Department of Energy
Office of Legacy Management

MAY 19 2010

Ms. Dana Bahar
Manager, Superfund Oversight Section
New Mexico Environment Department
Ground Water Quality Bureau
1190 St. Francis Drive
Santa Fe, NM 87502

Subject: Groundwater Investigations at the Ambrosia Lake and Bluewater, New Mexico, Disposal Sites

Dear Ms. Bahar:

The enclosed report summarizes U.S. Department of Energy, Office of Legacy Management (DOE-LM) activities to date and proposed actions consistent with DOE-LM's commitment to support the 5-Year Plan for the Grants Mining District.

DOE-LM has been investigating the hydrogeologic conditions at both sites since August 2009. This work has included extensive literature searches, field mapping, and additional groundwater sampling and analysis, and has led to the proposals contained in the enclosed report.

The report includes descriptions of the hydrogeologic conditions, proposed new monitoring wells, and plans for monitoring the groundwater at both DOE-LM sites. Locations of new monitoring wells are contingent upon concurrence by the New Mexico Environment Department (NMED), so well construction has not started. DOE-LM proposes to conduct isotopic analysis of groundwater at the sites, but the actual isotopes to be monitored need to be coordinated with NMED.

Please call me at (970) 248-6073 if you have any questions.

Sincerely,

Richard P. Bush
Site Manager

Enclosure

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REPLY TO: Grand Junction Office

FSME20

MAY 19 2010

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File: AMB 405.02(B) (Roberts)
BLU 405.02(B) (Roberts)

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LMS/AMB/BLU/S06533

Groundwater Investigations at the Ambrosia Lake and Bluewater Uranium Mill Tailings Disposal Sites

May 2010

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Groundwater Investigations at the Ambrosia Lake and Bluewater Uranium Mill Tailings Disposal Sites

May 2010

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The U.S. Department of Energy Office of Legacy Management (LM) proposes to conduct the following actions at the Ambrosia Lake and Bluewater, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) disposal sites in support of the 5-year plan for the assessment of health and environmental impacts of uranium mining and milling in the Ambrosia Lake Subdistrict of the Grants Mining District (5-year plan).

Ambrosia Lake UMTRCA Title I Disposal Site

LM has no regulatory requirement to monitor groundwater at the Ambrosia Lake site. The U.S. Nuclear Regulatory Commission (NRC) concurred with LM's application of supplemental standards on the basis that they are protective of human health and the environment. The justification for this concurrence was that the uppermost aquifer (Tres Hermanos-C Sandstone in the lower part of the Mancos Shale) does not represent a groundwater resource because of the limited extent of saturation in the aquifer and its inability to sustain a yield of 150 gallons per day to wells. The uppermost aquifer is expected to return to its premilling and mining condition of little-to-no saturation, further eliminating the unit as a potential future groundwater resource. Groundwater does not discharge to the land surface, and no current or foreseen exposure pathways due to groundwater contamination exist. Figure 1 shows a geologic cross section of the region.

Historical records suggest that the alluvium at the site was essentially dry prior to becoming saturated during mining and milling activities. Current water level measurements in well 0675 indicate that water is still present in the alluvium at the site. Some transient drainage may still be occurring from the disposal cell, but it is likely that storm water runoff from the cell recharges the alluvial aquifer through the cell's surrounding rock apron. Previous investigations indicate that the alluvial groundwater moves southwest from the site and then recharges underlying Tres Hermanos Sandstone units of the Mancos Shale as the groundwater crosses these units. Groundwater in these sandstone units moves to the northeast along the dip of the sandstone units. Figure 2 depicts the thickness of alluvium under the site, derived from former site characterization and monitoring wells. A hydrogeologic cross section of the site is shown on Figure 3.

Although groundwater monitoring is not required, at the New Mexico Environment's (NMED's) request LM has been monitoring nitrate, molybdenum, selenium, sulfate, and uranium every 3 years. Monitoring well 0675 is completed in alluvium, and well 0678 is completed in the Tres Hermanos-B Sandstone (the next deeper aquifer below the Tres Hermanos-C Sandstone) of the Mancos Shale (Figure 4). To support the 5-year plan, LM proposes the following actions.

- Install a new monitoring well on the site to evaluate the uppermost aquifer underlying the disposal cell to verify assumptions regarding groundwater conditions. Figure 4 shows the proposed location for well 0405, which would be completed in the Tres Hermanos-C Sandstone.
- Analyze an expanded list of constituents, including certain isotopes to differentiate between naturally occurring and mill-related constituents.
- Increase sampling frequency to annual monitoring. Evaluate results after three sampling events to determine whether the frequency and/or list of analytes can be reduced.

- Evaluate sampling data to determine how the groundwater is changing under the site.
- Provide the data to NMED for comparison with San Mateo drainage basin alluvial groundwater data obtained by NMED downgradient of the site. The data will be used to evaluate whether contaminated alluvial groundwater at the site is contributing to downgradient alluvial contamination.

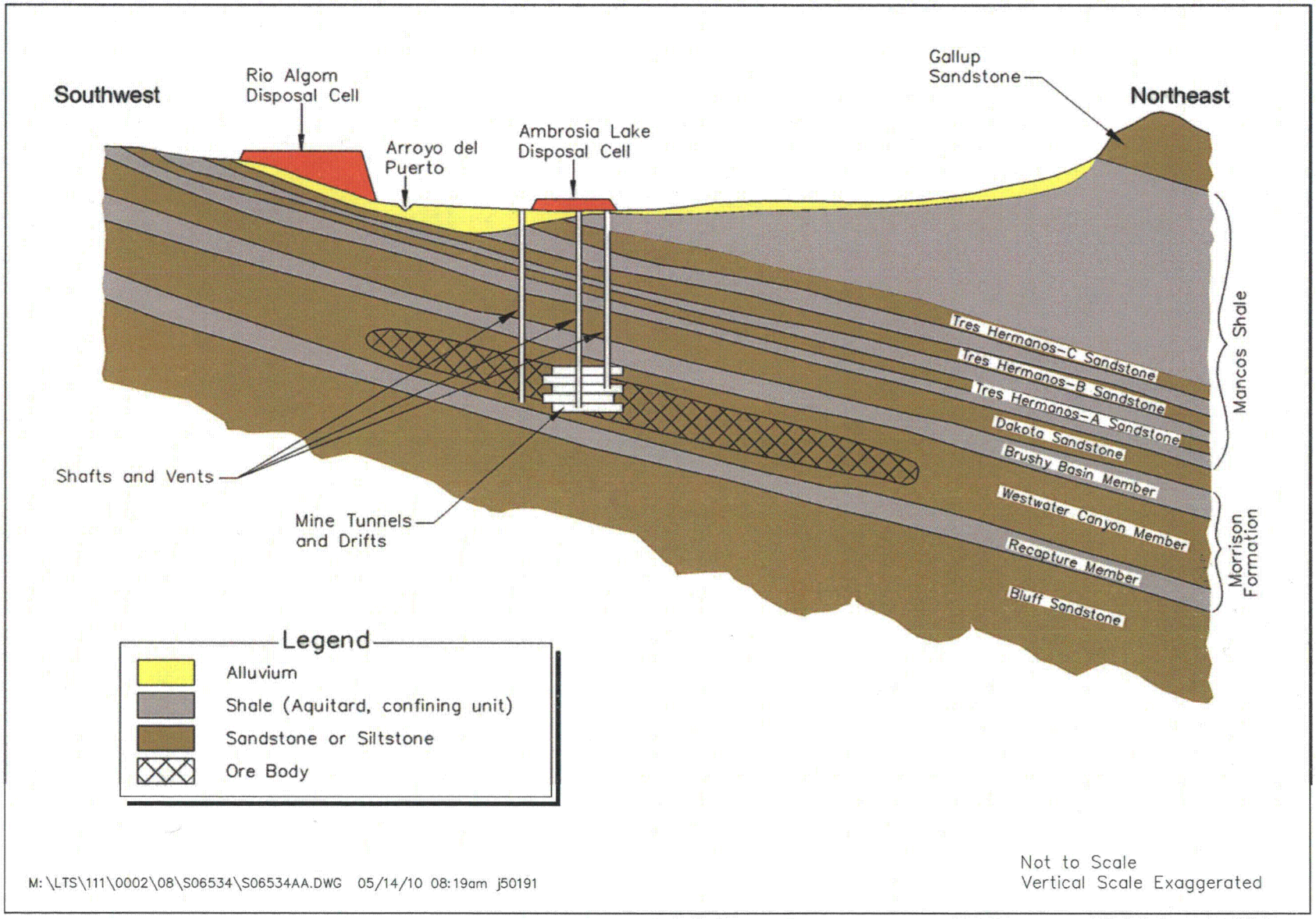

Figure 1. Geologic Cross Section of the Ambrosia Lake Region

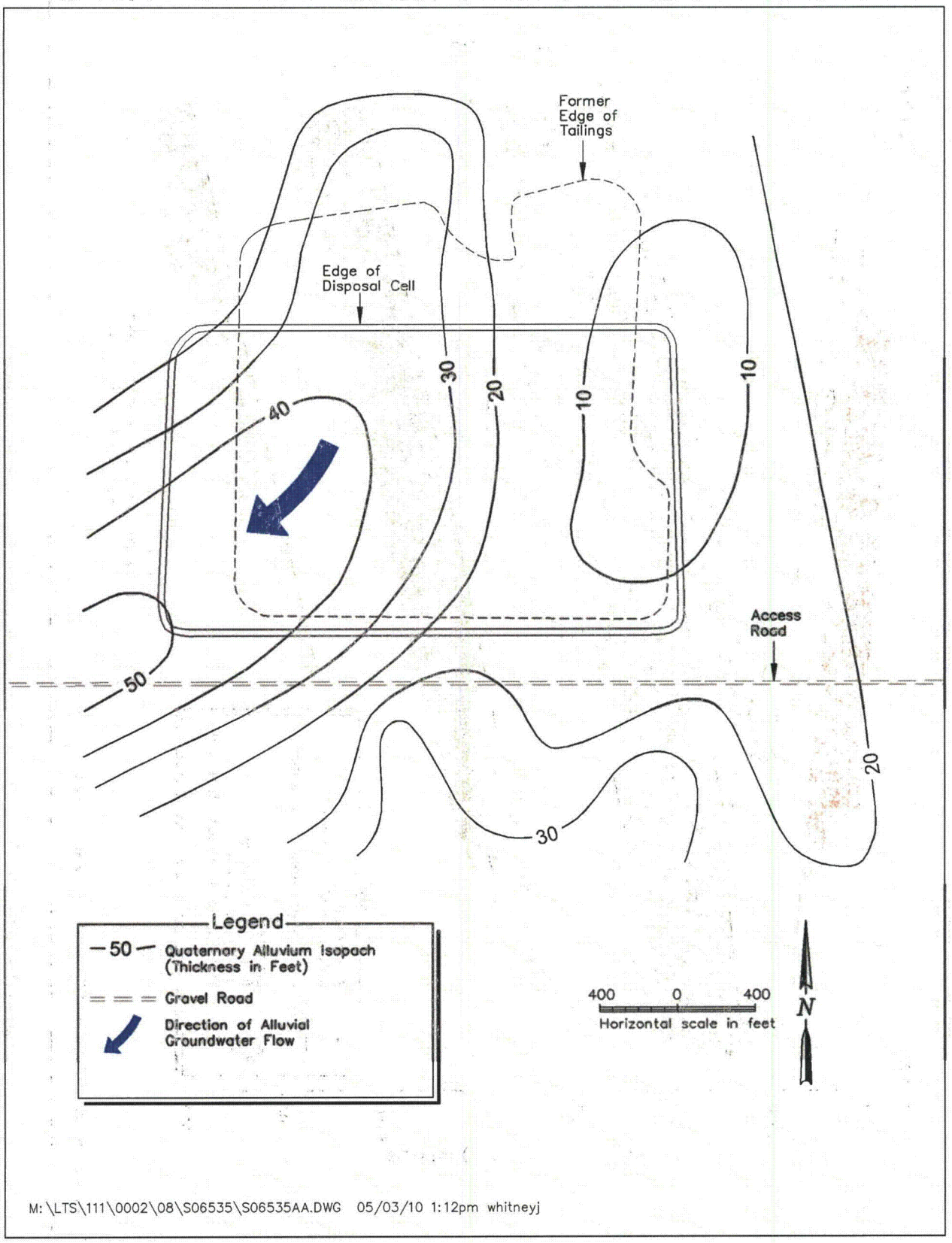

Figure 2. Alluvium Thickness at the Ambrosia Lake, New Mexico, Disposal Site

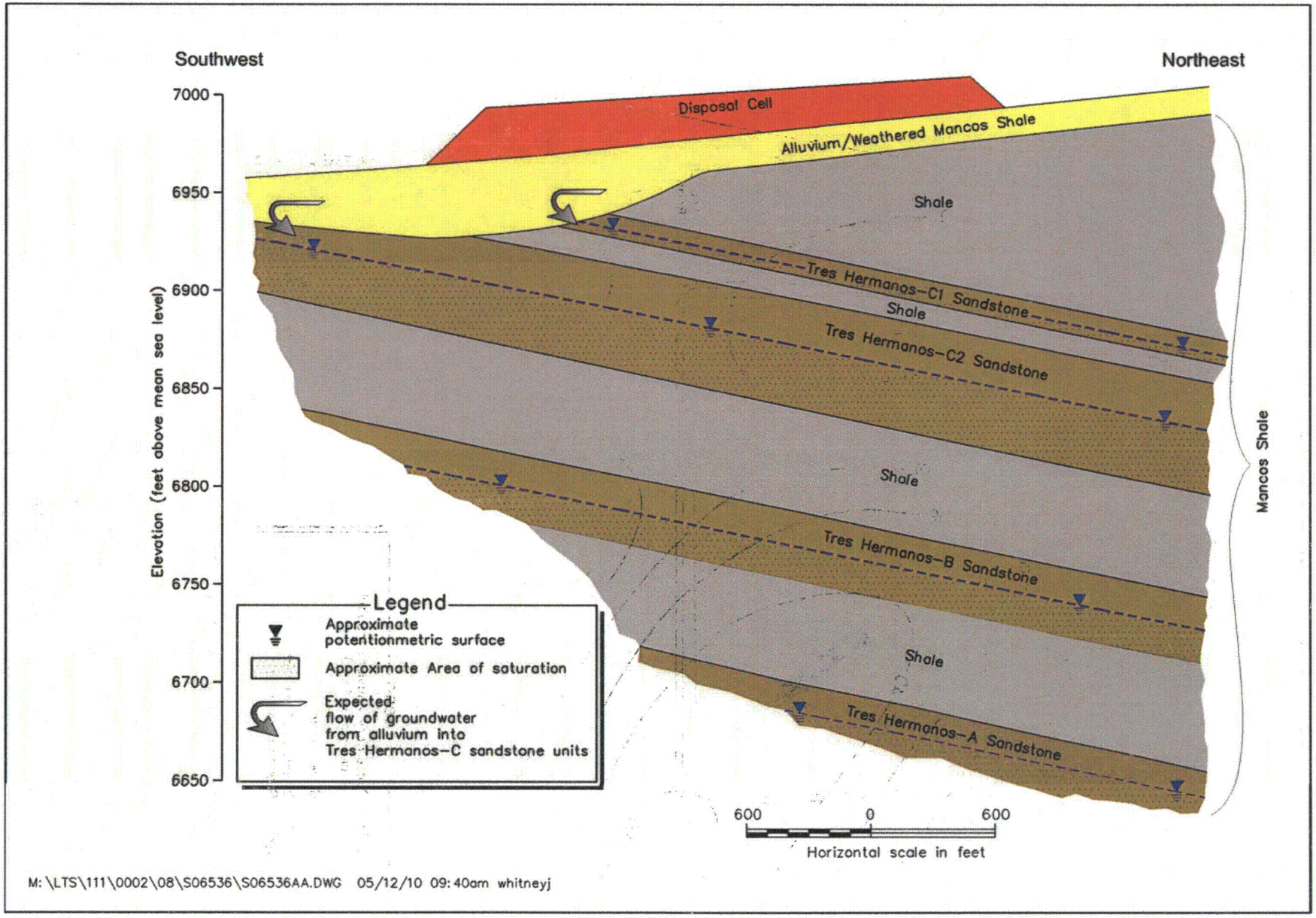

Figure 3. Hydrogeologic Cross Section of the Ambrosia Lake, New Mexico, Disposal Site

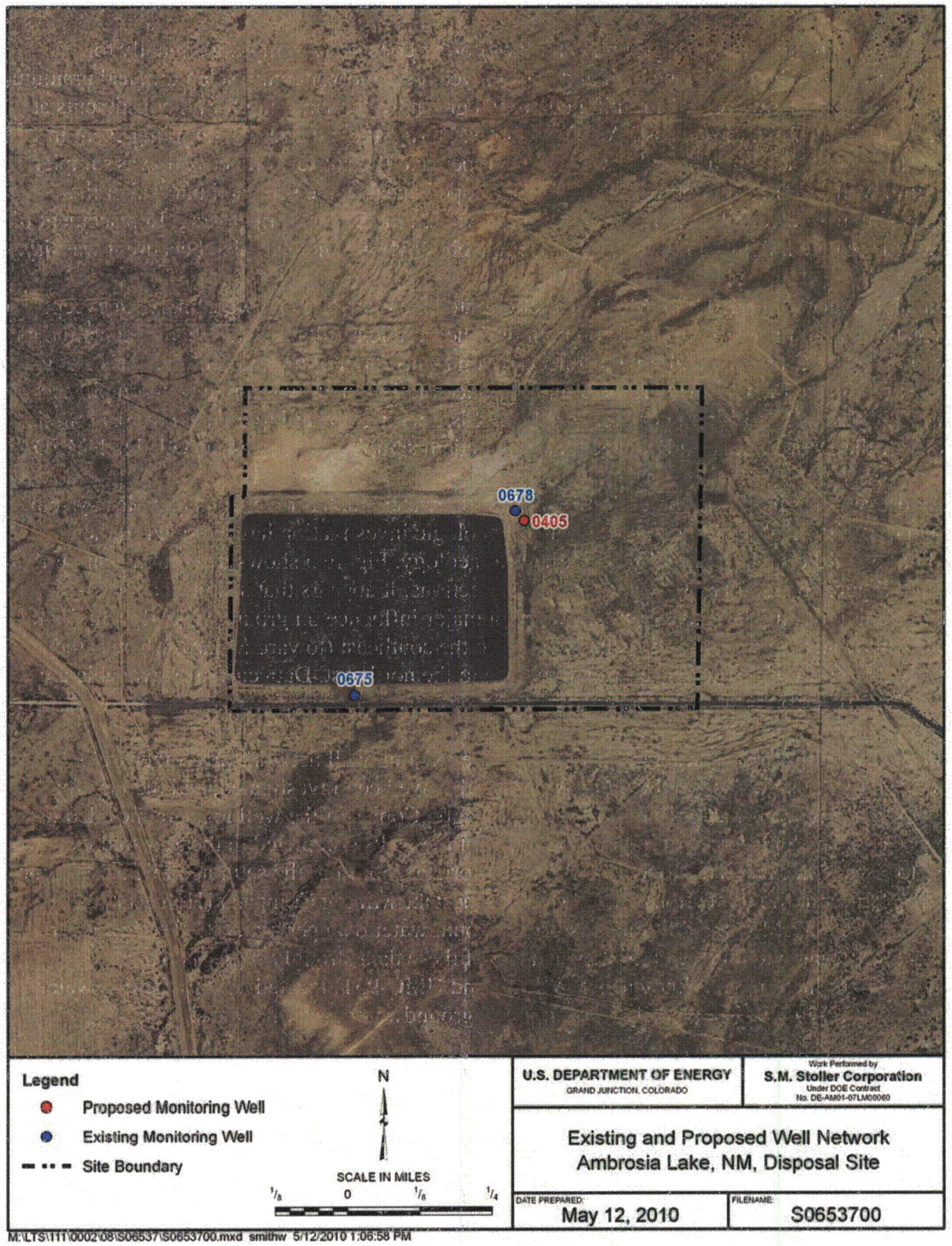

Figure 4. Existing and Proposed Monitoring Well Network at the Ambrosia Lake, New Mexico, Disposal Site

Bluewater UMTRCA Title II Disposal Site

The regulatory requirement for groundwater monitoring consists of sampling annually for polychlorinated biphenyls in one well and every 3 years for molybdenum, selenium, and uranium in six other wells. However, LM reinitiated annual groundwater sampling for all constituents at all of the wells in 2008 to address NMED concerns. During the most recent sampling event in November 2009, the alluvium wells were redeveloped and the entire well network was sampled. Alluvium well T(M) could not be properly redeveloped because the screened interval of the metal casing has corroded, and pieces of metal prevented the bailer from closing. Replacement of this well is planned. Alluvium point-of-exposure well X(M) was not sampled because it was dry.

The analytes recommended by NMED in a letter dated October 1, 2009, were analyzed except for volatile and semivolatile organic compounds. The sample results indicate that no constituents exceeded the NRC-approved alternate concentration limits (ACLs) provided in the site's Long-Term Surveillance Plan. However, the uranium concentration in alluvium point-of-compliance well T(M) was 0.41 milligram per liter (mg/L) and is trending upward to the ACL of 0.44 mg/L. A copy of the Data Validation Package that included all sample results was provided to NMED.

The hydrogeologic investigation underway at the Bluewater site has revealed a complex system. Research of historical geologic data and on-site geologic investigation has provided further clarification of the site stratigraphy and structural geology. Figure 5 shows a geologic map of the site, and Figures 6, 7, and 8 show geologic cross sections. It appears that a significant east-striking fault crossing the middle of the site has a major influence on groundwater flow under the site. Groundwater south of the fault likely flows to the southeast (toward Milan), whereas the groundwater north of the fault is expected to flow to the northeast. Data currently available are insufficient to verify these assumptions.

Additionally, original hand-written well logs for the existing well network (and other wells abandoned by Atlantic Richfield Company [ARCO]) have been investigated, and the logs for LM's monitoring wells have been updated accordingly. Copies of the well logs are included in Appendix A. The long screened intervals in some of the wells completed in the San Andres Limestone and Glorieta Sandstone (San Andres-Glorieta) represent the saturated thickness of the bedrock aquifer at those locations. ARCO and Homestake Mining Company (Homestake) recently provided LM with additional historical groundwater data pertaining to the Bluewater site and immediate vicinity. An initial evaluation of these data strongly suggests that a Homestake production well (known as BWSI-34 and HMC-951) located next to the Bluewater site entrance (Figure 9) is adversely impacting the groundwater system at the site.

To support the 5-year plan, LM proposes the following actions.

- Install additional monitoring wells at the site. The proposed new wells are described in Table 1 and are shown on Figure 9. Proposed well 14(SG) would be located upgradient of former mill site activities and disposal cells and is expected to provide background characteristics of the San Andres-Glorieta aquifer. Existing well L(SG), completed in the San Andres Limestone west of the main disposal cell, was considered to be a background well but may have been or could be affected by tailings fluids because of the structural geologic characteristics at that location.

Table 1. Proposed New Monitoring Wells at the Bluewater, New Mexico, Disposal Site

Proposed Well	Aquifer	Purpose
13(SG)	San Andres-Glorieta	Monitor effects caused by the nearby Homestake production well (BWSI-34) and evaluate groundwater flow direction and potential interaction between the alluvial and bedrock aquifers south of the major east-striking fault
14(SG)	San Andres-Glorieta	New background well to monitor groundwater quality and evaluate flow direction south of the major east-striking fault
15(SG)	San Andres-Glorieta	Monitor groundwater quality and evaluate flow direction and potential interaction between the alluvial and bedrock aquifers south of the major east-striking fault
22(M)	Alluvium	Replacement for point-of-compliance well T(M)

- Analyze an expanded list of constituents, including certain isotopes to differentiate between naturally occurring and mill-related constituents.
- Continue annual sampling of all wells. Evaluate results after three sampling events to determine whether the frequency and/or list of analytes can be reduced.
- Evaluate sampling data to determine how the groundwater is flowing and changing under the site.
- Provide the data to NMED for comparison with San Mateo Creek drainage basin alluvial and bedrock groundwater data obtained by NMED downgradient of the site to evaluate whether contaminated groundwater at the site is contributing to downgradient contamination.
- Evaluate the effect that pumping of the Homestake well is having on the Bluewater site groundwater systems.

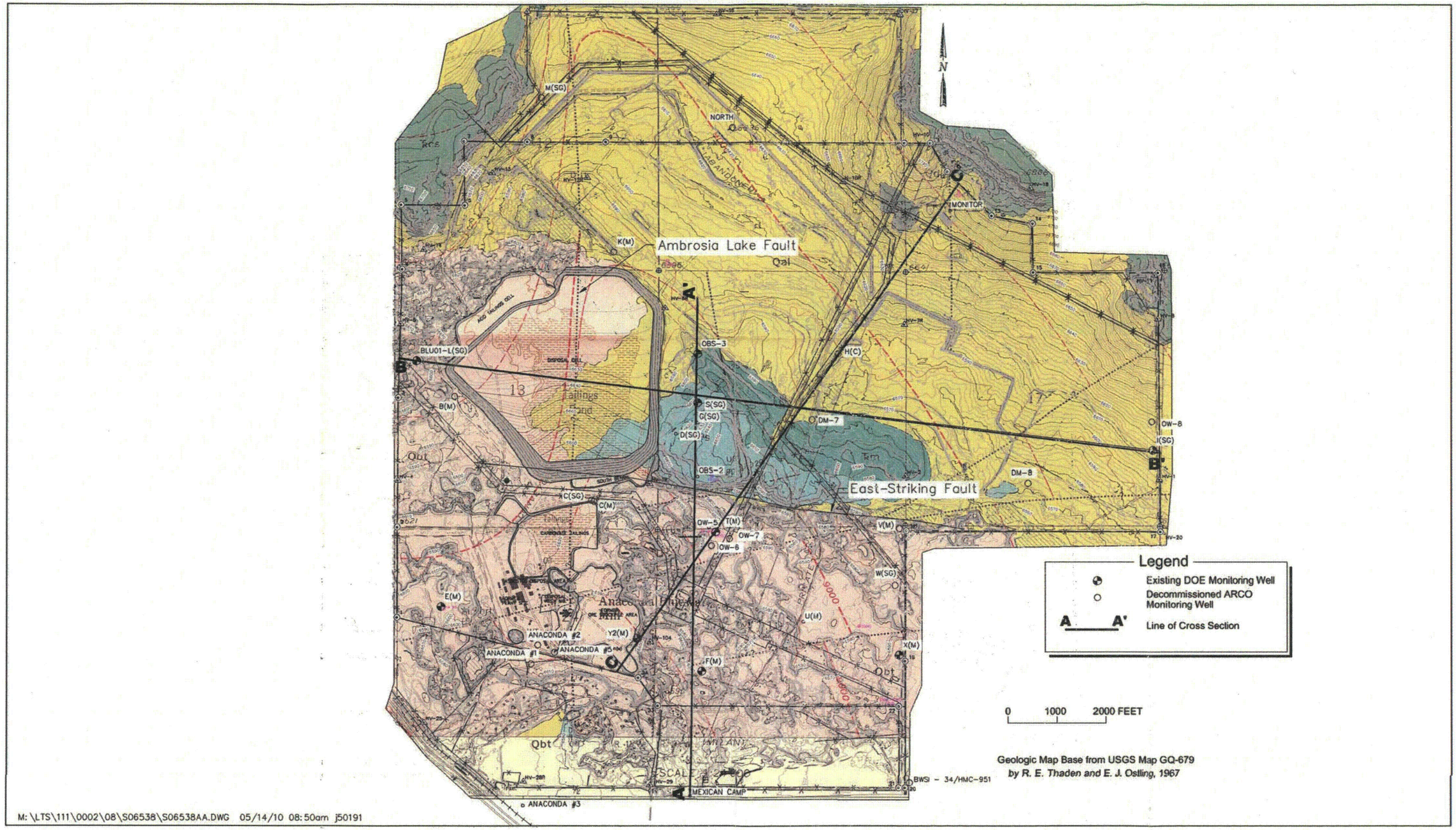

Figure 5. Geologic Map of the Bluewater, New Mexico, Disposal Site

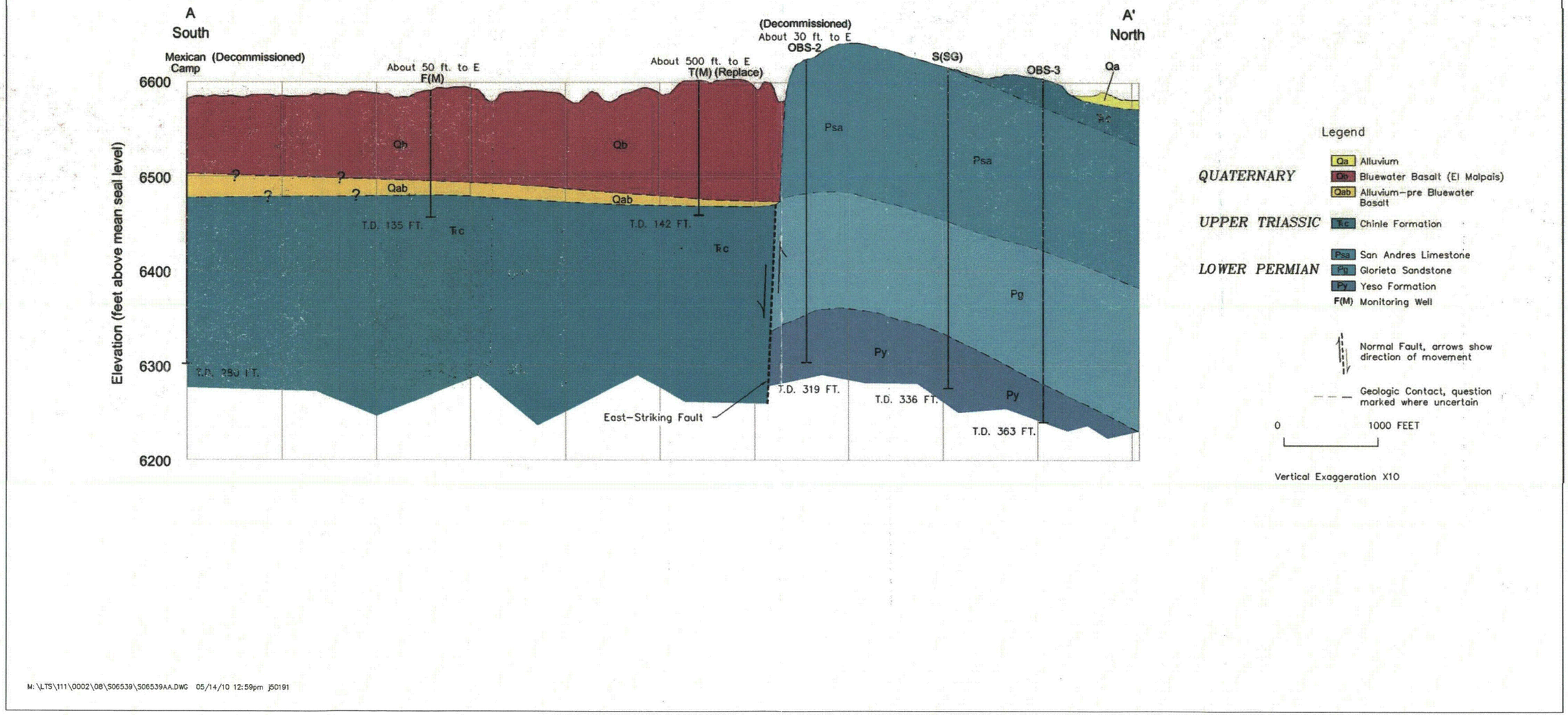

Figure 6. Geologic Cross Section A–A' of the Bluewater, New Mexico, Disposal Site

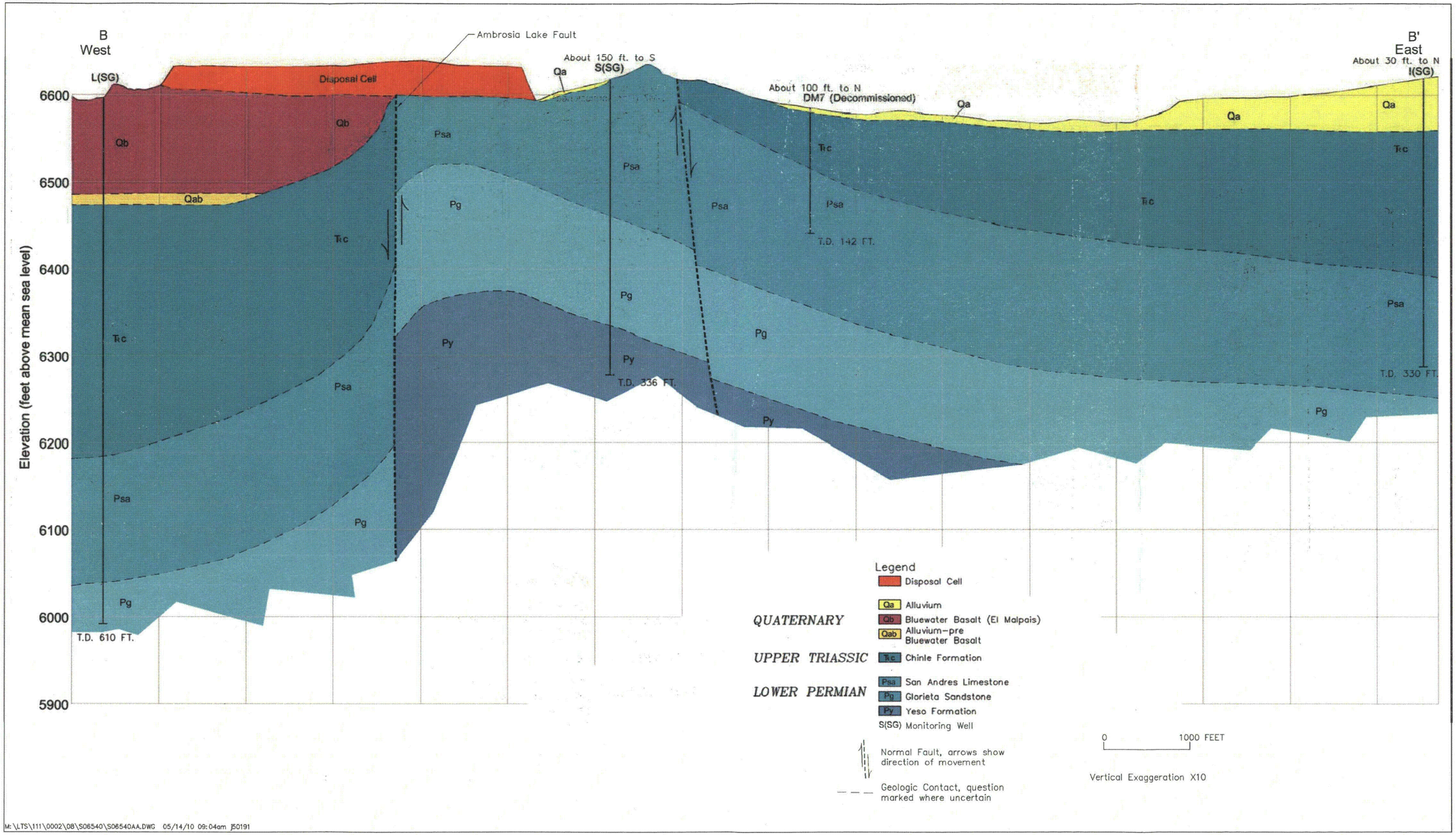

Figure 7. Geologic Cross Section B–B' of the Bluewater, New Mexico, Disposal Site

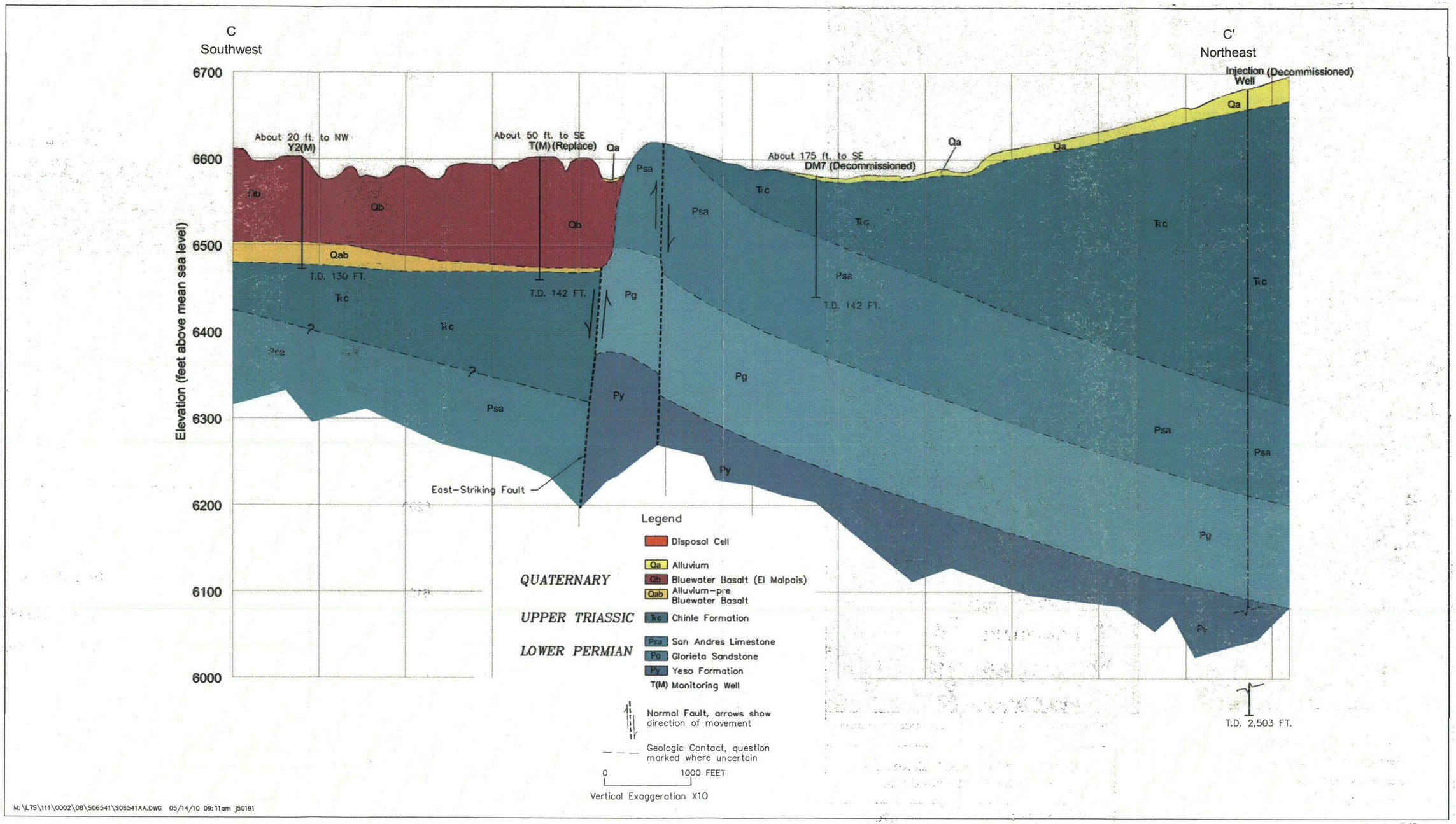

Figure 8. Geologic Cross Section C–C' of the Bluewater, New Mexico, Disposal Site

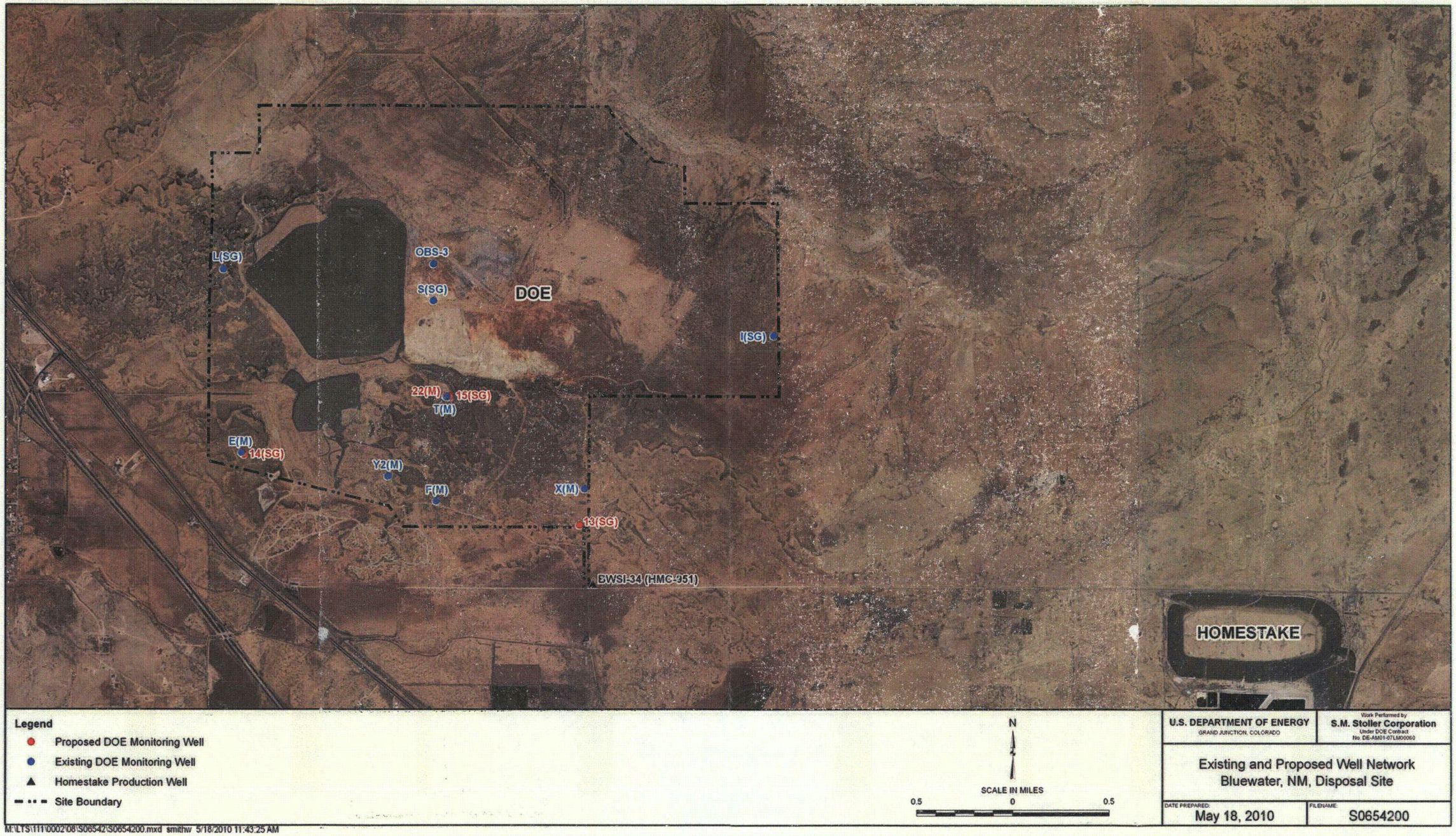

Figure 9. Existing and Proposed Monitoring Well Network at the Bluewater, New Mexico, Disposal Site

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Appendix A

Well Logs for the Bluewater, New Mexico, Disposal Site

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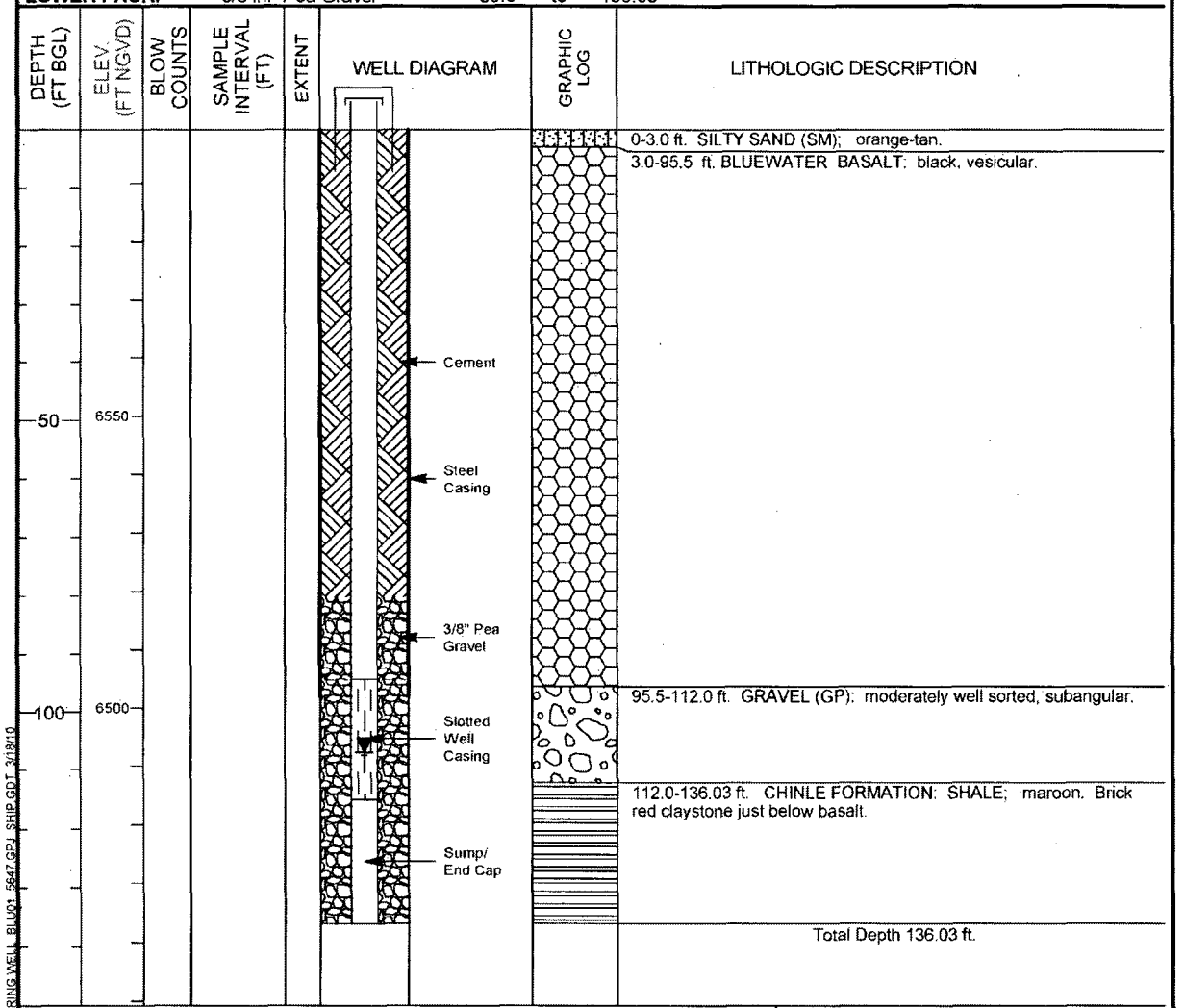
MONITORING WELL COMPLETION LOG BLU01-F(M)

PROJECT	LM	**WELL NUMBER**	BLU01-F(M)	**DATE DRILLED**	6/2/1978 to 6/6/1978
LOCATION	NM	**NORTH COORD. (FT)**	1547617.57	**SURFACE ELEV. (FT NGVD)**	6599.18
SITE	Bluewater Disposal Site	**EAST COORD. (FT)**	468854.40	**TOP OF CASING (FT)**	6600.31
DRILLING METHOD	Air/Mud Rotary	**HOLE DEPTH (FT BGS)**	136.03	**MEAS. PT. ELEV. (FT)**	6600.31
DRILL COMPANY	Adkison Drilling	**WELL DEPTH (FT BGS)**	136.03	**SLOT SIZE (IN)**	3X1/8
RIG TYPE	Midway HD 1500	**WATER LEVEL (FT BTOC)**	108.0	**BIT SIZE(S) (IN)**	6.0 / 7.88

WELL INSTALLATION		**INTERVAL (FT BGS)**		
SURFACE CASING:	6.62 in. Steel	0.0	to	97.25
BLANK CASING:	4.5 in. Steel	-1.13	to	94.2
WELL SCREEN:	4.5 in. Slotted Steel	94.2	to	114.87
SUMP/END CAP:	4.5 in. Steel	114.87	to	136.03
SURFACE SEAL:				
GROUT:	Cement	0.0	to	80.0
SEAL:				
UPPER PACK:				
LOWER PACK:	3/8 in. Pea Gravel	80.0	to	136.03

WATER LEVEL DATE 6/6/1978
DRILLER
LOGGED BY LCA
SAMPLING METHOD GRAB
DATE DEVELOPED 6/16/1978
REMARKS Bailed a steady 5.0-6.0 gpm.



LM MONITORING WELL BLU01 5647.GPJ SHIP.GDT 3/18/10

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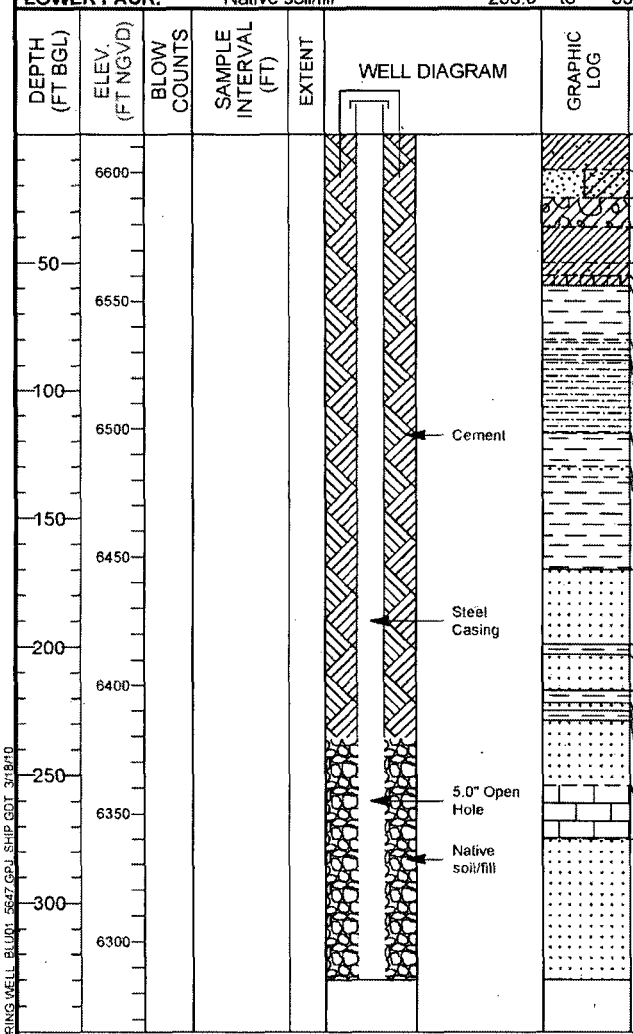
MONITORING WELL COMPLETION LOG BLU01-I(SG)

PROJECT	LM	**WELL NUMBER**	BLU01-I(SG)	**DATE DRILLED**	7/15/1979 to 7/23/1979
LOCATION	NM	**NORTH COORD. (FT)**	1552131.20	**SURFACE ELEV. (FT NGVD)**	6615.00
SITE	Bluewater Disposal Site	**EAST COORD. (FT)**	478106.06	**TOP OF CASING (FT)**	6616.17
DRILLING METHOD	Air/Mud Rotary	**HOLE DEPTH (FT BGS)**	330.00	**MEAS. PT. ELEV. (FT)**	
DRILL COMPANY	Adkison Drilling	**WELL DEPTH (FT BGS)**	235.00	**SLOT SIZE (IN)**	
RIG TYPE	Midway HD 1500	**WATER LEVEL (FT BGS)**		**BIT SIZE(S) (IN)**	5.0 / 7.88

WELL INSTALLATION		**INTERVAL (FT BGS)**			**WATER LEVEL DATE**	
SURFACE CASING:					**DRILLER**	Adkison, R.
BLANK CASING:	5.56 in. Steel	-1.17	to	235.0	**LOGGED BY**	LHM
WELL SCREEN:					**SAMPLING METHOD**	GRAB
SUMP/END CAP:					**DATE DEVELOPED**	7/23/2009
SURFACE SEAL:					**REMARKS**	No screen used, open hole from 236.0 ft. to TD.
GROUT:	Cement	0.0	to	236.0		
SEAL:						
UPPER PACK:						
LOWER PACK:	Native soil/fill	236.0	to	330.0		



0-59.0 ft. ALLUVIUM:
0-14.0 ft. SANDY CLAY (CL-SC);
14.0-25.0 ft. SAND WITH CLAY (SP-SC); red brown.
25.0-36.0 ft. SANDY CLAY WITH GRAVEL (SC-GC);
36.0-50.0 ft. CLAY (CL); red, adobe.
50.0-55.0 ft. SANDY CLAY (CL-SC); reddish brown.
55.0-59.0 ft. SILTY CLAY (CL-ML);
59.0-170.0 ft. CHINLE FORMATION:
59.0-80.0 ft. CLAYSTONE; red brown to purple, some green mottles and purple concretions.
80.0-86.0 ft. SILTSTONE/CLAYSTONE; purple siltstone and red-brown claystone.
86.0-88.0 ft. CLAYSTONE; green and red brown.
88.0-117.0 ft. SILTSTONE/CLAYSTONE; variegated-purple, red brown, gray, light green.
117.0-130.0 ft. CLAYSTONE; mostly dark purple and brown, minor amount of yellow green and yellow colors.
130.0-134.0 ft SANDSTONE AND CLAYSTONE; yellow brown.
134.0-170.0 ft. CLAYSTONE; purple, red-brown, and gray.
170.0-275.0 ft. SAN ANDRES LIMESTONE:
170.0-199.0 ft. SANDSTONE; very fine to medium grained, poor to well cemented, white, yellow, and gray.
199.0-203.0 ft. CLAYSTONE; red-brown to dark purple.
203.0-217.0 ft. SANDSTONE; white to yellow.
217.0-222.0 ft. CLAYSTONE; chocolate brown, gray, and light green.
222.0-225.0 ft. SANDSTONE: very hard, yellow brown.
225.0-229.0 ft. CLAYSTONE: green to red-brown.
229.0-254.0 ft. SANDSTONE; fine to medium grained, light to dark brown to light yellow, some pyrite crystals. @240.0 ft. Making water.
254.0-275.0 ft. LIMESTONE; sandy and siliceous, light brown.
275.0-330.0 ft. GLORIETA SANDSTONE; light brown.
277.0-318.0 ft. SANDSTONE; medium grained, white, light brown, yellow.
@303.0 ft. Q = 6 gpm
@315.0 ft. Q=8 gpm
318.0-321.0 ft. sandstone, light yellow, soft.
321.0-330.0 ft. sandstone, hard.
Total Depth 330.0 ft.

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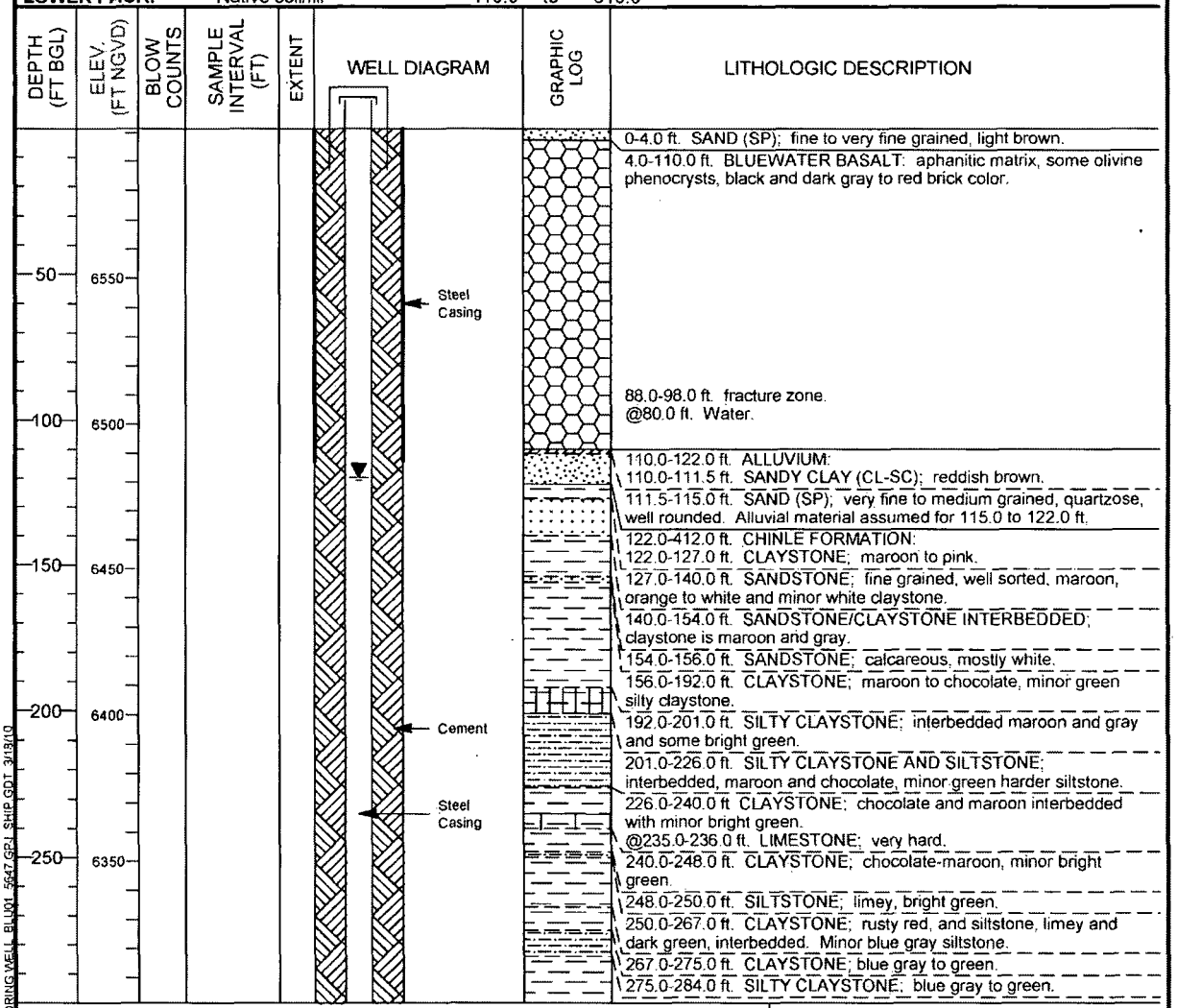
MONITORING WELL COMPLETION LOG BLU01-L(SG)

PROJECT	LM	**WELL NUMBER**	BLU01-L(SG)	**DATE DRILLED**	12/19/1980 to 1/18/1981
LOCATION	NM	**NORTH COORD. (FT)**	1553955.42	**SURFACE ELEV. (FT NGVD)**	6601.43
SITE	Bluewater Disposal Site	**EAST COORD. (FT)**	463034.55	**TOP OF CASING (FT)**	6602.60
DRILLING METHOD	Air/Mud Rotary	**HOLE DEPTH (FT BGS)**	610.00	**MEAS. PT. ELEV. (FT)**	6602.60
DRILL COMPANY	Adkison Drilling	**WELL DEPTH (FT BGS)**	412.00	**SLOT SIZE (IN)**	
RIG TYPE	Midway HD 1500	**WATER LEVEL (FT BTOC)**	121.0	**BIT SIZE(S) (IN)**	7.88 / 9.88 / 4.75

WELL INSTALLATION		**INTERVAL (FT BGS)**			**WATER LEVEL DATE** 1/18/1981
SURFACE CASING:	8.62 in. Steel	0.0	to	114.0	**DRILLER**
BLANK CASING:	5.56 in. Steel	-1.17	to	412.0	**LOGGED BY** LSE, JC, LPB,SLR, GSM
WELL SCREEN:					**SAMPLING METHOD** GRAB
SUMP/END CAP:					**DATE DEVELOPED** 1/8/1981
SURFACE SEAL:					
GROUT:	Cement	0.0	to	419.0	**REMARKS** No screen used, open hole from 419.0 ft to TD.
SEAL:					
UPPER PACK:					
LOWER PACK:	Native soil/fill	419.0	to	610.0	



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MONITORING WELL COMPLETION LOG BLU01-L(SG)

PROJECT LM
SITE Bluewater Disposal Site
WELL NUMBER BLU01-L(SG)
DATES DRILLED 12/19/1980 to 1/18/1981

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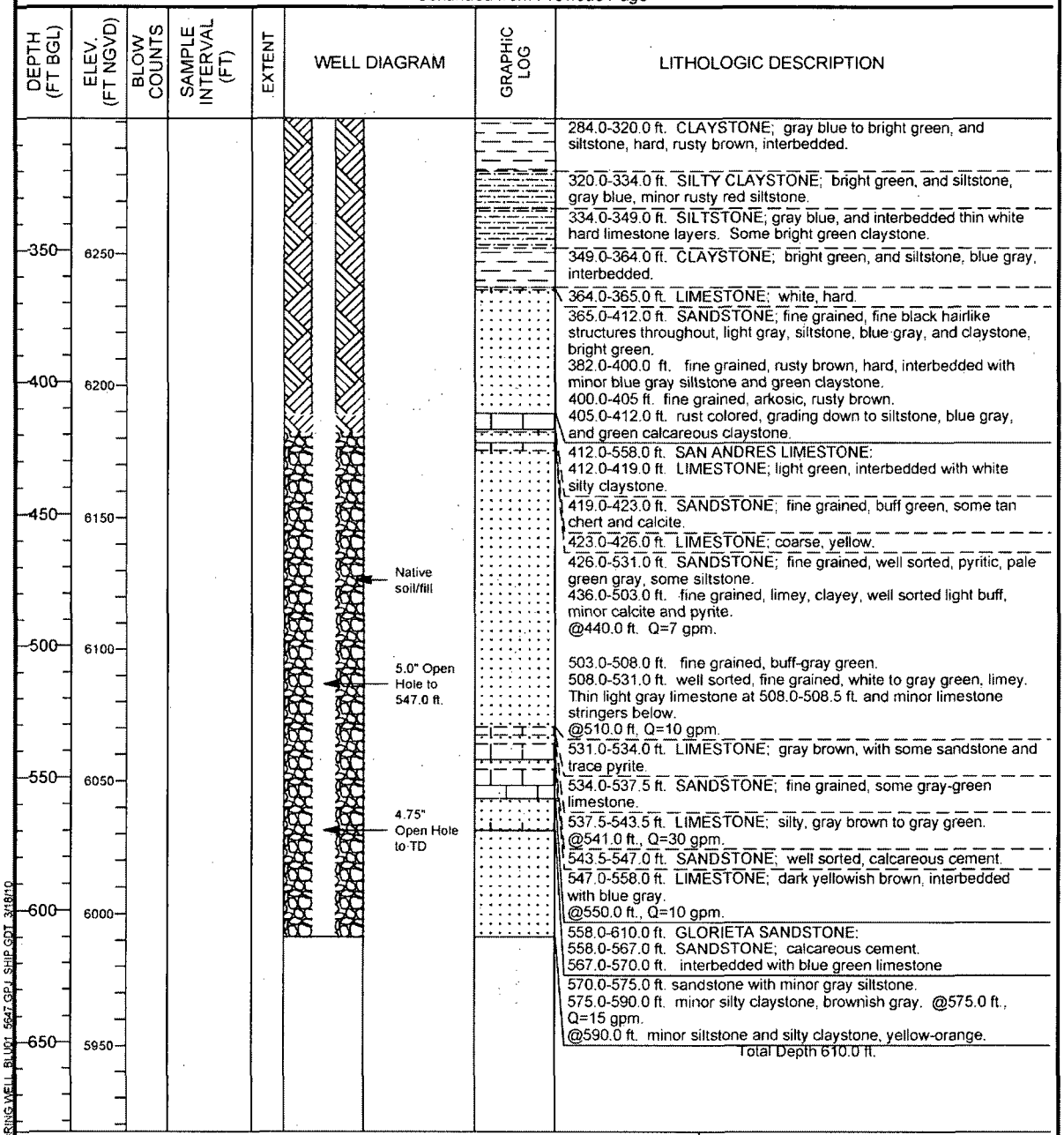

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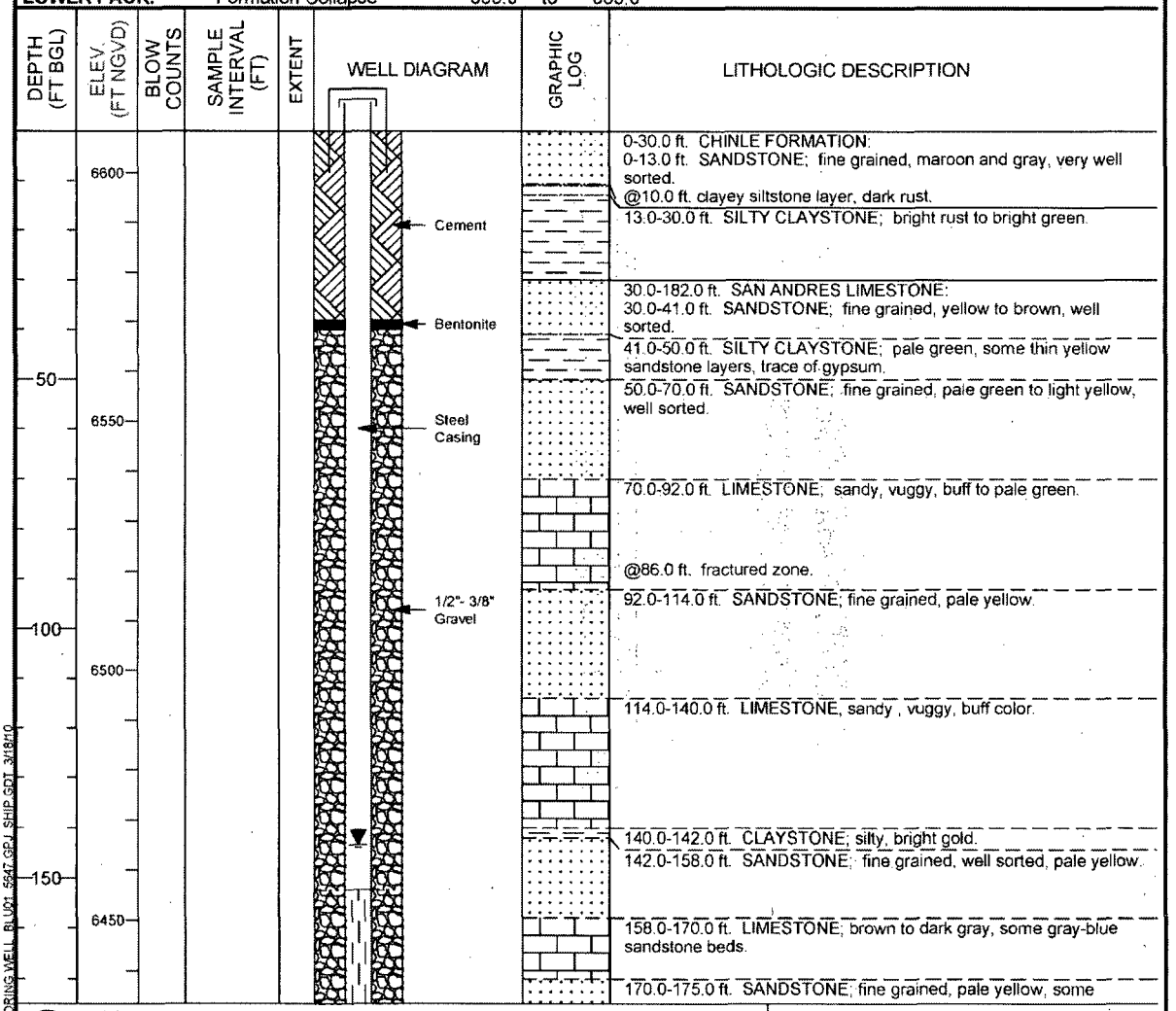
MONITORING WELL COMPLETION LOG BLU01-OBS-3

PROJECT	LM	**WELL NUMBER**	BLU01-OBS-3	**DATE DRILLED**	2/2/1981 to 2/6/1981
LOCATION	NM	**NORTH COORD. (FT)**	1554101.25	**SURFACE ELEV. (FT NGVD)**	6608.43
SITE	Bluewater Disposal Site	**EAST COORD. (FT)**	468776.17	**TOP OF CASING (FT)**	6612.60
DRILLING METHOD	Air/Mud Rotary	**HOLE DEPTH (FT BGS)**	363.00	**MEAS. PT. ELEV. (FT)**	6612.60
DRILL COMPANY	Adkison Drilling	**WELL DEPTH (FT BGS)**	353.00	**SLOT SIZE (IN)**	4X1/8
RIG TYPE	Midway HD 1500	**WATER LEVEL (FT BTOC)**	147.6	**BIT SIZE(S) (IN)**	7.88 / 6.5

WELL INSTALLATION		**INTERVAL (FT BGS)**		
SURFACE CASING:				
BLANK CASING:	5.56 in. Steel	-4.17	to	152.4
WELL SCREEN:	5.56 in. Slotted Steel	152.4	to	350.0
SUMP/END CAP:	5.56 in. Steel	350.0	to	353.0
SURFACE SEAL:				
GROUT:	Cement	0.0	to	38.0
SEAL:	Bentonite	38.0	to	40.0
UPPER PACK:	1/2 to 3/8 in. Gravel	40.0	to	355.0
LOWER PACK:	Formation Collapse	355.0	to	363.0

WATER LEVEL DATE 2/23/1981
DRILLER
LOGGED BY SLR, LPB
SAMPLING METHOD GRAB
DATE DEVELOPED 2/22/1981
REMARKS Bentonite placed on top of gravel for seal.



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MONITORING WELL COMPLETION LOG BLU01-OBS-3

PROJECT LM
SITE Bluewater Disposal Site
WELL NUMBER BLU01-OBS-3
DATES DRILLED 2/2/1981 to 2/6/1981

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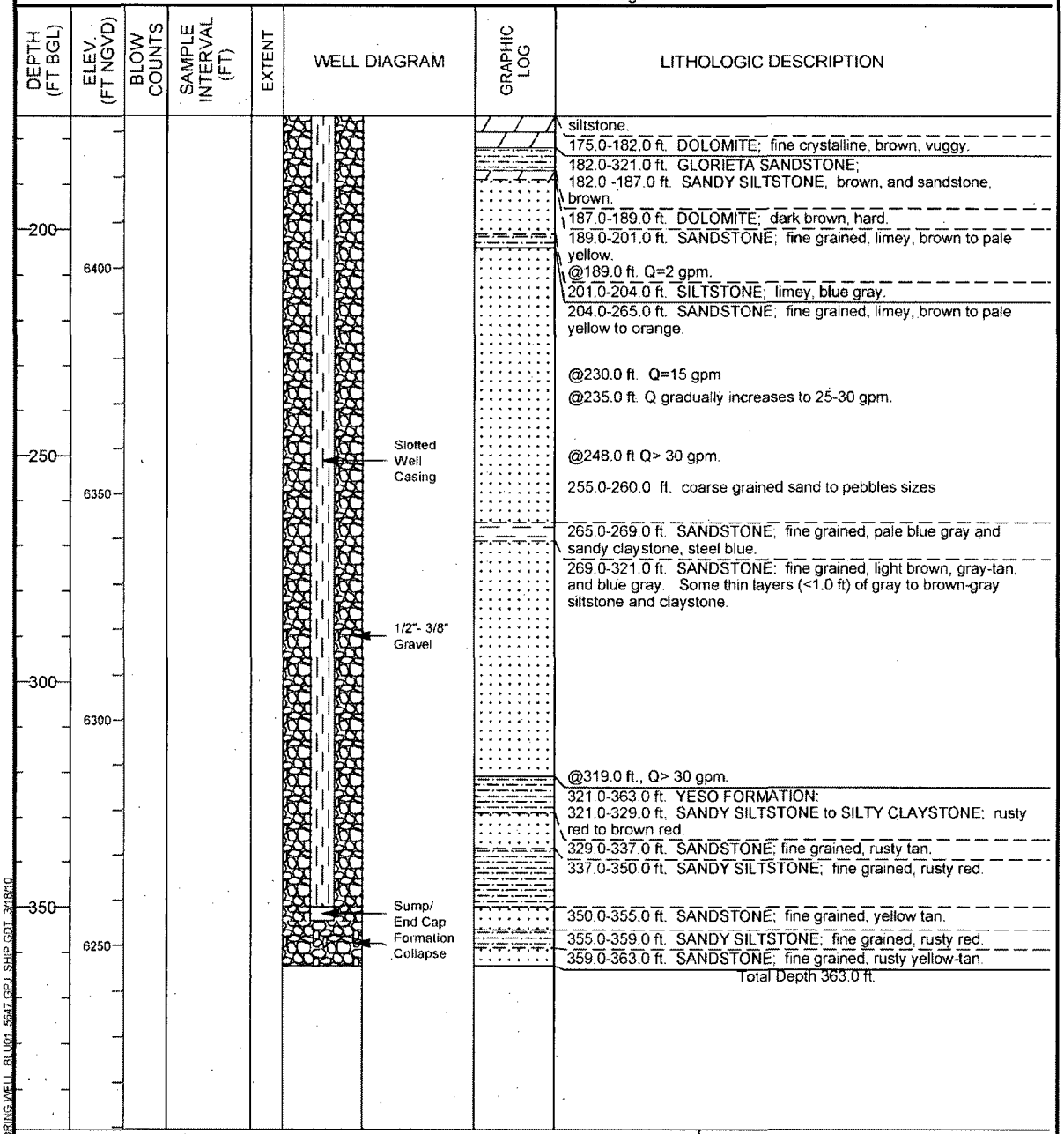

LM MONITORING WELL BLU01 5647.GPJ SHIP.GDT 3/18/10

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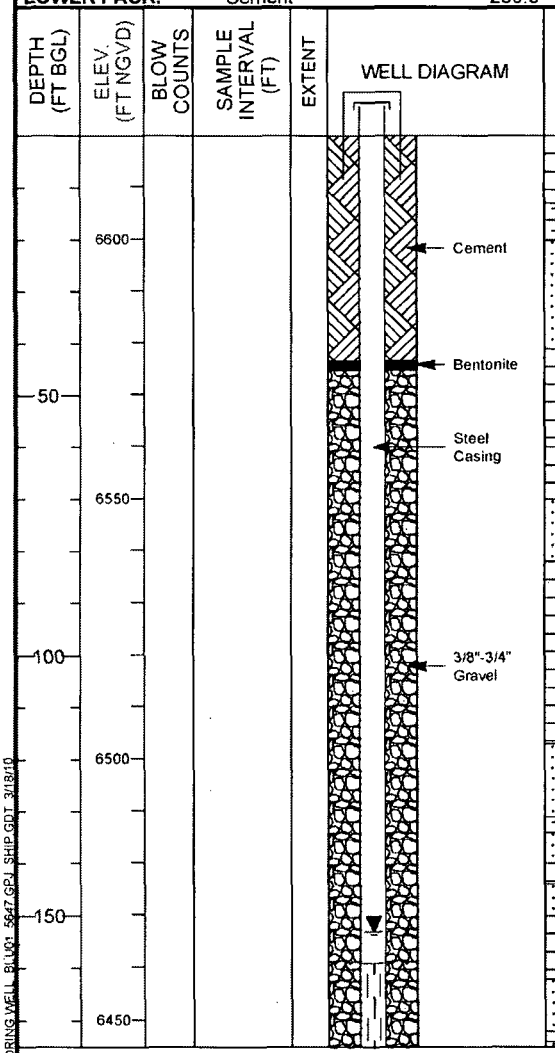
MONITORING WELL COMPLETION LOG BLU01-S(SG)

PROJECT	LM	**WELL NUMBER**	BLU01-S(SG)	**DATE DRILLED**	1/19/1981 to 2/13/1981
LOCATION	NM	**NORTH COORD. (FT)**	1553097.93	**SURFACE ELEV. (FT NGVD)**	6619.72
SITE	Bluewater Disposal Site	**EAST COORD. (FT)**	468775.21	**TOP OF CASING (FT)**	6621.14
DRILLING METHOD	Air/Mud Rotary	**HOLE DEPTH (FT BGS)**	336.00	**MEAS. PT. ELEV. (FT)**	6621.14
DRILL COMPANY	Adkison Drilling	**WELL DEPTH (FT BGS)**	280.00	**SLOT SIZE (IN)**	Mill cut slots
RIG TYPE	Midway HD 1500	**WATER LEVEL (FT BTOC)**	154.5	**BIT SIZE(S) (IN)**	6.5 / 7.88 / 12.25

WELL INSTALLATION		**INTERVAL (FT BGS)**			**WATER LEVEL DATE** 2/23/1981
SURFACE CASING:					**DRILLER** Adkison, W.H.
BLANK CASING:	8.62 in. Steel	-1.42	to	159.0	**LOGGED BY** LPB, GSM
WELL SCREEN:	8.62 in. Slotted Steel	159.0	to	280.0	**SAMPLING METHOD** GRAB
SUMP/END CAP:					**DATE DEVELOPED** 2/22/1981
SURFACE SEAL:					**REMARKS** Bentonite placed on top of gravel for seal.
GROUT:	Cement	0.0	to	43.0	
SEAL:	Bentonite	43.0	to	45.0	
UPPER PACK:	3/8 to 3/4 in. Gravel	45.0	to	280.0	
LOWER PACK:	Cement	280.0	to	336.0	



LITHOLOGIC DESCRIPTION

0-162.0 ft. SAN ANDRES LIMESTONE:
0-5.0 ft. LIMESTONE; hard, yellowish brown.
5.0-13.0 ft. limestone, yellow gray, claystone, dusky yellow, and sandstone, calcareous.
13.0-20.0 ft. CLAYSTONE; yellowish gray to brownish ochre, and siltstone, yellowish brown to green-orange.
20.0-41.0 ft. SANDSTONE, fine grained, friable, brownish gray.
41.0-60.0 ft. LIMESTONE: pale yellowish brown.
60.0-70.0 ft. LIMESTONE; grades downward to sandstone, medium grained, buff.
70.0-82.0 ft. SANDSTONE; fine grained, well sorted, white to buff.
82.0-117.0 ft. LIMESTONE; sandy, gray.
@85.0 ft. limestone becomes less sandy.
117.0-131.0 ft. SANDSTONE; well sorted, calcareous, white, yellowish orange, and grayish yellow.
131.0-134.0 ft. CLAYSTONE; light brown to red, and limestone, sandy, gray.
134.0-140.0 ft. SANDSTONE; medium to well sorted, calcareous, white to dark gray.
140.0-144.0 ft. LIMESTONE; grayish brown.
144.0-150.0 ft. SANDSTONE: medium grained, yellowish gray, and sandy siltstone, light gray, and minor gray brown limestone.
150.0-162.0 ft. LIMESTONE; gray brown to gray black.
162.0-280.0 ft. GLORIETA SANDSTONE:
162.0-172.0 ft. SANDSTONE; fine grained, clacareous, white to yellow gray.

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MONITORING WELL COMPLETION LOG BLU01-S(SG)

PROJECT LM
SITE Bluewater Disposal Site
WELL NUMBER BLU01-S(SG)
DATES DRILLED 1/19/1981 to 2/13/1981

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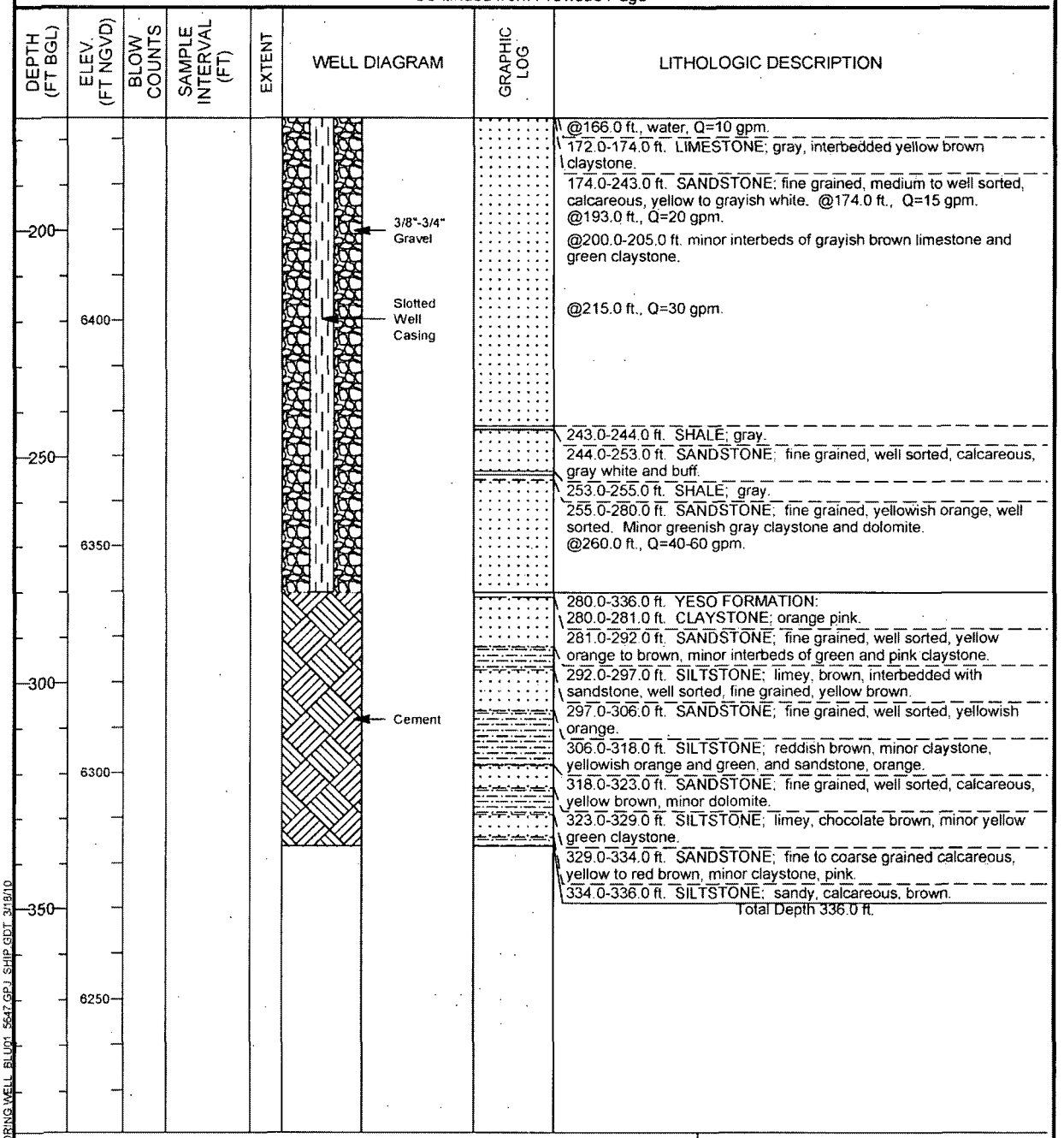

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MONITORING WELL COMPLETION LOG BLU01-T(M)

PROJECT	LM	**WELL NUMBER**	BLU01-T(M)	**DATE DRILLED**	11/14/1980 to 11/16/1980
LOCATION	NM	**NORTH COORD. (FT)**	1550460.89	**SURFACE ELEV. (FT NGVD)**	6608.65
SITE	Bluewater Disposal Site	**EAST COORD. (FT)**	469141.12	**TOP OF CASING (FT)**	6609.40
DRILLING METHOD	Air/Mud Rotary	**HOLE DEPTH (FT BGS)**	142.00	**MEAS. PT. ELEV. (FT)**	6609.40
DRILL COMPANY	Adkison Drilling	**WELL DEPTH (FT BGS)**	135.00	**SLOT SIZE (IN)**	4 X 1/16
RIG TYPE	Midway HD 1500	**WATER LEVEL (FT BGS)**		**BIT SIZE(S) (IN)**	7.88 / 6.5 / 6.0

	WELL INSTALLATION	INTERVAL (FT BGS)		
SURFACE CASING:	6.62 in. Steel			128.0
BLANK CASING:	4.5 in. Steel	-0.75	to	128.0
WELL SCREEN:	4.5 in. Slotted Steel	128.0	to	133.0
SUMP/END CAP:	4.5 in. Steel	133.0	to	135.0
SURFACE SEAL:				
GROUT:	Cement	0.0	to	128.0
SEAL:				
UPPER PACK:				
LOWER PACK:	1/4 to 3/8 in. Gravel	128.0	to	142.0

WATER LEVEL DATE

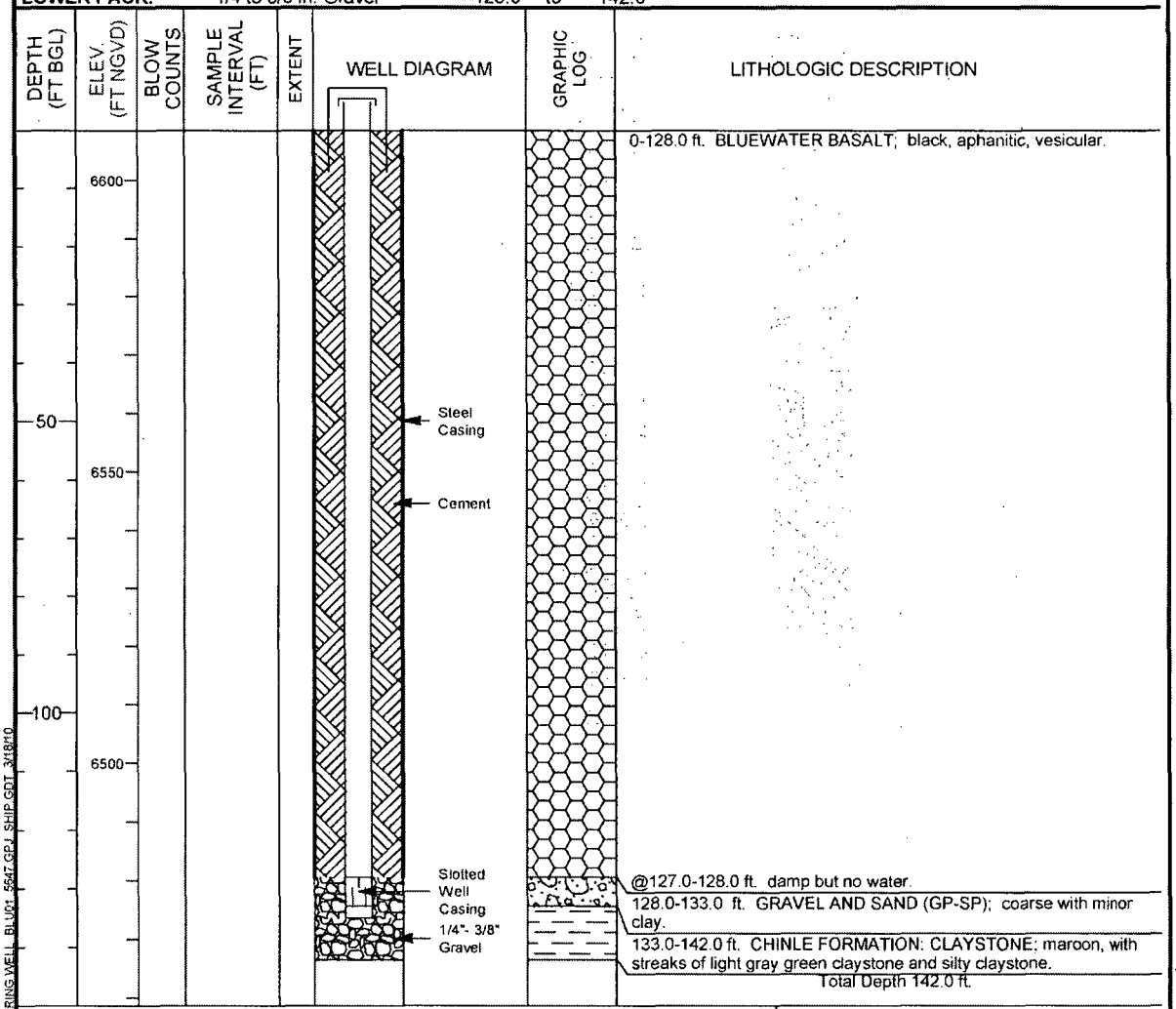
DRILLER Adkison, R.

LOGGED BY LPB, KSD

SAMPLING METHOD GRAB

DATE DEVELOPED 11/18/1980

REMARKS



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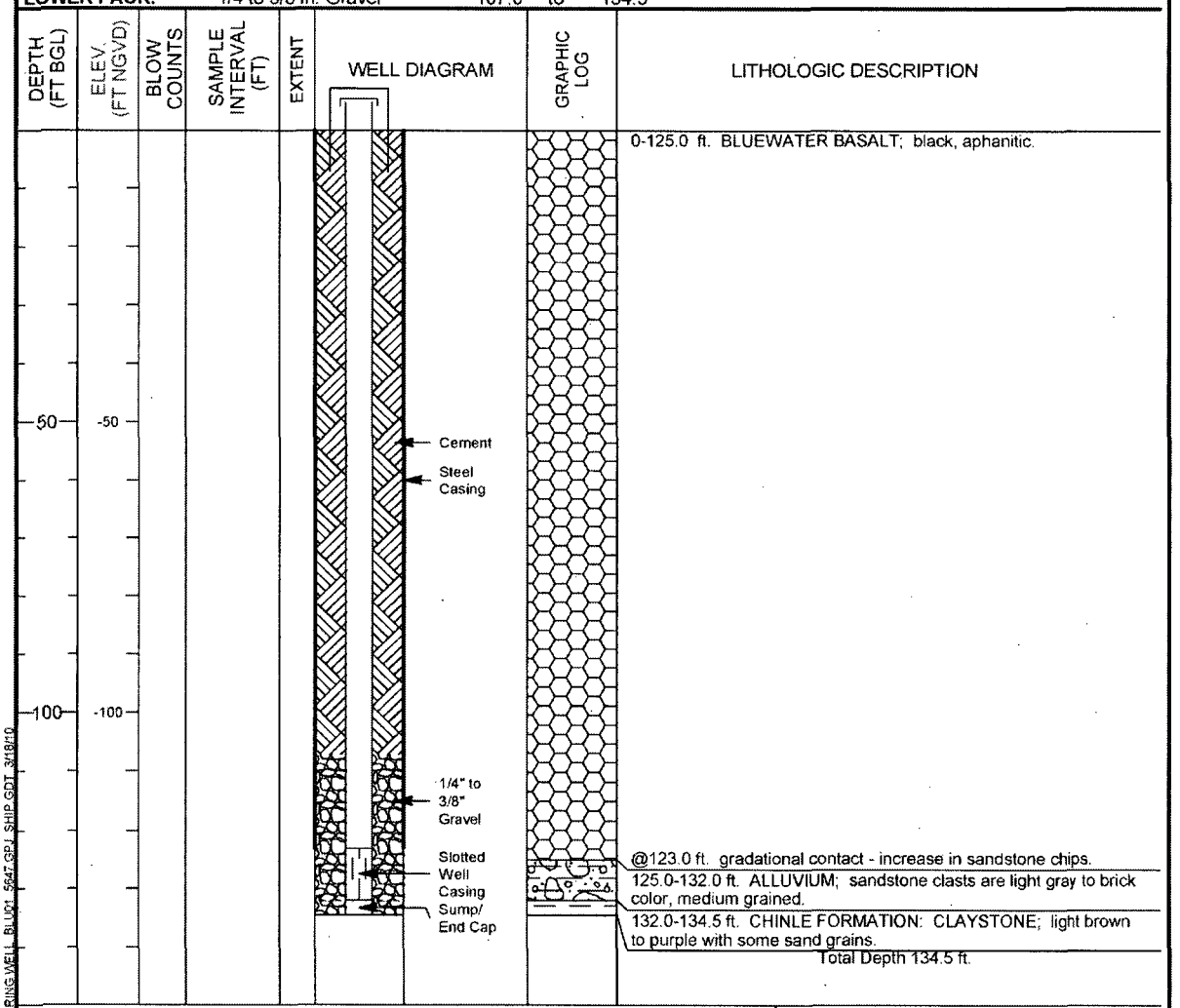
MONITORING WELL COMPLETION LOG BLU01-X(M)

PROJECT	LM	**WELL NUMBER**	BLU01-X(M)	**DATE DRILLED**	12/11/1980 to 12/18/1980
LOCATION	NM	**NORTH COORD. (FT)**	1547948.81	**SURFACE ELEV. (FT NGVD)**	
SITE	Bluewater Disposal Site	**EAST COORD. (FT)**	472906.86	**TOP OF CASING (FT)**	
DRILLING METHOD	Air/Mud Rotary	**HOLE DEPTH (FT BGS)**	134.50	**MEAS. PT. ELEV. (FT)**	
DRILL COMPANY	Adkison Drilling	**WELL DEPTH (FT BGS)**	134.50	**SLOT SIZE (IN)**	Mill cut slots
RIG TYPE	Midway HD 1500	**WATER LEVEL (FT BTOC)**	121.3	**BIT SIZE(S) (IN)**	6.5 / 7.88

WELL INSTALLATION		**INTERVAL (FT BGS)**			**WATER LEVEL DATE** 12/18/1980
SURFACE CASING:	6.62 in. Steel	0.0	to	123.0	**DRILLER** Adkison, R.
BLANK CASING:	4.5 in. Steel		to	123.0	**LOGGED BY** Clark, J.
WELL SCREEN:	4.5 in. Slotted Steel	123.0	to	132.0	**SAMPLING METHOD** GRAB
SUMP/END CAP:	4.5 in. Steel	132.0	to	134.5	**DATE DEVELOPED** 12/19/1980
SURFACE SEAL:					
GROUT:	Cement	0.0	to	107.0	**REMARKS**
SEAL:					
UPPER PACK:					
LOWER PACK:	1/4 to 3/8 in. Gravel	107.0	to	134.5	



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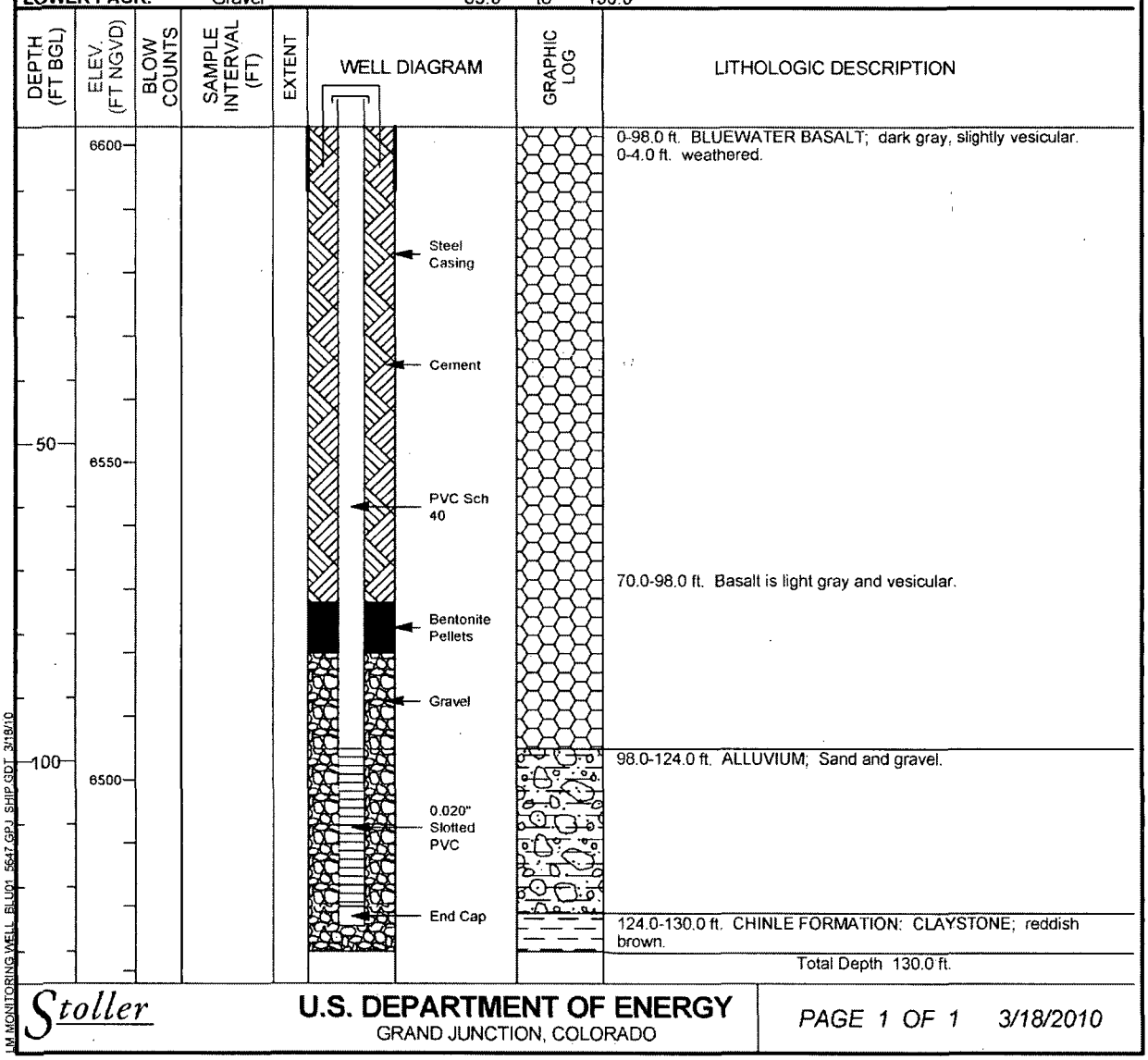
MONITORING WELL COMPLETION LOG BLU01-Y2(M)

PROJECT	LM	WELL NUMBER	BLU01-Y2(M)	DATE DRILLED	9/10/1996 to 9/11/1996
LOCATION	NM	NORTH COORD. (FT)	1548289.19	SURFACE ELEV. (FT NGVD)	6602.98
SITE	Bluewater Disposal Site	EAST COORD. (FT)	467531.78	TOP OF CASING (FT)	6605.40
DRILLING METHOD	Air/Mud Rotary	HOLE DEPTH (FT BGS)	130.00	MEAS. PT. ELEV. (FT)	6605.40
DRILL COMPANY	Stewart Bros.	WELL DEPTH (FT BGS)	126.00	SLOT SIZE (IN)	0.020
RIG TYPE	Midway HD 1500	WATER LEVEL (FT BGS)		BIT SIZE(S) (IN)	8.75

WELL INSTALLATION		INTERVAL (FT BGS)			WATER LEVEL DATE	
SURFACE CASING:	6.62 in. Steel	-3.0	to	10.0	DRILLER	
BLANK CASING:	4 in. PVC Sch 40	-2.42	to	98.0	LOGGED BY	Patel, N
WELL SCREEN:	4 in. Slotted PVC	98.0	to	123.0	SAMPLING METHOD	GRAB
SUMP/END CAP:	4 in. PVC Sch 40	123.0	to	126.0	DATE DEVELOPED	9/11/1996
SURFACE SEAL:					REMARKS	
GROUT:	Cement	0.0	to	75.0		
SEAL:	Bentonite Pellets	75.0	to	83.0		
UPPER PACK:						
LOWER PACK:	Gravel	83.0	to	130.0		



LM MONITORING WELL BLU01 5647.GPJ SHIP.GDT 3/18/10

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