840
260					End of well 256.0 feet			1835

Date Boring Started: 9/23/20 12:10 pm
 Date Boring Completed: 9/24/20 5:00 pm
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-161'
 Native Sentinel Butte Formation: 161-256'
 Spaer Bed Lignite: 242-250'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 1 OF 8

P:\BISMARCK\34.ND\29\34291096 BASINELECTRIC-LATERAL LANDFILLWORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft	Completion Depth:	236.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0					TOPSOIL: very dark gray 10YR 3/1; dry to moist; trace roots.			
1		1	CL		LEAN CLAY (CL): gray to brown; moist; soft; few fine to coarse gravel; medium plasticity; 10% gravel, 90% fines.		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2090
5			CL		LEAN CLAY WITH SAND (CL): dark gray to brown; moist; soft; medium plasticity; 20% sand, 80% fines.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5'	2085
10		2	SM		SILTY SAND (SM): fine grained; dark gray 10YR 4/1; moist.		GROUT Type: Neat Cement Interval: 0-214.5' bgs	2080
15			CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; high plasticity.		SEAL Type: Bentonite Interval: 214.5-220' bgs	
20			SM		SILTY SAND (SM): fine grained; dark gray 10YR 4/1; moist.	Mine Spoils	SANDPACK Type: 35-45 10WS Interval: 220-236' bgs	2075
25		3	CL-CH		LEAN TO FAT CLAY (CL-CH): brown to very dark gray 10YR 4/3 - 3/1; moist; firm to hard; trace fine sand, trace lignite inclusions; medium to high plasticity.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	2070
30		4	SC-CL		CLAYEY SAND TO SANDY CLAY (SC-CL): fine grained; dark gray 10YR 4/1; moist; low plasticity.			2065
35			CL-CH		LEAN TO FAT CLAY WITH SAND (CL-CH): fine grained; very dark gray 10YR 3/1; moist; trace lignite inclusions; medium to high plasticity.			2060

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 2 OF 8

P:\BISMARCK\34_ND\29\34291096_BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft	Completion Depth:	236.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
35			CL-CH		LEAN TO FAT CLAY WITH SAND (CL-CH): fine grained; very dark gray 10YR 3/1; moist; trace lignite inclusions; medium to high plasticity. (continued)	Mine Spoils	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2055
40		5	CH		LIGNITE: black; weathered. FAT CLAY (CH): very dark gray to dark brown 10YR 3/1 - 3/2; moist; hard; trace sand, trace fine gravel; high plasticity.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5'	2050
45			CH		FAT CLAY WITH LIGNITE (CH): very dark gray to dark brown 10YR 3/1 - 3/2; moist; hard; trace sand, trace fine gravel; high plasticity; 50% lignite.		GROUT Type: Neat Cement Interval: 0-214.5' bgs	2045
50		6	SM-SC		SILTY SAND TO CLAYEY SAND (SM-SC): fine grained; dark gray 10YR 4/1; moist; firm to hard.		SEAL Type: Bentonite Interval: 214.5-220' bgs	2040
55							SANDPACK Type: 35-45 10WS Interval: 220-236' bgs	2035
60		7	CL-CH		LEAN TO FAT CLAY (CL-CH): dark gray 10YR 4/1; moist; hard; few fine sand lenses throughout; medium to high plasticity.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	2030
65								

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 3 OF 8

P:\BISMARCK\34.ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPC AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft	Completion Depth:	236.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
65								
			SC		CLAYEY SAND (SC): fine grained; gray 10YR 5/1; moist; soft.		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2025
			CL-CH		LEAN TO FAT CLAY (CL-CH): gray to brown; moist; firm to hard; fine sand lenses throughout.			
70			SM		SILTY SAND (SM): fine grained; gray 10YR 5/1; moist.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5'	2020
		8	CH		FAT CLAY (CH): brown 10YR 4/3; moist; hard; trace lignite inclusions, few fine gravel; high plasticity.			
75							GROUT Type: Neat Cement Interval: 0-214.5' bgs	2015
			CH		FAT CLAY (CH): dark gray 10YR 4/1; moist; hard; fine sand/silt lenses throughout; high plasticity.			
80							SEAL Type: Bentonite Interval: 214.5-220' bgs	2010
		9	CH		FAT CLAY (CH): dark gray 10YR 4/1 to brown 10YR 4/3; moist; hard; fine sand/silt lenses throughout, trace orange oxidized staining, trace fine gravel; high plasticity.			
85							SANDPACK Type: 35-45 10WS Interval: 220-236' bgs	2005
			CH		FAT CLAY (CH): dark gray 10YR 4/1 to brown 10YR 4/3; moist; hard; fine sand/silt lenses throughout, trace orange oxidized staining, trace fine gravel; high plasticity.			
90							SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	2000
		10	CH		FAT CLAY (CH): dark gray 10YR 4/1 to brown 10YR 4/3; moist; hard; fine sand/silt lenses throughout, trace orange oxidized staining, trace fine gravel; high plasticity.			
95								1995
			CH		FAT CLAY (CH): dark gray to brown 10YR 4/1 - 4/3; moist; trace orange oxidized staining, trace fine gravel and scoria; high plasticity.			

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 4 OF 8

P:\BISMARCK\34.ND\29\34291096.BAS\INELECTRIC-LATERAL.LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC.WELL LOGS.GPJ.BARR\LIBRARY.GLB.ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft	Completion Depth:	236.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
100		11	CH		FAT CLAY (CH): dark gray to brown 10YR 4/1 - 4/3; moist; trace orange oxidized staining, trace fine gravel and scoria; high plasticity. <i>(continued)</i>		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1990
105			CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; high plasticity.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5'	1985
110		12			FAT CLAY (CH): brown 10YR 4/3; moist; firm; few fine to coarse gravel; high plasticity; 10% gravel, 90% fines. 106-116' - soft drilling.	Mine Spoils	GROUT Type: Neat Cement Interval: 0-214.5' bgs SEAL Type: Bentonite Interval: 214.5-220' bgs	1980
115					116-126' - wet to moist.		SANDPACK Type: 35-45 10WS Interval: 220-236' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	1975
120		13	CH					1970
125								1965
130								

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 5 OF 8

P:\BISMARCK\34_ND\29\34291096_BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft	Completion Depth:	236.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
130		14			FAT CLAY (CH): brown 10YR 4/3; moist; firm; few fine to coarse gravel; high plasticity; 10% gravel, 90% fines. (continued) 1" band of fine sandstone.	Mine Spoils	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5' GROUT Type: Neat Cement Interval: 0-214.5' bgs SEAL Type: Bentonite Interval: 214.5-220' bgs SANDPACK Type: 35-45 10WS Interval: 220-236' bgs	1960
135			CH					1955
140		15				Native Sentinel Butte Formation	GROUT Type: Neat Cement Interval: 0-214.5' bgs SEAL Type: Bentonite Interval: 214.5-220' bgs SANDPACK Type: 35-45 10WS Interval: 220-236' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	1950
145								1945
150		16			END OF MINE SPOILS - FAT CLAY (CH): very dark gray 10YR 3/1; dry to moist; hard; silt/fine sand lenses throughout, thin lignite lenses throughout.			1940
155			CH					1935
160		17						1930

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 6 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft	Completion Depth:	236.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SCUC	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
165					END OF MINE SPOILS - FAT CLAY (CH): very dark gray 10YR 3/1; dry to moist; hard; silt/fine sand lenses throughout, thin lignite lenses throughout. (continued)	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1925
170		18					RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5'	1920
175			CH				GROUT Type: Neat Cement Interval: 0-214.5' bgs	
180		19					SEAL Type: Bentonite Interval: 214.5-220' bgs	1915
185							SANDPACK Type: 35-45 10WS Interval: 220-236' bgs	
190		20			FAT CLAY (CH): dark greenish gray GLEY1 4/1; moist; hard; trace brachiopod fossil imprints; high plasticity.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	1910
195			CH					1905

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 7 OF 8

P:\BISMARCK\34.ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCLG.WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft	Completion Depth:	236.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet		
195			CH			Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5' GROUT Type: Neat Cement Interval: 0-214.5' bgs SEAL Type: Bentonite Interval: 214.5-220' bgs SANDPACK Type: 35-45 10WS Interval: 220-236' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	1895		
			SM		SILTY SAND (SM): fine grained; gray 10YR 6/1; dry to moist; firm to hard.					
			CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; high plasticity.					
200			CH							1890
					SHALE: very dark gray 10YR 3/1; very hard.					
205		22						1885		
			CH		FAT CLAY (CH): dark gray 10YR 4/1; moist; hard; thin fine sand/silt lenses throughout; high plasticity.			1880		
210		23	CH					1875		
			CH		FAT CLAY (CH): dark gray 10YR 4/1; moist; hard; high plasticity.			1870		
215		24	CH					1865		
					LIGNITE: Spaer Bed; black 10YR 2/1; dry; hard; fractured, crumbly, some orange/brown staining 10YR 4/4, thin wet bands at 225.3' and 228'.			1865		

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-22(S)

SHEET 8 OF 8

P:\BISMARCK\34.ND\29\34291096 BASINELECTRIC-LATERAL LANDFILLWORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPC AVS Landfill Expansion	Surface Elevation:	2091.4 ft	Top of Casing Elev.:	2094.3 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 632,582.1 ft E 1,675,123.0 ft		Completion Depth:	236.0 ft	
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
230		25			LIGNITE: Spaer Bed; black 10YR 2/1; dry; hard; fractured, crumbly, some orange/brown staining 10YR 4/4, thin wet bands at 225.3' and 228'. (continued)	Spaer Bed Lignite	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1860
235		26			SILTY SAND TO SANDY SILT: fine grained; dark gray 10YR 4/1; dry to moist; hard.	Native Sentinel Butte Formation	RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 223' to surface + 2.5'	1855
			CH		FAT CLAY (CH): dark gray 10YR 4/1; dry to moist; hard; high plasticity.		GROUT Type: Neat Cement Interval: 0-214.5' bgs	1850
240					End of well 236.0 feet		SEAL Type: Bentonite Interval: 214.5-220' bgs	1845
245							SANDPACK Type: 35-45 10WS Interval: 220-236' bgs	1840
250							SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 223-233' bgs	1835

Date Boring Started: 9/9/20 12:50 pm
 Date Boring Completed: 9/11/20 9:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-148'
 Native Sentinel Butte Formation: 148-236'
 Spaer Bed Lignite: 224.9-232.3'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 1 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
0					TOPSOIL: black; moist; soft; few roots.			
0-5		1	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; brown 10YR 4/3; moist; firm; angular to subangular.		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2075
5-10			CL-CH		LEAN TO FAT CLAY WITH SAND (CL-CH): dark gray 10YR 4/1; moist; hard; trace lignite inclusions; medium to high plasticity; 20% sand, 80% fines.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6'	2070
10-15		2					GROUT Type: Neat Cement Interval: 0-190' bgs	2065
15-196.5						Mine Spoils	SEAL Type: Bentonite Interval: 190-196.5' bgs	
196.5-213			SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; grayish brown 10YR 5/2; moist; angular to subangular.		SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs	2060
213-220			CL		SANDY LEAN CLAY (CL): fine to medium grained; grayish brown 10YR 5/2; moist; 40% sand, 60% fines.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	2055
220-25		3	SC-SM		CLAYEY TO SILTY SAND (SC-SM): fine to medium grained; gray 10YR 5/1; moist; trace orange oxidized staining.			2050
25-26					SANDSTONE: fine grained; light gray 10YR 7/1; dry; crushed.			
26-29					POORLY GRADED SAND WITH SILT: fine to medium grained; gray 10YR 5/1; moist; angular to subangular.			
29-30		4	CL		SANDY LEAN CLAY (CL): fine to medium grained; brown to gray; moist; firm to hard; few fine gravel; 8% gravel, 35% sand, 57% fines.			

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 2 OF 8

P:\BISMARCK\34_ND\29\34291096_BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
35			CL		SANDY LEAN CLAY (CL): fine to medium grained; brown to gray; moist; firm to hard; few fine gravel; 8% gravel, 35% sand, 57% fines. <i>(continued)</i>	Mine Spoils	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2045
40		5	CH		FAT CLAY (CH): dark gray 10YR 4/1; moist; hard; trace lignite inclusions, thin sand lenses throughout; high plasticity.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6'	2040
45					LIGNITE: black; hard; fractured, crumbly.		GROUT Type: Neat Cement Interval: 0-190' bgs	2035
50			CH		FAT CLAY (CH): dark gray 10YR 4/1; moist; firm to hard; trace orange oxidized staining; high plasticity.		SEAL Type: Bentonite Interval: 190-196.5' bgs	2030
55			6	SC-SM	CLAYEY TO SILTY SAND (SC-SM): fine to medium grained; gray to pale brown 10YR 5/1 - 6/3; dry to moist; hard; angular to subangular; trace lignite, crumbly.		SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs	2025
60					MUDSTONE: light gray 10YR 7/1; dry; hard; fractured, crushed.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	2020
65			7					2015

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 3 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
65					MUDSTONE: light gray 10YR 7/1; dry; hard; fractured, crushed. (continued)			
70		8	CH		FAT CLAY WITH GRAVEL (CH): fine grained; dark yellowish brown 10YR 3/4; moist; hard; little lignite inclusions, trace orange staining, trace sand lenses; 25% gravel, 2% sand, 73% fines.		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6' GROUT Type: Neat Cement Interval: 0-190' bgs SEAL Type: Bentonite Interval: 190-196.5' bgs SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	2010
75								2005
80		9	SP-SM		POORLY GRADED SAND WITH SILT (SP-SM): fine grained; gray 10YR 5/1; hard; crumbly.			2000
85			CH		FAT CLAY WITH GRAVEL (CH): fine grained; dark yellowish brown 10YR 3/4; moist; hard; little lignite inclusions, trace orange staining, trace sand lenses; 25% gravel, 2% sand, 73% fines. Moist to wet.	Mine Spoils		1995
90		10			SILTSTONE: light gray 10YR 7/1; dry; fractured, crushed.			1990
95			CH		FAT CLAY WITH GRAVEL (CH): fine grained; dark yellowish brown 10YR 3/4; moist; hard; little lignite inclusions, trace orange staining, trace sand lenses; 25% gravel, 2% sand, 73% fines.			1985

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 4 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPC AVS Landfill Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SOCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
100		11			FAT CLAY WITH GRAVEL (CH): fine grained; dark yellowish brown 10YR 3/4; moist; hard; little lignite inclusions, trace orange staining, trace sand lenses; 25% gravel, 2% sand, 73% fines. <i>(continued)</i> 96-106' - moist to wet; firm. 96-106' - moist to wet; firm. <i>(continued)</i>	Mine Spoils	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1980
105				Harder.			RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6'	1975
110		12					GROUT Type: Neat Cement Interval: 0-190' bgs	1970
115							SEAL Type: Bentonite Interval: 190-196.5' bgs	1965
120		13			END OF MINE SPOILS - LEAN TO FAT CLAY (CL-CH): dark gray 10YR 4/1; dry to moist; hard; 1" lignite bands throughout; medium to high plasticity.	Native Sentinel Butte Formation	SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs	1960
125							SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	1955
130								1950

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 5 OF 8

P:\BISMARCK\34_ND\29\34291096_BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCLANDFILL\LOGS\GFIJ_BARR\LIBRARY.GLB_ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCLANDFILL Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SOCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
130		14	CL-CH		END OF MINE SPOILS - LEAN TO FAT CLAY (CL-CH): dark gray 10YR 4/1; dry to moist; hard; 1" lignite bands throughout; medium to high plasticity. (continued) 1" siltstone band.	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1945
135			CH		FAT CLAY (CH): gray to very dark gray 10YR 3/1 - 4/1; dry to moist; hard; high plasticity.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6'	1940
140		15	CH		FAT CLAY (CH): dark greenish gray GLEY1 4/1; dry to moist; hard; high plasticity.		GROUT Type: Neat Cement Interval: 0-190' bgs	1935
145			CH		FAT CLAY (CH): dark greenish gray GLEY1 4/1; dry to moist; hard; high plasticity.		SEAL Type: Bentonite Interval: 190-196.5' bgs	1930
150		16	ML		SILT (ML): gray 10YR 6/1; dry to moist; hard; bands of lean clay throughout.		SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs	1925
155			CH		FAT CLAY (CH): very dark gray 10YR 3/1; moist; hard; high plasticity.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	1920
160		17	CL-ML		LEAN CLAY TO SILT WITH SAND (CL-ML): fine grained; dark gray 10YR 3/1; dry to moist; low plasticity.			

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 6 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
165		18			FAT CLAY (CH): very dark gray 10YR 3/1; dry to moist; hard; trace 1" lignite bands throughout; high plasticity.	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1915
170		19	CH		Very hard. Trace fine sand/silt lenses.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6'	1910
175		20					GROUT Type: Neat Cement Interval: 0-190' bgs	1905
180		21					SEAL Type: Bentonite Interval: 190-196.5' bgs	1900
185							SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs	1895
190							SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	1890
195			SC		CLAYEY SAND (SC): fine grained; very dark gray 10YR 3/1; moist; very hard; few organics/lignite lenses; 70% sand, 30% fines.			1885
					SHALE: very dark gray 10YR 3/1; dry to moist; very hard; with little fine sand, few organics/lignite lenses; 20% sand, 80% fines.			

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 7 OF 8

P:\BISMARCK\34.ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCC AVS Landfill Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	USCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
195								
			SM-SC		SILTY TO CLAYEY SAND (SM-SC): fine grained; dark gray 10YR 4/1; moist; crumbly.	Spaer Bed Lignite	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1880
200		23			LIGNITE: Spaer Bed; black to very dark brown 10YR 2/1 - 2/2; dry; with few bands appearing wet, fractured, crumbly.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6'	1875
205		24					GROUT Type: Neat Cement Interval: 0-190' bgs	
210			SM-SC		SILT TO SILTY SAND (SM-SC): fine grained; gray 10YR 5/1; dry to moist; hard; 50% sand, 50% fines.	Native Sentinel Butte Formation	SEAL Type: Bentonite Interval: 190-196.5' bgs	1870
215			CL-CH		LEAN TO FAT CLAY (CL-CH): gray to very dark gray 10YR 3/1 - 5/1; dry to moist; hard; medium to high plasticity.		SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs	1865
220		26	CL		SANDY/SILTY LEAN CLAY (CL): fine grained; gray 10YR 5/1; moist; hard to soft; medium plasticity; 40% sand, 60% fines.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	1860
225			CL-SC		SANDY LEAN CLAY TO CLAYEY SAND (CL-SC): fine grained; gray 10YR 5/1; moist; hard to firm; 50% sand, 50% fines.			1855

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-23(S)

SHEET 8 OF 8

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPC AVS Landfill Expansion	Surface Elevation:	2077.6 ft	Top of Casing Elev.:	2080.6 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 633,544.9 ft E 1,675,138.1 ft	Completion Depth:	240.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSCS	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
230		27	CL-SC		SANDY LEAN CLAY TO CLAYEY SAND (CL-SC): fine grained; gray 10YR 5/1; moist; hard to firm; 50% sand, 50% fines. (continued)	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1850
235							RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 200' to surface + 2.6'	1845
240					End of well 240.0 feet		GROUT Type: Neat Cement Interval: 0-190' bgs	1840
245							SEAL Type: Bentonite Interval: 190-196.5' bgs	1835
250							SANDPACK Type: 35-45 10WS Interval: 196.5-213' bgs	1830
255							SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 200-210' bgs	1825
260								1820

Date Boring Started: 9/12/20 2:25 pm
 Date Boring Completed: 9/14/20 11:30 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-118'
 Native Sentinel Butte Formation: 118-240'
 Spaer Bed Lignite: 199-208'

Additional data may have been collected in the field which is not included on this log.



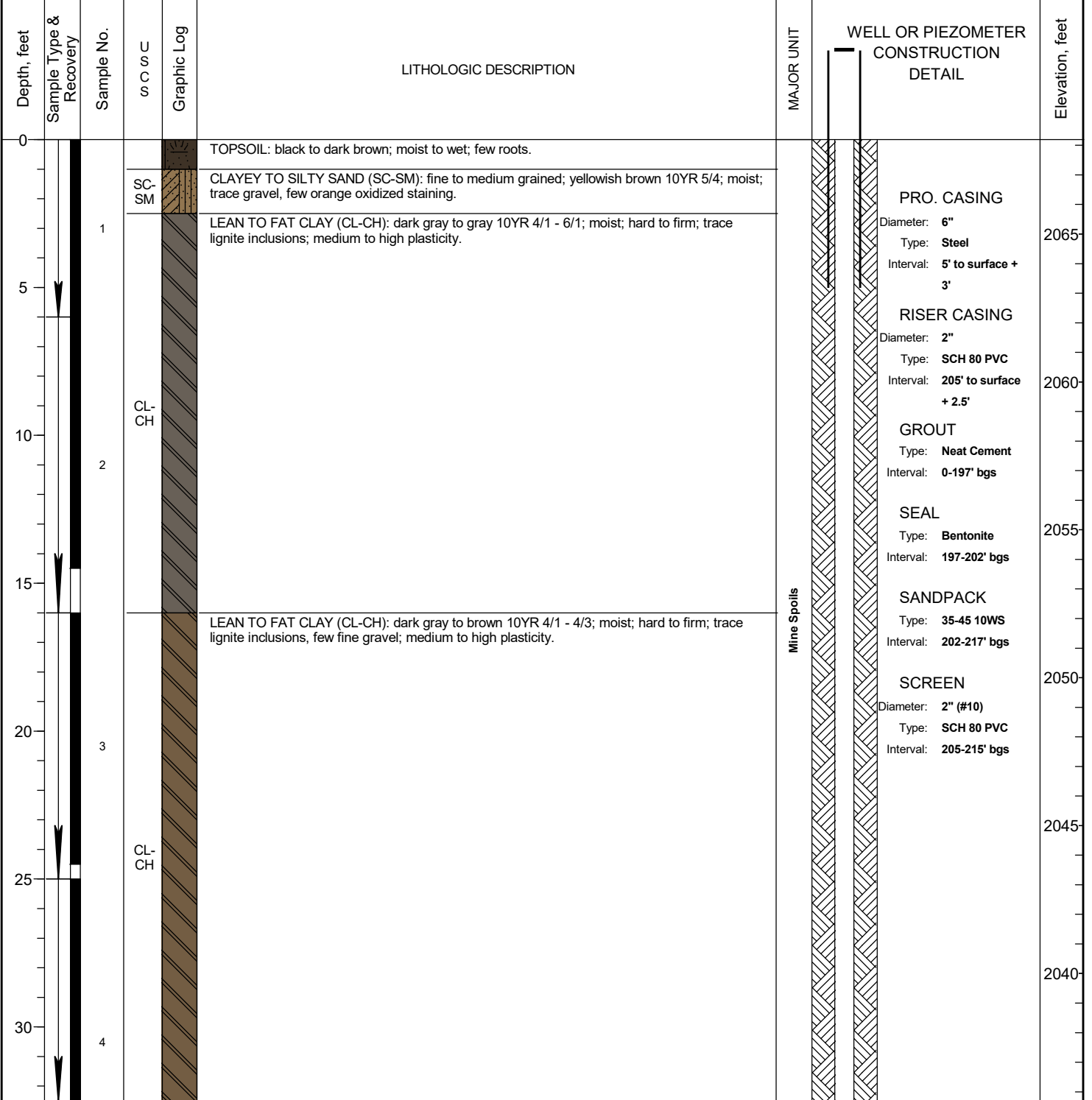
Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-24(S)

SHEET 1 OF 7

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2068.2 ft	Top of Casing Elev.:	2071.0 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 634,449.4 ft E 1,675,151.4 ft	Completion Depth:	220.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				



Date Boring Started: 9/15/20 2:30 pm
 Date Boring Completed: 9/17/20 11:40 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-122'
 Native Sentinel Butte Formation: 122-220'
 Spaer Bed Lignite: 206-214'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-24(S)

SHEET 2 OF 7

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPC AVS Landfill Expansion	Surface Elevation:	2068.2 ft	Top of Casing Elev.:	2071.0 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 634,449.4 ft E 1,675,151.4 ft	Completion Depth:	220.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SCUC	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
35					LEAN TO FAT CLAY (CL-CH): dark gray to brown 10YR 4/1 - 4/3; moist; hard to firm; trace lignite inclusions, few fine gravel; medium to high plasticity. (continued)		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2035
40		5					RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 205' to surface + 2.5'	2030
45							GROUT Type: Neat Cement Interval: 0-197' bgs	2025
50							SEAL Type: Bentonite Interval: 197-202' bgs	2020
55					52.5 - 54.5' - bands of fine sand/silt throughout.	Mine Spoils	SANDPACK Type: 35-45 10WS Interval: 202-217' bgs	2015
60					2" siltstone band, fractured, light gray.		SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 205-215' bgs	2010
65		7						2005

Date Boring Started: 9/15/20 2:30 pm
 Date Boring Completed: 9/17/20 11:40 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-122'
 Native Sentinel Butte Formation: 122-220'
 Spaer Bed Lignite: 206-214'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-24(S)

SHEET 3 OF 7

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARRLIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2068.2 ft	Top of Casing Elev.:	2071.0 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 634,449.4 ft E 1,675,151.4 ft	Completion Depth:	220.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	U C S	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
65					SANDY LEAN CLAY TO CLAYEY SAND (CL-SC): fine grained; dark gray 10YR 4/1; moist; low plasticity; 50% sand, 50% fines.		PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	2000
70		8			FAT CLAY (CH): dark gray and brown 10YR 4/1 - 4/3; moist; firm; little fine gravel, trace orange oxidized staining; high plasticity; 15% gravel, 85% fines.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 205' to surface + 2.5'	1995
75							GROUT Type: Neat Cement Interval: 0-197' bgs	
80		9					SEAL Type: Bentonite Interval: 197-202' bgs	1990
85							SANDPACK Type: 35-45 10WS Interval: 202-217' bgs	
90		10					SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 205-215' bgs	1985
95					FAT CLAY (CH): dark gray 10YR 4/1; moist; firm to hard; few fine gravel; 10% gravel, 90% fines.			1980
								1975

Date Boring Started: 9/15/20 2:30 pm
 Date Boring Completed: 9/17/20 11:40 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-122'
 Native Sentinel Butte Formation: 122-220'
 Spaer Bed Lignite: 206-214'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-24(S)

SHEET 4 OF 7

P:\BISMARCK\34.ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2068.2 ft	Top of Casing Elev.:	2071.0 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 634,449.4 ft E 1,675,151.4 ft	Completion Depth:	220.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
100		11			FAT CLAY (CH): dark gray 10YR 4/1; moist; firm to hard; few fine gravel; 10% gravel, 90% fines. (continued)	Mine Spoils	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1970
105		12	CH				RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 205' to surface + 2.5'	1965
110		13			LIGNITE: black; wet to saturated; soft; weathered.		GROUT Type: Neat Cement Interval: 0-197' bgs	1960
115		14	CL-CH		LEAN TO FAT CLAY WITH LIGNITE (CL-CH): gray to black; moist; firm; 30% lignite, weathered.		SEAL Type: Bentonite Interval: 197-202' bgs	1955
120		15	CH		FAT CLAY (CH): gray and brown; moist; firm to hard; few fine gravel; 10% gravel, 90% fines.		SANDPACK Type: 35-45 10WS Interval: 202-217' bgs	1950
125			CL-CH		END OF MINE SPOILS - LEAN TO FAT CLAY (CL-CH): very dark gray 10YR 3/1; dry to moist; hard; fractured; medium to high plasticity; 1" lignite band at 127'.	Native Sentinel Butte Formation	SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 205-215' bgs	1945
130			CL-CH		LEAN TO FAT CLAY (CL-CH): dark greenish gray GLEY1 4/1; dry to moist; hard; fractured with black organic staining on fracture planes; medium to high plasticity.			1940

Date Boring Started: 9/15/20 2:30 pm
 Date Boring Completed: 9/17/20 11:40 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-122'
 Native Sentinel Butte Formation: 122-220'
 Spaer Bed Lignite: 206-214'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-24(S)

SHEET 5 OF 7

P:\BISMARCK\34_ND\29\34291096_BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCL WELLS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPCL AVS Landfill Expansion	Surface Elevation:	2068.2 ft	Top of Casing Elev.:	2071.0 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 634,449.4 ft E 1,675,151.4 ft	Completion Depth:	220.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
130		16	CL-CH		LEAN TO FAT CLAY (CL-CH): dark greenish gray GLEY1 4/1; dry to moist; hard; fractured with black organic staining on fracture planes; medium to high plasticity. (continued)	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 205' to surface + 2.5' GROUT Type: Neat Cement Interval: 0-197' bgs SEAL Type: Bentonite Interval: 197-202' bgs SANDPACK Type: 35-45 10WS Interval: 202-217' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 205-215' bgs	1935
135		17	CL-CH		LEAN TO FAT CLAY (CL-CH): very dark gray 10YR 3/1; dry to moist; hard; fractured with black organic staining on fracture planes; medium to high plasticity.		1930	
140		18	CL-CH				1925	
145		18	CL-CH				1920	
150		18	CL-ML		LEAN CLAY TO SILT WITH FINE SAND (CL-ML): greenish gray GLEY1 5/1; moist; hard; low plasticity; 15% sand, 85% fines.		1915	
155		19	CL-CH		MUDSTONE: light gray 10YR 7/1; fractured.		1910	
155		19	CL-CH		LEAN TO FAT CLAY (CL-CH): very dark gray 10YR 3/1; moist; hard; thin fine sand lenses throughout; medium to high plasticity.			
160					MUDSTONE: light gray 10YR 7/1; fractured.			
160			CL-CH		LEAN TO FAT CLAY (CL-CH): very dark gray 10YR 3/1; moist; hard; medium to high plasticity; 1" lignite band at 162.9'.			

Date Boring Started: 9/15/20 2:30 pm
 Date Boring Completed: 9/17/20 11:40 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-122'
 Native Sentinel Butte Formation: 122-220'
 Spaer Bed Lignite: 206-214'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-24(S)

SHEET 6 OF 7

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCLG.WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPC AVS Landfill Expansion	Surface Elevation:	2068.2 ft	Top of Casing Elev.:	2071.0 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 634,449.4 ft E 1,675,151.4 ft	Completion Depth:	220.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SSSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
165		20	CL-CH		LEAN TO FAT CLAY (CL-CH): greenish gray GLEY1 6/1; moist; hard; medium to high plasticity.	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3'	1905
170		21	CL-CH		LEAN TO FAT CLAY (CL-CH); very dark gray 10YR 3/1; moist; hard; medium to high plasticity; 1" lignite band at 166' and 168'.		RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 205' to surface + 2.5'	1900
175		22	CL-CH		LEAN TO FAT CLAY (CL-CH): dark gray to greenish gray; moist; hard; medium to high plasticity.		GROUT Type: Neat Cement Interval: 0-197' bgs	1895
180		23	CL-CH		182-193' - lenses of fine to medium sand throughout.		SEAL Type: Bentonite Interval: 197-202' bgs	1890
185							SANDPACK Type: 35-45 10WS Interval: 202-217' bgs	1885
190							SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 205-215' bgs	1880
195			SC-SM		CLAYEY TO SILTY SAND (SC-SM): fine grained; dark gray; moist; hard; fractured; 65% sand, 35% fines.			1875

Date Boring Started: 9/15/20 2:30 pm
 Date Boring Completed: 9/17/20 11:40 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-122'
 Native Sentinel Butte Formation: 122-220'
 Spaer Bed Lignite: 206-214'

Additional data may have been collected in the field which is not included on this log.



Barr Engineering Company
 234 West Century Avenue
 Bismarck, ND 58503
 Telephone: 701-255-5460

LOG OF WELL MW-24(S)

SHEET 7 OF 7

P:\BISMARCK\34_ND\29\34291096 BASINELECTRIC-LATERAL LANDFILL\WORKFILES\PHASE I&II WORK PLAN\MONITORING WELL BORINGS AND INSTALLATION\BEPCC WELL LOGS.GPJ BARR\LIBRARY.GLB ENVIRO LOG BARR TEMPLATE.GDT

Project:	BEPC AVS Landfill Expansion	Surface Elevation:	2068.2 ft	Top of Casing Elev.:	2071.0 ft
Project No.:	34291096	Drilling Method:	Rotosonic		
Location:	Antelope Valley Station, Beulah, ND	Sampling Method:	Rotosonic Core		
Coordinates:	N 634,449.4 ft E 1,675,151.4 ft	Completion Depth:	220.0 ft		
Datum:	ND State Plane, South Zone, 1927 NAD				

Depth, feet	Sample Type & Recovery	Sample No.	SCSU	Graphic Log	LITHOLOGIC DESCRIPTION	MAJOR UNIT	WELL OR PIEZOMETER CONSTRUCTION DETAIL	Elevation, feet
195								
200		24	SC-SM		CLAYEY TO SILTY SAND (SC-SM): fine grained; dark gray; moist; hard; fractured; 65% sand, 35% fines. (continued)	Native Sentinel Butte Formation	PRO. CASING Diameter: 6" Type: Steel Interval: 5' to surface + 3' RISER CASING Diameter: 2" Type: SCH 80 PVC Interval: 205' to surface + 2.5' GROUT Type: Neat Cement Interval: 0-197' bgs SEAL Type: Bentonite Interval: 197-202' bgs SANDPACK Type: 35-45 10WS Interval: 202-217' bgs SCREEN Diameter: 2" (#10) Type: SCH 80 PVC Interval: 205-215' bgs	1870
205								1865
210		25			LIGNITE: Spaer Bed; black to very dark brown 10YR 2/1 - 2/2; dry; fractured, crumbly.	Spaer Bed Lignite		1860
215		26	SM		SILTY SAND (SM): fine grained; greenish gray GLEY1 5/1; moist; hard; 70% sand, 30% fines.	Native Sentinel Butte Formation		1855
220					End of well 220.0 feet			1850
225								1845

Date Boring Started: 9/15/20 2:30 pm
 Date Boring Completed: 9/17/20 11:40 am
 Logged By: MLJ2
 Drilling Contractor: Cascade
 Drill Rig: Rotosonic

Remarks: Mine Spoils: 0-122'
 Native Sentinel Butte Formation: 122-220'
 Spaer Bed Lignite: 206-214'

Additional data may have been collected in the field which is not included on this log.