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FINAL SUMMARY OF HYDROLOGIC AND CHEMICAL CHARACTERIZATION STUDIES VOLUME 3 OF 3 NAS FORT WORTH TX

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FINAL REPORT

Summary of Hydrologic and Chemical Characterization Studies

Volume III

Prepared for:

U.S. Army Engineer District
Ft. Worth, Texas

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Prepared by:

Environmental Science & Engineering, Inc.

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APPENDIX C

MONITOR WELL LOGS

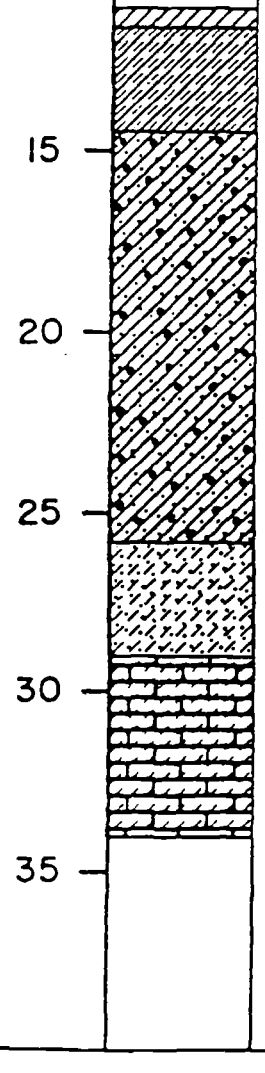
Table C-1. Well Inventory - Terrace Deposits Wells

HM-1	HM-36	HM-72	HM-108
HM-2	HM-37	HM-73	HM-110
HM-3A	HM-38	HM-74	HM-111
HM-3B	HM-39	HM-75	HM-112
HM-4A	HM-40	HM-76	HM-113
HM-5	HM-41	HM-77	HM-114
HM-6	HM-42	HM-78	HM-115
HM-7	HM-43	HM-79	HM-116
HM-8	HM-44	HM-80	HM-117
HM-9	HM-45	HM-81	HM-118
HM-10	HM-46	HM-82	HM-121
HM-11	HM-47	HM-83	HM-122
HM-12	HM-48	HM-84	HM-123
HM-13	HM-49	HM-85	HM-124
HM-14	HM-50	HM-86	HM-125
HM-15	HM-51	HM-87	HM-126
HM-16	HM-52	HM-88	HM-127
HM-17	HM-53	HM-89	
HM-18	HM-54	HM-90	
HM-19	HM-55	HM-91	
HM-20	HM-56	HM-92	
HM-21	HM-57	HM-93	
HM-22	HM-58	HM-94	
HM-23	HM-59	HM-95	
HM-24	HM-60	HM-96	
HM-25	HM-61	HM-97	
HM-26	HM-62	HM-98	
HM-27	HM-63	HM-99	
HM-28	HM-64	HM-100	
HM-29	HM-65	HM-101	
HM-30	HM-66	HM-102	
HM-31	HM-67	HM-103	
HM-32	HM-68	HM-104	
HM-33	HM-69	HM-105	
HM-34	HM-70	HM-106	
HM-35	HM-71	HM-107	

FIGURE B-1

LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-1

MAP COORDINATES: S 895, R 2,794	**DATE DRILLED:** 12-01-82
GROUND ELEV.: 666.4	**DRILLED BY:** Southwestern Laboratories, Inc.
DRILLING METHOD: Flight Auger	
BOREHOLE DEPTH: 34 feet	**BOREHOLE DIAMETER:** 7 inches



DEPTH	DESCRIPTION OF MATERIALS	
	FILL:	Gravelly clay, dark brown, moist, stiff, cohesive.
		At 2 feet, asphalt particles.
		At 4 feet, zones of green chemical residue
5		At 5 feet, green chemical sludge with some silty clay, moist to wet, red oxidized zones, strong solvent odor.
		At 6 feet, sludge with some gravelly clay.
		At 7 feet, greenish yellow chemical sludge, very wet, soft, strong solvent odor.
		At 8 feet, lenses of stiff gravelly clay.
10		At 9 feet, water seepage into borehole.
		At 10 feet, very strong solvent odor.
	CLAY:	Dark brown, moist, zones of greenish yellow chemical residue, zones of reddish-orange residue, small particles of black organic material, strong solvent odor.
	SILTY CLAY:	Yellowish-brown, slightly moist, stiff, zones of reddish-orange residue, strong solvent odor.
15	GRAVELLY CLAY:	Brown; moist: white limestone gravel up to 3/4-inch diameter; some silt; strongly weathered zones of black, yellow, and orange; slight solvent odor.
20		
25		
	SILTY SAND:	Brown-orange with zones of yellow and pink, moist, fine grained, weathered, slight chemical odor.
		At 26 feet, very moist.
30	CLAYEY LIMESTONE: *(Goodland Limestone)*	Grey, moist, weathered, zones of orange and black discoloration, slight chemical odor.
35		

FIGURE B-2
LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-2

MAP COORDINATES: S 1,648, R 3,508
GROUND ELEV.: 654.7
DRILLING METHOD: Flight Auger
BOREHOLE DEPTH: 35 feet

DATE DRILLED: 12-02-82
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Dark brown clay with light brown gravelly-clay zones, moist, firm, grey-white limestone fragments up to 3/4-inch diameter with chalky residue where weathered. At 2 feet, dark brown to black, At 3 feet, slightly moist, stiff. At 4 feet, reddish-brown oxidized zones, very stiff, grass roots.
5		GRAVELLY CLAY:	Reddish-brown, slightly moist, very stiff, gravel up to 3/4-inch diamter, some sand. At 6 feet, moist, stiff, chalky weathered limestone fragments up to 1-1/2-inch diameter.
10		CLAYEY SAND:	Orange-brown, slightly moist, slightly dense, fine grained, some white chalky limestone gravel. At 9 feet, grading to more clay, moist, black zones in clay, gravel up to 1-1/2-inch diameter.
		SANDY CLAY:	Orange-brown, moist, firm to stiff, uniform, trace of weathered limestone gravel. At 13 feet, grading sandier.
15		SAND:	Orange-buff, moist to slightly moist, loose, fine-grained quartz sand, uniform, clay in zones, trace of limestone gravel. At 18 feet, some grey limestone gravel up to 1-1/2-inch diameter and with abundant shells. At 19 feet, zones of dark brown clay, moist, firm.
20		GRAVELLY SAND:	Brownish-buff, moist, grading to more gravel and clay at 20.5 feet.
25		SILTY SAND:	Buff, very wet, coarse.
		SANDY CLAY:	Light brown-buff, very wet, soft to firm, cohesive.
30		SAND/GRAVEL:	Light brown-buff, very wet, fragments of limestone, quartz, and chert, some clay.
35		LIMESTONE: *(Walnut Formation)*	Blue-grey, moist, dense abundant shells

FIGURE B-3
LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-3a

MAP COORDINATES:	S 251, R 2,613	**DATE DRILLED:**	12-02-82
GROUND ELEV.:	655.0	**DRILLED BY:**	Southwestern Laboratories, Inc.
DRILLING METHOD:	Flight Auger		
BOREHOLE DEPTH:	25.5 feet	**BOREHOLE DIAMETER:**	7 inches

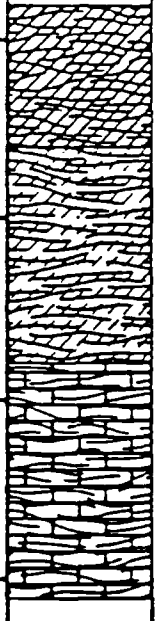
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		Fill:	Dark brown clay with orange sand, moist, soft to firm, some gravel. At 1 foot, slightly moist, firm, grading sandier, some white weathered limestone fragments. At 2 feet, clay is stiffer. At 3 feet, gravelly clay, light to dark brown, wet, soft to firm, limestone fragments, white residue throughout.
5			At 7 feet, sand and gravel, light brown, wet, limestone fragments, strong chemical odor.
10		SHALEY CLAY: *(Goodland Limestone)*	Grey-green, moist, stiff, uniform, brown-orange oxidized zones, strong chemical odor. At 10 feet, color predominantly grey.
		CLAYEY SHALE:	Grey, moist, very dense, orange oxidized zones, chemical odor.
15			At 17 feet, color change to light grey, slightly moist.
20		SHALEY LIMESTONE:	Light grey, slightly moist, very dense, chemical odor.
25			
30			

FIGURE B-4

LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-3b

MAP COORDINATES: S 261, R 2,614	**DATE DRILLED:** 12-03-82
GROUND ELEV.: 655.4	**DRILLED BY:** Southwestern Laboratories, Inc.
DRILLING METHOD: Flight Auger	
BOREHOLE DEPTH: 10.5 feet	**BOREHOLE DIAMETER:** 7 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Sandy clay, brown, moist, soft to firm, some gravel up to 1-1/2-inch diameter, grass roots. At 1 foot, white residue, some chalky limestone gravel.
2			At 2 feet, light brown, slightly moist, very stiff, some gravel up to 2-inch diameter.
4			At 4 feet, color change to grey.
6			At 5 feet, clayey gravel, grey, slightly moist, very dense, limestone fragments, white residue, orange oxidized zones. At 5.5 feet, gravelly clay, grading to light brown-grey, firm, white limestone fragments up to 1-1/2-inch diameter, slight chemical odor. At 6 feet, moist, soft, zones of white-orange-brown residue, strong chemical odor. At 7 feet, sand and gravel, moist to wet, fine to coarse, brown-orange residue, very strong chemical odor.
8		SHALEY CLAY: *(Goodland Limestone)*	Greenish-grey, very stiff, moist, some gravel, zones of orange-brown-white residue, very strong chemical odor.
10			
12			

FIGURE B-5

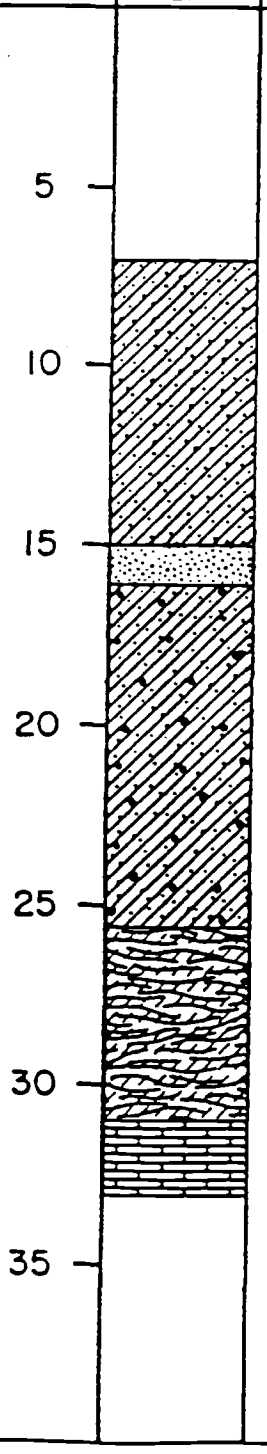
LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-4a

MAP COORDINATES: S 144, R 2,614	**DATE DRILLED:** 12-03-82
GROUND ELEV.: 654.5	**DRILLED BY:** Southwestern Laboratories, Inc.
DRILLING METHOD: Flight Auger	
BOREHOLE DEPTH: 26 feet	**BOREHOLE DIAMETER:** 7 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Sandy clay, light brown, moist, firm, some gravel, grass roots. At 2 feet, color change to brown, chemical odor. At 3 feet, green-black chemical sludge, very moist, soft, some orange-brown sandy clay, very strong chemical odor. At 4 feet, orange-brown sandy clay with green-black chemical sludge, very moist, soft, strong chemical odor. At 5 feet, sandy clay, orange-brown, moist, firm, strong chemical odor. At 8 feet, some gravel, zones of white and black residue, strong chemical odor. At 9 feet, color change to light brown.
5			
10		SHALEY CLAY: *(Goodland Limestone)*	Green-grey, moist, very stiff, red and black oxidized zones, slight chemical odor.
		CLAYEY SHALE:	Grey, moist, slight odor.
15		SHALE:	Grey, slightly moist, very stiff, interbedded sandy and clayey zones, red oxidized zones, chemical odor.
		LIMESTONE/ SHALE:	Grey, slightly moist, interbedded, chemical odor.
20		SHALEY LIMESTONE:	Grey, moist, orange oxidized zones, chemical odor.
25		SHALEY LIMESTONE/ CLAYEY SHALE:	Grey, moist, interbedded, orange-brown-black oxidized zones, chemical odor.
30			

FIGURE B-6
LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-5

MAP COORDINATES: S 1,295 R 4,528	**DATE DRILLED:** 12-02-82
GROUND ELEV.: 664.4	**DRILLED BY:** Southwestern Laboratories, Inc.
DRILLING METHOD: Air-Rotary	
BOREHOLE DEPTH: 33 feet	**BOREHOLE DIAMETER:** 7 inches



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Gravelly clay, dark brown, dry, very stiff, small amounts of refuse.
		SANDY CLAY:	Brown, moist, slightly soft to firm, trace of gravel.
			At 14.5 feet, very wet, probably saturated.
		SAND:	Orange-brown, slightly moist, very fine, uniform, some silt, no odor.
		CLAY/ GRAVELLY CLAY:	Brown, moist, firm to very stiff, 10-15 percent gravel. At 18 feet, color change to grey-brown and yellow-brown.
			At 22 feet, very stiff.
		SHALE/CLAYEY SHALE: *(Walnut Formation)*	Dark grey to blackish grey, slightly moist, very stiff, some brown clay.
		LIMESTONE:	Dark grey, slightly moist, very dense.

FIGURE B-7

LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-6

MAP COORDINATES: S 2,964 R 2,856	DATE DRILLED: 12-04-82
GROUND ELEV.: 640.7	DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Flight Auger	
BOREHOLE DEPTH: 19 feet	BOREHOLE DIAMETER: 7 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Asphalt and subgrade.
			At 1 foot, gravelly clay, light brown, moist, firm.
			At 1.5 feet, sandy clay, dark brown to black, moist, firm, black tar-like residue, strong oil odor.
3			At 2 feet, black with zones of light brown, trace of limestone gravel, tar-like residue, strong oil odor.
			At 4 feet; local red, grey, and green discoloration; fragments of glass, cloth, and metal wire, strong oil odor.
6			At 6 feet, same but predominantly gravelly clay.
			At 8 feet, sandy clay, light brown to black, moist, stiff, some gravel, fragments of paper and metal, tar-like residue, strong oil odor.
9			At 9 feet, red and white discoloration, firm, grass roots, strong oil odor.
			At 10 feet, sandy clay, predominantly black, very moist, firm, some gravel, grass roots, tar-like residue.
			At 11 feet, clayey sand/sandy clay, brown to black, saturated, oil seepage, grass roots, very strong oil odor.
12		GRAVELLY SAND:	Very moist to wet, very dense, strong oil odor.
			At 13 feet, black grading to light grey-brown, saturated, oily, gravel lens with limestone fragments up to 1-inch diameter.
15			At 15 feet, grey, saturated, dense, very strong diesel fuel odor.
			At 16 feet, less than 10 percent fines.
18		GRAVELLY SAND/ SANDY GRAVEL:	Grey-black, saturated, abundant limestone fragments, trace of clay, odor.
		LIMESTONE: *(Walnut Formation)*	Dark grey, saturated, fossiliferous, odor.
21			

FIGURE 8-8
LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-7

MAP COORDINATES: S 3,051 R 2,898	**DATE DRILLED:** 12-04-82
GROUND ELEV.: 639.1	**DRILLED BY:** Southwestern Laboratories, Inc.
DRILLING METHOD: Flight Auger	
BOREHOLE DEPTH: 15 feet	**BOREHOLE DIAMETER:** 7 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Asphalt and subgrade.
			At 1 foot, gravelly clay, brown, slightly moist, slightly firm, gravel up to 1/2-inch diameter, glass fragments, oil odor.
			At 2 feet, increasing gravel content, less odor.
3			At 3 feet, dark brown to black, decreasing gravel content, firm to very firm, grass roots, oil odor.
			At 5 feet, some fragments of black burnt material, musky odor.
6			At 6 feet, slightly moist to moist, zones of green discoloration, grass roots, metal fragments, oil odor.
			At 7 feet, some concrete fragments, 10 percent core recovery.
9			At 9 feet, gravelly clay, greyish black, oil odor.
		GRAVELLY SAND:	Grey-brown, wet, water seepage, limestone fragments, slight oil odor.
12			
		LIMESTONE: *(Walnut Formation)*	Light grey, dense.
15			

FIGURE B-9

LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-8

MAP COORDINATES:	S 481 R 3,670	**DATE DRILLED:**	12-05-82
GROUND ELEV.:	670.3	**DRILLED BY:**	Southwestern Laboratories, Inc.
DRILLING METHOD:	Flight Auger		
BOREHOLE DEPTH:	50 feet	**BOREHOLE DIAMETER:**	7 inches

DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
		GRAVELLY CLAY:	Brown-dark brown, moist, firm, grass roots. At 1 foot, increasing gravel content, stiff, white weathered limestone fragments. At 3 feet, increasing gravel content, slightly moist, very stiff.
5			At 5 feet, light brown to buff, slightly moist, very stiff.
10		SANDY CLAY:	Light orange-brown, very moist, firm, uniform, moderately cohesive, fine sand, trace of gravel. At 12 feet, increasing gravel content, moist.
15			At 15 feet, decreasing sand and gravel content.
20			At 20 feet, 1-inch thick lens of gravelly clay. At 21 feet, several lenses of gravelly clay.
25			At 25 feet, slightly darker in color, trace of gravel. At 26 feet, brown, dense grey limy zones, decreasing sand content, trace of limestone gravel. At 27 feet, increasing content of grey limy zones.
30			At 29 feet, light grey-brown, moist, firm, trace of limestone gravel, orange and black oxidized zones.
		SAND:	Buff, very moist, loose, fine grained, clean.
35		GRAVELLY SAND:	Light brown-buff, wet, slightly dense, water seepage, limestone and quartz gravel.
40			

FIGURE B-9
LITHOLOGIC LOG, UPPER ZONE
MONITOR WELL HM-8

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

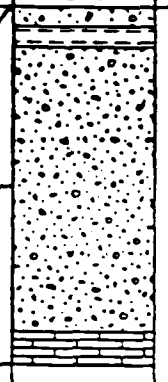
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
40		CLAYEY SILT:	Light brown, wet soft, moderately cohesive.
		GRAVELLY SAND:	Light brown-buff, wet, slightly dense, water seepage, limestone and quartz gravel.
45			
50		LIMESTONE: *(Walnut Formation)*	Blue with black and grey, moist, dense.

FIGURE B-10

LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-9

MAP COORDINATES: S 1,443 R 4,712	**DATE DRILLED:** 12-05-82
GROUND ELEV.: 635.7	**DRILLED BY:** Southwestern Laboratories, Inc.
DRILLING METHOD: Flight Auger	
BOREHOLE DEPTH: 5.5 feet	**BOREHOLE DIAMETER:** 7 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Gravelly clay, dark brown, moist, cohesive, no odor.
2			
4		LIMESTONE: *(Walnut Formation)*	Grey to blue-grey, wet, very dense, no odor.
6			

FIGURE B-11

LITHOLOGIC LOG, UPPER ZONE MONITOR WELL HM-10

MAP COORDINATES: S 2,702 R 2,913	**DATE DRILLED:** 12-06-82
GROUND ELEV.: 643.3	**DRILLED BY:** Southwestern Laboratories, Inc.
DRILLING METHOD: Flight Auger	
BOREHOLE DEPTH: 22 feet	**BOREHOLE DIAMETER:** 7 inches

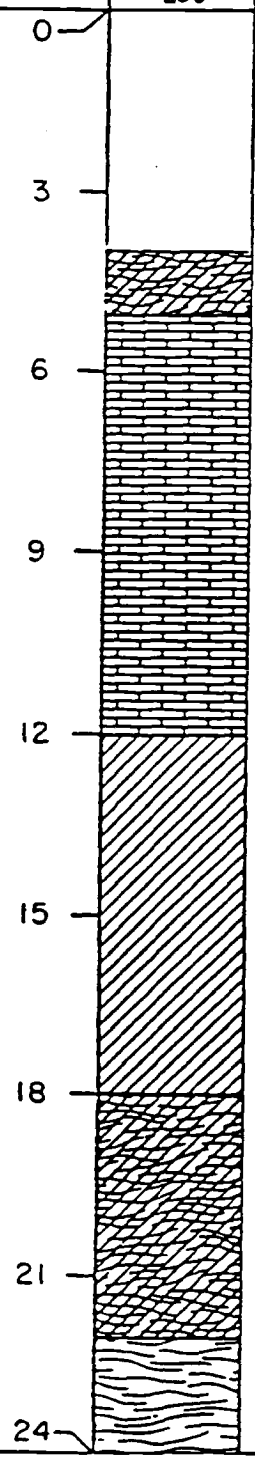
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Asphalt and subgrade. At 1 foot, sandy clay, light brown to black, slightly moist, very firm, zones with white limestone gravel up to 3/4-inch diameter, glass and metal refuse, slight tar-like odor At 2 feet, slightly moist to moist, firm to very stiff, zones with light brown loose silty sand; zones of red, orange, and bright green discoloration, fragments of tar shingles, black zones with appearance and odor of burnt charcoal. At 3 feet, same with no silty sand.
3			
6			At 6 feet, slightly moist, firm, some gravel, zones of white and red discoloration, metal wire and rubber refuse, odor. At 8 feet, gravelly sand, white and black, moist, slightly loose, zones of orange, blue, and green discoloration, no refuse, no apparent odor.
9			At 10 feet, gravelly clay, dark brown, moist, slightly firm, zones of red refuse including metal wire and glass, musky odor.
12			At 12 feet, wet, water seepage.
15		GRAVELLY SAND:	Light brown-buff, wet, slightly dense, fine to coarse sand consisting of quartz, chert, and limestone, limestone gravel up to 3/4-inch diameter, no odor.
18			At 18 feet, alternating zones of buff and light brown, wet, dense, gravel up to 1-inch diameter, red-yellow discoloration. At 19 feet, trace of clay in zones.
21		SHALEY LIMESTONE: *(Walnut Formation)*	Greyish blue-green, saturated, very dense, trace of clay, zones of dark green no odor.
24			

FIGURE 8-12

LITHOLOGIC LOG OF MONITOR WELL HM-11 (UPPER ZONE)

MAP COORDINATES: S.-18 feet; R. 2,103 feet
GROUND ELEV.: 651.7 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 35.5 feet

DATE DRILLED: 3-28-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Asphalt and subgrade. At 1 foot: Gravelly clay, brown, moist to slightly wet, no odor. At 2 feet: Gravelly clay, brown, moist, firm, cohesive, whitish-yellow limestone gravel up to 1/4-inch diameter, some chert fragments, no visible fossils, some orange discoloration, no odor apparent.
3		CLAYEY SHALE: *(Goodland Limestone)*	Light buff to brown, moist, firm, some thin beds of limestone, no visible fossils, some orange-yellow-brown discoloration, no odor.
6		LIMESTONE:	Light buff to white, slightly moist, dense, brittle, slightly fossiliferous, some yellow and orange discoloration, trace of clay, no odor.
9			At 8 feet: Limestone becoming more massive, with some interbedded clay. At 10 feet: Beds of clay are more numerous, clay is slightly moist to moist, firm, cohesive, with orange-brown discoloration.
12		CLAY:	Buff-brown-green, moist, very firm, cohesive, shaley zones, some interbedded dense limestone, no odor. At 14 feet: Limestone beds are few.
15			
18		SHALEY CLAY:	Buff-green with orange hue, slightly moist, firm, slightly cohesive to cohesive, some orange discoloration, no odor. At 19 feet: Thin limestone bed. At 20 feet: Slightly moist to moist, firm to very firm, slightly cohesive, water seepage into borehole noted by driller.
21			
24		SHALE:	Dark grey, moist (?), stiff, brittle, fissile, no fossils visible, limey, no odor.

FIGURE 8-12 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-11 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

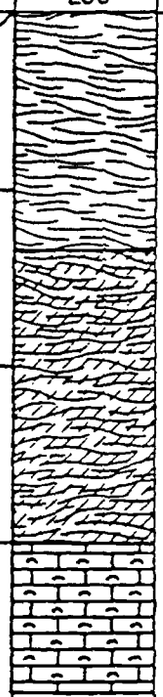
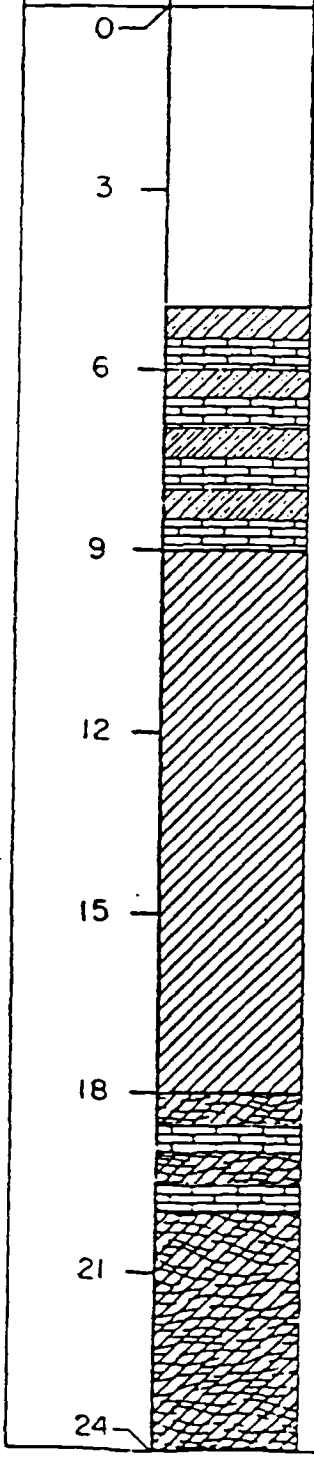
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
		At 26 feet: Slightly dense, some clay, some fossil shells (mollusks).
27		
		CLAYEY SHALE: Dark grey, moist (?), slightly stiff, brittle, fissile, some fossil shells (mollusks), limey, cohesive clay.
30		At 30 feet: Slightly firm to stiff.
33		SHELL AGGLOMERATE: *(Walnut Formation)* Light to dark grey, moist (?), dense, brittle, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
36		

FIGURE B-13

LITHOLOGIC LOG OF MONITOR WELL HM-12 (UPPER ZONE)

MAP COORDINATES: S.-21 feet; R. 2,639 feet
GROUND ELEV.: 654.3 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 40 feet

DATE DRILLED: 3-29-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Asphalt and subgrade.
			At 2 feet: Silty clay, dark brown, moist, firm, cohesive, no odor.
3			At 4 feet: Color change to medium brown.
6		SILTY CLAY/ LIMESTONE: *(Goodland Limestone)*	Interbedded; light brown to medium brown silty clay, moist, slightly firm, slightly cohesive, some brown-orange discoloration; light buff limestone, dense, some fossils (mollusks), no odor.
			At 8 feet: Becoming more moist, some chert, some white-yellow discoloration, no odor.
9		CLAY:	Greenish-buff, moist, slightly firm to firm, cohesive, orange-yellow discoloration, calcareous, no odor.
12			
15			
18		SHALEY CLAY/ LIMESTONE:	Interbedded; greenish-buff shaley clay, moist, slightly firm, slightly cohesive, some brown-orange discoloration, grey limestone moist (?), dense, fossiliferous (mollusks), brown discoloration, no odor.
		SHALEY CLAY:	Greyish-buff, moist, firm, slightly cohesive, some orange-brown discoloration.
21			At 22 feet: Firm to slightly stiff, no odor.
24			

FIGURE B-13 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-12 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

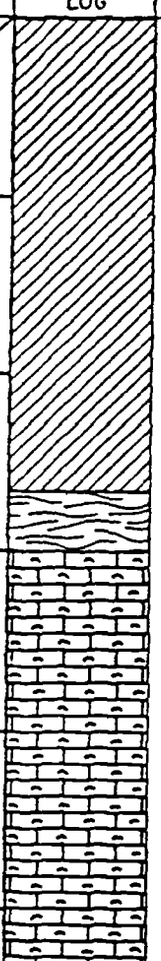
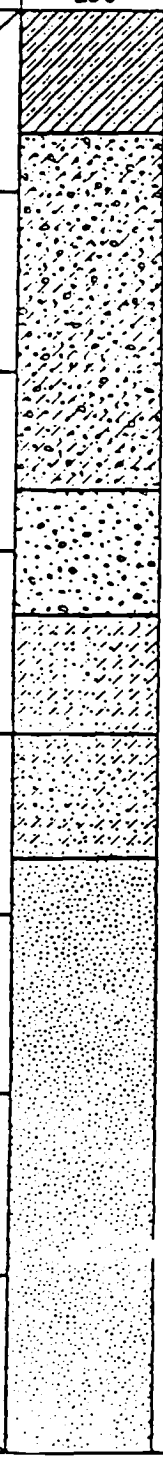
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		CLAY:	Greenish-buff, moist, firm to slightly stiff, slightly cohesive, some orange-brown discoloration, no odor.
			From 26 to 28 feet: Some interbedded shale.
27			
			At 28 feet: Some interbedded dark grey clay.
30			At 30 feet: Becoming shaley.
		SHALE:	Medium to dark grey, very moist to slightly wet, firm to stiff, slightly cohesive, calcareous, some interbedded clay.
33		SHELL AGGLOMERATE: *(Walnut Formation)*	Light to dark grey, moist (?), dense to very dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay, some pyritization of fossils.
36			
			At 38 feet: No visible pyritization.
39			
42			

FIGURE B-14

LITHOLOGIC LOG OF MONITOR WELL HM-13 (UPPER ZONE)

MAP COORDINATES: S.-9 feet; R. 3,138 feet
GROUND ELEV.: 658.1 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 44 feet

DATE DRILLED: 3-29-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches



DEPTH	DESCRIPTION OF MATERIALS	
0	SILTY CLAY:	Dark brown, moist, firm, cohesive, grass roots, organic material, no odor.
3	CLAYEY GRAVELS:	Greyish-buff, moist, unconsolidated, weathered dense limestone fragments up to 1-inch diameter, fossiliferous (mollusks); clay is dark brown, slightly firm, slightly cohesive, no odor.
6		At 4 feet: Gravel grading coarser, limestone fragments up to 1-1/2-inch diameter, some coarse sand, less clay content.
9	SANDY GRAVEL:	Greyish-buff gravel and light brown sand, very moist, loose, weathered limestone fragments up to 1-1/2-inch diameter, fossiliferous (mollusks), fine- to - coarse grained quartz sand.
12	CLAYEY SILTY SAND:	Orange-buff, slightly wet, loose, fine- to medium-grained quartz sand, sand is well sorted, sub-angular to sub-rounded, clay is slightly firm and slightly cohesive, no odor.
	SILTY SAND:	Orange-buff, wet, loose, very fine- to fine-grained quartz sand, sand is well sorted, sub-angular to sub-rounded, some clay.
15	SAND:	Orange-buff, slightly wet, loose, very fine- to fine-grained quartz, well sorted, sub-angular to sub-rounded, some silt, no odor.
18		
		At 20 feet: Buff color.
21		
		At 22 feet: Buff color with orange hue.
24		

FIGURE B-14 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-13 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

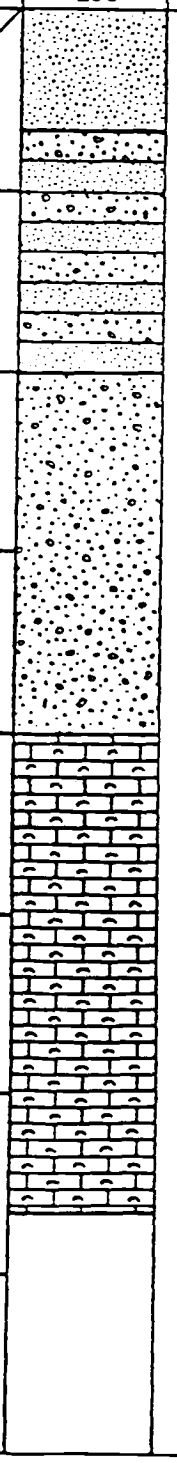
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		At 24 feet: Orange color, very fine- to medium-grained, no silt.
		SAND/GRAVEL: Interbedded; gravel is white-buff-brown, slightly wet, dense weathered fossiliferous limestone fragments and shell fragments up to 1-inch diameter, some chert fragments, sub-angular to sub-rounded, very poorly sorted, manganese oxide; sand is buff, otherwise same as sand at 24 feet, no odor.
27		At 28 feet: Some of the finer gravel is quartz.
30		GRAVEL: Same gravel as at 28 feet except grading coarser, less sand, some fragments of well-cemented sand, more chert fragments, some iron nodules.
		At 32 feet: Some silty clay, clay is slightly firm, slightly cohesive, no odor.
33		At 34 feet: No clay.
36		SHELL AGGLOMERATE: *(Walnut Formation)* Medium to dark grey, wet (?), dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
39		
42		
45		

FIGURE B-15

LITHOLOGIC LOG OF MONITOR WELL HM-14 (UPPER ZONE)

MAP COORDINATES S.-16 feet; R. 3,793 feet
GROUND ELEV.: 662.9 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 58 feet

DATE DRILLED: 3-30-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches to 41 feet; 5 inches to 58 feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SILTY CLAY:	Dark brown, moist, firm to slightly stiff, slightly cohesive, some limestone gravel, grass roots.
			At 2 feet: Cohesive, no roots, no odor.
3			
6		SANDY CLAY:	Light brown, moist, firm to very firm, slightly cohesive, sand is predeominantly quartz fragments with some limestone fragments, some limestone and chert gravel up to 1/4-inch diameter, no odor.
			At 8 feet: Slightly firm to firm; some light buff to white, dense, fossiliferous, sub-angular, limestone gravel up to 3/4-inch diameter.
9		SILTY CLAYEY SAND:	Light buff with orange hue, moist to slightly wet, loose, very fine- to fine-grained quartz sand with some limestone sand, clay is slightly cohesive, some caliche, some fossiliferous limestone and chert gravel up to 1/2-inch diameter, no odor.
12		SILTY SANDY CLAY:	Light brown, slightly wet to wet, slightly firm to firm, slightly cohesive, very fine to fine quartz sand with some limestone sand, some light buff fossiliferous limestone gravel up to 1/4-inch diameter.
15		CLAYEY SAND:	Light brown, moist, loose, very fine- to fine-grained quartz sand with some limestone sand, slightly cohesive clay, some light buff fossiliferous limestone gravel up to 1/4-inch diameter.
18			At 18 feet: Sand is very fine- to medium-grained, some of the sand and gravel is white.
21		SANDY GRAVEL:	Light brown overall with various other colors, moist, loose to slightly dense, fine- to medium-grained and fine- to coarse-gravel consisting of limestone and mollusk shell fragments, sub-angular to angular, manganese oxide stains on limestone fragments, trace of clay.
24			

FIGURE B-15 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-14 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

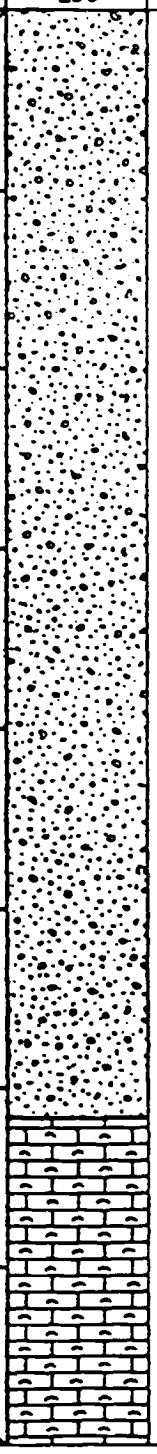
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		At 28 feet: Higher clay content.
30		At 30 feet: Smaller sand to gravel ratio.
33		At 32 feet: Very fine- to medium-grained sand, subrounded to subangular, gravel up to 2-inch diameter.
36		
39		At 40 feet: Gravel is light grey.
42		At 42 feet: Medium- to coarse-grained sand, increasing content of chert fragments.
45		SHELL AGGLOMERATE: *(Walnut Formation)* Medium to dark grey, wet, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay, no odor.
48		

FIGURE B-15 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-14 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

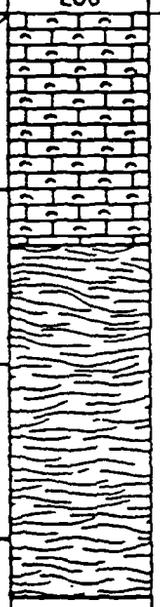
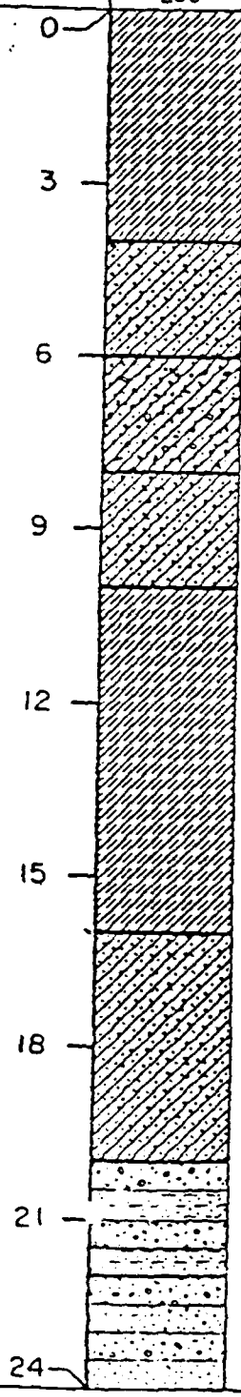
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
48		
51		SHALE: Medium to dark grey, wet, stiff, brittle, fissile, calcareous, some fossils (oysters).
54		At 54 feet: Very firm to stiff, increasing fossil content (oysters).
57		At 56 feet: Some shell agglomerate.
60		

FIGURE B-16

LITHOLOGIC LOG OF MONITOR WELL HM-15 (UPPER ZONE)

MAP COORDINATES: S. 696 feet; R. 2,785 feet
GROUND ELEV.: 665.5 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 50 feet

DATE DRILLED: 3-30-83 to 4-1-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches to 38 feet; 5 inches to 50 feet



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SILTY CLAY:	Dark brown, moist, firm, slightly cohesive, some fine-grained gravel, grass roots, organic matter, no odor.
3			At 2 feet: Medium brown.
		SANDY CLAY:	Medium brown, moist, firm to stiff, slightly cohesive, very fine-grained, sand, some fine-grained weathered limestone gravel, trace of caliche.
6		SANDY GRAVELLY CLAY:	Light to medium brown, moist, firm to very firm, slightly cohesive, very fine- to fine-grained sand, weathered white limestone gravel up to 1-inch diameter, trace caliche.
9		SANDY CLAY:	Medium brown, moist, firm to very firm, slightly cohesive, fine-grained sand consisting of limestone and shell fragments with some quartz, some fine-grained weathered limestone gravel up to 1-inch diameter, trace caliche.
12		SILTY CLAY:	Light brown, moist to very moist, slightly firm, cohesive, some fine-grained sand, some white weathered limestone gravel up to 3/4-inch diameter.
			At 12 feet: No gravel.
15			At 14 feet: Some white weathered limestone.
18		SANDY CLAY:	Light brown, moist, slightly firm, slightly cohesive, very fine-to fine-grained sand, some weathered buff limestone gravel up to 1-inch diameter, limestone is fossilferous (mollusks).
			At 18 feet: Slightly wet.
21		GRAVEL/SANDY SILT:	Interbedded; gravel is greyish-buff fragments of limestone and shells with some chert and and iron concretions, slightly moist, loose, fragments up to 1-1/2-inch diameter, manganese oxide and red-orange stains; sandy silt is light brown with orange hue, fine- to medium-grained limestone and shells with some quartz, trace of clay.
24		GRAVEL/SILTY SAND:	Same description as for sample at 20 feet except gravel is predominantly fine-grained.

FIGURE B-16 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-15 (UPPER ZONE)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	
BOREHOLE DEPTH:	BOREHOLE DIAMETER:

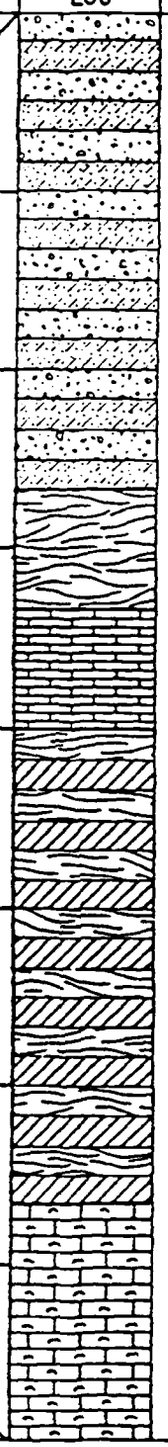
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
27			
30			
33		SHALE: *(Goodland Limestone)*	Light buff, slightly moist, slightly firm, non-cohesive.
		LIMESTONE:	Greyish-buff, slightly moist, dense, fossiliferous (mollusks), interbedded with firm shale/clay.
36		SHALE/CLAY:	Interbedded; light buff, slightly moist, slightly firm to firm, slightly cohesive, orange-brown discoloration.
			At 38 feet: Dark greyish-buff color.
39			At 40 feet: Darker color, moist, very firm to dense shale.
42			
45		SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, moist, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
48			

FIGURE B-16 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-15 (UPPER ZONE)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	
BOREHOLE DEPTH:	BOREHOLE DIAMETER:

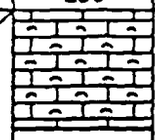
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
48		
51		

FIGURE B-17

LITHOLOGIC LOG OF MONITOR WELL HM-16 (UPPER ZONE)

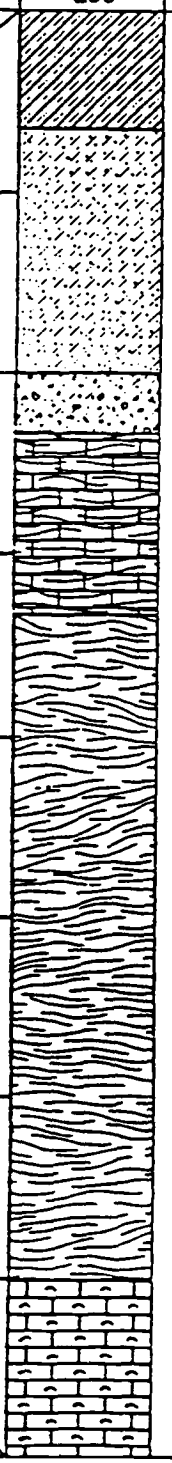
MAP COORDINATES: S. 1,047 feet; R. 2,793 feet
GROUND ELEV.: 664.2
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 50 feet
DATE DRILLED: 3-31-83 to 4-1-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SILTY CLAY:	Dark brown, moist, firm to very firm, slightly cohesive, grass roots, organic matter, some limestone gravel up to 1-inch diameter.
3			At 2 feet: Medium to dark brown, slightly firm to firm, cohesive trace caliche.
			At 4 feet: Medium brown, firm to slightly stiff.
6		GRAVELLY CLAY:	Medium brown, moist, slightly cohesive, slightly fossiliferous limestone gravel up to 1-1/2-inch diameter, some limestone and quartz sand.
9			
		SILTY CLAY:	Light brown, moist, slightly firm, slightly cohesive, some limestone sand and gravel with manganese oxide stains, trace caliche.
12		GRAVELLY SANDY CLAY:	Light brown, moist, slightly firm, slightly cohesive, weathered limestone gravel up to 1-inch diameter, limestone and quartz sand.
15		SILTY CLAY:	Light brown, moist, slightly firm, moderately cohesive, some fine-grained weathered limestone gravel, some very fine- to fine-grained limestone and quartz sand.
			At 16 feet: Light brown to buff, slightly moist, very firm to stiff, slightly cohesive some fine-grained limestone and shell gravel, some fine- to medium-grained sand, orange and white discoloration, no odor apparent.
18			At 18 feet: Light brown, moist, firm, some very fine- to fine-grained limestone and quartz sand, some fine-grained limestone gravel.
21		SANDY GRAVEL:	Light buff to brown, slightly moist, loose, predominantly fine-grained weathered fossiliferous limestone gravel, some gravel up to 1-1/2-inch diameter, some clay.
24		SILTY CLAY/ CLAYEY SILT:	Light orange-brown, slightly moist to moist, slightly firm, some sand, some buff weathered limestone gravel up to 1-1/2-inch diameter.

FIGURE B-17 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-16 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	DESCRIPTION OF MATERIALS	
24	CLAYEY SAND/ CLAYEY SILT:	Light orange-brown, moist, loose sand, slightly cohesive clay, very fine- to fine-grained sand, trace of gravel.
27	SILTY SAND:	Light orange-brown, moist, loose, very fine- to fine-grained quartz sand, trace of gravel.
		At 28 feet: No gravel.
30	GRAVELLY SILTY SAND:	Light brown to buff, moist, loose, very fine- to fine-grained quartz sand, limestone gravel.
	SHALEY LIMESTONE: *(Goodland Limestone)*	Light buff, slightly moist, slightly dense to dense, fossilferous (mollusks).
33	SHALE:	Light buff, slightly moist, very firm to stiff, interbedded fossiliferous limestone
36		At 36 feet: Light greenish buff, firm to very firm, orange-brown discoloration, no odor.
39		At 38 feet: Dark grey, slightly firm to very firm, fissile.
42		
		At 44 feet: Very firm to stiff.
45	Shell Agglomerate: *(Walnut Formation)*	Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
48		

FIGURE B-17 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-16 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

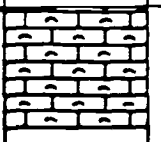
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
48		
51		

FIGURE B-18
LITHOLOGIC LOG OF MONITOR WELL HM-17 (UPPER ZONE)

MAP COORDINATES: S. 884 feet; R. 2,583 feet
GROUND ELEV.: 657.0 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 45 feet

DATE DRILLED: 3-31-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Concrete pavement and subgrade.
3			At 2 feet: Gravel/silty clay, light brown to buff, moist; gravel is slightly dense, subrounded to angular weathered limestone fragments up to 2-1/2-inch diameter; clay is slightly firm, slightly cohesive; no odor.
6			
9			At 8 feet: Gravel/silty sand, light brown to buff, moist; gravel is slightly dense, subrounded to angular, weathered limestone; sand is very fine- to fine-grained quartz with some limestone; trace of clay.
12			
15		GRAVEL/SILTY SAND:	Light brown to buff, moist; gravel is slightly dense, subrounded to angular, fine- to medium-grained weathered limestone; sand is very fine- to fine-grained quartz with some limestone; trace of clay. At 16 feet: Gravel is slightly coarser.
18		SHALE: *(Goodland-Limestone)*	Light grey to buff with green hue, moist, firm to stiff, slightly cohesive, brown-orange discoloration, no odor.
21		LIMESTONE/SHALE:	Interbedded; light grey to buff, slightly moist to moist; limestone is dense, fossiliferous (mollusks), weathered, with manganese oxide stain; shale is firm to stiff, slightly cohesive, with brown-orange discoloration, no odor.
24			

FIGURE B-18 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-17 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

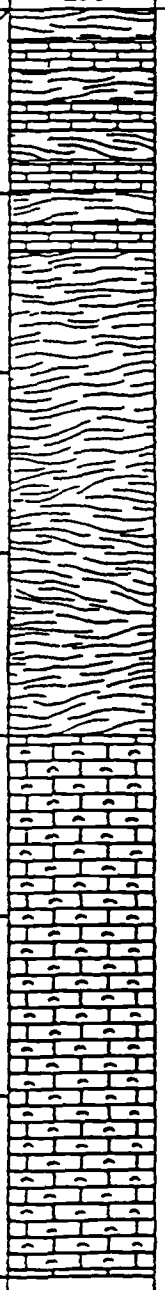
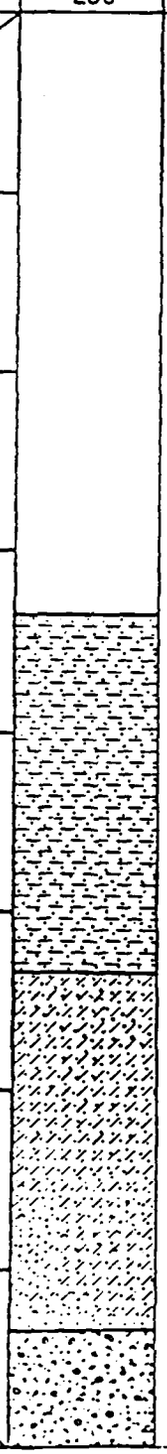
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
27		SHALE:	Dark grey, slightly moist, very firm to stiff, fissile, some clay.
30			
33			
36		SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, wet (?), dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
39			
42			
45			

FIGURE B-19

LITHOLOGIC LOG OF MONITOR WELL HM-18 (UPPER ZONE)

MAP COORDINATES: S. 2,229 feet.; R. 3,006 feet
DATE DRILLED: 3-31-83
GROUND ELEV.: 654.5 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 38 feet
BOREHOLE DIAMETER: 7-3/4 inches



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Asphalt and subgrade.
3		At 2 feet: Gravelly clay, brown to black, moist, slightly firm, limestone gravel up to 1-inch diameter, yellow-brown discoloration, tar and petroleum odor.
6		At 4 feet: Silty sandy clay, rusty red, moist, firm, cohesive, trace gravel, slight odor.
9		At 8 feet: Silty sand, rusty brown, slightly moist, loose, uniform, very fine- to fine-grained quartz sand.
12	SANDY SILT:	Tan, slightly moist, loose, uniform, very fine- to fine-grained quartz sand, trace of limestone gravel up to 3/4-inch diameter, no odor.
15		
18	SILTY SAND:	Darker tan than unit above, moist, loose, uniform, very fine- to fine-grained quartz sand.
21		
24	GRAVELLY SILTY SAND:	Tan, moist, loose, uniform, very fine- to fine-grained quartz sand, limestone gravel, zones of cemented silty sand, calcareous cement.

FIGURE B-19 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-18 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

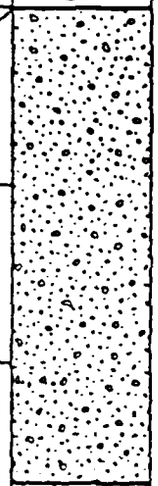
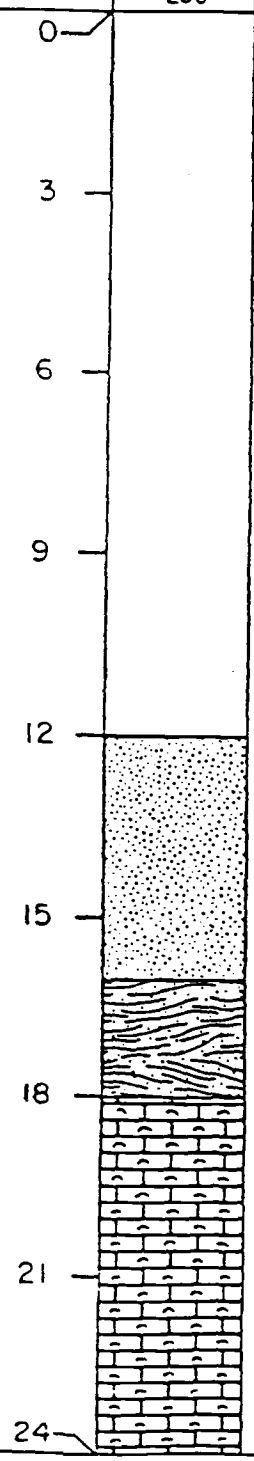
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		GRAVEL:	Multi-colored, wet, loose; fine- to medium-grained fragments of mollusk shells, limestone, chert, and quartz; fragments up to 3/4-inch diameter.
27			At 26 feet: Up to 20% coarse gravel.
30			At 30 feet: Up to 40% coarse gravel.
33		Shell Agglomerate: *(Walnut Fomation)*	Medium to dark grey, wet, dense, very fossiliferous (oysters), calcareous shale and clay matrix.
36			
39			

FIGURE B-20

LITHOLOGIC LOG OF MONITOR WELL HM-19 (UPPER ZONE)

MAP COORDINATES: S. 3,192 feet; R. 2,787 feet
DATE DRILLED: 4-1-83
GROUND ELEV.: 644.0 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 28 feet
BOREHOLE DIAMETER: 7-3/4 inches



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Asphalt and subgrade.
3		At 2 feet: Sandy clay, medium to dark brown, moist, slightly firm, slightly cohesive, rusty red discoloration, trace of limestone gravel up to 1-1/2-inch diameter, tar- like odor.
6		At 4 feet: Sandy clay, dark brown, moist, slightly firm to firm, moderately cohesive, some fine- to medium-grained quartz sand with some limestone, slight odor.
		At 6 feet: Sandy silty clay, dark brown, moist, firm, slightly cohesive, orange-yellow discoloration, trace of limestone gravel, no odor.
9		At 10 feet: Silty sand, orange-brown, moist, loose, fine- to medium-grained quartz sand, some cohesive clay, trace of limestone gravel.
12	SAND:	Light tan, slightly moist, loose, well sorted, subrounded, fine- to medium-grained quartz sand, trace of weathered limestone gravel up to 1-inch diameter.
15		
	SANDY SHALE/ SANDY CLAY: *(Goodland Lime-Stone)*	Greyish-buff, slightly moist, firm to stiff, slightly cohesive, fissile, fossiliferous (mollusks), fine- to medium-grained sand, no odor.
18	SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, slightly moist, dense, very fossiliferous (oysters), matrix and interbeds of calcareous, shale and clay.
		At 20 feet: Predominantly dark grey shale.
21		At 21.5 feet: Same as unit described at 18 feet.
24		

FIGURE B-20 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-19 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

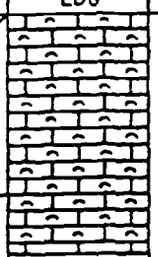
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		
30		

FIGURE B-21
LITHOLOGIC LOG OF MONITOR WELL HM-20 (UPPER ZONE)

MAP COORDINATES: S. 2,943 feet; R. 2,608 feet
GROUND ELEV.: 653.0 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 40 feet

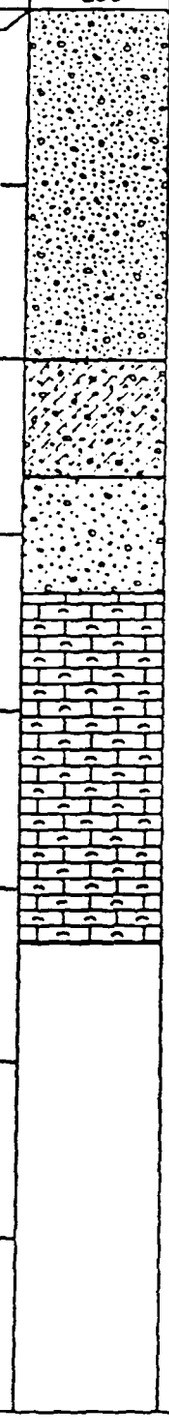
DATE DRILLED: 4-1-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7-3/4 inches to 38 feet; 5 inches to 40 feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Sandy gravelly clay, wet, slightly firm, slightly cohesive, limestone gravel up to 1-1/2-inch diameter, petroleum odor.
3			At 2 feet: Sandy gravelly clay, dark brown to black, moist, slightly firm, moderately cohesive, tar-like odor.
			At 4 feet: Silty clay, dark grey to brown, moist, slightly firm, cohesive, trace of fine-grained limestone gravel, no odor.
6			
9			At 8 feet: Sandy clay, rusty red, moist, firm, slightly cohesive, fine- to medium-grained quartz sand, some silt.
12		SAND:	Orange-tan, moist, loose, uniform well sorted, subrounded, fine-grained quartz sand, some silt.
			At 14 feet: Tan, slightly moist, very loose, trace of silt.
15			At 16 feet: Moist to slightly wet.
18			At 18 feet: Slightly moist.
			At 20 feet: Moist to slightly wet, fine- to medium-grained, trace of clay blebs.
21			At 22 feet: [illegible] loose, moderately sorted, subrounded to subangular, medium- to coarse-grained, some coarse sand and fine gravel composed of angular fragments of limestone and shells.
24			

FIGURE B-21 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-20 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	DESCRIPTION OF MATERIALS	
24–27	GRAVELLY SAND:	Tan to buff, slightly wet, loose, medium- to coarse-grained quartz sand, fine- to medium-grained gravel composed of limestone and shell fragments. At 26 feet: Increasing gravel content, some chert and quartz gravel. At 28 feet: Wet, some clay blebs.
27–30	CLAYEY GRAVELLY SAND:	Light buff to brown, wet, loose, medium- to coarse-grained quartz and limestone sand; fine- to coarse-grained gravel composed of mollusk shells, limestone, quartz, and chert.
30–33	SANDY GRAVEL:	Buff, wet, loose, fine-grained limestone gravel, coarse-grained sand, trace of clay.
33–39	SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, wet, dense, weathered, very fossiliferous (oysters), calcareous shale and clay matrix. At 36 feet: Unweathered.

FIGURE B-22

LITHOLOGIC LOG OF MONITOR WELL HM-21 (UPPER ZONE)

MAP COORDINATES: S. 2,948 feet; R. 3,075 feet
DATE DRILLED: 4-1-83
GROUND ELEV.: 632.7 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 15 feet
BOREHOLE DIAMETER: 7-3/4 inches

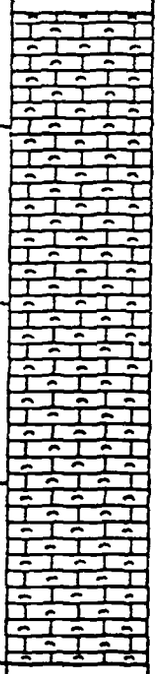
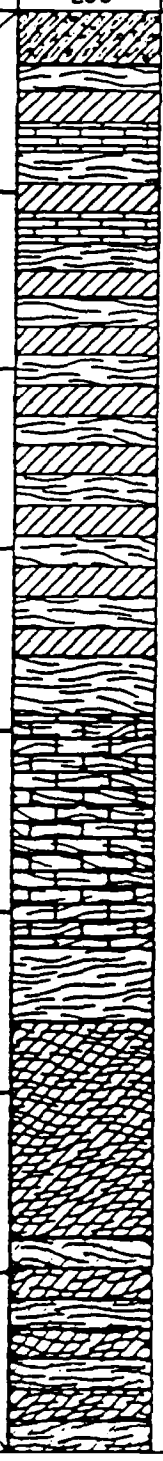
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty clay, brown, moist, slightly firm, slightly cohesive, white and orange discoloration, some medium-grained limestone and quartz sand, trace of fine-grained limestone gravel, chunks of asphalt, grass roots.
3			At 2 feet: Light brown to black, possible odor.
		SHELL AGGLOMERATE: *(Walnut Formation)*	Light buff to brown, moist, dense, weathered, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay, strong chemical odor.
6			
			At 7 feet: Medium to dark grey, unweathered.
9			
12			
15			
18			
21			
24			

FIGURE B-23

LITHOLOGIC LOG OF MONITOR WELL HM-22 (UPPER ZONE) 232 41

MAP COORDINATES S. 687 feet; R. 4,845 feet
GROUND ELEV.: 682.7 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 55 feet

DATE DRILLED: 5-23-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SILTY GRAVELLY CLAY:	Light to dark brown, moist, slightly firm, slightly cohesive, limestone gravel, trace sand, no odor.
		SHALE/CLAY/LIMESTONE: *(Goodland Limestone)*	Interbedded; light buff to brown, slightly moist, dense limestone, firm shale and clay, weathered, fossiliferous (mollusks), no odor.
5			At 4 feet: Predominantly shale and clay.
			At 6 feet: Less weathering, more grey color.
		SHALE/CLAY:	Interbedded; light grey to brown, slightly moist, slightly firm to slightly stiff, slightly cohesive, slightly fossiliferous.
10			At 12 feet: Few thin limestone layers.
15			
		SHALE:	Dark grey, slightly moist, firm, brittle, fissile, no odor.
20		SHALEY LIMESTONE:	Medium grey, slightly moist, slightly dense to dense, brittle, slightly fossiliferous, no odor.
25		SHALE:	Dark grey, slightly moist, slightly firm to firm, slightly cohesive, fissile, no visible fossils, no odor.
		SHALEY CLAY:	Dark grey, slightly moist, slightly firm to firm, slightly cohesive, no fossils visible, no odor.
30			At 30 feet: Slightly fossiliferous (mollusks)
			At 32 feet: Thin beds of limestone, limestone is dark grey and dense).
35		SHALEY CLAY/CLAYEY SHALE:	Interbedded; dark grey, slightly moist, slightly firm to firm, slightly cohesive, slightly fossiliferous (mollusks).
40			

FIGURE B-23 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-22 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

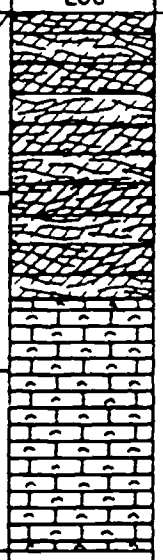
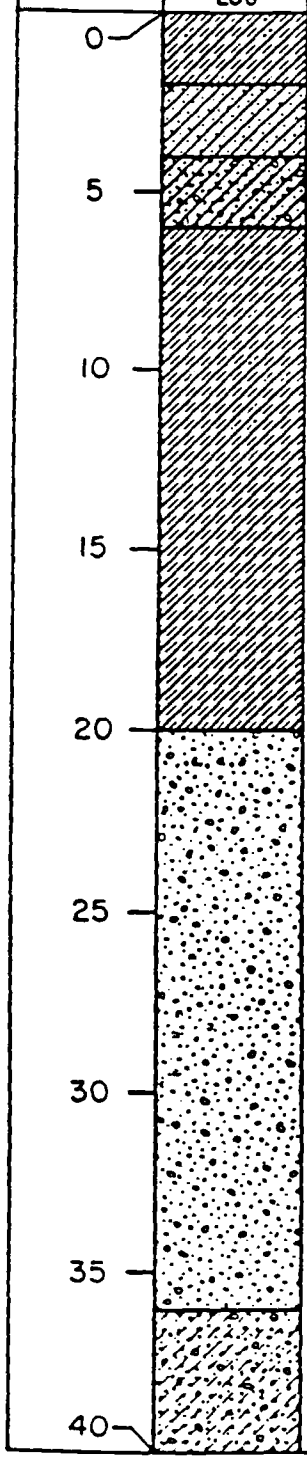
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		At 42 feet: Thin beds of limestone, limestone is dark grey and dense.
45		
50		SHELL AGGLOMERATE: *(Walnut Formation)* Medium to dark grey, dense to very dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
55		

FIGURE B-24

LITHOLOGIC LOG OF MONITOR WELL HM-23 (UPPER ZONE)

MAP COORDINATES: S. 5 feet; R. 4,284 feet
GROUND ELEV.: 671.4 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 50 feet

DATE DRILLED: 5-23-83 to 5-24-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches



DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
0		SILTY CLAY:	Dark brown, moist to slightly wet, slightly firm, slightly cohesive, trace gravel, roots grass.
		SANDY CLAY:	Medium brown, moist, firm, very slightly cohesive, trace limestone gravel, no odor.
5		SANDY GRAVELLY CLAY:	Medium brown, moist, firm, slightly cohesive, weathered limestone gravel.
		SILTY CLAY:	Light brown, moist to very moist, slightly firm, slightly cohesive, some weathered white limestone gravel up to 3/4-inch diameter.
10			At 8 feet: Very moist, cohesive, less gravel. At 10 feet: Higher percentage of silt with some very fine sand, very moist to wet, no gravel.
15			At 14 feet: Wet, slightly cohesive.
			At 18 feet: Trace gravel.
20		SAND AND GRAVEL:	Light buff to brown, moist to very moist, loose, coarse-grained, angular to rounded fragments of weathered limestone and mollusk shells up to 1-1/2-inch diameter, some clay, some iron oxide.
25			At 24 feet: Some iron nodules.
30			At 32 feet: Higher clay content, wet.
35		CLAYEY SANDY GRAVEL:	Light buff to brown, wet, loose, coarse-grained fragments of weathered limestone and shells, angular to rounded. iron oxide.
40			

FIGURE B-24 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-23 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

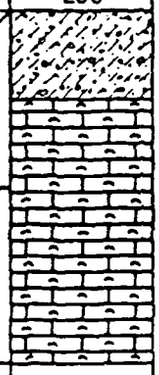
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
40		SHELL AGGLOMERATE: *(Walnut Formation)*	Light to dark grey, slightly moist to moist, very dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
45			
50			

FIGURE B-25

LITHOLOGIC LOG OF MONITOR WELL HM-24 (UPPER ZONE)

MAP COORDINATES: S. 195 feet; R. 2,750 feet

GROUND ELEV.: 658.4 feet msl

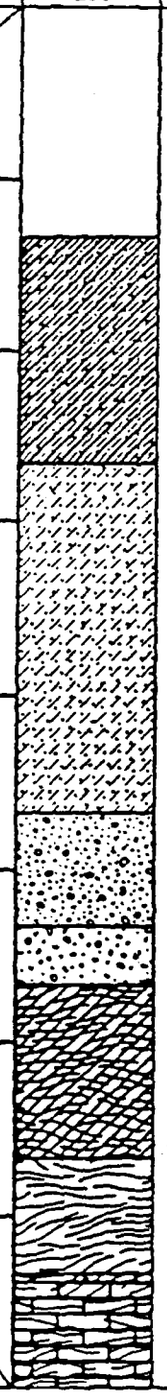
DRILLING METHOD: Air-rotary with drag bit

BOREHOLE DEPTH: 43 feet

DATE DRILLED: 5-24-83

DRILLED BY: Southwestern Laboratories, Inc.

BOREHOLE DIAMETER: 8 inches



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Clay, dark brown, very moist, slightly firm, slightly cohesive, grass roots, no odor.
		At 2 feet: Medium to dark brown.
3		
	SILTY SANDY CLAY:	Light brown, moist, firm, very slightly cohesive, trace gravel, no odor.
6		
9	CLAYEY SANDY SILT:	Light brown, slightly moist, slightly loose, trace limestone gravel up to 3/4-inch diameter, no odor.
12		At 12 feet: Slight chemical odor.
15	GRAVELLY SAND:	Medium brown; wet; loose; coarse-grained fragments of quartz, shells, and limestone; some clay; slight chemical odor.
	SANDY GRAVEL:	Light brown to grey, wet, loose, weathered limestone and shell fragments, very strong chemical odor.
18	SHALEY CLAY: *(Goodland Limestone)*	Greenish buff, wet, very firm to slightly stiff, slightly cohesive, very strong chemical odor.
21	SHALE:	Greenish buff, slightly moist, stiff, slightly cohesive, very strong chemical odor.
24	SHALEY LIMESTONE:	Buff to grey, slightly moist, slightly dense, brittle, few visible fossils, very slight odor.

FIGURE B-25 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-24 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

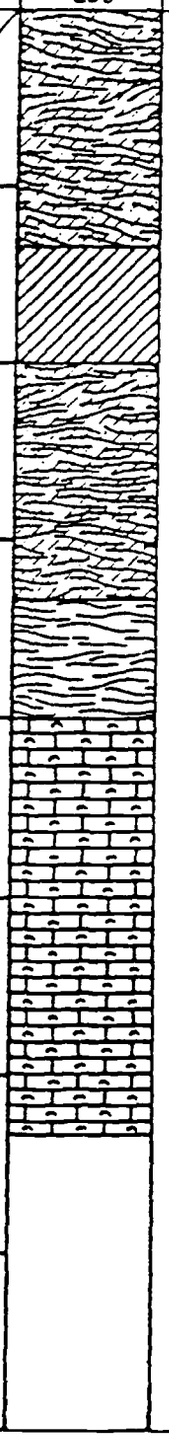
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		CLAYEY SHALE :	Buff to grey with orange-brown discoloration, slightly moist to moist, firm to stiff, no visible fossils. At 26 feet: Wet.
27		CLAY:	Dark grey, very moist to wet, firm, slightly cohesive, no fossils, no odor.
30		CLAYEY SHALE:	Dark grey, moist, very firm, slightly cohesive, fissile, some orange-brown zones which cross bedding planes, no fossils. At 32 feet: Orange-brown color overall.
33		SHALE:	Dark grey, slightly moist, dense, fissile, brittle, some thin beds of limestone, slightly fossiliferous, no odor.
36		SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, slightly moist, very dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
39			
42			
45			

FIGURE B-26

LITHOLOGIC LOG OF MONITOR WELL HM-25 (UPPER ZONE)

MAP COORDINATES S. 204 feet; R. 2,460 feet
GROUND ELEV.: 653.7 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 42 feet

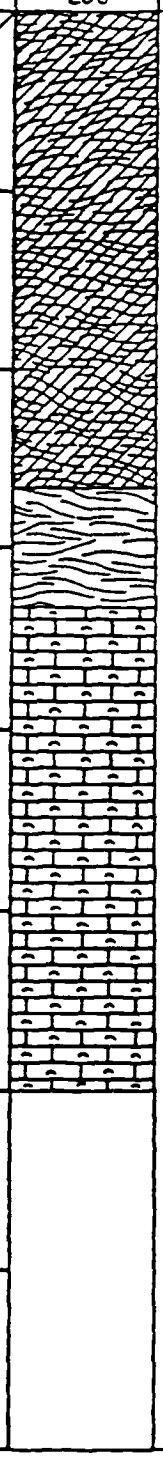
DATE DRILLED: 5-24-83 to 5-25-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Concrete pavement and subgrade. At 1 foot: Sandy silt, light brown, moist, slightly loose, trace clay, vinyl odor. At 2 feet: Strong vinyl odor.
3			
		SILTY SANDY CLAY:	Light brown, moist, slightly firm, slightly cohesive, trace gravel, strong vinyl odor.
6			
			At 8 feet: Very moist.
9			At 10 feet: Wet.
12		SANDY CLAYEY SILT:	Light brown, very moist to wet, slightly loose, trace gravel up to 1-inch diameter, strong vinyl odor.
		SILTY SANDY CLAY:	Light brown, wet, slightly firm, slightly cohesive, trace gravel, strong vinyl odor.
15			At 16 feet: Medium brown, strong paint thinner odor.
18			At 18 feet: Stronger paint thinner odor.
		SANDY GRAVELLY CLAY:	Medium brown, wet, slightly soft to slightly firm, slightly cohesive, very strong paint thinner odor.
21		SAND AND GRAVEL:	Wet, loose, coarse-grained limestone sand, weathered limestone gravel up to 1-1/2-inch diameter, some clay, very strong chemical odor.
24			

FIGURE B-26 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-25 (UPPER ZONE)

MAP COORDINATES
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



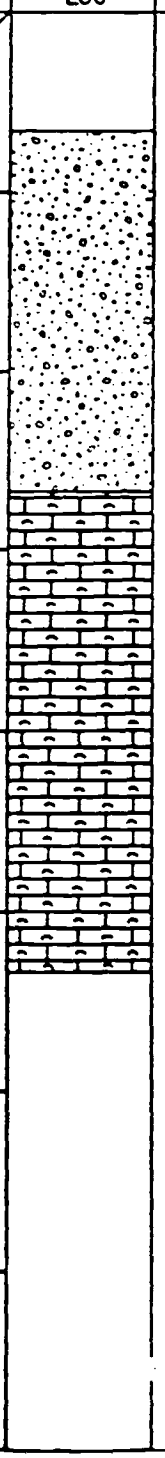
DEPTH	DESCRIPTION OF MATERIALS	
24	SHALEY CLAY: *(Goodland Limestone)*	Greenish buff, very moist, firm to very firm, slightly cohesive, very strong chemical odor similar to odor in chemical pits in Die Yard.
27		At 28 feet: Slightly weaker odor.
30		At 30 feet: Orange-brown zones which cross bedding planes, slight chemical odor.
33	SHALE:	Medium to dark grey, slightly moist, slightly dense to dense, brittle, some thin beds of limestone, no fossils, no odor.
36	SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, slightly moist, very dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay, no odor.
39		
42		

FIGURE B-27

LITHOLOGIC LOG OF MONITOR WELL HM-26 (UPPER ZONE)

MAP COORDINATES: S. 2,528 feet; R. 3,239 feet
GROUND ELEV.: 630.7 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 16 feet

DATE DRILLED: 5-25-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches



DEPTH		DESCRIPTION OF MATERIALS
0	FILL:	Clayey sand, light to dark brown, moist, loose, coarse-grained, poorly sorted, trace gravel, grass roots, no odor.
3	SAND AND GRAVEL:	Grey-brown, wet, loose, coarse-grained, sub-angular to subrounded, quartz and limestone sand, limestone and shell gravel up to 1-inch diameter, no odor. At 4 feet: Grading coarser, weathered limestone gravel up to 2-inch diameter.
6		At 6 feet: Slight oil odor.
9	SHELL AGGLOMERATE: (Walnut Formation)	Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
12		
15		
18		

FIGURE B-28

LITHOLOGIC LOG OF MONITOR WELL HM-27 (UPPER ZONE) 232 30

MAP COORDINATES S. 2,618 feet; R. 3,169 feet
DATE DRILLED: 5-25-83
GROUND ELEV.: 631.6 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 16 feet
BOREHOLE DIAMETER: 8 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty clay, light brown to black, very moist, slightly firm, slightly cohesive, appears to be black burnt material, no odor. At 2 feet: Sand, buff to grey with black discoloration, wet, loose, fine- to medium-grained quartz, well sorted, trace gravel, black oil sludge, saturated with fuel/oil, strong fuel/oil odor.
3			
6		SAND AND GRAVEL:	Wet, loose, coarse-grained limestone and quartz sand, gravel up to 1-1/2-inch diameter, saturated with fuel/oil, very strong fuel/oil odor. At 6 feet: Coarser-grained, gravel up to 2-inch diameter, lower percentage of fluid is fuel/oil. At 8 feet: Concentration of fuel/oil appears to be decreasing.
9			
12		SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
15			
18			

FIGURE B-29

LITHOLOGIC LOG OF MONITOR WELL HM-28 (UPPER ZONE)

232 51

MAP COORDINATES: S. 423 feet; R. 2,613 feet
GROUND ELEV.: 656.8 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 41.5 feet

DATE DRILLED: 5-25-83 to 5-26-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Sandy clay, light to medium brown, very moist, slightly firm, slightly cohesive, trace gravel, grass roots, no odor.
3			At 4 feet: Sand and gravel, light buff to brown, moist, loose, coarse-grained sand, fine-grained gravel, predominantly limestone and shell fragments, no odor.
6		SILTY CLAY/CLAYEY SILT:	Light brown, slightly moist, slightly firm, trace sand and gravel, no odor.
			At 8 feet: Moist to very moist.
9			
12			
15			
		SANDY CLAYEY SILT:	Light brown, moist, slightly loose, fine- to medium-grained sand, trace gravel, no odor.
18			
		SANDY GRAVELLY CLAY:	Light to medium brown, moist to very moist, firm, slightly cohesive, some limestone gravel, no odor.
21			
24			

FIGRUE B-29 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-28 (UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		SANDY CLAY:	Light to medium brown, slightly moist to moist, slightly firm, slightly cohesive, trace gravel, no odor.
27		SAND AND GRAVEL:	Light brown to buff, wet, loose, coarse-grained, poorly sorted, limestone gravel, some clay, no odor.
30		CLAY/SHALE: *(Goodland Limestone)*	Interbedded; greyish green, moist, very firm to stiff, slightly cohesive, brown-orange zones which cross bedding planes, no odor.
			At 32 feet: Wet.
33		SHALE:	Medium to dark grey, slightly moist, dense, brittle, fissile, no odor.
36		SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
39			
42			

FIGURE B-30

LITHOLOGIC LOG OF MONITOR WELL HM-29 (UPPER ZONE) 232 53

MAP COORDINATES: S. 2,906 feet; R. 2,322 feet
DATE DRILLED: 5-25-83 to 5-26-83
GROUND ELEV.: 656.9 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 44 feet
BOREHOLE DIAMETER: 8 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty gravelly clay, medium brown, slightly moist, slightly firm, slightly cohesive, gravel up to 2-inch diameter, grass roots, no odor.
3			At 2 feet: Silty clay, rust red, slightly moist, firm, slightly cohesive, trace sand and fine gravel, no odor.
			At 4 feet: Moist, more loose.
6			At 6 feet: Silty sand, light brown with red hue, slightly moist, loose, moderately sorted, some clay, no odor.
9		SILTY SAND:	Light buff, slightly moist, loose, very fine- to fine-grained sand, well sorted, no odor.
			At 10 feet: Some slightly cemented zones, trace gravel.
12			At 12 feet: Trace clay.
15			At 14 feet: Slightly darker color, moist to very moist.
			At 16 feet: Very moist.
18			At 18.5 to 19 feet: Layer of gravel and cobbles.
21			At 22 feet: Wet.
24			

FIGURE B-30 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-29 (UPPER ZONE)

MAP COORDINATES
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED
DRILLED BY:
BOREHOLE DIAMETER:

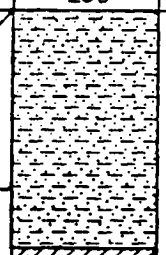
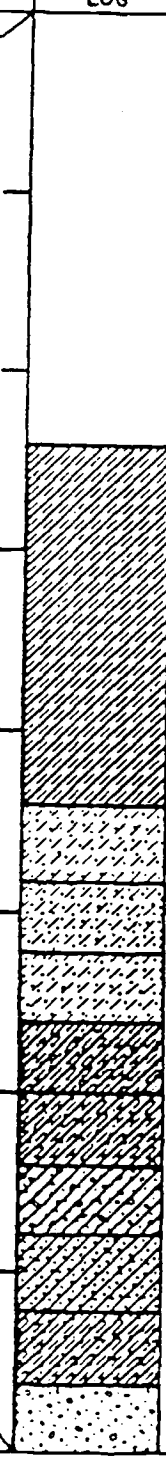
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		SANDY SILT:	Light buff to brown, very moist to wet, slightly loose, very fine- to fine-grained sand, moderately to well sorted, some clay, trace gravel, no odor.
27		SILTY CLAY:	Light brown, wet, slightly firm, slightly cohesive to cohesive, some sand, no odor.
30			
33		SANDY GRAVELLY CLAY:	Light to medium brown, wet, slightly firm, slightly cohesive, gravel composed of limestone and shell fragments, coarse-grained limestone and quartz sand, no odor.
		SAND AND GRAVEL:	Medium to light buff-brown, wet, loose, coarse-grained sand, limestone and mollusk shell gravel up to 1-1/2-inch diameter.
36			
39		SHALE: *(Walnut Formation)*	Dark grey, wet, dense, brittle, fissile, no odor.
		SHELL AGGLOMERATE:	Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
42			
45			

FIGURE B-31

LITHOLOGIC LOG OF MONITOR WELL HM-30 (UPPER ZONE) 232 55

MAP COORDINATES: S. 904 ft.; R. 3,051 ft.
GROUND ELEV.: 668.4 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 54 feet

DATE DRILLED: 5-26-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Silty clay, dark brown, moist, slightly firm to firm, slightly cohesive, grass roots, no odor.
		At 2 feet: Medium to dark brown, no roots.
5		At 4 feet: Medium brown, firm, trace sand and gravel, no odor.
		At 6 feet: Sandy clay, light to medium brown, moist, slightly firm, slightly cohesive, some gravel up to 3/4-inch diameter.
10		At 8 feet: Sandy gravelly clay, light to medium brown, very moist, slightly firm, slightly cohesive, gravel up to 1½-inch diameter.
		At 10 feet: Wet, limestone gravel up to 2-inch diameter.
15	SILTY CLAY:	Light brown, wet, slightly firm, very slightly cohesive, trace gravel, no odor.
20		At 20 feet: Some fine- to medium-grained sand.
	CLAYEY SILT:	Light buff to brown, very moist, slightly loose, some fine- to medium-grained sand, trace limestone gravel, no odor.
25	SILTY SAND/SANDY SILT:	Light buff to brown, very moist, slightly loose, very fine- to medium-grained sand, trace clay and gravel, no odor.
	CLAYEY SILT:	Light buff to brown, very moist, loose, some sand and gravel, no odor.
	SILTY GRAVELLY CLAY:	Light buff to brown, very moist, slightly firm, slightly cohesive, no odor.
30	SILTY SANDY CLAY:	Light brown, moist, slightly firm, slightly cohesive, fine to medium quartz sand, trace gravel, no odor.
	CLAYEY SAND AND GRAVEL:	Light brown, very moist, loose, fine to medium quartz sand, limestone and shell gravel.
35	SANDY CLAY:	Light brown, very moist, slightly firm, slightly cohesive, some gravel, no odor.
	SILTY SANDY CLAY:	Light brown, very moist, slightly firm slightly cohesive, very fine to medium sand, trace gravel, no odor.
40	SAND AND GRAVEL:	Light grey to light brown; wet; slightly loose; limestone, quartz, and shell fragments; no odor.

FIGURE B-31 (con't)

LITHOLOGIC LOF OF
MONITOR WELL HM-30 (UPPER ZONE)

232 55

MAP COORDINATES	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	
BOREHOLE DEPTH:	BOREHOLE DIAMETER:

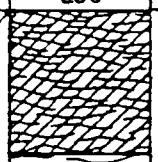
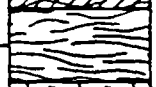
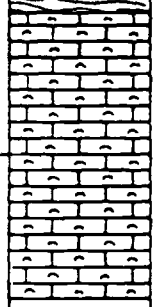
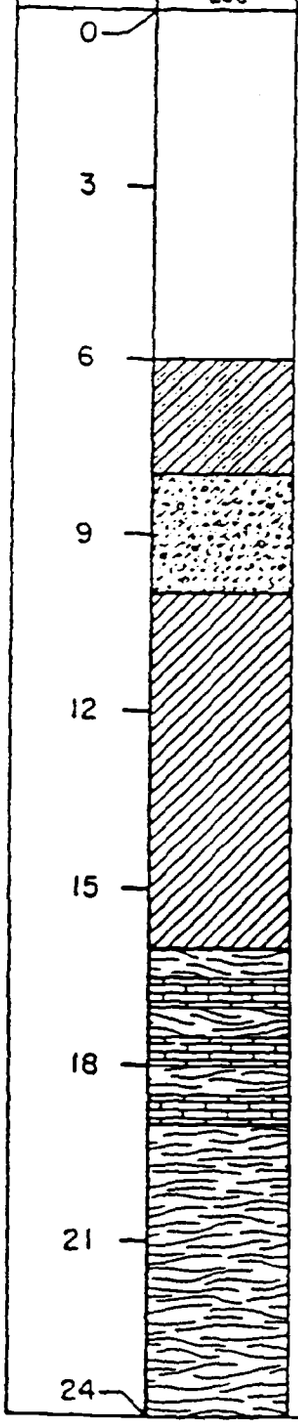
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
40		SHALEY CLAY: *(Goodland Limestone)*	Greenish grey with zones of rusty brown, slightly firm to firm, slightly cohesive, no odor.
45		SHALE:	Dark grey, slightly moist, dense, brittle, fissile, no fossils, no odor.
50		SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
55			

FIGURE B-32

LITHOLOGIC LOG OF MONITOR WELL HM-31 (UPPER ZONE) 232 57

MAP COORDINATES: S. 4 feet; R. 1,531 feet
GROUND ELEV.: 647.2 feet msl
DRILLING METHOD: Air-rotary with drag bit
BOREHOLE DEPTH: 41 feet

DATE DRILLED: 5-26-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches



DEPTH	DESCRIPTION OF MATERIALS	
0–3	FILL:	Silty clay, light to medium brown, moist, slightly firm, slightly to moderately cohesive, trace limestone sand and gravel, grass roots, no odor. At 2 feet: Clay, moist, slightly firm, slightly to moderately cohesive, some silt, trace gravel, no odor. At 4 feet: Wet, weathered limestone gravel up to 1-inch diameter.
6	SILTY CLAY:	Medium to dark brown, wet, slightly firm, moderately cohesive, trace limestone gravel up to 1/4-inch diameter, no odor.
9	CLAYEY SAND AND GRAVEL:	Light buff to brown, wet, loose, weathered limestone sand and gravel, cobbles up to 5-inch diameter, no odor.
12–15	CLAY: *(Goodland Limestone)*	Greenish grey, moist, very firm, cohesive, orange-brown zones which cross bedding planes, no odor. At 14 feet: Some shaley zones.
15–18	SHALE/LIMESTONE:	Interbedded; light grey, moist, dense limestone, slightly stiff and brittle shale, no visible fossils.
18–24	SHALE:	Medium to dark grey, slightly moist, slightly dense to dense, brittle, fissile no odor.

FIGURE B-32 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-31 (UPPER ZONE)

MAP COORDINATES
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

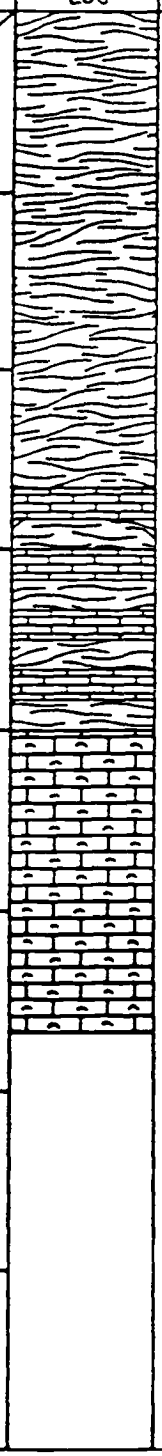
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		
		At 28 feet: Clayey in zones.
30		At 30 feet: Slightly moist.
		SHALE/LIMESTONE: Interbedded; medium to dark grey, slightly moist, dense limestone, brittle and fissile shale, clayey in zones, no visible fossils; no odor.
33		At 34 feet: Predominantly shale.
36		SHELL AGGLOMERATE: *(Walnut Formation)* Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
39		
42		

FIGURE B-33

LITHOLOGIC LOG OF MONITOR WELL HM-32 (UPPER ZONE)

232 59

MAP COORDINATES: S. 468 feet; R. 2,997 feet
DATE DRILLED: 04/13/84
GROUND ELEV.: 665.2 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 8 inches
BOREHOLE DEPTH: 46 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty clay, dark brown, moist to very moist, trace of gravel, firm, cohesive.
3		SANDY CLAYEY SILT:	Orange brown, slightly moist, some gravel, fine to coarse sand, loose.
		SANDY SILTY GRAVEL:	Buff to light brown, slightly moist to moist, some clay, loose.
6		SILTY CLAYEY SAND:	Light orange, slightly moist to moist, fine- to coarse-grained, trace gravel. Poorly sorted.
9		GRAVELLY SAND:	Buff to light brown, slightly moist, coarse-grained, fine limestone gravel with shell fragments.
12			
15		SILTY SAND:	Light orange, slightly moist, fine- to medium-grained, trace of clay, some gravel (borehole contamination?) At 16 feet: Fine- to coarse-grained.
18			
21		SANDY SILT:	Light grey and light brown, moist, trace of clay and gravel, sand medium to coarse-grained.
24		SILTY CLAY/CLAYEY SILT:	Light grey and light brown, moist, clay is slightly cohesive and slightly firm; contains thin gravel stringers.

FIGURE B-33 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-32
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
		SILTY CLAY:	Light brown, moist, slightly cohesive, firm.
27			
		GRAVELLY SAND:	Light grey and light brown, slightly moist fine-grained sand with fine limestone gravel, trace clay, loose.
30			
		SILTY SAND AND GRAVEL:	Light grey and light brown, moist, fine- to medium-grained sand, fine limestone gravel, loose.
33			
			Below 34 feet: sand is medium- to coarse-grained, consists predominantly of limestone and shell fragments.
36			
39			
		SHELL AGGLOMERATE: (Walnut Formation)	Medium to dark grey, wet (?), dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
42			
45			
		TOTAL DEPTH 46 FEET	
48			

FIGURE B-34

232 61

LITHOLOGIC LOG OF MONITOR WELL HM-33 (UPPER ZONE)

MAP COORDINATES: S. 1,565 feet; R. 4,213 feet
DATE DRILLED: 04/11/84
GROUND ELEV.: 652.2 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 28 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty clay and sandy clay, moist to very moist, trace limestone gravel, trace concrete. Clay is firm, cohesive.
3			
			Drilling without returns 4-18 feet.
6			
9			
12			
15			
18			Base of fill at 18 feet.
		CLAY:	Grey to green, slightly moist to moist, firm, cohesive.
21		CLAYEY SHALE: (Goodland Limestone)	Grey to green, slightly moist, contains some shell fragments.
24		SHELL AGGLOMERATE: (Walnut Formation)	Light to dark grey, weathered, very fossiliferous (oysters), matrix and interbeds of calcareous shale of clay.

FIGURE B-34 (con't)
LITHOLOGIC LOG OF
MONITOR WELL HM-33
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

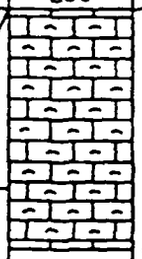
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		Below 26 feet: Shaley, less weathered.
27		
		Total Depth 28 feet.
30		

FIGURE B-35

LITHOLOGIC LOG OF MONITOR WELL HM-34 (UPPER ZONE)

MAP COORDINATES: S. 2,131 feet; R. 3,459 feet DATE DRILLED: 04/11/84

GROUND ELEV.: 636.6 feet msl DRILLED BY: Southwestern Laboratories, Inc.

DRILLING METHOD: Air Rotary BOREHOLE DIAMETER: 4 3/4 inches

BOREHOLE DEPTH: 20 Feet

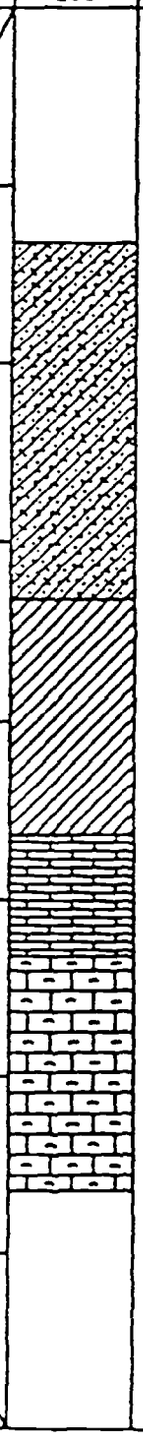
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
0		FILL: Silty clay, sandy clay, and clay, moist to very moist, some sand and gravel, firm, cohesive.
3		
6		CLAY: Pink to orange, moist to very moist, firm, cohesive. Some rounded limestone coarse sand and fine gravel, some angular orange-stained weathered limestone.
9		SANDY SILTY CLAY: Medium brown, moist, some fine angular to rounded limestone fragments.
		SILTY CLAY: Grey, moist, slightly sandy, calcareous.
12		
15		SHELL AGGLOMERATE (Walnut Formation): Dark grey, moist to wet, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
18		Below 18 feet: Less Shale.
		Total Depth 20 Feet.
21		

REMARKS: Poor returns while drilling fill.

FIGURE B-36

LITHOLOGIC LOG OF MONITOR WELL HM-35 (UPPER ZONE)

MAP COORDINATES: S. 2,231 feet; R. 3,301 feet
DATE DRILLED: 04/11/84
GROUND ELEV.: 637.8 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 20 Feet



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Clay, orange to brown, moist, some sand, some plant material, cohesive, plastic.
3	SANDY CLAY:	Orange-brown, moist, with some fine limestone gravel.
6		
9	CLAY:	White to orange, wet, cohesive, contains some white limestone and shell fragments.
12		At 14 Feet: Slight odor.
15	LIMESTONE: (Walnut Formation)	Yellow to white, moist, sandy, weathered, very fossiliferous (oysters).
	SHELL AGGLOMERATE:	Dark grey, fresh, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
18		
	Total Depth 20 Feet.	
21		

FIGURE B-37

LITHOLOGIC LOG OF MONITOR WELL HM-36 (UPPER ZONE)

232 65

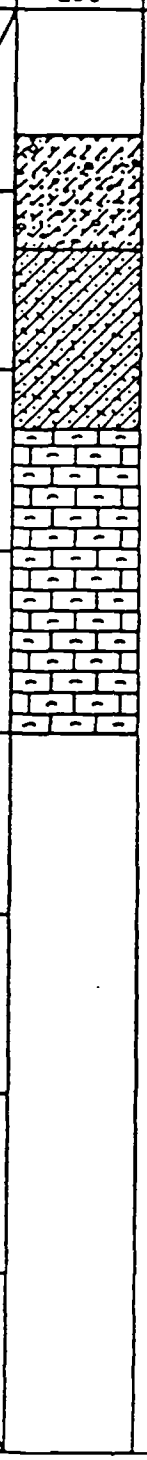
MAP COORDINATES: S. 2,375 feet; R. 3,249 feet
DATE DRILLED: 04/11/84
GROUND ELEV.: 634.3 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 16 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
0		CLAY: Medium to dark brown, moist, plastic, cohesive, with some fine rounded limestone gravel.
3		SANDY CLAY: Medium brown to yellow, moist, fine- to coarse-grained sand, some fine rounded limestone gravel.
6		SANDY GRAVEL: Medium brown to white, very moist to wet, some clay, medium to coarse limestone and quartz sand. Subangular to moderately rounded gravel, predominantly limestone, some chert.
9		SANDY CLAY/ CLAYEY SAND: Orange-brown, very moist to wet, fine to coarse-grained, some fine limestone gravel.
12		SANDY GRAVEL: Medium brown to yellow, very moist to wet, fine- to coarse-grained sand, subangular to moderately rounded gravel, predominantly limestone, some chert.
15		SHELL AGGLOMERATE: (Walnut Formation) Dark grey, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay. Below 14 Feet: Less Shale.
18		Total Depth 16 Feet.

FIGURE B-38

LITHOLOGIC LOG OF MONITOR WELL HM-37 (UPPER ZONE)

MAP COORDINATES: S. 2,779 feet; R. 3,193 feet
DATE DRILLED: 04/11/84
GROUND ELEV.: 632.0 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 12 Feet



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Clay, light brown to orange, moist, some sand, some white clay, some plant material.
3	CLAYEY GRAVEL:	Grey to yellow, moist, sub-angular to slightly rounded, predominantly limestone.
6	SANDY CLAY:	Dark brown, very moist to wet, contains much limestone gravel.
9	SHELL AGGLOMERATE: (Walnut Formation)	Medium to dark-grey, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
12	Total Depth 12 Feet.	

FIGURE B-39

LITHOLOGIC LOG OF MONITOR WELL HM-38 (UPPER ZONE)

232 67

MAP COORDINATES: S. 2,970 feet; R. 3,154 feet
GROUND ELEV.: 628.3 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 25 Feet

DATE DRILLED: 04/11/84
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 4 3/4 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Gravelly clay, dark brown to black, slightly moist, firm. Gravel is weathered limestone.
3		FILL:	Limestone cobbles and boulders.
6		FILL:	Clay, sand, and gravel, light grey to black, slightly moist to moist, loose. Contains fragments of asphalt and concrete.
9			
12		FILL:	Gravelly clay, medium brown, slightly moist to moist, fine limestone gravel, some asphalt fragments. Clay slightly firm.
15		FILL:	Sand and gravel, brown, slightly moist, medium to coarse-grained sand, fine limestone gravel. Some asphalt fragments.
18		SILTY SAND:	Buff-green, slightly moist, medium to coarse-grained, some fine limestone gravel, trace of clay.
		CLAYEY SAND AND GRAVEL:	Buff-green, slightly moist, medium to coarse limestone and quartz sand, fine limestone gravel.
21		SHELL AGGLOMERATE: (Walnut Formation)	Medium grey, dense, slightly weathered, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
25		Total Depth 25 Feet.	

FIGURE B-40

LITHOLOGIC LOG OF MONITOR WELL HM-39 (UPPER ZONE)

232 68

MAP COORDINATES: S. 3,234 feet; R. 3,062 feet
GROUND ELEV.: 631.4 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 14 Feet

DATE DRILLED: 04/11/84
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 4 3/4 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
0		FILL: Gravelly clay/clayey gravel, tan to orange, slightly moist to moist, contains plant material.
3		FILL: Silty clayey sand, medium to dark brown, slightly moist, some limestone gravel. Contains some trash.
6		SHELL AGGLOMERATE: (Walnut Formation) Medium to dark grey, weathered, moist, fossiliferous (oysters), matrix and interbeds of calcareous and clay.
9		
12		
		Total Depth 14 Feet.
15		

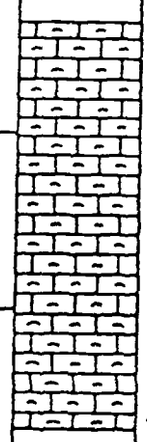


FIGURE B-41

LITHOLOGIC LOG OF MONITOR WELL HM-40 (UPPER ZONE)

MAP COORDINATES: S. 1,019 feet; R. 3,427 feet
DATE DRILLED: 04/12/84
GROUND ELEV.: 668.2 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 53 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CLAY:	Dark brown to black, moist, brittle, contains plant material.
3		CLAY:	Dark brown, moist to very moist, some silt, trace of sand, plastic, cohesive.
6		SANDY CLAY:	Orange to white, moist, fine sand, contains sub-angular to subrounded limestone gravel.
9		SILTY CLAY:	Buff to light brown, moist, some fine sand.
12		SAND:	Orange, moist, fine-grained, some silt and clay, well sorted.
15			Below 14 Feet: Moist to very moist.
18			Below 18 Feet: Some thin clay interbeds.
21		SILTY SANDY CLAY:	White to light orange, moist, slightly cohesive.
24			

FIGURE B-41 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-40
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
24		SILTY FINE SAND:	Orange, moist, some clay, slightly cohesive.
27			26 to 28 Feet: More clay, white to orange.
30			30 to 32 Feet: Less clay, more silt.
33		SAND:	Light orange, moist, fine-grained, some silt, some clay.
36			
39		SILTY SAND/ SANDY SILT:	Light orange, very moist to wet, fine-grained.
42		SAND:	Light orange, very moist to wet, fine- to medium grained, trace silt, trace clay.
45			Increasing coarseness with depth.
48		SANDY GRAVEL:	Light orange, very moist to wet, medium- to coarse sand, fine limestone gravel, some chert.

FIGURE B-41 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-40
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

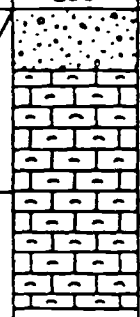
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
48		SHELL AGGLOMERATE: (Walnut Formation) Dark grey, weathered, friable, clayey, very fossiliferous (oysters), matrix and interbeds of calereous shale and clay.
51		Below 52 Feet: Less weathered.
		Total Depth 53 Feet.
54		

FIGURE B-42

LITHOLOGIC LOG OF MONITOR WELL HM-41 (UPPER ZONE)

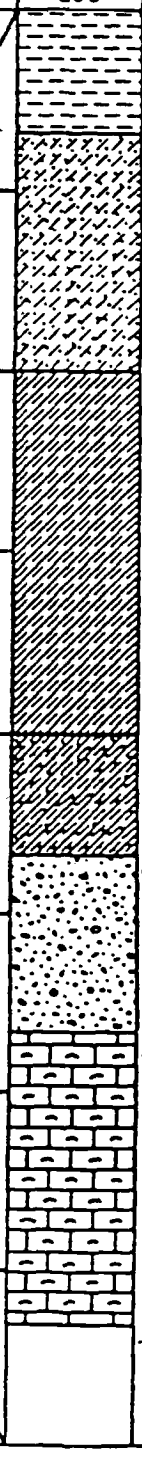
MAP COORDINATES: S. 1,560 feet; R. 3,046 feet
DATE DRILLED: 04/12/84
GROUND ELEV.: 664.9 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 46 feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SILTY CLAY:	Dark brown to black, slightly moist to moist, some sand, trace of fine limestone gravel, cohesive.
3		CLAY:	Light brown to orange, moist to very moist, slightly sandy, some silt, some limonite stains, cohesive.
6			
9		SILTY FINE SAND:	Orange, moist, some clay, slightly cohesive.
12			12 to 14 Feet: Some white sandy clay.
15			
18			
21			
24		SILTY CLAY:	Light brown to light orange, trace of sand, slightly cohesive.

FIGURE B-42 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-41
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

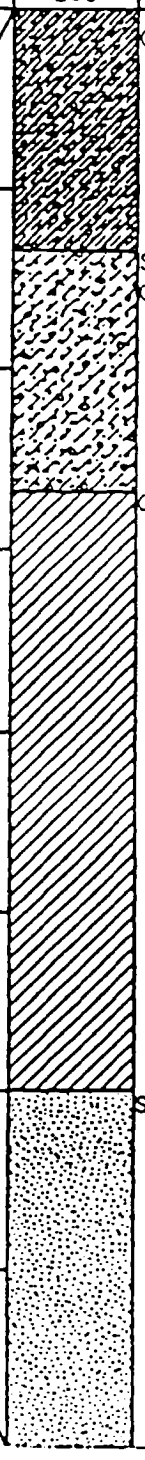


DEPTH	DESCRIPTION OF MATERIALS	
24	SILT:	Orange, moist, some fine sand, some clay, slightly cohesive.
27	SILTY SAND:	Orange, moist, fine-grained, trace of clay.
30	SILTY CLAY:	Light brown to light orange, moist to very moist, some sand.
33		Below 34 Feet: Very moist to wet.
36	SANDY SILTY CLAY:	Orange, very moist to wet, fine-grained sand.
39	GRAVEL:	Yellow to orange, wet, fine limestone gravel with some chert and quartz, some medium to coarse quartz and limestone sand.
42	SHELL AGGLOMERATE: (Walnut Formation)	Dark grey, weathered, friable, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
45		
	Total Depth 46 Feet.	
48		

FIGURE B-43

LITHOLOGIC LOG OF MONITOR WELL HM-42 (UPPER ZONE)

MAP COORDINATES: S. 1,327 feet; R. 3,858 feet
DATE DRILLED: 04/12/84
GROUND ELEV.: 663.6 feet msl
DRILLED BY: Southwestern Laboratories, Inc
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 48 feet



DEPTH	DESCRIPTION OF MATERIALS
0	GRAVELLY SILTY CLAY: Medium brown, moist, firm, cohesive, trace of limestone gravel.
3	
	SILTY SAND AND GRAVEL: Light grey and brown, moist, medium- to coarse-grained sand, some clay, fine limestone gravel.
6	
	CLAY: Green to grey and buff to orange, moist to very moist, cohesive, firm to stiff, silty.
9	
12	
15	
18	SAND: Orange to buff, slightly moist, fine-grained, well sorted, loose.
21	Below 22 Feet: Medium- to coarse-grained sand, some fine limestone gravel, loose.
24	

FIGURE B-43 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-42
(UPPER ZONE)

232 75

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		SANDY GRAVEL:	Buff to light orange, moist, medium to coarse sand, fine limestone gravel, loose.
27			
30			
33			
36			
39		SANDY CLAY:	Dark grey, wet, slightly cohesive, firm.
42			
		SANDY SHALE: (Walnut Formation)	Dark grey to black, wet (?), slightly dense, some shell fragments.
45			
		SHELL AGGLOMERATE:	Medium to dark grey, dry (?), dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
48		Total Depth 48 Feet.	

REMARKS: Severe caving conditions 28 to 34 feet.

FIGURE B-44

LITHOLOGIC LOG OF MONITOR WELL HM-43 (UPPER ZONE)

MAP COORDINATES: S. 1,083 feet; R. 4,276 feet
DATE DRILLED: 04/12/84
GROUND ELEV.: 670.3 feet msl
DRILLED BY Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 22 Feet

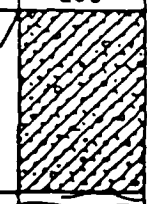
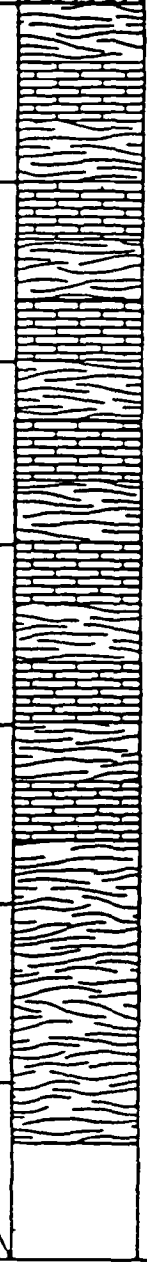
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
0		GRAVELLY CLAY: Dark brown, very moist, very firm, cohesive, fine limestone gravel, some plant material.
3		LIMESTONE/SHALE: (Goodland Limestone) Interbedded. Light grey and light buff, slightly moist (?). Dense limestone, very stiff shale, some fossils, weathered.
6		6-12 Feet: Predominantly shale.
9		
12		12-14 Feet: Shale beds are greenish grey and orange.
15		14-17 Feet: Predominantly limestone.
		SHALE: Medium to dark grey, orange-stained in zones, slightly moist (?), very stiff, fissile.
18		
21		
		Total Depth 22 Feet.
24		

FIGURE B-45

LITHOLOGIC LOG OF MONITOR WELL HM-44 (UPPER ZONE)

MAP COORDINATES: S. 781 feet; R. 4,183 feet
GROUND ELEV.: 673.5 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 40 Feet

DATE DRILLED: 04/13/84
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 4 3/4 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SILTY CLAY:	Light to dark brown, slightly moist, some fine sand, trace of fine gravel, slightly to moderately cohesive.
3			Below 4 Feet: Moist.
6			
9		SILTY CLAY/ CLAYEY SILT:	Light orange, moist, some fine sand, loose.
12		CLAY:	Buff to tan, moist, slightly silty, trace fine sand, slightly cohesive.
15			Below 16 Feet: Less cohesive.
18		SILTY SAND/ SANDY SILT:	Medium orange, moist to very moist, very fine-grained, some silt, trace of clay.
21			22-24 Feet: Very moist to wet, some clay.
24			

FIGURE B-45 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-44
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		SANDY SILT: Medium orange, very moist, very fine-grained, some clay.
27		SILTY CLAY: Medium to dark orange, very moist to wet, trace sand, loose.
30		SANDY SILTY CLAY: Medium to dark orange, wet, very fine to fine sand, trace fine limestone gravel, slightly cohesive.
33		GRAVEL: Buff to orange, wet, predominantly limestone, trace of chert, trace of siltstone, some sandy clay.
36		LIMESTONE: (Goodland Limestone) Buff to yellow, soft, friable, sandy, silty, slightly fossiliferous (shell fragments), shaley in zones.
39		Below 38 Feet: Grey, hard, fresh, not fossilferous.
42		Total Depth 40 Feet.
45		
48		

FIGURE B-46

LITHOLOGIC OF MONITOR WELL HM-45 (UPPER ZONE)

MAP COORDINATES: S. 1,417 feet; R. 2,706 feet
DATE DRILLED: 04/13/84
GROUND ELEV.: 660.8 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 43 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Clay and silt, dark brown, moist to very moist trace of sand and gravel, slightly firm to firm, cohesive.
3		SILTY CLAY:	Orange, slightly moist to moist, some sand, trace of gravel, stiff, slightly cohesive.
6			
9			
12		SANDY SILTY CLAY:	Light orange, moist, fine to medium sand, trace of gravel, firm, cohesive.
15		SANDY GRAVELLY CLAY:	Tan to light orange, moist, fine to medium sand, fine limestone gravel, firm, slightly cohesive.
18			
21		SANDY SILT/ SILTY SAND:	Light orange, moist, very fine-grained sand, trace of clay.
24		SILTY SAND:	Light orange, moist to very moist, very fine- to fine-grained sand, some fine limestone gravel.

FIGURE B-46 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-45
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		24-28 feet: Fine- to coarse-grained sand.
27		
		CLAYEY SHALE: (Goodland Limestone) Greenish-buff, moist, stiff, slightly cohesive.
30		
		CLAYEY SHALE/ LIMESTONE: Green shale with orange stains in partings, slightly moist, stiff, cohesive; thin interbeds of grey to buff limestone, dense, with no visible fossils.
33		Below 32 feet: Predominantly shale.
36		CLAYEY SHALE: (Walnut Formation) Dark grey, slightly moist (?) stiff, cohesive.
		LIMESTONE: Dark grey, slightly moist (?) dense, fossiliferous (oysters).
39		
		SHELL AGGLOMERATE: Medium to dark grey, dry (?), dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
42		
		TOTAL DEPTH 43 Feet.
45		

FIGURE B-47

232081

LITHOLOGIC LOG OF MONITOR WELL HM-46 (UPPER ZONE)

MAP COORDINATES: S. 1,785 feet; R. 3,214 feet
DATE DRILLED: 04/14/84
GROUND ELEV.: 657.3 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 44 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Gravelly clay, brown, moist to very moist, some sand, some coarse limestone gravel, some light grey clay. Some limestone cobbles up to 10" diameter in borehole.
3			
6		SILTY SAND:	Tan to light orange, moist, loose, very fine- to fine-grained.
9			
12			Below 12 feet: Increasing silt content.
15		SANDY SILT:	Tan to light orange, moist, very fine sand, well graded and tightly packed.
18		CLAYEY SILT:	Tan to light orange, moist, very fine sand, well graded and tightly packed.
21		SILTY SAND:	Tan to light orange, moist, very fine- to fine-grained, moderately well sorted, loose.
24			

FIGURE B-47 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-46
(UPPER ZONE)

232082

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
27		SANDY CLAY/ CLAYEY SAND:	Tan to light orange moist, very fine to fine quartz sand, firm, slightly cohesive.
30		SILTY CLAYEY SAND:	Tan to light orange, moist to very moist, very fine to fine quartz sand.
33		SAND AND GRAVEL:	Buff to brown, wet, coarse quartz and limestone sand, fine limestone gravel, many shell fragments, loose.
36			
39		SHELL AGGLOMERATE: (Walnut Formation)	Dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
42			
44		TOTAL DEPTH 44 Feet.	

FIGURE B-48

232083

LITHOLOGIC LOG OF MONITOR WELL HM-47 (UPPER ZONE)

MAP COORDINATES: S. 303 feet; R. 2,033 feet
GROUND ELEV.: 652.2 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 36 Feet

DATE DRILLED: 04/14/84
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-5" concrete. Sandy clay, light brown to orange, moist, very fine to fine sand, trace fine limestone gravel, firm, slightly cohesive.
3			
		CLAYEY SILT:	Tan to light orange, moist, some very fine to fine sand, loose.
6			
9			
12			
		SANDY CLAY/ CLAYEY SAND:	Orange brown, moist, medium to coarse sand, trace fine limestone gravel, firm, slightly cohesive.
15			
		SAND AND GRAVEL:	Buff to brown, slightly moist to moist, medium to coarse sand, fine gravel, trace of clay, loose.
18			
21			
24			

FIGURE B-48 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-47
(UPPER ZONE)

232034

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

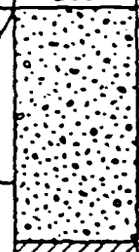
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
27		CLAY: (Goodland Limestone)	Greenish-buff with orange stains in zones, moist, trace of silt, weathered, firm, slightly cohesive.
30		CLAYEY SHALE: (Walnut Formation)	Dark grey, slightly moist (?), stiff, cohesive.
		LIMESTONE:	Dark grey, dense, very silty, brittle, some fossils.
33		SHELL AGGLOMERATE:	Medium to dark grey, dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
36		TOTAL DEPTH 36 Feet.	

FIGURE B-49

LITHOLOGIC LOG OF MONITOR WELL HM-48 (UPPER ZONE)

MAP COORDINATES: S. 990 feet; R. 2,277 feet
GROUND ELEV.: 654.2 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 33 Feet

DATE DRILLED: 04/14/84
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-5" concrete. Sand, gravel, and clay, light brown, moist to wet, loose to firm, slightly cohesive.
3			
		SAND AND GRAVEL:	Buff to brown, moist, coarse sand, fine limestone gravel, trace clay, loose.
6			
		SILTY SANDY CLAY:	Light orange-brown, moist, fine sand, firm, slightly cohesive.
9			
		CLAYEY SAND AND GRAVEL:	Light orange-brown, moist, coarse sand, fine limestone gravel, loose.
12			At 12 feet: Moist to very moist.
			At 14 feet: Wet.
15			
		LIMESTONE/SHALE: (Goodland Limestone)	Interbedded: greenish buff silty limestone with greenish buff clayey shale layers, moist, stiff, and dense, no visible fossils.
18			
21			
24			

FIGURE B-49 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-48
(UPPER ZONE)

232036

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

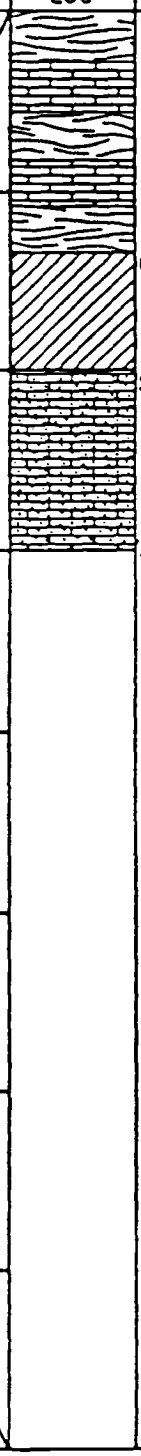
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		
		CLAY: (Walnut Formation) — Dark grey, moist, stiff, slightly cohesive.
30		SANDY LIMESTONE: — Dark grey, dense, brittle, fossiliferous (oysters)
33		TOTAL DEPTH 33 Feet.

FIGURE B-50

LITHOLOGIC LOG OF MONITOR WELL HM-49 (UPPER ZONE)

232087

MAP COORDINATES: S. 3,575 feet; R. 2,874 feet
DATE DRILLED: 04/15/84
GROUND ELEV.: 632.7 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 10.5 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Gravelly clay, medium to dark brown, moist, some limestone gravel, firm, slightly cohesive, some trash (glass, wire).
3			
		CLAY:	Brown, moist, some limestone gravel, firm, cohesive.
6		SHELL AGGLOMERATE: (Walnut Formation)	Light to dark grey, dense, weathered, fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
9			
		TOTAL DEPTH 10.5 Feet.	

FIGURE B-51

232035

LITHOLOGIC LOG OF MONITOR WELL HM-50 (UPPER ZONE)

MAP COORDINATES: S: 3,252 feet; R. 2,934 feet
DATE DRILLED: 04/15/84
GROUND ELEV.: 636.9 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 14.5 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Gravelly clay, brown, slightly moist to moist, some limestone gravel and cobbles, some trash (wire, glass).
3		FILL:	Sandy clay, dark brown, tan and greenish buff, very moist, medium to coarse sand, trace limestone gravel, firm, cohesive, oil and tar odor.
6			
9		SHELL AGGLOMERATE: (Walnut Formation)	Light grey, slightly moist, weathered, dense, fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
12			Below 12 feet: Fresh, dark grey, less clay.
14		TOTAL DEPTH 14.5 Feet.	
17			

FIGURE B-52

LITHOLOGIC LOG OF MONITOR WELL HM-51 (UPPER ZONE)

232039

MAP COORDINATES: S. 3,557 feet; R. 2,704 feet
GROUND ELEV.: 639.5 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 20 Feet

DATE DRILLED: 04/15/84
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 8 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-4" asphalt. Sandy clay and silty sand, dark brown, very moist to wet, fine- to medium-grained sand, trace fine limestone gravel, loose to firm.
3			
		SANDY CLAY:	Buff-brown, very moist, fine to medium sand, firm, slightly cohesive.
6			
			At 7 feet: Driller reports wet gummy clay.
		SILTY SANDY CLAY:	Greenish-brown, moist, fine sand, slightly cohesive, firm to stiff.
9			
		SILTY CLAY:	Greenish-grey, moist, trace of fine sand, stiff slightly cohesive.
12		SHELL AGGLOMERATE: (Walnut Formation)	Light grey and brown, very weathered, dense, fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
15			
			Below 17 feet: Dark grey, fresh.
18			
		TOTAL DEPTH 20 Feet.	
21			

FIGURE B-53

LITHOLOGIC LOG OF MONITOR WELL HM-52 (UPPER ZONE)

MAP COORDINATES: S. 1,471 feet; R. 2,259 feet
DATE DRILLED: 04/15/84
GROUND ELEV.: 654.5 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 8 inches
BOREHOLE DEPTH: 26 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-5" concrete. Gravelly sandy clay, orange brown, very moist to wet, some silt, firm, slightly cohesive.
3			
		SILTY CLAYEY SAND:	Tan to orange, moist, very fine- to medium-grained, trace of fine limestone gravel, slightly cohesive.
6			
		SAND AND GRAVEL:	Tan, moist, coarse sand and fine limestone gravel, some clay, loose.
9			
12			
15			
18		SANDY LIMESTONE/ CLAYEY SHALE: (Goodland Limestone)	Interbedded, greenish grey, slightly moist, dense limestone, stiff clayey shale, no visible fossils.
21			
24			

FIGURE B-53 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-52
(UPPER ZONE)

232091

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

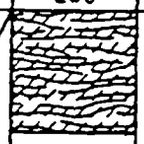
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		Below 24 feet: Clayey shale without limestone interbeds.
		TOTAL DEPTH 26 Feet.
27		

FIGURE B-54
LITHOLOGIC LOG OF MONITOR WELL HM-53 (UPPER ZONE)

MAP COORDINATES: S. 2,511 feet; R. 2,264 feet
DATE DRILLED: 04/16/84
GROUND ELEV.: 654.7 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 8 inches
BOREHOLE DEPTH: 37 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-5" concrete. Silty sandy clay, reddish-brown, very moist to wet, fine to coarse sand, trace limestone gravel, slightly firm, slightly cohesive.
3			
		SILTY SAND:	Light brown, moist, fine- to medium-grained, trace of fine gravel, loose.
6		SAND:	Light brown, slightly moist, fine- to medium-grained, some silt, loose.
		SILTY SAND:	Light brown, slightly moist, fine to medium-grained, loose.
9			
12			
		GRAVELLY SILTY SAND:	Light brown, moist, fine- to medium- grained, fine limestone gravel, loose, poorly sorted.
15			
		CLAYEY SAND:	Light brown, very moist, fine- to medium-grained, trace fine limestone gravel, loose to firm.
18			
		SAND:	Light brown, wet, medium- to coarse-grained, trace fine limestone gravel, loose.
21			
		SAND AND GRAVEL:	Buff to brown, very moist, coarse sand, fine limestone gravel, loose, fuel odor.
24			

FIGURE B-54 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-53
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		Below 24 feet: Wet, very strong fuel odor.
27		
30		
		CLAY: (Goodland Limestone) Greenish-grey, wet, stiff, slightly cohesive, fuel odor.
33		SANDY LIMESTONE: (Walnut Formation) Dark grey, dense, fossiliferous (oysters).
36		SHELL AGGLOMERATE: Dark grey, dense, fossiliferous (oysters), matrix and interbeds of sandy limestone, calcareous shale and clay.
		TOTAL DEPTH 37 Feet.

FIGURE B-55

LITHOLOGIC LOG OF MONITOR WELL HM-54 (UPPER ZONE)

MAP COORDINATES: S. 3,453 feet; R. 2,299 feet
DATE DRILLED: 04/16/84
GROUND ELEV.: 650.3 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 8 inches
BOREHOLE DEPTH: 27 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-5" concrete. Sand, tan to orange, moist, fine- to medium-grained, trace of silt.
3			
6			
9		FILL:	Silty sand, tan to orange, very moist to wet, fine-grained, trace of clay, loose.
		GRAVELLY SAND:	Brown and tan-orange, wet, fine- to coarse-grained, fine limestone gravel, loose.
12		CLAYEY SHALE: (Goodland Limestone)	Greenish-grey, moist, weathered, firm to stiff, slightly cohesive.
		CLAYEY SHALE/ SANDY LIMESTONE:	Interbedded: Light grey sandy limestone, weathered, dense, greenish-grey shale, weathered, firm to stiff, slightly cohesive.
15			
18			18-20 feet: Predominantly clayey shale.
21		CLAYEY SHALE: (Walnut Formation)	Dark grey, very stiff, some thin interbeds of fossiliferous sandy limestone.
24			

FIGURE B-55 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-54
(UPPER ZONE)

232095

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

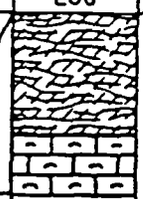
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		SHELL AGGLOMERATE: Medium to dark grey, dense, fossiliferous (oysters), matrix and interbeds of sandy limestone, calcareous shale and clay.
27		TOTAL DEPTH 27 Feet.
30		

FIGURE B-56

LITHOLOGIC LOG FOR MONITOR WELL HM-55 (UPPER ZONE)

232096

MAP COORDINATES: S. 3,453 feet; R. 2,266 feet DATE DRILLED: 04/16/84

GROUND ELEV.: 654.4 feet msl DRILLED BY: Southwestern Laboratories, Inc.

DRILLING METHOD: Air Rotary BOREHOLE DIAMETER: 4 3/4 inches

BOREHOLE DEPTH: 33 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-5" concrete. Clayey gravel, light brown, very moist, fine to medium limestone gravel, loose.
3		SANDY SILTY CLAY:	Light brown, moist, fine sand, trace of fine limestone gravel, firm, slightly cohesvie.
6		SILTY CLAY:	Light brown, moist, some fine sand, trace fine gravel, very firm, slightly cohesive.
9		SILTY SANDY CLAY:	Light brown, moist, fine to medium sand, very firm, slightly cohesive.
12			
15			
18			Below 18 Feet: Very moist to wet.
21		SANDY GRAVEL:	Buff to brown, very moist to wet, coarse sand, fine limestone gravel, loose.
24		SANDY LIMESTONE/ CLAYEY SHALE. (Goodland Limestone)	Interbedded; light grey dense fossiliferous sandy limestone (with shell fragments); greenish-grey shale, moist, stiff, slightly cohesive.

FIGURE B-56 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-55
(UPPER ZONE)

232097

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

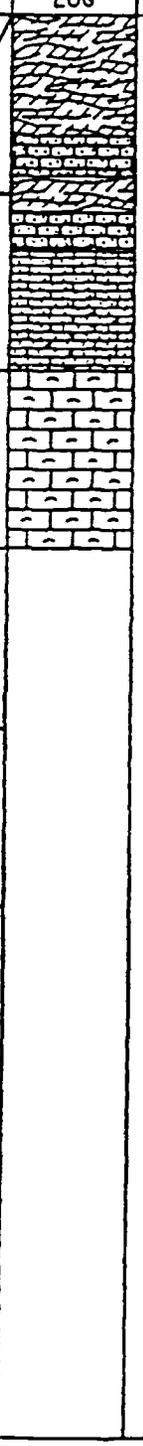
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		24-26 Feet: Predominantly clayey shale, some orange stains.
27		SANDY LIMESTONE: (Walnut Formation) Light grey, dense, fossiliferous (shell fragments), some shaley interbeds.
30		SHELL AGGLOMERATE: Buff to light grey, dense, fossiliferous (oysters), matrix and interbeds of sandy limestone, calcareous shale, and clay.
33		TOTAL DEPTH 33 Feet.

FIGURE B-57

LITHOLOGIC LOG OF MONITOR WELL HM-56 (UPPER ZONE)

MAP COORDINATES: S. 2,344 feet; R. 1,561 feet
DATE DRILLED: 4/16/84
GROUND ELEV.: 654.9 feet msl
DRILLED BY: Southwestern Laboratories Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 40 feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Sandy silty clay, dark brown and orange tan, moist, fine to medium sand, trace of fine gravel, slightly firm, slightly cohesive.
3		CLAY:	Dark brown, moist to very moist, some fine sand, firm to stiff, cohesive.
6		SANDY GRAVELLY CLAY:	Dark brown to light orange, moist, fine sand, fine limestone gravel, firm, slightly cohesive.
9		SANDY SILTY CLAY:	Light orange-brown, very moist to wet, very fine sand, stiff, cohesive.
12		SILTY CLAY:	Light orange-brown, moist, trace fine sand, stiff, cohesive.
15		SANDY SILTY CLAY:	Light orange, very moist, fine to medium sand, trace fine limestone gravel, very firm, slightly cohesive.
			Below 16 feet: very moist to wet.
18			
21			22-24 feet: greenish brown, wet, strong fuel odor.
24			

FIGURE B-57 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-56
(UPPER ZONE)

232099

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

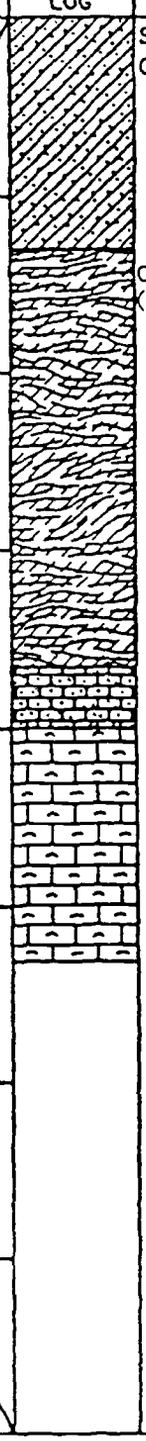
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		SANDY CLAY/ CLAYEY SAND: Greenish buff and brown, very moist to wet, fine to medium sand, trace fine limestone gravel, firm, slightly cohesive, strong solvent odor.
27		
		CLAYEY SHALE: (Goodland Limestone) Greenish buff with orange-brown stains, moist, stiff, slightly cohesive, some thin interbeds of sandy limestone, solvent odor less strong.
30		
33		
		SANDY LIMESTONE: (Walnut Formation) Light grey, dense, fossiliferous (oysters).
36		SHELL AGGLOMERATE: Medium grey, dense, fossiliferous (oysters), matrix and interbeds of sandy limestone, calcareous shale, and clay.
39		
		TOTAL DEPTH 40 feet.
42		

FIGURE B-58

LITHOLOGIC LOG OF MONITOR WELL HM-57 (UPPER ZONE)

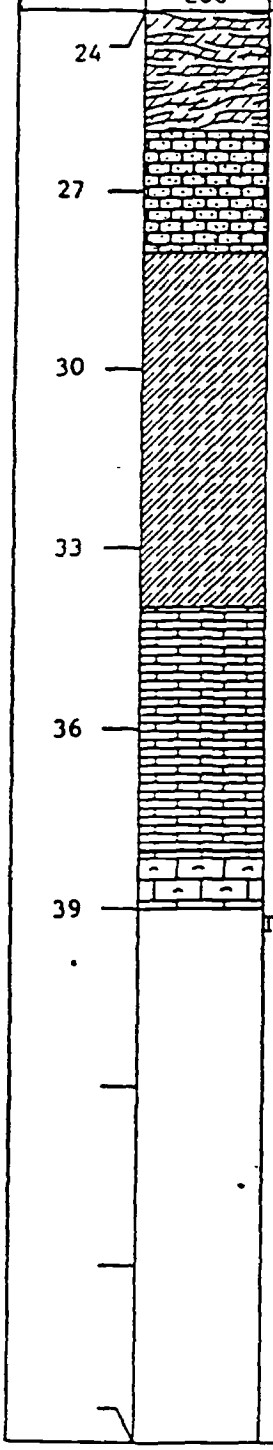
MAP COORDINATES: S. 1,519 feet; R. 1,562 feet
DATE DRILLED: 4/17/84
GROUND ELEV.: 655.4 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 39 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
0		FILL: Clayey sand, medium to dark brown, moist to very moist, medium- to coarse-grained, some silt.
3		FILL: Clay and gravel, dark brown, moist, some coarse sand, clay is cohesive, firm.
6		CLAYEY SHALE: (Goodland Limestone?) Brown, some yellow limonite stains, moist, some coarse sand, some clay
9		
12		CLAY: Yellow-brown, slightly moist to moist, slightly silty, brittle.
15		Below 14 feet: slightly silty, brittle to slightly plastic.
18		
21		
24		CLAYEY SHALE: (Goodland Limestone) Yellow brown, slightly moist, some silt, some fine sand, fissile, contains thin limestone interbeds.

FIGURE B-58 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-57
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DESCRIPTION OF MATERIALS	
SANDY LIMESTONE:	Grey to yellow, slightly moist, fine sand, some silt, thin bedded, with shaley clay interbeds.
SILTY CLAY:	Yellow-brown to dark grey, moist to very moist, slightly sandy, limonite stained, shaley, plastic, moderately cohesive.
LIMESTONE: (Walnut Formation)	Dark grey, slightly shaley, contains interbeds of dark grey clay.
SHELL AGGLOMERATE:	Light to dark grey, dense, fossiliferous (oysters) matrix and interbeds of calcareous shale and clay.
TOTAL DEPTH 39 FEET.	

FIGURE B-59

LITHOLOGIC LOG OF MONITOR WELL HM-58 (UPPER ZONE)

MAP COORDINATES: S. 4,079 feet; R. 2,003 feet
DATE DRILLED: 4/17/84
GROUND ELEV.: 653.6 feet msl
DRILLED BY: Southwestern Laboratories, Inc
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 31 feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-1.5' concrete. Sandy clay, sand, and gravel, orange to brown, moist to very moist.
3			
		SAND AND GRAVEL:	Medium brown, wet, medium to coarse sand, fine limestone gravel, contains blebs of sandy clay.
6			
		GRAVELLY CLAY:	Light grey and light brown, wet, some coarse sand, fine limestone gravel, firm, cohesive.
9			
		CLAYEY SHALE: (Goodland Limestone)	Light grey and greenish grey, orange limonite stains, very moist, weathered, very firm, slightly cohesive
12		LIMESTONE/ CLAYEY SHALE:	Interbedded; light grey dense limestone, light grey and greenish grey shale, moist, stiff.
15			
18			
			Below 20 feet: more clayey shale, less limestone.
21		CLAYEY SHALE: (Walnut Formation)	Brown to dark grey, moist, very firm, slightly cohesive.
24			

FIGURE B-59 (con't)

LITHOLOGIC LOG OF MONITOR WELL HM-58
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

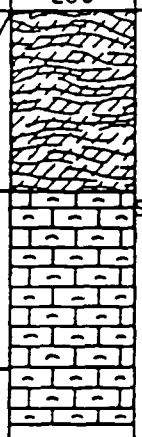
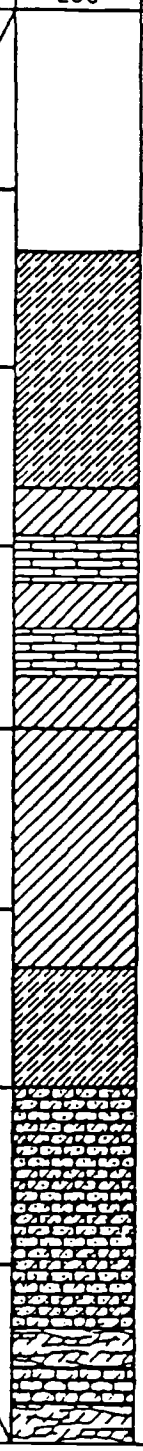
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		SHELL AGGLOMERATE: Light to medium grey, dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
30		
		TOTAL DEPTH 31 feet.
33		

FIGURE B-60

LITHOLOGIC LOG OF MONITOR WELL HM-59 (UPPER ZONE)

MAP COORDINATES: S. 3,709 feet; R. 1,563 feet
GROUND ELEV.: 655.2 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 38 Feet
DATE DRILLED: 4/17/84
DRILLED BY: SOUTHWESTERN LABORATORIES INC.
BOREHOLE DIAMETER: 4 3/4 inches



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Sandy clay, dark brown, very moist, medium sand, some fine limestone gravel, very firm, slightly cohesive.
3		
	SILTY CLAY:	Dark brown, very moist, some sand, fine limestone gravel, firm, slightly cohesive.
6		
	CLAY/LIMESTONE: (Goodland Limestone)	Interbedded; orange-brown, moist, firm, cohesive, with light grey dense silty limestone, some fossils (shell fragments).
9		
12	CLAY:	Yellow-brown, moist, cohesive, firm. No limestone interbeds.
15		14-16 feet: Some silty clay interbeds.
	SILTY CLAY:	Yellow-brown, slightly moist to moist, trace of sand, firm, moderately cohesive.
18	SILTY SANDY LIMESTONE:	Light-brown, slightly moist, some clay and interbeds of clay, brittle, medium-hard.
21		
	CLAYEY SHALE/ SILTY LIMESTONE:	Interbedded; greenish-grey shale with orange limonite stains, moist, stiff, with light-grey silty limestone.
24		

FIGURE B-60 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-59
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

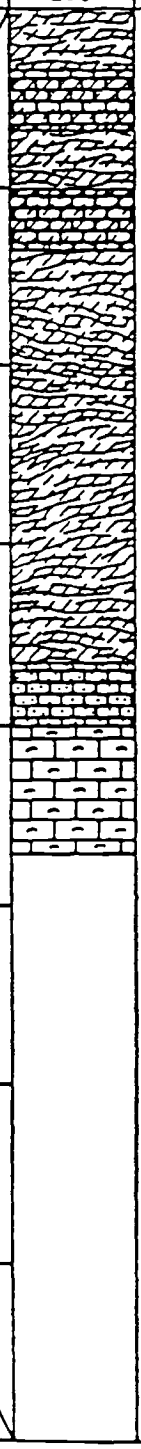
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
27		CLAYEY SHALE:	Greenish-grey and orange-brown, moist, stiff.
30			Below 32 feet: very stiff.
33			
		SANDY LIMESTONE: (Walnut Formation)	Light grey, slightly dense, brittle.
36		SHELL AGGLOMERATE:	Medium-grey, very dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
39		TOTAL DEPTH 38 feet.	

FIGURE B-61

LITHOLOGIC LOG OF MONITOR WELL HM-60 (UPPER ZONE)

MAP COORDINATES: S. 575 feet; R. 2,370 feet
GROUND ELEV.: 653.8 feet msl
DRILLING METHOD: Air rotary
BOREHOLE DEPTH: 36 feet
DATE DRILLED: 4/17/84
DRILLED BY: Southwestern Laboratories Inc.
BOREHOLE DIAMETER: 4 3/4 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-1 foot: concrete. Clayey sand/sandy clay, medium brown, moist to very moist, fine- to coarse-grained, some gravel.
3		SANDY CLAY:	Orange-brown, very moist, very fine to fine grained sand, firm, slightly cohesive
		SILTY SANDY CLAY:	Light orange-brown, moist to very moist, firm, slightly cohesive.
6		SANDY CLAYEY GRAVEL:	Light brown and grey, very moist to wet, medium to coarse sand, fine to medium gravel.
9			
		SAND AND GRAVEL:	Light grey and light brown, very moist to wet, coarse sand, fine gravel, some silt.
12			
15			
18			
		CLAYEY GRAVEL:	Light brown and light grey, moist, trace of fine to coarse sand, loose, slightly firm, slightly cohesive.
21			Below 22 feet: very moist to wet, more clay.
24			

FIGURE B-61 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-60
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		Below 24 feet: no sand, silty clay.
27		
		SAND AND GRAVEL: Light brown and light grey, very moist to wet, coarse sand and fine to medium gravel, some silt and clay, loose.
30		SILTY CLAY: (Goodland Limestone) Greenish-grey, moist, firm, slightly cohesive.
33		SANDY LIMESTONE: (Walnut Formation) Medium to dark grey, slightly dense, fossiliferous (oysters).
		SHELL AGGLOMERATE: Medium to dark grey, very dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
36		TOTAL DEPTH 36 feet.

FIGURE B-62

LITHOLOGIC LOG OF MONITOR WELL MM-61 (UPPER ZONE)

MAP COORDINATES: S. 3,926 feet; R. 2,498 feet
GROUND ELEV.: 653.4 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 35 Feet
DATE DRILLED: 4/17/84
DRILLED BY: Southwestern Laboratories, Inc
BOREHOLE DIAMETER: 4 3/4 inches

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-8" Concrete Gravelly clay, dark brown to black, moist to very moist, fine to medium limestone gravel, some silt and sand, firm, slightly cohesive.
3			
		FILL:	Silty sandy clay, light orange-brown, very moist, fine to medium sand, very firm, slightly cohesive. At 6 Feet: 40% black clay.
6			
9			
		SILTY CLAY:	Green and black, moist, some fine sand, very firm, slightly cohesive, with roots.
12			
			Below 14 feet: some fossil shell fragments.
15			
		SILTY CLAY/ CLAYEY SHALE: (Goodland Limestone)	Green, moist, stiff, slightly cohesive, some fossil shell fragments.
18			Below 18 feet: some thin interbeds of sandy limestone, fossiliferous.
		SILTY SHALE/ LIMESTONE:	Interbedded; medium grey, stiff shale with slightly dense, sandy limestone.
21			
		SILTY SHALE:	Dark grey, slightly moist, trace of fine sand, stiff.
24			

FIGURE B-62 (con't)

LITHOLOGICAL LOG OF MONITOR WELL HM-61
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

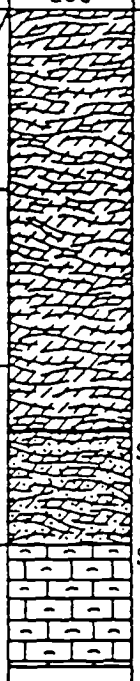
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		
30		
		SILTY SANDY SHALE: (Walnut Formation) Dark grey, stiff.
33		SHELL AGGLOMERATE: Dark grey, very dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
		TOTAL DEPTH 35 feet.
36		

FIGURE B-63 (con't)

LITHOLOGIC LOG OF MONITOR WELL HM-62
(UPPER ZONE)

232120

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		SANDY SILT/ SILTY SAND: Light orange-tan, wet, very fine- to fine-grained, trace of clay.
30		GRAVEL: Buff, grey, and brown, wet, fine to medium limestone gravel, loose.
33		SHELL AGGLOMERATE: (Walnut Formation) Medium to dark grey, very dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
36		
39		TOTAL DEPTH 39 feet.

FIGURE B-64

232111

LITHOLOGIC LOG OF MONITOR WELL HM-63 (UPPER ZONE)

MAP COORDINATES: S. 1,952 feet; R. 2,674 feet
DATE DRILLED: 4/18/84
GROUND ELEV.: 659.4 feet msl
DRILLED BY: Southwestern Laboratories, Inc.
DRILLING METHOD: Air Rotary
BOREHOLE DIAMETER: 4 3/4 inches
BOREHOLE DEPTH: 40 Feet

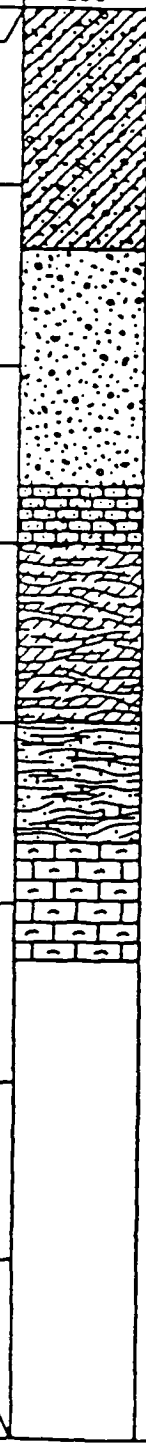
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
0		FILL: Asphalt surface. Clayey gravel, medium to dark brown, moist, fine to medium limestone gravel, loose.
3		GRAVELLY SILTY CLAY: Medium brown, moist to very moist, fine limestone gravel, firm, slightly cohesive.
6		SANDY GRAVELLY CLAY: Light brown, moist, some silt, firm, slightly cohesive.
9		
12		SILTY SAND: Light orange to tan, moist, very fine- to fine-grained, well graded, well packed.
15		Below 14 feet: very moist, with some clay.
18		SAND AND GRAVEL: Light brown and buff, very moist, medium to coarse sand, fine limestone gravel, some clay blebs, loose.
21		
24		

FIGURE B-64 (con't)

LITHOLOGIC LOG OF MONITOR WELL HM-63
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	DESCRIPTION OF MATERIALS	
24	SANDY GRAVELLY CLAY:	Light brown, very moist, fine sand, fine limestone gravel, firm, slightly cohesive.
		Below 26 feet: wet.
27	SAND AND GRAVEL:	Light brown and buff, wet, medium to coarse sand, fine limestone gravel, some clay blebs, loose.
30		
	SANDY LIMESTONE: (Goodland Limestone)	Medium grey, dense, some silt.
33	CLAYEY SHALE:	Greenish grey, moist, stiff, slightly cohesive.
36	SANDY CALCAREOUS SHALE: (Walnut Formation)	Dark grey, dense, fossiliferous (oysters).
	SHELL AGGLOMERATE:	Medium to dark grey, very dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
39		
	TOTAL DEPTH 40 Feet.	

REMARKS: Caving conditions below 20 feet.

FIGURE B-65

LITHOLOGIC LOG OF MONITOR WELL HM-64 (UPPER ZONE)

MAP COORDINATES: S. 3,297 feet; R. 1,918 feet DATE DRILLED: 4/18/84

GROUND ELEV.: 654.8 feet msl DRILLED BY: Southwestern Laboratories, Inc.

DRILLING METHOD: Air Rotary BOREHOLE DIAMETER: 4 3/4 inches

BOREHOLE DEPTH: 38 Feet

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-7" concrete. Sandy clay, blue-grey, wet, medium sand, slightly firm, strong solvent or fuel odor.
3		FILL:	Sandy silty clay, medium to dark brown, very moist to wet, very firm, slightly cohesive, solvent odor.
6		SILTY SANDY CLAY:	Light orange-brown, moist, slightly cohesive, stiff, no odor.
		SILTY CLAY:	Light orange, brown, and buff, very moist to wet, trace limestone gravel, very firm, slightly cohesive.
9		SAND:	Light orange, moist to very moist, fine-grained, some clay, trace limestone gravel, loose.
12			
15			Below 14 feet: more gravel.
18			Below 18 feet: medium to coarse sand with some gravel.
21			
24		SAND AND GRAVEL:	Light orange tan, moist, medium to coarse sand, fine limestone gravel, loose.

FIGURE B-65 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-64
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

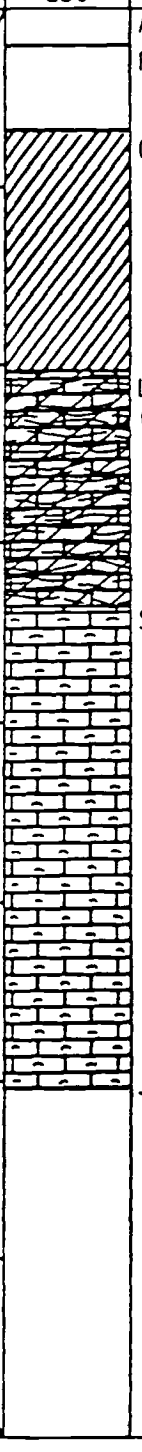
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		GRAVELLY SAND:	Light tan, very moist, medium- to coarse-grained sand, fine limestone gravel, no clay, loose.
27			Below 26 feet: wet.
30		CLAYEY SHALE: (Goodland Limestone)	Orange-green and blue-grey, moist, stiff, slightly cohesive.
33		SANDY LIMESTONE: (Walnut Formation)	Light grey, slightly dense.
36		SHELL AGGLOMERATE:	Medium to dark grey, very dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
		TOTAL DEPTH 38 Feet.	
39			

FIGURE B-66

LITHOLOGIC LOG OF MONITOR WELL HM-65 (UPPER ZONE)

MAP COORDINATES: S.3722 feet; R.2732 feet
GROUND ELEV.: 634.3 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 18 ft.

DATE DRILLED: 1-4-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"



DEPTH	DESCRIPTION OF MATERIALS	
0	ASPHALT:	
	FILL:	Clay grey to black, moist, cohesive, strong solvent odor.
3	CLAY:	Clay, brown to grey, moist, cohesive strong solvent odor, greasy texture.
6	LIMEY SHALE,CLAY: (Goodland Formation)	Tan, green, moist, fissile, cohesive in part, < 10% coarse grained.
		Tan, dry, fissile < 10% coarse grained.
9	SHELL AGGLOMERATE:	Medium to dark grey, very dense fossiliferous (oysters)
12		
15		
18	TOTAL DEPTH 18 FEET.	

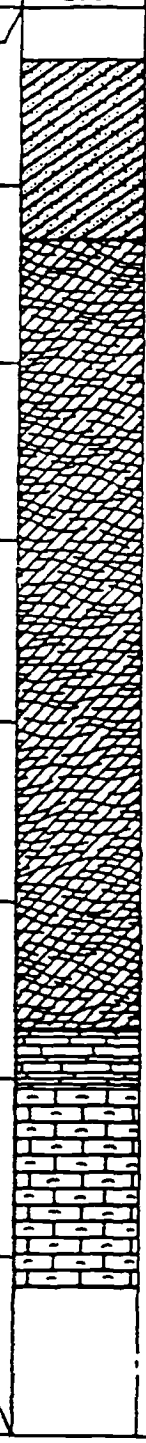
REMARKS:

FIGURE B-67

LITHOLOGIC LOG OF MONITOR WELL HM-66 (UPPER ZONE)

MAP COORDINATES: S.3343 feet; R.2760 feet
GROUND ELEV.: 644.7
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 21.5 ft.

DATE DRILLED: 1-5-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		ASPHALT:	
		SANDY CLAY:	Sandy clay, light brown, moist at top, some coarse sand, cohesive, plastic.
3		CLAY/SHALE: (Goodland Formation)	Tan to grey green, moist, banded, cohesive
6			
9			
12			
15			
18		LIMESTONE: (Walnut Formation)	Tan to white, dry, weathered, very fossiliferous (oysters).
		SHELL Agglomerate:	Dark grey, fresh, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
21		TOTAL DEPTH 21.5 FEET.	

REMARKS:

FIGURE B-68

LITHOLOGIC LOG OF EXPLORATORY BORING HM-67 (UPPER ZONE)

MAP COORDINATES: S.1979 feet; R. 578 feet
GROUND ELEV.: 646.7 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 82 ft.

DATE DRILLED: 1-5-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
0		SOIL:	Black to tan, moist, clayey, with grass and organic material.
3		CLAY:	Brown, moist, cohesive.
6			
9		SANDY CLAY:	Brown, moist, cohesive, some fine gravel or caliche nodules
12			
15			
18			
			At 20 Feet: More sandy.
21			
24			

REMARKS:

FIGURE B-68 (con't)
LITHOLOGIC LOG OF EXPLORATORY BORING HM-67
(UPPER ZONE)

232118

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

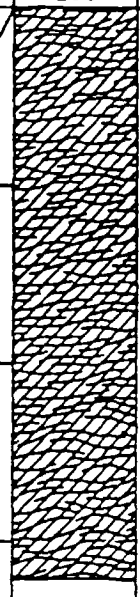
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
48		
51		
54		54-60 feet: No returns to surface.
57		
60		
63		SHALEY CLAY/ CLAYSTONE: Red to grey, slightly fissile, dry to moist, stiff, hard, brittle.
66		
69		
72		

REMARKS:

FIGURE B-68 (con't)
LITHOLOGIC LOG OF EXPLORATORY BORING HM-67
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

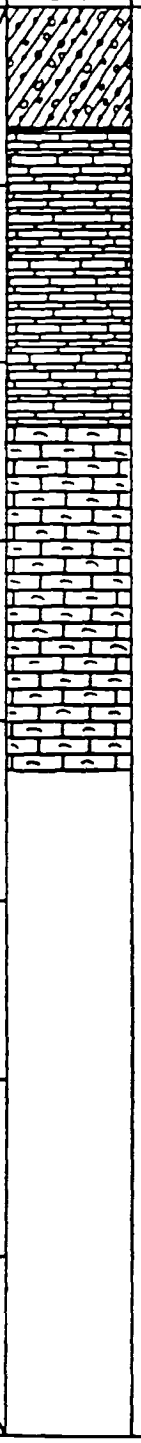
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
72		
75		Below 74 feet: harder; more consolidated. Some fragments of sandy limestone; some shell fragments.
78		
81		
		TOTAL DEPTH 82 FEET.

REMARKS:

FIGURE B-69 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-68
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
		LIMESTONE: Dark grey, dry, dense, fossiliferous (oysters).
27		
30		
		SHELL AGGLOMERATE: Medium tp dark grey, dry, dense, fossiliferous (oysters), matrix and interbeds of of calcareous shale and clay.
33		
36		TOTAL DEPTH 37 FEET.

REMARKS:

FIGURE B-70

LITHOLOGIC LOG OF MONITOR WELL HM-69 (UPPER ZONE)

MAP COORDINATES: S.311 feet; R.1033 feet
GROUND ELEV.: 646.9 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 38 ft.

DATE DRILLED: 1-7-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		ASPHALT:	
		FILL:	Brown clay, tan gravel (50%) moist cohesive some minor sands (<5%).
3			
		GRAVEL:	Buff, weathered, dry.
6			
9			
		CLAYEY SHALE: (Goodland Limestone)	Tan brown, moist, stiff, cohesive, fissile, minor sand interbeds.
12			
15			
18			
21			
24			

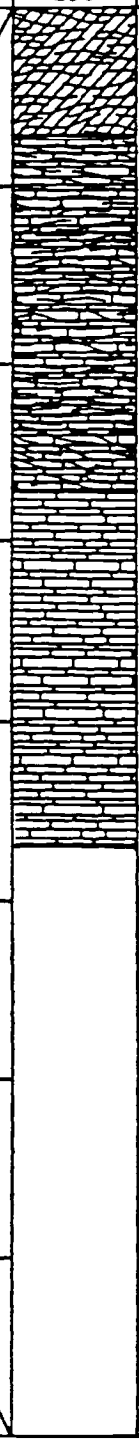
REMARKS:

FIGURE B-70 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-69
(UPPER ZONE)

232122

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
		CALCAREOUS SHALE: Dark grey, dry, stiff, slightly cohesive.
27		
30		
		LIMESTONE: Medium to dark grey, dense, very silty, some fossils.
33		
36		
		TOTAL DEPTH 38 FEET.

REMARKS:

FIGURE B-71

LITHOLOGIC LOG OF MONITOR WELL HM-70 (UPPER ZONE)

MAP COORDINATES: S.738 feet; R.1358 feet
GROUND ELEV.: 652.5 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 47 ft.

DATE DRILLED: 1-8-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SOIL:	
		FILL:	Clay, brown, moist, sticky, some gravel and sand, some organic material.
3			
6		SANDY CLAY:	Tan brown, moist, some sand, cohesive.
9			
12			
15			
18			
21			
24			

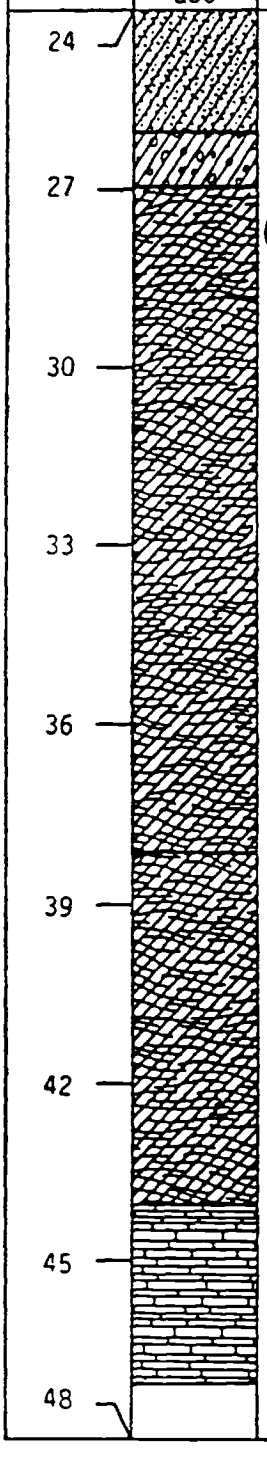
REMARKS:

FIGURE B-71 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-70
(UPPER ZONE)

232124

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
		GRAVELLY CLAY:	Tan to buff, moist, some sand.
27		SHALEY CLAY: (Goodland Formation)	Tan brown, moist, cohesive, banded
30			
33			
36			
39		CLAYEY SHALE: (Walnut Formation)	Dark grey, dense, very silty, some fossils (oysters).
42			
45		LIMESTONE:	Dark grey, dense, very silty.
48		TOTAL DEPTH 47FEET.	

REMARKS:

FIGURE B-72

LITHOLOGIC LOG OF MONITOR WELL HM-71 (UPPER ZONE)

MAP COORDINATES: S.3358 feet; R.578 feet
GROUND ELEV.: 646.2 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 56 ft.

DATE DRILLED: 1-8-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Brown clay and soil, moist, cohesive, some coarse sand.
3			
6		SANDY CLAY:	Tan brown, moist, cohesive, some coarse sand and gravel (some lost circulation poor returns).
9			
12			
15			
18			
21			
24			

REMARKS:

FIGURE B-72 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-71
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

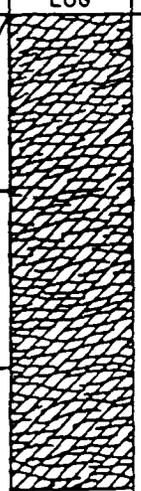
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		
30		
33		
36		
39		
42		
45		
48		CLAYEY SHALE (Walnut Formation) — Dark Grey, dense, brittle, sandy.

REMARKS:

FIGURE B-72 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-71
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
48		
51		
54		
		TOTAL DEPTH 56 FEET.
57		

REMARKS:

FIGURE B-73

LITHOLOGIC LOG OF MONITOR WELL HM-72 (UPPER ZONE)

MAP COORDINATES: S.4534 feet; R.963 feet
GROUND ELEV.: 651.3
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 40 ft.

DATE DRILLED: 1-9-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Clay, black, moist, very cohesive, some limestone, gravel.
3		CLAY:	Clay, black, moist, very cohesive, some leuses of limestome gravel and sand.
6			
9			
12		CLAY:	Tan to brown, very moist, cohesive, some fine limestone gravel.
15			
18			
21			
24			

REMARKS:

FIGURE B-73 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-72
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
		SHALEY CLAY:	Green and tan, moist, slightly cohesive, banded and fissile.
27			
30		SANDY SHALE:	Light tan to green, calcareous, some limestone.
33			
36		LIMESTONE: (Walnut Formation)	Dark grey, very dense, fossiliferous (oysters), some calcareous shale.
39			
		TOTAL DEPTH 40 FEET.	
42			

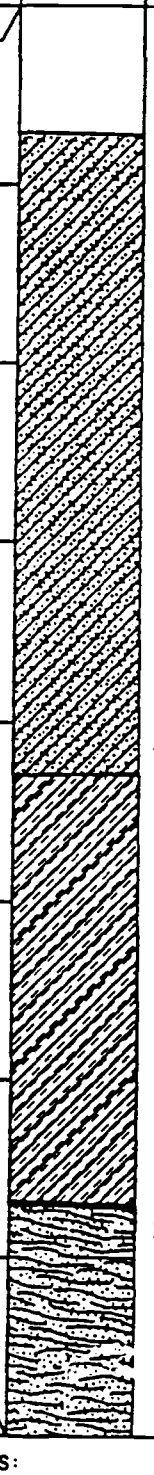
REMARKS:

FIGURE B-74

LITHOLOGIC LOG OF MONITOR WELL HM-73 (UPPER ZONE)

MAP COORDINATES: S.4962 feet; R.1567 feet
GROUND ELEV.: 654.6 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 45 feet

DATE DRILLED: 1-9-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CONCRETE:	
3		SANDY CLAY:	Black, red brown, slightly moist to dry, cohesive, some coarse sand and gravel.
6			
9			
12			
		SILTY CLAY	Green tan, slightly moist, cohesive, fissile, some coarse sand.
15			
18			
21		SANDY SHALE: (Goodland Limestone)	Tan green, dry, weathered some clay, fossiliferous (Ammonites and gastropods).
24			

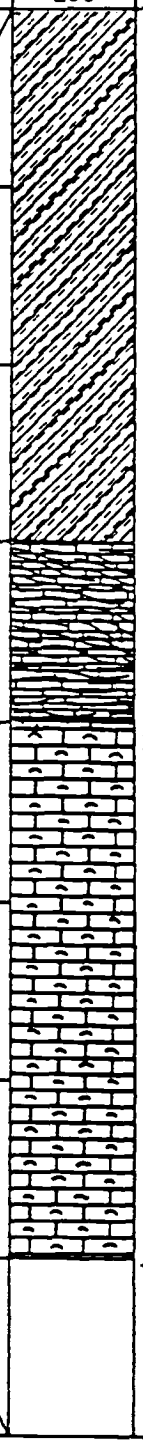
REMARKS:

FIGURE B-74 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-73
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		SILTY CLAY:	Green tan, dry, fissile, banded.
27			
30			
33		CALCAREOUS SHALE: (Walnut Formation)	Dark grey, dry, dense, brittle, some fossils.
36		SHELL AGGLOMERATE:	Dark Grey, very dense, fossiliferous (oysters) and interbeds of sandy limestone and calcareous shale.
39			
42			
45		TOTAL DEPTH 45 FEET.	



REMARKS:

FIGURE B-75

LITHOLOGIC LOG OF MONITOR WELL HM-74 (UPPER ZONE)

MAP COORDINATES: S.4967 feet; R.2020 feet
GROUND ELEV.: 653.1 msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 40 ft.

DATE DRILLED: 1-9-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CONCRETE:	
3		FILL:	Brown red, slightly moist, cohesive, medium to coarse sand and gravel.
6		SHALEY CLAY:	Tan to red brown, slightly moist, cohesive, varying amounts of coarse sand and gravel.
9			
12			
15			
18			
21			
24			

REMARKS:

FIGURE B-75 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-74
(UPPER ZONE)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	BOREHOLE DIAMETER:
BOREHOLE DEPTH:	

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
27			
30			
33		LIMESTONE: (Walnut Formantion)	Tan weathered, dry, fossiliferous (oysters), dense.
36			
39		SHELL AGGLOMERATE:	Dark grey, very dense, fossiliferous (oysters), matrix and interbeds of sandy limestone and calcareous shale.
		TOTAL DEPTH 40 FEET.	
42			

REMARKS:

FIGURE B-76

LITHOLOGIC LOG OF MONITOR WELL HM-75 (UPPER ZONE)

MAP COORDINATES: S.4345 feet; R.2255 feet
GROUND ELEV.: 650.0
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 30 ft.

DATE DRILLED: 1-9-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

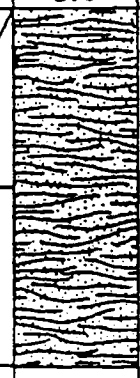
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CONCRETE:	
3		SANDY CLAY:	Tan, dry, cemented brittle.
6		SILTY CLAY: (Goodland Formation)	Green, tan, moist, cohesive, soft, fissile, some sandy lenses.
9			
12			
15			
18			
21			
24		SANDY SHALE: (Walnut Formation)	Dark grey, slightly moist, calcareous, fissile, stiff.

REMARKS:

FIGURE B-76 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-75
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		
30		TOTAL DEPTH 30 FEET:

REMARKS:

FIGURE B-77

LITHOLOGIC LOG OF MONITOR WELL HM-76 (UPPER ZONE)

MAP COORDINATES: S.3629 feet; R.2560 feet
GROUND ELEV.: 652.8
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 34 ft.

DATE DRILLED: 1-10-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

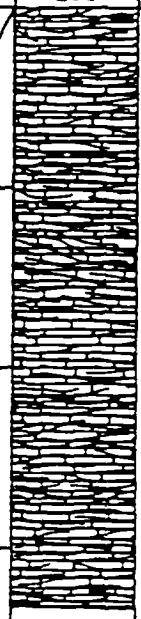
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CONCRETE:	
		FILL:	Red brown and tan, moist, cohesive, coarse sand and gravel.
3			
6			
9			
12			
15			
		CLAYEY SHALE: (Goodland Limestone)	Tan and greenish gray, slightly moist, cohesive, fissile, firm.
18			
21			
24			

REMARKS:

FIGURE B-77 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-76
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		CALCAREOUS SHALE: (Walnut Formation)	Dark grey, dry, brittle, fossiliferous (oysters)
27			
30			
33			
		TOTAL DEPTH 34 FEET.	
36			

REMARKS:

FIGURE B-78

LITHOLOGIC LOG OF MONITOR WELL HM-77 (UPPER ZONE)

MAP COORDINATES: S.410 feet; R.2331 feet
GROUND ELEV.: 653.4
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 35 ft.

DATE DRILLED: 1-10-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

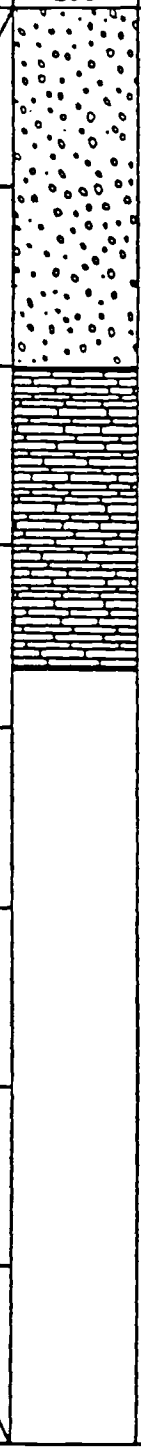
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CONCRETE:	
		SILTY CLAY	Tan brown, moist, cohesive, plastic, some minor coarse sand.
3			
6			
9			
12			
15			
18		GRAVEL:	Tan white, weathered limestone, subangular to subrounded, some sand.
21			
24			

REMARKS:

FIGURE 3-78 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-77
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		
30		LIMESTONE: (Walnut Formation) Dark grey, dense, fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
33		
		TOTAL DEPTH 35 FEET.
36		

REMARKS:

FIGURE B-79

LITHOLOGIC LOG OF MONITOR WELL HM-78 (UPPER ZONE)

MAP COORDINATES: S.5656 feet; R.2323 feet
GROUND ELEV.: 644.1 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 30 ft.

DATE DRILLED: 1-11-85
DRILLED BY: Southwestern Laboraties, Inc.
BOREHOLE DIAMETER: 7.5"

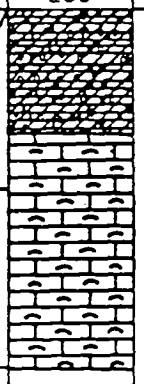
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CONCRETE:	
		SILTY CLAY:	Red brown, moist, cohesive, some gravel.
3			
6			
		SANDY CLAY:	Tan brown, moist, cohesive, trace gravel. Strong fuel odor.
9			
12			
15			
18			
21			
		CLAYEY LIMESTONE GRAVEL:	White to tan, subangular to subrounded, wet.
24			

REMARKS:

FIGURE B-79 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-78
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
27		SHELL AGGLOMERATE: (Walnut Formation) Light to dark grey, dense, fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
30		TOTAL DEPTH 30 FEET.

REMARKS:

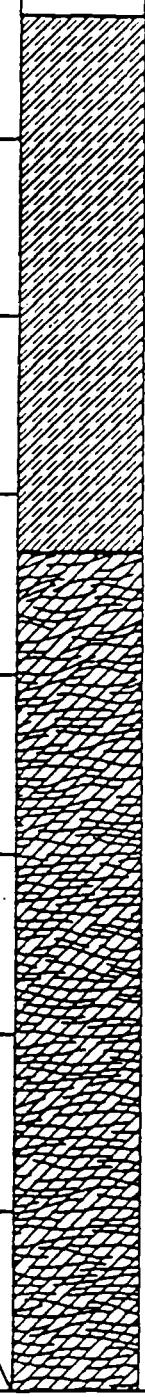
FIGURE B-80

LITHOLOGIC LOG OF MONITOR WELL HM-79 (UPPER ZONE)

MAP COORDINATES: S.3663 feet; R.1163 feet
GROUND ELEV.: 651.7
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 42 ft.

DATE DRILLED: 1-15-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		ASPHALT:	
		SILTY CLAY:	Brown and black, moist, cohesive, plastic, some gravel.
3			
6			
9			
		SHALEY CLAY:	Tan brown, moist, cohesive, plastic, some weathered limestone fossiliferous gravel (<10%).
12			
15			
18			
21			
24			

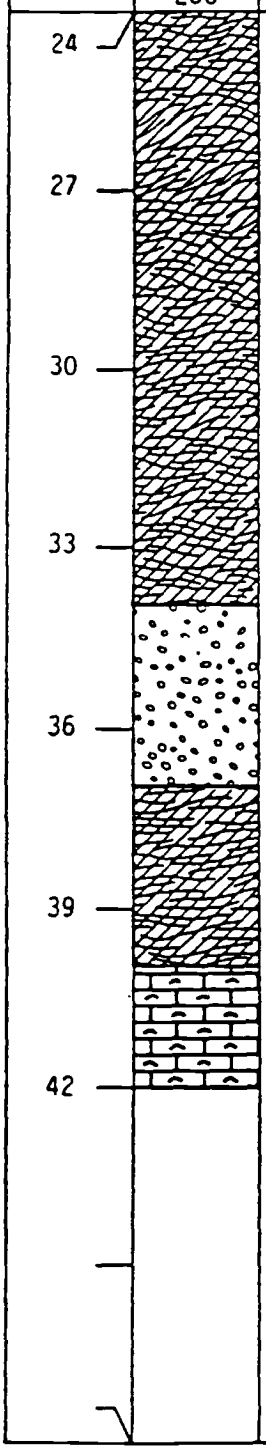


REMARKS:

FIGURE B-80 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-79
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24			
27			
30			
33			
		GRAVEL:	Tan, weathered limestone, wet, rounded to subrounded, some sand, silt, and clay.
36			
		CLAYEY SHALE: (Walnut Formation)	Brown to dark grey, moist, very firm, brittle, calcareous.
39			
		SHELL AGGLOMERATE:	Dark grey, dense, fossiliferous (oysters), matrix and interbeds of sandy limestone.
42		TOTAL DEPTH 42 FEET.	

REMARKS:

FIGURE B-81

LITHOLOGIC LOG OF MONITOR WELL HM-80 (UPPER ZONE)

MAP COORDINATES: S.4734 feet; R.2504 feet
GROUND ELEV.: 647.7
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 30 ft.

DATE DRILLED: 1-15-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

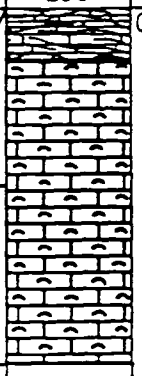
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		CONCRETE:	
3		FILL:	Brown and black silty clay, moist, cohesive, plastic some coarse sand and gravel.
6		SHALEY CLAY: (Goodland Formation)	Green and tan, moist, cohesive, fissile, contains sandy interbeds.
9			
12			
15			
18			
21			
24			

REMARKS:

FIGURE B-81 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-80
(UPPERZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
24		CALCAREOUS SHALE: (Walnut Formation)	Dark grey, moist, stiff, some sand.
		SHELL AGGLOMERATE	Dark grey, dense, fossiliferous (oysters) matrix and interbeds of sandy limestone and calcareous shale.
27			
30		TOTAL DEPTH 30 FEET:	

REMARKS:

FIGURE B-82
LITHOLOGIC LOG OF MONITOR WELL HM-81 (UPPER ZONE)

MAP COORDINATES: S.6175 feet; R.2133 feet
GROUND ELEV.: 642.5 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 26 ft.

DATE DRILLED: 1-6-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5 "

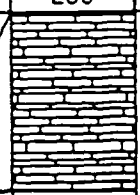
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty clay, red brown, moist, cohesive, some fine fossiliferous gravel.
3			
6		SILTY CLAY:	Tan and brown, moist, cohesive, plastic, fissile, some fine gravel.
9			
12			
15		CLAYEY SHALE: (Goodland Limestone)	Light green, greenish grey, moist, cohesive, firm, plastic, fissile.
		SANDY SHALE:	Calcareous.
18		LIMESTONE:	Medium to dark grey, dense fossiliferous (oysters) matrix and interbeds of sandy limestone and calcareous shale.
21			
24			

REMARKS:

FIGURE B-82 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-81
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		
26		TOTAL DEPTH 26 FEET:

REMARKS:

FIGURE B-83

LITHOLOGIC LOG OF MONITOR WELL HM-82 (UPPER ZONE)

MAP COORDINATES: S.1969 feet; R.578 feet
GROUND ELEV.: 646.7 feet msl
DRILLING METHOD: Air Rotary
BOREHOLE DEPTH: 50 ft.

DATE DRILLED: 1-16-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 7.5"

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SOIL:	Brown clay, moist, cohesive, some organic material.
3		SILTY CLAY:	Tan, moist, cohesive, plastic, fissile some fine gravel
6			
9			
12			
15			
18			
21			
24			

REMARKS:

FIGURE B-83 (con't)

LITHOLOGIC LOG OF MONITOR WELL HM-82

(UPPER ZONE

MAP COORDINATES:

GROUND ELEV.:

DRILLING METHOD:

BOREHOLE DEPTH:

DATE DRILLED:

DRILLED BY:

BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
24		SAME AS ABOVE:
27		
30		
33		
36		
39		
42		
45		
48		

REMARKS:

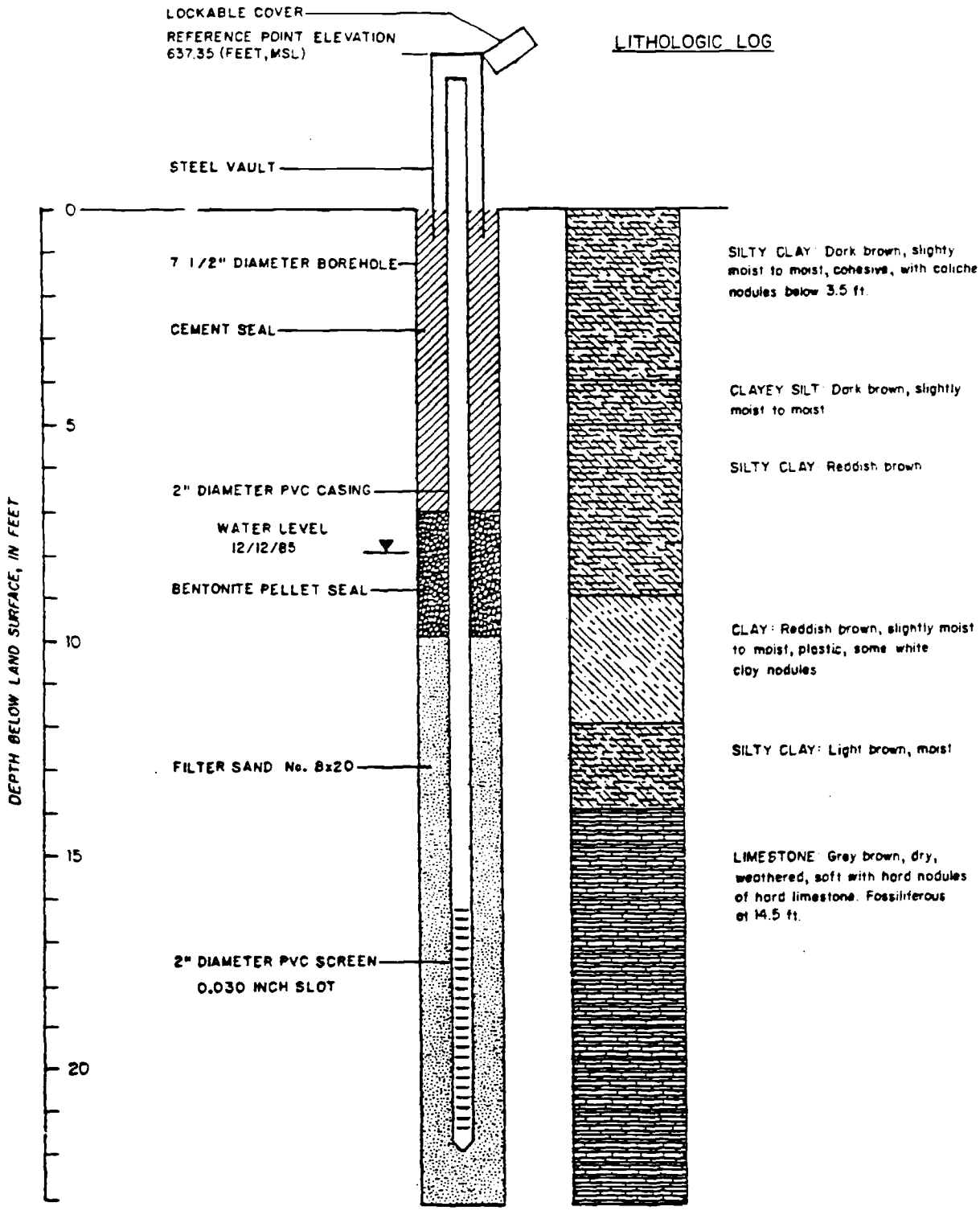
FIGURE B-83 (con't)
LITHOLOGIC LOG OF MONITOR WELL HM-82
(UPPER ZONE)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
48		SAME AS ABOVE:
51		TOTAL DEPTH 50 FEET:

REMARKS:

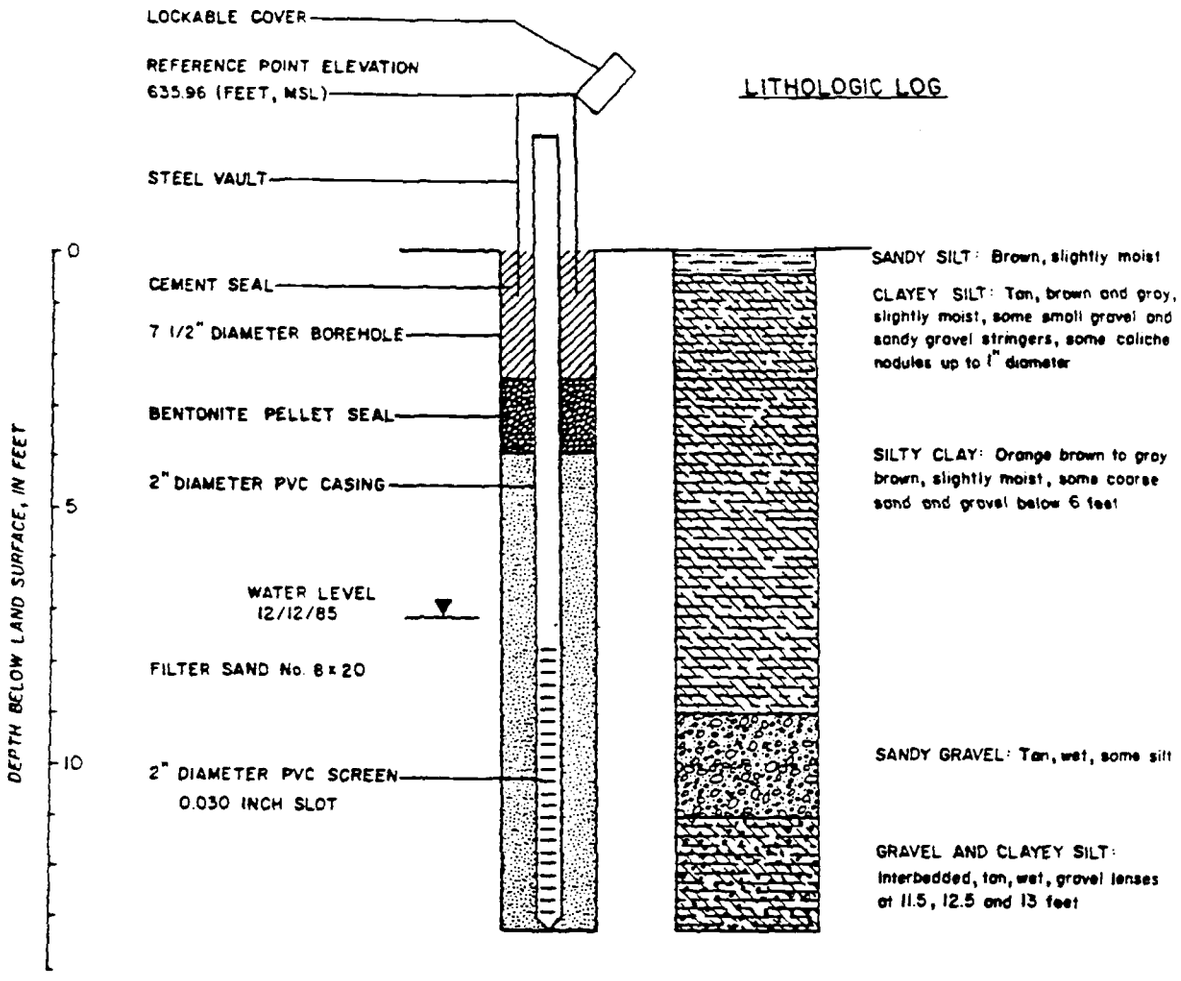


APPROXIMATE LAND SURFACE ELEVATION 633.7 (FEET, MSL)

TOTAL DEPTH OF BOREHOLE 23 FEET

FIGURE 2. WELL CONSTRUCTION DIAGRAM FOR MONITOR WELL HM-83

HARGIS - ASSOCIATES INC.

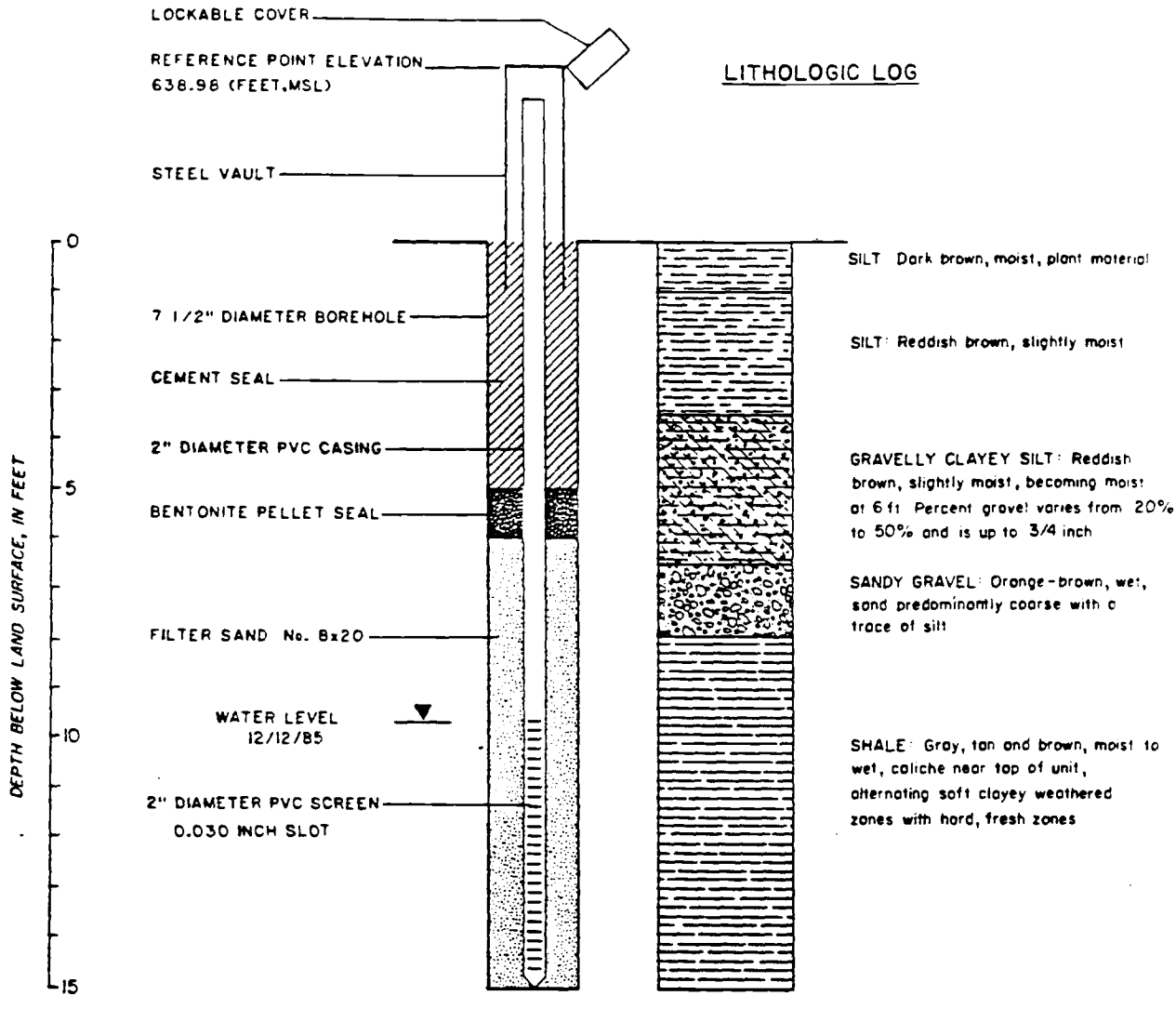


APPROXIMATE LAND SURFACE ELEVATION 632.9 (FEET, MSL)

TOTAL DEPTH OF BOREHOLE 13 FEET

FIGURE 3. WELL CONSTRUCTION DIAGRAM FOR MONITOR WELL HM-84

HARGIS + ASSOCIATES INC.



APPROXIMATE LAND SURFACE ELEVATION 635.4 (FEET, MSL)

TOTAL DEPTH OF BOREHOLE 15 FEET

FIGURE 4. WELL CONSTRUCTION DIAGRAM FOR MONITOR WELL HM-85

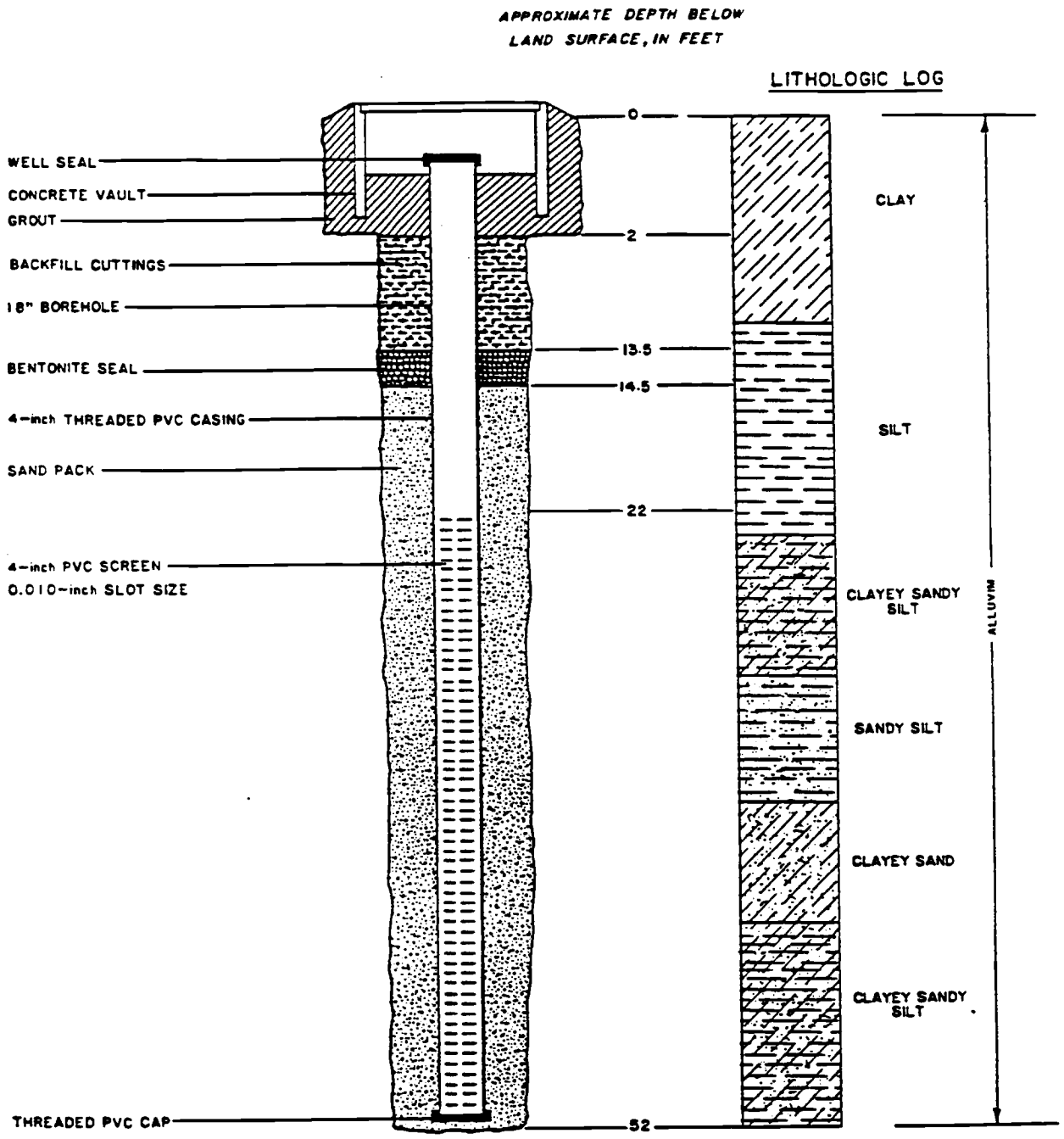


FIGURE B-1 SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL HM-86

TABLE B-1

LITHOLOGIC LOG OF MONITOR WELL HM-87

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	ASPHALT AND SUBGRADE	--	
0.5 - 35	CLAYEY SILT	CL	Yellowish brown (10 YR 5/4) 50 percent silt, 50 percent clay, soft, plastic. Interbedded with pale yellow (2.5Y 7/4) 85 percent silt, 15 percent clay, soft to firm, plastic, cohesive, minor black mottling, some limestone stringers, trace fine sand.
35.0 - 37.0	SHALY LIMESTONE	--	White shaly limestone, hard, brittle, calcareous silt interbeds, hard, brittle.
37.0 - 42.0	CLAYEY SILT/LIMESTONE	--	Gray (5Y 6/1), 80 percent silt, 20 percent clay, soft, plastic, interbedded with gray limestone, hard, brittle, shell fragments, harder with depth. Softens at 41 feet.

TOTAL DEPTH OF BOREHOLE: 42 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-2

LITHOLOGIC LOG OF MONITOR WELL HM-88

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
0 - 7.0	SILTY CLAY	CL	Grayish orange (10 YR 7/4), plastic, slightly cohesive.
7.0 - 22.0	SANDY SILT	SM	Yellow orange (10 YR 5/4), 85 percent silt, 15 percent sand, sand is very fine- to fine-grained, well rounded.
22.0 - 27.0	GRAVELLY SAND	GP	Varicolored, sand is coarse- to medium-grained, rounded to subangular, loose.
27.0 - 32.0	GRAVELLY SILT	ML	Grayish orange (10 YR 7/4), soft, plastic, gravel is angular to subrounded approximately percent.
32.0 - 37.0	GRAVELLY SILT	ML	Yellowish orange (10 YR 5/4), gravel approximately 10 percent fine- to medium-grained, subrounded.
37.0 - 45.0	SANDY GRAVEL	GP	Varicolored, fine- to medium-grained, subangular to subrounded.
45.0 - 47.0	FOSSILIFEROUS LIMESTONE	--	Gray (N4 - N8), abundant shell fragments, minor shale and clay.

TOTAL DEPTH = 47.0 FEET

*Unified Soil Classification System
ASTM D-2487

TABLE B-3

LITHOLOGIC LOG OF MONITOR WELL HM-89

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
0 - 8.0	SILTY CLAY	SL	Light brown (5 YR 5/2), soft, plastic, trace gravel, fine- to medium-grained, rounded.
8.0 - 36.0	CLAY	CH	Light brown (5 YR 5/2), soft, plastic, moderately cohesive.
36.0 - 49.0	GRAVEL	GP	Varicolored, fine- to medium-grained, rounded to subrounded, saturated.
49.0 - 52.0	FOSSILIFEROUS LIMESTONE	--	Dark gray (N8), abundant shell fragments, Walnut Formation.

TOTAL DEPTH OF BOREHOLE: 52.0 FEET

*Unified Soil Classification System
ASTM D-2487

TABLE B-4

LITHOLOGIC LOG OF MONITOR WELL HM-90

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 10.0	CLAY	CH	Dark gray (N 3), firm, sticky, cohesive.
10.0 - 12.0	SILTY CLAY	CL	Dark olive gray (5 Y 6/1), firm, cohesive, trace medium-grained sand.
12.0 - 20.0	CLAYEY SILT	ML	Grayish orange (10 YR 7/4), firm, cohesive, some medium- to coarse-grained sand.
20.0 - 32.0	SILTY SANDY GRAVEL, GRAVELLY SAND	GM-SP	Grayish orange (10 YR 7/4), gravel is fine- to medium-grained, angular, consisting mainly of fossil fragments, sand is fine- to coarse-grained, angular rounded.
32.0 - 42.0	SANDY GRAVELLY SILTY CLAY	SP	Dark yellowish orange (10 YR 6/6), soft, sticky, gravel is medium- to fine-grained consisting mainly of rounded limestone.
42.0 - 52.0	SILTY CLAY WITH SAND	CL	Yellowish orange (10 YR 6/6), soft, sticky, trace fine- to medium-grained sand.
52.0 - 61.0	SANDY GRAVEL	GP	Varicolored, gravel is rounded with angular shell fragments, sand is fine to coarse, subangular.
61.0 - 61.5	LIMESTONE	--	Medium gray to white (N 6 - N 9), hard, Walnut Formation.

TOTAL DEPTH OF BOREHOLE: 61.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-5

LITHOLOGIC LOG OF MONITOR WELL HM-91

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 1.0	CONCRETE	--	
1.0 - 3.5	CLAYEY SILT	CL	Dusky-grayish brown (5 YR 2.5/2) slightly damp, slightly cohesive.
3.5 - 9.0	SANDY CLAYEY SILT	ML	Light brown (5 YR 5/2), sticky, non-cohesive; some varicolored subangular 1/4-inch chert grains. At 6.5 feet, color change to (5 YR 5/6).
9.0 - 13.0	GRAVELLY AND SANDY, CLAYEY SILT	CL	Interbedded, light brown (5 YR 5/6), sticky; sand is very fine to coarse grained, gravel is subangular.
13.0 - 18.0	CLAYEY GRAVELLY SILT	CL	Light brown (5 YR 5/6), sticky; limestone gravel is subangular to subrounded; minor clay.
18.0 - 20.0	SANDY CLAYEY SILT	CL	Light brown (5 YR 5/6) sticky; sand is coarse and subangular.
20.0 - 30.0	SANDY SILT	ML	Light brown (5 YR 5/6) sticky; sand is fine to coarse subangular grains; clay interbeds.
30.0 - 50.0	SANDY CLAYEY SILT	CL	Interbedded light brown (5 YR 5/6) sticky, slightly cohesive; sand is very fine to fine grained. At 35.0-40.0 feet, not much retention in screen.
50.0 - 60.0	GRAVELLY SAND	GP	Varicolored, sand and gravel is fine to medium grained, angular to well rounded, gravel consists of limestone, quartz, and chert.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-5 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-91

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
60.0 - 62.0	FOSSILIFEROUS LIMESTONE	--	Light gray to dark gray, very well cemented, shell fragments (oysters).

TOTAL DEPTH OF BOREHOLE: 62 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-6

LITHOLOGIC LOG OF MONITOR WELL HM-92

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 2.0	GRASS, ROOTS AND FILL	--	
2.0 - 2.5	GRAVELLY FILL	--	
2.5 - 5.0	CLAY	CH	Gray black (N 2), damp, plastic, sticky; minor gravel, medium grained, subangular.
5.0 - 7.0	GRAVELLY CLAY	CL	Olive black (5 YR 2/I), wet, plastic; 10 percent gravel, fine to coarse, subangular.
7.0 - 15.0	CLAYEY SILT	ML	Light brown (5 YR 5/6) moderately cohesive, sticky; minor gravel, fine to coarse, subangular.
15.0 - 17.0	SILTY SAND	SM	Light brown (5 YR 5/6) moderately cohesive, sticky; sand is very fine grained.
17.0 - 20.0	CLAYEY SILT	ML	Light brown (5 YR 5/6) moderately cohesive, sticky, minor sand.
20.0 - 37.0	SANDY SILT	SM	Light brown (5 YR 5/6) cohesive moderately plastic, sticky; sand is very fine grained. At 25.0-28.0, gravel stingers. At 30.0-32.0, gravel stringers.
37.0 - 45.0	GRAVELLY SAND	GP	Light brown (5 YR 5/6) sand is fine to coarse grained; gravel is varicolored, fine to coarse grained, subangular to rounded.
45.0 - 58.0	SILTY CLAY	CL	Light brown (5 YR 5/6) very dense, cohesive, plastic, sticky.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-6 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-92

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
58.0 -61.75	SILTY SAND	SM	Varicolored, sand is fine to coarse grained, subangular; silt is light brown (5 YR 5/6) moderately cohesive.
61.75	FOSSILIFEROUS LIMESTONE	--	Light gray to dark gray very well cemented, shell fragments (oysters).

TOTAL DEPTH OF BOREHOLE: 61.75 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-7

LITHOLOGIC LOG OF MONITOR WELL HM-93

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 2.0	ASPHALT AND FILL	--	
2.0 - 5.0	SANDY SILTY CLAY	CL	Light brown (5 YR 5/6) sticky; slightly cohesive; sand is fine grained; minor gravel.
5.0 - 8.0	SANDY SILT	ML	Light brown (5 YR 5/6) slightly cohesive; sand is very fine grained.
8.0 - 16.0	GRAVEL	GP	Varicolored, fine to medium grained, subangular to rounded; clay is interbedded, grayish orange (10 YR 7/4).
16.0 - 33.0	SILTY SAND, SANDY SILT	SM	Grayish orange (10 YR 7/4) sand is very fine grained, slightly cohesive.
			At 22 feet, less sand.
33.0 - 37.0	SILTY CLAY	CL	Grayish orange (10 YR 7/4) moderately cohesive.
37.0	FOSSILIFEROUS LIMESTONE	--	Light to medium gray, very well cemented, shell fragments (oysters).

TOTAL DEPTH OF BOREHOLE: 37 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-8

LITHOLOGIC LOG OF MONITOR WELL HM-94

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0 - 7.0	SANDY CLAY	CL	Yellow brown (10 YR 5/4), clay is cohesive, plastic, sand is medium- to coarse-grained, subrounded, mainly white opaque grains.
7.0 - 19.0	SILTY CLAY/ CLAYEY SILT	CL/ML	Grayish orange (10 YR 7/4), cohesive, moderately plastic, soft.
19.0 - 26.5	SANDY GRAVELLY SILT	ML	Silt is gray orange (10 YR 7/4), cohesive, slightly plastic, fine-grained sand to very coarse gravel, poorly sorted, varicolored.
26.5 - 55.0	SILTY CLAY	CL	Light brown (5 6/4), cohesive, plastic, soft.
55.0 - 59.5	COBBLEY GRAVEL	GP	Varicolored, subrounded to rounded, gravel is fine- to medium-grained, cobble-size cuttings.
59.5 - 61.0	FOSSILIFEROUS LIMESTONE	--	Gray (N 8 to N 4), hard, brittle, very well cemented.
61.0 - 66.0	SANDY CLAY/ CLAYEY SAND	CL/SC	Gray (N 3), cohesive clay, slightly plastic, very fine-grained sand.
66.0 - 73.0	SILTY CLAY/ SHALE	CL	Gray (N 6), moderately plastic, hard, trace fine-grained sand.
73.0 - 79.0	SHALE/ SANDSTONE	--	Shale is same as above. Sandstone is pinkish gray (5 YR 8/1), fine-grained sand, poorly cemented, sandstone and shale interbedded, shale is predominant.
79.0 - 87.0	SANDSTONE	--	Pinkish gray (5 YR 8/1), fine-grained sand, poorly cemented, non-uniform cementation.
87.0 - 93.5	CLAY/SHALE	CL/CH	Medium light gray (N 6), plastic to highly plastic, some silt.

*Unified Soil Classification System ASTM D-2487

**Borehole grouted with neat cement from 59.0 feet to 121.0 feet bls

TABLE B-8 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-94

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
93.5 - 99.0	SANDSTONE/ CLAY	--	Very light gray (N 8), fine-grained sand with some clay, poorly cemented, frequent clay interbeds, same as 87.5 - 93.5.
99.0 - 121.0	CLAYEY SANDSTONE	--	Very light gray (N 8), fine-grained sand, poorly cemented.

TOTAL DEPTH OF BOREHOLE: 121.0 Feet

*Unified Soil Classification System ASTM D-2487

**Borehole grouted with neat cement from 59.0 feet to 121.0 feet bls

TABLE B-9

LITHOLOGIC LOG OF MONITOR WELL HM-95; SOIL BORING RSB-1

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 7.0	CLAY	CH	Reddish (5 YR 4/20 very cohesive, plastic.
7.0 - 20.0	SANDY SILTY CLAY	CL	Gray orange (10 YR 7/4) moderately cohesive, plastic; approximately 20 percent silt; sand is varicolored, very fine to very coarse grained.
20.0 - 26.0	CLAY	CH	Buff (10 YR 7/4) very plastic, very cohesive.
26.0 - 40.0	SANDY SILT-SILTY SAND	SM	Red brown (10 YR 5/4); silt is sand is fine to very fine grained; slightly cohesive, slightly plastic.
40.0 - 44.5	GRAVELLY SAND	GP	Varicolored, subrounded, medium to very coarse grained sand, medium grained gravel.
44.5 - 45.0	FOSSILIFEROUS LIMESTONE	--	Gray (N 4 to N 8) angular chips of shell fragments (Walnut Formation).

TOTAL DEPTH OF BOREHOLE: 45 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-10

LITHOLOGIC LOG OF MONITOR WELL HM-96; SOIL BORING RSB-7

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 4.0	CLAY WITH SAND	CL	Red brown (5 YR 4/2) dry, plastic, cohesive; less than 5 percent sand, coarse grained, subangular fragments.
4.0 - 6.0	SANDY GRAVEL	GP	Varicolored, coarse grained, subrounded.
6.0 - 32.0	SANDY CLAY	CL	Buff (10 YR 7/4) moderately plastic, cohesive; sand is varicolored, coarse grained, subangular, approximately 20 percent.
32.0 - 40.0	SILTY CLAY	CL	Red brown (5 YR 4/2) slightly cohesive, moderately plastic; some fine sand, less than 5 percent, very fine grained.
40.0 - 47.0	SILTY SAND	SM	Red brown (5 YR 4/2); sand is well rounded, medium to very coarse grained; silt is nonplastic, noncohesive.
47.0 - 52.5	GRAVEL	GP	Varicolored, subrounded grains, fine to very coarse grained.
52.5 - 54.0	FOSSILIFEROUS LIMESTONE	--	Gray (N 4 to N 8), brittle angular shell fragments (Walnut Formation).

TOTAL DEPTH OF BOREHOLE: 54 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-11

LITHOLOGIC LOG OF MONITOR WELL HM-97

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 7.0	TOP SOIL AND SANDY SILT	ML	Brown (10R 3/4), varicolored, angular grains, 35 percent sand, medium to very coarse; silt is nonplastic, noncohesive.
7.0 - 35.0	SILTY SANDY CLAY	CL	Gray orange (10 YR 7/4), moderately cohesive, moderately plastic.
35.0 - 43.0	CLAY	CH	Yellow brown (10 YR 5/4), very plastic, very cohesive.
43.0 - 47.0	GRAVELLY SAND	GP	Varicolored, well rounded, medium to very coarse grained.
47.0 - 51.0	GRAVEL	GP	Varicolored, well rounded, fine to very coarse grained.
51.0 - 51.5	FOSSILIFEROUS LIMESTONE	--	Gray (N 7 to N 3) brittle angular shell fragments (Walnut Formation).
51.5 - 71.0	CLAYEY SAND	SC	Gray (N 7) very fine grained, slightly cohesive, nonplastic.
71.0 - 76.0	SANDY CLAY	CL	Gray (N 5 to N 4) moderately cohesive, slightly plastic; approximately 10 percent very fine sand.
76.0 -76.25	SANDSTONE	SW	Light gray (N 8) very well cemented, very fine grained, hard, brittle.
76.25 -80.0	CLAYEY SANDSTONE	SC	Gray (N 7) very fine grained, well rounded, approximately 70 percent sand.

TOTAL DEPTH OF BOREHOLE: 80 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-12

LITHOLOGIC LOG OF MONITOR WELL HM-98; SOIL BORING RSB-16

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.0	CLAYEY SILT	ML	Moderate brown (5 YR 3/4), slightly cohesive, dry.
1.0 - 6.5	SILTY CLAY	CL	Dusky brown (5 YR 2/2), cohesive, moderately plastic, dry.
			At 3.5-4.0 feet, color change to moderate brown (5 YR 4/4).
6.5 - 14.0	CLAYEY SILT	ML	Moderate brown (5 YR 4/4), slightly cohesive, nonplastic, dry.
			At 9.0-14.0 feet, color change to dark yellowish orange (10 YR 6/6), less clay.
14.0 - 19.0	SANDY GRAVEL	GM	Dark yellowish orange (10 YR 6/6), gravel is varicolored, fine- to coarse-grained, angular to subrounded; sand is fine to coarse; dry.
19.0 - 25.0	SANDY SILT	SM	Dark yellowish orange (10 YR 6/6) with whitish streaking, silt is moderately cohesive; sand is fine-grained; dry to 23.0 feet.
			At 23.0 feet, color change to very pale orange (10 YR 8/2), moist.
25.0 - 31.0	SILTY GRAVELLY SAND	GM	Varicolored, sand and gravel are fine- to coarse-grained, subangular to subrounded grains.
			At 28.75 feet, saturated, more fine sand and silt, less gravel.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-12 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-98; SOIL BORING RSB-16

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
31.0 - 31.5	DENSE LIMESTONE	--	Tan, no fossils, dry.

TOTAL DEPTH OF BOREHOLE: 97 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-13

LITHOLOGIC LOG OF MONITOR WELL HM-99; SOIL BORING RSB-18

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 5.0	CLAYEY SILT	ML	Moderate brown to dusky yellowish brown (5 YR 3/4 to 10 YR 2/2), moderately cohesive, nonplastic, moist.
5.0 - 9.0	SILT	MH	Light brown to moderate yellowish brown (5 YR 5/6 to 10 YR 5/4), slightly cohesive, nonplastic; some fine- to coarse-grained whitish limestone gravel and sand as stringers; some clay; moist.
9.0 - 11.0	GRAVELLY SILT	GM	Light brown to moderate yellowish brown (5 YR 5/6 to 10 YR 5/4), noncohesive; gravel is medium- to coarse-grained, subangular to subrounded.
11.0 - 27.0	CLAYEY SILT	ML	Light brown to moderate yellowish brown (5 YR 5/6 to 10 YR 5/4), slightly cohesive, nonplastic; moist. At 25.0 feet, TIP reading was 10-40 ppm. At 25.0-27.0 feet, whitish caliche, friable.
27.0 - 38.5	SANDY SILT-SILTY SAND	SM	Light brown (5 YR 5/6), slightly cohesive, sand is fine-grained. At 30.0 feet, TIP reading was 7.5 ppm. At 33.0 feet, saturated. At 35.0 feet, TIP reading was 15-20 ppm.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-13 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-99; SOIL BORING RSB-18

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
38.5 - 44.0	SANDY GRAVEL	SP	Varicolored, sand and gravel are fine to coarse, some oyster fossils in gravel, loose; trace limestone and very well cemented, coarse-grained sandstone, angular to subangular.
44.0	DENSE LIMESTONE	--	Auger refusal, no cuttings obtained in core.

TOTAL DEPTH OF BOREHOLE: 44.0 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

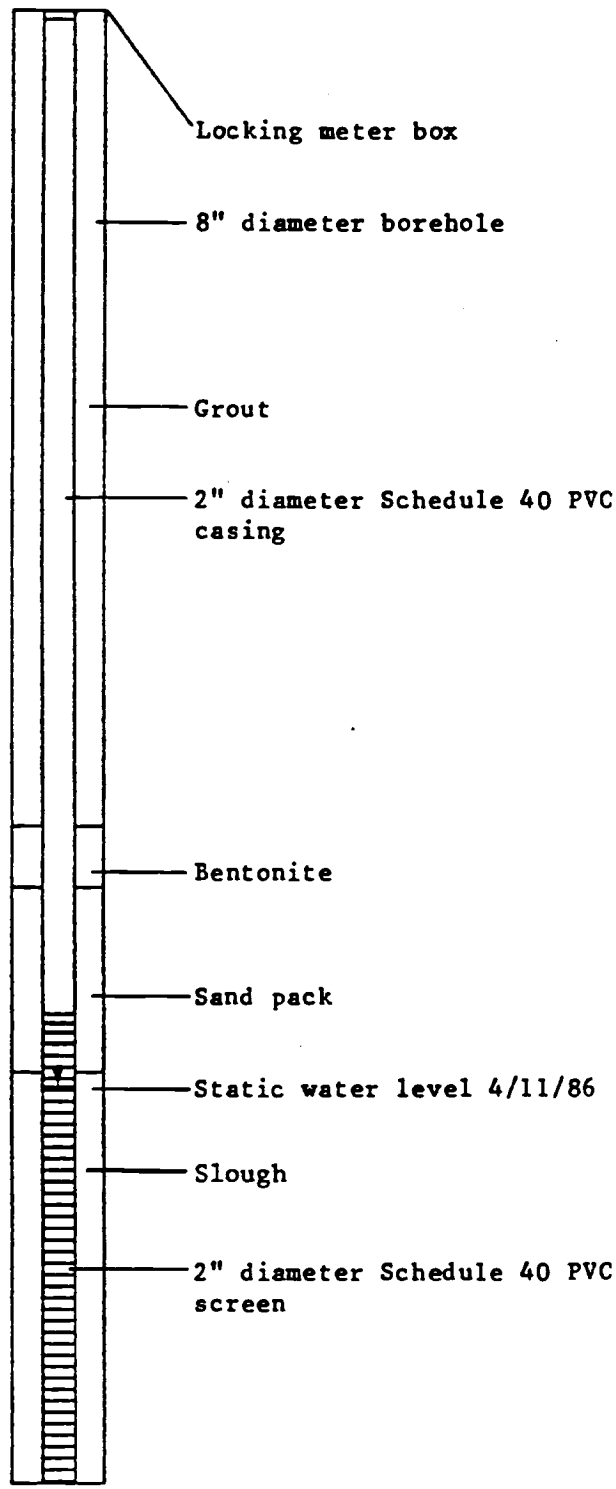
232173

Boring or Well No. HM-100 Project Air Force Plant 4 IRP

Location Former Fuel Storage Area Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
Clay and Gravel		0, 5
Sand and Gravel		10, 15
Silt and Sand		20
	Upper Alluvium	25
Silt, Sand and Minor Gravel		30, 35
Sand and Gravel		40, 45, 50

Well Construction Diagram



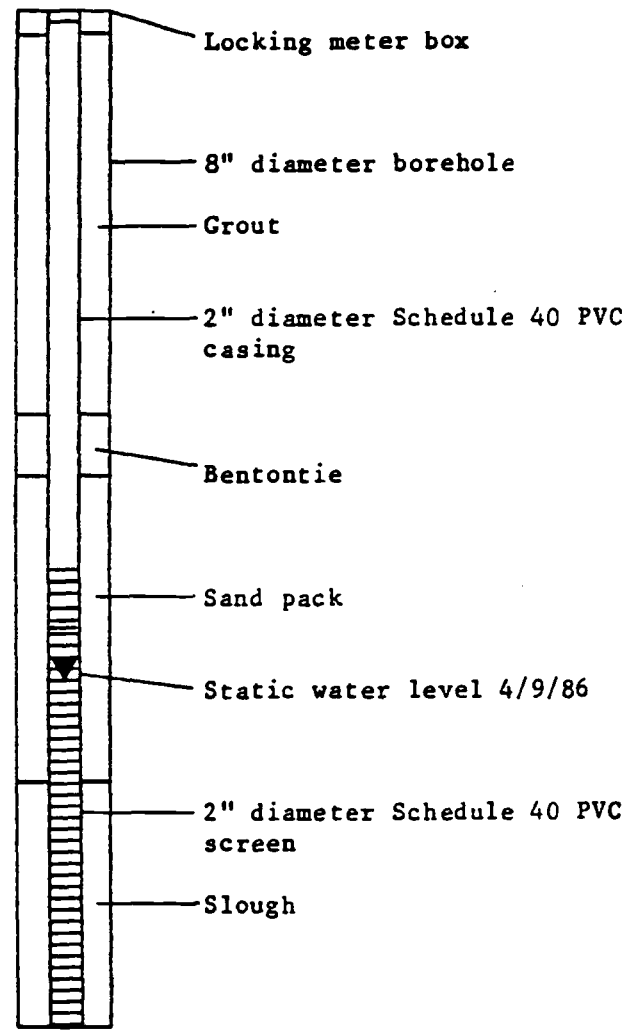
RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-101 Project Air Force Plant 4 IRP
Location FDTA No.3 Area Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
		0
Silt and Sand		5
		10
Sand	Upper Alluvium	15
		20
Sand and Gravel		25
		30
Lime-stone	Walnut Formation	
		35
		40
		45
		50

Well Construction Diagram



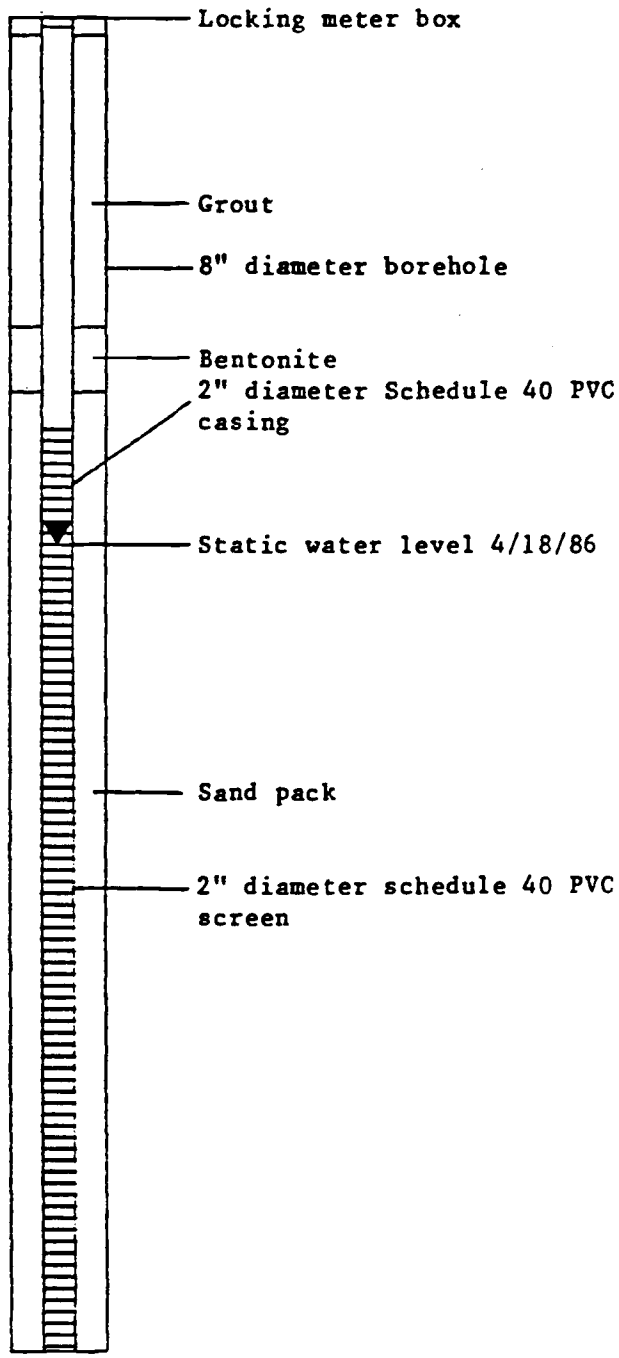
RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-102 Project Air Force Plant 4 IRP
Location Landfill No.2 Area Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
Clay and Gravel	Upper Alluvium	0
		5
Sand		
Lime-stone		10
		15
		20
	Goodland Formation	
Shale		25
		30
		35
		40
Lime-stone	Walnut Formation	
		45
		50

Well Construction Diagram



RADIAN CORPORATION

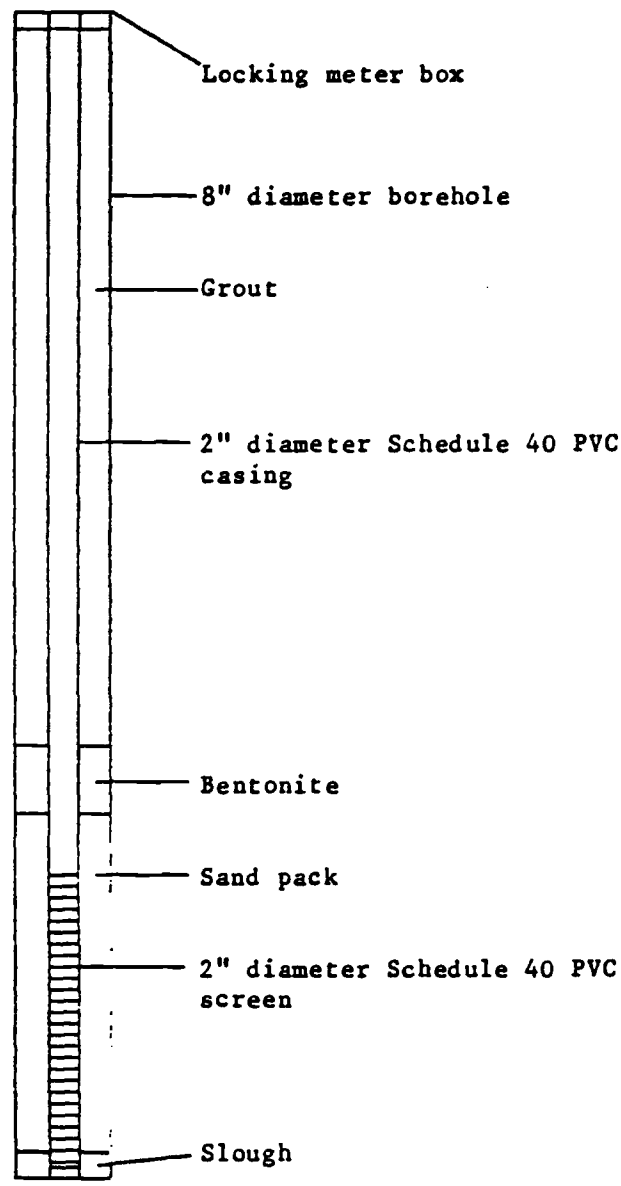
MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-103 Project Air Force Plant 4 IRP

Location NE Corner/Bldg. 188 Chrome Pit 1 Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
Sand and Silt		0
		5
		10
Clayey Silt	Upper Alluvium	15
		20
		25
Silt		30
		35
Shale	Goodland Formation	40
		45
		50

Well Construction Diagram



RADIAN CORPORATION

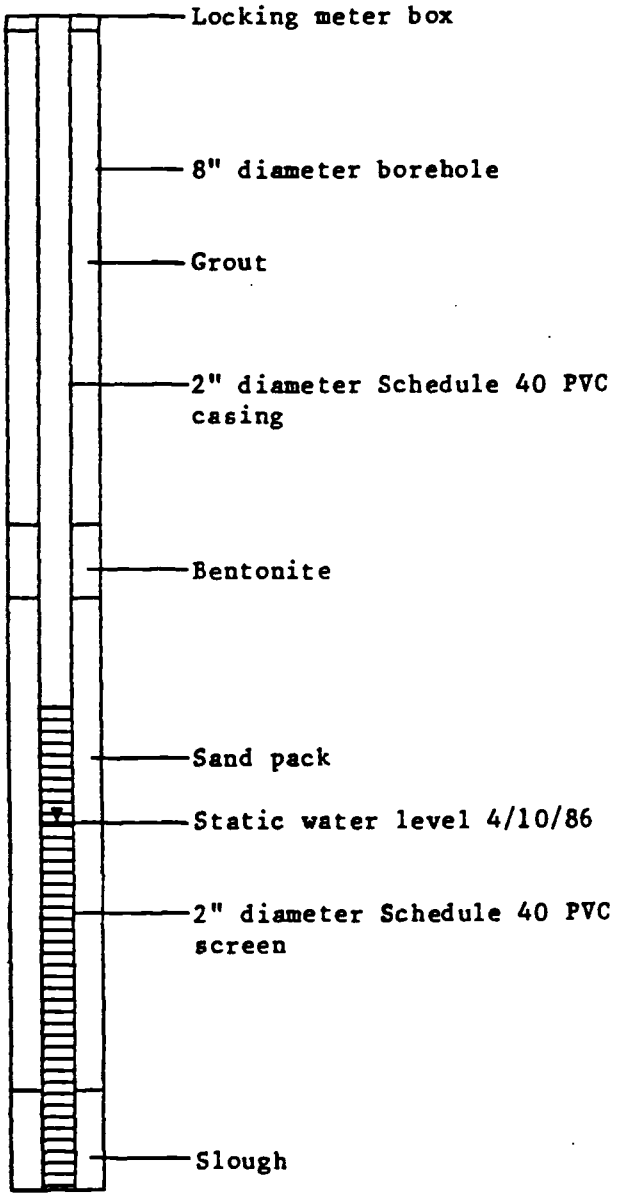
MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-104 Project Air Force Plant 4 IRP

Location SW Corner of Bldg. 188 Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
		0
Clayey Silt	Upper Alluvium	5
		10
Clay		15
		20
	Goodland Formation	25
Shale		30
		35
Lime-stone	Walnut Formation	40
		45
		50

Well Construction Diagram



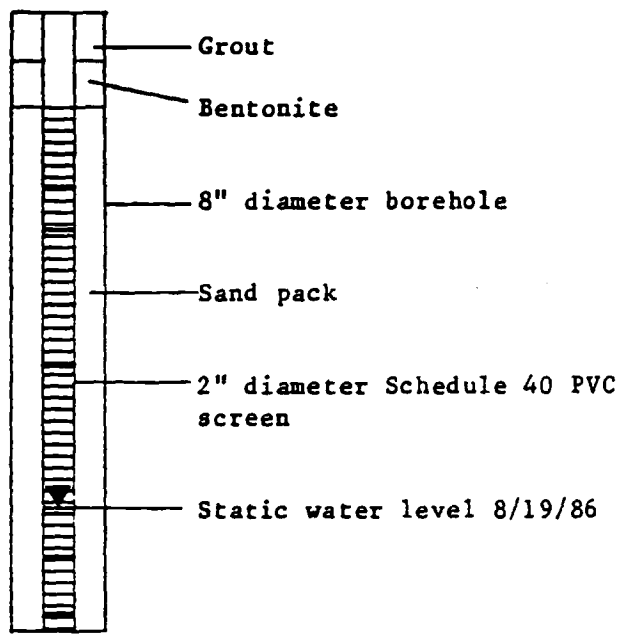
RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-105 Project Air Force Plant 4 IRP
Location Bldg. 21, Fuel Test Area Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
----------		0
Clay	Alluvium	5
Clay	---------	10
	Goodland Formation	15
		20
		25
		30
		35
		40
		45
		50

Well Construction Diagram



RADIAN CORPORATION

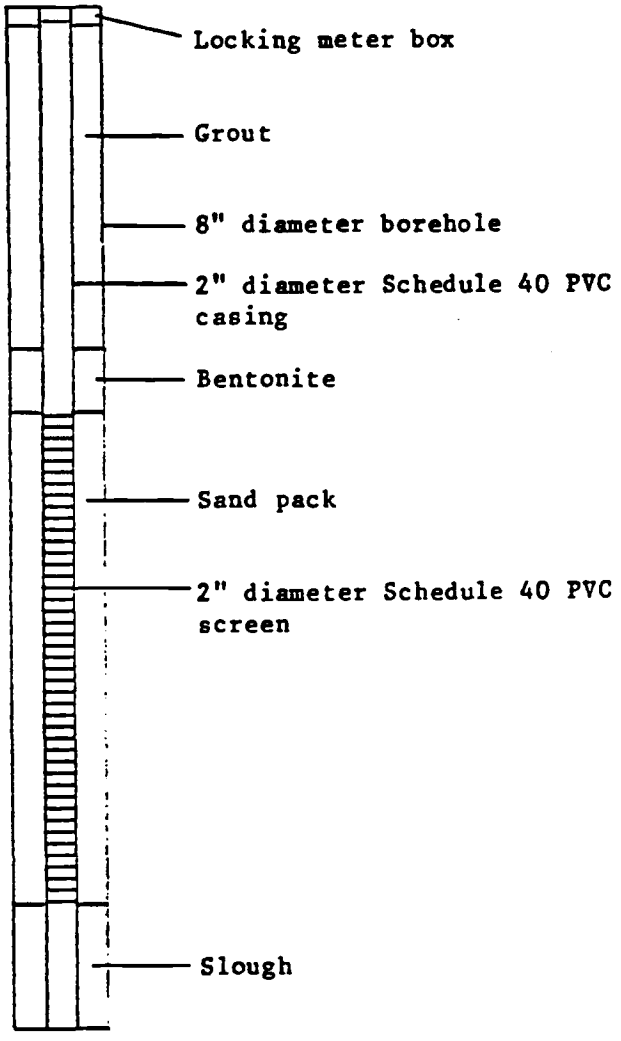
MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-106 Project Air Force Plant 4 IRP

Location NW Corner of Solvent Line Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
Silt and Sand	Alluvium	0, 5, 10
Clay and Shale		15, 20
Shale and Lime-stone	Goodland Formation	25
Lime-stone	Walnut Formation	30, 35, 40, 45, 50

Well Construction Diagram



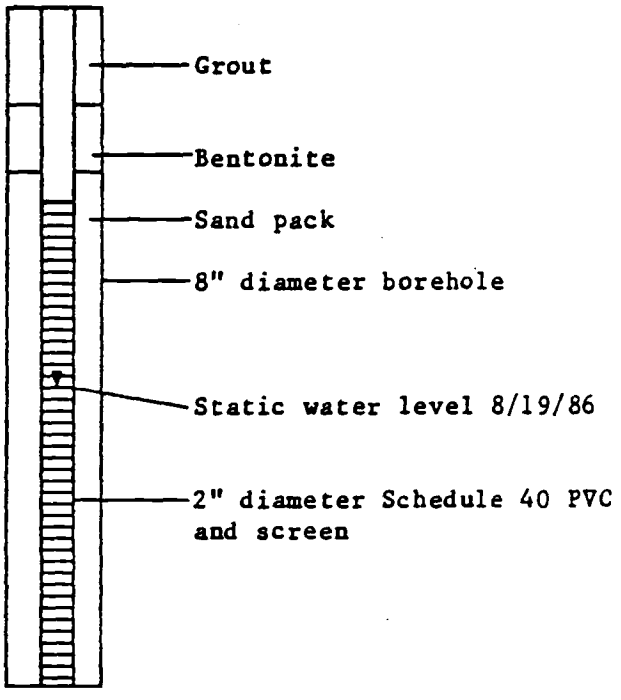
RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-107 Project Air Force Plant 4 IRP
Location Bldg. 21, Fuel Test Area Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
		0
		5
Sand		
Clay	Alluvium	10
		15
Silt and Gravel		
		20
	Walnut Formation @ TD	25
		30
		35
		40
		45
		50

Well Construction Diagram



RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. HM-108 Project Air Force Plant 4 IRP

Location Bldg. 21, Fuel Test Area Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
		0
Clayey Sand and Gravel		5
Clay	Alluvium	10
		15
	Walnut Formation @ TD	20
		25
		30
		35
		40
		45
		50

Well Construction Diagram

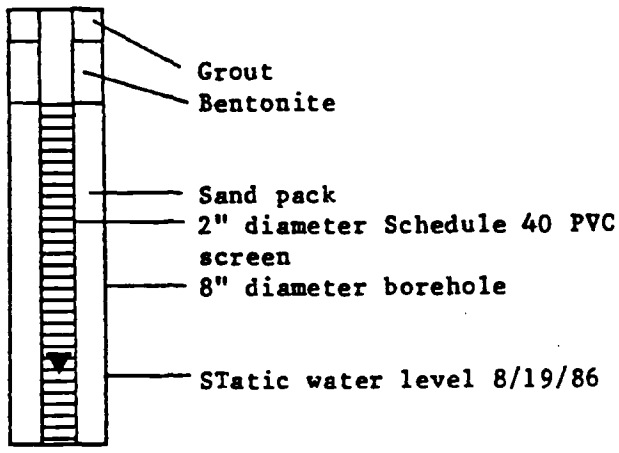


TABLE B-14

LITHOLOGIC LOG OF MONITOR WELL HM-110

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 4.0	GRAVELLY SILTY CLAY	CL	Brown (5 YR 6/4), very slightly damp, 60 percent clay, 30 percent silt, 10 percent gravel, moderately cohesive, moderately plastic; gravel is of angular, medium grained, whitish.
4.0 - 20.0	CLAYEY SILT	ML	Light brown (5 YR 6/4), moderately cohesive, slightly plastic.
20.0 - 28.5	CLAYEY GRAVELLY SAND	SP	Light brown (5 YR 5/6), damp; sand is medium to coarse, subangular; gravel is fine to medium grained, subangular; clay is moderately plastic, cohesive. 50 percent sand, 40 percent gravel, 10 percent clay 60 percent gravel from 25 to 28.5 saturated at 29 feet below land surface.
28.5 - 32.5	SILTY SAND	SM	Light brown (5 YR 5/6), saturated; sand is fine to very fine grained, well rounded.
32.5 - 34.0	SILTY CLAY	CL	Moderately brown (5 YR 4/4), very cohesive, plastic, hard.
34.0 - 37.0	FOSSILIFEROUS LIMESTONE	--	Gray (N 4 to N 7), from 34 to 35 limestone is well weathered, competent at 35 feet bls, brittle angular shell fragments with iron stain (oxidation).

TOTAL DEPTH OF BOREHOLE: 37 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-15

LITHOLOGIC LOG OF MONITOR WELL HM-111; SOIL BORING RSB-24

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 3.0	SILTY CLAY	CL	Moderate brown (5 YR 4/4), moderately cohesive, nonplastic, moist.
3.0 - 5.0	SILT	MH	Grayish orange (10 YR 7/4), noncohesive, friable; minor gravel and caliche, gravel is subangular to rounded, fine- to medium-grained, varicolored, limestone; moist.
5.0 - 15.0	SANDY SILTY GRAVEL	GM	Varicolored gravel, fine- to coarse-grained, angular to well-rounded; silt is noncohesive; sand is fine-grained; silt and sand vary in color from pinkish gray to light brown (5 YR 8/1 to 5 YR 6/4). At 13.0-13.5 feet, pure fine sand.
15.0 - 28.0	CLAYEY SILT	ML	Light brown (5 YR 5/6), slightly cohesive, nonplastic; trace gravel, subangular to rounded; moist.
28.0 - 43.0	SANDY SILT	SM	Light brown (5 YR 5/6), slightly cohesive, nonplastic; trace gravel, subangular to rounded; moist. At 30.0 feet, TIP reading was 50-60 ppm. At 32.0 feet, saturated. At 35.0 feet, TIP reading was 5-6 ppm.
43.0 - 49.0	SILTY SANDY GRAVEL	GM	Varicolored, loose, fine- to coarse-grained; silt is light brown (5 YR 5/6), slightly cohesive.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-15 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-111; SOIL BORING RSB-24

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
49.0 - 53.0	FOSSILIFEROUS LIMESTONE	--	Medium bluish gray to light bluish bray (5 B 5/1 to 5 B 7/1), dense; oyster fossils. At 49.0-49.5 feet, limestone is weathered and oxidized. At 53.0 feet, bluish gray (5 B 5/1) clay on auger bit teeth.

TOTAL DEPTH OF BOREHOLE: 53 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-16

LITHOLOGIC LOG OF MONITOR WELL HM-112; SOIL BORING RSB-25

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 25.0	GRAVELLY SILTY CLAY	CL	Light brown (5 YR 6/4), slightly plastic, moderately cohesive; gravel is subrounded, fine to medium grained whitish, matrix is very slightly damp.
25.0 - 27.0	GRAVEL	GP	Varicolored, medium to very coarse grained, subangular to subrounded, dry.
27.0 - 45.0	SILTY SAND - SANDY SILT	SM	Light brown (5 YR 5/6), very slightly cohesive, very slightly plastic, saturated; sand is very fine to fine grained, well rounded.
45.0 - 50.5	SANDY GRAVEL	GP	Varicolored, subrounded; sand is medium to very coarse grained, subrounded to subangular; gravel is fine to coarse grained, subangular to subrounded.
50.5 -50.75	FOSSILIFEROUS LIMESTONE	--	(N 4 to N 6), abundant shell fragments, hard.

TOTAL DEPTH OF BOREHOLE: 50.75 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-17

LITHOLOGIC LOG OF MONITOR WELL HM-113; SOIL BORING RSB-29

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 30.0	SILTY CLAY, CLAYEY SILT	CL/ML	Light brown to medium brown (5 YR 5/6 to 5 YR 4/4), moderately cohesive, nonplastic, moist.
30.0 - 47.0	SILTY SAND	SM	Light brown (5 YR 5/6), sand is very fine-grained; silt is slightly cohesive; saturated.
47.0 - 49.0	GRAVELLY SAND	GP	No recovery from core barrel.
			At 49.0 feet, auger refusal.

TOTAL DEPTH OF BOREHOLE: 49 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-18

LITHOLOGIC LOG OF MONITOR WELL HM-114

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 7.0	SILTY CLAY	CL	Dark reddish brown (5 YR 3/2), moderately cohesive, moderately plastic, some white friable calcareous nodules, trace angular fine-grained gravel; dry. At 5.0 to 6.0 feet, SPT indicates same material, dark reddish gray (5 YR 4/2).
7.0 - 12.0	CLAYEY SILT	ML	Reddish yellow (7.5 YR 7/8), moderately cohesive, slightly plastic; some gravel, fine to coarse grained, angular to subrounded, manganese oxide staining; dry. At 10.0 to 11.0 feet, SPT verifies.
13.0 - 25.0	SAND	SP	Yellow (10 YR 7/8), very fine-grained, soft; trace silt. At 15 to 16 feet, SPT zero percent recovery. At 20 to 21 feet, ten percent recovery; sand is a little coarser but still fine; slightly moist.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-16 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-114

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
25.0 - 36.5	GRAVELLY SAND	SW	Reddish yellow (7.5 YR 7/8), medium to coarse, angular to well rounded; gravel is varicolored, fine, angular to well rounded. At 30 to 31 feet, no return from SPT. At 36.5 feet, auger refusal.

TOTAL DEPTH OF BOREHOLE: 36.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-19

LITHOLOGIC LOG OF MONITOR WELL HM-115

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	—	
0.5 - 7.0	CLAYEY SILT/ SILTY CLAY	ML/CL	Dark yellowish brown (10 YR 3/4), moderately cohesive, moderately plastic, trace fine-grained friable calcareous nodules; moist.
7.0 - 10.0	GRAVELLY CLAYEY SILT	GC	Yellow (10 YR 7/8), brittle, noncohesive; gravel is 10-20 percent, fine- to medium-grained, subangular weathered limestone.
10.0 - 14.0	CLAYEY SILT	ML	Yellow (10 YR 7/8), noncohesive.
			At 14 feet, trace sand.
14.0 - 16.0	CLAYEY GRAVELLY SILT	GC	Same as 7.0 to 10.0 feet, more gravel.
			At 15.5 to 16 feet, color change to light gray (10 YR 7/2), no gravel.
16.0 - 20.0	SILTY SAND	SM	Brown (7.5 5/4) to yellowish red (5 YR 5/8), very fine to fine, well sorted, soft, clean.
			At 17 feet, saturated.
20.0 - 24.0	SANDY GRAVEL	GP	Varicolored, fine- to coarse-grained; wet.
24.0 - 27.0	LIMEY CLAY	CL	Gray (5 YR 6/1), weathered, oxidized; moist.
27.0	LIMESTONE	---	Light gray (5 YR 7/1) to white (5 YR 8/1), hard, dense, dry.

TOTAL DEPTH OF BOREHOLE: 27.0 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-20

LITHOLOGIC LOG OF MONITOR WELL HM-116

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 4.0	CLAYEY SILT	ML	Yellowish brown (10 YR 5/8), moderately cohesive, moderately plastic; trace limey gravel, some pieces are friable, some are fine grained, angular to subrounded; moist.
4.0 - 6.0	LIMEY SILT	ML	White to light brown (N 8 to 7.5 YR 6/4), loose, brittle; weakly cemented, reactive with HCl; moist.
6.0 - 20.0	LIMEY CLAY	CL	White (N 8), brittle, friable to firm, noncohesive; moist. At 6.0 to 9.5 feet, some fine- to coarse-weathered limestone gravel, white to gray (N 8 to N 6), angular to subrounded. At 9.5 feet, reddish yellow (7.5 YR 6/6), no gravel, weathered.
20.0 - 31.5	SILTY SAND/ SANDY SILT	SM	Reddish yellow (7.5 YR 7/8), sand is very fine grained; silt is slightly cohesive; moist to damp. At 24 feet, some clay, more cohesive. At 28 feet, saturated.
31.5 - 32.0	SANDY GRAVEL	GP	Varicolored, gravel is fine- to coarse-grained, subangular to well rounded weathered limestone and chert; sand is varicolored, fine- to coarse-grained, subangular to well rounded; wet.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-20 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-116

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
32.0 - 33.0	LIMESTONE	---	Light gray (N 7), top 1 inch is weathered with hydrocarbon odor; bottom is hard; dry. At 33 feet, auger refusal.

TOTAL DEPTH OF BOREHOLE: 33.0 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-21

LITHOLOGIC LOG OF MONITOR WELL HM-117

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	ASPHALT AND FILL	---	
0.5 - 9.0	GRAVELLY SILTY CLAY	GM-GC	Reddish yellow (7.5 to 6/6), clay is moderately cohesive, moderately plastic; gravel is weathered limestone, five percent, fine- to medium-grained; some thin, soft, friable caliche zones; moist.
9.0 - 24.0	CLAYEY SILT	ML	Same as 0.5-9.0 feet but less cohesive. At 23.0-25.5 feet, caliche layer.
24.0 - 26.0	SILT	ML	Same as 9.0-24.0 feet, trace clay; very damp.
26.0 - 36.0	SILTY SAND/ SANDY SILT	SM	Yellowish red (5 YR 5/6), sand is fine-grained, well sorted; silt is slightly cohesive, soft; wet.
36.0 - 39.5	GRAVELLY SAND	GM	Varicolored, sand is fine to very coarse, subangular to well rounded, poorly sorted; gravel is fine to coarse, angular to well rounded grains of limestone, chert, and shell fragments, poorly sorted.
39.5	FOSSILIFEROUS LIMESTONE	---	Gray (N 5 to N 7), fossils consist of oyster shells.

TOTAL DEPTH OF BOREHOLE: 39.5 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-22

LITHOLOGIC LOG OF MONITOR WELL HM-118

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 10.0	CLAYEY SILT	ML	Yellowish red (5 YR 5/8), moderately cohesive, moderately plastic, some interbedded loose caliche; moist. At 5.0 to 9.0 feet, noncohesive, brittle and friable; slightly moist. At 9.5 to 10.0 feet, limey clay, gray (N 7), moderately cohesive, moderately plastic.
10.0 - 13.5	SILT	ML	Reddish yellow (7.5 7/6), soft, noncohesive, slightly moist.
13.5 - 14.0	CLAYEY SILT	ML	Reddish yellow (7.5 7/6), firm, noncohesive; vertical seams of limey clay; slightly moist.
14.0 - 18.0	SILT	ML	Same as 10.0 to 13.5 feet but damp.
18.0 - 27.0	SAND	SP	Yellowish red (5 YR 5/8), fine-grained, soft, clean, well sorted. At 19 feet, saturated. At 24.0-25.0 feet, very fine-grained with small (0.01'-0.03) well cemented sandstone concretions. At 25.0-27.0 feet, fine-grained with some larger (up to 0.15') well sandstone concretions, and coarse-grained subangular to subrounded limestone gravel; trace oyster shells.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

HARGIS + ASSOCIATES, INC.

TABLE B-22 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-118

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
27.0	LIMESTONE	---	Light gray (N 8), dense, hard; dry.

TOTAL DEPTH OF BOREHOLE: 27 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

HARGIS + ASSOCIATES, INC.

TABLE B-23

LITHOLOGIC LOG OF MONITOR WELL HM-119

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 1.5	CLAYEY SILT	ML	Yellowish red (5 YR 5/6), moderately cohesive, moderately plastic; trace loose caliche; moist.
1.5 - 4.0	SILTY CLAY	CL	Dark reddish brown (5 YR 3/2), moderately cohesive, moderately plastic; moist.
4.0 - 6.0	SILT	ML	Dark reddish gray (5 YR 4/2), to reddish brown (5 YR 5/3), soft, some firm to friable lenses; dry.
6.0 - 9.0	SILTY GRAVELLY SAND	GM	Yellowish red to reddish brown (5 YR 5/6 to 5 YR 4/3); slightly moist.
9.0 - 14.0	SILTY SAND/ SANDY SILT	SM	Reddish yellow (5 YR 6/8), to white (10 YR 8/2), slightly cohesive, firm to friable; slightly moist.
14.0 - 26.0	SAND	SP	Very pale brown (10 YR 8/4), very fine- to fine-grained, soft, well sorted. At 17.0 feet, saturated. At 19.0-24.0 feet, no recovery from core sampler.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

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TABLE B-23 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-119

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
26.0 - 32.0	SANDY GRAVEL WITH COBBLES	GM	Varicolored, fine to coarse, angular to subrounded, predominantly limestone and chert; sand is same material, fine to coarse, angular to subrounded; cobbles up to 2.5 inches, angular to subangular. At 29.0-32.0 feet, no recovery from core sampler. At 32 feet, auger refusal.

TOTAL DEPTH OF BOREHOLE: 32 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-24

LITHOLOGIC LOG OF MONITOR WELL HM-120

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 3.0	SILTY SAND/ SANDY SILT	SM	Yellowish red (5 YR 5/8), slightly cohesive; sand is very fine- to fine-grained; slightly moist. At 2.5 to 3.0 feet, more sand, dark gray (5 YR 4/1).
3.0 - 9.0	CLAYEY SAND	SC	Light olive gray (5 Y 6/2); sand is very fine to fine; clay is moderately cohesive and plastic; slightly moist. At 8.5 to 9.0 feet, trace clay.
9.0 - 11.5	GRAVELLY SAND/ SANDY GRAVEL	GP	Yellowish red (5 YR 5/6), sand is fine to coarse, angular to subangular, predominantly quartz; gravel is varicolored, fine- to medium-grained, angular to well rounded; saturated. At 10.5-11.5 feet, more gravel.
11.5 - 14.0	LIMEY CLAY	CL	Light gray (10 YR 7/1), dense, firm, blocky; dry. At 11.5 feet, thin layer of hard limestone; dry.
14.0 - 19.0	LIMEY CLAY	CL	Light gray (10 YR 7/1), sticky, very cohesive, slightly plastic; wet. At 15.0-15.5 feet, some sand; saturated. At 15.5-19.0 feet, more dense limey clay; moist.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

HARGIS + ASSOCIATES, INC.

TABLE B-24 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-120

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
19.0 - 20.0	LIMESTONE	---	Light gray (N 7 to N 8), dense, hard; some thin interbedded moist clay stringers. At 20.0 feet, rock flour on auger teeth; dry.

TOTAL DEPTH OF BOREHOLE: 20 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

HARGIS + ASSOCIATES, INC.

TABLE B-25

LITHOLOGIC LOG OF MONITOR WELL HM-121

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 3.0	SILTY CLAY	CL	Dark brown (7.5 YR 4/2), moderately cohesive, moderately plastic; some fine-grained weathered limestone gravel; moist.
3.0 - 11.0	SILTY CLAY/ CLAYEY SILT	CL	Reddish yellow (7/5 YR 6/8), slightly cohesive, nonplastic, weathered; some white caliche zones, loose to friable; slightly moist. At 6.0-9.0 feet, clayey silt.
11.0 - 16.5	SILT	MH	Reddish yellow (7/5 YR 6/8), soft, loose, noncohesive; slightly moist. At 11.5-12.0 feet, some clay.
16.5 - 24.0	SAND	SP	Yellow (10 YR 7/6), very fine- to fine-grained, well sorted. At 20 feet, saturated. At 22 feet, trace gravel, fine- to medium-grained, subrounded limestone; sand gradational to coarser grains. At 22.0-24.0 feet, no recovery.
24.0 - 30.0	GRAVELLY SAND	SP	Varicolored, sand is fine to coarse, subrounded to rounded grains; gravel is fine to very coarse, subangular to subrounded; ten percent, well sorted; trace subangular weathered limestone cobbles. At 20 feet, OVA reading of 250 ppm above background.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-25 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-121

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
30.0 - 31.5	SANDY GRAVEL	GW	Varicolored, gravel is poorly sorted, fine- to coarse-grained, subangular to well rounded weathered limestone, oyster shells, and chert; sand has same characteristics; trace subrounded limestone cobbles; wet. At 31.5 feet, auger refusal, plug of well cemented sand and gravel, hard, reactive with HCl; no visible limestone; dry.

TOTAL DEPTH OF BOREHOLE: 31.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-26

LITHOLOGIC LOG OF MONITOR WELL HM-122

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 5.0	SILTY CLAY	CL	Dark brown, moderately cohesive, moderately plastic; some loose to friable caliche nodules; slightly moist. At 4.5-5.0 feet, silty sand, lightly cemented, friable; dry.
5.0 - 15.0	GRAVELLY SILTY CLAY/GRAVELLY CLAYEY SILT	GC/GM	Dark brown, slightly cohesive, slightly plastic; gravel is varicolored, fine- to coarse-grained, angular to subrounded limestone and caliche; trace cobbles; slightly moist.
15.0 - 20.0	GRAVELLY LIMEY CLAY	GC	Greenish gray, moderately cohesive; gravel is fine- to medium-grained. At 16.0-16.5 feet, dark brown silty clay; no gravel. At 18.5 feet, 2-inch light gray limestone layer, hard.
20.0 - 24.0	SILTY CLAY	CL	Dark brown, moderately cohesive, moderately plastic; some gravel, fine- to medium-grained, angular to subangular limestone; slightly moist. At 24 feet, wet.
24.0 - 28.5	LIMEY GRAVEL	GC	Greenish gray, fine to ??? cobble size, angular to subrounded weathered limestone; nonvisible fossils; limey clay matrix, moderately cohesive, sticky.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-26 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-122

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
28.5	LIMESTONE	---	Greenish gray, hard, no visible fossils.

TOTAL DEPTH OF BOREHOLE: 28.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-27

LITHOLOGIC LOG OF MONITOR WELL HM-123

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 3.5	SILTY CLAY	CL	Dark brown, moderately cohesive, moderately plastic, sticky, firm; moist. At 2.0 feet, thin gravelly zone with cobbles. At 3.0 feet, thin gravelly zone with cobbles.
3.5 - 13.5	CLAYEY SILT	ML	Light reddish brown, moderately cohesive, slightly plastic; some weathered limestone gravel, fine- to coarse-grained, angular to subrounded. At 6.0 feet, thin gravelly zone, fine- to coarse-grained weathered limestone. At 8.5-13.5 feet, color change to dark brown, slightly cohesive, slightly plastic; trace chert and limestone gravel.
13.5 - 20.0	CLAYEY SANDY GRAVEL WITH COBBLES	GL	Tan, gravel is fine- to coarse-grained weathered limestone, angular to subrounded; sand is fine- to coarse-grained, poorly sorted; clay is slightly sticky; numerous cobbles of weathered limestone; slightly moist.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-27 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-123

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
20.0 - 35.0	SAND		Light reddish brown, very fine-grained, soft, clean; trace silt; slightly moist. At 23.5-24.5 feet, silty sand, slightly moist. At 29.0-35.0 feet, sand is gradational to coarse-grained, poorly sorted; trace gravel, fine- to medium-grained; saturated.
35.0 - 40.5	SANDY GRAVEL		Varicolored, fine- to coarse-grained, angular to well rounded chert, limestone and fossils; some coarse sand zones. At 40.5, auger refusal, no returns.

TOTAL DEPTH OF BOREHOLE: 40.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-28

LITHOLOGIC LOG OF MONITOR WELL HM-124

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 7.0	SILTY CLAY	CL	Dark brown, moderately cohesive, slightly plastic, firm; slightly moist.
7.0 - 14.0	CLAYEY SILT	ML	Tan, slightly cohesive, nonplastic; some fine-grained, gravel consisting of angular weathered limestone; slightly moist.
14.0 - 19.0	SANDY SILTY GRAVEL	GM	Varicolored, gravel consists of medium to very coarse weathered limestone, noncohesive, loose, lightly cemented; dry.
19.0 - 23.5	LIMEY CLAY	CL	Light gray, firm, blocky; slightly moist.
23.5 - 25.0	Limestone	---	Light gray, hard, dry.
			At 24.0-25.0 feet, dark gray limey shale.

TOTAL DEPTH OF BOREHOLE: 25 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-29

LITHOLOGIC LOG OF MONITOR WELL HM-125

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0-0.5	GRASS AND TOPSOIL	---	
0.5-18.0	SILTY CLAY/ CLAYEY SILT	CL/ML	Tan, moderately cohesive, moderately plastic; trace fine angular limestone gravel; slightly moist. At 2.0-3.0 feet, fine to medium limestone gravel, 30 percent. At 10.0-18.0 feet, interbedded light gray limey clay.
18.0-19.0	CLAYEY SILT	ML	Tan to orange, slightly cohesive, slightly plastic; trace fine-grained sand; slightly moist.
19.0-25.0	SAND	SP	Tan, very fine- to fine-grained, well sorted, soft; trace silt; slightly moist. At 22 feet, saturated.
25.0-27.0	GRAVELLY SAND	GW	Sand is tan to orange, fine- to coarse-grained, angular, poorly sorted; gravel is varicolored, fine- to coarse-grained consisting of limestone, oyster shell fossils and chert, subangular to well rounded; wet.
27.0-33.0	LIMEY CLAY	CL	Light gray, firm, blocky, highly weathered; some orange oxidation staining; slightly moist.
33.0	CLAYEY SHALE	---	Blue gray, firm, dry.

TOTAL DEPTH OF BOREHOLE: 33.0 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-30

LITHOLOGIC LOG OF MONITOR WELL HM-126

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 4.5	SILTY CLAY	CL	Dark brown (7.5 YR 3/2), moderately cohesive, slightly plastic, sticky; some medium-grained subrounded limestone; some fine-grained friable caliche nodule.
4.5 - 9.0	CLAYEY SILT	ML	Very dark brown (10 YR 3/2), slightly cohesive, nonplastic; trace fine-grained chert gravel; slightly moist.
9.0 - 17.0	CLAYEY GRAVELLY SILT	GC-GM	Brownish yellow (10 YR 6/6), slightly cohesive, nonplastic; gravel is fine- to coarse-grained weathered limestone, angular to subrounded, 40 to 50 percent. At 17.0 feet, saturated.
17.0 - 32.0	SILTY SAND	SM	Reddish yellow (5 YR 6/6), very fine-grained, well sorted; silt is slightly cohesive; trace clay; wet.
32.0 - 36.0	SAND	SP	Reddish yellow (5 YR 6/6), very fine-to fine-grained, well sorted; trace silt. At 35.5-36.0, coarser sand.
36.0 - 37.0	SANDY GRAVEL	SW	Varicolored, fine- to coarse-grained, angular to subrounded weathered limestone, oyster fossils and chert nodules.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-30 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-126

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
37.0	LIMESTONE	---	Light gray (N 6 to N 7), weathered, hard; dry.

TOTAL DEPTH OF BOREHOLE: 37 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE B-31

LITHOLOGIC LOG OF MONITOR WELL HM-127

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	GRASS AND TOPSOIL	---	
0.5 - 2.0	CLAYEY SILT	ML	Reddish brown (5 YR 4/4), moderately cohesive, slightly plastic; some weathered fine to medium limestone gravel; slightly moist.
2.0 - 3.0	LIMEY CLAYEY SILT WITH GRAVEL	GC	Silt is yellowish red (5 YR 4/6); limey clay is white (5 YR 8/1), silt and clay is slightly cohesive; gravel is medium to coarse-grained, angular to subangular weathered limestone; slightly moist.
3.0 - 11.0	GRAVELLY CLAYEY SILT	GC	Reddish yellow (7/5 YR 6/8), slightly cohesive, nonplastic; gravel is fine- to coarse-grained, angular to subrounded weathered limestone; slightly moist.
11.0 - 20.0	GRAVELLY SILT	GM	Pink to reddish yellow (7.5 YR 7/4 to 7.5 YR 7/4), noncohesive; gravel is fine- to coarse-grained, angular to subrounded weathered limestone; trace cobbles of limestone; dry. At 15.0-16.0 feet, same as 3.0-11.0 feet.
20.0 - 25.0	CLAYEY SILT/ SILTY CLAY	ML/CL	Strong brown (7.5 YR 5/6). At 20.0-24.0 feet, 30 percent recovery, noncohesive, slightly moist. At 24.0-25.0 feet, more clay, slightly cohesive, firm, blocky, slightly moist. At 25 feet, saturated.

*Unified Soil Classification System ASTM D-2487

**Drilled by flight auger

TABLE B-31 (continued)
LITHOLOGIC LOG OF MONITOR WELL HM-127

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
25.0 - 36.0	SAND	SP	Reddish yellow (7/5 YR 6/8), very fine- to fine-grained, well sorted; saturated. At 29.0-34.0 feet, no recovery from core sampler, probably sand slurry.
36.0 - 38.5	GRAVELLY SAND	GM	Reddish yellow (7.5 YR 6/8), sand is fine- to coarse-grained, poorly sorted; gravel is fine- to medium-grained, subangular to subrounded; trace coarse gravel consisting of weathered limestone, chert, and oyster fossils.
38.5	FOSSILIFEROUS LIMESTONE	---	Gray (N 6), hard, dense; fossils are oyster shells, few and well cemented within limestone.

TOTAL DEPTH OF BOREHOLE: 38.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

Paluxy Wells

Well #	Const. Diag.	Lith. Log	Well #	Const. Diag.	Lith. Log
P-1	X	X	P-13M	X	X
P-2	X	X	P-15U	X	X
P-3	X	X	P-15US	X	X
P-4	X	X	P-16US	X	X
P-5U	X	X	P-17US	X	X
P-5US	X		P-18US	X	X
P-5UN	X	X	P-19US	X	X
P-5M	X	X	*P-20M	X	X
P-6U	X	X	*P-21U	X	X
P-6M	X	X	*P-22U	X	X
P-7U	X	X	*P-22M	X	X
P-7M	X	X	*P-23U	X	X
P-8U	X	X	P-24U	X	X
P-8US	X		P-24M	X	X
P-8UN	X	X	P-25U	X	X
P-8M	X	X	P-25M	X	X
P-9U	X	X	P-26U	X	X
P-9US	X		P-26M	X	X
P-9UN	X	X	P-14U	X	X
P-9M	X	X	P-14US	X	X
P-10U	X	X			
P-10M	X	X			
P-11U	X	X			
P-11US	X	X			
P-11M	X	X			
P-12U	X	X			
P-12US	X				
P-12UN	X	X			
P-12M	X	X			
P-13U	X	X			
P-13US	X	X			

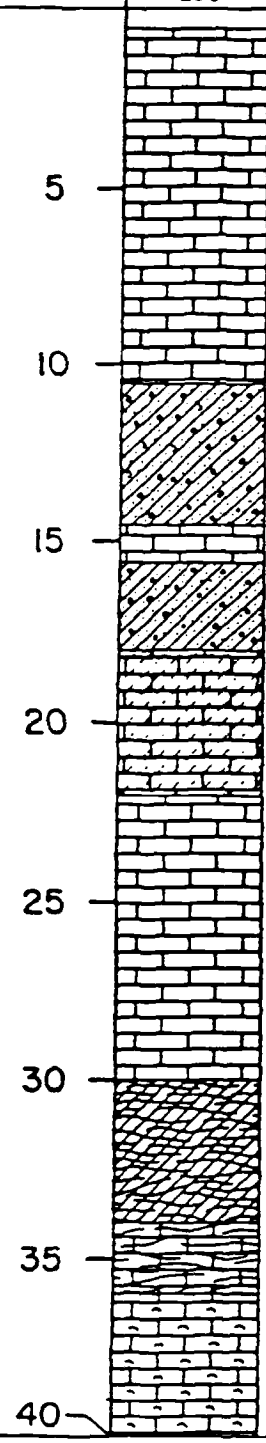
*Diagram and log combined.

FIGURE C-1

LITHOLOGIC LOG OF MONITOR WELL P-1 (PALUXY FORMATION)

MAP COORDINATES: S.-14 ft.; R. 2,089 ft.
GROUND ELEV.: 650.6
DRILLING METHOD: Mud-Rotary
BOREHOLE DEPTH: 214 feet

DATE DRILLED: March 1-9, 1983
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 15" to 37 feet; 9-5/8" to 79 feet; 6-1/8" to 214 feet



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
		FILL:	Asphalt and Subgrade.
		LIMESTONE: *(Goodland Limestone)*	Light grey, dense, fossiliferous (mollusks), some thin beds of soft silt and clay, clay is noncohesive, some brown and orange zones of oxidation, very slight odor - may be natural.
5			At 5 feet: Some soft to firm beds of silt and clay, clay is brownish yellow to grey, very slight odor - may be natural.
10		CLAY:	Light brownish yellow with some dark brown, soft to firm, slightly cohesive, light grey limestone, limestone is dense and and fossiliferous (mollusks), some brown and orange zones of oxidation, very slight odor - may be natural.
15		LIMESTONE:	Same as depth interval 5 to 10.5 feet.
		CLAY:	Same as depth interval 10.5 to 14.5 feet.
20		CLAYEY LIMESTONE:	Light to dark grey, dense, fossiliferous (mollusks) with fewer shells than upper limestones, clay is soft to firm and cohesive, brown and orange zones of oxidation, no odor apparent. At 20 feet: Decreasing shell content.
25		LIMESTONE with CLAYEY SHALE/ SHALEY CLAY:	Light to medium grey, dense, fossiliferous (mollusks) with fewer shells than limestone above, clay and shale is soft to firm, some brown and orange zones of oxidation. At 25 feet: Limestone is cleaner with fewer clay and shale seams, fewer shells. At 28 feet: Clay and shale seams are more frequent and/or thicker.
30		CLAYEY SHALE/ SHALEY CLAY with LIMESTONE:	Medium to dark grey, soft to firm, slightly cohesive clay, limestone seams are dense and slightly fossiliferous (mollusks). At 32 feet: All clayey shale with thin or infrequent limestone seams.
35		SHALEY LIMESTONE: *(Walnut Formation)*	Medium to dark grey, dense, fossiliferous (mollusks), shale is clayey and soft to firm.
40		SHELL AGGLOMERATE:	Dark grey with some light grey, dense, well cemented, very fossiliferous (mollusks) with shells up to 1½-inch diameter, firm to very dense clay/shale matrix with some limestone, matrix appears moist, some pyritization of shells.

FIGURE C-1 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-1 (PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

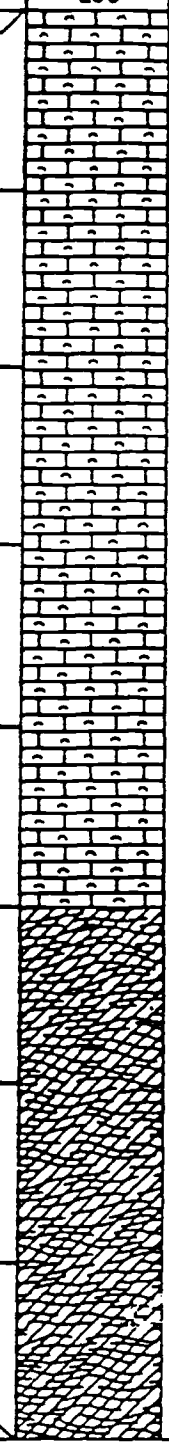
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
40			
45			
50			
			From 54 to 56 feet: Matrix is more clayey.
55			
60			
65		CLAYEY SHALE/ SHALEY CLAY:	Medium to dark grey, soft to slightly firm, cohesive.
70			
75			
			At 77 feet: Firm to very dense, fossiliferous (mollusks), moist (?), harder to drill.
80			

FIGURE C-1 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-1 (PALUXY FORMATION)

202224

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

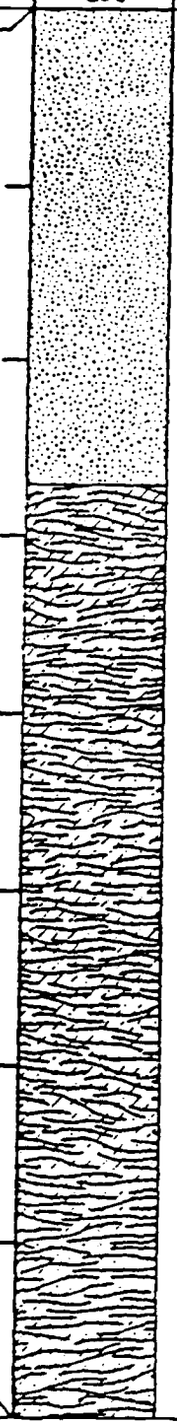
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
80		SAND: *(Paluxy Formation)*	Buff, very fine- to fine-grained quartz, sub-rounded to well rounded, well sorted, unconsolidated but closely packed, some thin beds of darker buff clayey silt or clayey sand.
85			
90			
95		SILTY CLAY/ SILTY SHALE:	Dark buff with some light brown, soft to slightly firm, clay is slightly to moderately cohesive, thin beds of silt, some very fine sand. At 95 feet: Brown, soft to firm.
100			
105			
110			
115			
120			

FIGURE C-1 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-1 (PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

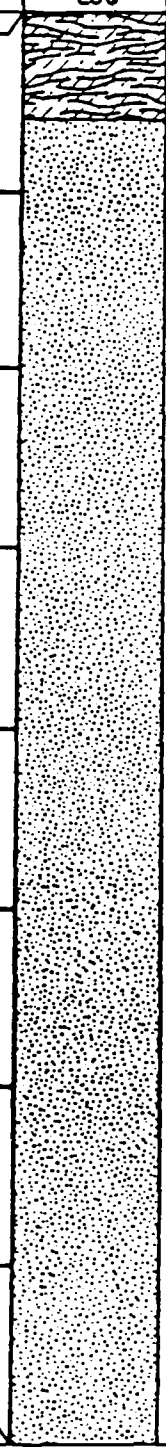
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
120		SAND: Buff, very fine- to fine-grained quartz, sub-rounded to well rounded, well sorted, unconsolidated but closely packed, some thin beds of darker buff clayey silt or clayey sand.
125		
130		
135		At 135 feet: Some small zones of well cemented sand.
140		
145		
150		
155		
160		

FIGURE C-1 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-1 (PALUXY FORMATION)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	
BOREHOLE DEPTH:	BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
160		At 160 feet: Some thin beds of blue-green silty shale/silty clay, some of these beds are brown.
165		From 165 to 205 feet: Beds of blue-green silty shale/silty clay are increasingly more numerous and/or thicker.
170		
175		
180		
185		
190		
195		
200		

FIGURE C-1 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-1 (PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

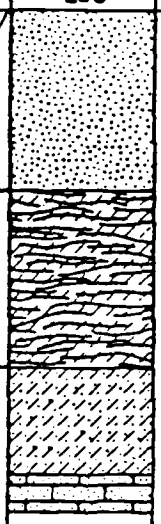
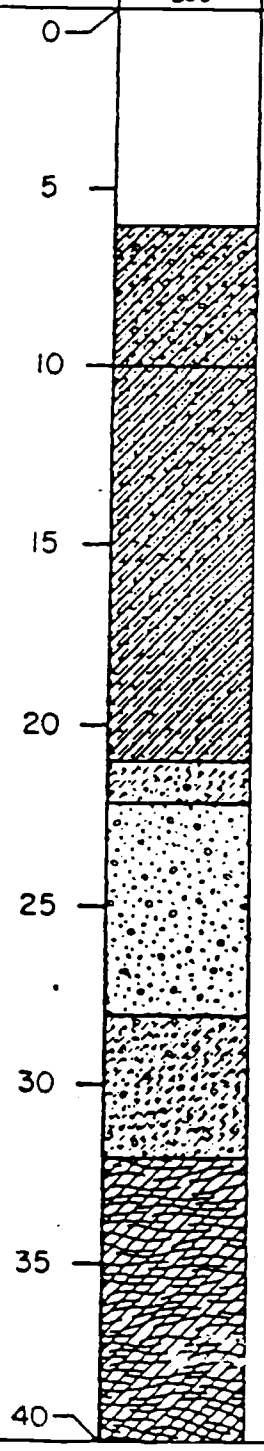
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
200			
205		SILTY SHALE/ SILTY CLAY:	Blue-green with brown, soft to firm, slightly to moderately cohesive, some very fine sand.
210		SILTY SAND/ CLAYEY SAND:	Light grey with a blue-green hue, very fine-grained unconsolidated quartz, closely packed.
		SANDY LIMESTONE: *(Glen Rose Formation)*	Light brownish grey to grey, dense, brittle, some blue-green shaley beds, no visible fossils.
215			

FIGURE C-2

LITHOLOGIC LOG OF MONITOR WELL P-2 (PALUXY FORMATION)

MAP COORDINATES: S. 710 ft; R. 2,816 ft.
GROUND ELEV.: 665.8 feet msl
DRILLING METHOD: Auger to 43.5 ft., rotary to 183 ft.
BOREHOLE DEPTH: 183 feet
DATE DRILLED: 6-6-83 to 6-17-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 18 inches to 43.5 ft.; 12-1/4 inches to 78 ft.; 7-7/8 inches to 183 ft.

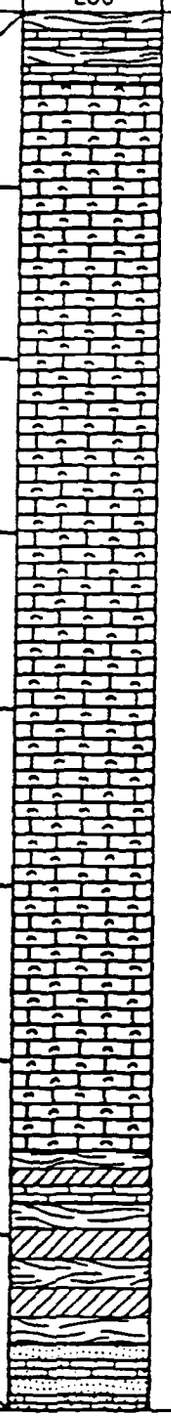


DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty clay, dark brown, very moist, slightly firm, slightly cohesive, trace gravel, grass roots, no odor. At 2 feet: Dark red-brown, moist.
5		SILTY GRAVELLY CLAY:	Light brown, moist, slightly firm, slightly cohesive, weathered limestone gravel, trace sand, caliche in zones.
10		SILTY SANDY CLAY:	Light brown, moist, slightly soft to slightly firm, slightly to moderately cohesive, trace limestone gravel, no odor. At 12 feet: No gravel, slight increase in sand content.
15			At 16 feet: Moist to very moist, slightly cohesive, trace limestone gravel.
20			At 19 feet: Some limestone gravel up to 2-inch diameter.
		CLAYEY GRAVELLY SAND:	Light brown, moist, slightly loose, limestone gravel up to 1-inch diameter, no odor.
25		SAND AND GRAVEL:	Light brown to grey, moist, loose, coarse-grained sand and gravel composed of limestone and shell fragments up to 2-inch diameter. At 26 feet: Trace silt and clay.
30		CLAYEY SAND AND GRAVEL:	Light brown to grey, moist, loose, coarse-grained sand and gravel composed of limestone and shell fragments up to 3-inch diameter.
35		SHALEY CLAY: *(Goodland Limestone)*	Greenish-buff with brown-orange in zones, slightly moist to moist, firm to slightly stiff, slightly cohesive, calcareous, no odor. At 34 feet: Moist. At 37 feet: Fissile in zones, iron concretions, dendritic manganese oxide stains. At 38 feet: Medium grey along bedding planes, fissile.
40			

FIGURE C-2 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-2 (PALUXY FORMATION)

MAP COORDINATES
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	DESCRIPTION OF MATERIALS
40	SHALE/LIMESTONE: Interbedded; light to dark grey, slightly moist; shale is firm, brittle; limestone is dense, no fossils.
45	SHELL AGGLOMERATE: *(Walnut Formation)* Medium to dark grey, slightly dense to dense, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay. At 44 feet: Very dense.
50	
55	
60	At 64 feet: Shale and clay interbeds are more numerous.
65	From 70 to 71.5 feet: Shale. From 71.5 to 72.5 feet: Few shale and clay interbeds.
70	
75	SHALE/CLAY/LIMESTONE: Interbedded; medium to dark grey; shale and clay is slightly firm to stiff, calcareous; limestone is dense. SHALE/CLAY: Interbedded; light to dark grey, firm to stiff, fossiliferous, some very dense black shale, thin sandy and silty zones.
80	SANDSTONE/SANDY LIMESTONE: *(Paluxy Formation)* Interbedded; light buff to dark grey, slightly dense to dense, quartz sand, limestone is fossiliferous (mollusks).

FIGURE C-2 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-2 (PALUXY FORMATION)

232200

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	
BOREHOLE DEPTH:	BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
80		CLAY:	Medium grey, slightly soft, cohesive, some pyrite nodules.
85			
		SAND:	Buff to light grey, loose, very fine- to fine-grained quartz, well sorted, rounded, hard zones of pyrite nodules, some grey clay.
90			
95			
100			At 100 feet: Light buff, slightly loose to loose, fine- to medium-grained quartz, clean, well packed.
105			From 105 to 110 feet: Predominantly medium-grained.
110			
115			
120			

FIGURE C-2 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-2 (PALUXY FORMATION)

201221

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

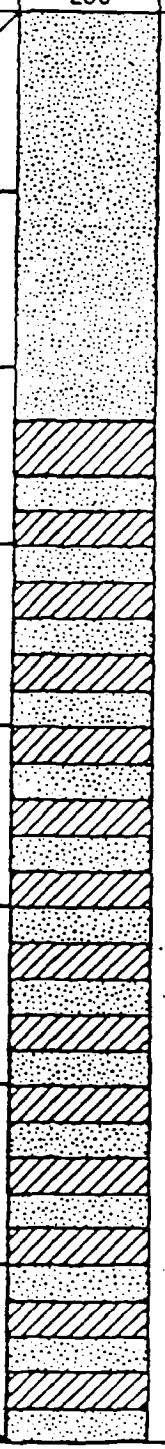
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
120		
125		
130		From 131 to 131.5 feet: Lignite, black, low-grade, appears to be carbonized wood.
		CLAY: Blue-green, slightly soft, cohesive, stratified
		SAND/CLAY: Interbedded; sand is buff to light grey, slightly loose, fine- to medium-grained quartz, well sorted, rounded, well packed; clay occurs in thin beds and is blue-green, slightly soft, cohesive.
135		At 136.5 feet: Sand is very fine- to fine-grained, with zones of moderately cemented medium-grained sand, calcareous cement.
140		At 140 feet: Sand is light buff, clay is medium grey.
145		
150		At 150 feet: Sand is fine- to medium-grained.
155		At 155 feet: Clay layers are medium to dark grey and less numerous.
160		

FIGURE C-2 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-2 (PALUXY FORMATION)

MAP COORDINATES
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

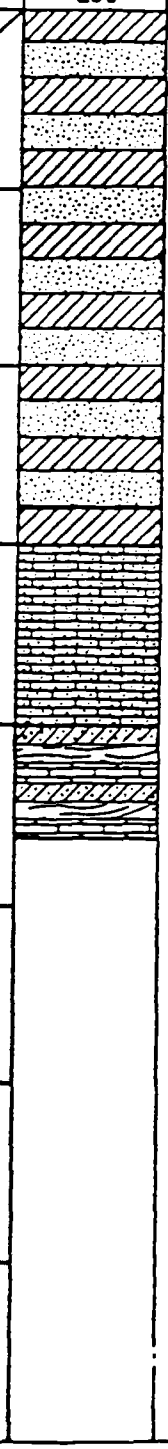
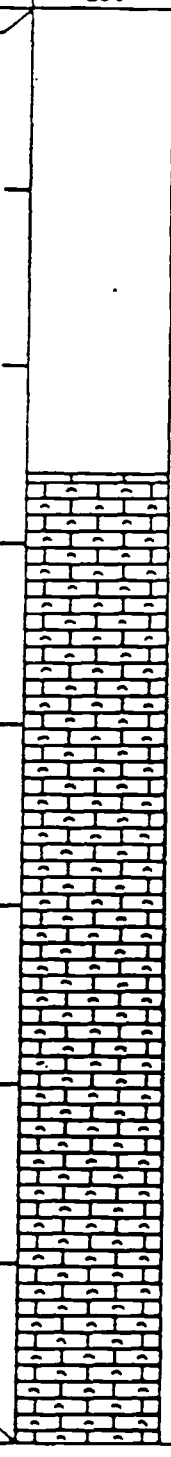
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
160		At 160 feet: Very few thin clay layers.
165		
170		
175		CLAY: Blue-green, slightly soft, slightly cohesive, silt and sand in zones, no odor.
		SANDY LIMESTONE: Light buff, dense, massive, no visible fossils, chert.
		At 178 feet: Very dense, slightly fossiliferous.
180		SANDY CLAY/SHALE/ LIMESTONE: Interbedded; clay and shale are blue-green, slightly soft to firm, non-cohesive to slightly cohesive; limestone is light, buff, dense, slightly fossiliferous, contains chert.
185		

FIGURE C-3

LITHOLOGIC LOG OF MONITOR WELL P-3 (PALUXY FORMATION) 232223

MAP COORDINATES: S. 6,750 ft.; R. 2,193 ft.
GROUND ELEV.: 644.5 ft. msl
DRILLING METHOD: Auger to 18 ft., rotary to 221 ft.
BOREHOLE DEPTH: 221 ft.
DATE DRILLED: 6-6-83 to 6-18-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 18 inches to 18 ft.; 12-1/4 inches to 46 ft.; 7-7/8 inches to 221 ft.

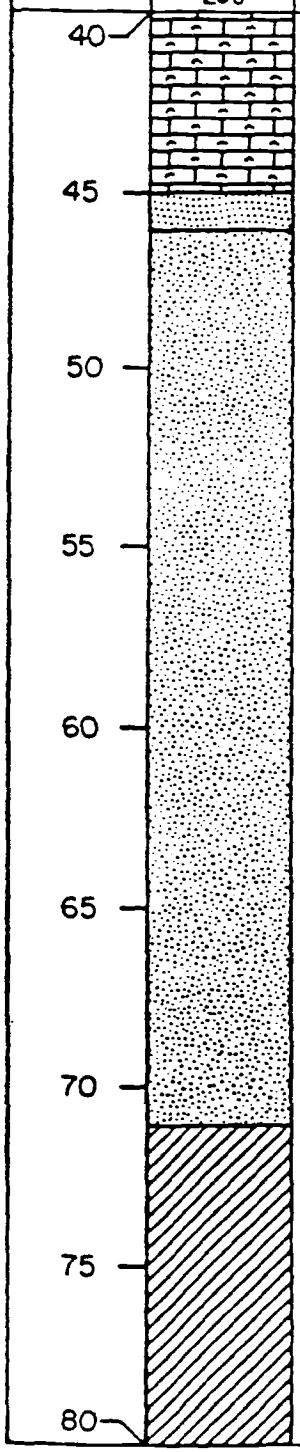


DEPTH	DESCRIPTION OF MATERIALS
0	FILL: Asphalt and subgrade.
	At 2 feet: Silty clay and shaley clay; silty clay is dark reddish brown, moist, slightly firm, slightly cohesive; shaley clay is reworked Goodland Limestone, greenish buff to blue-green, slightly stiff, cohesive, moist, caliche residue; slight asphalt odor.
5	At 6 feet: Sandy gravelly clay, dark reddish brown, moist, slightly firm, slightly cohesive, sand and gravel composed of shell and limestone fragments, no odor.
	At 8 feet: Some limestone gravel up to 2-inch diameter.
10	At 10 feet: Silty sandy clay, dark brown, moist, slightly soft, non-cohesive, granular with some rounded gravel, plant parts, shells, organic odor.
	At 12 feet: Light grey, slightly firm, slightly cohesive to cohesive, more than 30% silt, roots, ashy appearance, no odor.
15	SHELL AGGLOMERATE: *(Walnut Formation)* Light buff to grey, dense, weathered, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay, weathered layers of shale and clay are slightly moist.
	At 18 feet: Medium to dark grey, unweathered, shale and clay is slightly firm to dense.
20	
25	
30	At 30 feet: Shale and clay beds are more numerous.
35	At 36 feet: Some zones of loosely cemented shells, trace of pyrite nodules.
40	

FIGURE C-3 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-3 (PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DESCRIPTION OF MATERIALS	
SANDSTONE: *(Paluxy Formation)*	White to light buff, slightly loose to slightly dense, quartz sand, slightly cemented with calcareous cement, cross-bedded, well sorted.
SAND:	Light buff, loose to slightly loose, very fine- to fine-grained quartz, well sorted, rounded, small zones of moderately cemented sand with calcareous cement, losing drilling water into formation.
	At 48 feet: Fine- to medium-grained.
	At 67 feet: Some thin beds of clay.
CLAY:	Blue-green, slightly soft, cohesive.
	At 77 feet: Some thin beds of sand and sandy clay.

FIGURE C-3 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-3 (PALUXY FORMATION)

232225

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

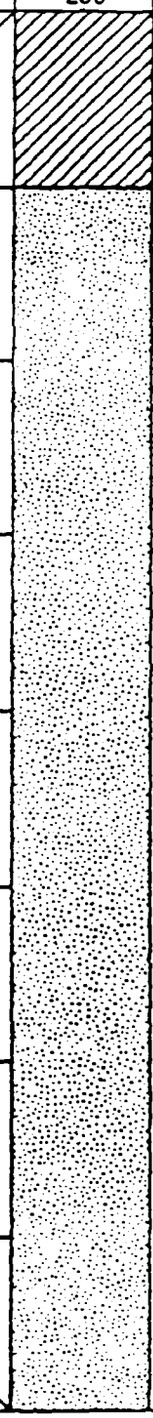
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		SAND: Light grey to light buff, loose, fine- to medium-grained quartz, well sorted, rounded, small zones of moderately cemented sand with calcareous cement, some thin beds of blue-green clay.
90		At 90 feet: Very few clay beds.
95		At 97 feet: No clay.
100		
105		
110		
115		
120		

FIGURE C-3 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-3 (PALUXY FORMATION)

203225

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

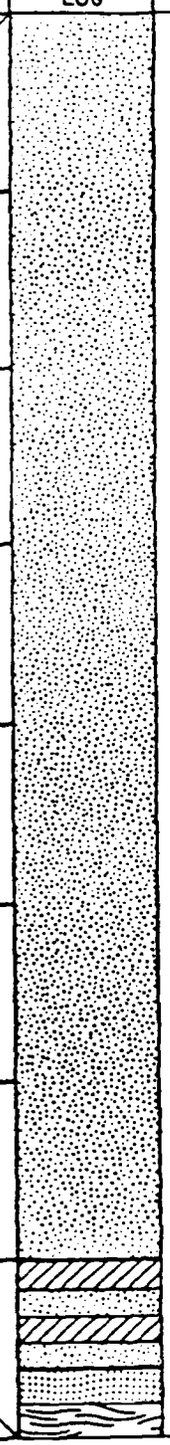
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
120			
125			
130			From 130 to 135 feet: Slightly finer grained.
135			
140			At 142 feet: Some thin beds of clay.
145			
150			At 150 feet: Clay beds are more numerous.
155		CLAY/SAND:	Interbedded; clay is blue-green; thin zone of low-grade black lignite.
		SANDSTONE/SHALE/CLAY:	Interbedded; sandstone is buff to blue-green, slightly dense, very fine- to fine-grained
160			

FIGURE C-3 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-3 (PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

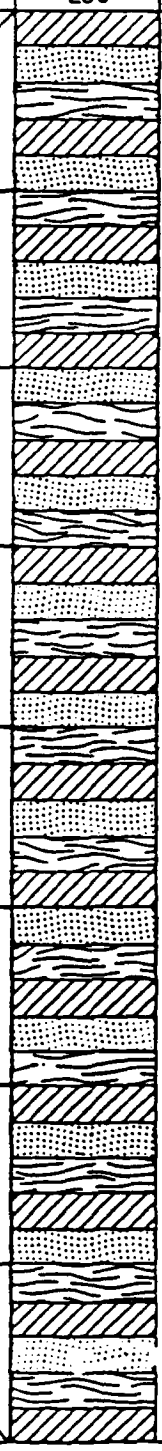
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
160		quartz, moderately cemented with calcareous cement; some pyrite nodules; shale and clay beds are thin, blue-green to buff, slightly soft to slightly stiff, slightly cohesive, fissile, sandy in zones, some dark grey clay.
165		
170		
175		At 175 feet: Some loose sand.
180		At 180 feet: Shale and clay beds are predominant.
185		
190		
195		
200		

FIGURE C-3 (continued)
LITHOLOGIC LOG OF
MONITOR WELL P-3 (PALUXY FORMATION)

232228

MAP COORDINATES	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	
BOREHOLE DEPTH:	BOREHOLE DIAMETER:

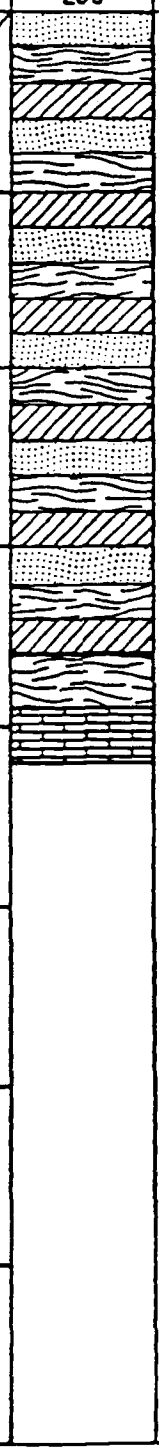
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
200		
205		
210		
215		At 215 feet: Some dark green shale.
		SHALE: Dark green to dark grey, stiff, fissile.
220		LIMESTONE: *(Glen Rose Formation)* White to light buff, dense, fossiliferous.
225		

FIGURE C-4

LITHOLOGIC LOG OF MONITOR WELL P-4 (PALUXY FORMATION)

MAP COORDINATES: S. 2,806 ft.; R. 2,713 ft.
GROUND ELEV.: 648.3 ft msl
DRILLING METHOD: Auger to 28 ft., rotary to 228 ft.
BOREHOLE DEPTH: 228 feet
DATE DRILLED: 6-7-83 to 6-15-83
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 18 inches to 28 ft.; 12¼ inches to 57 ft.; 7-7/8 inches to 228 ft.

DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
0		FILL:	Asphalt and subgrade.
		FILL:	Sandy clay, reddish brown, moist, slightly firm, slightly cohesive, trace gravel, no odor.
5			At 4 feet: Silty clayey sand, light reddish brown, slightly moist, slightly loose, very fine- to fine-grained quartz sand, no odor.
			At 6 feet: Decreasing clay content.
			At 8 feet: Silty sand, light reddish tan, slightly moist, slightly loose, fine- to medium-grained quartz.
10			At 10 feet: Sand, tan, slightly moist, loose, well sorted, fine- to medium-grained quartz, trace silt and clay.
			At 12 feet: Light tan, dry to slightly moist.
			At 14 feet: Slightly moist.
15			At 15.5 feet: Tan, moist, some cream colored clay which is soft and slightly cohesive.
			At 16.5 feet: Some silt, moist to very moist.
			At 20 feet: Wet
20			At 22 feet: Gravelly clayey sand, light tan to light brown, wet, slightly loose, sand is fine- to medium-grained quartz, gravel contains subangular to subrounded fragments of limestone, shells and chert.
			At 24 feet: Clay, sand, and gravel; light to medium brown and grey, wet, loose, greenish-buff clay of the Goodland Limestone occurs in zones but is not in place.
25		SHELL AGGLOMERATE: *(Walnut Formation)*	Medium to dark grey, dry to slightly moist, dense, brittle, very fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
			At 28 feet: Very dense.
30			
35			At 38 to 44 feet: Increasing shell content.
40			

FIGURE C-4 (continued)
LITHOLOGIC LOG OF MONITOR
WELL P-4 (PALUXY FORMATION)

MAP COORDINATES
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

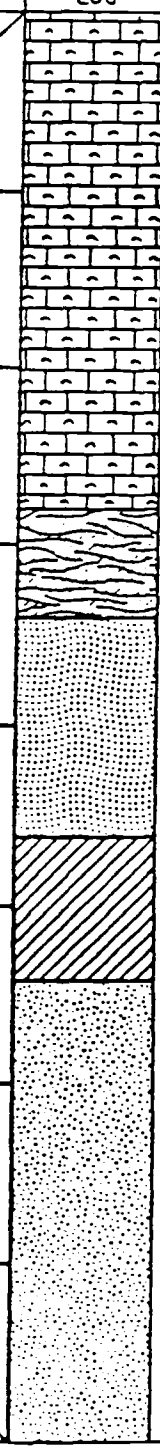
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		
45		
50		
55		SILTY SHALE: Medium to dark grey, slightly firm, very slightly cohesive, calcareous. From 55 to 57 feet: Increasing content of very fine- to fine-grained quartz sand with depth.
60		SANDSTONE: *(Paluxy Formation)* Medium greyish-buff, slightly loose, well sorted, subrounded, very fine- to fine-grained quartz, partially cemented with calcareous cement, trace silt and clay. At 61 feet: Some loose sand; some thin beds of medium grey to buff clay, slightly soft, slightly cohesive.
65		CLAY: Medium grey to buff, slightly soft, slightly cohesive, some thin beds of sand, no odor. At 65 feet: Some thin beds of shale, medium grey with brown along bedding plane, slightly firm, slightly cohesive, fissile.
70		SAND: Greyish buff, loose, very fine- to fine-grained quartz, well sorted, subrounded to rounded, well packed, some moderately to well cemented zones, some thin beds of greyish buff to dark brown soft clay and slightly stiff to stiff brown sandy shale; losing drilling water to the formation. At 70 feet: No clay or shale.
75		From 70.5 to 71.5 feet: Lignite, low grade, dense, appears to be carbonized wood, turned drilling water black temporarily.
80		

FIGURE C-4 (continued)
LITHOLOGIC LOG OF MONITOR
WELL P-4 (PALUXY FORMATION)

202231

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
80			At 80 feet: Some thin beds of clay and shale.
85			
		CLAY:	Light blue-green, slightly soft, cohesive, shaley in zones, some thin beds of dark brown clay.
90			At 90 feet: Some thin beds of cemented sandstone and shale, pyrite nodules.
95		CLAY/SANDSTONE:	Interbedded; clay is light blue-green, slightly soft to slightly firm, cohesive, shaley in zones; sandstone is light buff, slightly dense, well sorted, very fine- to fine-grained quartz, moderately cemented, crossbedded, some pyrite nodules.
100			At 100 feet: Predominantly clay.
105			At 105 feet: Grading sandier.
		SAND:	Medium grey to light buff, loose to slightly dense, fine- to medium-grained quartz, well sorted, rounded, uncemented to partialley cemented with calcareous cement, few thin beds of blue-green clay.
110			At 110 feet: Sand is predominantly loose and well packed, no clay.
115			
120			

FIGURE C-4 (continued)
LITHOLOGIC LOG OF MONITOR
WELL P-4 (PALUXY FORMATION)

232232

MAP COORDINATES	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	
BOREHOLE DEPTH:	BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
120		
125		
130		
135		
140		
145		From 145 to 155 feet: 5% coarse to very coarse quartz sand, thin zones of cemented sand, trace of pink sand.
150		
155		
160		

FIGURE C-4 (continued)
LITHOLOGIC LOG OF MONITOR
WELL P-4 (PALUXY FORMATION)

202233

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
160		CLAY:	Blue-green, slightly soft, cohesive, some shaley zones, some thin beds of sand.
165			
170		SAND:	Medium grey to light buff, loose, very fine- to fine-grained quartz, moderately cemented in zones, well sorted, few thin beds of blue-green clay.
175			At 175 feet: Fewer beds of clay.
180			At 180 feet: Fine- to medium-grained quartz.
185			
190			At 190 feet: No clay.
195			
200			

FIGURE C-4 (continued)
LITHOLOGIC LOG OF MONITOR
WELL P-4 (PALUXY FORMATION)

232234

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

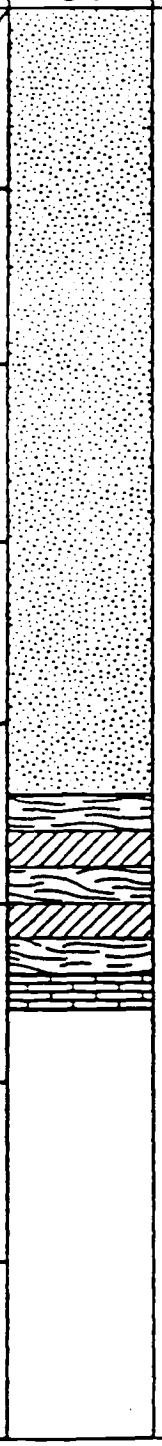
DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
200			From 202 to 202.5 feet: Lignite, low grade, appears to be carbonized wood.
205			At 205 feet: Some thin beds of blue-green clay.
210			
215			At 215 feet: More beds of blue-green clay.
220			
		SHALE/CLAY:	Interbedded; blue-green, firm, cohesive, no odor.
225			
		LIMESTONE: *(Glenrose Formation)*	Buff to white, slightly dense.
230			

FIGURE C-5

LITHOLOGIC LOG OF MONITOR WELL P-5 UPPER (PALUXY FORMATION)

MAP COORDINATES:

GROUND ELEV.:

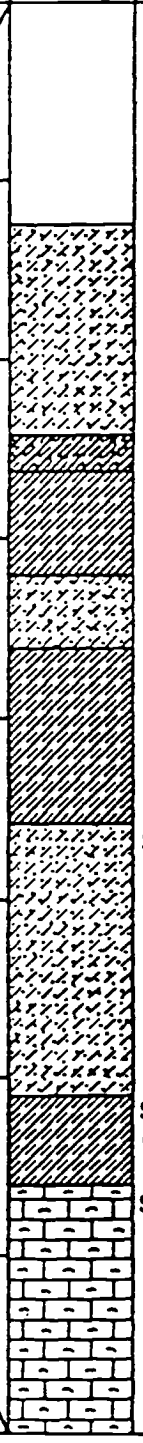
DRILLING METHOD: Auger to 61.5 ft., Mud rotary to 101 ft.

BOREHOLE DEPTH: 101 ft.

DATE DRILLED: 5-1-84 to 6-3-84

DRILLED BY: Southwestern Laboratories, Inc.

BOREHOLE DIAMETER: 28" to 36 ft.; 18" to 61.5 ft.; 12 3/4" to 101 ft.



DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	Sandy clay, dark red to brown, moist, fine-to medium-grained, slightly cohesive.
5		
	SILTY SAND:	Light orange, brown, moist, very fine-to fine-grained, loose.
10		
	SANDY CLAYEY SILT:	Light tan, moist, fine-to medium-grained sand.
	CLAYEY SILT:	Light tan, moist, some very fine sand, dense.
15		
	SILTY SAND:	Light tan, moist, very fine-to fine-grained, loose, contains some light grey clay.
	SILTY CLAY:	Light tan, moist, trace sand, slightly cohesive, very firm.
20		
	SILTY SAND:	Light brown, very moist to wet, very fine-to fine-grained, trace of clay, loose. At 25-57 feet: Medium to coarse grained.
25		
30		
	SILTY CLAY: (Walnut Formation)	Light tan, wet, trace of fine-to coarse-grained sand, firm.
	SHELL AGGLOMERATE:	Medium to dark grey, slightly dense to dense fossiliferous (oysters) matrix and interbeds of calcareous shale and clay.
35		
40		

REMARKS:

FIGURE C-5 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-5 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		
45		At 46 feet: Very slightly sandy.
		At 49.5 feet: Medium to dark grey, shaley, more clay.
50		At 52.5 feet: Less shaley, hard, more fossiliferous.
55		At 57 feet: Very slightly sandy.
60		At 61.5 feet: Medium to light grey, very hard, sandy.
		CLAY: Dark grey, carbonaceous, soft, poorly cohesive. (Paluxy Formation)
65		SANDY/CLAY: Interbedded: grey to light grey sand is very fine- to fine, loose to poorly cemented, carbonaceous in places. Clay is moderately firm, moderately cohesive.
70		67-69 feet: Predominately sand. 69-71 feet: Predominately clay. 71-73 feet: Sand poorly to well cemented.
75		SAND/ SANDSTONE: Buff to grey, very fine-to fine grained, loose to very well cemented (predominately hard, well cemented to very well cemented).
80		At 79 feet: Trace pyrite, lignite.

FIGURE C-5 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-5 UPPER
(PALUXY FORMATION)

232237

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
		SAND: Grey, very fine-to fine-grained, loose to poorly cemented, carbonaceous, trace pyrite, some thin clay interbeds. 85-89 feet: No clay interbeds. 89-93 feet: Some dark grey to brown carbonaceous clay interbeds.
85		
90		
95		CLAY: Blue-grey, carbonaceous, poorly cohesive, soft. 95-99 feet: Sandy.
100		TOTAL DEPTH 101 feet.
105		
110		
115		
120		

TABLE E-1

LITHOLOGIC LOG OF MONITOR WELL P-5UN

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 6.0	SILTY SAND - SANDY SILT	SM	Reddish brown (10 R 5/4), sand is fine- to very coarse-grained, sub-angular, silt is non-cohesive, non-plastic.
6.0 - 24.0	SAND SILT	SM	Grayish orange (10 YR 7/4), interbedded with pale orange (10 YR 8/2), silt is slightly cohesive, non-plastic, sand is approximately 30 percent, fine- to very fine-grained, well rounded.
24.0 - 32.0	SILTY GRAVELLY SAND	SP	Varicolored, fine- to medium-grained, slightly cohesive.
32.0 - 60.5	FOSSILIFEROUS LIMESTONE	--	Gray (N 4 to N 7), fossils, consist of oyster shell shards.
60.5 - 66.0	CLAY WITH LIMESTONE INTERBEDS	--	Limestone is same as above, clay is sandy, approximately 10 percent, fine- to medium-grained, subrounded, greenish gray (5 GY 4/1), slightly cohesive, slightly plastic.
66.0 - 68.0	SANDY CLAY - CLAYEY SAND	CL	Gray (N 3), very fine-grained, loose interbeds of sandy clay and clay, clay is gray (N 4), slightly cohesive, moderately plastic.
68.0 - 74.0	SANDY CLAY	SC	Gray (N 8), moderately cohesive, moderately plastic, sand decreases with depth.
74.0 - 76.5	SANDSTONE	--	Light gray, very well cemented, medium- to fine-grained, well rounded.
76.5 - 81.0	SANDY CLAY	SC	Gray (N 8), moderately cohesive, moderately plastic, some pyrite and lignite.

*Unified Soil Classification System ASTM D-2487

**Drilled by mud rotary

TABLE E-1 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-5UN

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
81.0 - 96.0	SAND	SP	Gray (N 7), fine- to medium-grained, subrounded, moderately cemented. At 81.0 to 84.0 feet, abundant pyrite and lignite.
96.0 - 98.0	SILTY CLAY	CL	Blue gray (5 B 7/1), slightly cohesive, slightly plastic.

TOTAL DEPTH OF BOREHOLE: 98 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

FIGURE C-6

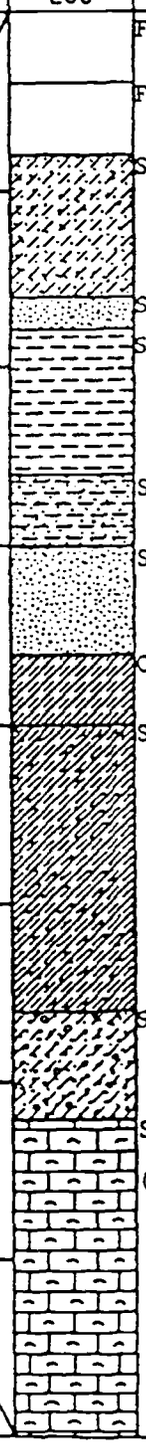
LITHOLOGIC LOG OF MONITOR WELL P-5 MIDDLE (PALUXY FORMATION)

MAP COORDINATES: S. 3,016 ft.; R. 2,302 ft. DATE DRILLED: 5-1-84 to 6-5-84

GROUND ELEV.: 653.4 ft. msl DRILLED BY: Southwestern Laboratories, Inc.

DRILLING METHOD: Auger to 61.5 ft.; Mud rotary to 162 ft. BOREHOLE DIAMETER: 36" to 35 ft.; 28" to 46 ft.; 26" to 61.5 ft.; 18 3/4" to 107.5 ft.; 12 3/4" to 162 ft.

BOREHOLE DEPTH: 162 ft.



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Silty sandy clay, dark red to brown, moist, fine-to medium-grained sand, slightly cohesive, slightly firm, trace limestone gravel.
		FILL:	Clayey sand, dark red to brown, moist, fine-to medium-grained, moderately loose, some silt, no gravel.
5		SILTY SAND:	Light brown, moist, very fine to fine grained, trace clay, loose, some cemented standstone blebs.
		SAND:	Light tan, moist, very fine-to fine-grained, loose, trace silt.
10		SILT:	Light tan, moist, some very fine-to fine-grained sand, trace clay.
		SANDY SILT/ SILTY SAND:	Light tan to light brown, moist, very fine-grained.
15		SAND:	Light brown, moist to very moist, very fine- to fine-grained, slightly cemented in zones.
		CLAYEY SILT:	Light tan, moist, some very fine-grained sand, firm.
20		SANDY CLAYEY SILT:	Light tan, moist to very moist, very fine-grained sand, firm.
25			At 25 feet: Very moist to wet.
30		SILTY SAND AND GRAVEL:	Light brown, wet, medium-to coarse-grained sand, some fine limestone and chert gravel (subangular to sub-rounded), loose.
		SHELL AGGLOMERATE: (Walnut Formation)	Weathered, light brown to grey, dense, fossiliferous (oysters), matrix and interbeds of calcareous shale and clay.
35			At 33 feet: Fresh, medium to dark grey, very dense.
40			

FIGURE C-6 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-5 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

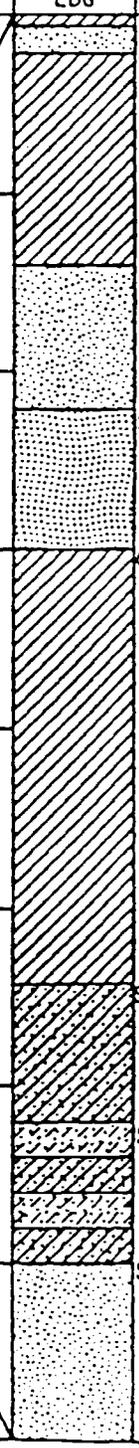
DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		43-46 feet: Very slightly sandy, less fossiliferous.
45		
50		
55		At 55.5 feet: Oysters and pectins.
60		57.5-62 feet: Very slightly sandy to sandy, less fossiliferous.
65	SAND/CLAY: (Paluxy Formation)	Interbedded; grey; sand fine-to medium-grained, poorly cemented, w/some lignite and pyrite. Clay dark grey to grey, slightly sandy to sandy, slightly cohesive, w/some lignite and pyrite.
70	SANDSTONE:	Light grey to white, very fine to fine grained, hard to very hard, well cemented, some pyrite in zones.
75		75-77 feet: very fine-to medium-grained, soft to hard, poorly cemented to well cemented, carbonaceous, some lignite, some pyrite.
80	SAND/CLAY	Interbedded; sand very fine-to medium-grained, loose to poorly cemented, carbonaceous, w/some lignite and pyrite. Clay sandy, carbonaceous, w/some lignite and pyrite.

Figure C-6 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-5 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	DESCRIPTION OF MATERIALS
80	
	CLAY: Medium grey to brown, very sandy w/very fine-to fine-grained sand, carbonaceous w/some lignite, trace pyrite. Some thin sand interbeds.
85	
	SAND: Medium grey, very fine-to fine-grained, loose to poorly cemented, carbonaceous, some lignite, some pyrite. Some thin clay interbeds.
90	
	SANDSTONE: Medium grey, fine-to medium-grained, poorly to well cemented, soft to hard. Some clay interbeds; medium grey to light blue, firm, slightly cohesive.
95	
	CLAY: Grey, slightly sandy, carbonaceous, slightly cohesive, firm.
100	Below 99 feet: Light blue, firm, cohesive, no sand.
105	
	SANDY CLAY: Blue, grey to brown, firm, cohesive, carbonaceous in zones, some clayey sand interbeds.
110	
	SANDY CLAY/ CLAYEY SAND: Interbedded (predominately sandy clay); clay grey, firm, slightly cohesive, carbonaceous. Sand grey, silty, very fine-to fine-grained.
115	
	SAND: Grey, very fine to fine grained, loose to poorly cemented, some thin sandy carbonaceous clay interbeds.
120	Below 119 feet: Loose, very little clay.

LITHOLOGIC LOG OF MONITOR WELL P-5 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

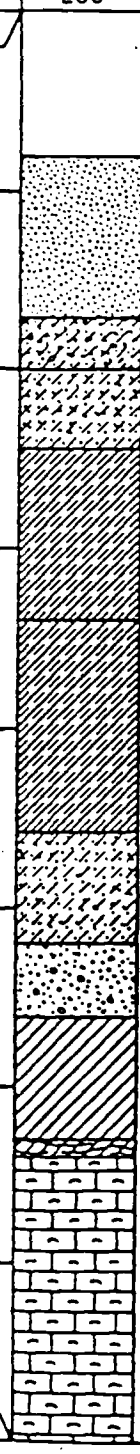
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
120			Below 123 feet: Fine- to medium-grained.
125			
		CLAY:	Grey, sandy, firm, slightly cohesive.
		SAND/SANDSTONE:	Buff to grey, very fine-to medium-grained, loose to moderately cemented, soft to moderately hard, some thin clay interbeds (white to grey clay, sandy, soft, poorly cohesive).
130			
		SANDSTONE/CLAY:	Interbedded: standstone very fine-to medium-grained, loose to moderately cemented, soft to moderately hard. Clay grey, loose, soft, slightly sandy.
135		SAND:	Buff to grey, very fine to medium grained, very loose, trace of lignite in places.
140			
		SAND/CLAY:	Interbedded: sand buff to grey, very fine-to medium-grained, very loose, trace lignite, trace pyrite. Clay buff to grey, loose, soft, no sand.
		SANDY CLAY:	Grey, loose, soft, slightly cohesive, carbonaceous. Some sand interbeds.
145			
		SAND:	Grey, very fine-to fine-grained, loose to moderately cemented, some sandy clay interbeds.
150		SANDSTONE:	Buff to grey, very fine-to fine-grained, loose to well cemented.
		SAND/SANDY CLAY:	Grey, fine-to medium-grained, loose soft, trace of lignite.
155			At 155 feet: Thin hard sandstone.
160		CLAY:	Blue-green, firm, cohesive, not sandy.
		TOTAL DEPTH 162 feet.	

FIGURE C-7

LITHOLOGIC LOG OF MONITOR WELL P-6 UPPER (PALUXY FORMATION) 202244

MAP COORDINATES: S. 2,417 ft.; R. 2,274 ft.
GROUND ELEV.: 654.8 ft. msl
DRILLING METHOD: Auger to 61 ft.; Mud rotary to 100 ft.
BOREHOLE DEPTH: 100 ft.

DATE DRILLED: 5-1-84 to 5-20-84
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 28" to 36 ft.; 18" to 61 ft.; 12 3/4" to 100 ft.



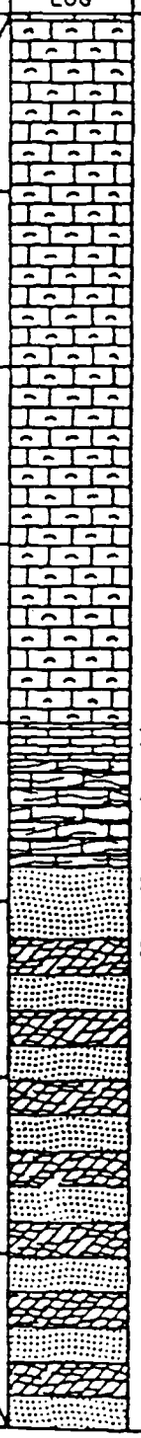
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	0-1 feet: Asphalt, concrete and sub-grade. 1-4 feet: Sandy clay, light brown, moist, slightly cohesive, trace of gravel.
5		SAND:	Medium brown, moist, fine-grained, some silt, loose, some light grey clay blebs.
10		SILTY SANDY GRAVEL:	Light brown to grey, moist, loose, predominately limestone.
		SILTY CLAYEY SAND:	Medium brown, moist, very fine-grained, trace of fine gravel.
15		CLAYEY SILT:	Light brown, moist, some fine sand and fine gravel, firm.
20		SILTY CLAY:	Light brown to grey, moist, some very fine sand, some fine gravel, firm, slightly cohesive.
25		SILTY SAND:	Light brown, wet, very fine-to medium-grained, trace of clay, some fine gravel. Fuel odor.
		SANDY GRAVEL:	Buff to grey, fine to medium gravel, some coarse sand, no clay or silt. Strong fuel odor, oily sheen
30		CLAY: (Goodland Limestone)	Green-brown to orange, moist, slightly cohesive, very stiff. Weathered, with prominent limonite stains.
		SHALEY CLAY: (Walnut Formation)	Blue-grey to dark grey, stiff, cohesive, with some limonite stains.
35		SHELL AGGLOMERATE:	Medium to dark grey, dense, fossiliferous (oysters), matrix of limestone, calcareous shale, and clay.
40			At 38.5 feet: very fossiliferous.

FIGURE C-7 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-6 UPPER
(PALUXY FORMATION)

2312245

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		
45		
		46-55 feet: Slightly sandy, less fossiliferous.
50		
55		
60		LIMESTONE: Light grey, dense, slightly sandy, crystalline, hard, tight, no clay.
		SHALEY LIMESTONE: Dark grey, moderately dense, fossiliferous, some sandy interbeds.
65		SANDSTONE: (Paluxy Formation) Medium grey, very fine-to fine-grained, poorly to moderately cemented.
		SHALEY CLAY/ SANDSTONE: Interbedded; clay medium to dark grey, moderately cohesive. Sandstone buff, very fine-to fine-grained, poorly to moderately cemented.
70		Below 71 feet: Some loose sand.
75		
		At 78.5 feet: Very hard, pyrite cement.
80		

REMARKS:

FIGURE C-7 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-6 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		SAND: Buff to brown, very fine- to fine-grained, loose to poorly cemented, some shaley clay interbeds, some pyrite.
85		83-91 feet: Fewer shaley clay interbeds.
90		
95		SHALEY CLAY/ SANDSTONE: Interbedded; clay dark grey, moderately cohesive, trace pyrite. Sandstone grey, very fine- to fine-grained, moderately to well cemented.
		SHALEY CLAY: Dark grey, fissile, soft to very firm, cohesive, trace pyrite, lignite, some blue-green clay.
100		TOTAL DEPTH 100 feet.

FIGURE C-8

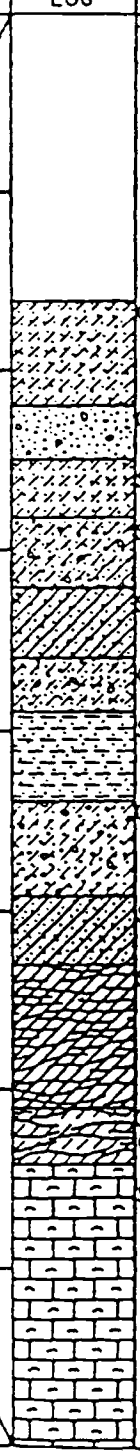
LITHOLOGIC LOG OF MONITOR WELL P-6 MIDDLE (PALUXY FORMATION)

MAP COORDINATES: S. 2,348 ft.; R. 2,274 ft. DATE DRILLED: 5-2-84 to 5-22-84

GROUND ELEV.: 654.4 ft. msl DRILLED BY: Southwestern Laboratories, Inc.

DRILLING METHOD: Auger to 60.5 ft., Mud rotary to 169 ft. BOREHOLE DIAMETER: 36" to 33.5 ft.; 24" to 60.5 ft.; 18 3/4" to 110 ft.; 12 3/4" to 169 Ft.

BOREHOLE DEPTH: 169 ft.



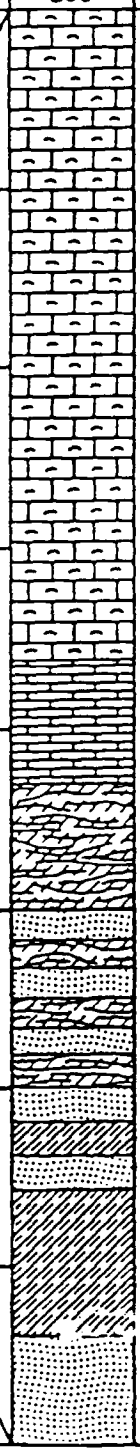
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Sandy clay, orange-brown, moist, fine-to coarse-grained sand, slightly cohesive, slightly firm.
5			
10		CLAYEY SILTY SAND:	Medium brown, moist, fine-grained, loose, trace weathered limestone gravel.
		GRAVELLY SAND:	Medium brown, moist, fine-to coarse-grained, loose, with fine limestone gravel.
		SILTY SAND:	Medium brown, moist, very fine-to fine-grained, loose, no clay.
15		SILTY SAND AND GRAVEL:	Medium brown, moist to very moist, medium- to coarse-grained sand, fine limestone gravel, loose.
		SANDY CLAY:	Yellow brown, moist, fine-to coarse-grained quartz and limestone sand, some fine limestone gravel, slightly cohesive, firm.
		CLAYEY SAND GRAVEL:	Medium brown, moist, coarse sand and fine gravel, quartz and limestone.
20		SANDY SILT/ SILTY SAND:	Medium brown, moist, very fine-to fine-grained, some clay, fuel odor.
		CLAYEY GRAVEL:	Medium brown, very moist, silty, cohesive clay matrix, fine to medium limestone gravel, strong fuel odor.
25		SANDY CLAY:	Grey to medium brown, wet, fine to coarse sand, slightly cohesive, moderately firm, strong fuel odor.
		SHALEY CLAY: (Goodland Limestone)	Greenish-orange, wet, cohesive, stiff, weathered, very strong fuel odor.
30		CLAYEY SHALE: (Walnut Formation)	Dark grey, dense, fissile, calcareous.
		SHELL AGGLOMERATE:	Medium to dark grey, very dense, fossiliferous (oysters), matrix of limestone and calcareous shale.
35			At 35.5 feet: grey to black.
40			

LITHOLOGIC LOG OF MONITOR WELL P-6 MIDDLE
(PALUXY FORMATION)

202245

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	DESCRIPTION OF MATERIALS	
		40.5-42 feet: Very slightly sandy.
	LIMESTONE:	Light grey to grey, slightly sandy to sandy, less fossiliferous than above, hard, shaley to crystalline.
	SILTY CLAYEY SHALE:	Medium grey, slightly sandy, fissile, slightly cohesive.
	SILTY CLAYEY SHALE/SANDSTONE: (Paluxy Formation)	Interbedded: shale medium grey, slightly sandy, fissile, slightly cohesive. Sandstone buff, very fine- to fine-grained, soft, poorly cemented.
	CLAYEY SILT/ SANDSTONE:	Interbedded; light grey, slightly sandy, slightly cohesive, firm. Sandstone buff, very fine-to fine-grained, soft pobrly cemented.
	SILTY CLAY:	Light grey, slightly cohesive, less firm than above, some hard sandy pyrite.
		At 75 feet: Hard sandy pyrite.
	SANDSTONE:	Light grey, very fine-grained, poorly cemented, some thin clay interbeds, some pyrite.
		Below 79 feet: Fine- to medium-grained, well-cemented, hard.

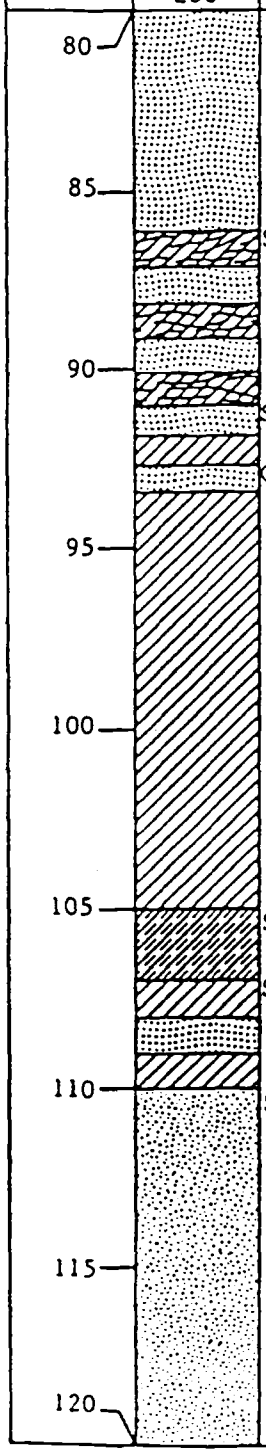
REMARKS:

FIGURE C-8 (continued)

LITHOLOGIC LOG OF MONITOR WELL P-6 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:



DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		
	SHALEY CLAY/ SANDSTONE:	Interbedded; sandstone buff to white, fine-to medium-grained, well cemented, hard. Clay grey to green, fissile, much pyrite, some lignite.
90		
	SANDSTONE/ CLAY:	Interbedded; sandstone buff to white, fine-to medium-grained, well cemented, hard. Clay grey, carbonaceous, slightly sandy, some pyrite, some lignite.
	CLAY:	Blue-green, firm, slightly cohesive, trace pyrite, trace lignite.
95		Below 97 feet: No lignite. Below 99 feet: No pyrite.
100		
		103-105 feet: Slightly silty.
105	SILTY CLAY/ CLAYEY SILT:	Blue-green, moderately firm, not cohesive, contains some brown carbonaceous clay.
	SANDSTONE/ CLAY:	Interbedded; sandstone buff, fine-to medium-grained, some silt, poorly to moderately cemented. Clay blue-green to buff, firm, cohesive, trace pyrite.
110	SAND:	Buff to light grey, very fine to fine, loose to poorly cemented, trace of lignite.
115		At 115 feet: Some brown carbonaceous clay.
120		

FIGURE C-8 (continued)

LITHOLOGIC LOG OF MONITOR WELL P-6 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	BOREHOLE DIAMETER:
BOREHOLE DEPTH:	

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
120		At 123.5 feet: very well cemented, hard.
125		At 125 feet: thin clay interbeds.
130		
135		
140		
145		Below 145 feet: increased lignite content, increased thin clay interbeds.
150		
155		
160		

FIGURE C-8 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-6 MIDDLE
(PALUXY FORMATION)

230251

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

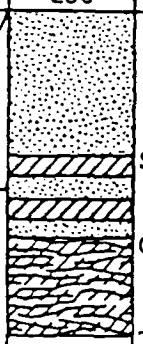
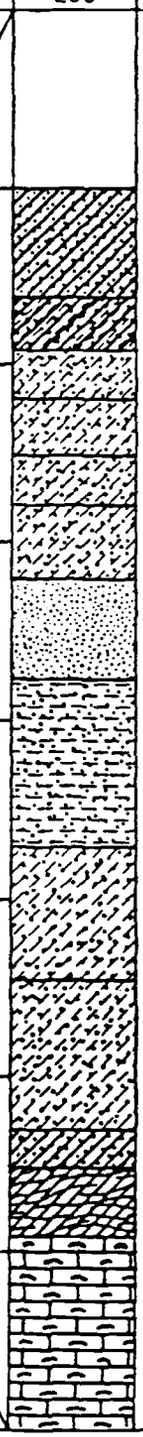
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
160		
		SAND/CLAY: Interbedded; sand buff to light grey, very fine-to fine-grained, loose, some lignite. Clay light grey to blue green, firm, cohesive.
165		
		CLAYEY SHALE: Blue-green, sandy, brittle, stiff, soft.
		TOTAL DEPTH 169 feet.
170		

FIGURE C-9

LITHOLOIC LOG OF MONITOR WELL P-7 UPPER (PALUXY FORMATION)

MAP COORDINATES: S. 2,328 ft.: R. 2,867 ft.
GROUND ELEV.: 656.2 ft. msl
DRILLING METHOD: Auger to 58.5 ft.; Mud Rotary to 111 ft.
BOREHOLE DEPTH: 111 ft.

DATE DRILLED: 5-2-84 to 1-6-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 28" to 36.5 ft.: 18" to 58.5 ft.; 12-3/4" to 111 ft.



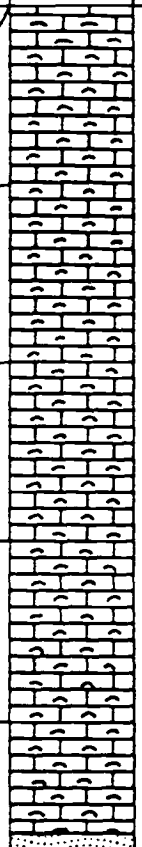
DEPTH	DESCRIPTION OF MATERIALS	
0	FILL:	0-1 feet: Asphalt and sub-grade. 1-5 feet: Sandy gravelly clay, medium to dark brown, very moist, medium to coarse sand and fine gravel, firm, slightly cohesive, sulfurous odor.
5	SANDY CLAY:	Red-brown, moist, fine-grained sand, trace fine limestone gravel, very firm, slightly cohesive.
	SANDY SILTY CLAY:	Red-orange, moist, fine-grained sand, trace fine limestone gravel, firm to very firm, slightly cohesive.
10	SILTY CLAYEY SAND:	Red-orange, moist, very fine to fine-grained, trace limestone gravel.
	SILTY SAND:	Tan to oragne, moist, very fine-to fine-grained, some clay loose.
	CLAYEY SAND:	Brown to orange, moist, fine-to medium-grained, some silt, some fine limestone gravel, loose.
15	SILTY SAND:	Tan to brown, moist, fine-to medium-grained, trace clay, trace fine limestone gravel.
	SAND:	Light brown, moist, very fine-to fine-grained, some silt, trace clay, loose.
20	SANDY SILTY:	Buff to grey, moist, very fine to fine sand, some clay, firm not cohesive.
25	SILTY CLAYEY SAND:	Light tan, very moist to wet, very fine-to fine-grained, some white clay blebs, volatile organic odor.
	SILTY SAND:	Yellow-tan, wet, very fine-to fine-grained, some clay, loose.
30	SANDY CLAY:	Yellow to white, wet, medium to coarse sand, some fine limestone gravel.
	SHALEY CLAY: (Walnut Formation)	Dark grey, stiff, cohesive calcareous.
35	SHELL AGGLOMERATE:	Medium to dark grey, dense, fossiliferous (oysters) matrix limestone, calcareous shale and clay.
40		

REMARKS:

FIGURE C-9 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-7 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		Below 40.5 feet: less fossiliferous, less clay.
45		Below 47.5 feet: increased clay content.
50		At 53 feet: very fossiliferous.
55		Below 57 feet: slightly sandy, some hard tight crystalline limestone.
60		
65		SANDSTONE: (Paluxy Formation) Light grey, very fine-grained to fine-grained; some clayc some lignite, poorly cemented.
70		
75		
80		

REMARKS:

FIGURE C-9 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-7 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		85-90 feet: some interbedded green clay.
90		90-92 feet: very well cemented.
95		
100		
105		
		CLAYSTONE: Green, firm.
		SANDSTONE: Light grey, fine-grained, moderately well cemented.
110		CLAYSTONE: Green, firm.
		TOTAL DEPTH 111 FEET.

REMARKS:

FIGURE C-10

LITHOLOGIC LOG OF MONITOR WELL P-7 MIDDLE (PALUXY FORMATION)

MAP COORDINATES: S. 2,368 ft.; R. 2,859 ft.
GROUND ELEV.: 655.3 ft. msl
DRILLING METHOD: Auger to 57 ft.; Mud Rotary to 165 ft.
BOREHOLE DEPTH: 165 ft.
DATE DRILLED: 1-7-85 to 2-13-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 36" to 39 ft.; 24" to 57 ft.; 18-3/4" to 111 ft.; 12-3/4" to 165 ft.

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Asphalt and sub-grade.
5, 10, 15		SILTY CLAY:	Brown to red-brown, some sand, some caliche in nodules and stringers.
20		SANDY CLAY:	Light brown, moist, very fine grained.
25, 30		CLAYEY SAND	Brown, moist, very fine grained, some silt. some weathered sandstone pebbles.
35		SHALEY CLAY: (Walnut Formation)	Dark grey, stiff, calcareous, fossiliferous (oysters).
40		SHELL AGGLOMERATE:	Grey, dense, fossiliferous (oysters), with interlayers of calcereous shale and clay.

REMARKS:

FIGURE C-10 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-7 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		
45		
50		At 50 feet: Thin interlayer of silty sandstone.
55		
		SANDSTONE: Grey, fine-grained, well sorted, some silt and clay. Some pyrite and lignite.
60		
65		
70		
75		
80		

REMARKS:

FIGURE C-10 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-7 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	BOREHOLE DIAMETER:
BOREHOLE DEPTH:	

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
80			
85			
90			
95			
100			
105		CLAYSTONE/ CLAYEY SHALE	Green, firm, contains sandstone interlayers.
110			111-118 feet: No returns.
115			
120		SANDSTONE:	Grey, very fine-grained, some silt, some clay.

REMARKS:

FIGURE C-10 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-7 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

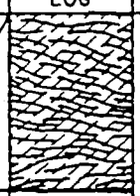
DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
120			At 122 feet: some lignite
125		SILTY CLAY:	Grey, soft, poorly consolidated, some sand.
130		SAND:	Grey, very fine to fine, some clay. Loose to poorly cemented.
135			
140			
145			146 to 150 feet: some lignite.
150			
155			
160			At 158 feet: trace of blue-green clay.

REMARKS:

FIGURE C-10 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-7 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	BOREHOLE DIAMETER:
BOREHOLE DEPTH:	

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
160		CLAYSTONE/ SHALEY CLAY:	Blue-green, firm, some sandstone interbeds.
165		TOTAL DEPTH 165 FEET	

REMARKS:

FIGURE C-11

LITHOLOGIC LOG OF MONITOR WELL P-8 UPPER (PALUXY FORMATION)

MAP COORDINATES: S. 1,150 ft.; R. 597 ft.
GROUND ELEV.: 644.5 ft. msl
DRILLING METHOD: Auger to 58 ft.; Mud Rotary to 92 ft.
BOREHOLE DEPTH: 92 ft.

DATE DRILLED: 1-8-85 to 1-19-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 24" to 38 ft.; 18" to 58 ft,; 12-3/4" to 92 ft.

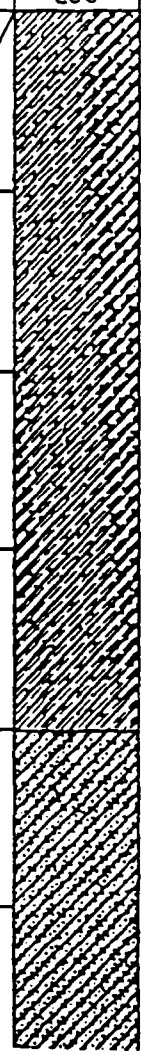
DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
0		SANDY SILTY CLAY:	Red-brown to light brown, slightly moist to dry, some caliche as nodules and stringers.
5			
10			At 10 feet: Some gravel.
15			
20		CLAYEY SAND:	Tan, slightly moist to dry, fossiliferous (contains nautiloids and gastropods re-worded from Goodland Formation).
25			

FIGURE C-11 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-8 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		CLAYSTONE/ CLAYEY SHALE: Blue-grey, firm, sandy.
90		
		TOTAL DEPTH 92 FEET.
95		

REMARKS:

TABLE E-2

LITHOLOGIC LOG OF MONITOR WELL P-8UN

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0 - 27.0	SILTY CLAY	CL	Grayish orange (10 YR 8/6), slightly plastic, slightly cohesive, firm, dry.
27.0 - 30.0	SANDY GRAVEL	GD	Varicolored, saturated, loose, medium- to very coarse-grained, well rounded.
30.0 - 58.5	FOSSILIFEROUS LIMESTONE	--	Gray (N 4 to N 8), dry, hard, abundant fossils, shale interbeds, Walnut Formation.
58.5 - 61.0	CLAYEY SANDSTONE	SP	Gray (N 4), wet, moderately cemented, sand is very fine-grained, well rounded.
61.0 - 73.0	SILTY CLAYSTONE	CL	Gray (N 5), wet, firm, slightly plastic non-cohesive.
73.0 - 84.0	SANDSTONE	SP	Whitish, moderately cemented, well sorted, very fine- to fine-grained, well rounded.
84.0 - 94.0	SILTY CLAY/SHALE	CL	Gray (N 4 to N 6), wet, firm, moderately plastic, moderately cohesive.

TOTAL DEPTH OF BOREHOLE: 94.0 Feet

*Unified Soil Classification System • ASTM D-2487

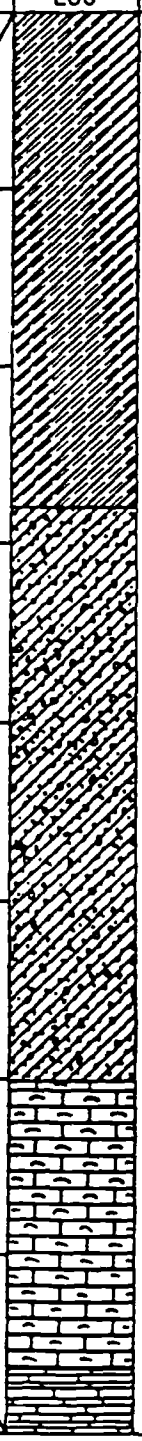
**Drilled by flight auger

FIGURE C-12

LITHOLOGIC LOG OF MONITOR WELL P-8 MIDDLE (PALUXY FORMATION)

MAP COORDINATES: S. 1,096 ft.; R. 597 ft.
GROUND ELEV.: 644.5 ft. msl
DRILLING METHOD: Auger to 58 ft., Mud Rotary to 169 ft.
BOREHOLE DEPTH: 169 ft.

DATE DRILLED: 1-8-85 to 1-29-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 36" to 39 ft.; 24" to 58 ft; 18-3/4 to 109 ft.; 12-3/4 to 169 ft.

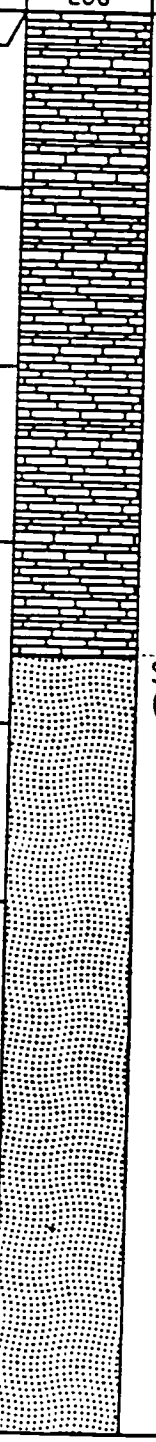
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SILTY CLAY:	Light brown, some sand, slightly cemented, some caliche nodules and stringers.
5			
10			
15		CLAYEY SAND AND GRAVEL:	Light brown, moist, very fossilferous (contains nautiloids and gastropods reworked from Goodland Formation).
20			
25			Dry at 25 ft.
30		SHELL AGGLOMERATE:	Grey, dry, clayey in places. Fossiliferous (oysters). Matrix of limestone and calcarous shale
35			
40		LIMESTONE:	Light grey to grey, slightly sandy to sandy, fossiliferous, shaley to crystalline.

REMARKS:

FIGURE C-12 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-8 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

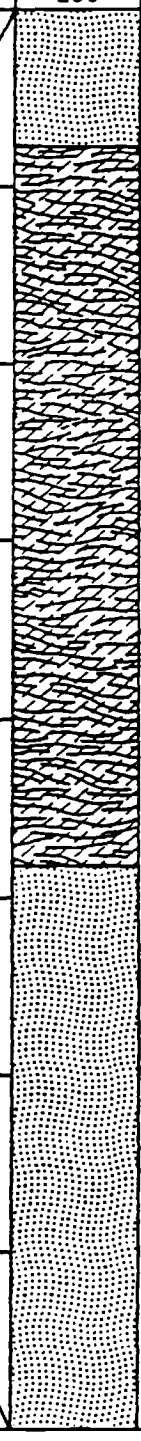
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		
45		
50		
55		
60		SANDSTONE: (Paluxy Formation) Grey, fine-grained, soft, friable.
65		
70		
75		
80		

REMARKS:

FIGURE C-12 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-8 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		CLAYSTONE/ CLAYEY SHALE:
90		
95		
100		
105		SANDSTONE: White to tan, medium grained, well rounded, some thin clay stringers.
110		
115		Below 116 feet: Very fine-grained, some pyrite.
120		

REMARKS:

FIGURE C-12 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-8 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
120		
125		
130		
135		At 135 feet: Some lignite
140		
145		146 - 156 feet: Fine to medium-grained white sand. Losing circulation.
150		
155		Below 156 feet: Very fine to fine grained.
160		

REMARKS:

FIGURE C-12 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-8 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
160		
165		
		CLAYSTONE/ CLAYEY SHALE — Blue-green, brittle, stiff, soft to hard.
170		TOTAL DEPTH 169 FEET

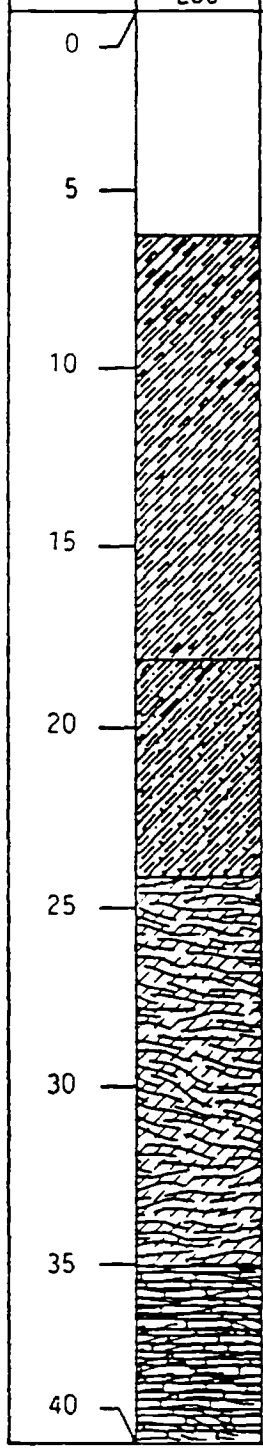
REMARKS:

FIGURE C-13

LITHOLOGIC LOG OF MONITOR WELL P-9 UPPER (PALUXY FORMATION)

MAP COORDINATES: S. 1,909 ft.; R. 1,510 ft.
GROUND ELEV.: 654.6 ft. msl
DRILLING METHOD: Auger to 63 ft.; Mud Rotary to 118 ft.
BOREHOLE DEPTH: 118

DATE DRILLED: 1-15-85
DRILLED BY: Southwestern Laboratories, Inc
BOREHOLE DIAMETER: 24" to 39.5 ft.; 18" to 63 ft.; 12-3/4" to 118ft



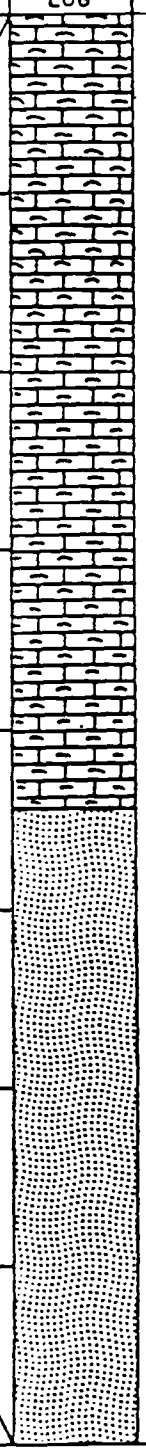
DEPTH	GRAPHIC LOG		DESCRIPTION OF MATERIALS
0		FILL:	Clay, red-brown, moist, cohesive, with some caliche.
5			
		SILTY CLAY:	Brown to red-brown, slightly moist to moist, brittle.
10			
15			
		SILTY SANDY CLAY:	Orange brown, slightly moist, brittle, some limonite stains, contains some fine gravel
20			
25		CLAYEY SHALE:	Grey-brown, dry, brittle, some linunite stains, fissile.
30			Goodland Formation dry throughout.
35		SHALEY LIMESTONE	Grey to black, dry, fissile, fossiliferous (oysters).
40			

REMARKS:

FIGURE C-13 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-9 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
40		SHELL AGGLOMERATE:	Medium to dark grey, dense, fossilferous (oysters), matrix of limestone and calcarous shale.
45			
50			
55			Below 54 feet: Becomes more sandy and harder with depth.
60			
65		SANDSTONE: (Paluxy Formation)	Grey, fine-grained, poorly to moderately cemented, some lignite and pyrite.
70			70 - 72 feet: Well cemented.
75			
80			

REMARKS:

FIGURE C-13 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-9 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		
90		
95		
100		
105		
110		
115		At 117 feet: Some lignite.
120		TOTAL DEPTH 118 FEET.

REMARKS:

TABLE E-3

LITHOLOGIC LOG OF MONITOR WELL P-9UN

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 0.5	ASPHALT AND SUBGRADE	--	
0.5 - 2.0	SILTY CLAY	CL	Brown (5 YR 3/4), moderately cohesive, slightly plastic.
2.0 - 7.0	SANDY SILT	SM	Grayish orange (10 YR 7/4), noncohesive nonplastic, sand is approixmately 30 percent, fine- to very coarse-grained, subangular to subrounded.
7.0 - 27.0	CLAYEY SILT - SILTY CLAY	ML - CL	Yellowish orange (10 YR 8/6), slightly cohesive, nonplastic, trace medium- to fine-grained sand.
27.0 - 36.0	SILTY SAND GRAVEL	GP	Varicolored, gravel is fine- to coarse-grained, subangular to rounded, sand is very fine- to coarse-grained, subangular to rounded.
36.0 - 63.0	FOSSILIFEROUS LIMESTONE WITH CLAY	--	Gray (N 7), hard, brittle, shell fragments are oyster shells, clay is interbedded, gray (N 2 to N 8), slightly cohesive, moderately plastic.
63.0 - 82.0	INTERBEDDED SILT, SAND, AND CLAY	SC	Gray (N 6 to N 8), sand is very fine-grained, clay is slightly cohesive. At 76.0 - 82.0 feet, drill cuttings indicate pyrite seams.
82.0 - 109	SANDSTONE	--	White to very light gray (N 8 to N 9), very fine- to medium-grained, well rounded, interbedded, loosely cemented to well cemented sandstone, trace silty sand.

*Unified Soil Classification System ASTM D-2487

**Drilled by mud rotary

TABLE E-3 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-9UN

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
109.0 - 112.0	SANDY CLAY	SC	Medium gray (N 5), cohesive, slightly plastic, sand is very fine-grained, some pyrite.

TOTAL DEPTH OF BOREHOLE: 112 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

FIGURE C-14

LITHOLOGIC LOG OF MONITOR WELL P-9 MIDDLE (PALUXY FORMATION)

MAP COORDINATES: S. 1,975 ft.; R. 1,510 ft.
GROUND ELEV.: 654.6 ft. msl
DRILLING METHOD: Auger to 62.5 ft.: Mud Rotary to 168 ft.
BOREHOLE DEPTH: 168 ft.

DATE DRILLED: 1-14-85 to 2-12-85
DRILLED BY: Southwestern Laboratories. Inc.
BOREHOLE DIAMETER: 36" to 39.5 ft.: 24" to 62.5 ft.; 18-3/4" to 128 ft.; 12-3/4" to 168 ft.

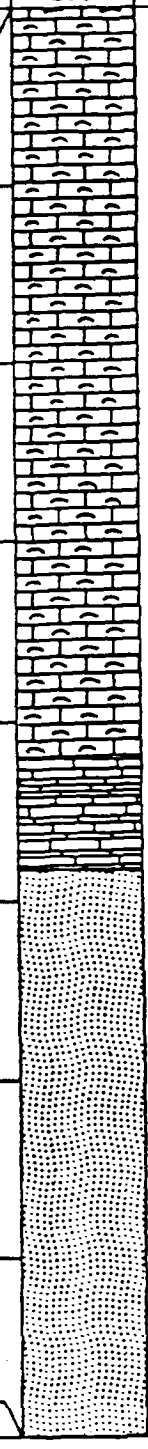
DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		FILL:	Clay, red-brown, moist, cohesive, with limestone or caliche pebbles.
5		SILTY CLAY:	Light brown, moist, cohesive, with some caliche nodules.
10			
15		CLAYEY SANDY GRAVEL:	Orange-brown, moist, cohesive, fossilferous (contains nautiloids and gastropods re-worked from Goodland Formation). At 16 feet: some quartz pebbles.
20			
25			Below 26 feet: wet, slight fuel oder.
30			
35			
40		SHELL AGGLOMERATE: (Walnut Formation)	Medium grey, dense, fossilferous (oysters), matrix and interbeds of sandy limestone, calcareous shale, and clay.

REMARKS:

FIGURE C-14 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-9 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		
45		
50		
55		Below 54 feet: becomes more sandy and harder with depth.
60		
		LIMESTONE: Grey, sandy, hard, fossilferous.
65		SANDSTONE: (Paluxy Formation) Grey, fine grained, silty, some clay, some lignite and pyrite.
70		
75		
80		

REMARKS:

FIGURE C-14 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-9 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		At 84 feet: very hard, well cemented, some pyrite cement.
90		
95		
100		
105		
110		At 110 feet: some grey clay.
115		
120		LIGNITE: Black, soft, woody, sandy, clayey.

REMARKS:

FIGURE C-14 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-9 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
120		CLAYEY SAND/ SANDY CLAY:	Grey, silty, very fine-to-fine-grained sand, some lignite
125			
		SANDSTONE:	Grey, fine-grained, loose to moderately cemented, some thin lignite seams.
130			
135			
140			
145			
150			Below 150 feet: Clean sand, little silt or clay. Well sorted. Some lost circulation during drilling.
155			
160			

REMARKS:

FIGURE C-14 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-9 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
160		
165		
		CLAYSTONE/ CLAYEY SHALE: Green, brittle, stiff, hard.
		TOTAL DEPTH 168 FEET.
170		

REMARKS:

FIGURE C-15

LITHOLOGIC LOG OF MONITOR WELL P-10 UPPER (PALUXY FORMATION)

MAP COORDINATES: S. 3,626 ft.; R. 3,286 ft.
GROUND ELEV.: 628.9 ft. msl
DRILLING METHOD: Auger to 28 ft.; Mud Rotary to 58 ft.
BOREHOLE DEPTH: 58 ft.

DATE DRILLED: 1-22-85 to 1-23-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 18" to 28 ft.; 12-3/4" to 58 ft.

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
0		SANDY CLAY:	Brown, moist, some silt, trace gravel.
		SHELL AGGLOMERATE: (Walnut Formation)	Light brown to grey, dense, fossiliferous (oysters). Contains interbeds of sandy claystone.
5			
10			
15			
20			
25			
30		SILTY CLAYEY/ SANDSTONE (Paluxy Formation)	Dark grey to brown, poorly cemented, some lignite and pyrite. Very fine grained.
35			
40			At 39 feet: hard, well cemented.

REMARKS:

FIGURE C-15 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-10 UPPER
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
40		Below 40 feet: less silt.
45		
50		Below 50 feet: some green claystone interbeds.
55	CLAYSTONE/ CLAYEY SHALE	Blue-green, firm, contains some sandstone interbeds.
60	TOTAL DEPTH 58 FEET.	

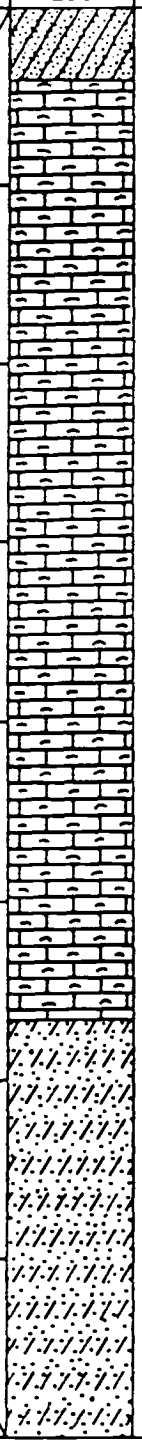
REMARKS:

FIGURE C-16

LITHOLOGIC LOG OF MONITOR WELL P-10 MIDDLE (PALUXY FORMATION)

MAP COORDINATES: S. 3,654 ft.; R. 3,286 ft.
GROUND ELEV.: 628.5 ft. msl
DRILLING METHOD: Auger to 32 ft; Mud Rotary to 134 ft.
BOREHOLE DEPTH: 134 ft.

DATE DRILLED: 1-22-85 to 2-10-85
DRILLED BY: Southwestern Laboratories, Inc.
BOREHOLE DIAMETER: 24" to 32 ft.; 18-3/4" to 63 ft.; 12-3/4" to 134 ft.



DEPTH	DESCRIPTION OF MATERIALS	
0	SANDY CLAY:	Brown, moist, some silt, trace gravel.
5	SHELL AGGLOMERATE: (Walnut Formation)	Light brown to grey, dense, fossiliferous (oysters). Contains interbeds of sandy claystone.
10		
15		
20		
25		Becomes hard crystalline limestone near base of Formation.
30	SILTY CLAYEY SANDSTONE (Paluxy Formation)	Dark grey, poorly to moderately cemented, some lignite and pyrite.
35		
40		

REMARKS:

FIGURE C-16 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-10 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS	
40			
45			
50			
55		CLAYSTONE/ CLAYEY SHALE:	Blue-green, firm.
60			
65			
70			
75			
80			

REMARKS:

FIGURE C-16 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-10 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:
GROUND ELEV.:
DRILLING METHOD:
BOREHOLE DEPTH:

DATE DRILLED:
DRILLED BY:
BOREHOLE DIAMETER:

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
80		
85		
		SANDSTONE: Grey, fine-grained, loose to moderately cemented, some silt and clay
90		
95		
100		
105		
110		
115		
120		

REMARKS:

FIGURE C-16 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-10 MIDDLE
(PALUXY FORMATION)

MAP COORDINATES:	DATE DRILLED:
GROUND ELEV.:	DRILLED BY:
DRILLING METHOD:	BOREHOLE DIAMETER:
BOREHOLE DEPTH:	

DEPTH	GRAPHIC LOG	DESCRIPTION OF MATERIALS
120		
125		
130		CLAYSTONE/ CLAYEY SHALE: Blue-green, firm.
135		TOTAL DEPTH 134 FEET.

REMARKS:

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 1 OF 2 SHEETS

1. PROJECT A.F. Plant #4(GD), Paluxy Aquifer	10. SIZE AND TYPE OF BIT *
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY USCE	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) P-11(u)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED 0
5. NAME OF DRILLER Brewer	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER ***
7. THICKNESS OF OVERBURDEN 8.3	16. DATE HOLE: STARTED 26 July 85; COMPLETED 13 Aug 85
8. DEPTH DRILLED INTO ROCK 84.7	17. ELEVATION TOP OF HOLE 638.67
9. TOTAL DEPTH OF HOLE 93.0	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR Robert McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10' 30' 50' 70' 90'		0.0 to 0.3 - Asphalt. 0.3 to 2.4 CLAY - high plasticity, medium stiff, slightly moist, dark brown, chemical odor. 2.4 to 6.5 GRAVEL - coarse to fine, angular, medium dense, slightly moist, brown, very sandy and clayey, calcareous. 6.5 to 8.3 CLAY - high plasticity, stiff, slightly moist, red, sandy lime. 8.3 to 12.3 SHALE - weathered to a high plastic and very stiff clay consistency, good blocky structure present, moist, yellow brown and light gray, a few scattered lime concentrations and shell fragments - possibly a reworked shale. 12.3 to 31.0 ARILLACEOUS LIMESTONE and SHALE interbedded - Walnut Fm. - weather stains noted until 19', then no apparent weathering, white L.S. and yellow brown shale which grades to gray by 19', the beds are generally less than 1' thick, very soft(rock classification) shale to hard L.S. 31.0 to 53.5 LIMESTONE - white, moderately hard to hard(rx class).			Note: Hole supervised by Robert McVey from 0.0 to 61.7' and then by James Christie from 61.7 to 93.0' - which also included installation of pipe and pump. Note: The lithology and their contacts were primarily discerned from gamma and electric logs and supported by drill cuttings. * Drilling 0 to 9' - 8" auger, 0 to 12.5' - 14" auger, auger refusal at 12.5', 12.5 to 61.7' - 14" rock bit. Hole bailed to 59.2' immediately after 10" metal casing welded and set in hole to 62'. Csng was grouted from bottom of hole(62') up to surface. 61.7 to 92.98' - 9 7/8" rockbit. *** Water check on 1 Aug 1985 read at 61.7' with csng in hole. 2 Aug 85 - water at 58.3 no water movement. After TD attained the water check on 12 Aug 85 read at 83.2', 28 Aug 85 reads at 82.3'. Jars A. 0.3 to 2.4 B. 2.4 to 6.5 C. 6.5 to 8.3 D. 8.3 to 12.3 Vial samples of fluid and cuttings taken at 93'.

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

Hole No. F-11(u)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 2 OF 2 SHEETS

1. PROJECT A.F. Plant #4(GD), Paluxy Aquifer	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) F-11(u)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE 93'	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR Robert McCly

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			31 to 53.5(continued) LIMESTONE - dense oyster shell beds scattered, occasional very hard(rx class) seams, shale seams scattered throughout. Walnut Fm. 53.5 to 54.0 SHALE 54.0 to 59.8 SANDSTONE 59.8 to 63.8 SHALE - unweathered dark gray, soft(rx class), thin lime stringers throughout, silty, sandy with numerous sand seams. Paluxy Fm. 63.8 to 70.1 SHALE and SAND interbedded - shale is as above shale and sand if fine grained, silty, grey, non cemented. Paluxy Fm. Transition zone. 70.1 to 93.0 SAND/SANDSTONE - fine, very silty, numerous silt seams, clayey with scattered clay/shale seams which generally occur in 0.4' thick or less seams, gray and brown, very soft to moderately hard(rock classification), friable, mostly non cemented, but cement noted from drill action.			Instrumentation For further information see diagram. After completion of drilling: Set 4" pvc from TD to surface and added gravel pack up to 38'. Location of joints of the 4" pipe from the bottom measuring up: 5.43'(bottom blank and plug), 19.82'(screen), 9.79, 9.79', 9.79', 9.79', 9.79', 9.79', & 9.79' totals 93.78' pipe with 0.8' stick up. Set submersible pump at total depth of 91.82' with intake screen at 89.22'. Joints on pump riser listed from bottom of pump and up to surface: pump length = 4.4', then 21.1', 21.08', 21.12', 21.12', 4.0' totals = 92.92' with 1' stick up. ALL DEPTHS FROM GROUND SURFACE Note: Lithology shown between depths 53.5 and 59.8 feet changed based on reinterpretation of geophysical log.

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT — HOLE NO.

TABLE E-4

LITHOLOGIC LOG OF MONITOR WELL P-11US

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0-1	ASPHALT AND SUBGRADE		Yellowish Brown (10 YR 5/4), with dark brown mottle, 50% clay, 50% silt, soft, plastic.
1-10	SILTY CLAY	CL	White to tan (2.5 Y 7/4), clay, very hard, dense, weathered, indurated reaction with HCl vigorous.
10-17	SHALE/LIMESTONE	--	Tan (2.5 Y 7/4), shale with black inclusions, reaction with HCl vigorous. Interbedded with tan limestone, soft to hard with depth.
17-54	SHALE/LIMESTONE	--	Gray (5 Y 6/1), shale, soft to hard, red staining. Interbedded with gray limestone, very hard brittle, more massive with depth. Lenses of white limestone with shell fragments with depth.
54-55	SILTY CLAY	CL	Gray (2.5 Y 6/1), 60 percent clay, 40 percent silt, plastic, soft to firm.
55-60	SAND WITH SILT	ML	Gray (2.5 Y 5/1), 90 percent sand, 10 percent silt, sand is very fine to fine, trace mica (biotite).
60-62	SILT/SAND SILT/CLAYEY SILT	ML-CL	Dark grayish brown (2.5 Y 4/2), to gray (5 Y 5/1), silt, dry, hard, graying to gray, 80 percent silt, 20 percent sand, sand is very fine, dry to slightly moist, slightly plastic, hard. At 62 feet, gray, 80 percent silt, 20 percent clay, plastic, hard.

TOTAL DEPTH OF BOREHOLE: 62 Feet

*Unified Soil Classification System ASTM D-2487

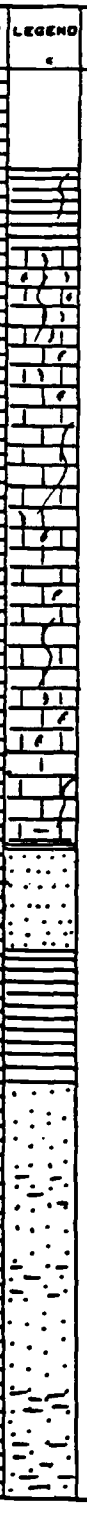
**Drilled by mud rotary

232287

Hole No. P-11(m)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 1 OF 2 SHEETS

1. PROJECT A.F. Plant #4(GD), Paluxy Aquifer	10. SIZE AND TYPE OF BIT *
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY USCE	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) P-11(m)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ** ; UNDISTURBED
5. NAME OF DRILLER Brewer	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER ***
	16. DATE HOLE: STARTED 13 Aug 85 ; COMPLETED 26 Aug 85
7. THICKNESS OF OVERBURDEN 7.0	17. ELEVATION TOP OF HOLE 638.84
8. DEPTH DRILLED INTO ROCK 158.4	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 165.4	19. SIGNATURE OF INSPECTOR Robert McCoy

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10' 20' 30' 40' 50' 60' 70' 80' 90' 100'		0.0 to 0.3 - Asphalt. 0.3 to 4.8 CLAY - high plasticity, medium stiff, slightly moist, dark brown, chemical odor at top of unit. 4.8 to 7.0 GRAVEL - coarse to fine, angular, medium dense, slightly moist, brown, very sandy and clayey. 7.0 to 12.7 SHALE - weathered to a plastic and very stiff clay consistency, slightly moist, yellow brown and gray, slightly limey, few scattered shell fragments. Walnut Fm. 12.7 to 54.0 LIMESTONE - weather stained, but mostly white, moderately hard to hard(rock classification), moderately to well cemented, dense oyster shell zones throughout, numerous soft(rx class) shale seams scattered within - they are generally less than 1' thick, but some do thicken up to 2.4', ie especially from 24.0 to 31.0', unit is very shaley with sand from 54 to 61.5'. Walnut Fm. 54.0 to 54.8 SHALE 54.8 to 61.5 SANDSTONE 61.5 to 71.0 SHALE - no apparent weathering, soft(rx class), grey to blue-grey, sand seams throughout, silty.			Note: Lithologic units and their contacts were primarily interpreted from gamma and electric logs. * Drilling 0 to 12.5' - 14" auger, 12.5 to 106' - 14" rockbit, set 106' of 10" metal csng and csng then grouted from bottom of hole to surface. 106 to 161.0' - 9 7/8" rockbit - the actual bottom of hole measured to be 165.4' - driller claimed wash out of loose sand. ** Vial samples of fluid and cuttings together at; 60', 70', 80', 90', 100', and 105.5'. A seperate vial for fluid and cuttings taken at 165'. *** Water check first thing on morning of 20 Aug 85 with TD of hole at 105.5' = 82'. Hole bailed to 95' on 22 Aug 85 with 10" csng in hole. Water recovered to 82' within ½ hour. Note: Lithology shown between depths 54.0 and 61.5 feet changed based on reinterpretation of geophysical log.

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

232233

Hole No. P-11(m)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 2 OF 2 SHEETS

1. PROJECT: A.F. Plant #4(GD), Paluxy Aquifer
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number): P-11(m)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 165.4'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED / COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Robert McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	110' 120' 130' 140' 150' 160' 165'		71.0 to 153.3 SAND/SANDSTONE - no apparent weathering, friable, weakly to non cemented, soft to moderately hard(rock classification), fine grained, very silty, grey, a few thin lime stringers scattered, clay/shale seams throughout and usually are less than 1' thick, pyrite concretions scattered, lignite noted after 82', harder zones noted at; 123.5 to 124.7', and 128.3 to 129.0', thicker shale/clay seams or very shaley zones noted at; 77.3 to 79.5', 83.8 to 86.1, 92.5 to 94', 96.0 to 99', 104 to 109.8', 127.2 to 129', 132.8 to 135', 140.0 to 142.2', 144.3 to 145', Paluxy Fm. 153.3 to 165.4 SAND and SHALE interbedded sand is fine, friable, and silty, the shale is dark grey, both are soft(rx class).			Instrumentation Set 4" pvc pipe to TD and gravel packed up to 83'. The 4" pvc joints were recorded from the bottom up as follows: plug and blank at bottom(165.4') with joints at .65', 4.75', the screens top joint at 19.77', then blank joints at 9.78', 9.73', 9.78', 9.79', 9.75', 9.78', 9.76', 9.76', 9.71',9.78', 9.79', 9.79', 9.79', 9.74', 4.77' which includews 1.3' stick up. Joints with stabilizers on them are indicated by underlining of the above - all stabilizers are 5' below said joint. Set submersible pump (Standard,1/2Hp, 8 gpm at 110') down to 159' with intake screen 2.6' above bottom of pump - this is followed by 7 sections of 1" metal pipe all of which have a 21.2' length with collars, an additional section of pipe of 7' at top included .77' stick up. For further details on installation see diagram. ALL DEPTHS FROM GROUND SURFACE

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

Hole No. P-12(u)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 1 OF 2 SHEETS

1. PROJECT A.F. Plant #4(GD), Paluxy Aquifer	10. SIZE AND TYPE OF BIT *
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY USCE	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) P-12(u)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ** ; UNDISTURBED
5. NAME OF DRILLER Brewer	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER ***
	16. DATE HOLE: STARTED 16 Sept 85; COMPLETED 24 Sept 85
7. THICKNESS OF OVERBURDEN 9.4	17. ELEVATION TOP OF HOLE 643.64
8. DEPTH DRILLED INTO ROCK 87.6	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 97'	19. SIGNATURE OF INSPECTOR Robert McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0 to 0.5 - Concrete. 0.5 to 1.0 - Base GRAVEL. 1.0 to 3.3 CLAY - high plasticity, stiff, slightly moist, dark brown, slightly sandy. 3.3 to 8.7 GRAVEL and SAND interbedded - both are coarse to fine, medium dense, slightly moist, dark brown to white, clayey and cobbles up to 6", calcareous. 8.7 to 9.4 CLAY - high plasticity, stiff to very stiff, slightly moist, yellow brown, lime nodules, oyster shells, sandy and gravelly, possibly a reworked shale. 9.4 to 54.6 LIMESTONE - weather stains, white with yellow brown, moderately hard to hard (rock classification), moderately to well cemented, soft(rx class) shale seams scattered throughout, oyster beds within. Very shaley zone from 15.9 to 25.5'. 54.6 to 55.2 SHALE 55.2 to 59.0 SANDSTONE 59.0 to 72.8 SHALE and SAND interbedded - sand is fine grained and friable, shale is an unweathered dark gray, both are soft(rx class).			Note: Lithologic units and their contacts wre primarily interpreted by project geologist from gamma and electric logs. * Drilling 0 to 0.5' - 14" rockbit, 0.5 to 10.5' - 14" auger, 10.5 to 97' - 14" rockbit, set 52' of 10" metal casing after 54' attained. The casing was then grouted in from the bottom and up to surface. ** Vial samples were taken at the following depths; at 4' - auger cuttings. at 97' - rockbit cuttings in one vial and drill fluid in another. *** Hole bailed after completion of drilling. Water level taken after installation of 4" pipe at 87.9'. Installation Set 4" pvc pipe to TD of 97' with screen from 97 to 67'(plug in bottom) and blanks to surface with 1' stick up. No pump installed. Pipe to be set inder ground at a later date. Pump for sampling installed later. ALL DEPTHS FROM GROUND SURFACE

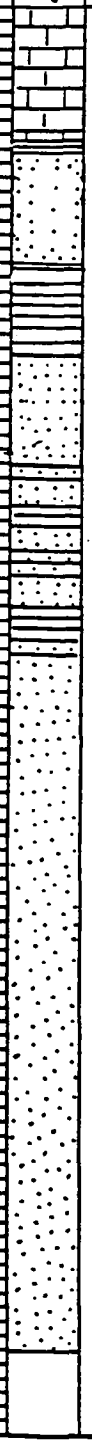
10' 20' 30' 40' 50'

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

Hole No. P-12(u)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 2 OF 2 SHEETS

1. PROJECT A.F. Plant #4(GD), Paluxy Aquifer	10. SIZE AND TYPE OF BIT *
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) P-12(u)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 97'	19. SIGNATURE OF INSPECTOR Robert McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	60' 70' 80' 90' 95'		72.8 to 97.0 SAND/SANDSTONE - fine grained, friable, mostly weak to non cemented, some moderately cemented seams, shale seams scattered, lime stringers within, overall has a grey to light grey color, soft(rx class)			Note: Lithology shown between depths 54.6 and 59.0 feet changed based on reinterpretation of geophysical log.

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

TABLE E-5

LITHOLOGIC LOG OF MONITOR WELL P-12UN

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0-1.5	CONCRETE AND FILL		
1.5-8.0	SILT	MH	Dark yellowish brown (10 YR 4/2), noncohesive buff colored chert nodules; trace sand.
8.0-15.0	SANDY SILTY LIMESTONE	--	Grayish orange (10 YR 7/4), silt is noncohesive, sand is fine grained 10-15 percent. At 10 feet, more varicolored sand, sub- to angular. At 14 feet, more silt, color change to light brown (5 YR 6/4). At 14.5 feet, gravel stringer, varicolored, fine-grained, subangular to subrounded.
15.0-58.0	FOSSILIFEROUS LIMESTONE	--	Medium light gray to medium gray (N 6 to N 5), dry well cemented, oyster fossils. At 20.5 to 21.0 feet, clay, medium light gray (N 6), sticky, cohesive, nonplastic. At 23.0 to 26.0 feet, same as above. At 37.0 to 38.0 feet, silty shale, shale is black; silt is medium gray (N 5). At 43.5 to 44.0 feet, soft layer, probably silt.
58.0-58.5	CLAYEY SILTSTONE	--	Medium gray (N 5), noncohesive.

*Unified Soil Classification System ASTM D-2487

**Drilled by mud rotary

TABLE E-5 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-12UN

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
58.5-61.0	LIMEY SANDSTONE	--	Medium gray (N 5), very fine-grained; some pyrite.
61.0-70.5	CLAYEY SILTSTONE-SANDY SILTSTONE	--	Medium gray (N 5), noncohesive; sand is very fine-grained.
70.5-77.0	SILTY SANDSTONE-SANDSTONE	--	Light gray (N 7), very fine-grained.
77.0-78.0	GRAVELLY SAND	GP	Varicolored, sand is fine- to medium-grained, subangular to subrounded; gravel consists of chert and limy nodules, fine- to medium-grained, subangular to subrounded; some pyrite.
78.0-97.0	SILTY SANDSTONE	--	Light gray (N 7), very fine-grained. At 82 feet, gravel stringer. At 85.5 feet, gravel stringer.

TOTAL DEPTH OF BOREHOLE: 97 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

Hole No. P-12(M)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 1 OF 2 SHEETS
1. PROJECT A.F. Plant #4(GD), Paluxy Aquifer		10. SIZE AND TYPE OF BIT *	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500	
4. HOLE NO. (As shown on drawing title and file number)	P-12(M)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED ** / UNDISTURBED
5. NAME OF DRILLER Brewer		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER ***	
		16. DATE HOLE	STARTED 3 Sept 85 / COMPLETED 16 Sept 85
7. THICKNESS OF OVERBURDEN	9.4	17. ELEVATION TOP OF HOLE 643.54	
8. DEPTH DRILLED INTO ROCK	146.1	18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE	155.5	19. SIGNATURE OF INSPECTOR Robert McVey	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0 to 0.5 - Concrete. 0.5 to 1.0 - Base GRAVEL. 1.0 to 3.5 CLAY - high plasticity, stiff, slightly moist, dark gray to dark brown, sandy and gravelly, calcareous. 3.5 to 8.7 SAND and GRAVEL interbedded - both are coarse to fine grained, medium dense, slightly moist, dark brown, clayey, cobbles, calcareous. 8.7 to 9.5 CLAY - high plasticity, stiff to very stiff, slightly moist, yellow brown, lime nodules and concentrations, sandy and gravelly, possibly a reworked shale. 9.5 to 54.4 LIMESTONE - weather stains throughout, white and yellow brown stains, moderately hard to very hard(rock classification), moderately to well cemented, oyster shells throughout with dense oyster beds within, shale seams scattered throughout as are lignite seams, a very shaley zone is encountered from 10.9 to 15.8', the shale is soft(rock classification). 54.4 to 55.0 SHALE 55.0 to 58.8 SANDSTONE 58.8 to 72.6 SHALE and SAND interbedded - sand is fine grained and friable, shale is essentially unweathered dark grey, both are soft(rx class) with lignite seams and lime stringers within.			Note: Lithologic interpretation and their contacts were determined by the project geologist primarily from gamma and electric logs. * Drilling 0 to 0.5' - 14" rockbit, 0.5 to 10.5' - 14" auger, 10.5 to 155.5' - rockbit, set 103' of 10" metal pipe of which one foot was stick up. The csng was then grouted up from the bottom to the surface. Installations Set 4" pvc pipe to TD with intake screen from 150 to 130'. This pipe was then graveled up to 77'. The bottom of pump was then set at 149.5' and 1" riser pipe to surface with 1' stickup. All pump and pipe system to be set under ground at a later date. Diagram to be completed when above system completed. *** Hole bailed after completion of drilling. Water check on 17 Sept 1985 at 87.9'. ** Vial samples taken at: one from auger cuttings one from drill fluid at 155.5' and one from rockbit cuttings at 155.5'. ALL DEPTHS FROM GROUND SURFACE

20' 40' 60' 80'

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

Hole No. P-12(M)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 2 OF 2 SHEETS

1. PROJECT: A.F. Plant #4(GD), Paluxy Aquifer
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: USCE
4. HOLE NO. (As shown on drawing title and file number): P-12(M)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 155.5'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED / COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR: Robert McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	80'		72.6 to 155.5 SAND/SANDSTONE - Paluxy Fm. fine grained, no apparent weathering, friable, non cemented to weakly cemented from top of unit to 115.5', then cementation tends to increase in hardness and frequency of appearance, light grey, some white, lime stringers scattered, shale seams and zones scattered throughout, ie, 100.5 to 102', 114.2 to 115.5', 145.4 to 148', and 153.1 to 154.3', this unit overall varies from soft to moderately hard(rock classification).			Note: Lithology shown between depths 54.4 and 65.8 feet changed based on reinterpretation of geophysical log.
	100'					
	120'					
	140'					
	160'					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

232235

DRILLING LOG SWD

INSTALLATION: Ft Worth

SHEET 1 OF 3 SHEETS

1. PROJECT: Air Force Plant 44	10. SIZE AND TYPE OF BIT: #
2. LOCATION (Coordinates or Station): Paluxy Aquifer	11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
3. DRILLING AGENCY: USCE	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
4. HOLE NO. (As shown on drawing title and file number): P-13(u)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0; UNDISTURBED 0
5. NAME OF DRILLER: Brewer	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER:
	16. DATE HOLE: STARTED 7 Jan 86; COMPLETED 30 Jan 86
7. THICKNESS OF OVERBURDEN: 14.4	17. ELEVATION TOP OF HOLE: 638.18
8. DEPTH DRILLED INTO ROCK: 76.1	18. TOTAL CORE RECOVERY FOR BORING: %
9. TOTAL DEPTH OF HOLE: 90.5	19. SIGNATURE OF INSPECTOR: James L. Christie

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0 to 6.9 CLAY - fill, medium plasticity, moderately stiff, slightly moist, black to brown, scattered gravels. 6.9 to 8.9 CLAY - medium plasticity, moderately stiff, slightly moist, black/brown, scattered gravels. 8.9 to 14.4 GRAVEL - slightly cobbly, clayey, slightly moist. 14.4 to 26.0 SHALE - calcareous. 26.0 to 28.3 LIMESTONE - shaly. 28.3 to 55.3 LIMESTONE - few shale seams except from 42.0 to 47.5' where shaly.			1* Drilling 0.0 to 14.5' - 10" auger, 14.5 to 68.0' - 12" pilot bit & 14" rockbit. 68 to 90.5' - 10" rockbit. 2. Bedrock lithologies identified from drill cuttings, rate of bit penetration, and from electric log. 3. Casing: 10" steel casing set to 68' with cement circulated to the ground surface. 4" pvc, 0.010 slot screen set 90.1' to 70.1'. 4" pvc schedule 80 csg set from 70.1 to surface 4. Pump: 2 7/8" dia, 20 stage, single phase, model 2x4 P050, 8gpm(max) pump, made by Standard Pump Co., Bartlesville, Ok. Pump suction at 88.1' below ground surface.

10'
20'
30'
40'

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE

PROJECT | HOLE NO.

232236

Hole No. P-13(u)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 2 OF 3 SHEETS

1. PROJECT Air Force Plant #4, Paluxy Aquifer	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) P-13(u)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
	15. ELEVATION GROUND WATER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	16. DATE HOLE: STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 90.5'	19. SIGNATURE OF INSPECTOR James L. Christie

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			55.3 to 56.0			
			SHALE -			
			56.0 to 63.7			
			SANDSTONE - silty.			
			63.7 to 72.0			
			SHALE.			
	50'		72.0 to 76.0			
			SANDSTONE - very silty decreasing with depth to slightly silty.			
			76.0 to 90.5			
			SANDSTONE - contains a number of shale streaks and thin seams.			
			- T.D. 90.5' -			
	60'					
	70'					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

Hole No. P-13(u)

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 3 OF 3 SHEETS

1. PROJECT: Air Force Plant #4, Paluxy Aquifer
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY:
4. HOLE NO. (As shown on drawing title and file number): P-13(u)
5. NAME OF DRILLER:
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 90.5'
10. SIZE AND TYPE OF BIT:
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED: COMPLETED:
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: James L. Christie

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	90'					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

TABLE E-6

LITHOLOGIC LOG OF MONITOR WELL P-13US

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0-0.5	TURF		
0.5-8.5	CLAYEY SILT	ML	Very dark grayish brown (2.5 Y 3/2) 85 percent silt, 15 percent clay, soft, plastic, cohesive, trace fine sand; grading to black (2.5 Y N/2); 50 percent silt, 50 percent clay, soft to firm, very plastic, cohesive.
8.5-11	GRAVEL/CLAYEY SILT	GM-GC	Mottled gravel with coarse sand, very angular to subround; interbedded with light olive brown (2.5 Y 5/4) 85 percent silt, 15 percent clay, plastic, cohesive.
11-27	SILT	MH	White (2.5 Y 8/2) silt, very soft, cohesive, trace very fine to fine sand. At 13 feet calcareous stringer, firm to hard, brittle.
27-54.5	CLAYEY SILT/LIMESTONE	--	Gray (2.5 Y 5/2) 85 percent silt, 15 percent clay, soft to firm, plastic, slightly cohesive, reaction with HCl, interbedded with gray (2.5 Y 5/2). Limestone, firm to hard, brittle. Clayey silt and limestone becoming harder with depth. At 29 feet thin, white, soft, limestone interbeds containing shell fragments.
54.5-61	SAND	SW	Gray (2.5 Y 5/2) sand, mottle gray to tan, very fine- to medium-grained, dense, friable.

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-6 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-13US

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
61-64	CLAYEY SILT	ML	Gray (2.5 Y 5/2) 60 percent silt, 40 percent clay, very plastic, grading to silt with clay, trace very fine sand, slight plasticity. At 64 feet, back to clayey silt as above.

TOTAL DEPTH OF BOREHOLE: 64 Feet

*Unified Soil Classification System
ASTM D-2487

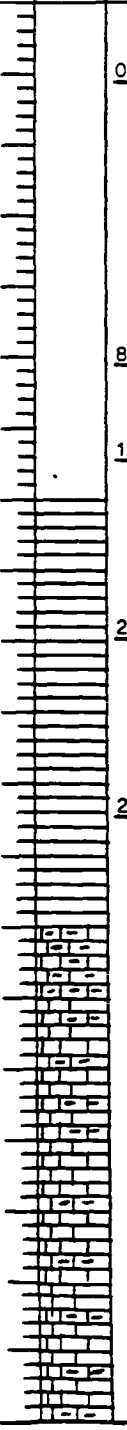
**Drilled by mud rotary

Hole No. P 13 - M

DRILLING LOG	DIVISION SWD	INSTALLATION Fort Worth	SHEET 1 OF 4 SHEETS

1. PROJECT	Air Force Plant Number 4
2. LOCATION (Coordinates or Station)	Paluxy Aquifer Pollution Investigation
3. DRILLING AGENCY	USCEC
4. HOLE NO. (As shown on drawing title and file number)	P 13 - M
5. NAME OF DRILLER	Brewer
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	14.0
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	
10. SIZE AND TYPE OF BIT	14" Reamer/6" Core Barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
12. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 0 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	4
15. ELEVATION GROUND WATER	See comment 1
16. DATE HOLE	STARTED 16 Dec. 85 / COMPLETED 3 Jan. 86 (110')
17. ELEVATION TOP OF HOLE	637.83
18. TOTAL CORE RECOVERY FOR BORING	65.0 %
19. SIGNATURE OF INSPECTOR	Randy Fischer

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0.0' to 6.5' CLAY FILL: black-brown; medium plasticity; medium stiff; slightly moist; scattered gravel. 6.5' to 8.5' CLAY: black-brown; medium plasticity; medium stiff; slightly moist; scattered gravel. 8.5' to 14.0' GRAVEL: some cobbles; clayey; slightly moist. 14.0' to 26.0' SHALE: calcareous. Identified by cuttings, rate of bit penetration, and electric log only. 26.0' to 28.0' LIMESTONE: Shaly. Identified by cuttings, rate of bit penetration, and electric log only. 28.0' to 55.5' LIMESTONE: occassional shale seams. Identified by cuttings, rate of bit penetration, and electric log only.			1. Water Level No water level was taken prior to the grouting of the casing. 2. Drilling Methods 0.0 - 14.5 - 14" auger. 14.5 - 56.0 - reamer (11" rockbit with a 14" expander). 56.0 - 77.0 - 10" rockbit. 77.0 - 100.0 - 6" core barrel. Reamed the hole to 100' with the reamer. 100.0 - 110.0 - reamer. Electric logged the hole. Placed 103' of steel casing. Grouted the casing in place. Drilled the grout out of the casing. From 14.0' to 77.0' - the lithic descriptions are generally based upon electric log interpretations.



ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: Air Force Plant No. 4 HOLE NO. P 13 -M

2323 11

Hole No.

DRILLING LOG	DIVISION SWD	INSTALLATION Fort Worth	SHEET 2 OF 3 SHEETS

1. PROJECT Air Force Plant Number 4	10. SIZE AND TYPE OF BIT 14" Reamer 6" Core Barrel
2. LOCATION (Coordinates or Station) Paluxy Aquifer Pollution Investigation	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY USCEC	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) P 13 - M	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0; UNDISTURBED 0
5. NAME OF DRILLER Brewer	14. TOTAL NUMBER CORE BOXES 4
6. DIRECTION OF HOLE [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER See comment 1
	16. DATE HOLE: STARTED 16 Dec. 85; COMPLETED 3 Jan. 86 (110')
7. THICKNESS OF OVERBURDEN 14.0	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING 65.0 %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR Randy Niebuhr

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			55.5' to 56.0' SHALE: Identified by cuttings, rate of bit penetration, and electric log only.			
			56.0' to 64.0' SANDSTONE: Identified by cuttings, rate of bit penetration, and electric log only.			
	50		64.0' to 72.0' SHALE: Identified by cuttings, rate of bit penetration, and electric log only.			
			72.0' to 110.0' SANDSTONE: 72.0' to 77.0': Identified by cuttings, rate of bit penetration; and electric log only. From 75.5 - 78.0 - cemented zone.			
	60		From 77.0 - 100.0 - 6" core. 77.0' to 96.0': gray; fine grained; calcareous; loosely cemented. Dark gray clay seams - 82.8-82.9, 84.8-85.0, 85.9-86.0, 86.4-86.5. Gray clay pocket at 87.2. 85.4-85.6 - a few lignitic laminations. 88.0-88.3 - interbedded sand and clay. 88.5-89.3 - dark gray clay seam. at 89.7 - hard clay seam with pyrite. at 91.0 - gray clay pocket. 91.4-91.5 - dark gray clay seam. 93.2-93.4 - interbedded clay and sand.	77.0 Run 1 L-23 80.0	BOX 1	
	70					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT Air Force Plant No. 4 HOLE NO. P ~~13~~ - M

Hole No. P 13 - M

DRILLING LOG	DIVISION SWD	INSTALLATION Fort Worth	SHEET 3 OF 3 SHEETS

1. PROJECT: Air Force Plant Number 4
2. LOCATION (Coordinates or Station): Paluxy Aquifer Pollution Investigation
3. DRILLING AGENCY: USCEC
4. HOLE NO. (As shown on drawing title and file number): P 13 - M
5. NAME OF DRILLER: Brewer
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 14.0
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE:
10. SIZE AND TYPE OF BIT: 14" Reamer/6" Core Barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 0; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 4
15. ELEVATION GROUND WATER: See comment 1
16. DATE HOLE: STARTED 16 Dec. 85; COMPLETED 3 Jan. 86
17. ELEVATION TOP OF HOLE:
18. TOTAL CORE RECOVERY FOR BORING: 65.0 %
19. SIGNATURE OF INSPECTOR: Randy Rizbach

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
				Run 2	B O X	
			94.2-94.5 - a few coarse sand layers dipping at 20°.	L-1.2	1	
				84.0		
			94.6-94.8 - interbedded clay and sand.	Run 3	84.8	
			95.2-95.3 - a few lignitic laminae.	L-0.0	B O X	
			96.0' to 110.0': soft-moderately hard; coarse grained.	88.0	2	
				Run 4	89.2	
	90		Below 100.0' the sand was identified by cuttings, rate of bit penetration, and electric log only. Cemented below 109.0'.	L-0.2	B O X	
				92.0		
				Run 5	3	
				L-1.2	94.7	
				96.0	B O X	
				Run 6		
				L-3.1	4	
				100.0		
	100					
	110					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: Air Force Plant No. 4 | HOLE NO. P 13 - M

Hole No. P-13(m) ext.

232393

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 1 OF 2 SHEETS

1. PROJECT Paluxy Aquifer Pollution Investigation	10. SIZE AND TYPE OF BIT *
2. LOCATION (Coordinates or Station) Air Force plant #4.	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY USCE	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) P-13(m)exstension	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED
5. NAME OF DRILLER Brewer/Merva	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER To be determined.
	16. DATE HOLE: STARTED 21 July 86; COMPLETED 25 July 86
7. THICKNESS OF OVERBURDEN 14'	17. ELEVATION TOP OF HOLE 637.83
8. DEPTH DRILLED INTO ROCK 153.8	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 167.8'	19. SIGNATURE OF INSPECTOR Robert McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	110'		110.0 to 167.7 SANDSTONE - Paluxy Fm. - mostly weak to non cemented, some scattered weak to moderate cementation, fine grained, light grey, thin lignite seams scattered throughout, silty and shaley with numerous thin seams throughout. 167.7 to 167.8 SHALE - greenish grey to white.			* Drilling P-13(m) previously drilled 16 dec 85 to 3 Jan 86 to 110'(drill log available). Hole was grout[illegible] up to 84.2 within metal casing. Plug from 92.2 to 92.8'. 84.2 to 92.3' - 9 7/8" rockbit - refusal on a metal plug installed with grout. 92.3 to 92.8' - 6" diamond core, 92.3 to 167.8' - 9 7/8" rockbit. Hole was gamma logged (natural) and well monitoring casing installed after drilling. - - - - - - - - - Well Installation TD = 167.8' Bottom of pump = 163.0' Pump intake = 160.5' 4" pvc pipe connects pump to surface and filter material placed around screen. A 5' sump placed below pump and 20' of .010 screen placed immediately above pump. Samples Two samples taken at 167.8'. One vial of drill fluid and one vial of cuttings with distilled water added to fill voids within vial. Note: Robert McVey present only during drilling portion, ie, 84.2 to 167.8'. Gerald Schoonover present for inspection during well installation and logging.
	120					
	130					
	140					
	150					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PROJECT HOLE NO.

Hole No. P-13(m)ext.

232394

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 2 OF 2 SHEETS

1. PROJECT Paluxy Aquifer, AF Plant #4	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY USCE	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) P-13(m)exstension	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE 167.8'	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR Robert McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	150					
	160					
	170					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

C-300

TABLE A-2

LITHOLOGIC LOG OF MONITOR WELL P-14US**

DEPTH INTERVAL (FEET BELOW LAND SURFACE)	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
0 - .5	ASPHALT	
.5 - 32.5	SILTY CLAY	Yellow orange, 10 YR 6/6, slightly firm very cohesive.
32.5-51.5	CLAYEY SANDY SILT	Pale orange, 10 YR 8/2, stiff, slightly cohesive; sand is varicolored, fine to coarse subrounded to subangular grains.
51.5-52.0	GRAVELLY SAND	Varicolored, medium to very coarse sand; gravel is varicolored, subangular, abundant fine gravel size fossils.
52.0-53.9	CLAYEY SANDY SILT	Pale orange, 10 YR 8/2, stiff, slightly cohesive; sand is varicolored, fine to very coarse subangular grains.
53.9-60.5	FOSSILIFEROUS LIMESTONE	Light gray to dark gray, N8 to N3, dry, very well cemented, large oyster fossils.
60.5-68.5	CLAYEY SANDY SILTSTONE-SILTY SANDSTONE	Interbedded, clay is dark gray, N4, wet, stiff, moderately cohesive; sandy siltstone-silty sandstone is light gray, N6, saturated, cemented, brittle, very fine subrounded grains, large vugs. Abundant pyrite in vugs.

*Unified Soil Classification System ASTM D-2487

** 53-86 Drilled by Mud Rotary

TABLE A-2 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-14US**

DEPTH INTERVAL (FEET BELOW LAND SURFACE)	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
68.5-70.0	SILTY CLAYSTONE	Dark gray, N4, wet, stiff, moderately cohesive.

*Unified Soil Classification System
ASTM D-2487

** 53-86 Drilled by Mud Rotary

TABLE A-3

LITHOLOGIC LOG OF MONITOR WELL P-14U**

DEPTH INTERVAL (FEET BELOW LAND SURFACE)	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
0 -.5	ASPHALT	
.5 - 12	SILTY CLAY	Dark yellowish orange, 10 YR 6/6, slightly damp, slightly firm, very cohesive, with caliche veins.
12 - 23	CLAYEY SILT	Dark yellowish orange, 10 YR 6/6, damp, firm, moderately cohesive.
23 - 33	CLAYEY SANDY SILT	Pale orange to dark yellowish orange, 10 YR 8/2 to 10 YR 6/6, very damp, stiff, slightly cohesive.
33 - 41.7	SILTY SAND	Sand is varicolored, saturated, loose, non-cohesive, fine to coarse subangular to subrounded grains; silt is grayish orange, 10 YR 7/4, slightly cohesive, minor amounts of shell fragments.
41.7 - 43	CLAY	Red brown, 10 R 4/6, wet, stiff, very cohesive.
43 - 45	SILTY SAND-SANDY SILT	Brown to yellowish orange, 10 YR 4/4 to 10 YR 6/6, wet, stiff, slightly cohesive, very fine grained sand.
45 - 49	CLAY	Light brown, 5 YR 5/6, wet, very stiff, very cohesive.
49 - 53	CLAYEY SANDY SILT-SILTY SAND	Brown to yellowish orange, 5 YR 4/4 to 10 YR 6/6, wet, stiff, moderately cohesive; sand is very fine grained.

*Unified Soil Classification System ASTM D-2487

** 0-53 Drilled by Flight Auger
53-86 Drilled by Mud Rotary

2323[illegible]

TABLE A-3 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-14UPPER**

DEPTH INTERVAL (FEET BELOW LAND SURFACE)	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
53 - 60.5	FOSSILIFEROUS LIMESTONE	Light gray to dark gray, N8 to N3, dry, very well cemented. Large fossils (oysters).
60.5-69.5	CLAY AND SANDY SILTSTONE-SILTY SANDSTONE	Interbedded, clay is dark gray, N4, wet, stiff, moderately cohesive; sandy siltstone - silty sandstone is light gray, N6, saturated, cemented, brittle, very fine subrounded grains.
69.5-74.5	SILTY CLAYSTONE	Dark gray, N4, wet, stiff, moderately cohesive.
74.5-82	SILTY SANDSTONE	Pinkish gray, 5 YR 8/1, saturated, dense, friable, very fine to fine rounded to subrounded grains.
82 - 84	SANDY SILTY CLAYSTONE	Dark gray, N4, wet, stiff, moderately cohesive.
84 - 86	SHALE	Green gray to blue gray, 5 G 6/1 to 5 B 5/1, wet, firm, fissile, moderately plastic, abundant organics.

*Unified Soil Classification System
ASTM D-2487

** 0-53 Drilled by Flight Auger
53-86 Drilled by Mud Rotary

TABLE A-3 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-14UPPER**

DEPTH INTERVAL (FEET BELOW LAND SURFACE)	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
53 - 60.5	FOSSILIFEROUS LIMESTONE	Light gray to dark gray, N8 to N3, dry, very well cemented. Large fossils (oysters).
60.5-69.5	CLAY AND SANDY SILTSTONE-SILTY SANDSTONE	Interbedded, clay is dark gray, N4, wet, stiff, moderately cohesive; sandy siltstone - silty sandstone is light gray, N6, saturated, cemented, brittle, very fine subrounded grains.
69.5-74.5	SILTY CLAYSTONE	Dark gray, N4, wet, stiff, moderately cohesive.
74.5-82	SILTY SANDSTONE	Pinkish gray, 5 YR 8/1, saturated, dense, friable, very fine to fine rounded to subrounded grains.
82 - 84	SANDY SILTY CLAYSTONE	Dark gray, N4, wet, stiff, moderately cohesive.
84 - 86	SHALE	Green gray to blue gray, 5 G 6/1 to 5 B 5/1, wet, firm, fissile, moderately plastic, abundant organics.

*Unified Soil Classification System
ASTM D-2487

** 0-53 Drilled by Flight Auger
53-86 Drilled by Mud Rotary

TABLE E-7

LITHOLOGIC LOG OF MONITOR WELL P-15U

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 15.0	CLAY	CH	Dark gray (N 2 to N 3), soft, plastic, sticky, trace fine sand.
15.0 - 18.0	SANDY CLAYEY SILT	ML	Grayish orange (10 YR 7/4), soft plastic.
18.0 - 22.0	SILTY SAND	SM	Varicolored, sand is fine to coarse, angular, silt is orange (10 YR 7/4), and approximately 10 percent.
22.0 - 42.0	SILTY SAND WITH GRAVEL	SM	Grayish orange (10 YR 7/4), sand is medium- to coarse-grained, silt content is approximately 20 percent, gravel consists of angular fossil fragments.
42.0 - 48.0	GRAVELLY CLAY	CL	Grayish orange (10 YR 7/4), clay is soft and sticky, gravel is fine- to medium-grained, subangular to rounded limestone, approximately 15 percent.
48.0 - 53.0	SANDY GRAVELLY SILT	ML	Grayish orange (10 YR 7/4), gravel is fine-grained, rounded limestone; sand is medium to coarse-grained limestone and silica, sand and gravel are approximately 30 percent of matrix.
53.0 - 55.0	SANDY GRAVEL	GM	Varicolored, fine- to medium-grained, angular, gravel is mostly shell fragments, sand is medium- to coarse-grained, angular to rounded.

*Unified Soil Classification System ASTM D-2487

**Drilled by mud rotary

TABLE E-7 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-15U

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
55.0 - 61.0	CLAYEY GRAVEL WITH FOSSILIFEROUS LIMESTONE	--	Core sample, 20 percent recovery, top six inches is clayey gravel, grayish orange (10 YR 7/4), soft, sticky, gravel is coarse-grained to cobble size consisting of limestone and chert, bottom six inches is fossiliferous limestone, white with reddish oxidation staining, some gray inclusions.
61.0 - 67.0	LIMESTONE WITH CLAY AND SILTY SANDSTONE	--	Core sample (61 to 65 feet), 7 percent recovery, limestone is tan, fossiliferous, hard, clay is gray (N4 to N5), moderately plastic, dense, sticky, silty sandstone gray (N6), loose, friable.
67.0 - 69.0	SILTY SAND	SM	Light olive gray (ST 6/1), soft well sorted.
69.0 - 75.0	CLAY	CL	Medium gray (N 5), firm, plastic.
75.0 - 82.0	CLAYEY SAND SILTY	SM	Very light gray (N 8), soft, plastic, sand is very fine-grained, approximately 30 percent, clay is approximately 20 percent. At 78.0 to 82.0 feet, less clay, sand is approximately 40 percent of matrix.
82.0 - 89.0	SANDY SILTY	SM	Light olive gray (5 Y 6/1), soft nonplastic, sand is very fine-grained.
89.0 - 95.0	SANDY CLAYEY SILT	ML	Very light gray (N 8), soft, moderately plastic; sand is very fine-grained.

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-7 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-15U

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
95.0 - 122	SAND	SP	Milky white, soft, fine-grained, well-sorted, lightly cemented. (Grouted from 92.0 to 122 feet; total depth of well is 92 feet).

TOTAL DEPTH OF BOREHOLE: 122 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-8

LITHOLOGIC LOG OF MONITOR WELL P-15US

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 10.0	CLAY	CH	Dark gray (N 3), firm, sticky, cohesive.
10.0 - 12.0	SILTY CLAY	CL	Dark olive gray (5 Y 6/1), firm, cohesive, trace medium-grained sand.
12.0 - 20.0	CLAYEY SILT	ML	Grayish orange (10 YR 7/4), firm, cohesive, some medium- to coarse-grained sand.
20.0 - 32.0	SILTY SANDY GRAVEL - GRAVELLY SAND	GM-SP	Grayish orange (10 YR 7/4), gravel is fine- to medium-grained, angular, consisting mainly of fossil fragments, sand is fine- to coarse-grained, angular to rounded.
32.0 - 42.0	SANDY GRAVELLY SILTY CLAY	SP	Dark yellowish orange (10 YR 6/6), soft, sticky, gravel is medium- to fine-grained consisting mainly of rounded limestone.
42.0 - 52.0	SILTY CLAY WITH SAND	CL	Yellowish orange (10 YR 6/6), soft sticky, trace fine- to medium-grained sand.
52.0 - 61.0	SANDY GRAVEL	GP	Varicolored, gravel is rounded with angular shell fragments, sand is fine to coarse, subangular.
61.0 - 63.0	LIMESTONE	--	Medium gray to white (N 6 to N9), hard.
63.0 - 68.0	SANDY SILT	SM	Very little cutting at surface, based on drilling rate and log from P-15U.

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

HARGIS + ASSOCIATES, INC.

TABLE E-8 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-15US

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
68.0 - 69.0	SILTY CLAY	CL	Light olive gray (5 Y 6/1), soft plastic, moderately cohesive.

TOTAL DEPTH OF BOREHOLE: 69 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by flight auger

TABLE E-9

LITHOLOGIC LOG OF MONITOR WELL P-16US

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0 - 4.0	SANDY CLAY	CL	Yellow brown (10 YR 5/4), cohesive, plastic, sand is medium to coarse-grained, predominantly white, opaque grains.
4.0 - 19.5	SILTY CLAY/ CLAYEY SILT	CL/ML	Grayish orange (10 YR 7/4), cohesive, moderately plastic, soft.
19.5 - 28.0	GRAVELLY CLAY	CL	Clay is gray orange (10 YR 7/4), cohesive, moderately plastic, soft, gravel is predominantly sandstone class.
28.0 - 56.0	SILTY CLAY	CL	Light brown (5 YR 6/4), cohesive, plastic, soft, trace gravel up to 1/4 inch.
56.0 -59.75	SANDY GRAVEL	GW	Varicolored, medium- to coarse-grained sand, fine- to coarse-grained gravel.
59.75 -62.0	FOSSILIFEROUS LIMESTONE	--	Gray (N 8 to N 4), hard, well cemented.
62.0 -64.75	CLAYEY SANDSTONE	--	Gray (N 3), fine-grained sandstone, poorly cemented, interbeds of sandy clay.
64.75 -69.0	CLAY	CL	Gray (N 8), moderately plastic, some sand, clayey sandstone interbeds, sand and sandstone interbeds decreasing with depth.

TOTAL DEPTH OF BOREHOLE: 69.0 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-10

LITHOLOGIC LOG OF MONITOR WELL P-17US

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
0 - 2.0	CLAY	CH	Black (N 2), very plastic, very cohesive.
2.0 - 7.0	SANDY SILT	ML	Brown, (10 R 3/4), slightly cohesive, nonplastic; sand approximately 15 percent, varicolored, angular to subangular grains, medium to coarse grains.
7.0 - 44.5	INTERBEDDED SILTY CLAY - CLAY SILT	CL	Gray orange (10 YR 7/4) moderately plastic, moderately cohesive.
44.5 -46.75	SAND	SW	Varicolored, medium- to very coarse-grained, rounded to well rounded.
46.75 -52.5	SANDY GRAVEL	GP	Varicolored, medium to very coarse sand, fine- to very coarse-grained gravel, rounded to well rounded grains.
52.5 - 54.0	FOSSILIFEROUS	--	Gray (N 6) brittle angular shell fragment (Walnut Formation).
54.0 -58.25	MASSIVE LIMESTONE	--	Gray (N 3 to N 8), brittle angular fragments, some organic streaks, gray N3.
58.25 -60.5	SANDSTONE	SW	Gray (N 4 to N 7) clay is slightly cohesive, slightly plastic; sand is very fine-grained, well rounded.

TOTAL DEPTH OF BOREHOLE: 71 Feet

*Unified Soil Classification System
ASTM D-2487

TABLE E-11

LITHOLOGIC LOG OF MONITOR WELL P-18US

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0-3.0	SILT	MH	Moderate brown (5 YR 3/4), noncohesive.
3.0-4.0	SILTY CLAY	CL	Moderate brown (5 YR 3/4), moderately cohesive, nonplastic, sticky.
4.0-20.0	SANDY SILT-SILTY SAND	SM	Light brown (5 YR 5/6), sand is fine-grained; silt is noncohesive. At 6.0 feet, some clay and chert nodules, moderately cohesive. At 20.0 feet, some black to brown black organic matter (N 1 to 5 YR 2/1).
20.0-36.0	SILTY CLAY-CLAYEY SILT	CK/ML	Light brown (5 YR 5/6), slightly cohesive, sticky, nonplastic. At 27.0 feet, trace buff colored clay, slightly cohesive, nonplastic.
36.0-43.0	SILTY SAND-CLAYEY SAND	SM/SC	Light brown (5 YR 5/6), sand is fine grained; clay is slightly cohesive, sticky.
43.0-45.5	SANDY GRAVEL	SW	Varicolored, gravel is fine to medium grained, angular to subrounded; sand is fine to coarse grained, angular to subrounded.
45.5-60.5	FOSSILIFEROUS LIMESTONE	--	Varicolored gray (N 5 to N8), dense, dry, very well cemented. Oyster fossils.
60.5-67.0	SANDSTONE	--	Gray (N 7), very fine-grained, very well cemented, well rounded. Some pyrite.

*Unified Soil Classification System ASTM D-2487

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TABLE E-11 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-18US

DEPTH INTERVAL (FEET BELOW LAND SURFACE)		GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
67.0-68.0	CLAYSTONE	--	Gray (N 5 to N7), moderately cemented.
68.0-73.5	SANDY CLAY-SANDSTONE	--	Gray (N 5 to N7), fine-grained, loose. At 73.0 feet, abundant organic matter, black (N 1).
73.5-75.0	SILTY CLAY	CL	Gray (N 7) cohesive, nonplastic.

TOTAL DEPTH OF BOREHOLE: 75 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-12

LITHOLOGIC LOG OF MONITOR WELL P-19US

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0-19.0	SANDY SILT	SM	Moderate reddish brown (10 YR 4/6), moderately cohesive, moderately plastic. At 3.0 feet, color change to light brown (5 YR 6/4) more sand, trace chert nodules.
19.0-31.0	SANDY SILT-SILTY SAND	SM	Grayish orange (10 YR 7/4), nodules, of quartz, chert, and limestone.
31.0-46.0	CLAYEY SILT	ML	Grayish orange (10 YR 7/4), noncohesive, sticky; trace sand. At 45.0 feet, more sand.
46.0-51.5	GRAVELLY SAND	SW	Varicolored, sand is medium- to coarse-grained, angular to subrounded; gravel is fine-grained, angular to subrounded.
51.5-56.0	FOSSILIFEROUS LIMESTONE	--	Gray (N 4 to N 7), dense, dry. Oyster fossils.
56.0-58.0	CLAYEY SANDSTONE	--	Medium gray (N 5), sand is fine-grained; clay is noncohesive.
58.0-69.5	SANDSTONE	--	Medium gray (N 5), very fine- to fine-grained.
69.5-70.5	SANDY CLAY	SC	Medium gray (N 5), clay is sticky, slightly cohesive; sand is fine-grained.

TOTAL DEPTH OF BOREHOLE: 70.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

HARGIS + ASSOCIATES, INC.

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end 3/04/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
		G		SOIL: silt and fine sand, dark brown, dry.	
		G		SHALE: calcareous, some limestone, dry. Goodland Formation.	
5	5-5.2	ST		SHALE: calcareous, some clay and limestone, tan, orange iron stains, laminae, dry to slight damp.	HNU 0.05 w/ 0.05 BG
10	10-10.3	ST		SHALE: same as above but minor clay.	HNU 0.05 w/ 0.05 BG
		G		SHALE: gray to light gray.	
15	15-15.2	ST		SILTY SHALE: calcareous, some clay, mottled tan and gray, dry.	HNU 0.15 w/ 0.15 BG
20	20-20.7	ST		CLAYEY SHALE: calcareous, dark gray, semi-hard, laminae, fissile, dry.	HNU 0.25 w/ 0.20 BG

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-20m
Location Radar Range, S. of Landfill 4
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NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/24/86 and end 3/04/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
25	25-25.2	ST		SHALE: calcareous, gray to dark gray, hard, laminae, fissile, dry.	HNU 0.25 w/ 0.20 BG
30	30-30.2	ST		SHALE: same as above.	HNU 0.30 w/ 0.25 BG
		G		CLAYEY SHALE: calcareous, dark gray, semi hard, laminae, fissile, dry.	
35	35-36	ST		SILTY SHALE: calcareous, dark gray, laminae, fissile, dry.	HNU 0.35 w/ 0.30 BG
40		ST		No returns. Walnut Formation. Mud rotary drilling.	HNU 0.30 w/ 0.30 BG

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LOG OF DRILLING OPERATIONS

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Project Air Force Plant 4 IRP
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Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
45		G		SHALE AND LIMESTONE: shale is calcareous and gray. Limestone is tan and gray and fossiliferous.	
		G		SHALE AND LIMESTONE: same as above but more fossiliferous.	
50		G		SHALE AND LIMESTONE: same as above.	
55		G		SHALE: calcareous, dark gray.	
		G		LIMESTONE AND SHALE: limestone is gray and tan and fossiliferous. Shale is calcareous and dark gray.	
60					

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LOG OF DRILLING OPERATIONS

Boring or Well No. P-20m
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Project Air Force Plant 4 IRP
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Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
65					
70		G		CLAYEY SILTY SHALE: minor limestone, shale is calcareous and dark gray.	
		G		CLAYEY SHALE: minor limestone, shale is calcareous and dark gray.	
75		G		SANDSTONE AND SHALE: sand is quartz, gray to white consolidated to weak cal-calcite cement. Shale is gray.	
80					

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-20m
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Project Air Force Plant 4 IRP
Beginning 2/24/86 and end 3/04/86 of drilling operation
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Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
85					
90		G		SANDSTONE: minor clay, quartz, very fine to fine, well sorted, rounded to subrounded, consolidated, dry to slight damp.	
95					
100		G		SANDSTONE AND SAND: interbedded. Sandstone is quartz, very fine, pyritized cement, very hard. Sand is very fine to fine, well sorted, rounded to subrounded, dry.	

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LOG OF DRILLING OPERATIONS

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Project Air Force Plant 4 IRP
Beginning 2/24/86 and end 3/04/86 of drilling operation
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Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
		G		SANDSTONE: quartz, white, very fine, calcite cement.	
		G		SAND: quartz, gray, very fine to fine, loose, well sorted, rounded, damp.	
105					
		G		CLAYEY SAND: quartz, gray, very fine to fine, well sorted, rounded, loose to semi-consolidated, slight damp.	
110		G		CLAYEY SAND: same as above but consolidated du to clay matrix, slight damp to dry.	
115		G		CLAYSTONE: sandy, mottled red and gray, firm, dry.	
120		G		CLAYSTONE: sandy, greenish gray, very fine to fine, firm, dry.	
		G		Pyrite.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-20m
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Project Air Force Plant 4 IRP
Beginning 2/24/86 and end 3/04/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500: Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
		G		CLAYSTONE AND SANDSTONE: minor siltstone, the claystone is as above. Sandstone is quartz, white, fine, well-sorted, rounded, silica cement. Siltstone is dark gray and firm.	
125		G		SANDSTONE: some claystone and minor pyrite sandstone is white to tannish white, very fine to fine, well sorted, rounded, consolidated with calcareous cement. Claystone is as above.	
130					
	131-131-2	SS		SAND: grayish white with slight pink hue, very fine to fine, well sorted, rounded, damp. Some minor greenish clay.	
135					
	137-137.2	SS		SAND: same as above but noted more greenish clay possibly a small lens.	
140					

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LOG OF DRILLING OPERATIONS

Boring or Well No. P-20m
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Project Air Force Plant 4 IRP
Beginning 2/24/86 and end 3/04/86 of drilling operation
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Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
145-	145-145.3	SS		SAND: same as above but moist.	
150-	150-150.5	SS		SAND: same as above but wet.	
155-	155-155.1	SS		SAND: same as above.	
				TD = 155 ft.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end 3/10/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
				0-5 clayey silt minor SAND & GRAVEL. Dark brown slight damp-dry roots, plastic.	
5-	5-6	ST		SAND/SILT: Very fine to coarse, plastic, slightly damp. Minor is gravel, calcareous, mottled dark brown and orange and white-is poorly sorted angular-subrounded.	
10-	10-11.1	ST		CLAY/SILT: minor graven and sand, reddish brown with white caliche, calcareous, plastic, slight damp-dry.	HNU 0.25 w/ 0.25 Polytest neg.
15-	15-15.5	ST		SAND AND GRAVEL: sand is orange subrounded fine to coarse, slight calcareous due to LS sand with quartz. Gravel is LS white-tan fine grained sand to small cobble.	HNU 0.25/ 0.25
20-	20-21.1	ST		SAND: minor is gravel-subrounded, orange, medium grain, well sorted quartz (not calcaroues), slightly damp-dry, roudned-subrounded.	HNU 0.35/ 0.30

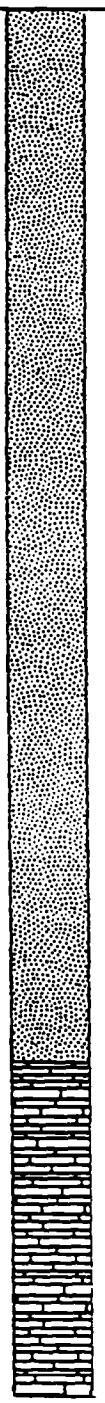
RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end 3/10/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500: Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
25	25-26	ST		SAND AS ABOVE 25.5. SILT SAND & GRAVEL worm tubes system mottled orange and tan, damp-moist.	HNU 0.35/ 0.35
				29 hit alot of LS & fossils (oysters) in SAND.	
30	30-32	ST		Hit water. SAND and some LS gravel. SAND medium grained, sub-angular to round, wet, sand is mainly quartz to aprox. 20% LS and light orange. LS is white-tan.	HNU 0.35/ 0.35
35	35-35.7	ST		LS gravel & SAND: slight orange, wet saturated, very fine (minor silt, sand is primarily quartz with some $CACO_3$. LS-mottled tan and orange, small-large gravel.	HNU 0.35/ 0.3
				At 37' hit walnut.	
40				40.5 ft. No returns.	



RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end 3/10/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
45		G		LIMESTONE AND SHALE: LS is tan to tannish gray, calcareous, firm, friable, dry.	
		G		Drilling easier 48-48.5' SHALE: dark gray, calcareous, fissile, dry.	
50		G		LIMESTONE AND SHALE: same as above. (45').	
				52-53' LIMESTONE AND SHALE BEDS.	
55		G		LIMESTONE: minor shale, description as above. Drilling easier 56-56.5'.	
60		G		LIMESTONE: minor shale same as above.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

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Project Air Force Plant 4 IRP
Beginning 2/25/86 and end 3/10/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
65		G		LIMESTONE: some shale and minor brown sandy siltstone and pyrite. Description on LS & Shale as above.	
70		G		SANDY SILTSTONE AND SANDSTONE: siltstone is brownish with very fine sand. Sandstone is tannish white calcareous, very fine to fine, well sorted, rounded. Minor pyrite.	
75		G		SILTY CLAY AND SANDSTONE: minor brown sandy siltstone and limestone. Clay is gray, sandstone is as above. Gray to white consolidated to weak calcite cement. Shale is gray. Drilling harder @ 78.5'.	
80		G		SAND AND SANDSTONE: minor pyrite and greenish clay, sand is probably consolidated but came up loose. Sandstone is grayish white, well cemented, fine, well sorted, rounded.	

Boring or Well No. P-21u
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Project Air Force Plant 4 IRP
Beginning 2/25/86 and end 3/10/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
85		G		SAND: minor pyrite, grayish white, fine, well sorted, rounded, dry.	
		G		SAND: same as above but damp.	
90		G		CLAYEY SAND: sand is fine, well sorted, rounded, mixture is damp to moist.	
		G		CLAYEY SAND: same as above but damp to dry.	
95		G		CLAYEY SAND: same as above.	
100		G		SANDSTONE: loose to consolidated with minor pieces having calcite cement. Grayish white, fine, well sorted, rounded, moist.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-21u
Location Radar Range
Log Recorded by Peter A. Waterreus
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, CB=Corebarrel, G=Grab

Project Air Force Plant 4 IRP
Beginning 2/25/86 and end 3/10/86 of drilling operation
Type Drill Rig and Operator Gardner Denver 1500; Lee Gebbert
Sampling Interval (Estimated) 5

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
105		G		CLAYSTONE AND CLAYEY SAND: interbedded, greenish, firm, dry to slight damp, sand is fine grained and rounded.	
110		G		SANDY SHALE: brownish gray, firm, slightly fissile, dry.	
				TD @ 110 ft.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-22u
Location Landfill No. 3
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/18/86 and end 3/20/86 of drilling operation
Type Drill Rig and Operator CME-75, Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
				TOPSOIL: with asphalt, moist, yellow-brown with gray silty shale.	Draeger poly-test (pos) 1 stroke HNU 35
5-	5-10			SHALE: silty, gray, with hard lime-stone fragments. Wet at 9-10', making water.	Contaminated cuttings 5-5.5', strong petroleum odor.
10-		ST		No sample. SHALE: silty, hard, with limestone fragments, turning to well consoli-dated limestone at 15'.	0.0
15-				FOSSILIFEROUS LIMESTONE: and shale, indurated, shale in calcareous.	0.0
		ST		At 18' no sample. LIMESTONE: light gray, fossiliferous, well indurated.	
20-				SHALE: gray, silty, turning to fossil-iferous limestone at 24', shell frag-ments, hard drilling.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-22u
Location Landfill No. 3
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/18/86 and end 3/20/86 of drilling operation
Type Drill Rig and Operator CME-75, Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
25				LIMESTONE: shaley, light gray, cemented, shell fragments and pyrite.	
30				CLAY: gray, silty, fairly plastic, turning to sandy clay, carbonaceous, pyrite.	
35		SS		SAND: light gray; unconsolidated, carbonaceous, dry, fine-grained, well sorted.	
40				SAND: bone white, dry, unconsolidated, clay matrix, well sorted.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-22u
Location Landfill No. 3
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/18/86 and end 3/20/86 of drilling operation
Type Drill Rig and Operator CME-75, Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
45		SS		SAND: silty, light gray, with clay matrix, unconsolidated.	
50				SAND: cemented, very hard, turning wet at 55', well sorted, silicic cement.	
55				SAND: brown, wet, fine-medium-grained, unconsolidated, quartrose.	Water at 50'.
60		SS		CLAY: gray-green, fairly plastic, turning to green confining clay, dry. TD: 62.5 ft.	

TABLE E-13

LITHOLOGIC LOG OF MONITOR WELL P-22M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL
0 - 4.0	FILL	SP	Varicolored, sand, gravel, clay, dry, no odor.
4.0 - 6.0	SANDY CLAY	CL	Gray (N 4), moderately cohesive, slightly plastic, wet, slight to strong solvent odor.
6.0 - 31.0	LIMESTONE	--	Gray (N 3 to N 8) brittle angular fragment, shell fragments, Walnut Formation.
31.0 - 55.0	SANDY CLAYSTONE - CLAYEY SANDSTONE	SW	Sand is whitish gray (N 7 to N 8) very fine-grained, well rounded, very well cemented; clay is gray, (N 4 to N 6), hard, moderately plastic, slightly cohesive, some shell fragments noted (Paluxy Formation).
55.0 - 61.0	SAND	SW	Whitish (N 8), very fine-grained, well rounded.
61.0 - 80.0	SILTY CLAY	ML	Bluish white (5B 9/1), slightly cohesive, moderately plastic; minor fine sand interbeds.
80.0 -133.0	SAND	SW	Grayish white (N 8), very fine-grained, well rounded.
133.0-136.0	CLAY	CH	Gray (N 5 to N 7), cohesive, plastic.

TOTAL DEPTH OF BOREHOLE: 136 Feet

*Unified Soil Classification System
ASTM D-2487

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-23u
Location Lake Worth Area
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/11/86 and end 3/17/86 of drilling operation
Type Drill Rig and Operator CME-75, Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
				LIMESTONE: yellow-gray, fossiliferous, turning to fine sand at 4-4.5'. 25% sand, 75% limestone over 5' interval.	Walnut Formation.
5				LIMESTONE: yellow-brown, fossiliferous, with thin stringers of sand (1/4" thick).	
				LIMESTONE: hard, gray, shaley; shale is calcareous, fissile, strong color change. First shale at 9'.	
10				LIMESTONE: hard, shaley, well cemented.	Rig chattering.
15				Fossiliferous 15-18'.	
				SHALE (18-19'). LIMESTONE (19-20'): fossiliferous.	
20				SHALE: dark gray with limestone stringers (fossiliferous limestone), shale is fissile, soft, calcareous.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-23u
Location Lake Worth Area
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/11/86 and end 3/17/86 of drilling operation
Type Drill Rig and Operator CME-75, Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
				LIMESTONE: light gray, fossiliferous, hard, minor shale (22-25').	
25				SHALE: soft, dark gray, silty, calcareous.	
30				SHALE: gray with fine silt, pyrite (10%), sand stringers.	
35	35-36	SS		SAND: light gray, siliceous with clay stringers, very fine-grained, dry, uncemented thin gravel 0.5' thick. 36-38' as above. SAND: yellow brown, fine-to-medium-grained, well sorted.	
40				SAND: yellow tan, fine-grained, well sorted, silty, wet, more moist with depth.	

RADIAN CORPORATION

LOG OF DRILLING OPERATIONS

Boring or Well No. P-23u
Location Lake Worth Area
Log Recorded by Toby Walters
NOTES: BG=Background, ST=Shelby Tube, SS=Split Spoon, G=Grab

Project Air Force Plant 4 IRP
Beginning 3/11/86 and end 3/17/86 of drilling operation
Type Drill Rig and Operator CME-75, Baggett
Sampling Interval (Estimated) 5 ft

Depth	Sample Zone	Sample Type Taken	Graphic Log	Stratigraphy	Remarks
45				SAND: brown, fine-grained, well sorted, silicic matrix, uncemented, moist.	
					Making water at 48'.
50				SAND: fine-grained, well sorted, with streaks of carbonaceous material; interbedded clay 53-55', gray with hard streaks of sandstone.	
					Abundant water.
55				SANDSTONE: hard, carbonaceous, with interbedded clay. TD: 55 ft.	

TABLE E-15

LITHOLOGIC LOG OF MONITOR WELL P-24U

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 25.0	FOSSILIFEROUS LIMESTONE	--	Light yellowish gray to light gray (5 Y 8/1 to N 5 to N 8); clay interbeds, firm, cohesive. At 17 feet, color grades to medium gray (N 4 to N 5), harder. At 18 feet, color grades to white to light gray (N 5 to N 9). At 23 feet, trace dark gray (N 4 to N 5), claystone-shale. At 23.5-25 feet; siltstone, medium to light gray (N 5 to N 8).
25.0 - 56.0	SILTY SAND-SANDY SILT	ML	Medium light gray (N 6), very fine-grained, soft, well sorted. At 49.5 feet, thin, hard layer, cuttings appear to be limestone. At 50-56 feet, intermittent, harder layers, trace lignite.
56.0 - 61.0	CLAYEY SILT	CL	Pale green to yellowish gray (5 BG 7/2 to 5 Y 8/1), soft, noncohesive.

TOTAL DEPTH OF BOREHOLE: 61 Feet

*Unified Soil Classification System ASTM D-2487

**Drilled by mud rotary

TABLE E-14

LITHOLOGIC LOG OF MONITOR WELL P-24M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 26.5	FOSSILIFEROUS LIMESTONE	--	Light yellowish gray to light gray (5 Y 8/1 to N5 to N 8), weathered clay interbeds. At 18 feet, darker gray (N 3 to N 5). At 22.5 feet, harder layer, white. At 25-26.5 feet, more silt and clay, hard.
26.5 - 56.0	SILTY SAND	ML	Dark gray (N 5), very fine-grained, well sorted; trace clay, dark gray (N 3 to N 4). At 40-41 feet, limestone, hard, very light gray to medium gray (N 5 to N 8). At 44-46 feet, hard layer.
56.0 - 72.0	CLAYEY SILT	CL	Medium gray (N 6), slightly cohesive; trace sand, trace lignite. At 60 feet, silty clay, more sticky, trace sand, color change to light bluish gray (5 B 7/1). At 61 feet, more sand. At 68 feet, some clay is form, some slightly cohesive, color change to light gray (N 7). At 72 feet, more sand.

*Unified Soil Classification System ASTM D-2487

**Drilled by mud rotary

TABLE E-14 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-24M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
72.0 -131.5	SAND	SP	Pinkish gray (5 YR 8/1), very fine- to fine-grained, well sorted, well rounded, slightly cemented. At 86.0-86.5 feet, lignite layer. At 90 feet, grading to very fine sand. At 111-112 feet, lignite layer. At 112-130 feet, trace silt and pyrite.
131.5-134.0	SILTSTONE-CLAYSTONE	CL	Light bluish gray (5 B 7/1), moderately cemented, interbedded harder layers.

TOTAL DEPTH OF BOREHOLE: 134 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-17

LITHOLOGIC LOG OF MONITOR WELL P-25U

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 6.0	SILTY SAND	SM	Light brown (5 YR 5/6), fine- to medium-grained; some weathered caliche nodules.
6.0 - 12.0	SANDY SILT	ML	Same color; trace clay. At 10 feet, color change to grayish orange (10 YR 7/4); less sand and more clay.
12.0 - 24.0	CLAYEY SILT	CL	Grayish orange (10 YR 7/4), slightly sticky; trace sand.
24.0 - 32.0	SANDY SILT	SM	Same color; sand is fine- to medium-grained.
32.0 - 33.0	GRAVELLY CLAY	GC	Same color, noncohesive; gravel is varicolored, fine-grained, angular to subrounded.
33.0 - 35.0	GRAVELLY SAND	GD	Varicolored, fine- to coarse-grained, angular to subrounded grains consisting of weathered limestone, chert, and caliche; gravel is fine-grained; some silt and clay.
35.0 - 37.0	LIMEY SHALE	--	Dark gray (N 3), weathered; clay interbeds; appears to have an oily based matrix; soft and easily friable. At 37 feet, some fossil fragments (oyster shells).

*Unified Soil Classification System
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**Drilled by mud rotary

TABLE E-17 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-25U

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
37.0 - 44.0	FOSSILIFEROUS LIMESTONE	--	Light gray (N 6 to N 7), dense, fossils are oyster shell fragments; light greenish gray (5 G 8/1) clay interbeds. At 41.0 feet, limey sand, fine-grained. At 41.5 feet, very dense, but still some clay and silt interbeds; trace pyrite.
44.0 - 55.0	LIMEY SHALE	--	Medium gray (N 4 to N 6); clay interbeds.
55.0 - 57.5	LIMESTONE	--	Same color, dense, no visible fossils; some clay interbeds.
57.5 - 61.0	SILTY CLAY/ CLAYEY SILT	CL	Medium gray to greenish gray (N 5 to N 6 to 5 G 6/1), slightly cohesive, slightly sticky; some lignite.
61.0 - 68.0	SANDY SILT	ML	Medium gray (N 3 to N 5); sand is very fine-grained.
68.0 - 80.0	SILTY SAND	SM	Light gray (N 6 to N 7), very fine-grained. At 68.5 feet, thin lignite layer. At 74.0 feet, some clay. At 78.0 feet, sandstone, very fine-grained. At 79.0 feet, thin lignite layer. At 80.0 feet, some clay.

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-17 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-25U

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
80.0 - 91.0	SILTY CLAY/ CLAYEY SILT	CL	Same as 57.5-61.0 feet.
			At 85-86 feet, sandstone, very fine-grained, strongly cemented.
			At 87-87.5 feet, trace pyrite.
			At 88.0 feet, whitish, silty sandstone.
91.0 -102.0	SANDY SILT/ SILTY SAND	ML	Light gray (N 6 to N 7), very fine-grained; silty content varies with depth; weakly cemented.
			At 100 feet, trace clay.
102.0-114.0	SAND	SP	Same color, very fine- to fine-grained, well sorted, subrounded to rounded, clean, soft.
			At 111-112, sandstone with pyrite; trace lignite.
114.0-115.0	SILTY CLAY/ CLAYEY SILT	CL	Greenish gray (5 GY 6/1), slightly cohesive; trace sand.

TOTAL DEPTH OF BOREHOLE: 115 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-16

LITHOLOGIC LOG OF MONITOR WELL P-25M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 32.0	SANDY SILT	ML	Grayish orange (10 YR 7/4), soft, noncohesive; sand is very fine- to medium-grained, angular to rounded, some grains appear to be limestone; mild reaction with HCl.
32.0 - 57.5	FOSSILIFEROUS LIMESTONE WITH SHALE	--	Medium gray (N 4 to N 6), fossils are oyster shell fragments. At 32-34 feet, weathered shell agglomerate, grayish orange (10 YR 7/4); some medium to coarse sand, varicolored, rounded. At 34-35 feet, harder. At 35-39 feet, shale-limestone interbeds; some medium sand grains. At 39-40 feet, more shale, dark gray (N 3). At 40-43 feet, harder, lighter gray. At 43-43.5 feet, more shale, darker gray. At 43.5-44.5 feet, harder, more shell fragments. At 44.5-47 feet, hard limestone-shale interbeds. At 47-49 feet, softer, more shaly bedded; some silty clay. At 49-56 feet, hard limestone-shale interbeds.

*Unified Soil Classification System ASTM D-2487

**Drilled by mud rotary

TABLE E-16 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-25M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
			At 56-57.5 feet, silt, yellowish gray (5 Y 8/1), soft, noncohesive, some fine sand.
57.5 - 58.5	CLAYEY SILT	CL	Medium gray (N 5), soft, moderately cohesive.
58.5 - 64.0	SANDY GRAVELLY SILT/ SANDY GRAVELLY CLAY	GM/GC	Medium to light gray (N 5 to N 6), sand is fine- to medium-grained; gravel is fine, angular; some layers of shale.
			At 59 feet, shale appears to have an oily matrix.
64.0 - 66.0	SILTY SANDY GRAVEL	GM	Varicolored, fine-grained, poorly sorted, angular; sand is very fine- to fine-grained; some clay.
66.0 - 69.0	SANDY SILT/ SANDY CLAY	SM/SC	Olive gray (5 Y 4/1), soft, moderately cohesive; sand is fine, 10-20 percent.
			At 67-69 feet, color change to medium gray (N 5).
69.0 - 74.0	CLAYEY SILT/ SANDY SILT	CL/SM	Medium light gray (N 6), interbedded.
74.0 - 76.0	CLAYSTONE/ SILTSTONE	--	Light olive gray (5 Y 6/1), moderately cemented; soft, moderately cohesive; some fine sand.
76.0 - 80.0	SILTY CLAY	CL	Light olive gray (5 Y 6/1), soft, moderately cohesive; some fine to very fine sand.
80.0 - 82.0	CLAY	CL	Light olive gray (5 Y 6/1), soft, cohesive, more dense with depth; trace fine sand.

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-16 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-25M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
82.0 - 91.5	SANDY SILTY CLAY	CL	Light olive gray (5 Y 6/1), soft, moderately cohesive; 10 percent sand is fine- to medium-grained, angular to rounded. At 82-83 feet, lignite layer. At 85 feet, color change to light greenish gray (5 G 8/1). At 85.5 feet, very fine sandstone or shale layer.
91.5 -100.0	SANDY SILT/ SILTY SANDSTONE	SM	Pinkish gray (5 YR 8/1), very fine- to fine-grained, lightly cemented, friable; cemented sandstone is higly reactive with HCl.
100.0-111.0	SAND	SP	Light gray (N 7 to N 8) to pinkish gray (5 YR 8/1), very fine- to fine-grained, well sorted, rounded to well rounded, clean, soft. At 105-106 feet, harder layer, probably sandstone.
111.0-125.0	SILTY CLAY/ CLAYEY SILT	ML/CL	Light greenish gray (5 G 8/1) to light olive gray (5 Y 6/1), slightly firm to soft, moderately cohesive; some lignite and fine sandstone.
125.0-158.0	SILTY SAND	SM	Pinkish gray (5 YR 8/1), very fine-grained, soft, loose, clean. At 142 feet, some clay. At 154 to 155 feet, sand is coarser but still fine-grained, well sorted and rounded, less silt.

*Unified Soil Classification System
ASTM D-2487

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TABLE E-16 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-25M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
158.0-160.0	SILTY CLAY	CL	Light bluish gray (5 B 5/1), slightly cohesive, trace sand.

TOTAL DEPTH OF BOREHOLE: 160 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-19

LITHOLOGIC LOG OF MONITOR WELL P-26U

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 1.0	ASPHALT AND GRAVEL FILL	--	
1.0 - 5.0	SILTY CLAY/ CLAYEY SILT WITH WEATHERED LIMESTONE	--	Dark yellowish brown, soft, moderately cohesive. At 4.5 feet, color change to grayish orange (10 YR 7/4).
5.0 - 12.0	CLAYEY LIMESTONE	--	Very pale orange (10YR to 7/4), limestone is weathered; clay is soft, slightly cohesive. At 11.0 feet, softer, more clay, color change to dark yellowish orange (10 YR 6/6).
12.0 - 23.5	WEATHERED LIMESTONE/ CLAYEY GRAVEL	--	Grayish orange (10 YR 7/4); gravel is fine- to medium-grained, rounded, to subangular limestone; clay is soft, moderately cohesive.
23.5 - 26.0	LIMESTONE	--	Medium bluish gray (5 B 5/1), hard. At 24.5 feet, shale/clay interbeds, color grades to medium light gray (N 6).
26.0 - 36.0	LIMEY SHALE AND CLAY	--	Medium gray to medium light gray (N 5 to N 6), no visible fossils, moderate reaction with HCl. At 28-34 feet, softer. At 34 feet, harder.
36.0 - 46.0	FOSSILIFEROUS LIMESTONE	--	Medium light gray (N 6 to N 7), hard, brittle, shell fragments, strong reaction with HCl. At 42.0 feet, softer, more shale.

*Unified Soil Classification System ASTM D-2487

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TABLE E-19 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-26U

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
46.0 - 53.0	SHALE	--	Medium gray (N 5), brittle, hard, some shell fragments; some clay interbeds.
53.0 - 65.0	LIMESTONE	--	Medium light gray (N 6), hard, some shell fragments. At 55-57 feet, limestone and shale interbeds. At 57-65 feet, hard, more shell fragments.
65.0 - 75.0	SILTY CLAY	CL	Light olive gray (5 Y 6/1), moderately soft, moderately cohesive. At 72-75 feet, color change to medium light gray (N 6 to N 7), more firm and cohesive.
75.0 - 90.0	SANDY SILT	ML	Light olive gray to yellowish gray, soft, noncohesive; sand less than 10 percent, very fine-grained.
91.0 - 93.0	SILTY CLAY	CL	Brownish gray (5 YR 4/1), soft, slightly cohesive. At 91.0 feet, thin pyrite layer.

TOTAL DEPTH OF BOREHOLE: 93 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-18

LITHOLOGIC LOG OF MONITOR WELL P-26M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
0.0 - 2.0	ASPHALT AND FILL		
2.0 - 5.0	SILTY CLAY	CL	Brownish gray (5 YR 4/1), soft, moderately cohesive.
5.0 - 12.0	CLAYEY LIMESTONE	--	Pinkish gray to yellowish gray (5 YR 8/1 to 5 Y 8/1), weathered; some clay is grayish orange (10 YR 7/4), dense, cohesive. At 9.0 feet, less clay, more silt, color grades to grayish orange (10 YR 7/4).
12.0 - 21.0	LIMESTONE	--	Yellowish gray (5 Y 8/1), weathered to grayish orange (10 YR 8/1); some subrounded gravel, fine- to medium-grained. At 14 feet, dense, sticky clay interbeds, grayish orange to dark yellowish orange (10 YR 7/4 to 10 YR 6/6).
21.0 - 24.0	CLAYEY LIMESTONE	--	Same as 5.0-12.0 feet.
24.0 - 36.0	LIMEY SHALY CLAY	--	Medium bluish gray (5 B 5/1), slightly cohesive; shale is brittle, friable; highly reactive with HCl. At 30 feet, softer, color grades to darker gray (N 3 to N 4). At 33.5 feet, clay is more dense and sticky, more shale. At 36 feet, trace pyrite and shell fragments.

*Unified Soil Classification System ASTM D-2487

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TABLE E-18 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-26M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
36.0 - 41.0	FOSSILIFEROUS LIMESTONE	--	Medium gray (N 5 to N 6), hard, trace pyrite, shell fragments.
			At 38-40 feet, softer.
41.0 - 52.0	LIMEY SHALE	--	Grayish black to medium gray (N 2 to N 5), brittle; clay interbeds are soft and noncohesive; appears to have an oily matrix.
			At 41.5 feet, thin, white siltstone (chalk).
52.0 - 80.0	LIMESTONE WITH SHALE	--	Medium gray (N 3 to N 5), hard, some shell fragments; trace chert.
			At 56 feet, more shale.
			At 58 feet, more limestone.
			At 60 feet, more shale.
			At 60.5-63.5 feet, hard limestone, numerous shell fragments.
			At 63.5 feet, shale with silty clay interbeds, medium gray (N 4 to N 5) to light olive gray (5 Y 6/1).
			At 77 feet, some sandstone, very fine-grained, well cemented very light gray (N 7).

*Unified Soil Classification System
ASTM D-2487

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TABLE E-18 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-26M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
80.0 - 94.0	CLAYEY SANDY SILT/ SILTY SANDY CLAY	--	Light olive gray (5 Y 6/1), soft, moderately cohesive, slightly sticky; sand is very fine-grained. At 86 feet, thin layer of light gray (N 7) very fine-grained sandstone, color grades to brownish gray (5 YR 4/1). At 87.5-88 feet, very fine-grained sandstone, light gray (N 7). At 89.5-90 feet, same as above. At 91 feet, thin lignite layer.
94.0 -106.0	CLAY	CH	Brownish gray (5 Y 6/1), dense, firm, cohesive, moderately plastic; trace lignite.
106.0-112.0	SILTY CLAY/ CLAYEY SILT	CL/ML	Brownish gray (5 Y 6/1), slightly cohesive; trace very fine-grained sand.
112.0-120.0	SAND	SP	Light gray (N 7 to N 8), very fine-grained, well sorted, soft, lightly cemented. At 112-114 feet, some silt. At 120 feet, thin lignite layer.
120.0-134.0	SANDY SILT/ SILTY SAND	SM	Light gray (N 7 to N 8), very fine-grained, noncohesive. At 120-122 feet, silt layer, brownish gray (5 Y 6/1).

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

TABLE E-18 (continued)
LITHOLOGIC LOG OF MONITOR WELL P-26M

DEPTH INTERVAL (feet below land surface)	SOIL TYPE	GROUP SYMBOL*	DESCRIPTION OF MATERIAL**
134.0-167.0	SAND	SP	Yellowish gray (5 Y 8/1), very fine- to fine-grained, well sorted, rounded, lightly cemented. At 165-167 feet, well cemented.
167.0-171.5	SILTSTONE/ SILT	ML	Light greenish gray (5 G 8/1), soft, slightly cohesive; interbedded with harder white siltstone layers.

TOTAL DEPTH OF BOREHOLE: 171.5 Feet

*Unified Soil Classification System
ASTM D-2487

**Drilled by mud rotary

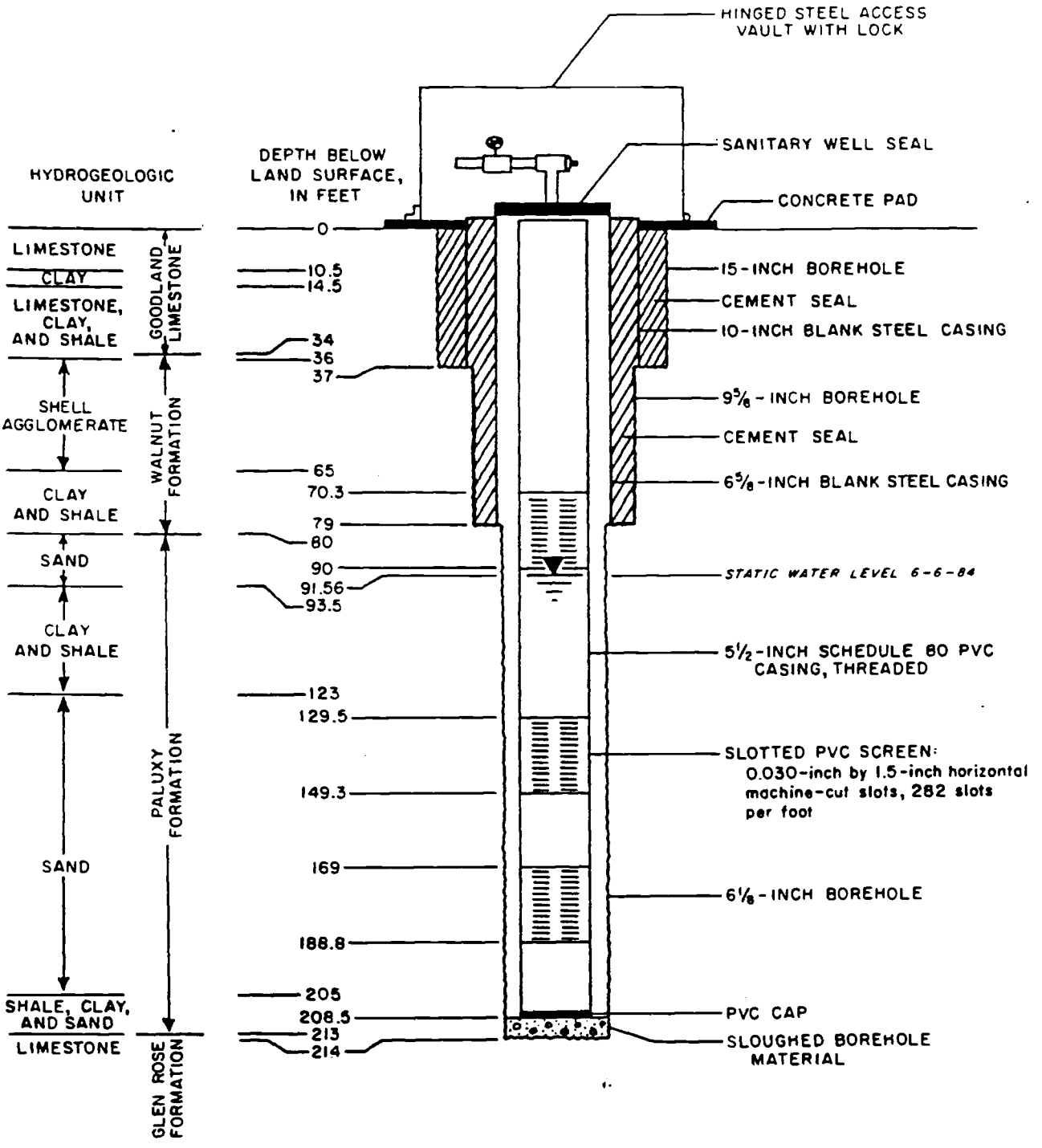


FIGURE D-2. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-1 (PALUXY FORMATION)

HARGIS + ASSOCIATES

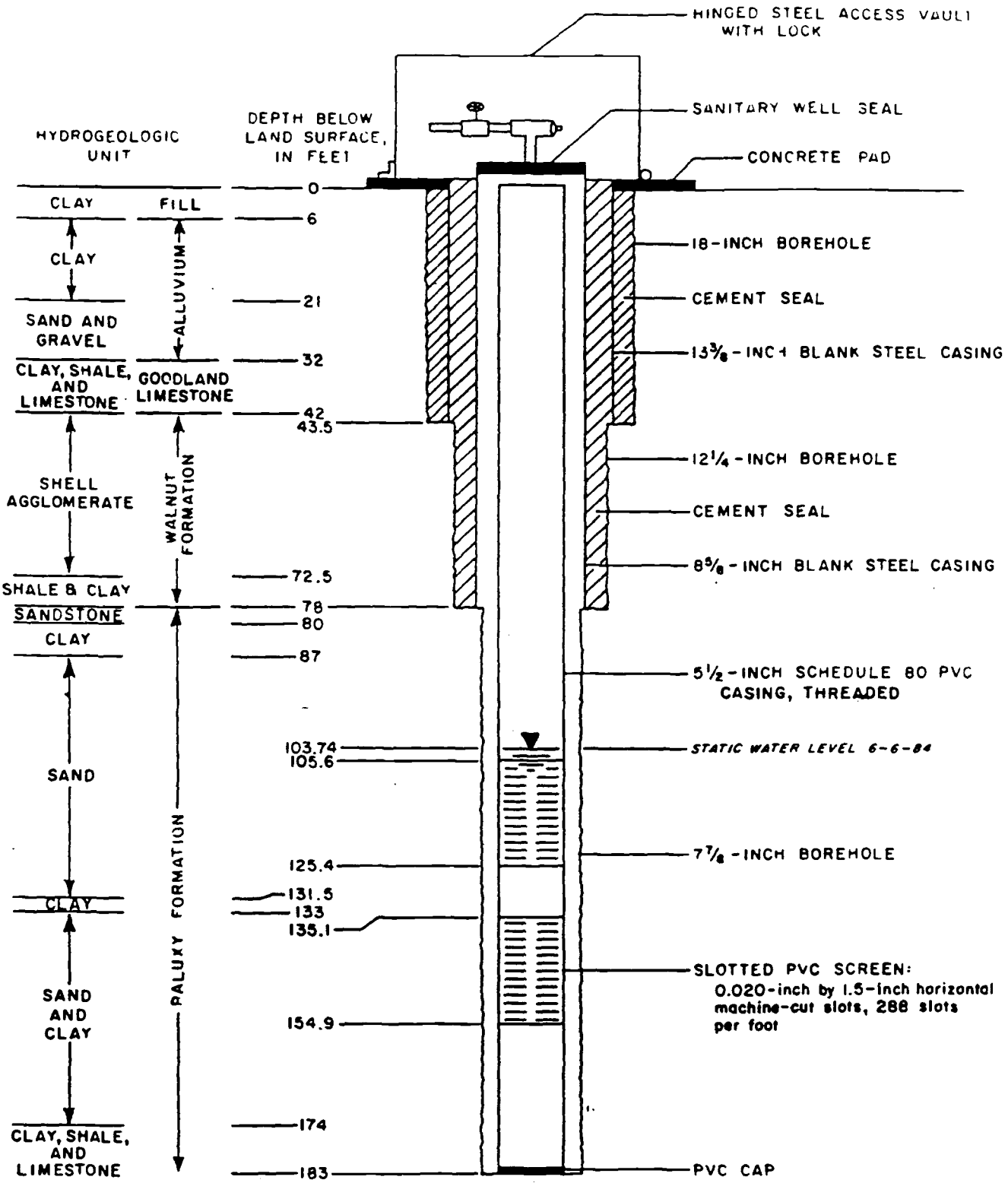


FIGURE D-3. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-2 (PALUXY FORMATION)

HARGIS + ASSOCIATES, INC.

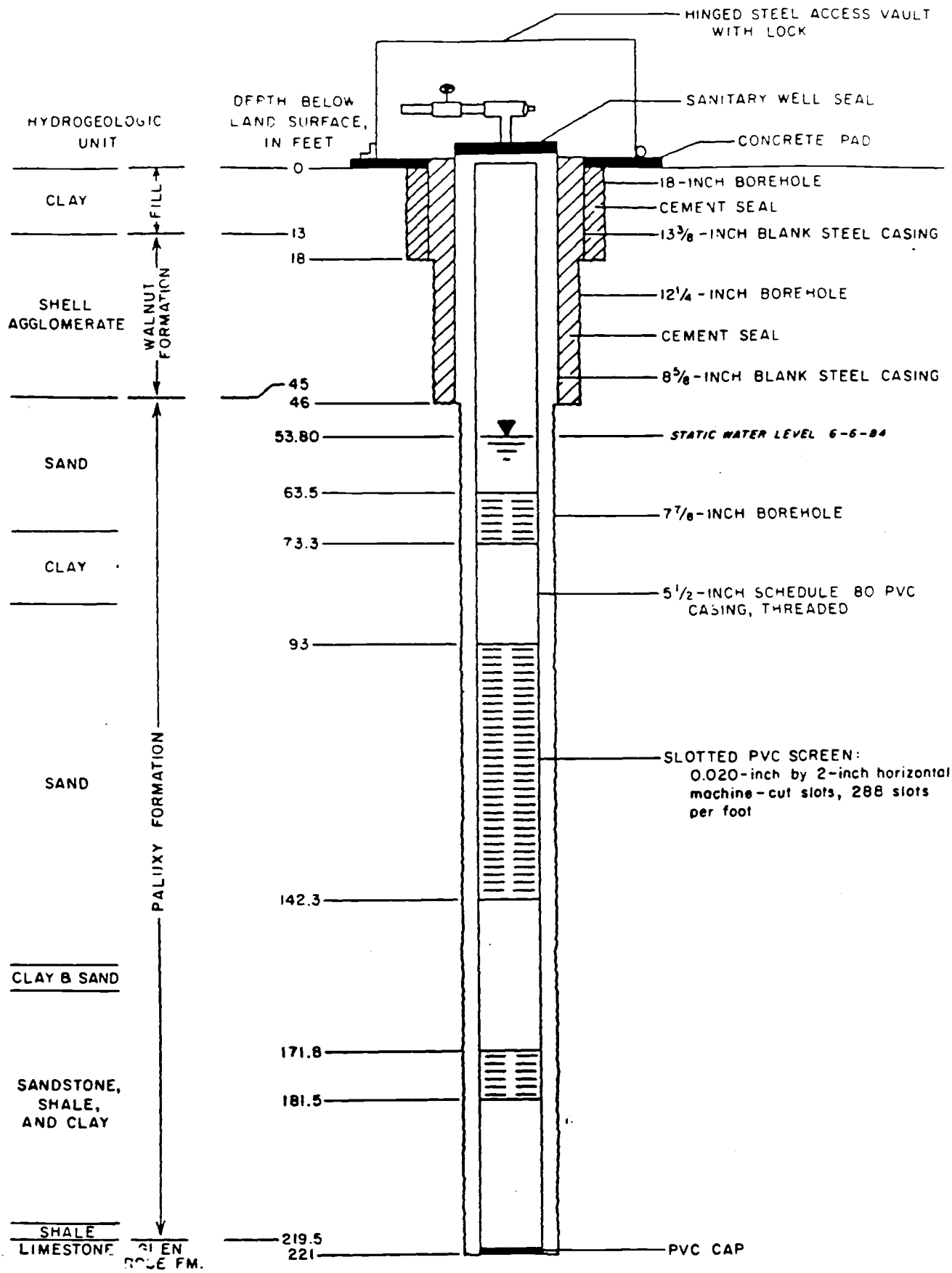


FIGURE D-4. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-3 (PALUXY FORMATION)

HARGIS + ASSOCIATES

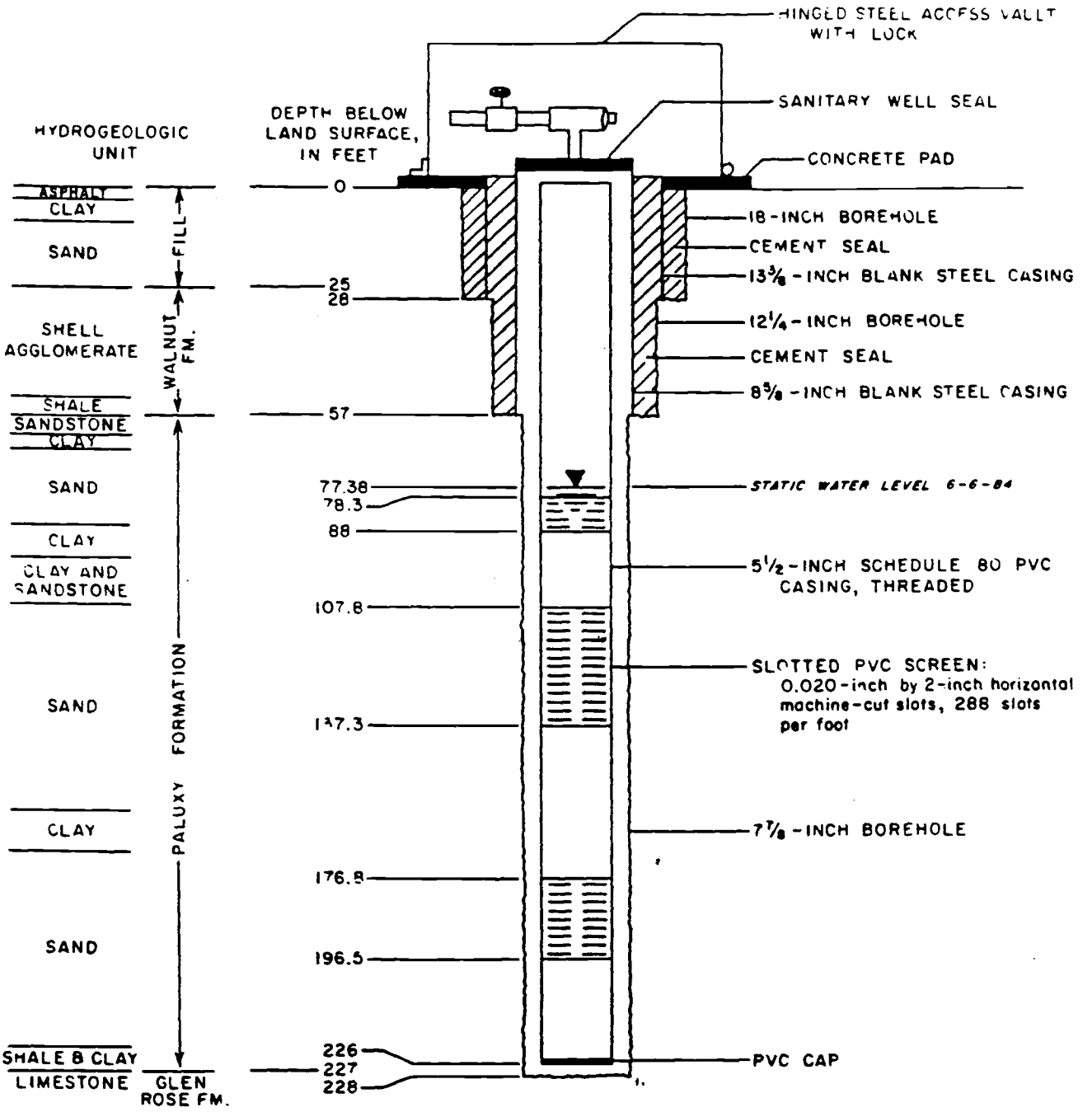


FIGURE D-5. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-4 (PALUXY FORMATION)

HARGIS + ASSOCIATES

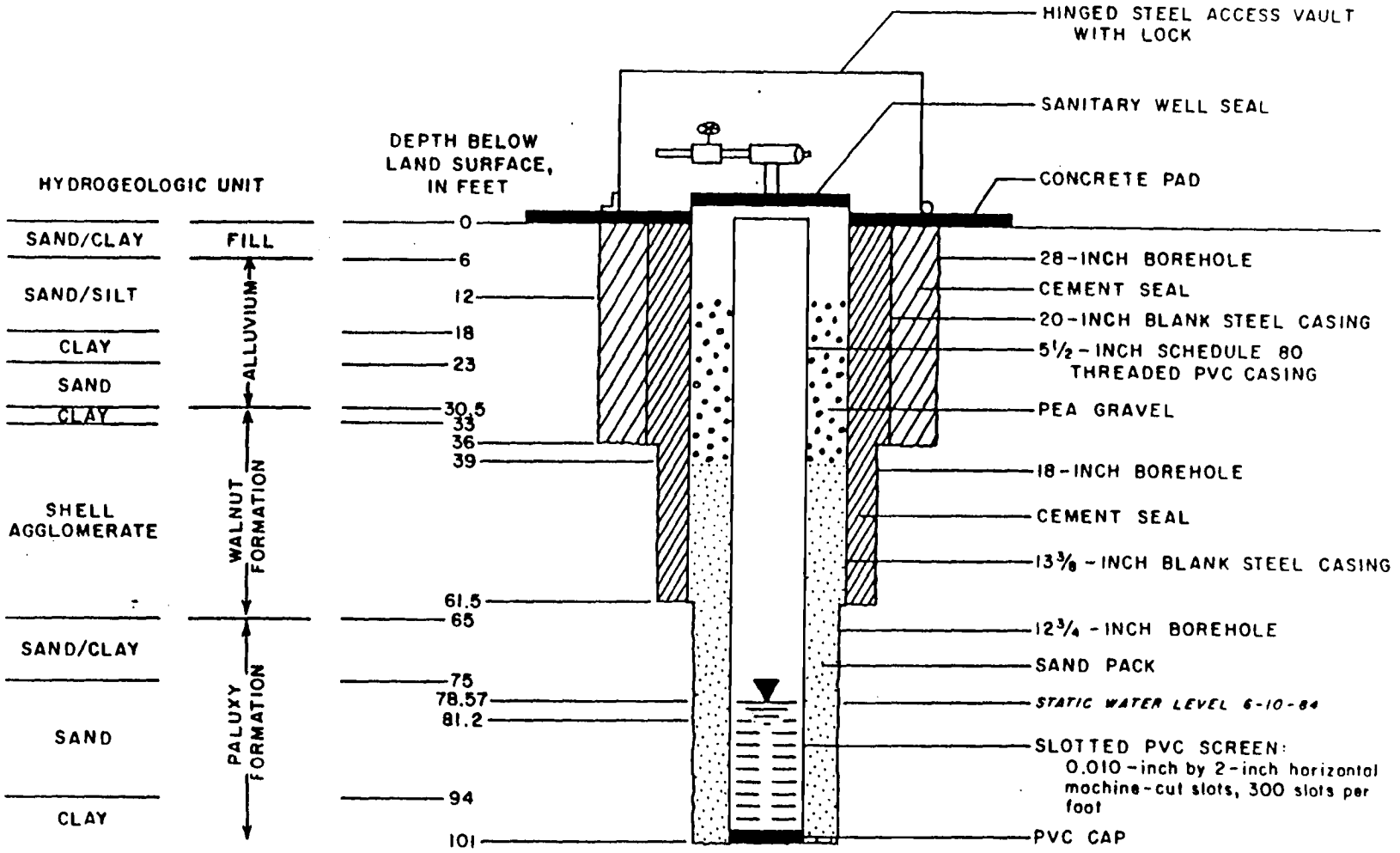


FIGURE D-6. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-5 UPPER (PALUXY FORMATION)

HARGIS + ASSOCIATES INC

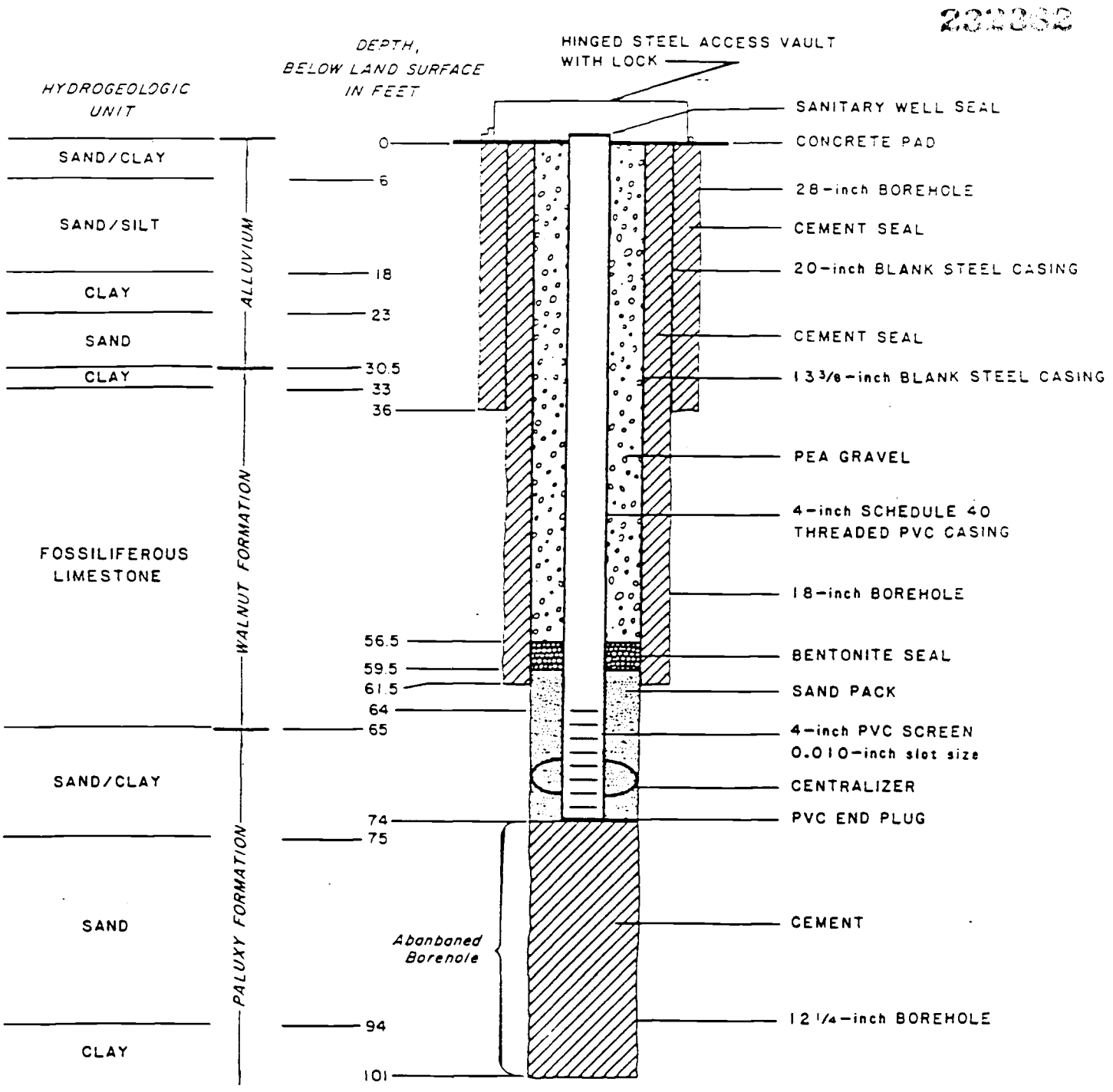


FIGURE F-2. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-5US

HARGIS + ASSOCIATES, INC.

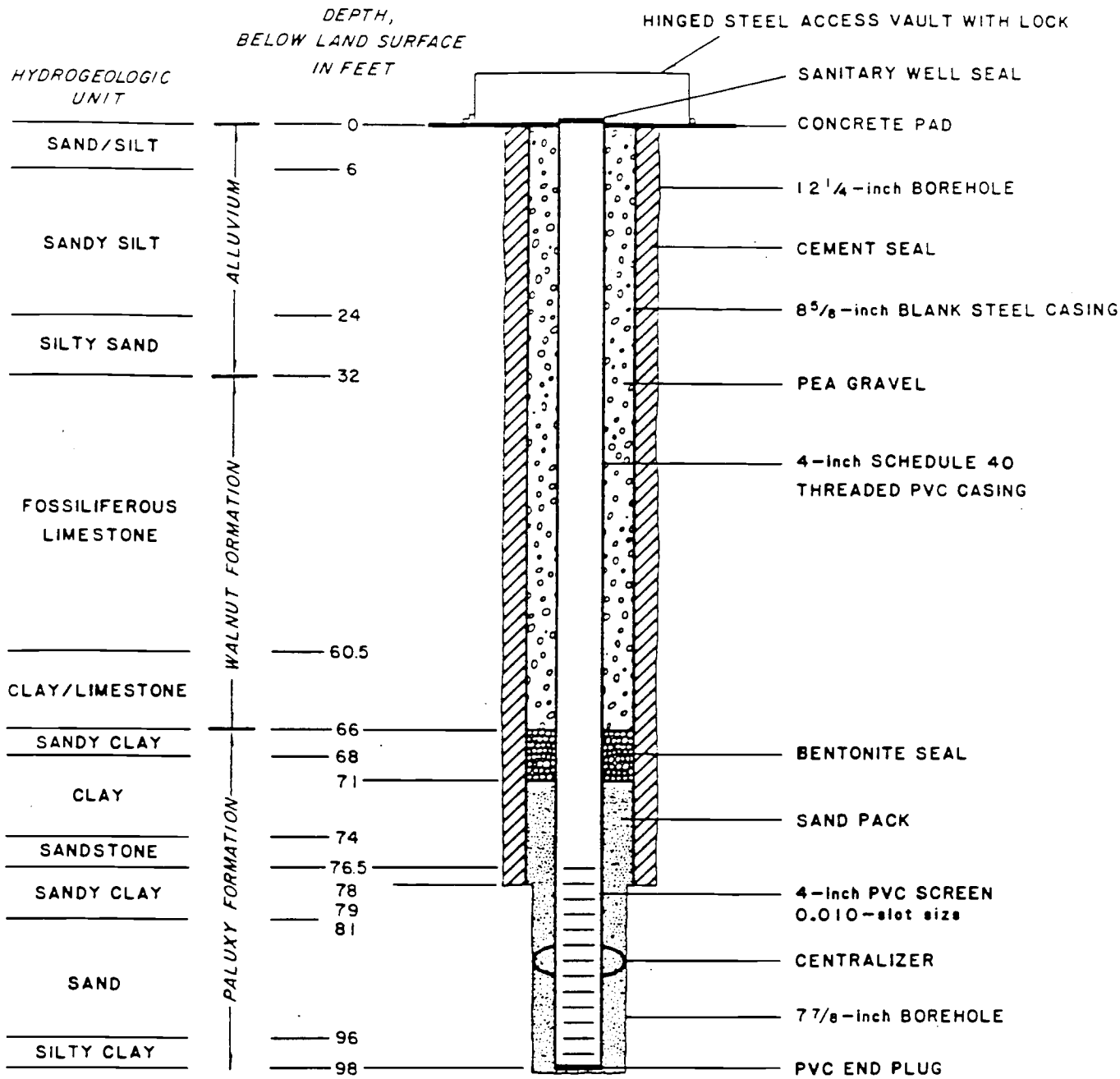


FIGURE F-3. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-5UN

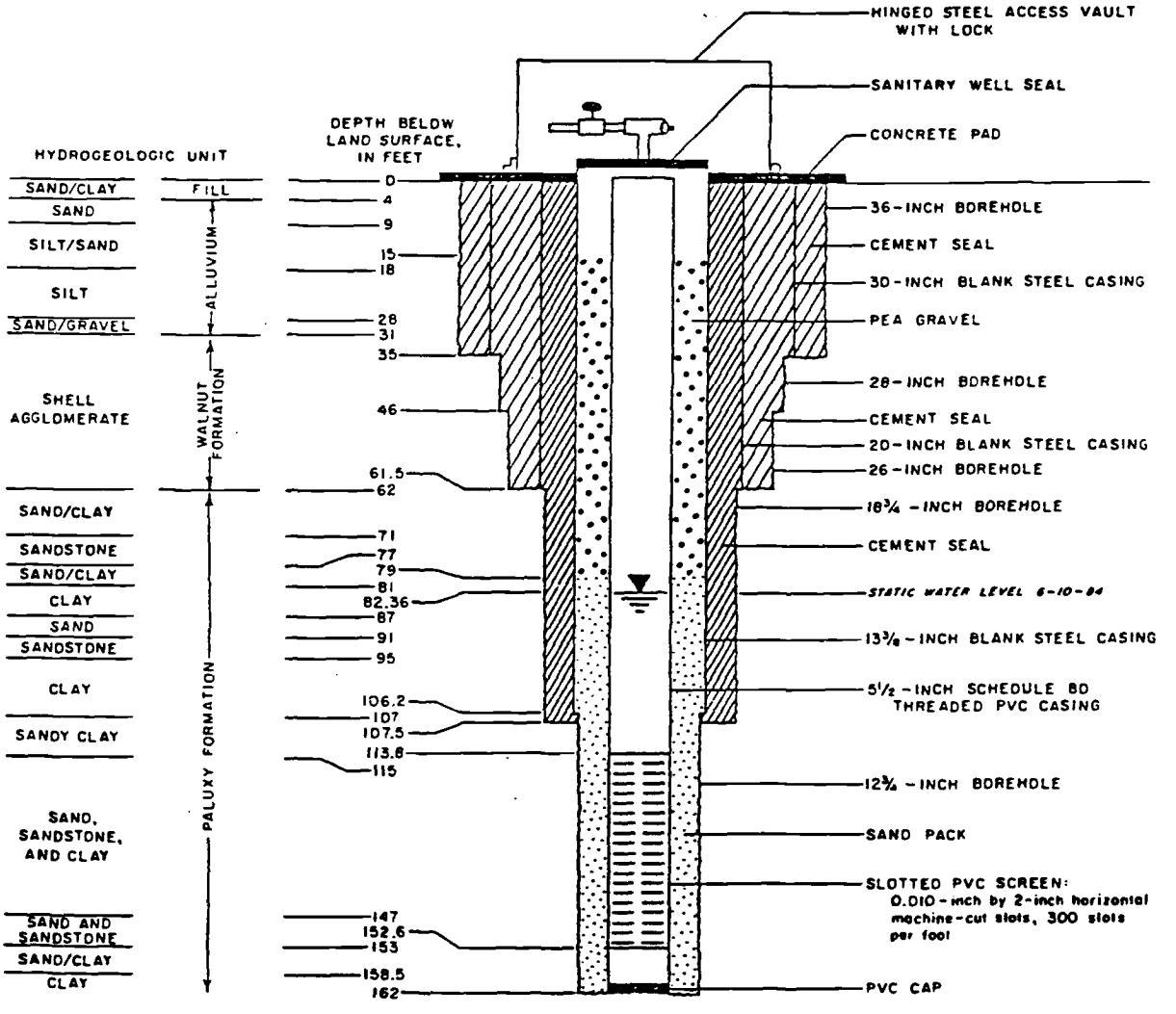


FIGURE D-7. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-5 MIDDLE (PALUXY FORMATION)

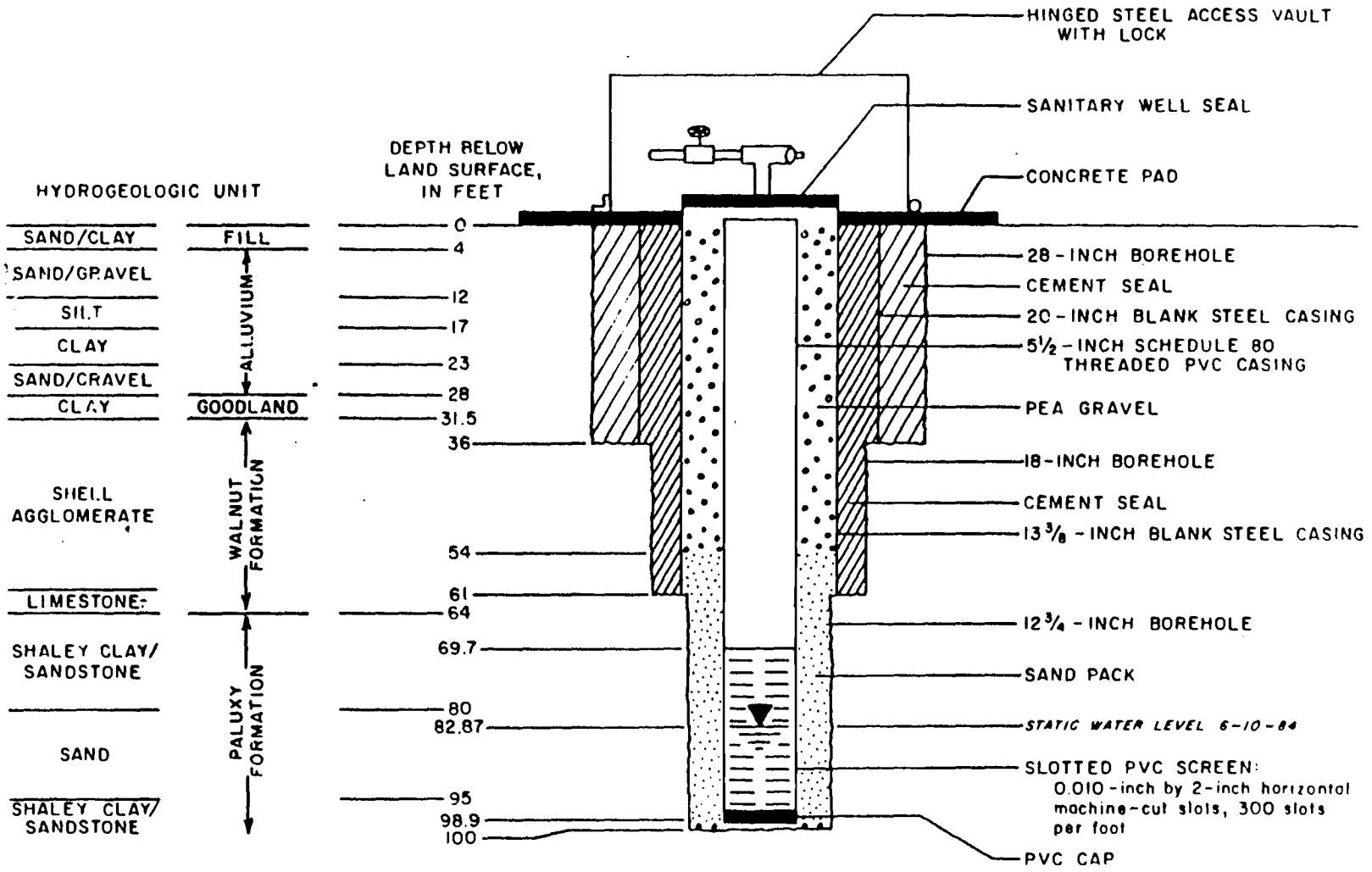


FIGURE D-8. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-6 UPPER (PALUXY FORMATION)

HARGIS + ASSOCIATES

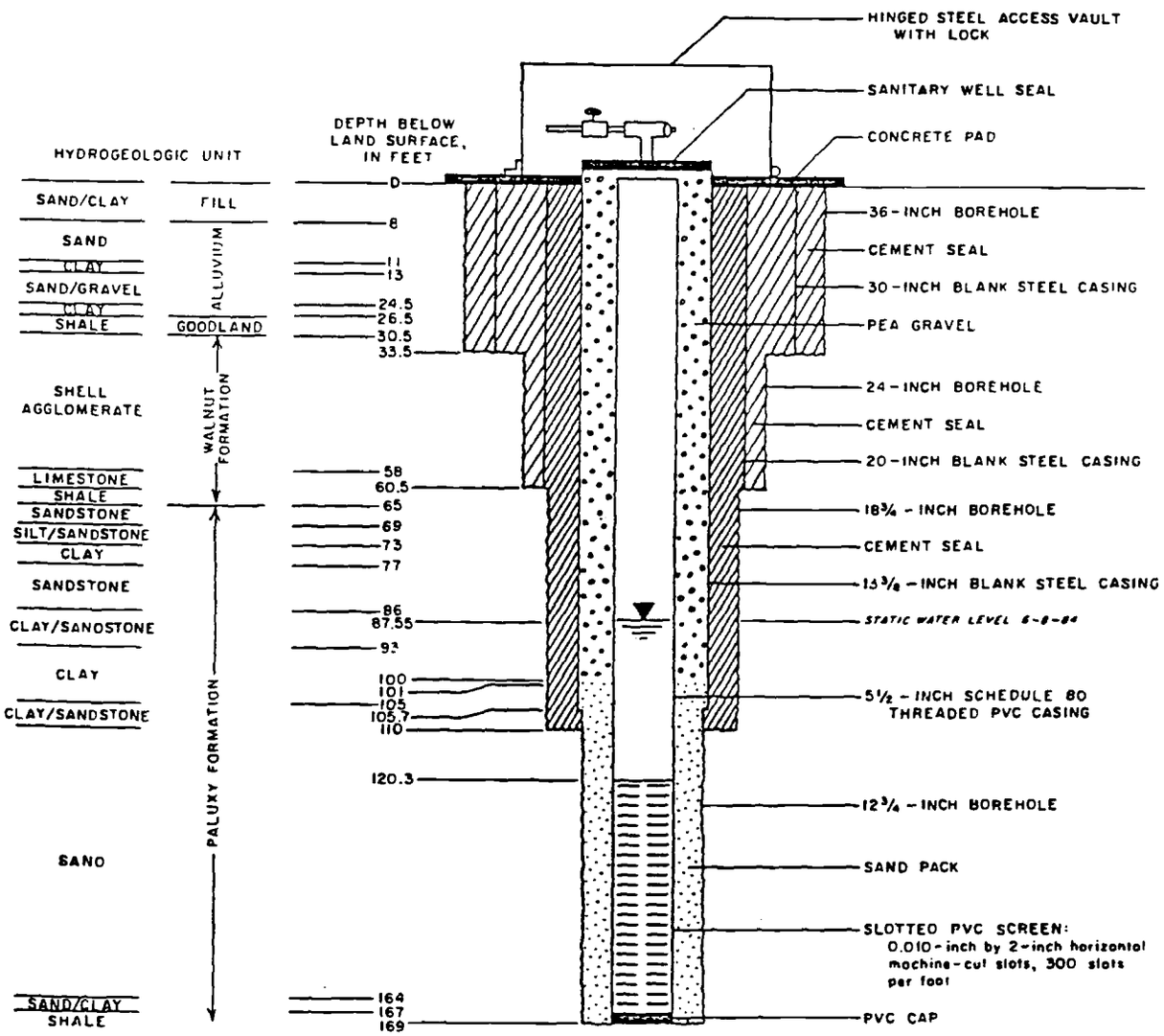


FIGURE D-9. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-6 MIDDLE (PALUXY FORMATION)

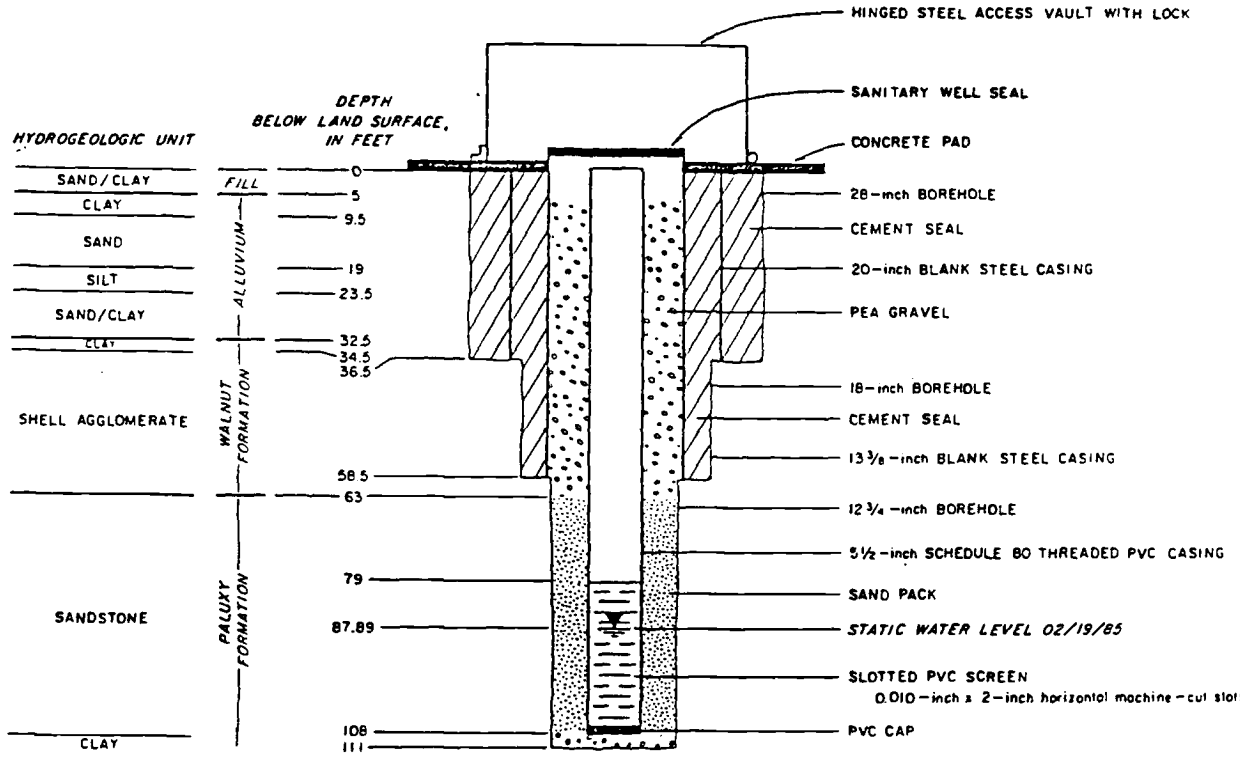


FIGURE D-10. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-7 UPPER (PALUXY FORMATION)

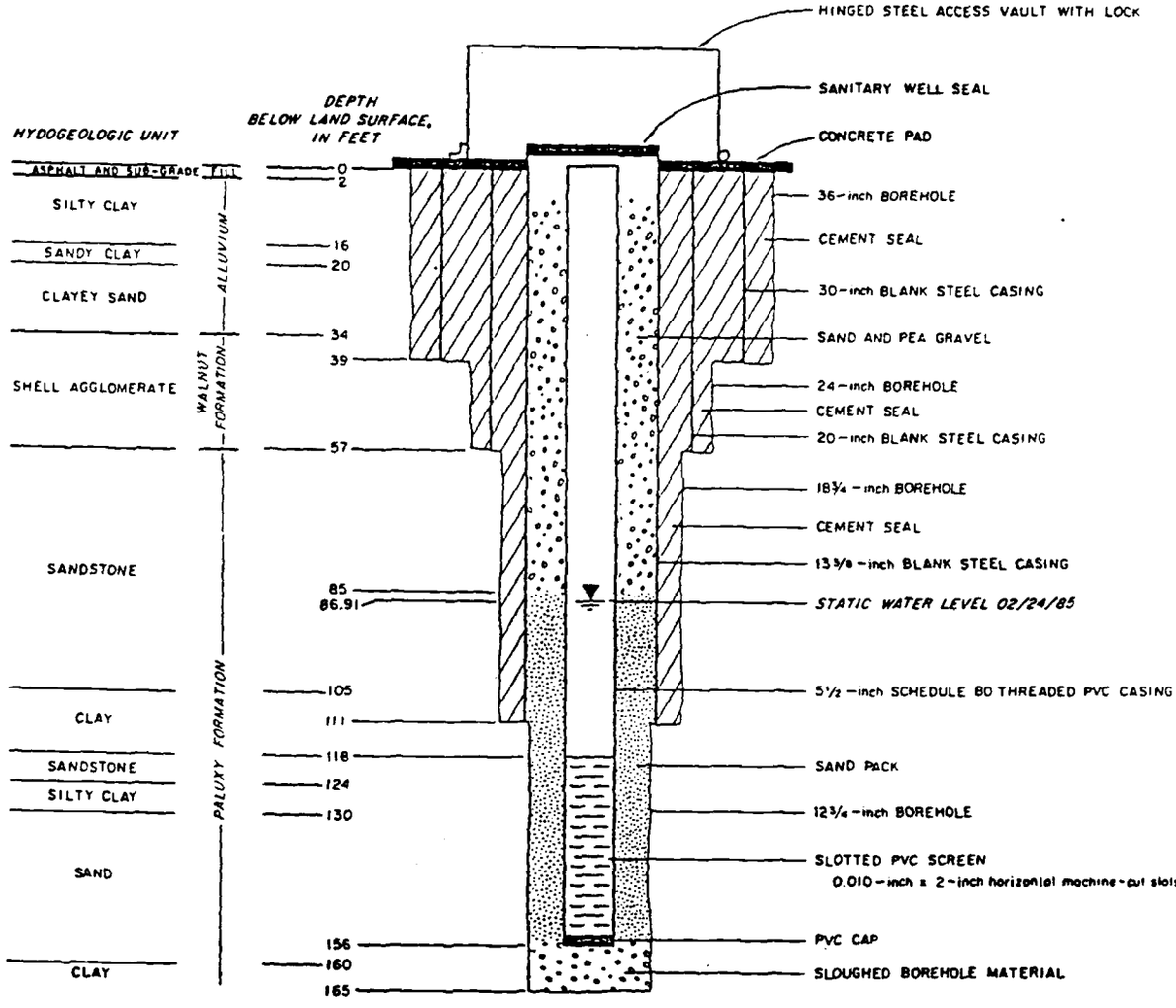


FIGURE D-11. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-7 MIDDLE (PALUXY FORMATION)

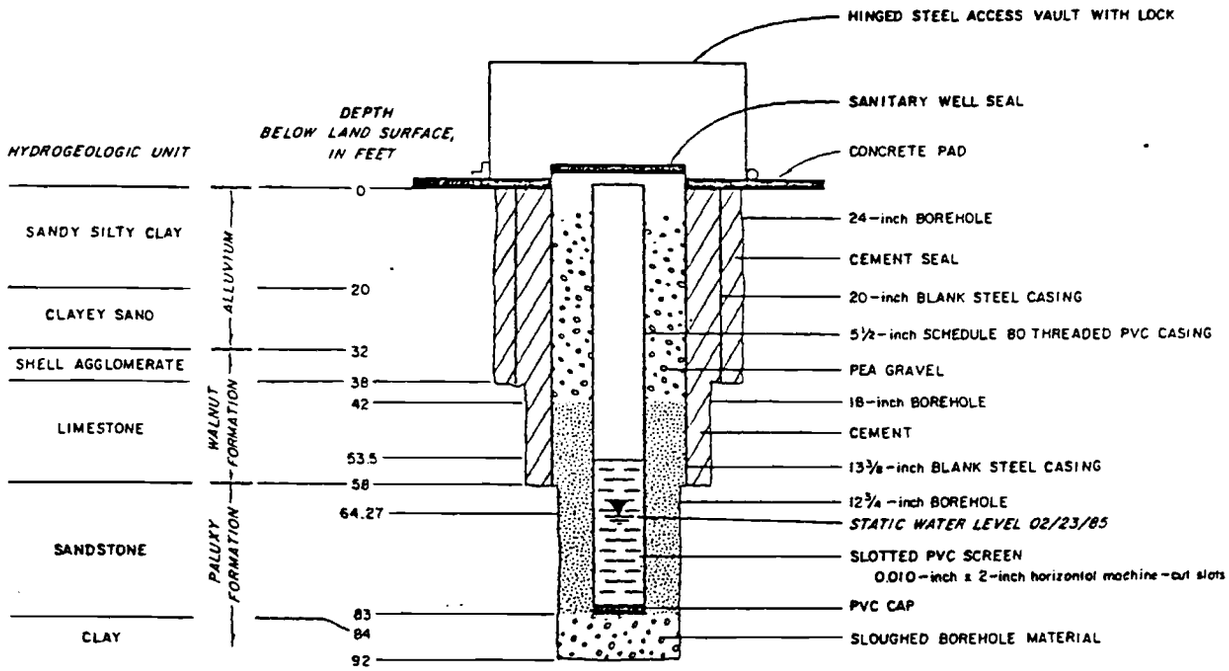


FIGURE D-12. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-8 UPPER (PALUXY FORMATION)

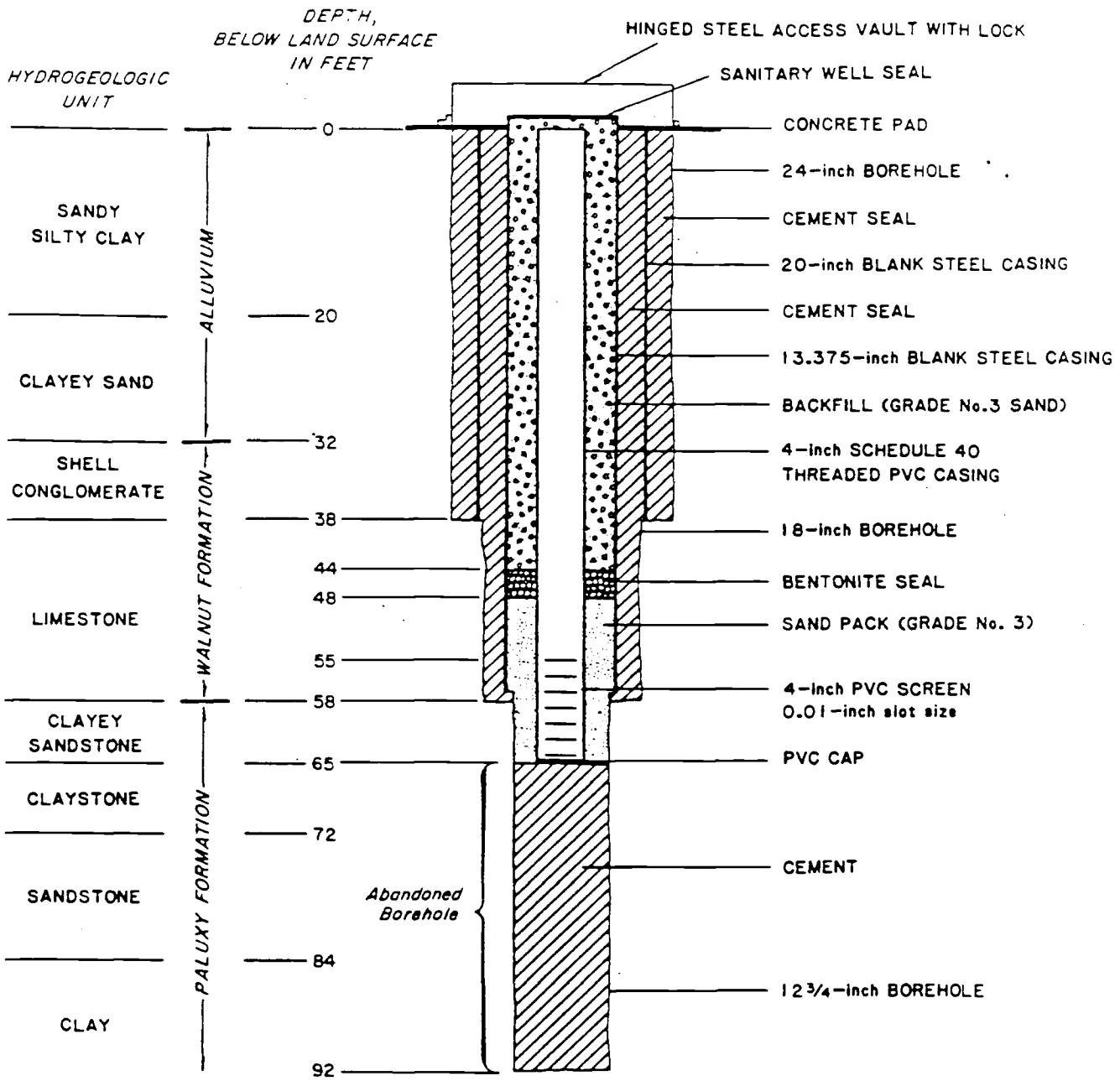


FIGURE F-4. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-8US

HARGIS + ASSOCIATES, INC.

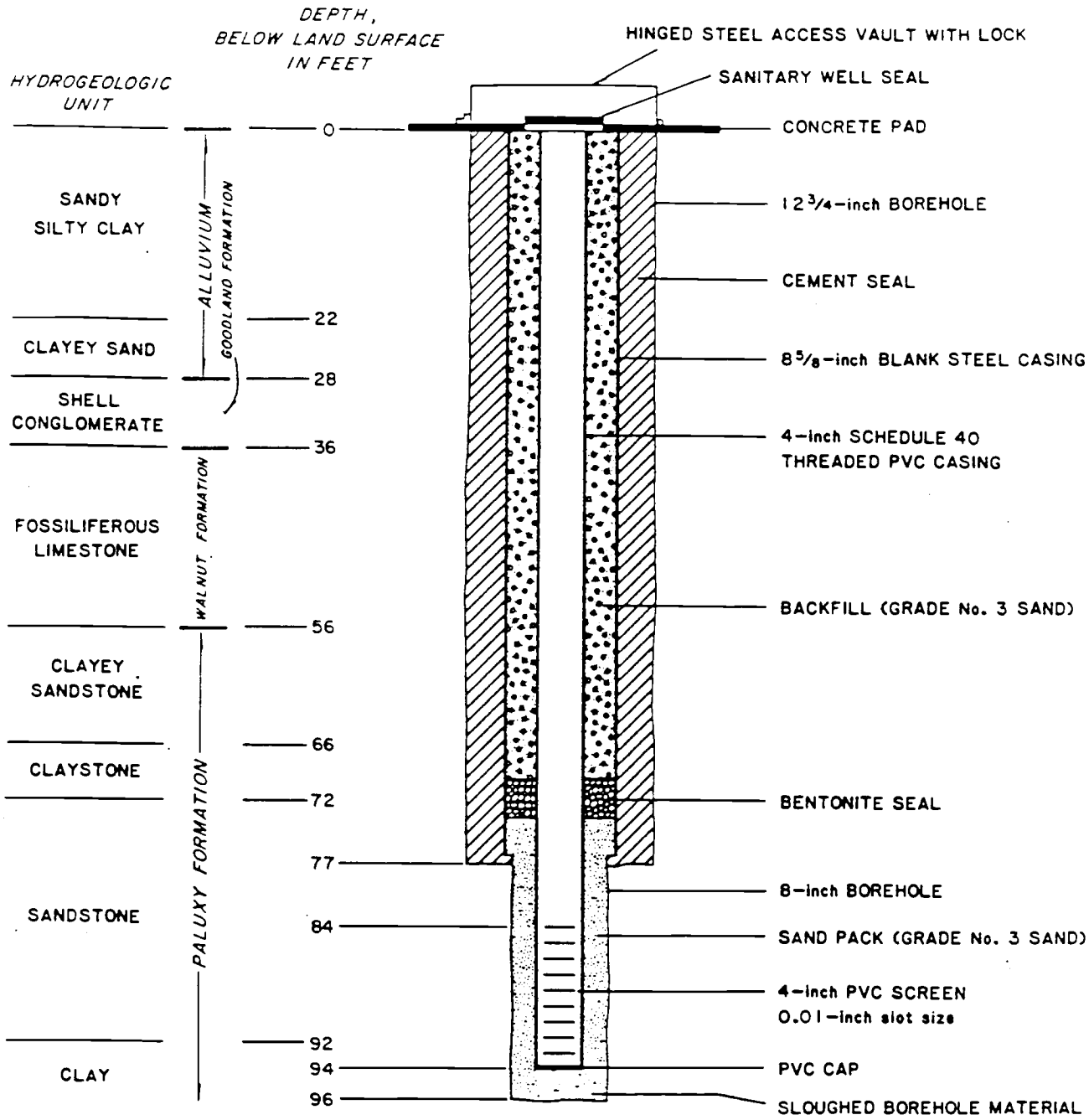


FIGURE F-5. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-8UN

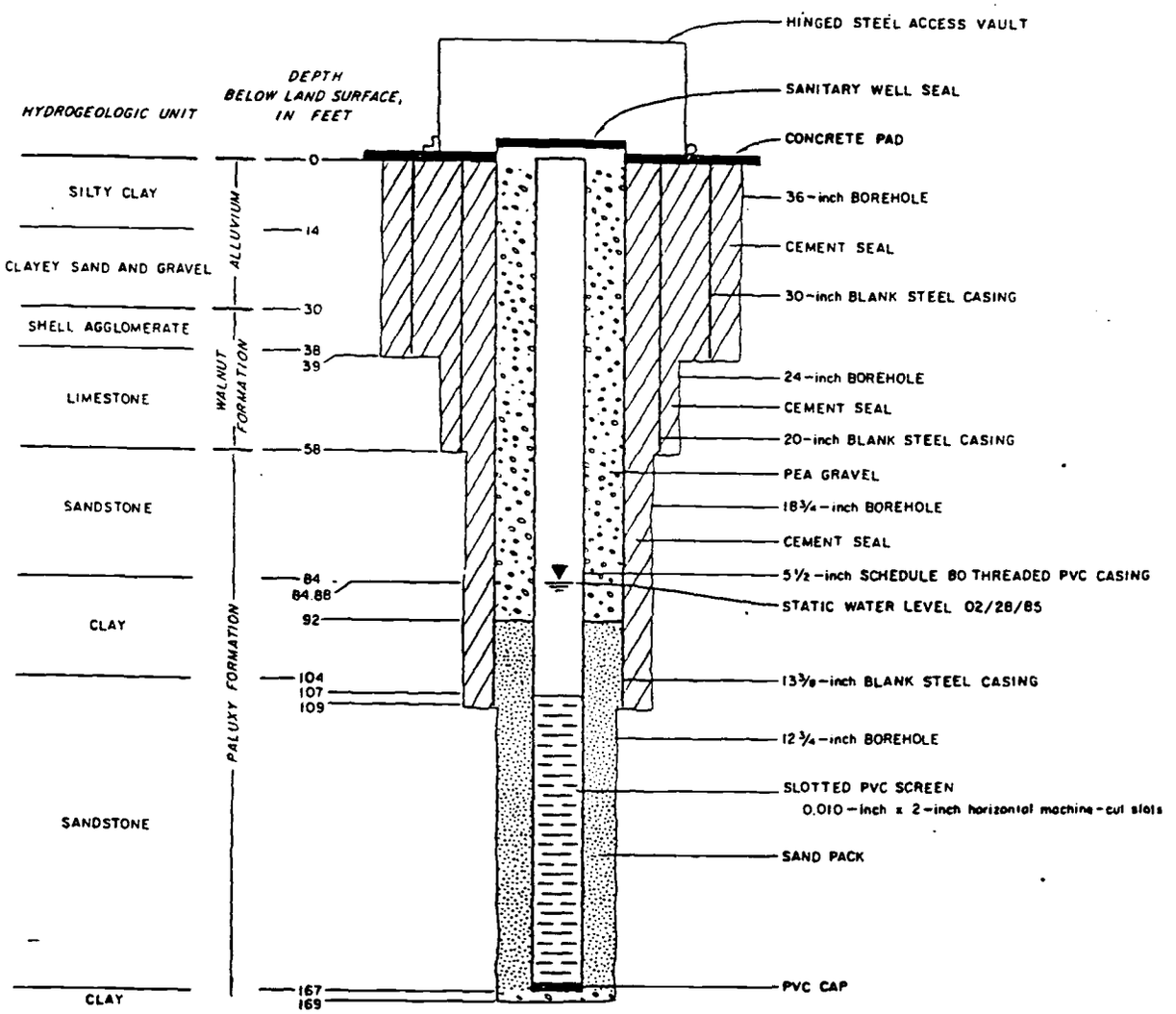


FIGURE D-13. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-8 MIDDLE (PALUXY FORMATION)

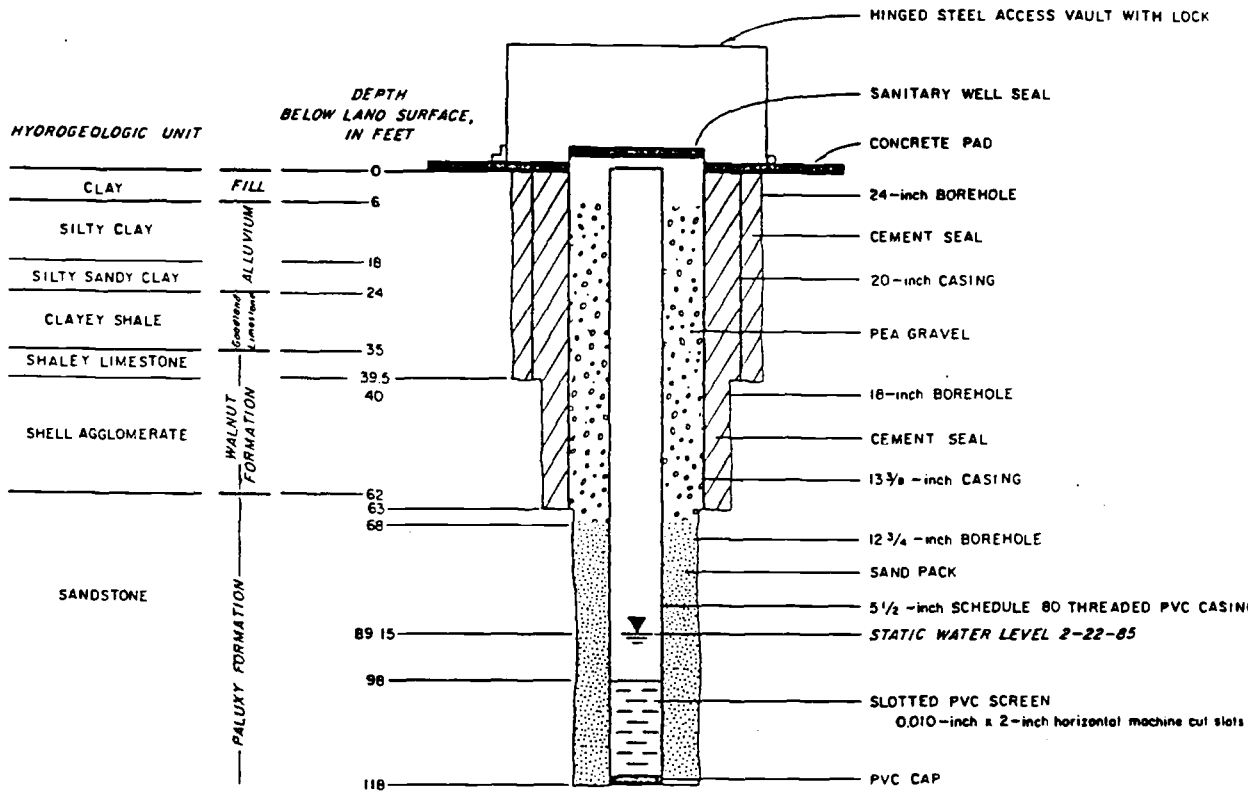


FIGURE D-14. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-9 UPPER (PALUXY FORMATION)

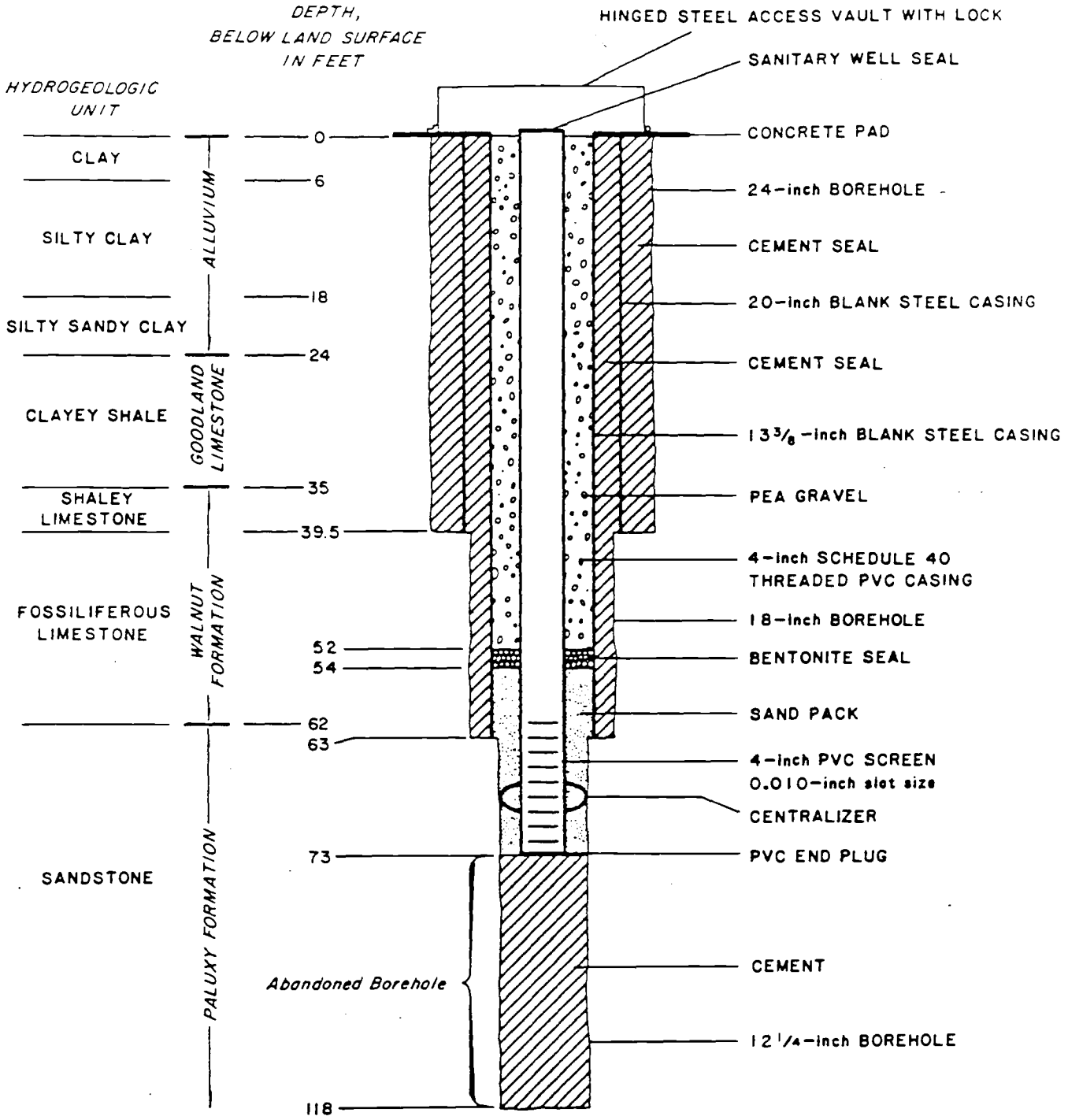


FIGURE F-6. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-9US

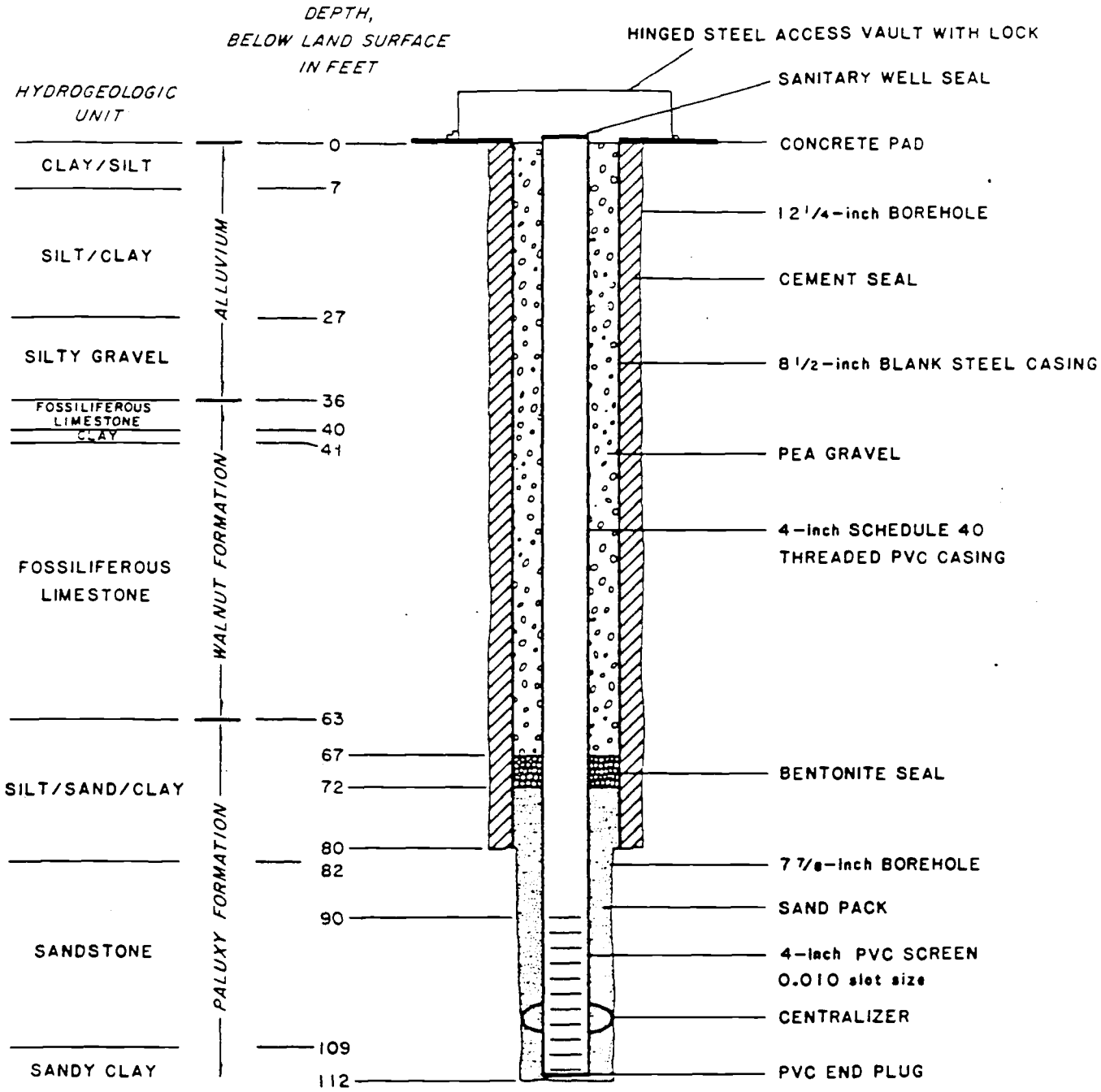


FIGURE F-7. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-9UN

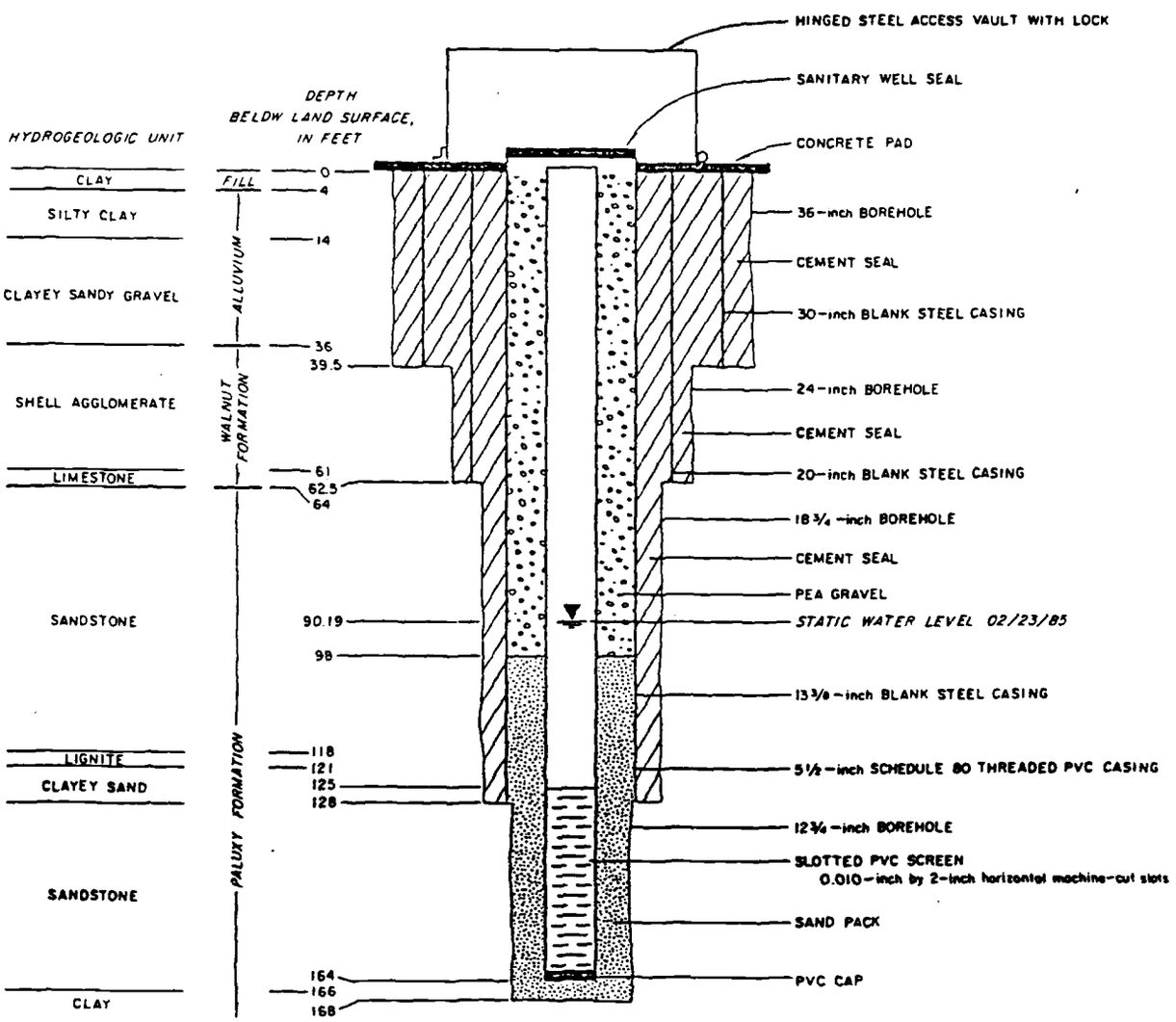


FIGURE D-15. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-9 MIDDLE (PALUXY FORMATION)

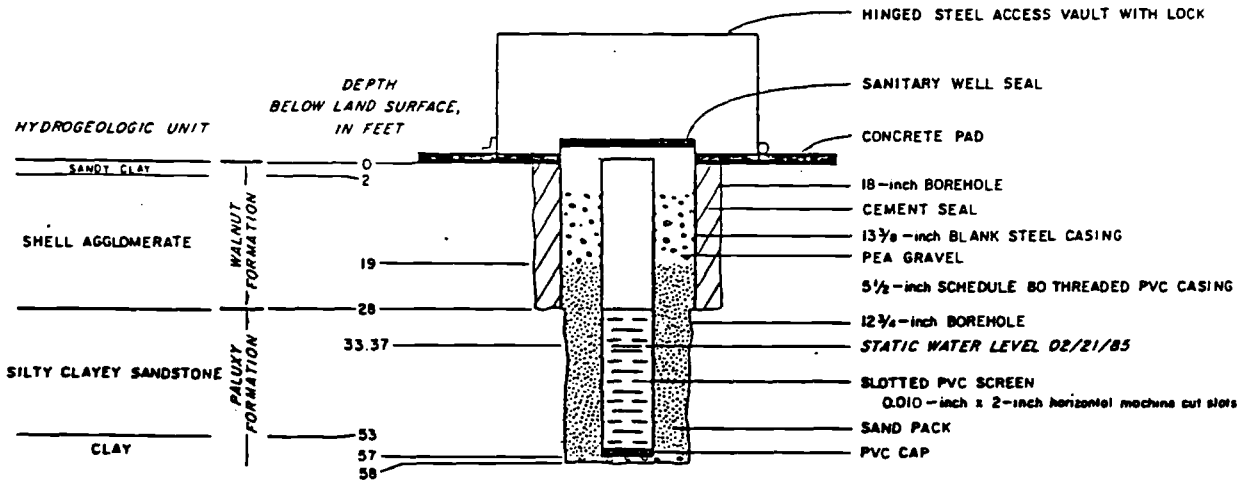


FIGURE D-16. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-10 UPPER (PALUXY FORMATION)

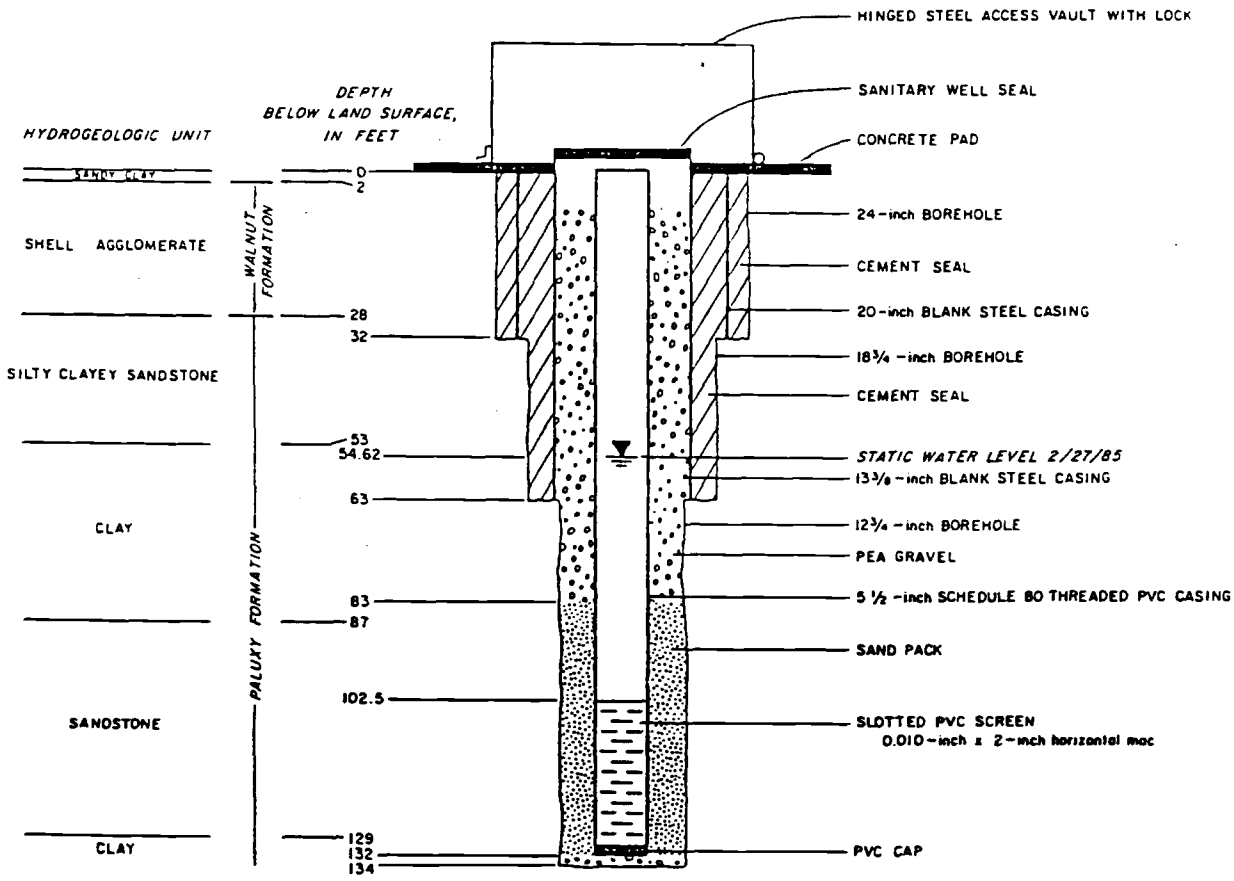
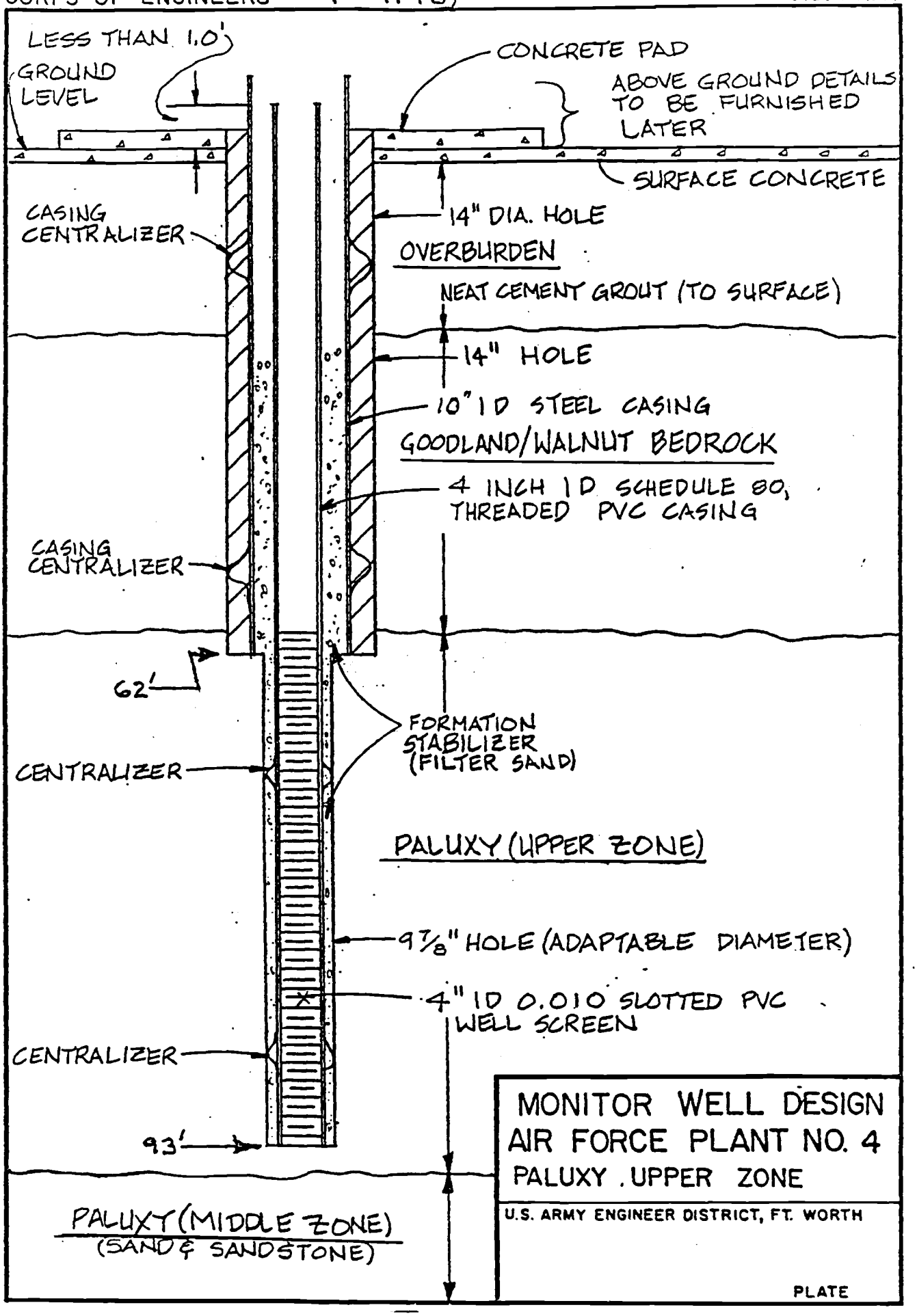
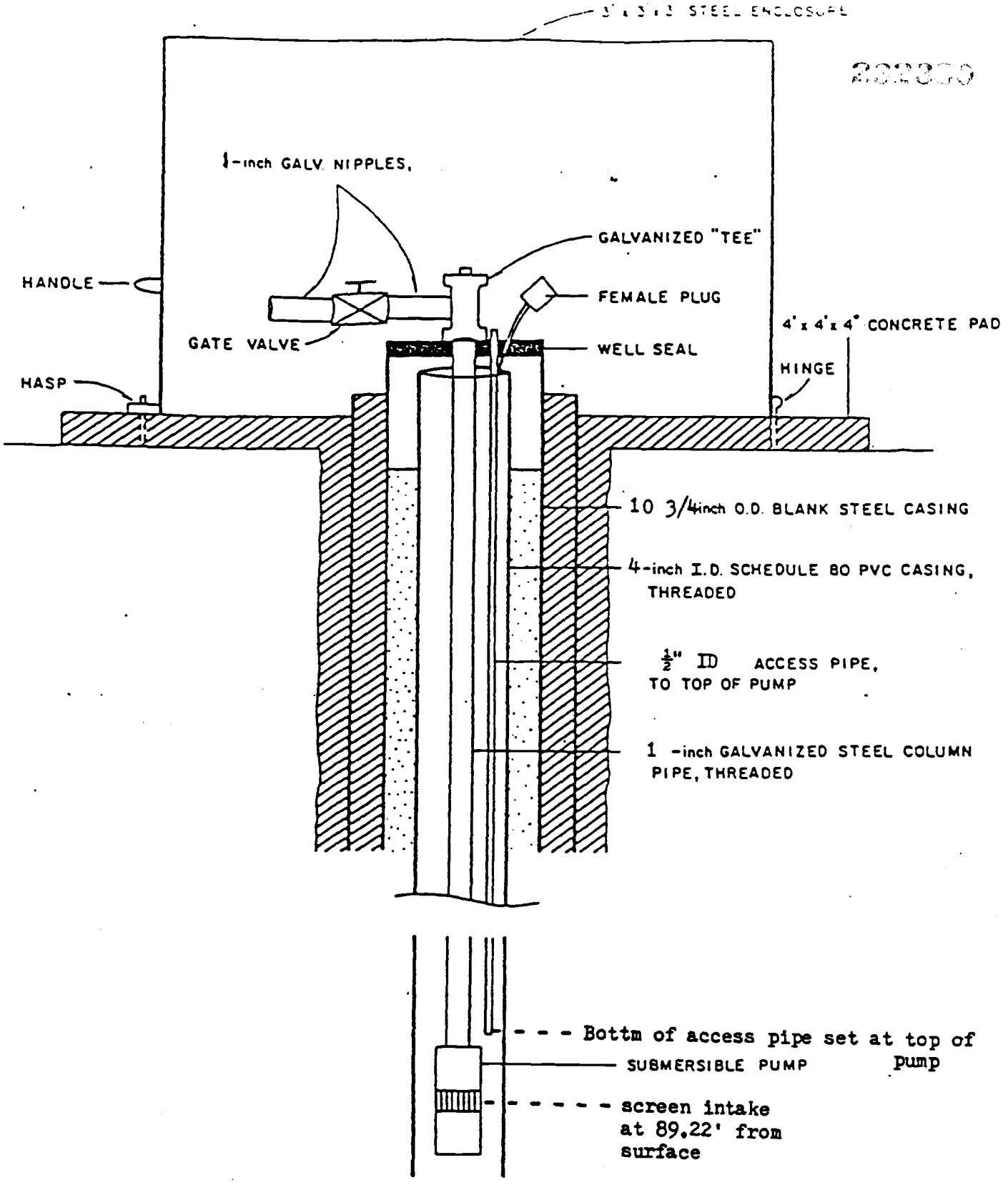


FIGURE D-17. SCHEMATIC CONSTRUCTION DIAGRAM OF MONITOR WELL P-10 MIDDLE (PALUXY FORMATION)


LESS THAN 1.0'
GROUND LEVEL
CONCRETE PAD
ABOVE GROUND DETAILS TO BE FURNISHED LATER
SURFACE CONCRETE
CASING CENTRALIZER
14" DIA. HOLE
OVERBURDEN
NEAT CEMENT GROUT (TO SURFACE)
14" HOLE
10" ID STEEL CASING
GOODLAND/WALNUT BEDROCK
4 INCH ID SCHEDULE 80, THREADED PVC CASING
CASING CENTRALIZER
62'
FORMATION STABILIZER (FILTER SAND)
CENTRALIZER
PALUXY (UPPER ZONE)
9 7/8" HOLE (ADAPTABLE DIAMETER)
4" ID 0.010 SLOTTED PVC WELL SCREEN
CENTRALIZER
93'
PALUXY (MIDDLE ZONE)
(SAND & SANDSTONE)
MONITOR WELL DESIGN
AIR FORCE PLANT NO. 4
PALUXY UPPER ZONE
U.S. ARMY ENGINEER DISTRICT, FT. WORTH
PLATE



P-11(upper) - Diagram 2 of 2
AF plant #4(GD) - Paluxy Aquifer

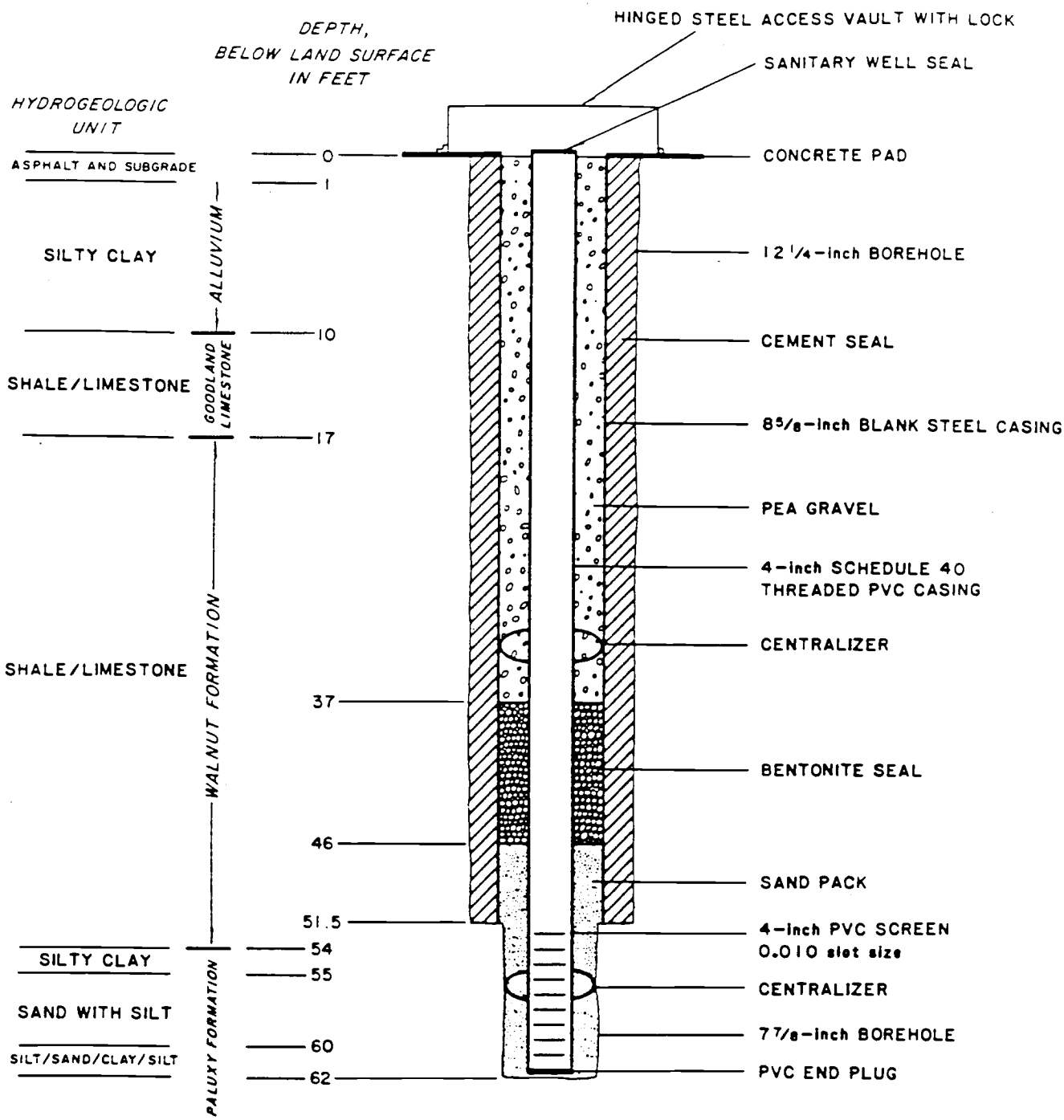
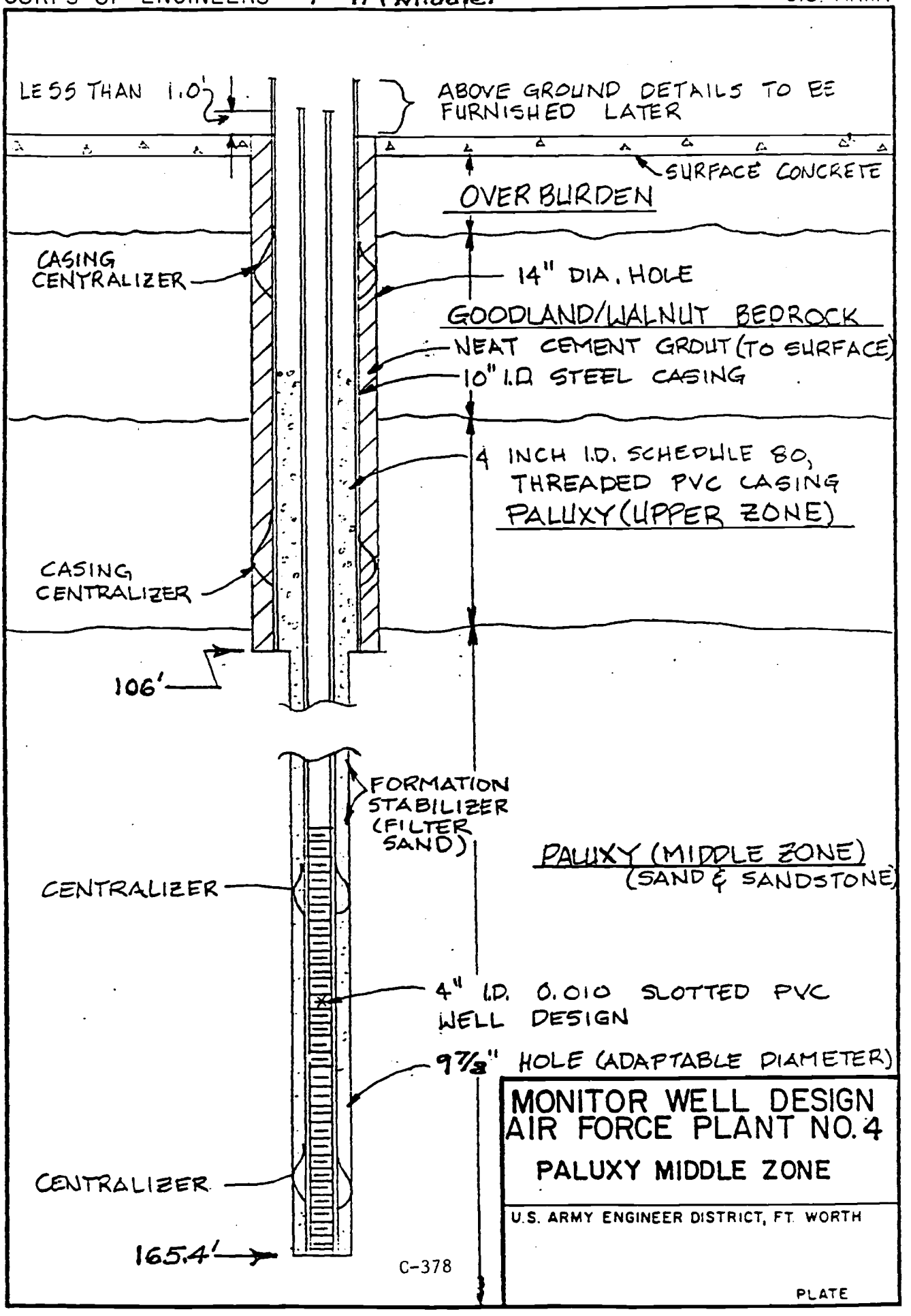


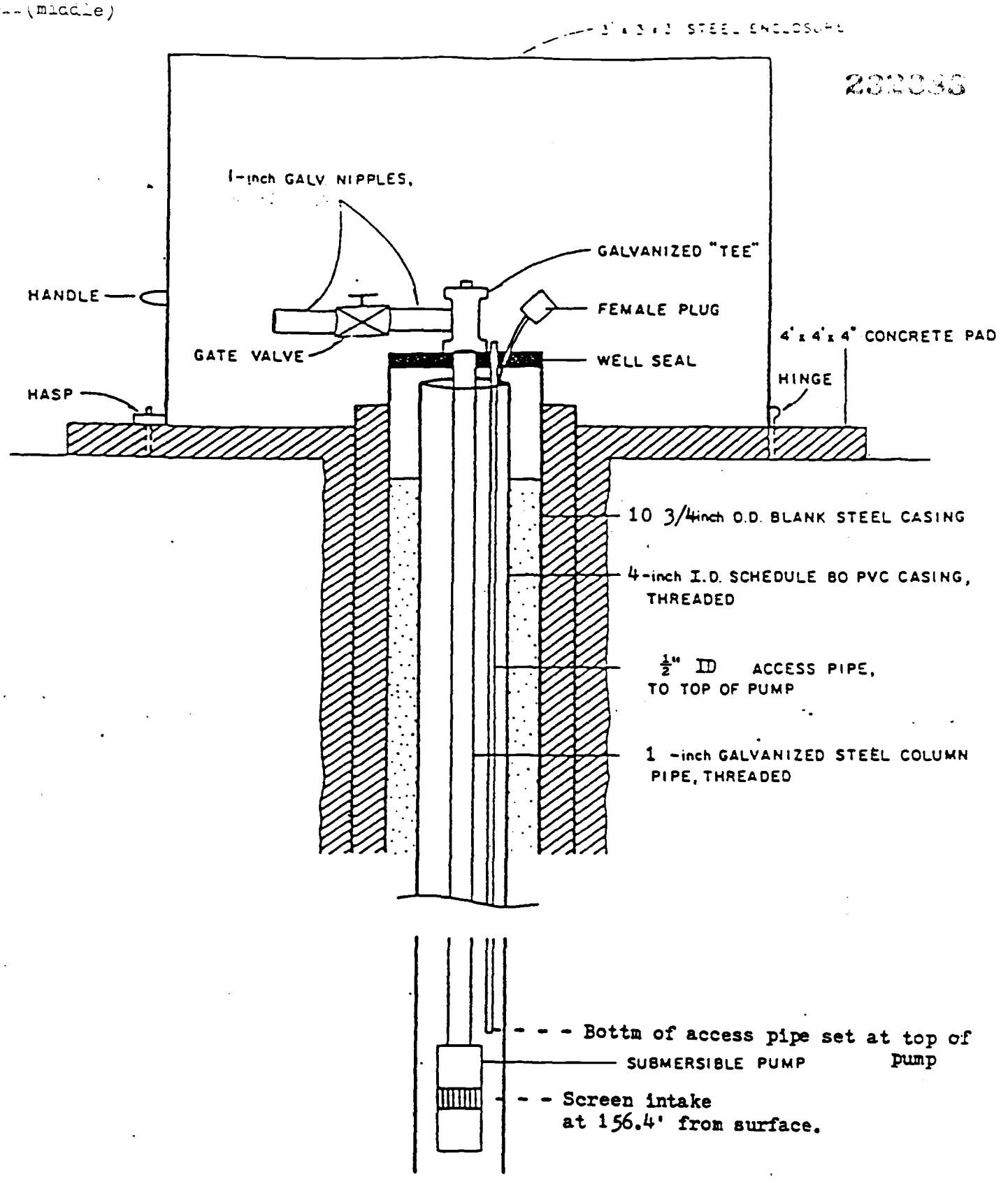
FIGURE F-8. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-11US



MONITOR WELL DESIGN
AIR FORCE PLANT NO. 4
PALUXY MIDDLE ZONE

U.S. ARMY ENGINEER DISTRICT, FT. WORTH

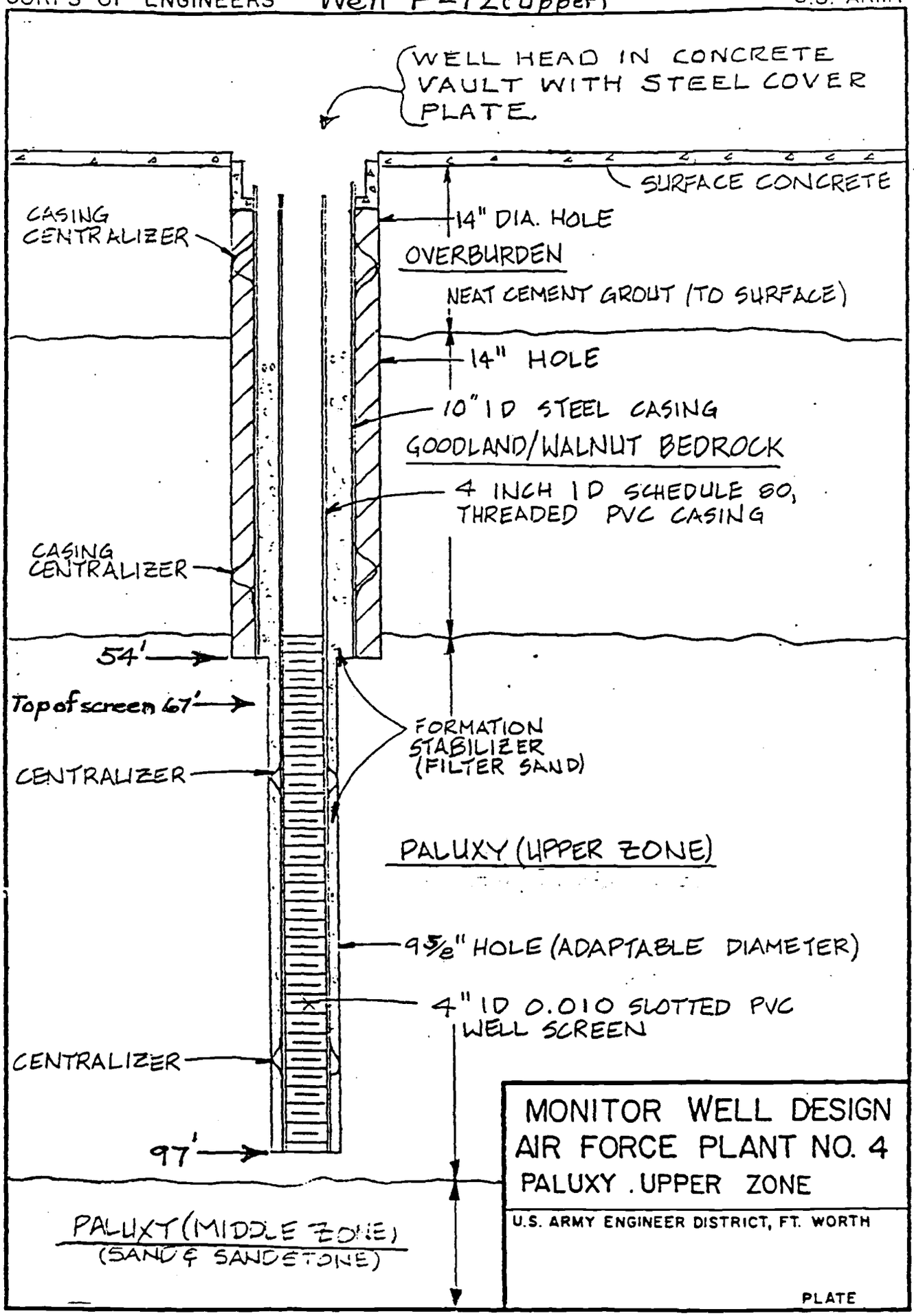
PLATE



Hole TD = 165.4'
Bottom of pump set at 159'.

P-11(middle) - Diagram 2 of 2
AF Plant #4(GD) - Paluxy Aquifer

CORPS OF ENGINEERS Well P-12 (upper) U.S. ARMY

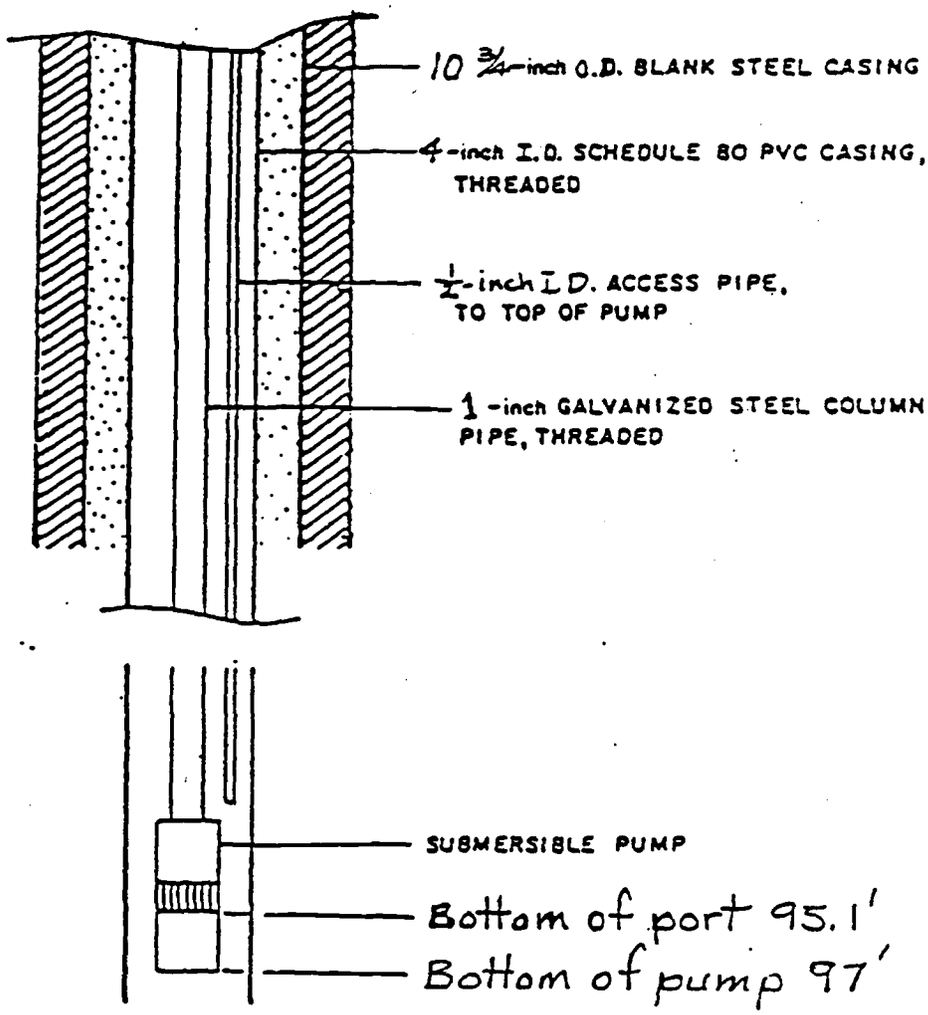


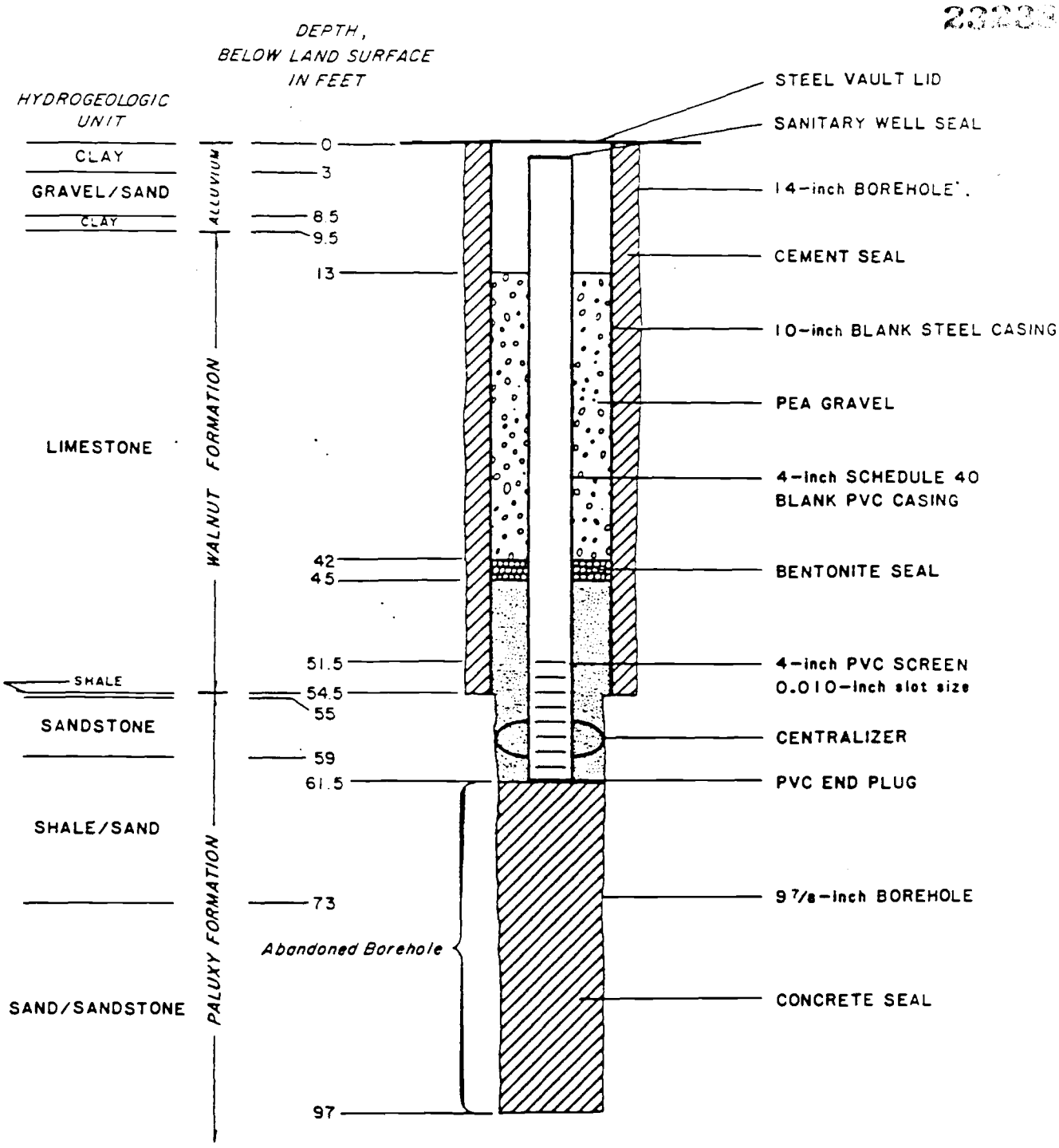
MONITOR WELL DESIGN
AIR FORCE PLANT NO. 4
PALUXY . UPPER ZONE

U.S. ARMY ENGINEER DISTRICT, FT. WORTH

PLATE

WELL P-12 (U)


10 3/4-inch O.D. BLANK STEEL CASING
4-inch I.D. SCHEDULE 80 PVC CASING, THREADED
1/2-inch I.D. ACCESS PIPE, TO TOP OF PUMP
1-inch GALVANIZED STEEL COLUMN PIPE, THREADED
SUBMERSIBLE PUMP
Bottom of port 95.1'
Bottom of pump 97'



NOTE: HYDROGEOLOGIC UNITS BASED ON DRILLING LOG INTERPRETED BY U.S. ARMY CORPS OF ENGINEERS, SEPTEMBER 16, 1985

FIGURE F-9. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-12US

HARGIS + ASSOCIATES, INC.

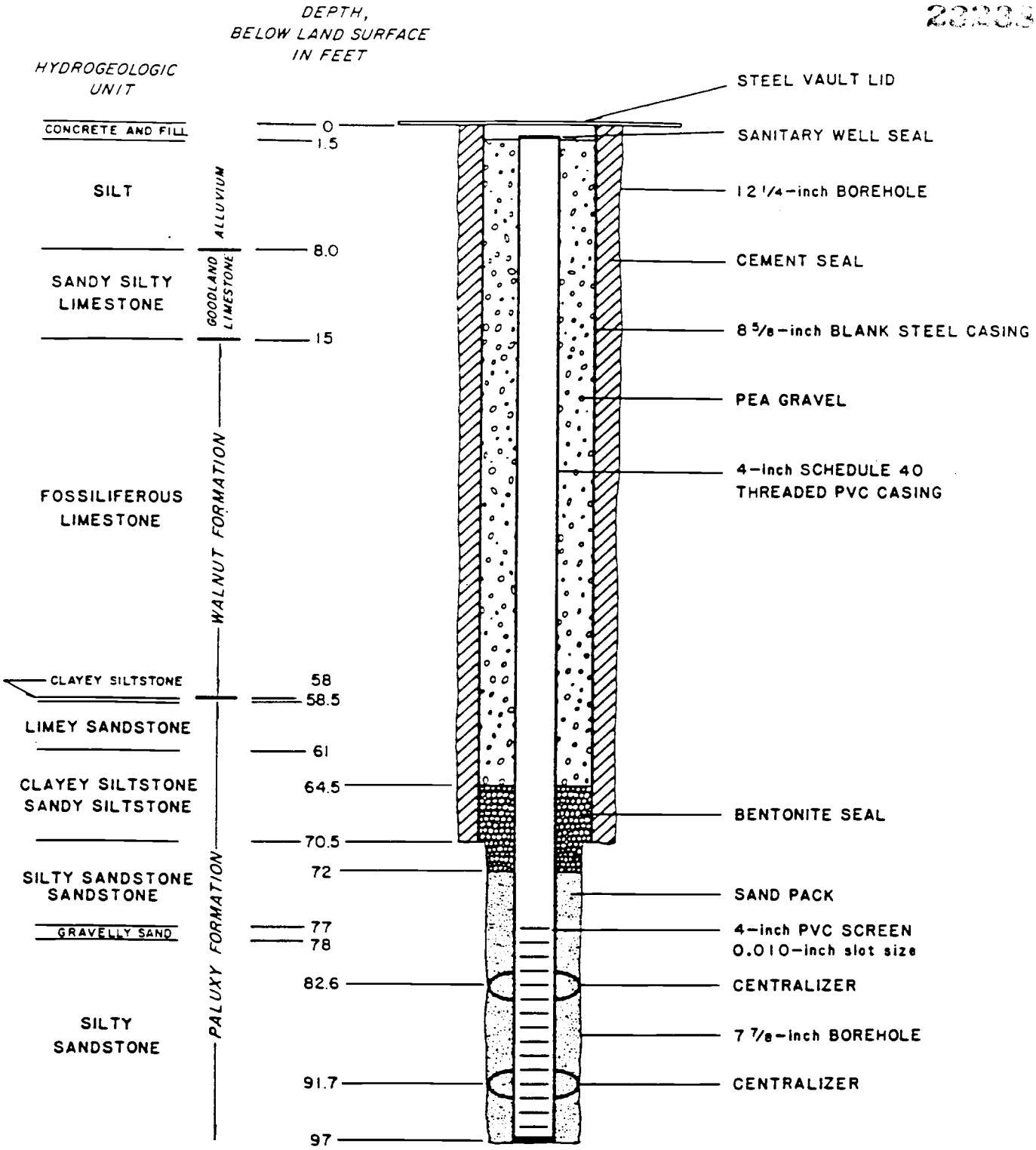
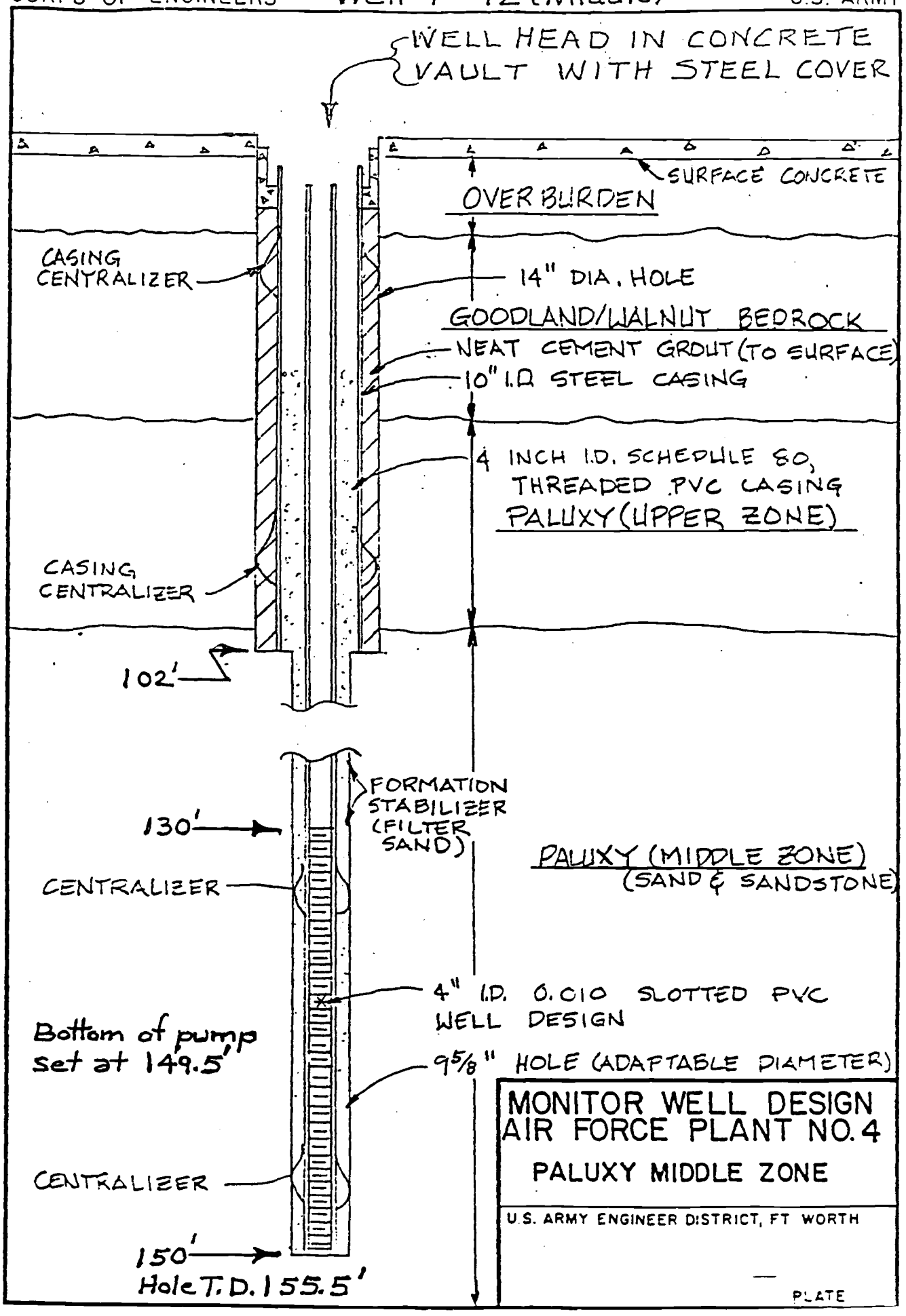
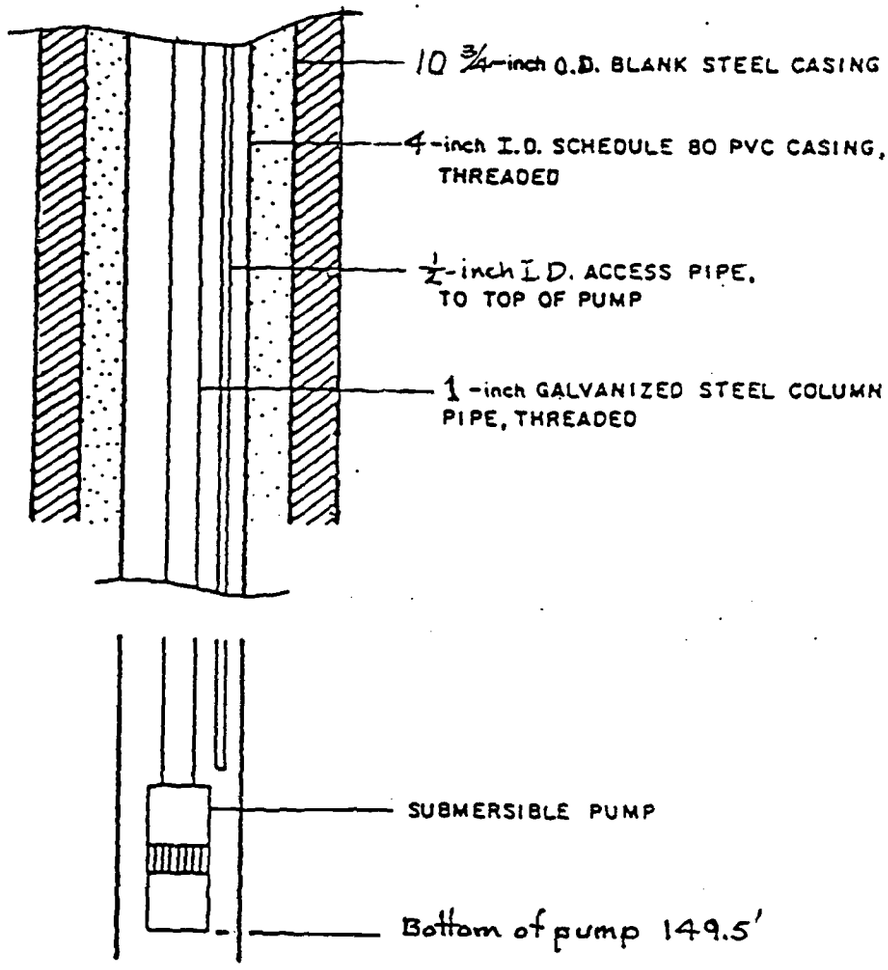


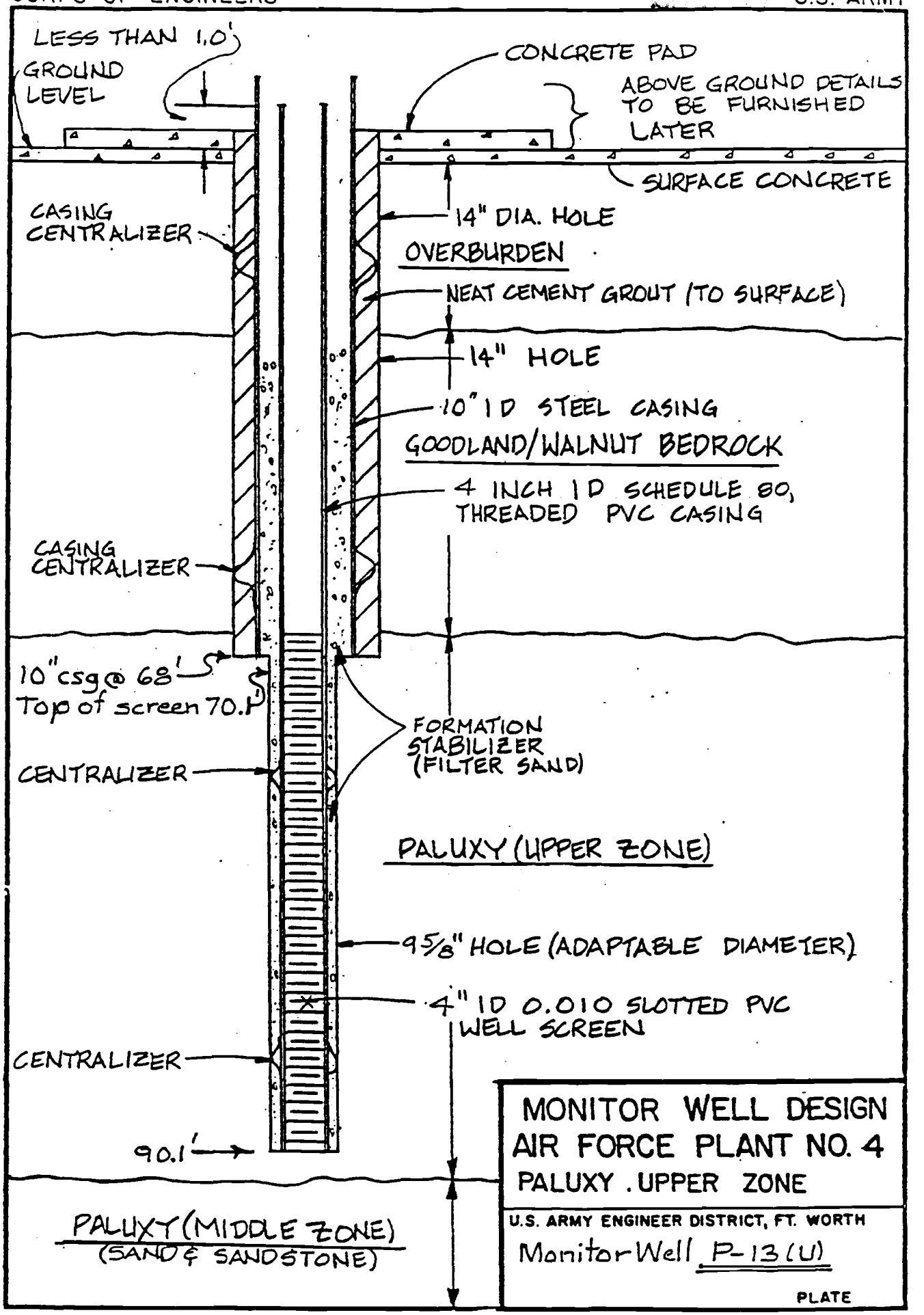
FIGURE F-10. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-12UN

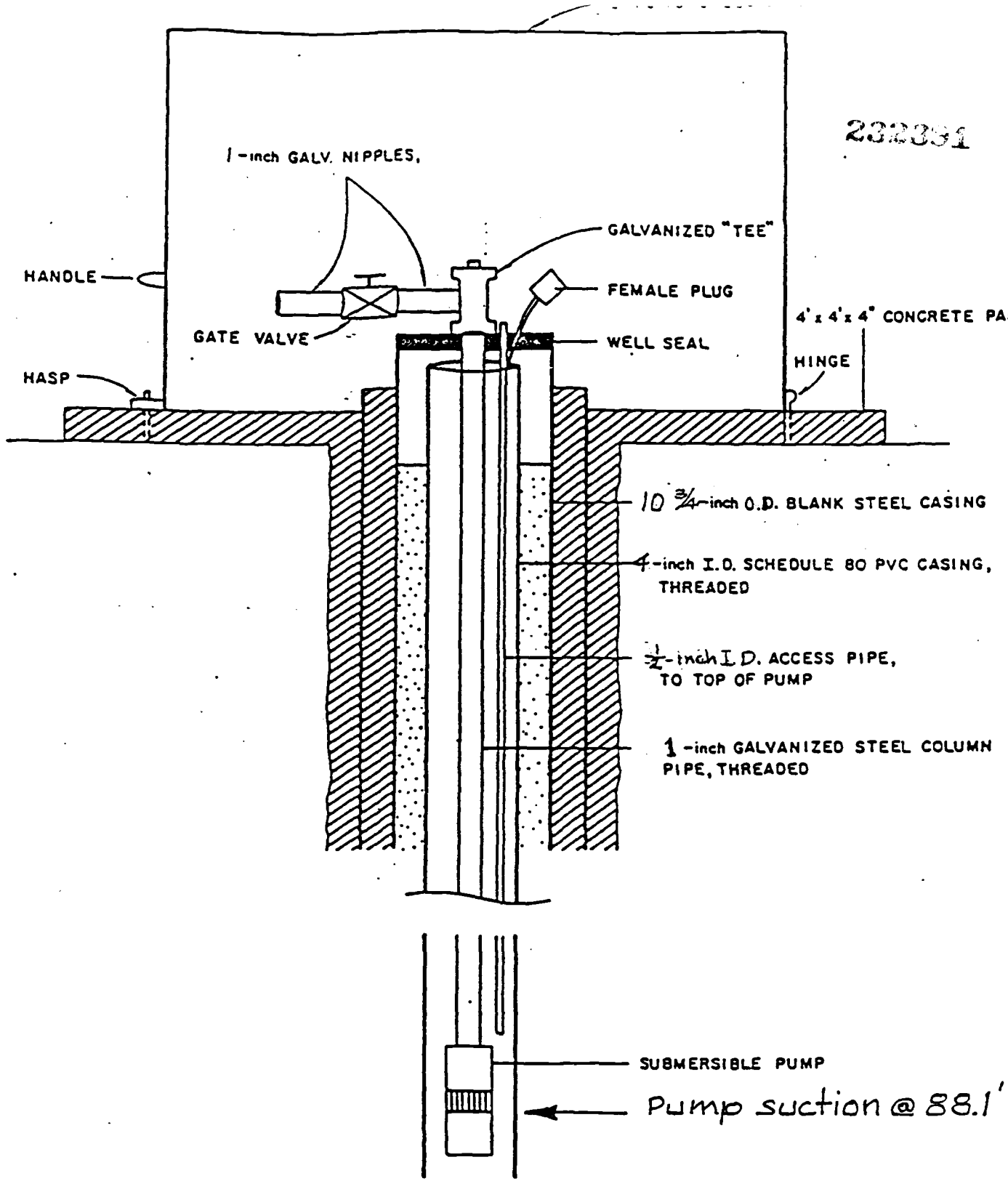
HARGIS + ASSOCIATES, INC.


WELL HEAD IN CONCRETE VAULT WITH STEEL COVER
SURFACE CONCRETE
OVER BURDEN
CASING CENTRALIZER
14" DIA. HOLE
GOODLAND/WALNUT BEDROCK
NEAT CEMENT GROUT (TO SURFACE)
10" I.D. STEEL CASING
4 INCH I.D. SCHEDULE 80, THREADED PVC CASING
PALUXY (UPPER ZONE)
CASING CENTRALIZER
102'
FORMATION STABILIZER (FILTER SAND)
130'
PALUXY (MIDDLE ZONE)
(SAND & SANDSTONE)
CENTRALIZER
4" I.D. 0.010 SLOTTED PVC WELL DESIGN
Bottom of pump set at 149.5'
9 5/8" HOLE (ADAPTABLE DIAMETER)
CENTRALIZER
150'
Hole T.D. 155.5'
MONITOR WELL DESIGN
AIR FORCE PLANT NO. 4
PALUXY MIDDLE ZONE
U.S. ARMY ENGINEER DISTRICT, FT WORTH
PLATE

WELL P-12(M)


10 3/4-inch O.D. BLANK STEEL CASING
4-inch I.D. SCHEDULE 80 PVC CASING, THREADED
1/2-inch I.D. ACCESS PIPE, TO TOP OF PUMP
1-inch GALVANIZED STEEL COLUMN PIPE, THREADED
SUBMERSIBLE PUMP
Bottom of pump 149.5'


LESS THAN 1.0'
GROUND LEVEL
CONCRETE PAD
ABOVE GROUND DETAILS TO BE FURNISHED LATER
SURFACE CONCRETE
CASING CENTRALIZER
14" DIA. HOLE
OVERBURDEN
NEAT CEMENT GROUT (TO SURFACE)
14" HOLE
10" ID STEEL CASING
GOODLAND/WALNUT BEDROCK
4 INCH ID SCHEDULE 80, THREADED PVC CASING
CASING CENTRALIZER
10" csg @ 68'
Top of screen 70.1'
FORMATION STABILIZER (FILTER SAND)
CENTRALIZER
PALUXY (UPPER ZONE)
9 5/8" HOLE (ADAPTABLE DIAMETER)
4" ID 0.010 SLOTTED PVC WELL SCREEN
CENTRALIZER
90.1'
PALUXY (MIDDLE ZONE)
(SAND & SANDSTONE)
MONITOR WELL DESIGN
AIR FORCE PLANT NO. 4
PALUXY . UPPER ZONE
U.S. ARMY ENGINEER DISTRICT, FT. WORTH
Monitor Well P-13 (U)
PLATE



Paluxy Monitor Well P-13 (U)

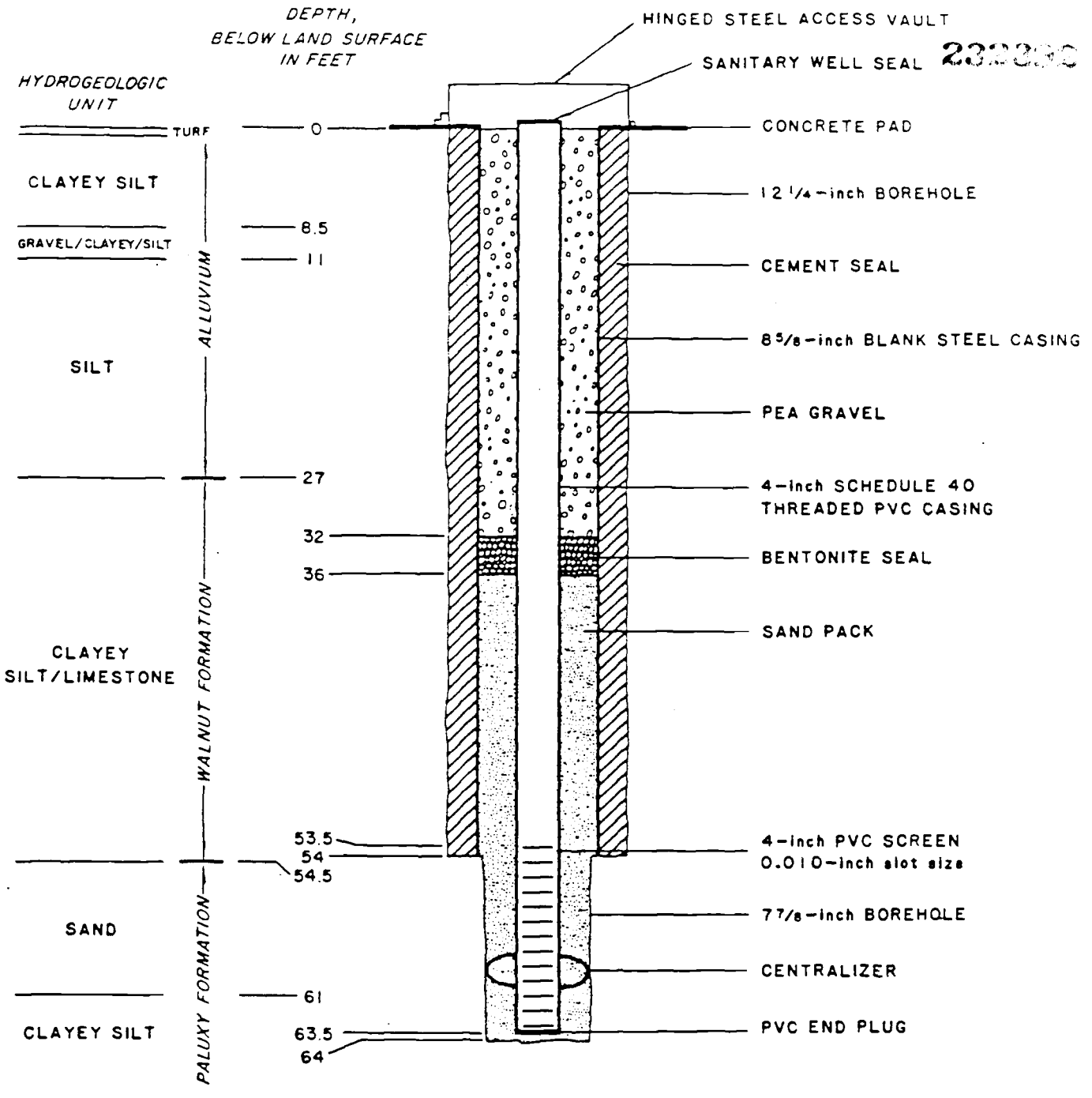
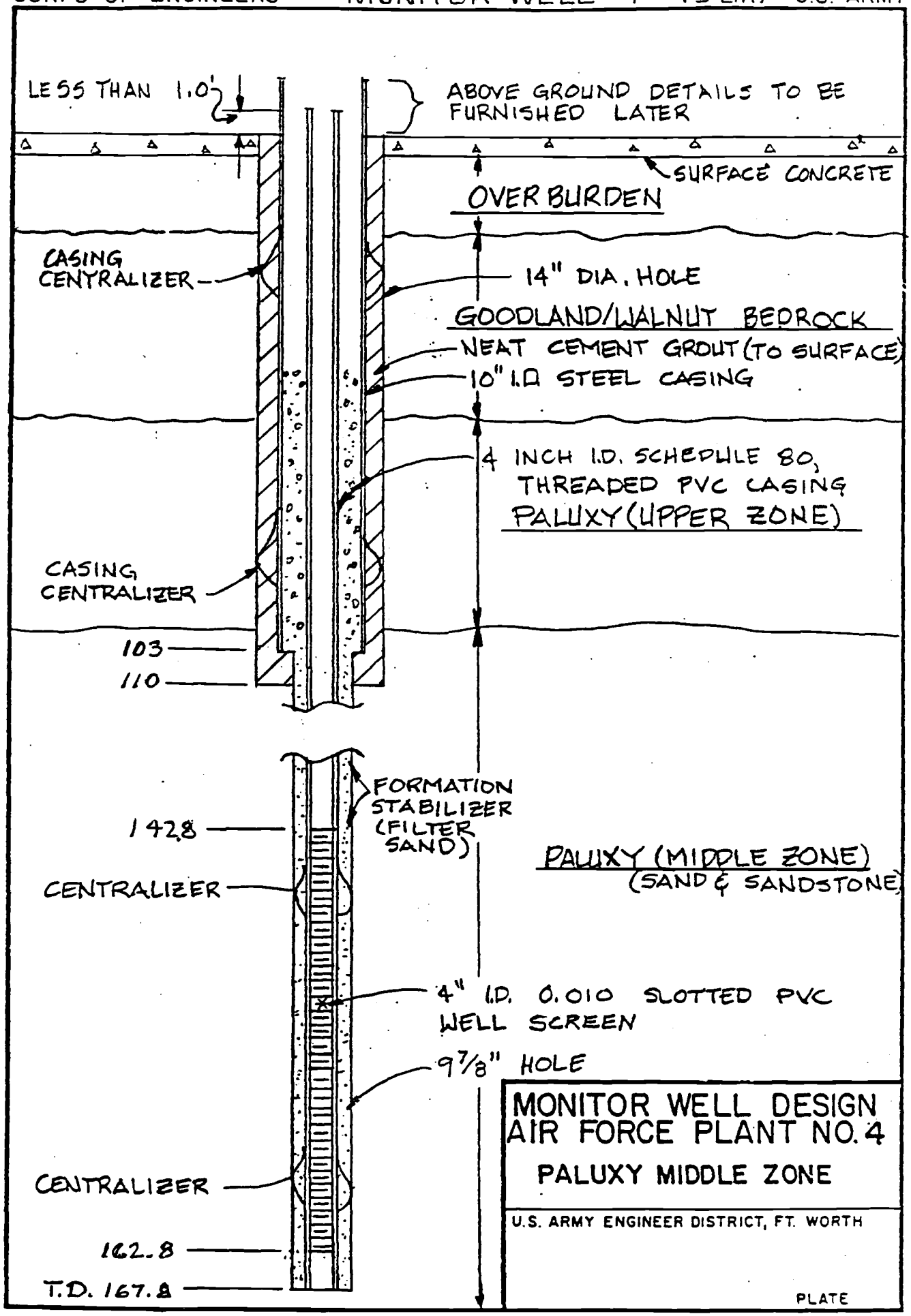
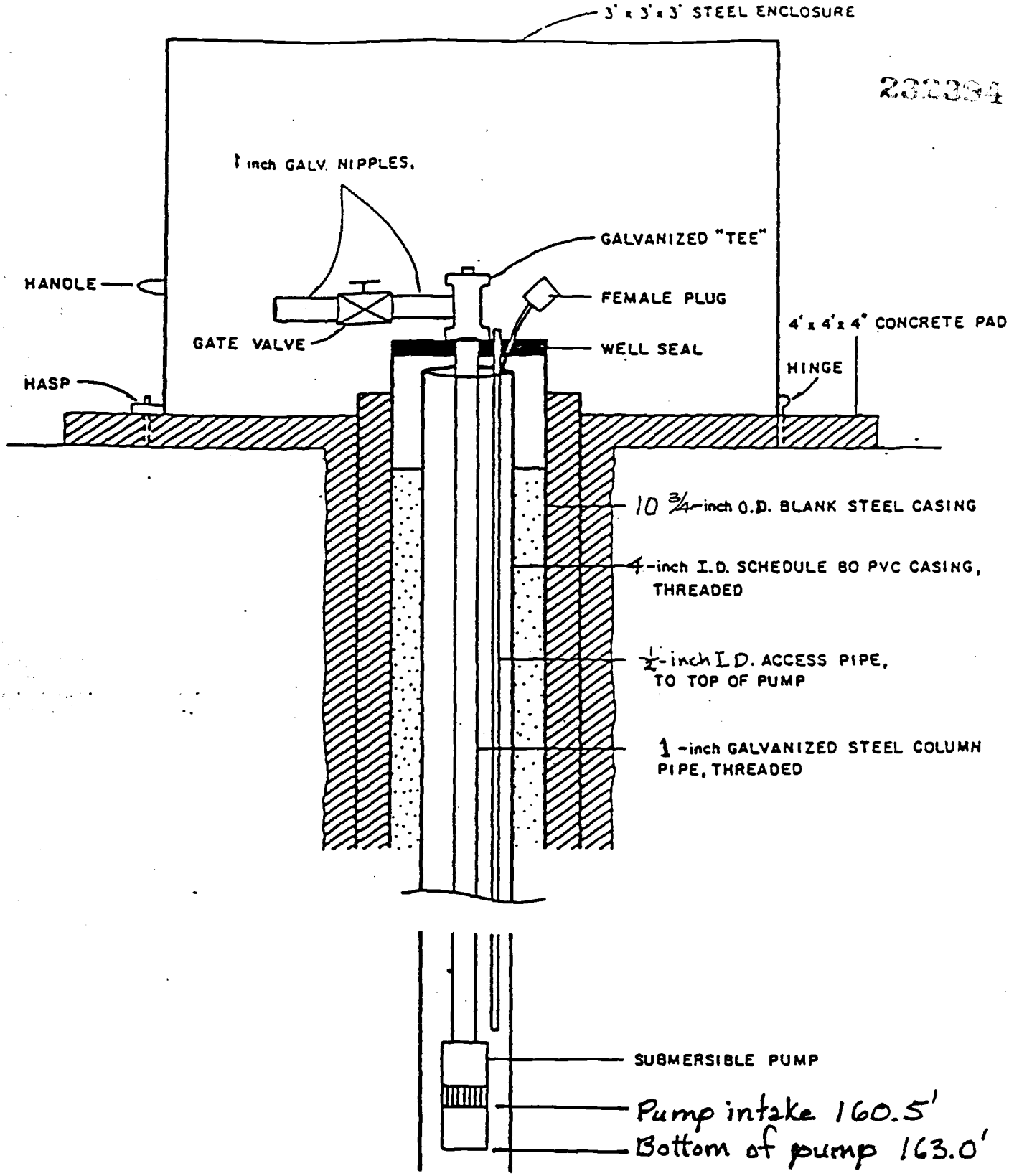


FIGURE F-11. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-13US

HARGIS + ASSOCIATES, INC.

CORPS OF ENGINEERS MONITOR WELL P-13 (M) U.S. ARMY





MONITOR WELL P-13(M)

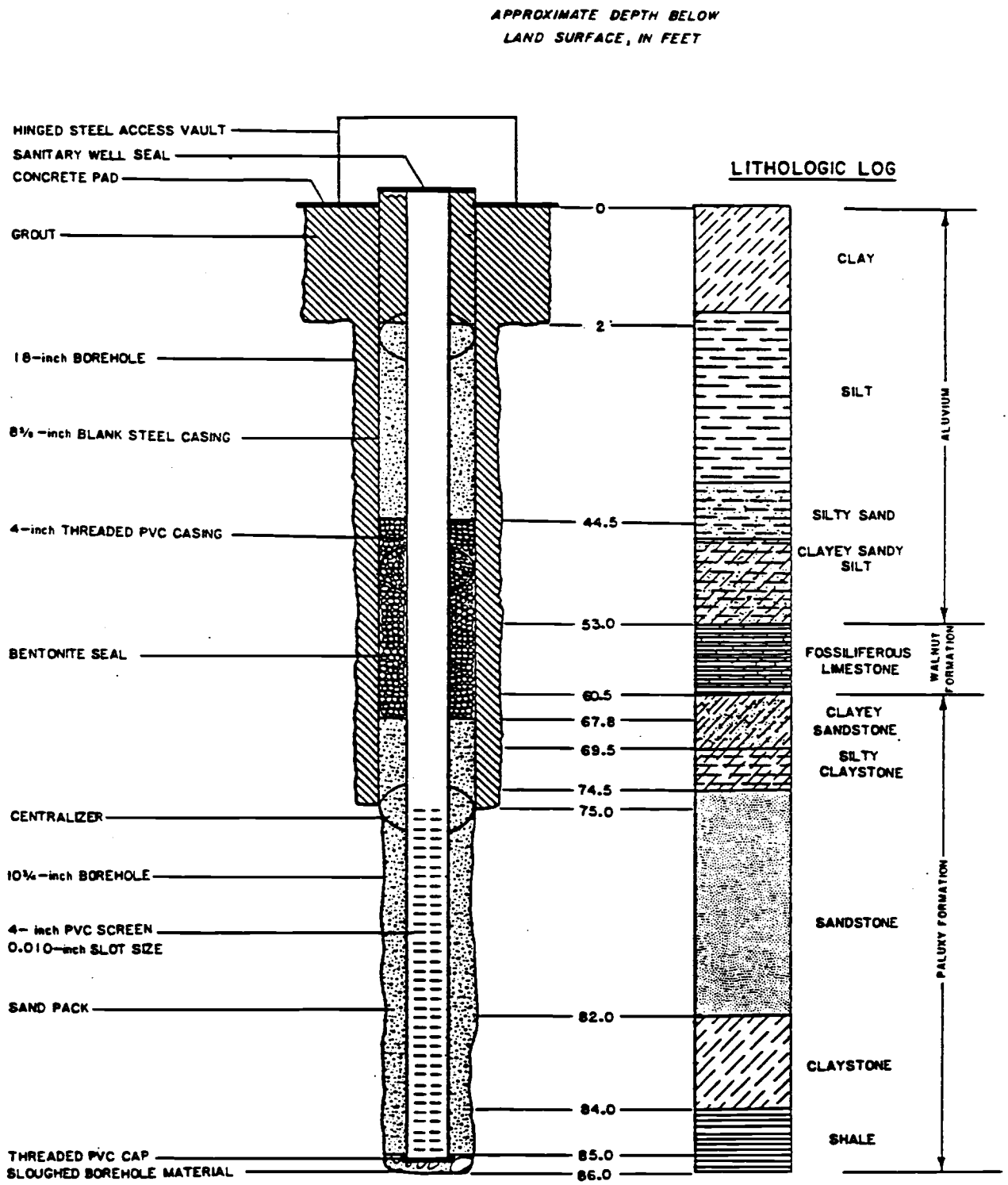


FIGURE B-3 SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-14U

HARGIS + ASSOCIATES

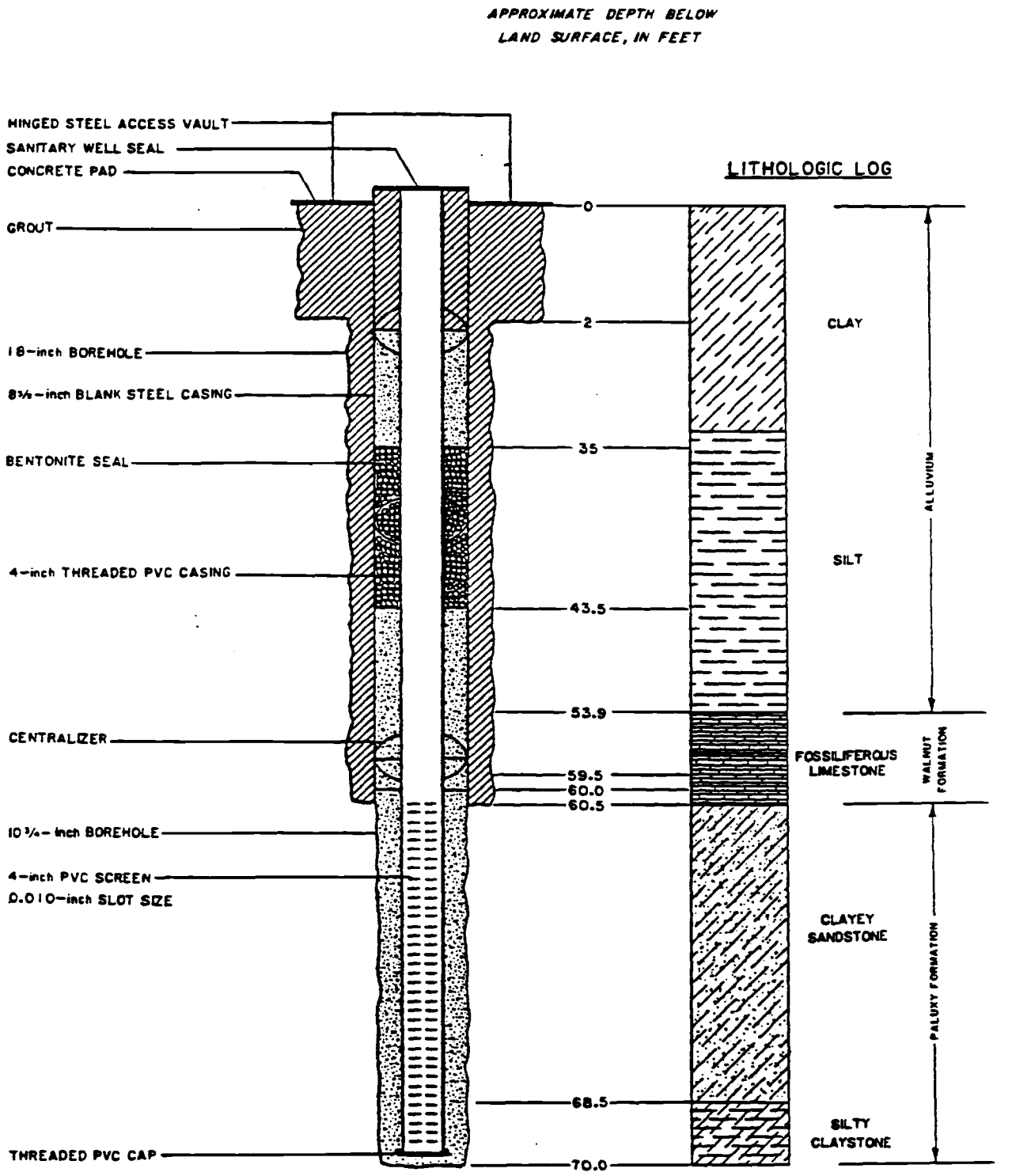


FIGURE B-2 SCHEMATIC CONSTRUCTION DAGRAM FOR MONITOR WELL P-14US

HARGIS - ASSOCIATES

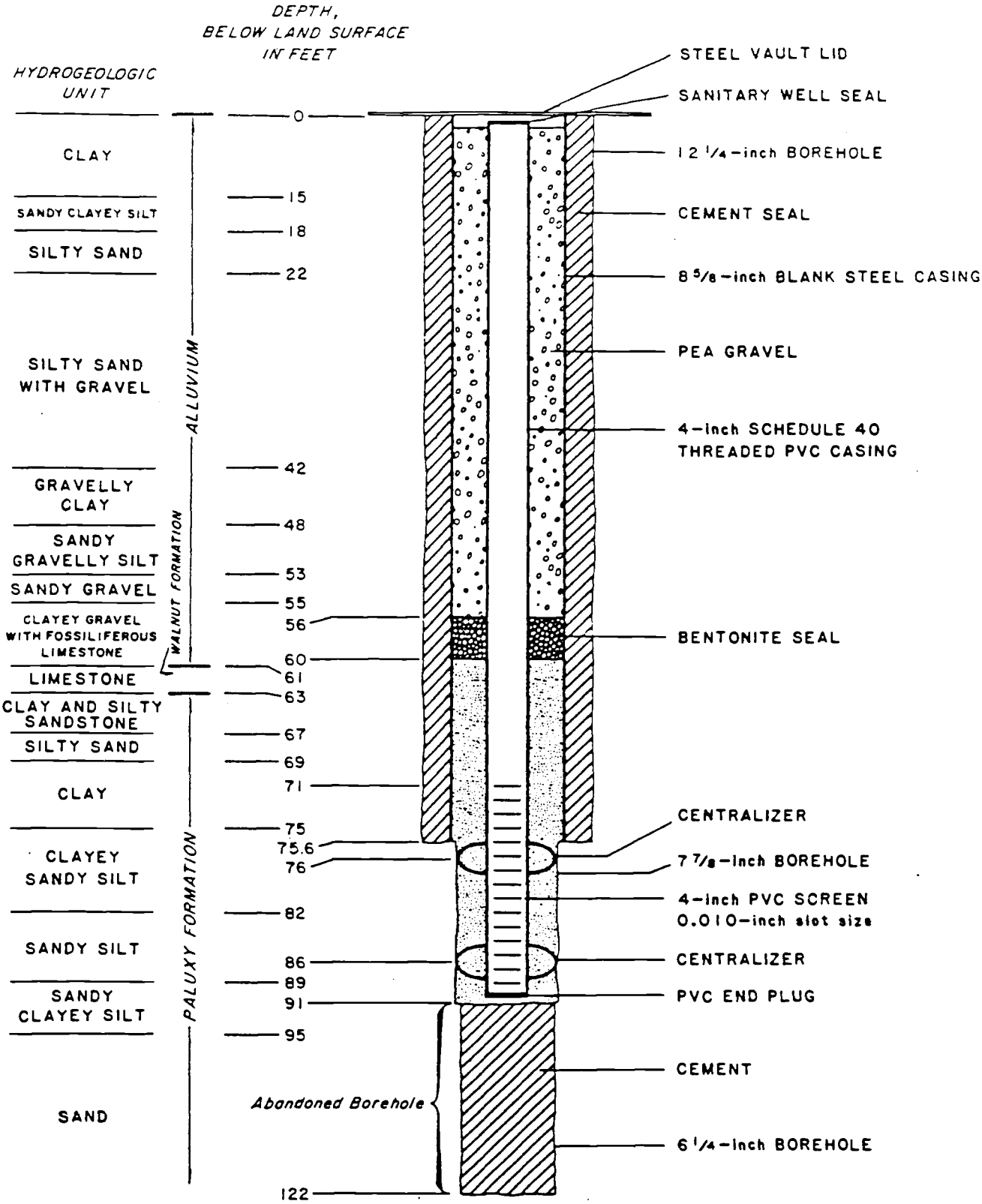


FIGURE F-13. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-15U

HARGIS + ASSOCIATES, INC.

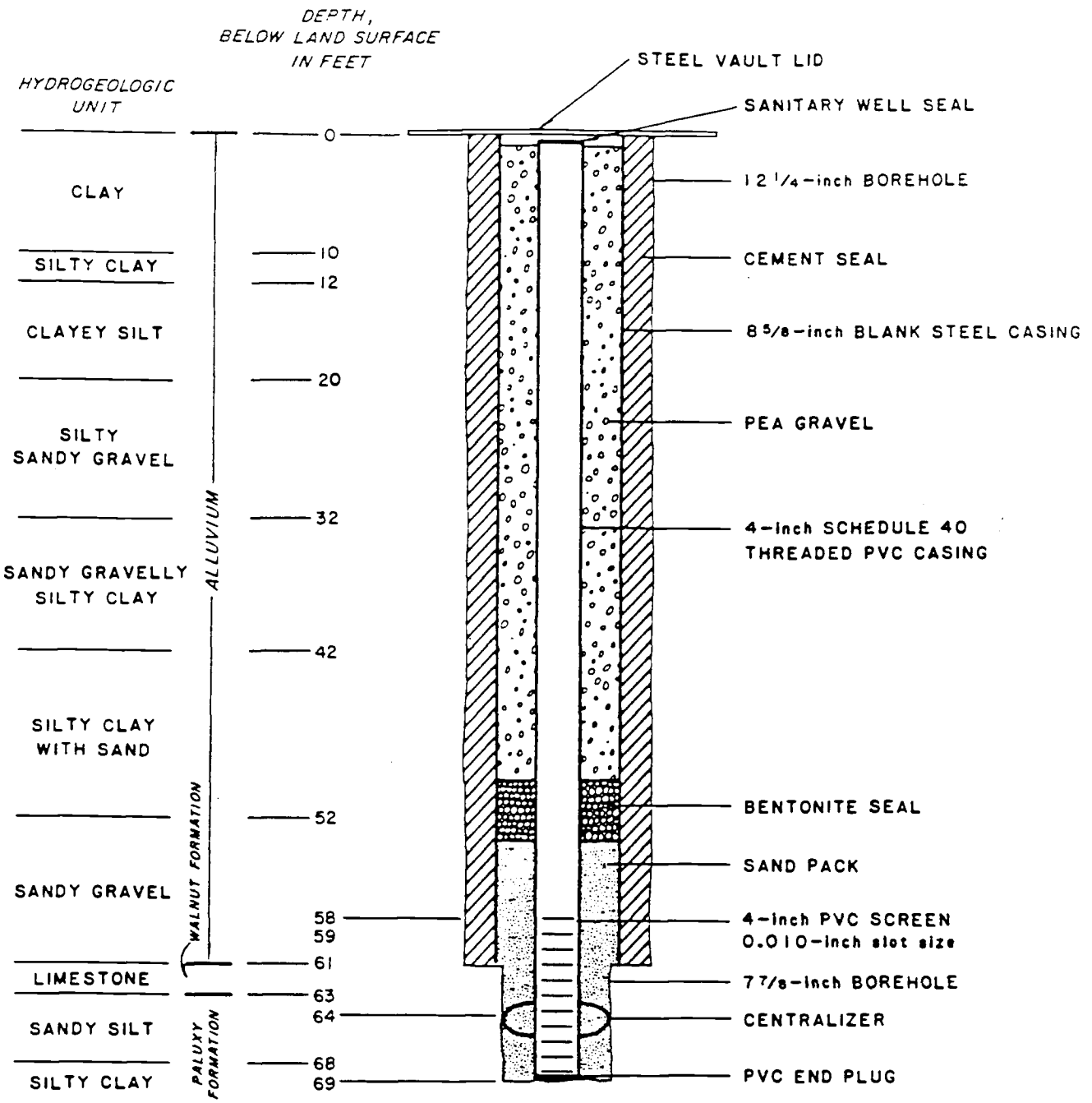


FIGURE F-12. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-15US

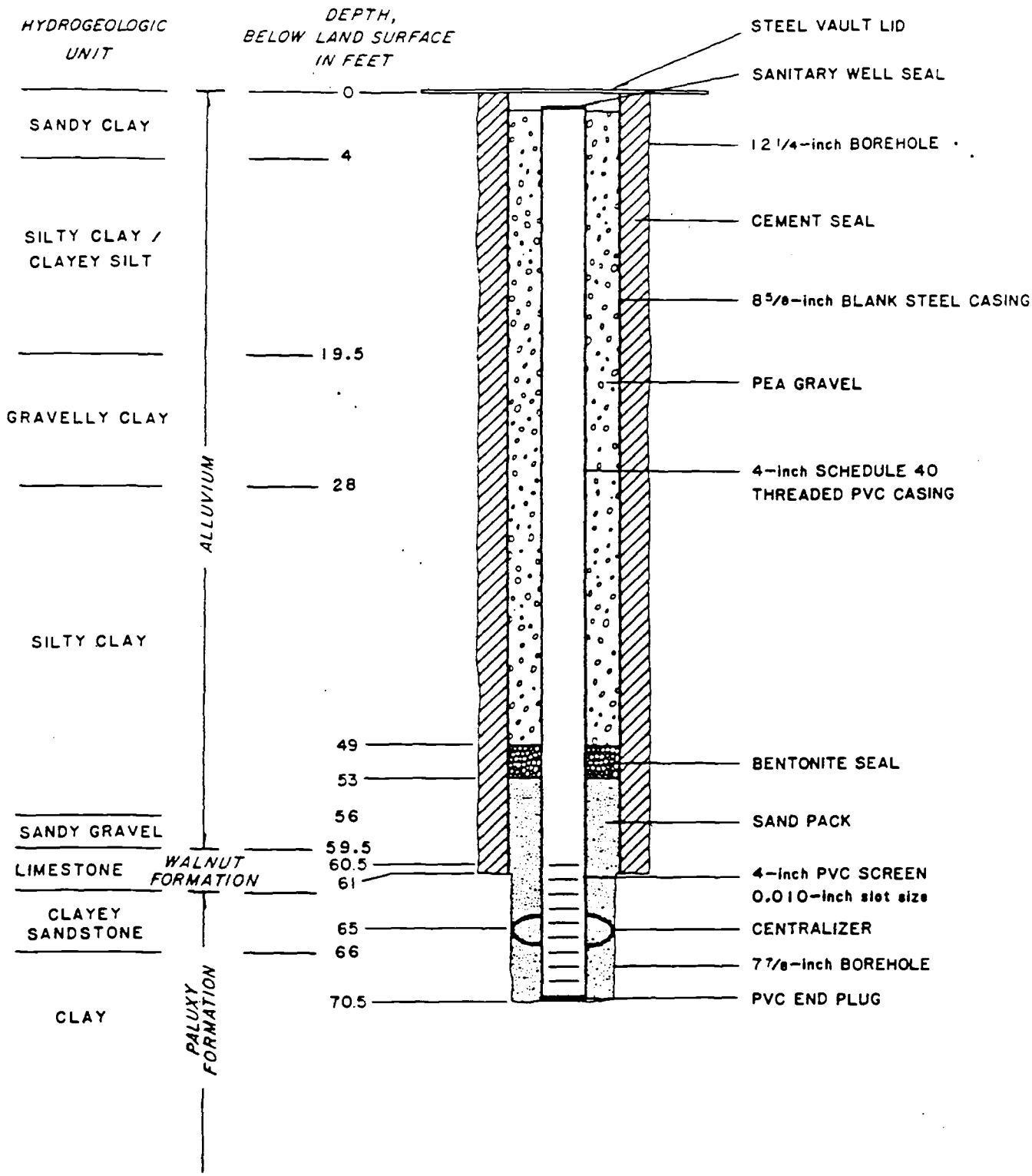


FIGURE F-14. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-16US

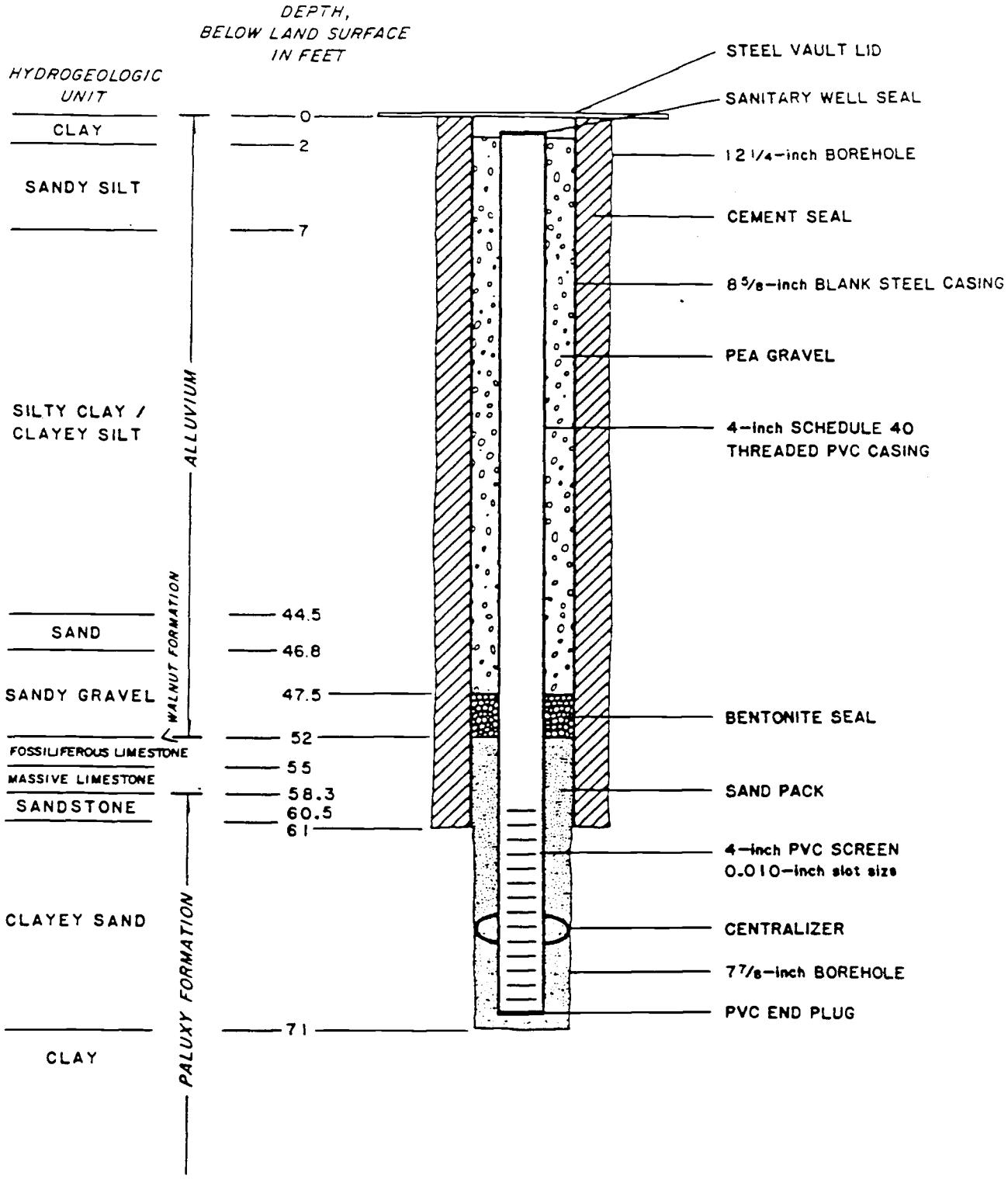


FIGURE F-15. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-17US

HARGIS + ASSOCIATES, INC.

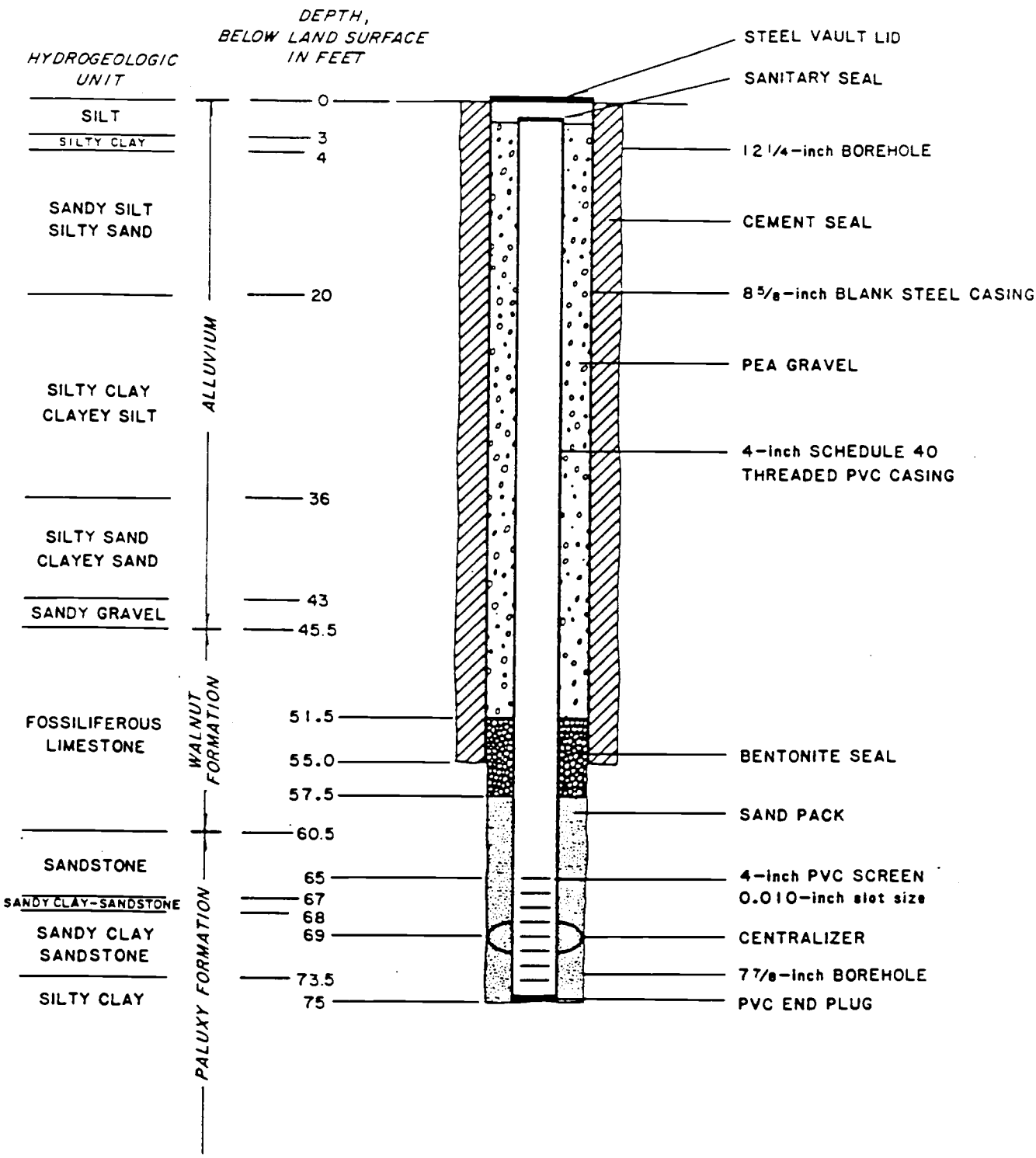


FIGURE F-16. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-18US

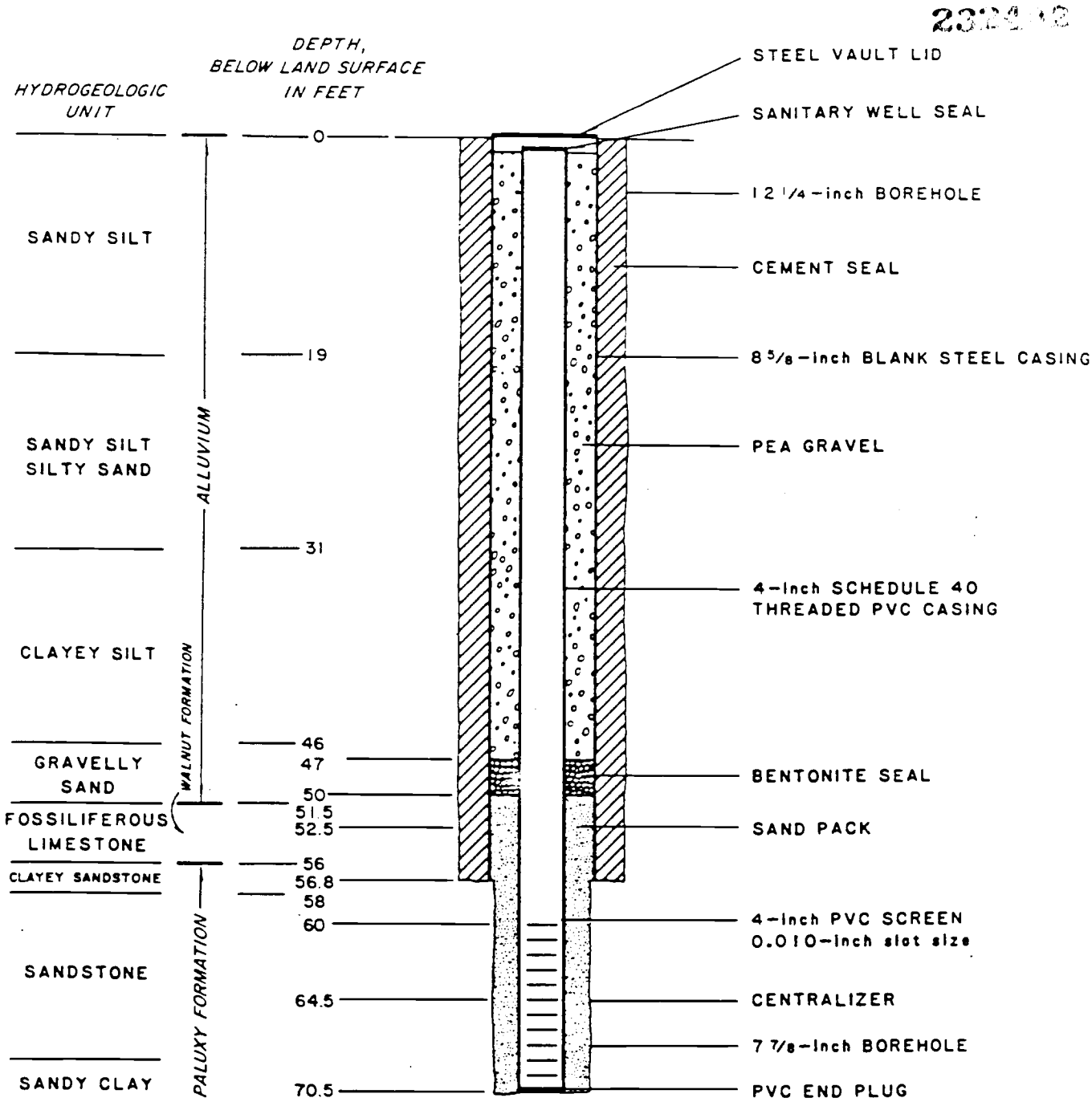


FIGURE F-17. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-19US

RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. P-20m

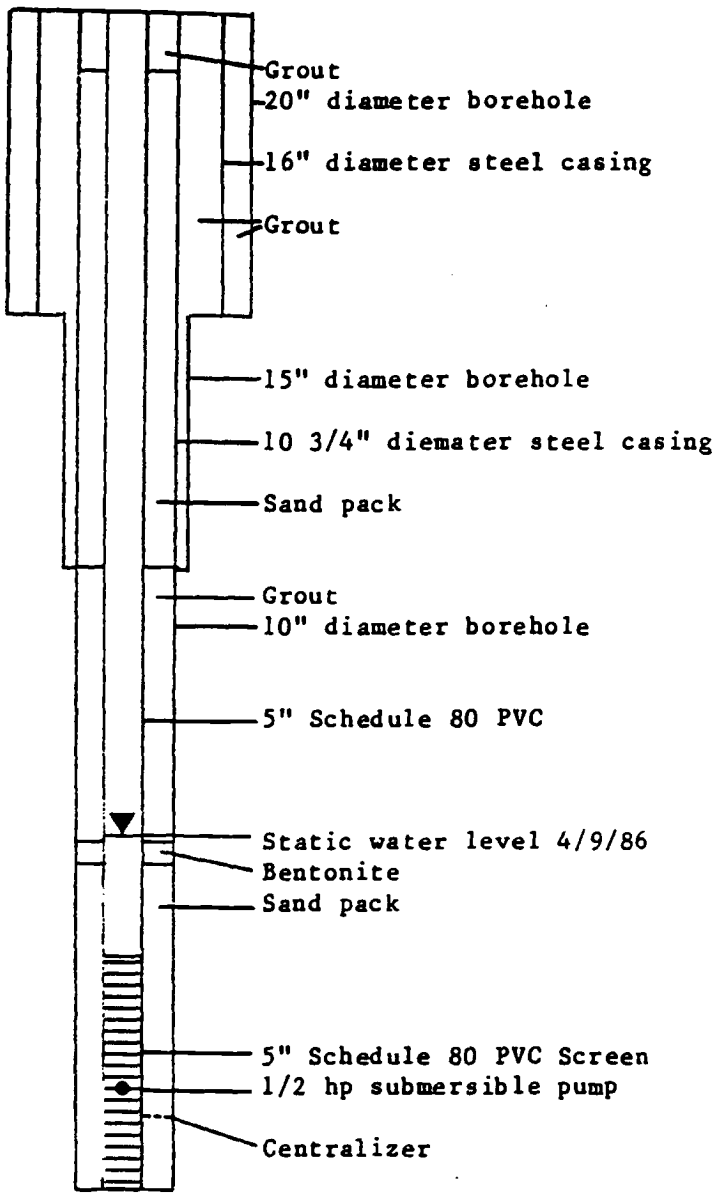
Project Air Force Plant 4 IRP

Location Radar Range, S. of Landfill 4

Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
Shale	Goodland Formation	0 – 40
Shale and Lime-stone	Walnut Formation	40 – 60
Sandstone and Sand		60 – 80
Clayey Sand & Claystone	Paluxy Formation	80 – 100
Sand-stone and Stone		100 – 200

Well Construction Diagram



RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. P-21u

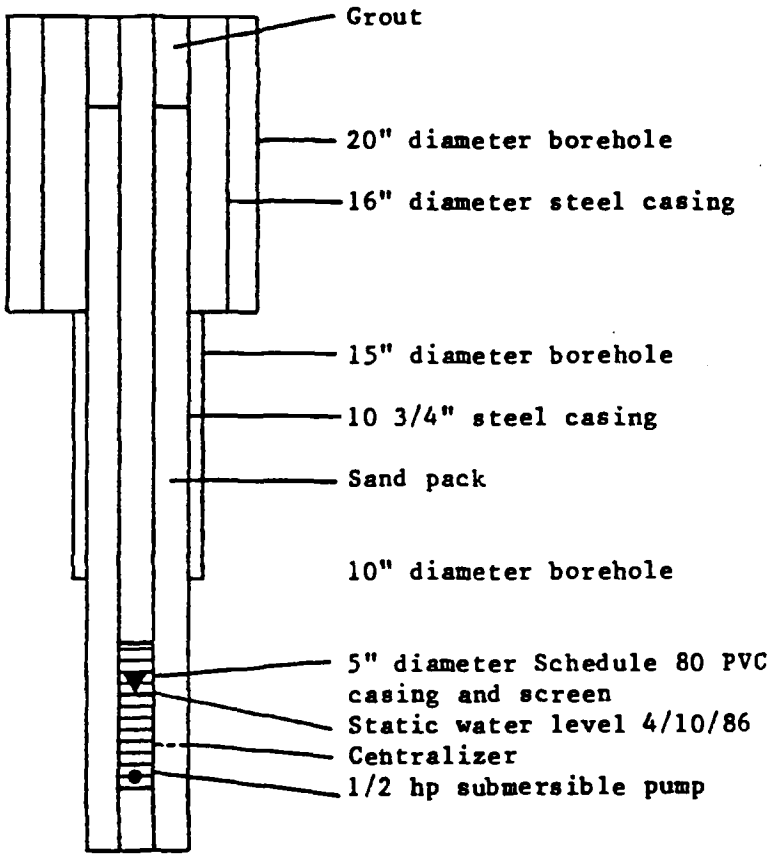
Project Air Force Plant 4 IRP

Location Radar Range, Landfill No. 2

Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
Clay and Silt	Alluvium	0
Sand and Gravel		20
		40
Lime-stone and Shale	Walnut Formation	60
Sand and Sandstone	Paluxy Formation	80
Clayey Sand		
Sandstone Claystone		100
		120
		140
		160
		180
		200

Well Construction Diagram



RADIAN CORPORATION

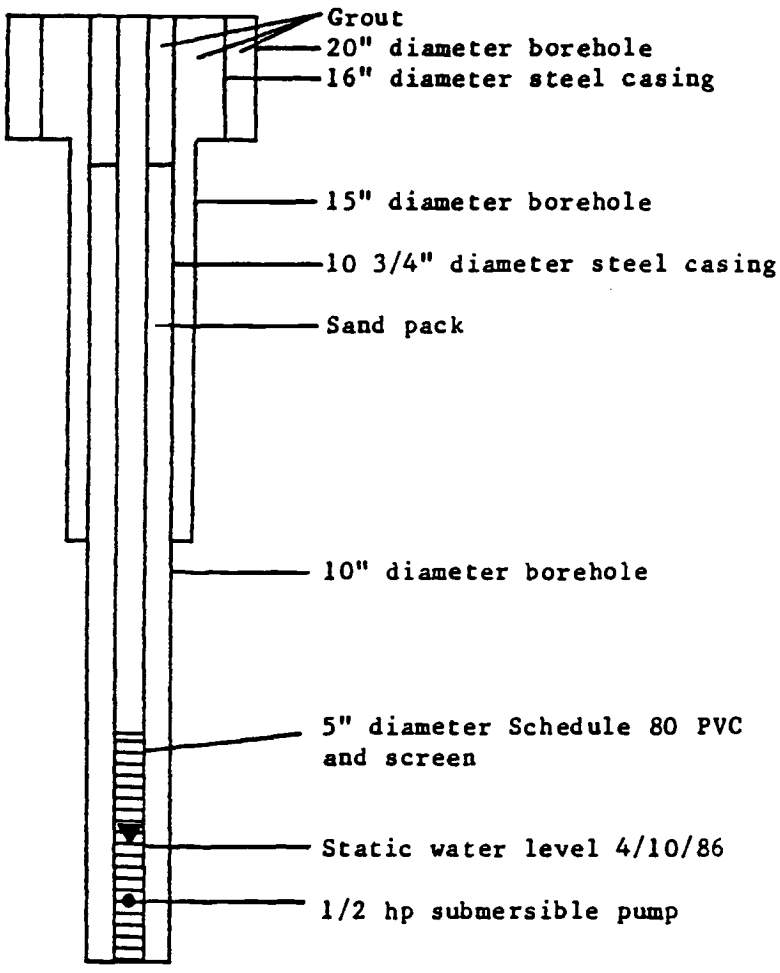
MONITOR WELL COMPLETION LOG: SHEET 3/3

Boring or Well No. P-22u
Location Landfill No. 3

Project Air Force Plant 4 IRP
Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
	Alluvium	0
Shale and Limestone	Walnut Formation	10, 20
Clay		30
Sand and Limestone	Paluxy Formation	40, 50
Clay		60
		70, 80, 90, 100

Well Construction Diagram



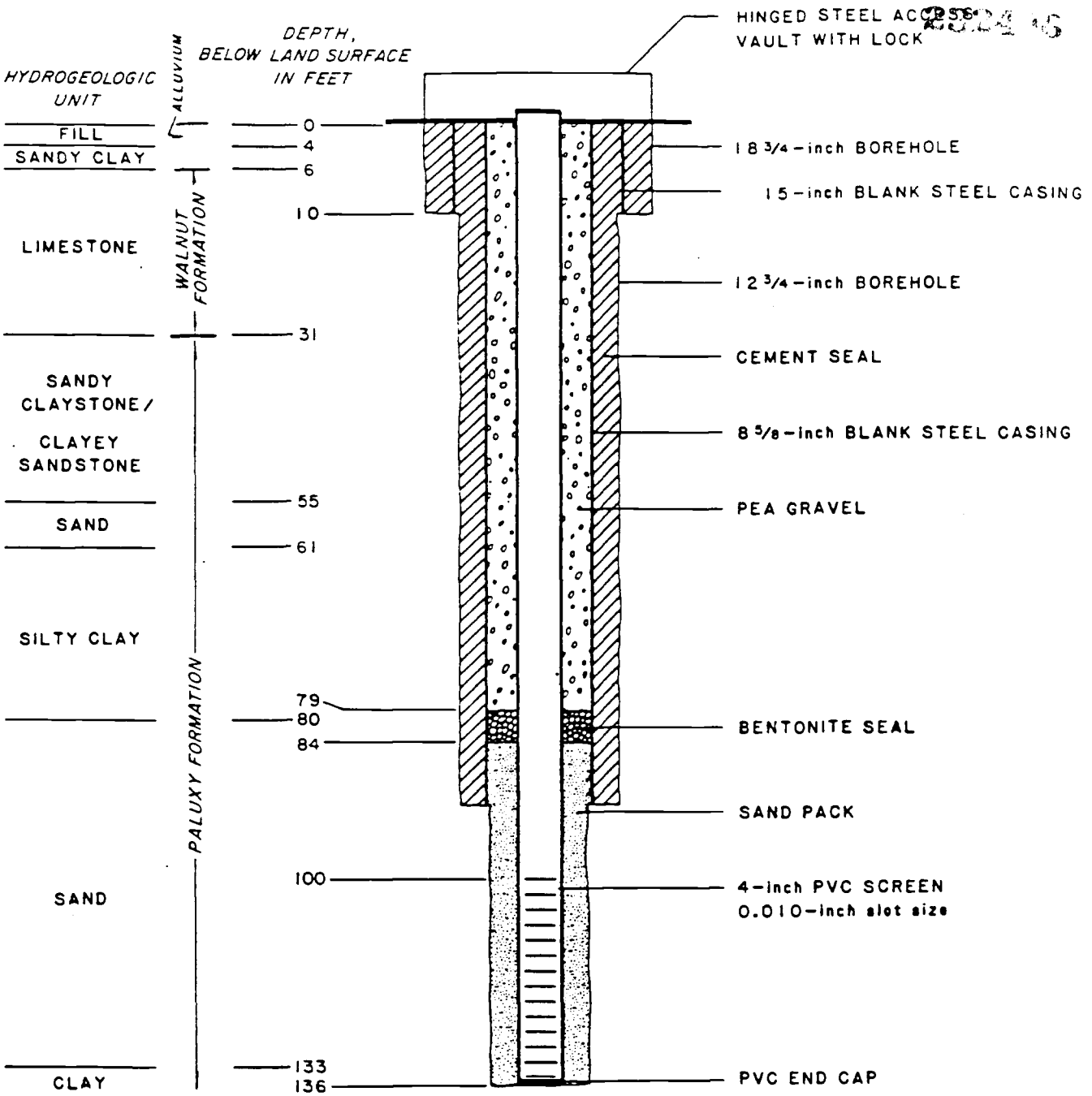


FIGURE F-18. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-22M

RADIAN CORPORATION

MONITOR WELL COMPLETION LOG: SHEET 3/3

232407

Boring or Well No. P-23u

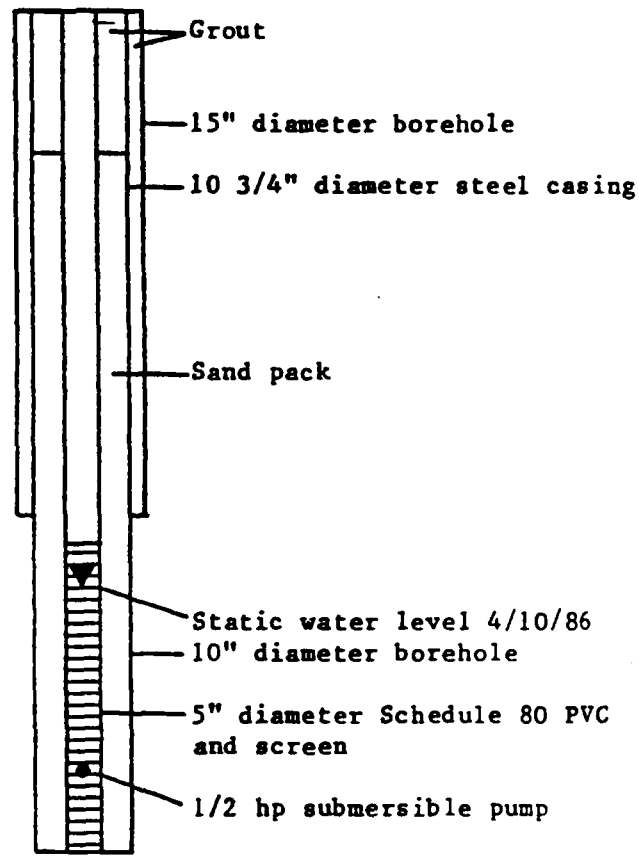
Project Air Force Plant 4 IRP

Location Lake Worth

Log Recorded by Peter A. Waterreus

Hydrogeologic Unit		Depth Below Surface (ft)
Lime-stone	Walnut Forma-tion	0, 10
Shale and Limestone		20
Shale		30
Sand	Paluxy Formation	40, 50
Sandstone/ Clay		60, 70, 80, 90, 100

Well Construction Diagram



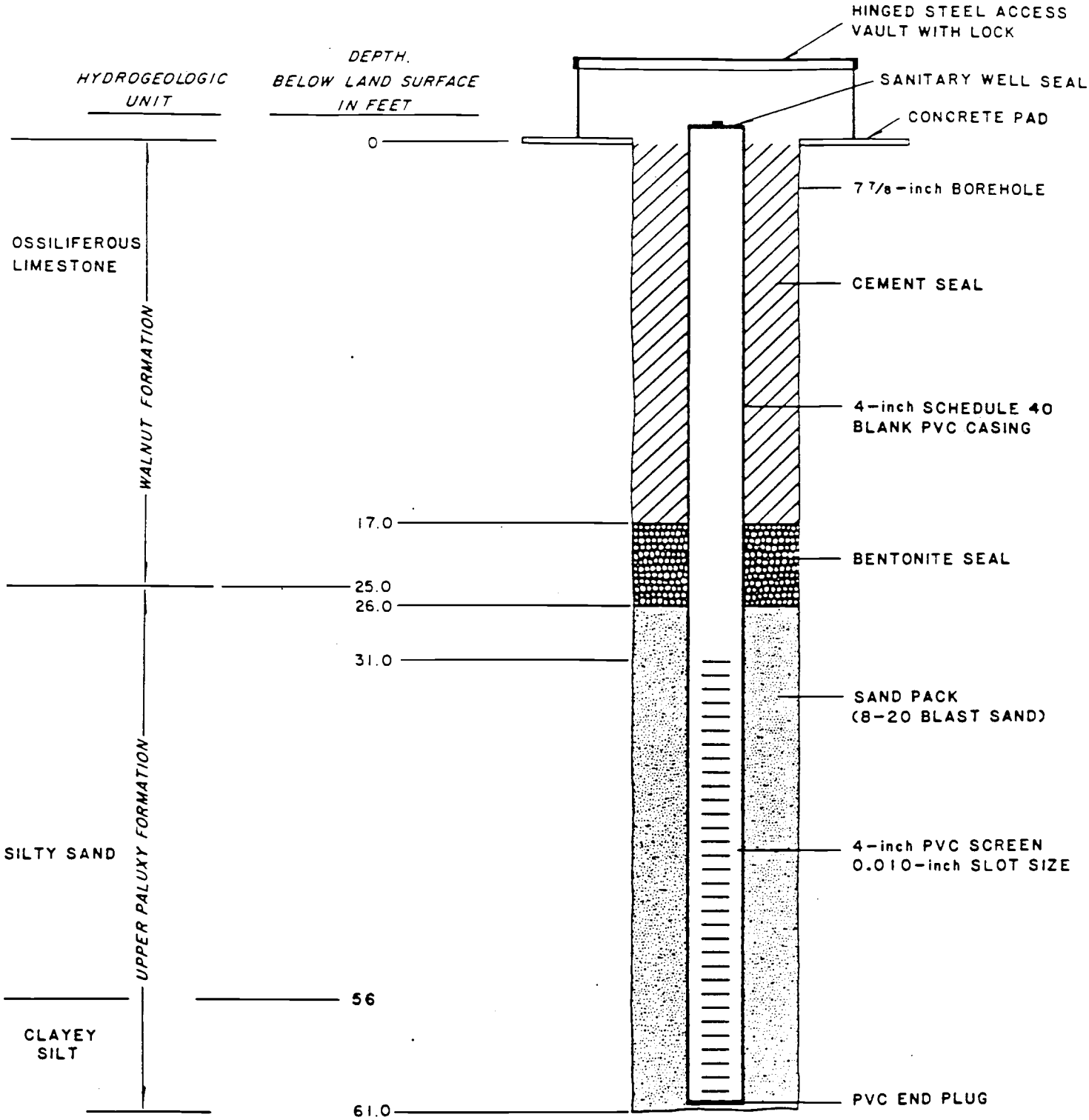


FIGURE F-19. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-24U

HARGIS + ASSOCIATES, INC.

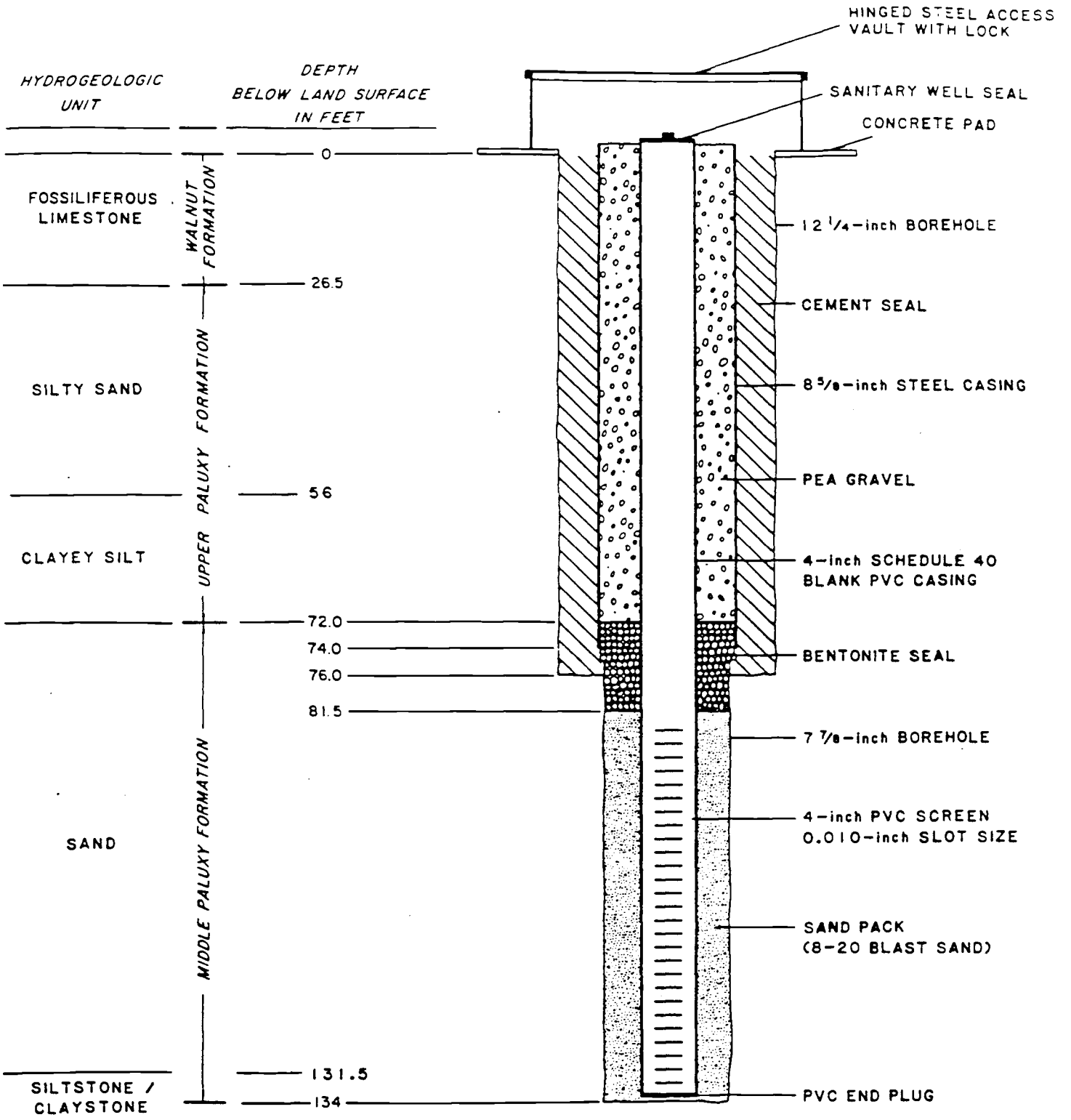


FIGURE F-20. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-24M

HARGIS + ASSOCIATES, INC.

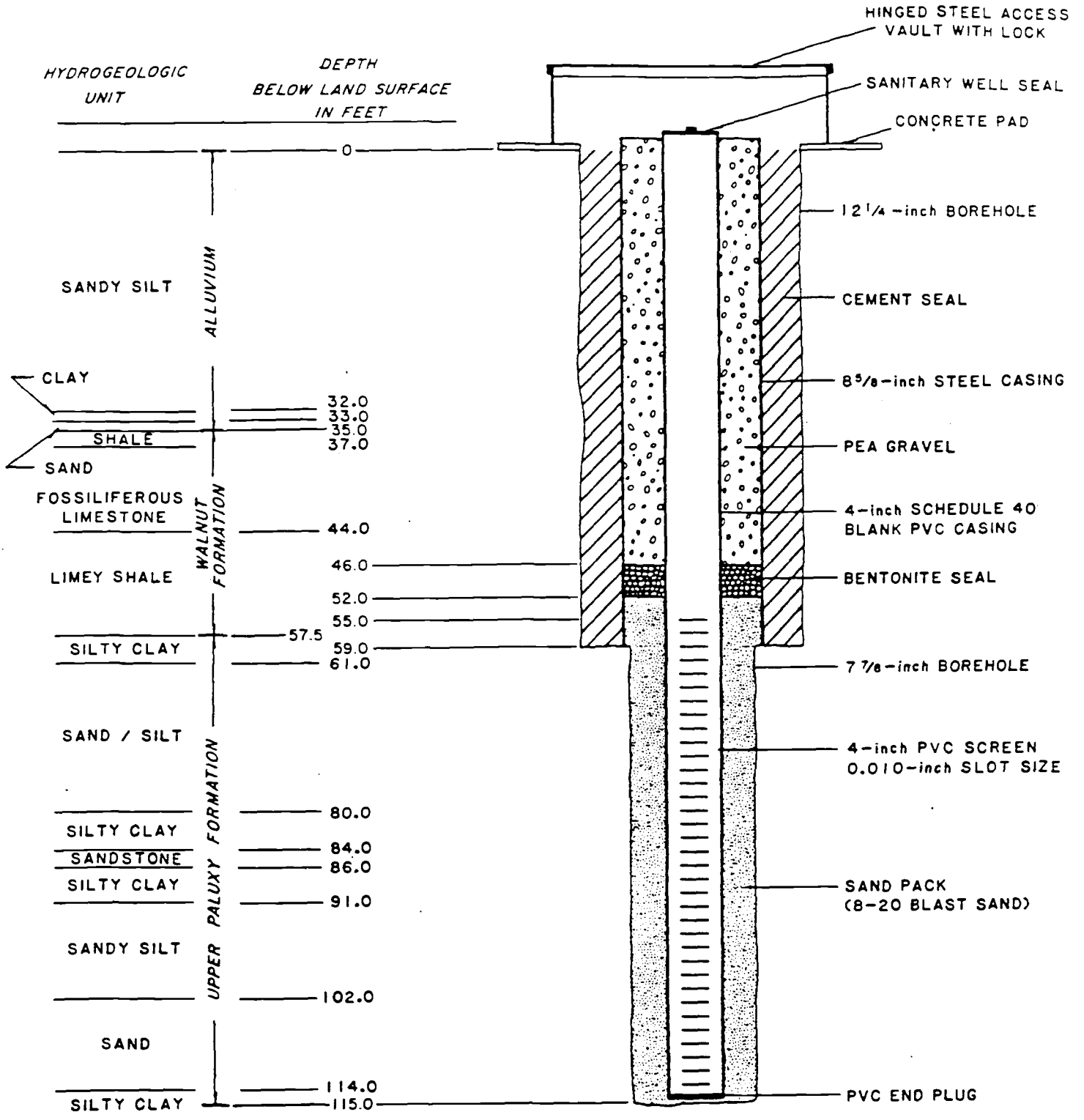


FIGURE F-21. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-25U

HARGIS + ASSOCIATES, INC.

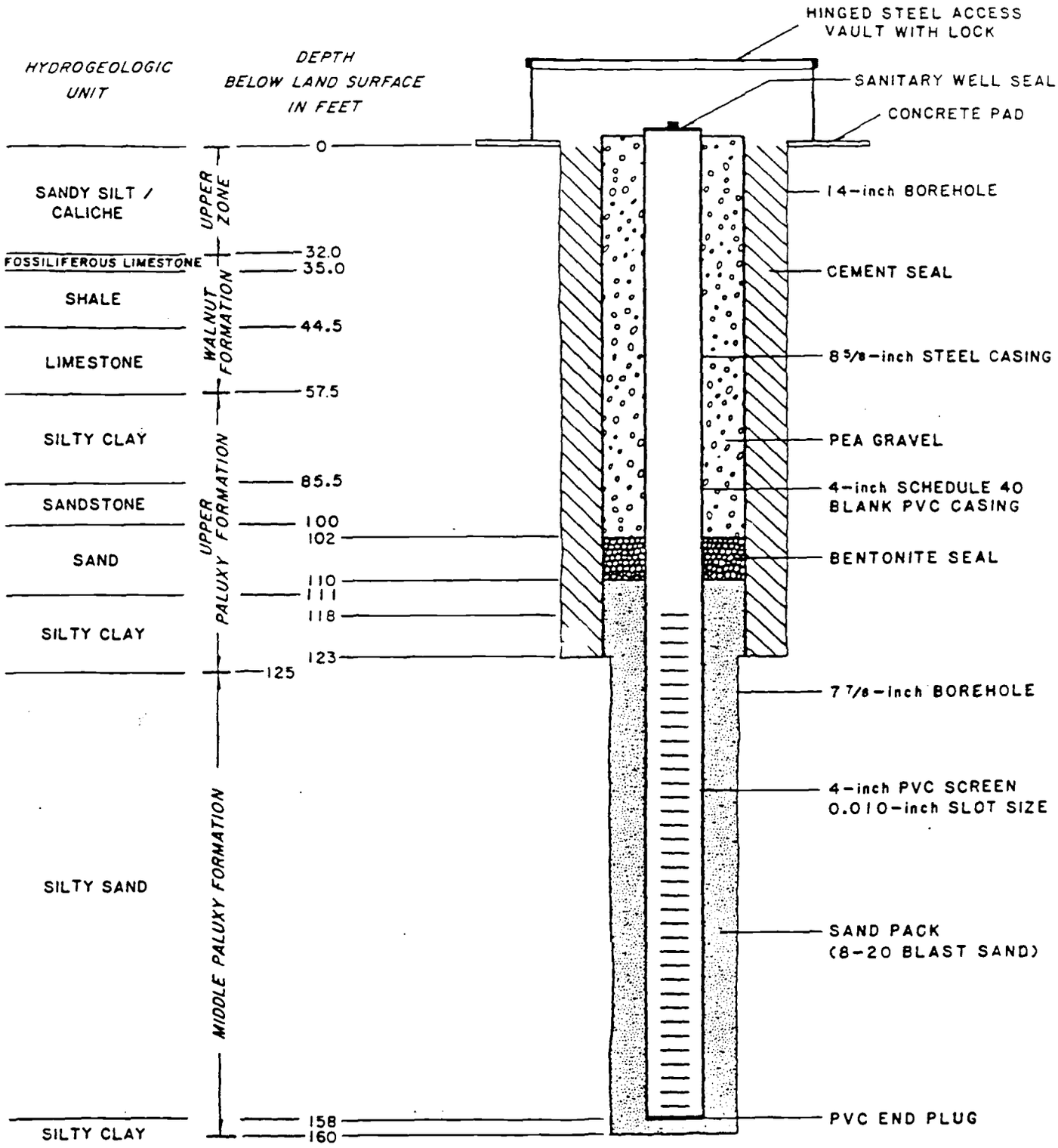


FIGURE F-22. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-25M

HARGIS + ASSOCIATES, INC.

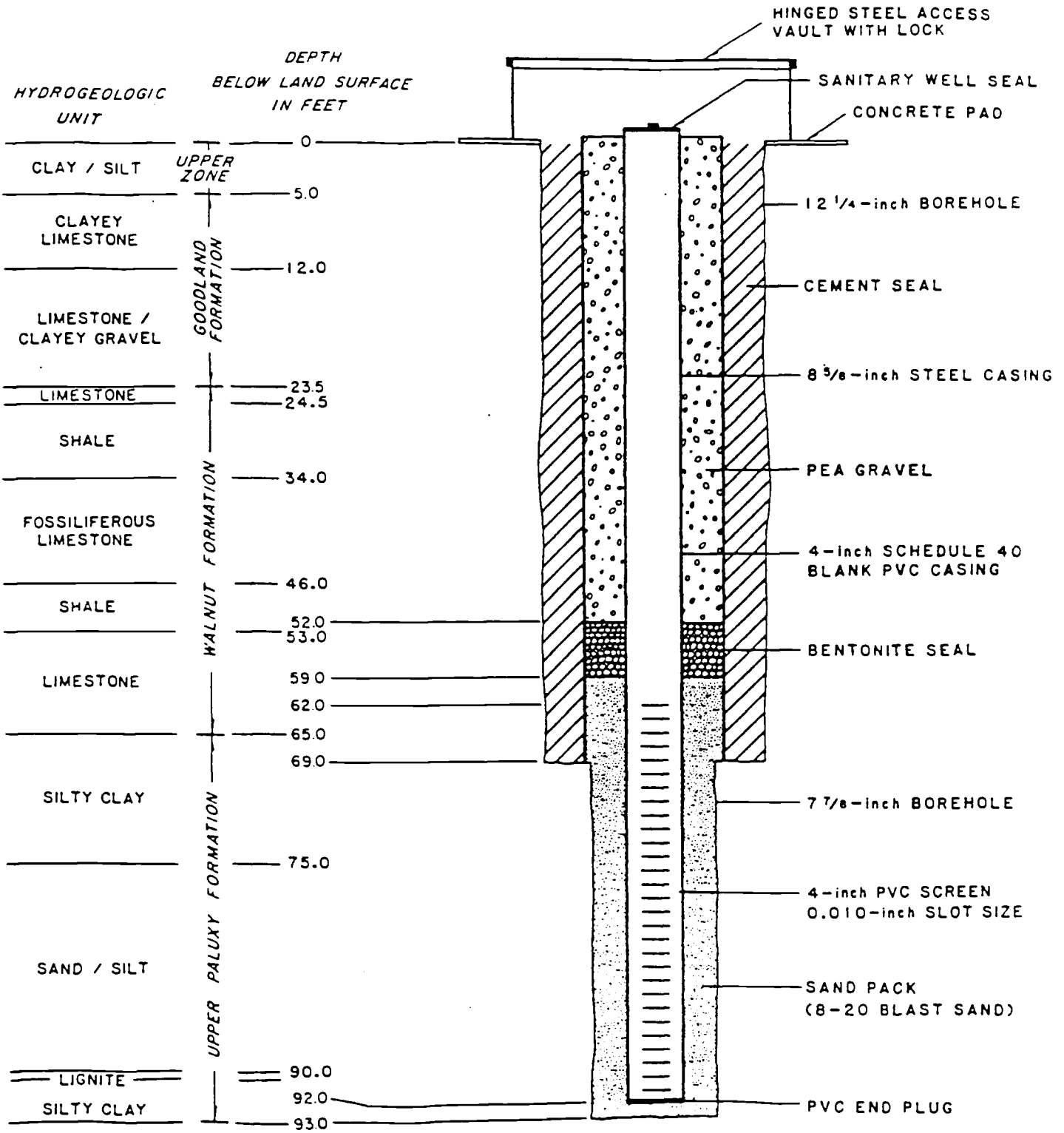


FIGURE F-23. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-26U

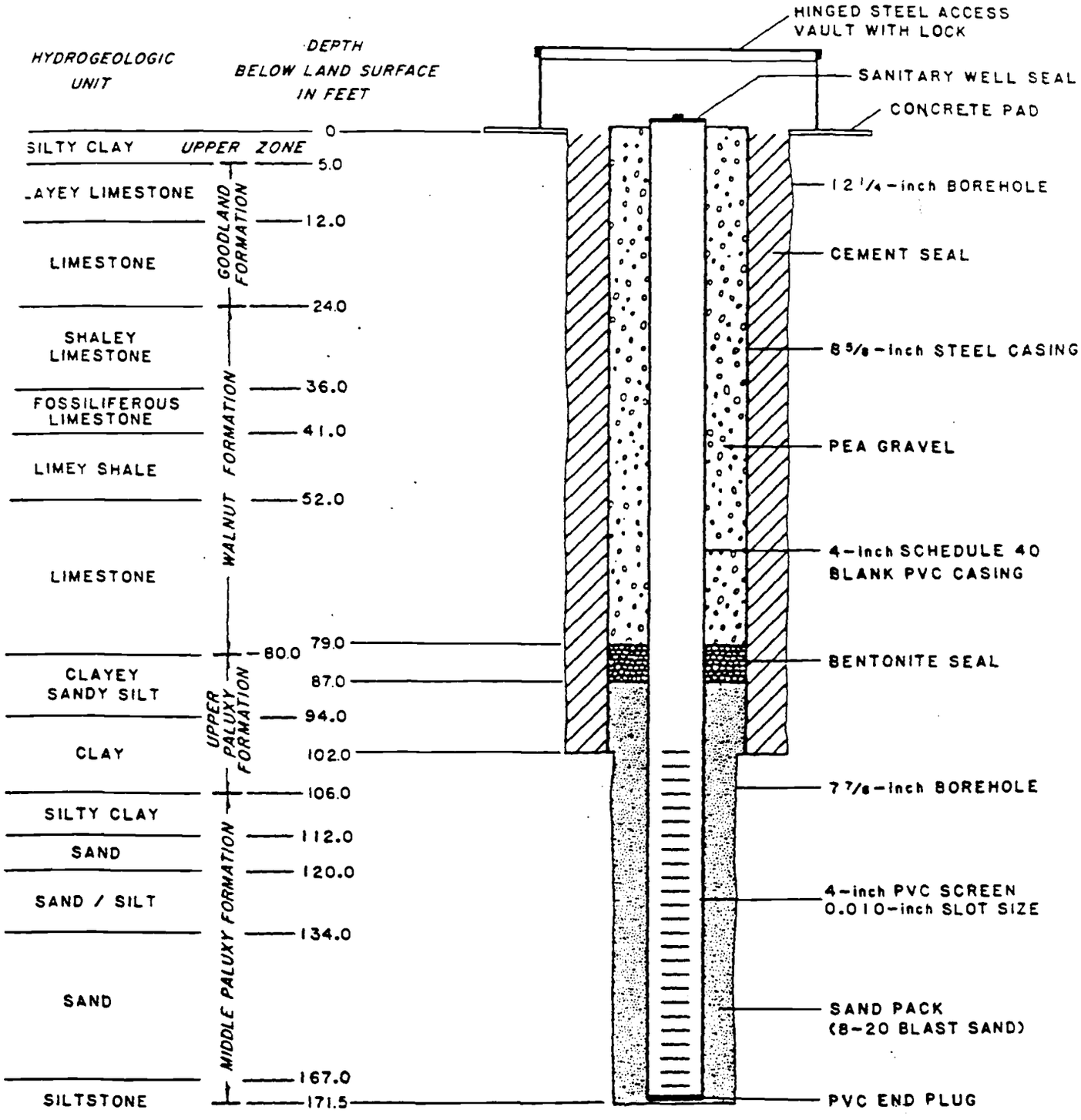


FIGURE F-24. SCHEMATIC CONSTRUCTION DIAGRAM FOR MONITOR WELL P-26M

HARGIS + ASSOCIATES, INC.

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ADMINISTRATIVE RECORD

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ADMINISTRATIVE RECORD

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