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THE STUDY ON
MANAGEMENT OF GROUNDWATER AND
LAND SUBSIDENCE
IN
THE BANDUNG METROPOLITAN AREA AND
ITS VICINITY

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KOKUSAI KOGYO CO., LTD.
TOKYO, JAPAN

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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF MINERAL RESOURCES
MINISTRY OF INDUSTRY
AND
PUBLIC WORKS DEPARTMENT
MINISTRY OF INTERIOR
THE KINGDOM OF THAILAND

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

DATA REPORT

MARCH 1995

KOKUSAI KOGYO CO., LTD.

TOKYO, JAPAN

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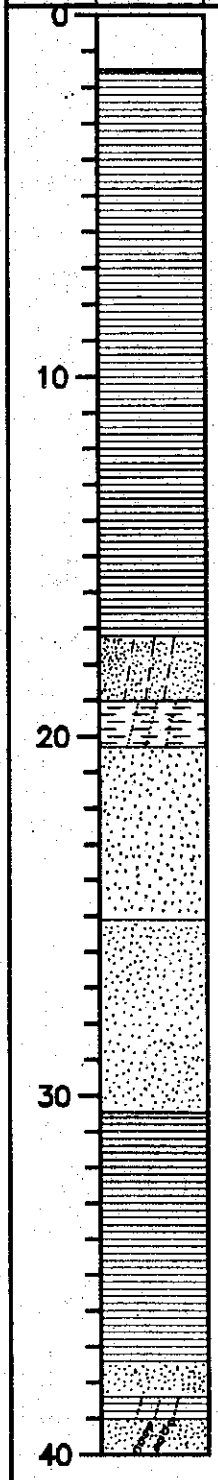
A. GEOLOGIC DESCRIPTION

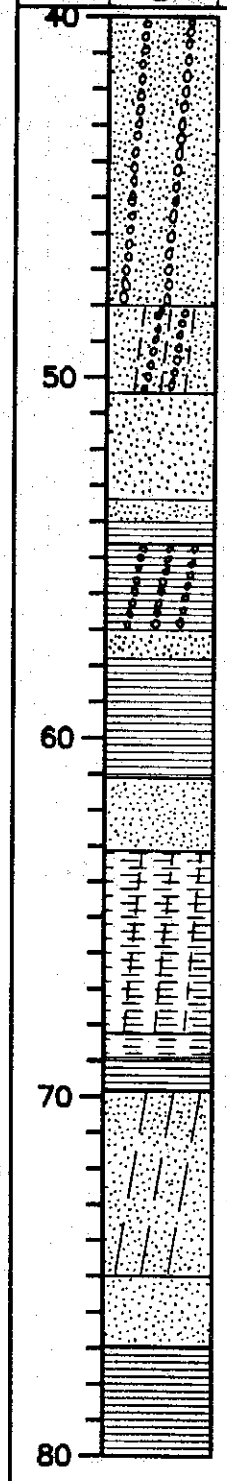
A.1 Lithologic Log of Site-A

LITHOLOGIC LOG OF SITE-A



GRAPHIC LOG	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
	0.00	TOP SOIL (CLAY). Soft.						
	1.50	CLAY. Dark greenish gray. Very soft.	●					A-1T
				●				A-2T
								A-3T
			●					A-4T
				●				A-5T
			●					A-6T
								A-7T
				●	●			A-8T
	17.20	SILTY VERY FINE SAND. Loose.	●					
				●	●			A-9T
	19.00	SANDY SILT. Greenish gray. Stiff.						
	20.30	MEDIUM SAND. Brown. Very dense.		●	●			
							● A-1S	
	25.10	FINE SAND. Light yellowish gray to light purplish gray. Very dense.						
							● A-2S	
							● A-3S	
	30.45	CLAY. Brown to purplish brown. Stiff to very stiff.		●	●	●		
								A-10D
								A-11D
								A-12D
	37.40	FINE SAND. Yellowish brown. Very dense.		●	●			
	38.40	SANDY CLAY. Light brownish gray. Very stiff.						
	39.00	FINE SAND WITH GRAVEL. Light brown to light yellowish brown.						

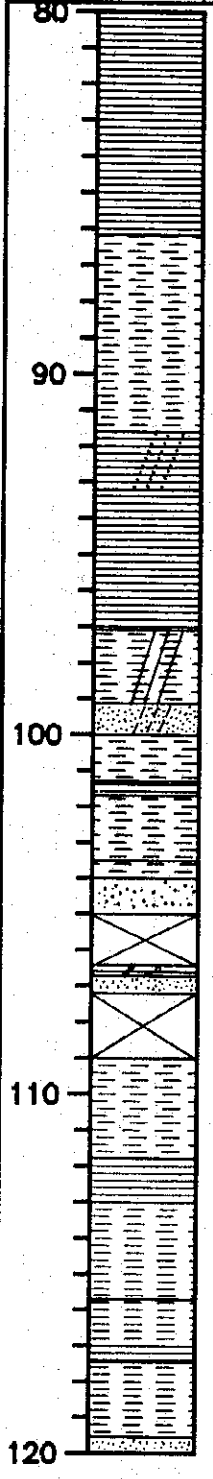
LITHOLOGIC LOG OF SITE-A



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	48.00	FINE SAND WITH GRAVEL. Light brown to light yellowish brown.
	50.45	SILTY SAND WITH GRAVEL. Dark brown. Very dense.
	53.40	MEDIUM SAND. Dark brown.
	54.00	FINE SAND. Greenish gray.
	54.63	CLAY. Brownish gray to greenish gray.
	57.00	GRAVELLY CLAY. Dark brown to brown.
	57.80	MEDIUM SAND. Brown.
	61.10	CLAY. Yellowish brown. Very stiff.
	63.12	FINE SAND. Dark brown.
	68.23	SANDY SILT. Yellowish brown to brownish gray. Very stiff.
	68.90	SILT. Reddish brown.
	69.85	CLAY. Grayish brown.
	75.00	SILTY FINE SAND. Brown.
	76.94	FINE SAND. Light brown.

SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
				A-4S	
				A-5S	
				A-6S	
				A-7S	
				A-8S	
				A-9S	
				A-10S	
				A-11S	
	●	●	●		A-13C
				A-12S	
	●	●			
				A-13S	
				A-14S	
				A-15S	
					A-14C

LITHOLOGIC LOG OF SITE-A

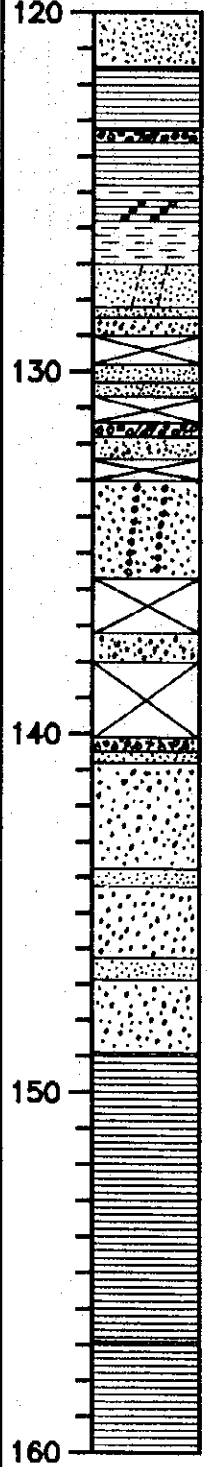


BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
86.15	CLAY. Dark brown to yellowish brown. Very stiff.
91.60	SILT. Yellowish brown. Stiff.
93.20	SANDY CLAY. Light brown. Very stiff.
97.10	CLAY. Yellowish brown to reddish brown. Very stiff.
99.12	CLAYEY SILT. Grayish brown.
100.00	SILTY VERY FINE SAND. Brown.
101.30	SILT. Brown, changing irregularly. Carbonized materials contained.
101.70	CLAY. Reddish brown.
103.50	SILT. Reddish brown. Containing gravel (dia.=2cm)
104.00	SILT. Brown.
105.00	F. TO M.SAND. Yellowish brown. Containing little carbonized materials.
106.41	Core loss
106.70	CLAY WITH GRAVEL. Brown.
107.20	FINE SAND. Grayish brown. Loose core.
108.00	Core loss
111.75	SILT. Brown, partly gray.
113.00	CLAY. Reddish brown. Moderately consolidated.
115.70	SILT. Brown, partly gray. Containing little carbonized materials.
117.00	SILT. Brownish gray. Partly consolidated. With calcareous materials.
117.45	CLAY WITH GRAVEL. Brown. Gravel dia.= 0.5 to 1cm. Clay is sticky.
119.55	SILT WITH FINE SAND. Brown but irregularly gray.
120.00	FINE SAND. Yellowish brown. With little carbonized materials.

SAMPLE

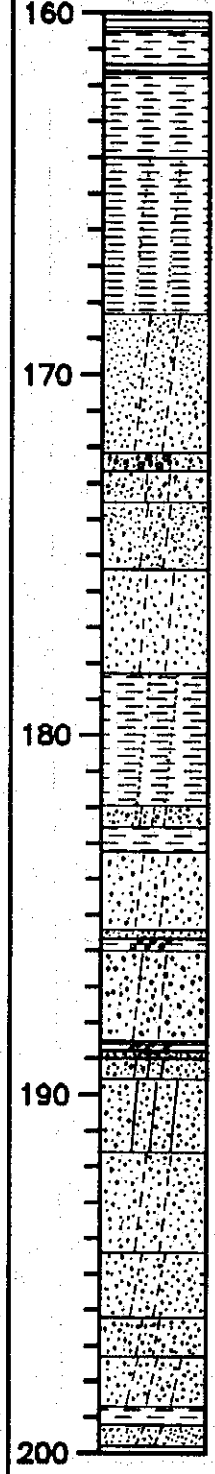
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●			○ A-15C
					○ A-16C
					○ A-17C
	●	●	●		
	●				
					○ A-18C
	●			● A-16S	
		●			
					○ A-19C
				● A-17S	
	●	●	●		○ A-20C

LITHOLOGIC LOG OF SITE--A



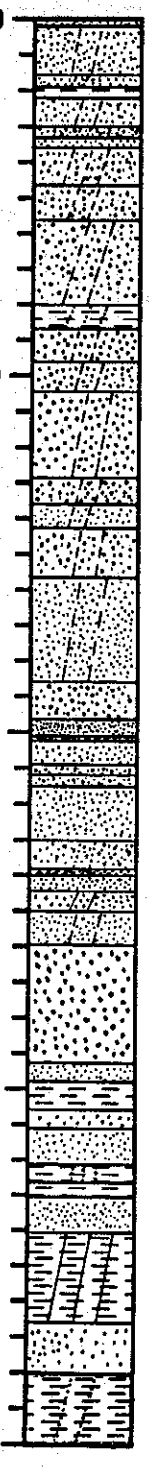
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS: C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST: Disturbed	Undisturbed
	120.00	F. TO M. SAND. Brownish gray. Loose core. 120.60–120.90m m.sand.					A-18S	
	121.50	CLAY WITH GRANULE AND C.SAND. 121.90–122.00m well consolidated.						
	122.00	CLAY. Reddish brown.						
	123.25							A-21C
	123.60	GRAVEL WITH CLAY. Subangular. Dia.= 0.5 to 1cm. CLAY. Reddish brown, partly gray. Moderately consolidated.						
	124.80							
	125.20	SILT. Yellowish brown, partly gray. CLAY WITH GRAVEL. Grayish brown. Gravel dia.= 0.5 to 5cm.						
	125.80	SILT. Reddish brown to gray.						
	127.00	FINE SAND WITH SILT. Containing little carbonized materials.						
	128.20							
	128.50	FINE SAND. Brownish gray. Loose core.						
	129.00	M. TO C. SAND. Brown to brownish gray. Trace of granule. Loose. Core loss.					A-19S	
	129.80	MEDIUM SAND. Brownish gray. Loose core.						
	130.30							
	130.70	FINE SAND WITH SILT. Gray to brownish gray. Trace of gravel. Core loss.			●			
	131.40							
	131.80	GRAVEL WITH CLAY. Angular to subangular. Dia.= 1 to 4cm. F. TO M. SAND. Brownish gray to brown.					A-20S	
	132.40	Core loss.						
	133.00	M. SAND WITH GRANULE. Brownish gray. Loose core.						
	135.70	Core loss.					A-21S	
	137.20	M. TO C. SAND. Brownish gray. Loose core.					A-22S	
	138.00	Core Loss.						
	140.10							
	140.50	C. SAND TO GRANULE. Yellowish brown.						
	140.80	FINE SAND. Brownish gray. M. TO C. SAND. Brownish gray. Loose core.			●		A-23S	
							A-24S	
	143.75	FINE SAND. Brownish gray.						
	144.25	COARSE SAND. Yellowish brown. Loose core.					A-25S	
	146.25	FINE SAND. Brownish gray.						
	146.85	M. TO C. SAND. Brownish gray.					A-26S	
	148.90	CLAY. Yellowish brown mottled with gray. Sticky.					A-27S	
				●	●			
								A-22C
	156.90	CLAY. Reddish brown. Hard. Trace of carbonized materials.						
				●	●	●		

LITHOLOGIC LOG OF SITE-A



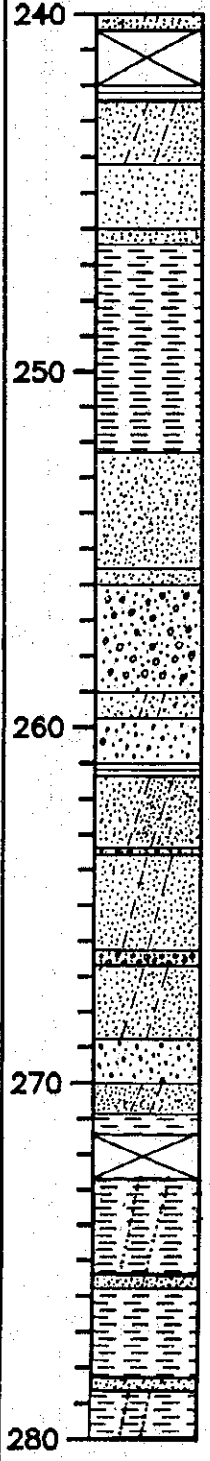
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
160	160.50	SILT. Brown mottled with gray. Hard.						
	161.42	CLAY. Brown. Sticky.						
	161.86	SILT. Brown. Moderately consolidated.						A-23C
	164.00	SILT WITH V.F. SAND. Brown mottled with gray, reddish brown. Containing carbonized materials. 164.3–164.7m laminated. 164.33–164.43m, 167.20–167.25m well consolidated.						
	168.30	V.F. SAND WITH SILT. Yellowish brown. 170.30–171.20m gray to purplish gray. Trace of carbonized materials.						
170	172.15	M. TO C. SAND WITH GRANULE. Trace of pebble (max. dia.=1cm)						
	172.65	F. TO M. SAND WITH SILT. Yellowish brown.						
	173.52	F. TO M. SAND WITH SILT. Brownish gray. 173.5–173.7m m.–c. sand. 173.52–173.70m medium to coarse sand.						
	175.40	M. SAND WITH SILT. Brown. Loose core. 178.22–178.28m granule to c. sand, well consolidated.						
	178.28	SILT WITH V.F. SAND. Brown mottled with gray. Trace of carbonized materials. 179.50–179.60m well consolidated.		●				A-24C
180	181.95	SILTY F. TO M. SAND. Brown. Loose core.						
	182.55	SILT. Brown mottled with gray.						
	183.25	M. TO C. SAND WITH SILT. Brown mottled with gray. Poor sorted. 184.5–184.8m with granule. 185.0–185.4m granule with silt.						
	185.40	FINE SAND. Yellowish brown.						
	185.65	GRAVELLY SILT. Yellowish brown. Gravel dia.=1 to 4cm, subangular.						
	186.00	M. TO C. SAND WITH SILT. Yellowish brown. Loose core.						
	188.35	GRAVELLY CLAY. Yellowish brown. Gravel dia.=0.5 to 1cm.						
	188.60	FINE SAND WITH SILT. Brownish gray.						
	188.80	CLAYEY F. TO M. SAND. Dark brown. Loose core.						
190	188.55	CLAYEY F. TO C. SAND. Dark brown. Poor sorted. 191.5–191.6m silt with granule.						
	191.60	F. TO M. SAND WITH SILT. Yellowish brown to brownish gray. Partly consolidated. 192.3–193.0m, 193.55–193.9m m. sand.						
	194.40	F. TO M. SAND WITH SILT. Brown. Loose core.						
	196.20	F. TO M. SAND WITH SILT. Yellowish brown to yellow. Loose core.						
	197.30	SILTY M. TO C. SAND. Brown. Loose core.						
	198.70	SILT. Light gray to yellow. Slightly grading.					● A-28S	
	199.20	FINE SAND WITH SILT. Gray. Well sorted.						
200	200.00	CLAY. Brown. Moderately consolidated.						

LITHOLOGIC LOG OF SITE-A



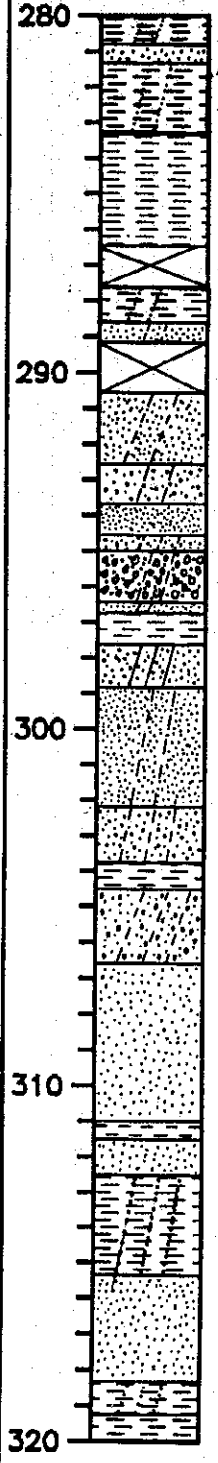
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
200	200.00	SILT WITH FINE SAND. Gray. Moderately consolidated.		●	●	●		
	200.90	F. SAND WITH SILT. Yellowish brown mottled with gray. 201.45–201.55m gravelly clay, gravel dia.=1 to 3cm.						
	201.35	FINE SAND WITH SILT. Yellowish brown.						
	201.80	SILT. Gray to brownish gray.						
	202.00	F. SAND WITH SILT. Brownish gray to gray. Trace of m. sand.						
	203.00	M. TO C. SAND WITH SILT. Brownish gray. Poor sorted.						
	203.80	FINE SAND. Yellowish brown. Well sorted.						
		F. TO M. SAND WITH SILT. Yellowish brown. Loose core.						
	204.65	F. TO M. SAND WITH SILT. Brownish gray. Poor sorted.						
	205.80	M. TO C. SAND WITH SILT. Brown. Loose core.					● A-28S	
	208.00	SANDY SILT. Dark gray to brownish gray. Normal grading.						
	208.68	MEDIUM SAND WITH SILT. Brownish gray. Loose core.		●				
210	208.80	F. TO M. SAND WITH SILT. Gray to brownish gray. 210.30–210.45m m. to c. sand with silt.						
	210.45	COARSE SAND WITH SILT. Brownish gray. Loose core.			●			
	212.85	M. TO C. SAND WITH SILT. Gray to yellowish gray mottled with brown.						
	213.80	FINE SAND WITH SILT. Gray to brownish gray.						
	214.25	F. TO M. SAND WITH SILT. Gray to brownish gray. 215.10–215.65m medium sand, loose core.						
	215.65	FINE SAND WITH SILT. Brownish gray to gray. Well sorted. 217.2–217.3m reddish gray.						
	218.80	M. TO C. SAND. Brownish gray. Loose core.						
220	219.65	VERY FINE SAND. Gray to greenish gray. Well sorted.		●	●			
	220.49	V.F. TO C. SAND. Brownish gray to brownish gray.						
	220.90	M. TO C. SAND. Greenish gray.						
	221.32	M. TO V.F. SAND. Gray to dark red. Reverse grading.						
		V.F. TO F. SAND WITH SILT. Greenish gray. Well sorted.						
	223.00	M. TO F. SAND WITH C. SAND. Grayish green. Poor sorted.						
	223.80	M. SAND WITH SILT. Brownish gray. Loose core.						
	224.00	FINE SAND. Greenish gray. Well sorted.						
	224.43	C. SAND WITH CLAY. Brownish gray. Loose core.						
	225.00	F. SAND WITH SILT. Greenish gray. Lower portion more silty.						
	225.95	COARSE SAND. Brownish gray. Loose core.					● A-30S	
230	228.25	FINE SAND. Greenish gray. Containing calcareous nodule.						
	229.80	SILT. Yellowish brown.		●	●			
	230.58	C. TO V.C. SAND. Gray. Loose core.						
	231.10	F. TO V.F. SAND. Brown to yellowish brown. Containing silt blocks.						
	232.12	SANDY SILT. Gray to dark gray. Laminated.						
	232.64	SILT. Gray. Slightly laminated.						
	233.05	F. TO V.F. SAND. Gray to yellowish brown. Reverse grading.						
	234.05	CLAYEY SILT. Brown to gray. Brown clay occurs irregularly.						○ A-25C
	236.80	V.C. TO C. SAND WITH SILT. Yellowish brown. Loose core.						
	238.00	SILT WITH V.F. SAND. Brownish gray mottled with gray. 238.00–238.15m clay. 238.5–239.0m v.f. sand.						
240	240.00							

LITHOLOGIC LOG OF SITE-A



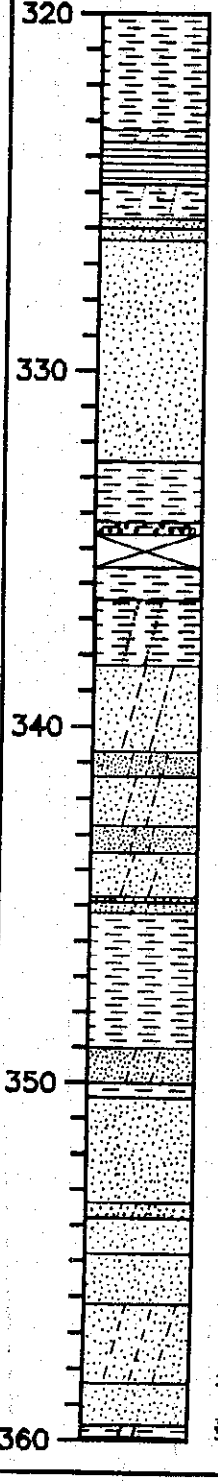
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
	240.00 240.45	V.F. SAND WITH SILT. Brownish gray. Core loss.		●	●	●		
	242.00 242.45	CLAY. Reddish brown. Sticky. V.F. SAND WITH SILT. Light to purplish gray. Normal grading.						
	244.20	FINE SAND. Yellowish gray. 245.55–247.80m well consolidated.						
	246.00 246.42	F. TO M. SAND. Light gray to yellowish brown. SILT. Brown to reddish brown mottled with gray. Partly consolidated by calcareous materials. 249.8–250.0m well consolidated. 250.35–251.2m consolidated.						
	252.30	VERY FINE SAND. Yellowish brown to brownish gray. 253.6–253.9m laminated. 10 deg. dipping.						
	255.55 256.00	FINE SAND. Brownish gray. Loose core. C. SAND TO GRANULE. Brownish gray. Loose core.						
	258.00 258.75	F. TO C. SAND WITH SILT. Black to brwonish gray. Poor sorted. 259.60–259.66m clay. Purplish gray. M. TO C. SAND. Brownish gray. Loose core.						
	261.00 261.37	CLAY. Reddish brown. V.F. SAND WITH SILT. Light to orange gray. High water content. Soft.		●	●			
	263.39 263.97	M. TO C. SAND. Brownish gray. Loose core. V.F. SAND WITH SILT. Yellowish gray mottled with gray.						
	266.24 266.68	M. SAND TO GRANULE. Gray to brownish gray. Trace of gravel. V.F. SAND WITH SILT. Brownish to yellowish gray. Reverse grading.						
	268.75	M. TO C. SAND. Brownish gray. Loose core.						
	270.00	V.F. SAND WITH SILT. Gray to brownish gray. Reverse grading.						
	270.85 271.43	SILT. Gray mottled with brown. Core loss.						
	272.68	SILT WITH F. SAND. Gray to brownish gray. 273.5–273.7m fine sand with silt.						
	275.40 275.78	SILTY F. TO M. SAND. Gray to dark gray. SILT. Light gray to yellowish gray.						
	278.27 278.64	SILTY F. TO M. SAND. Dark gray to black. Partly consolidated. SILT WITH V.F. SAND. Gray mottled with yellowish brown.						○ A-26C

LITHOLOGIC LOG OF SITE-A



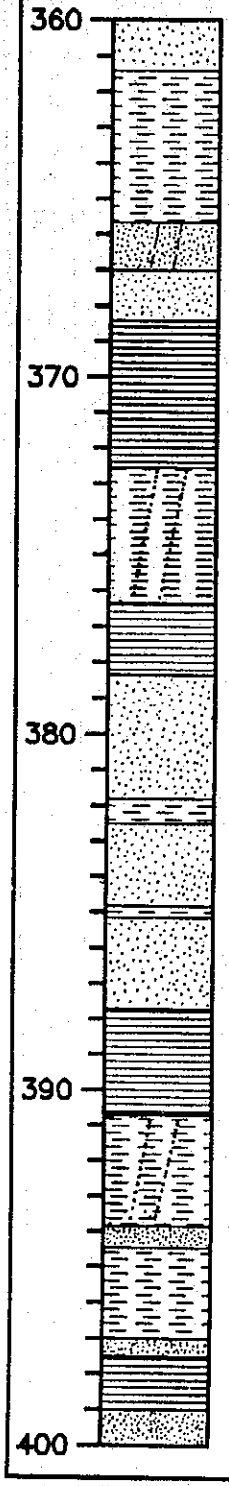
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
	280.80	MEDIUM SAND. Brownish gray. Loose core.		●	●			
	281.32	SILT WITH F. SAND. Gray to brownish gray. With calcareous nodules. Trace of carbonized materials.						
	283.30	SILT. Light to brownish gray. 284.40–284.53m f. sand with silt.						
	286.45	Core loss.						
	287.80	SILT WITH F. SAND. Gray to yellowish gray. Normal grading.						A-27C
	288.60	F. SAND. WITH SILT. Light gray.						
	289.15	Core loss.						
	290.55	F. SAND WITH SILT. Greenish to brownish gray. Soft core.						
	292.57	F. TO M. SAND WITH SILT. Light to brownish gray. 293.40–293.57m v.f. sand with silt.						
	293.68	VERY FINE SAND. Brown. Loose core.						
	294.55	SILTY F. TO M. SAND. Brown to greenish gray. Trace of granule.						
	295.00	V.C. SAND TO GRANULE WITH SILT. Greenish gray. Poor sorted. Slight normal grading.						
	296.45	F. SAND WITH SILT. Greenish gray. Moderately consolidated.						
	296.75	SILT. Greenish gray. Well consolidated like mudstone.		●	●	●		
	297.63	CLAYEY F. TO C. SAND. Gray mottled with reddish brown.						A-28C
	298.83	V.F. SAND WITH SILT. Dark brown. Loose core.						
							A-31S	
	302.20	SILTY F. TO C. SAND. Brownish to greenish gray. Well consolidated.						
	303.75	SILT. Gray. Moderately consolidated.						
	304.50	SILTY M. TO C. SAND. Light gray to gray. Trace of granule. Poor sorted. Moderately consolidated.						A-29C
	306.56	FINE SAND. Dark brown. Loose core.						
	311.00	SILT. Gray to brownish gray. trace of granule.						
	311.50	FINE SAND. Dark brown. Loose core.						
	312.50	SANDY SILT. Gray. Moderately consolidated like mudstone. 314.3–314.5m containing granule.						
	315.35	FINE SAND. Dark gray. Loose core.						
							A-32S	
	318.30	SANDY SILT. Light to brownish gray. Moderately consolidated.						
	319.25	SILT. Light gray. Moderately consolidated like mudstone. 323.00–323.25m reddish gray.						

LITHOLOGIC LOG OF SITE-A



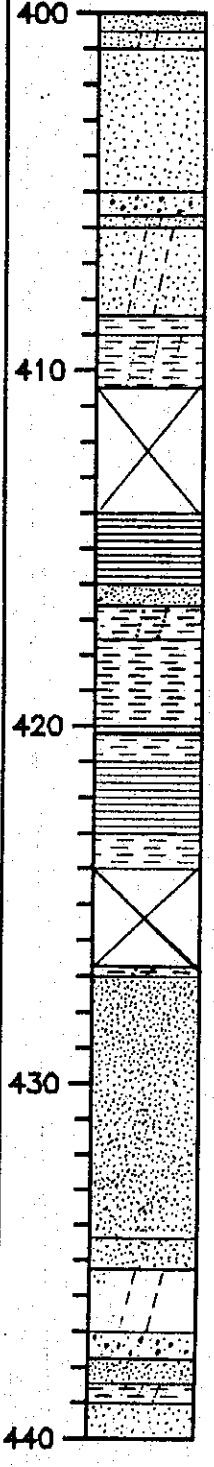
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST: Disturbed	Undisturbed
	323.25	SANDY SILT. Reddish brown.		●	●			A-30C
	323.60	CLAY. Dark reddish brown. 324.4–324.5m containing white patches.						
	324.75	SANDY SILT. Reddish brown. Containing cemented gray nodules.						
	325.73	FINE SAND. Brownish gray. Loose core.						A-31C
	326.00	FINE SAND WITH SILT. Light gray. Loose core.						
	326.34	FINE SAND. Dark gray. Loose core. Bedding plane of the bottom dips 20 deg.						
	332.54	SILT. Brown mottled with gray. Moderately consolidated.					● A-33S	
	334.25	SILT WITH GRANULE. Greenish gray.						
	334.60	Core loss.						
	335.55	SILT. Reddish brown. Hard. With consolidated calcareous nodules.						
	336.47	SILT WITH FINE SAND. Brown. Partly well consolidated.		●				
	338.30	FINE SAND WITH SILT. Brownish gray. Sand particles weathered.			●			
	340.70	SILTY V.F. SAND. Dark brown.						
	341.40	F. SAND WITH SILT. Gray to brownish gray.						
	342.75	V.F. SAND WITH SILT. Dark brownish gray.						
	343.50	FINE SAND WITH SILT. Dark brownish gray. Trace of biotite fragments.						
	344.23	MEDIUM SAND. Gray. Well consolidated. Like orkose sand.						
	345.20	FINE SAND WITH SILT. Dark gray. Like orkose sand.						
		SILT. Reddish brown. Normal grading.						A-32C
	349.00	V.F. SAND WITH SILT. Brownish gray.						
	350.00	SILT. Reddish brown to brownish gray.						
	350.40	V.F. TO F. SAND. Dark gray. Loose core.						
	353.35	SILTY M. SAND. Greenish gray. 353.6m containing silt gravel.						
	353.80	F. TO V.F. SAND WITH SILT. Gray to bluish gray.						
	354.80	FINE SAND. Bluish gray. Loose core.						
	356.20	SILTY F. TO V.F. SAND. Greenish to bluish gray. 356.20–356.35m v.f. sand. 357.0–357.3m silt with v.f. sand.						
	358.40	FINE SAND. Greenish gray. Well sorted.			●			
	359.60	SILT WITH F. SAND. Brown. Moderately consolidated.						
	359.90	FINE SAND. Greenish gray. Organic. 361.25m containing plant fossils.						

LITHOLOGIC LOG OF SITE-A



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS: C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST: Disturbed	Undisturbed
	361.40	SILT. Gray mottled with brown.						A-33C
	365.85	V.F. SAND WITH SILT. Brown to bluish gray. Normal grading.		●				
	367.00	FINE SAND. Dark brownish gray. Loose core.			●			
	368.40	CLAY. Greenish to brownish gray. Well consolidated. Spotted gray consolidated nodules.						
	372.55	SILT WITH V.F. SAND. Brownish gray. Loose core.						
	376.35	CLAY. Brown mottled with greenish gray.						
	378.35	V.F. TO F. SAND. Dark gray. Loose core.						A-34C
	381.80	SILT. Greenish gray.						
	382.50	FINE SAND. Dark greenish gray. 381.8-381.9m, 382.35-382.5m cemented like limestone. 382.5-383.0m, 383.8-384.8m loose core.						
	384.80	SILT. Dark gray. Organic. 384.8-384.9m wood fossil.	●	●				
	385.13	FINE SAND. Brownish gray. Loose core.						
	387.70	CLAY. Dark gray to dark greenish gray. 389.5-390.7m peaty.						
	390.70	SILT WITH V.F. SAND. Dark greenish gray.		●	●			
	393.85	V.F. SAND. Dark brownish gray. Loose core.						
	394.45	SILT. Dark brownish gray to reddish brown. Partly well consolidated.						
	397.00	V.F. SAND. Dark brownish gray. Loose core.						
	397.50	CLAY. Reddish brown mottled with gray. Well consolidated.						
	398.00	V.F. SAND. Dark brownish gray. Loose core.						

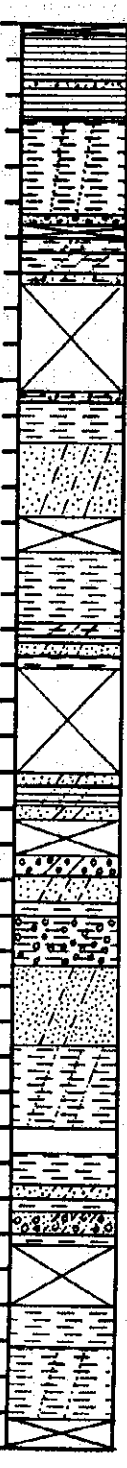
LITHOLOGIC LOG OF SITE-A



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	400.50	F. SAND WITH SILT. Greenish gray.
	401.00	FINE SAND. Dark gray. Loose core.
	405.00	M. TO C. SAND. Greenish gray.
	405.65	F. SAND WITH SILT. Greenish gray.
	406.00	F. SAND WITH SILT. Dark gray. Loose core.
	408.45	SILT. Dark brown mottled with dark gray. 408.6–408.8m clay.
	409.00	SANDY SILT. Greenish gray. 409.33–409.66m well consolidated. 409.90–409.95m fine sand with silt.
	410.50	Core loss.
	414.00	CLAY. Brownish to greenish gray. Sticky.
	416.00	VERY FINE SAND. Dark brownish gray. Loose core.
	416.60	SILT WITH F. SAND. Greenish gray. Moderately consolidated.
	417.55	SILT. Gray. 419.0–420.0m well consolidated. 418.8m containing calcareous nodules (dia.=1cm).
	420.00	CLAY. Dark brown. Sticky.
	420.25	SILT. Dark greenish gray. Consolidated like mudstone.
	421.00	CLAY. Brown to dark brownish gray mottled with greenish gray.
	423.00	SILT. Brown. Well sorted.
	424.00	Core loss.
	426.70	SILT WITH V.F. SAND. Reddish brown.
	427.00	VERY FINE SAND. Dark brownish gray. Loose core.
	434.37	V.F. TO F. SAND. Brownish gray. Slightly normal grading. 435.3–435.35m containing hard nodules (dia.=2 to 4cm).
	435.25	V.F. SAND WITH SILT. Dark brown. Loose core.
	437.00	M. TO C. SAND. Dark gray. Loose core.
	437.75	VERY FINE SAND. Brownish gray. Loose core.
	438.45	SANDY SILT. Light brownish gray.
	439.00	FINE SAND. Brownish gray. Loose core.
	440.00	

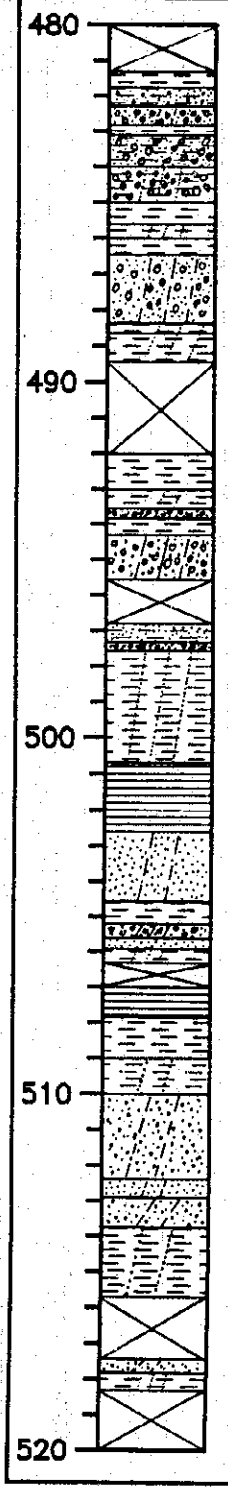
SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●			
					○ A-350
				● A-345	
	●	●			
				● A-355	

LITHOLOGIC LOG OF SITE-A



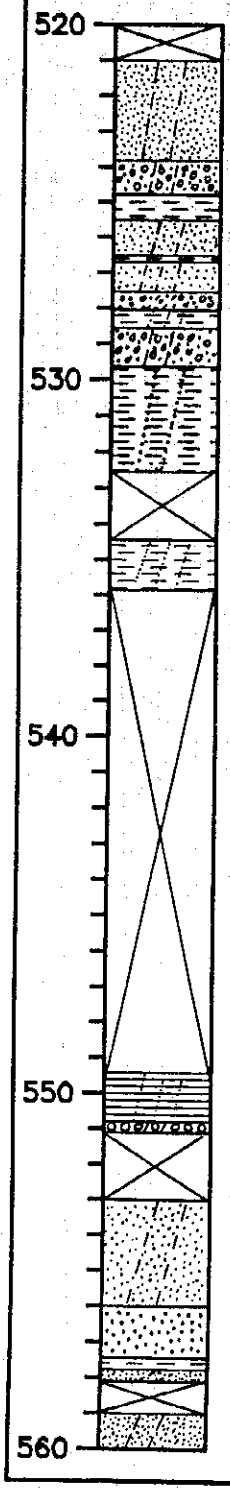
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
	440.00	Core loss.						
	440.20	CLAY. Gray to dark brownish gray.						
	441.55	M. TO C. SAND WITH SILT. Gray.						
	441.80	CLAY. Dark grey. Moderately consolidated.						
	442.70	SILT WITH F. SAND. Dark gray.						
	445.34							
	445.85	F. SAND TO GRANULE. Greenish to brownish gray.						A-36C
	446.00	Core loss.						
	446.40	SILT WITH F. SAND. Gray. 446.25-446.4m sandy silt.						
	447.00	SANDY SILT. Light greenish gray. Poor sorted.						
	447.30	SILTY M. TO C. SAND. Light greenish gray. 447.1m with granule.						
		Core loss.						
	450.39							
	450.60	SILT WITH M. TO C. SAND. Light greenish gray.						
		SILT. Gray to brownish gray. 451.11-451.29m sandy silt.						
	451.75	SILTY F. SAND. Greenish gray.						
		452.27-452.28m compact clay layer, green.						
	453.82	Core loss.						
	454.80	SILT. Brownish gray.						
	456.80	SANDY SILT. Gray. Well consolidated.						
	457.17	CLAY. Gray to brownish gray.						A-37C
	457.75	SILTY F. SAND TO GRANULE. Gray. Poor sorted.						
	458.10	SILT. Gray.						
		Core loss.						
	461.00							
	461.35	F. TO C. SAND WITH CLAY. Brownish gray. Clay is sticky. Poor sorted.						
	461.90	SANDY CLAY. Gray.		●	●	●		
	462.30	F. TO M. SAND WITH CLAY. Gray.						
		Core loss.						
	463.30	GRANULE WITH CLAY. Brownish gray. Trace of gravel (max. dia.=1cm).						
	463.85	SILTY F. SAND. Light gray to reddish brown.						
	464.80	SILT. Light greenish gray. Moderately consolidated like mudstone.						
	465.00	SILT WITH GRANULE. Greenish gray. Trace of gravel (max. dia.=2cm).						
	466.40	V. F. SAND WITH SILT. Dark brown. Loose core.						
	468.65	SANDY SILT. Greenish gray. Trace of granule.						
	471.00	SILTY F. TO C. SAND. Greenish gray. Poor sorted.						
	471.70	SANDY SILT. Greenish gray.						
	472.80							
	473.00	SILTY F. TO C. SAND. Greenish gray. Poor sorted.						
	473.35	SILT. Gray. Well consolidated.						
		SILTY F. SAND TO GRANULE. Greenish gray. Trace of gravel.						
	474.00	SILT. Gray. Moderately consolidated.						
	474.90	Core loss.						
	476.00	SILT. Light gray.						
	477.15	SILT WITH F. SAND. Light gray. Moderately consolidated.						
	479.15	Core loss.						A-38C

LITHOLOGIC LOG OF SITE-A



BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST: Disturbed	Undisturbed
481.30	SILT. Light gray. Normal grading.		●	●			
481.75	SILT WITH F. TO M. SAND. Light gray. Normal grading.						
482.28	F. SAND TO GRANULE WITH SILT. Light gray. Poor sorted.						
482.80	SILT. Light gray.						
483.10	SILT WITH F. SAND TO GRANULE. Light gray.						
484.00	SANDY SILT WITH GRANULE. Gray. Trace of gravel (max. dia.=3cm).						
485.00	SILT. Gray.						
485.80	SANDY SILT. Gray.						
486.00	SILT. Gray.						
486.46	SILTY F. SAND TO GRANULE. Light gray. Poor sorted.						
488.35	SILT. Gray.						
488.65	SANDY SILT. Gray. 488.65-488.68m with granule.						
489.45	Core loss.						
492.00	SILT. Light gray.						
493.00	SANDY SILT. Light gray.						○ A-39C
493.55	SILTY M. SAND TO GRANULE. Gray. Poor sorted.						
493.83	SILT. Light gray. Moderately consolidated.						
494.30	SILTY M. SAND TO GRANULE. Light gray. Poor sorted.						
495.57	Core loss.						
496.80	SILT WITH F. SAND. Light gray.						
497.33	SILTY M. SAND TO GRANULE. Light gray. Trace of gravel (dia.=1cm).						
497.56	SANDY SILT. Light gray.						
500.70	CLAY. Greenish gray. Well consolidated.		●				
502.60	F. SAND WITH SILT. Brown. Loose core.						
504.55	SILT. Light greenish gray. Moderately consolidated.						
505.20	CLAYEY M. SAND TO GRANULE. Light greenish gray. Trace of gravel.						
505.60	F. SAND WITH SILT. Light greenish gray.						
505.90	SANDY SILT. Greenish gray. Well consolidated.						
506.30	Core loss.						
507.00	CLAY. Greenish gray. Well consolidated.						
507.85	SILT. Gray.						
508.00	SILT WITH F. SAND. Light greenish gray. Lower portion is more sandy.						○ A-40C
510.00	F. TO M. SAND WITH SILT. Light gray. Moderately consolidated.						
512.37	F. SAND WITH SILT. Light gray.						
512.90	F. TO C. SAND WITH SILT. Gray. Moderately consolidated.						
513.75	SILT WITH F. SAND. Light grey. Well consolidated.						
515.70	Core loss.						
517.42	F. TO C. SAND WITH SILT. Light gray. Moderately consolidated.						
517.81	SANDY SILT. Greenish gray. Well consolidated.						
518.30	Core loss.		●	●			

LITHOLOGIC LOG OF SITE-A

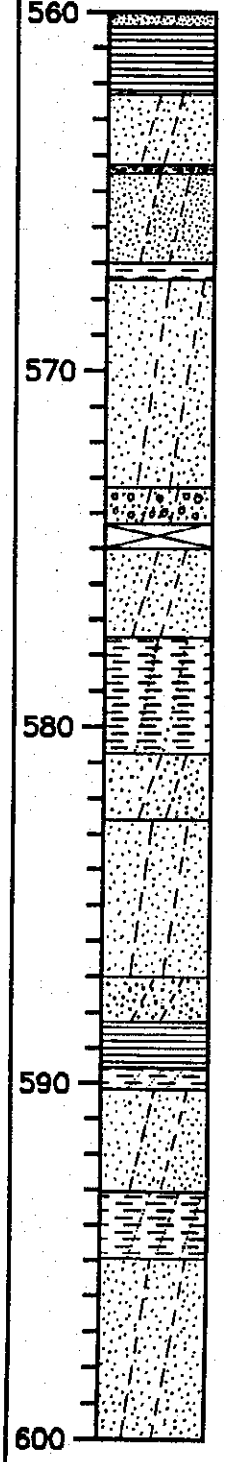


DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	521.00	V.F. SAND WITH SILT. Dark gray. Loose core.
	523.80	M. SAND TO GRANULE WITH SILT. Light gray to light greenish gray.
	524.78	SILT. Light brownish gray. Moderately consolidated.
	525.90	F. SAND WITH SILT. Light gray. Trace of granule.
	526.90	SILT. Light brownish gray.
	527.18	SILTY F. SAND. Light gray.
	527.55	M. SAND TO GRANULE WITH SILT. Light greenish gray.
	528.05	SANDY SILT. Light brownish gray.
	528.55	M. SAND TO GRANULE WITH SILT. Light gray to light greenish gray.
	529.65	SILT WITH F. SAND. Light gray.
	532.55	Core loss.
	534.45	SANDY SILT. Light brownish to greenish gray. Well consolidated.
	535.85	Core loss.
	548.40	CLAY. Light brownish gray.
	548.59	SANDY CLAY. Gray. Sticky.
	550.90	GRAVEL WITH CLAY. Brownish gray. Subangular to rounded.
	551.10	Core loss.
	553.00	V.F. TO F. SAND WITH SILT. Brownish gray. Loose core.
	556.00	V.C. SAND. Brownish gray. Well sorted. Loose core.
	557.45	SILT. Light gray.
	558.18	V.F. SAND WITH SILT. Brownish gray. Loose core.
	558.10	Core loss.
	559.00	V.F. SAND WITH SILT. Brownish gray. Loose core.

SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●	●		

A-41C
A-42C
A-36S

LITHOLOGIC LOG OF SITE-A

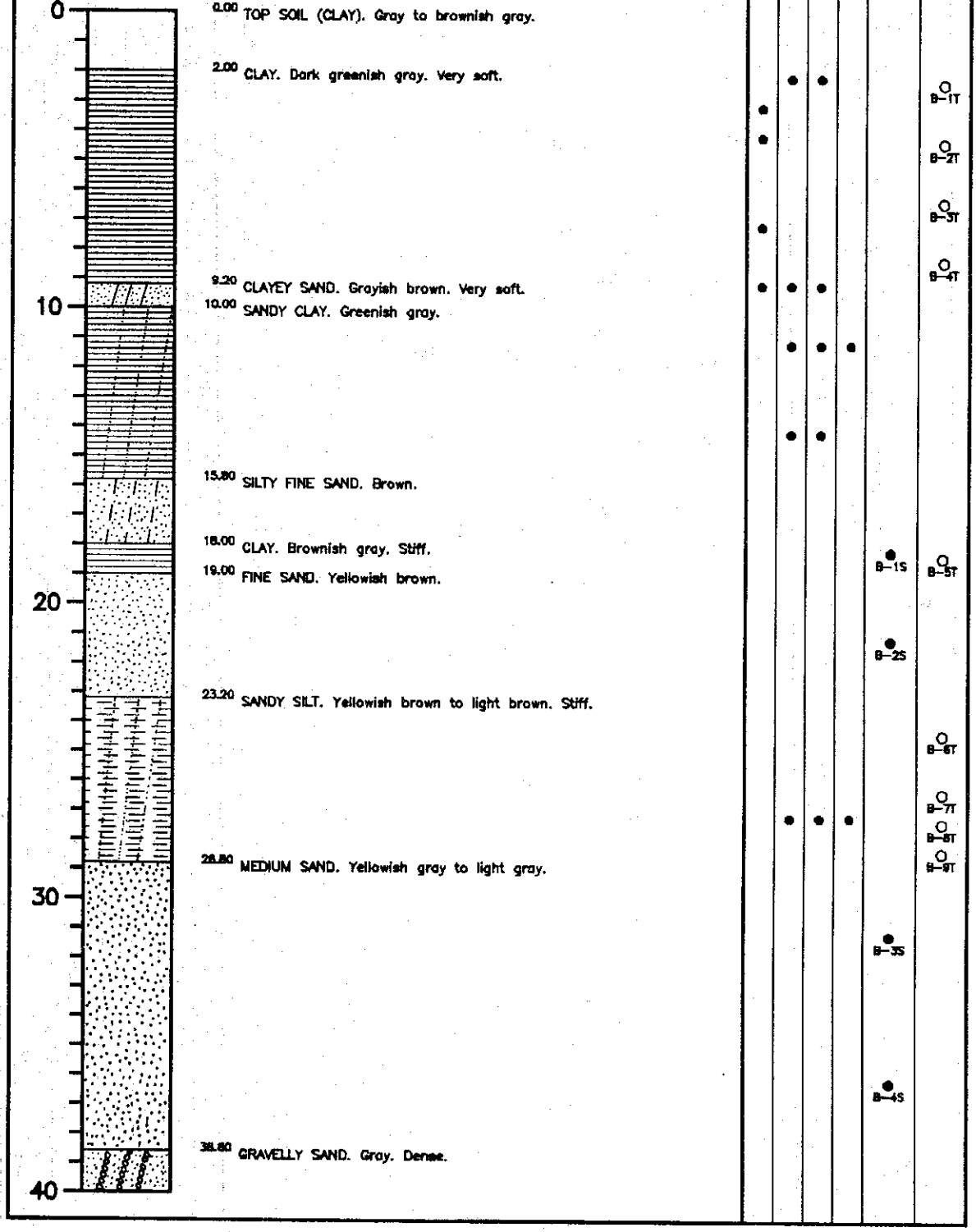


DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
	560.40	CLAY. Gray to brownish gray. Moderately consolidated.						
	562.30	F. SAND WITH SILT. Brownish gray. Loose core.						
	564.25	M. SAND TO GRANULE WITH SILT. Light greenish gray. Trace of gravel.						
	564.50	V.F. SAND WITH SILT. Brownish gray. Loose core.						
	567.00	SILT. Brownish gray.						
	567.45	F. SAND WITH SILT. Brown to dark brown. Loose core.					A-37S	
	573.28	M. SAND TO GRANULE WITH SILT. Gray to light greenish gray.						
	574.30	Core loss.						
	575.00	F. SAND WITH SILT. Brownish gray. Loose core.						
	577.50	SILT WITH V.F. SAND. Brownish to light greenish gray. Moderately to well consolidated.						
	580.75	F. TO M. SAND WITH SILT. Reddish brown.		●	●			
	582.60	F. SAND WITH SILT. Brownish gray. Loose core.					A-38S	
	587.00	F. TO C. SAND WITH SILT. Yellowish brown. Trace of granule.						
	588.25	CLAY. Reddish brown to reddish gray.						
	589.55	SANDY SILT. Reddish to brownish gray. Well consolidated.						
	590.16	F. SAND WITH SILT. Brownish gray. Loose core.						
	593.05	SANDY SILT. Greenish to dark gray. Well consolidated.						
	594.95	F. SAND WITH SILT. Brownish gray. Loose core.		●	●			
	600.00	(End of bore hole).					A-39S	

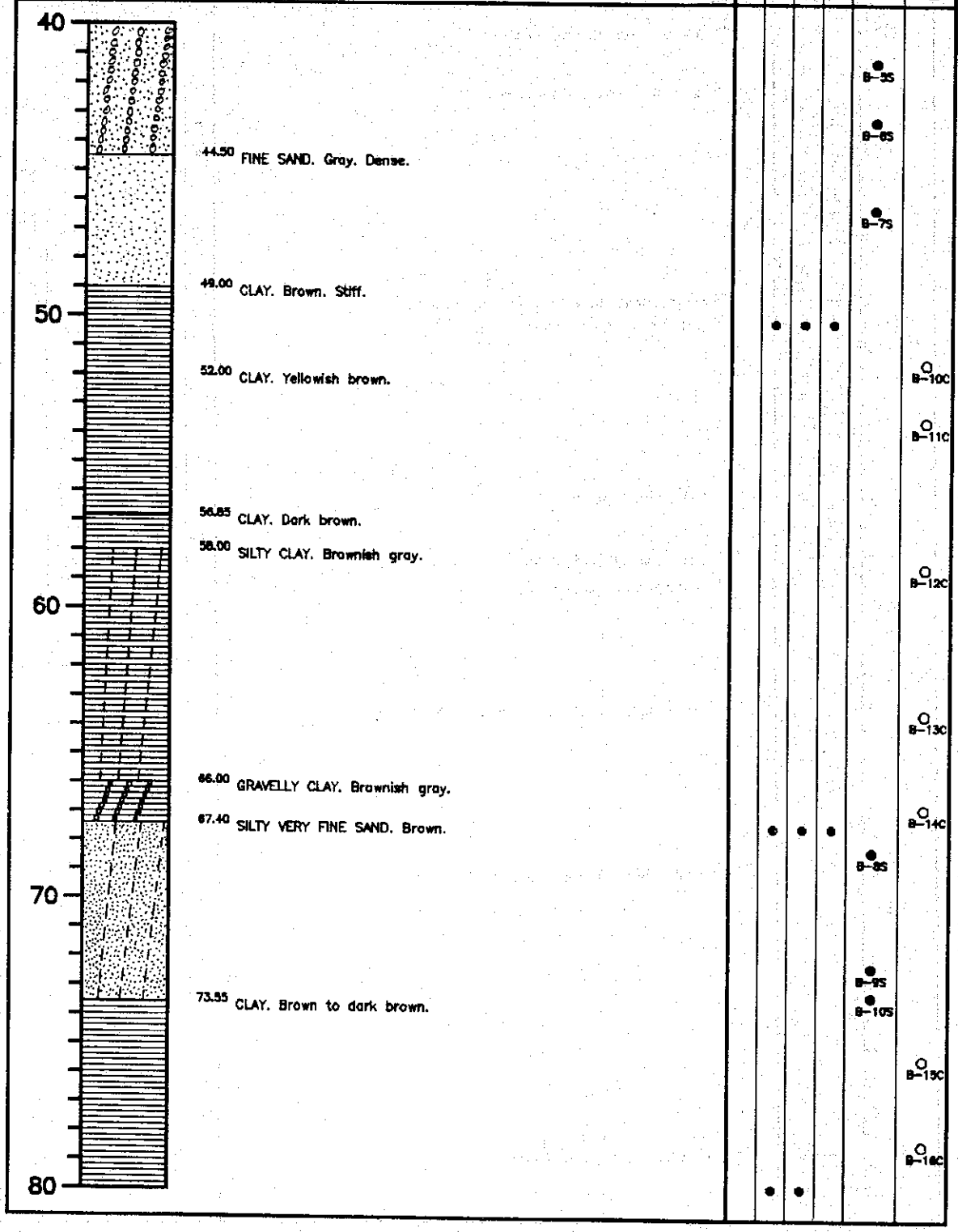
A. GEOLOGIC DESCRIPTION

A.2 Lithologic Log of Site-B

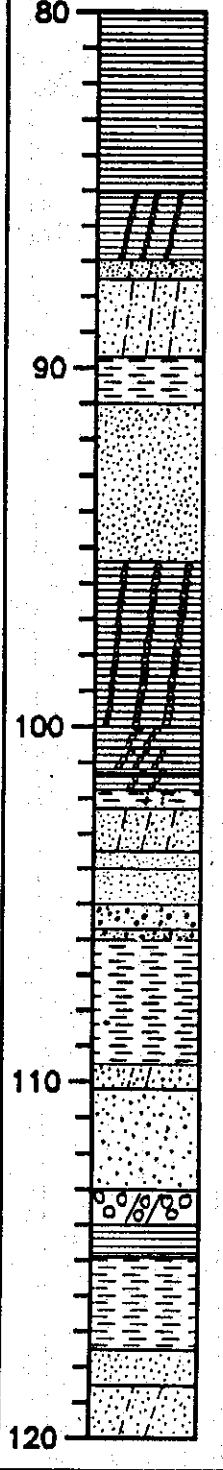
LITHOLOGIC LOG OF SITE-B



LITHOLOGIC LOG OF SITE-B



LITHOLOGIC LOG OF SITE-B



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	81.00	CLAY. Yellowish brown.
	85.05	GRAVELLY CLAY. Brown.
	86.85	SILTY VERY FINE SAND. Brown.
	87.50	SILTY FINE SAND. Brown.
	89.70	SILT. Grayish brown.
	91.00	VERY FINE SAND. Dark brown. Loose.
	95.40	GRAVELLY CLAY. Brown to yellowish brown.
	100.00	CLAY WITH GRAVEL. Yellowish brown. Gravel dia.=0.2 to 2cm.
	100.60	GRAVELLY CLAY. Brown. Gravel is calcareous, dia.= 0.5 to 3cm.
	101.30	CLAY WITH GRAVEL. Brownish gray. Clay is sticky.
	101.75	SILT WITH GRAVEL. Reddish brown mottled with gray.
	102.30	SILTY F. SAND. Brown. Trace of subangular gravel (dia.=1 to 2cm).
	103.50	FINE SAND. Yellowish brown.
	104.00	FINE SAND. Yellowish brown. Loose core.
	105.00	F. TO M. SAND. Yellowish brown. Trace of granule. Loose core.
	105.70	F. TO M. SAND. Yellowish brown. Trace of granule.
	106.00	SILT. Gray to greenish gray. Moderately consolidated. 106.0–107.0m containing calcareous gravel (dia.= 0.5 to 1cm). 109.0–109.5m soft core, brown.
	109.50	M. SAND WITH SILT. Brown to gray.
	110.20	F. TO M. SAND. Brownish gray. Loose core.
	113.00	GRAVEL WITH CLAY. Brown. Dia.=0.5 to 2cm. Gravel is subrounded to subangular.
	114.00	CLAY. Brown mottled with gray. Trace of m. sand.
	114.90	SILT. Gray to brownish gray. Moderately consolidated. Containing calcareous nodules and carbonized materials. Trace of f. to m. sand.
	117.50	FINE SAND. Yellowish brown.
	118.50	FINE SAND WITH SILT. Yellowish brown. Loose core.
	120.00	

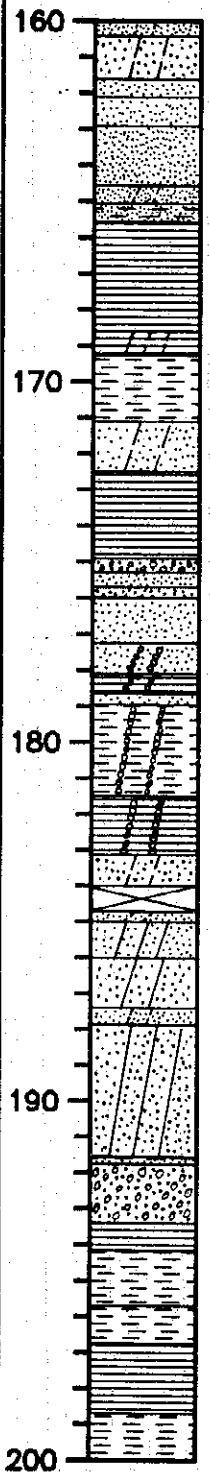
SAMPLE						
CORE ANALYSIS				SOIL TEST		
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed	
					B-17C	
					B-18C	
					B-19C	
					B-20C	
				B-11S		
				B-12S		
				B-13S		
				B-14S		
	●	●				
				B-15S		
				B-16S		
	●	●	●			
				B-17S		
				B-18S		
	●					
		●		B-19S	B-21C	

LITHOLOGIC LOG OF SITE-B

DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	120.00	CLAYEY GRANULE. Yellowish brown. Granule is subangular.
	120.40	CLAY WITH F. SAND. Yellowish brown.
	121.00	FINE SAND. Brown. Loose core.
	123.00	V. F. SAND. Yellowish brown. Well sorted. Loose core.
	125.20	SANDY CLAY. Brown.
	125.60	C. SAND WITH SILT. Brownish gray. Poor sorted. Loose core.
	126.25	CLAY. Yellowish brown mottled with gray. Sticky. Trace of gravel (max. dia.=3cm) and carbonized fragments.
	132.05	SILT. Reddish brown mottled with gray. Trace of granule. 132.7-134.1m laminated with v.f. sand.
	134.30	V. F. SAND. Brown.
	134.50	F. TO M. SAND. Brown. Trace of granule. 134.6-134.7m clayey.
	135.60	CLAY. Reddish brown mottled with gray. Sticky. Trace of granule.
	137.10	V. F. TO F. SAND. Brown mottled with gray. Well sorted. Normal grading with lamination. Trace of carbonized materials.
	138.60	GRAVELLY CLAY. Brown. Angular to subangular (dia.=0.5 to 2cm).
	138.00	M. SAND WITH CLAY. Dark brown. Reverse grading.
	138.45	SILT. Reddish brown mottled with gray. Moderately consolidated.
	140.00	F. TO V.F. SAND WITH SILT. Brown mottled with gray. Moderately consolidated. Trace of carbonized materials.
	141.60	V.F. TO F. SAND. Brownish gray. Loose core.
	144.40	F. SAND WITH SILT. Brown.
	145.00	SILT. Brown. Trace of gravel. Moderately consolidated.
	148.00	SILT WITH V.F. SAND. Brown mottled with gray.
	148.40	VERY FINE SAND. Brown. Well sorted.
	149.10	V.F. SAND WITH SILT. Brown.
	149.90	Core loss.
	151.80	FINE SAND. Brown.
	152.40	F. TO M. SAND. Brown. Loose core.
	154.25	SILT. Brown. 154.25-154.5m laminated with organic thin layers.
	155.00	SILT AND F. SAND ALTERNATION. Brown to brownish gray. Laminated.
	157.35	SILT AND V.F. SAND ALTERNATION. Brown to brownish gray.
	159.10	SILT WITH V. F. SAND. Brownish gray. Laminated.
	159.70	V.F SAND WITH SILT. Brown.

SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
				B-20S	
				B-21S	
					B-22C
	●	●			
	●	●			
	●				
					B-23C
	●	●	●		
				B-22S	

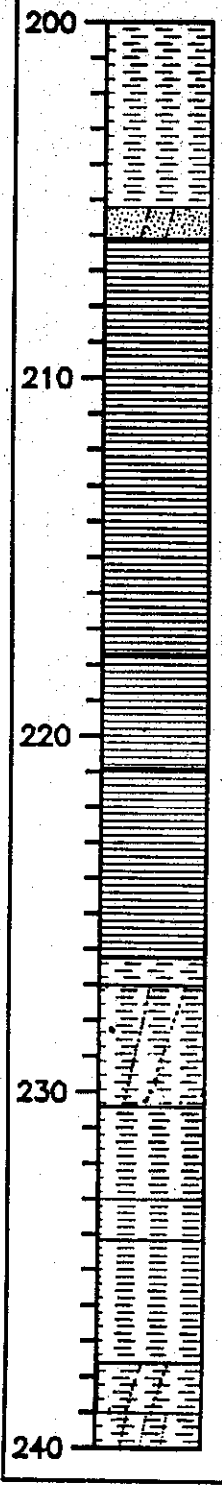
LITHOLOGIC LOG OF SITE-B



BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
160.40	M. TO C. SAND WITH SILT. Loose core.
161.60	FINE SAND. Brown.
162.10	FINE SAND. Brown to dark brownish gray. Loose core.
162.90	F. TO V.F. SAND. Brownish gray. Loose core.
164.55	V.F. SAND WITH SILT. Brown.
165.05	V.F. SAND AND SILT ALTERNATION. Brown to purplish gray. Laminated.
165.35	CLAY. Reddish brown to gray mottled with greenish gray. Moderately consolidated like mudstone.
168.80	SILTY CLAY. Brown mottled with gray.
169.25	SILT. Brown. Trace of gravel. Well consolidated.
171.10	F. SAND WITH SILT. Brown to reddish brown.
172.50	CLAY. Reddish brown. Trace of granule. Well consolidated.
174.90	C. TO M. SAND WITH GRANULE. Greenish gray to brown.
175.30	FINE SAND. Brown.
175.70	M. SAND WITH SILT. Brownish gray.
176.00	FINE SAND. Brownish gray. Loose core.
177.25	F. SAND WITH GRAVEL. Brown. Dia.=2 to 5cm, subangular.
178.10	CLAY WITH GRAVEL. Brown to reddish brown. Gravel dia.=0.3 to 3cm.
178.65	C. TO F. SAND. Yellowish brown. Normal grading.
178.95	SILT WITH GRAVEL. Brown mottled with gray. Gravel dia.=1 to 3cm.
181.50	CLAY WITH GRAVEL. Brown. Dia.=1 to 2cm, angular.
183.13	F. TO M. SAND WITH SILT. Yellowish brown.
184.00	Core loss.
184.70	F. SAND WITH SILT. Yellowish to brownish gray.
185.00	CLAYEY F. SAND. Brown. Loose core.
186.00	M. TO C. SAND WITH CLAY. Brown to reddish brown. Loose core. Trace of oxidized Mg and Fe nodules (dia.=1 to 2cm).
187.39	F. SAND WITH SILT. Gray to brownish gray. Trace of granule.
187.86	CLAYEY F. TO M. SAND. Brown. Loose core.
191.55	SILT WITH F. SAND. Brown to gray. Partly consolidated.
191.75	V.C. SAND TO GRANULE. Gray to brownish gray. 193.27–193.4m cemented like sandstone.
193.40	CLAY. Dark brown. 193.55–193.65m containing oxidized nodule.
194.15	SILT. Brown mottled with gray. Well sorted. Trace of calcareous materials.
195.70	SILT. Reddish brown. 196.0–196.5m many carbonized materials.
196.75	CLAY. Reddish brown. Moderately consolidated and fractured.
198.70	SILT. Reddish brown mottled with gray. Irregularly containing v.f. sand. 204.5–205.0m fractured.

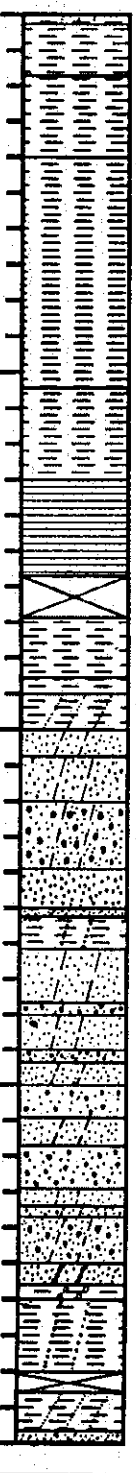
SAMPLE	CORE ANALYSIS				SOIL TEST	
DEPTH (m)	C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
			●		B-23S	
						B-24C
						B-25C
					B-24S	
					B-25S	
					B-26S	
		●	●	●		B-26C
					B-27S	
					B-28S	
		●	●			

LITHOLOGIC LOG OF SITE-B



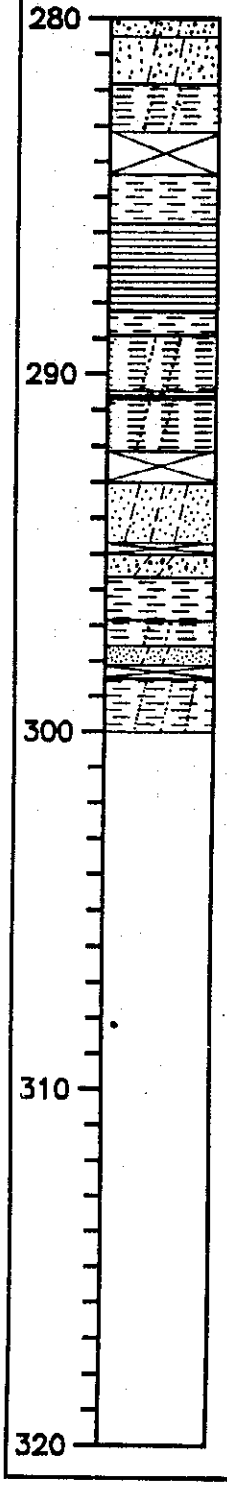
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS C-14	Diatom	Foraminifera	Cl concent.	SOIL TEST Disturbed	Undisturbed
	205.20	V.F. TO F. SAND WITH SILT. Yellowish brown to brownish gray.						
	206.10	CLAY. Brown mottled with gray. 209.2–210.0m fractured. 213.25m containing calcareous nodule.		●	●	●		○ B-27C
	217.00	CLAY. Reddish brown.						
	217.70	CLAY. Yellowish brown. Sticky. 219.5–219.7m containing calcareous nodule.						
	220.90	CLAY. Reddish brown. 221.0–222.5m well consolidated and fractured. 223.5–223.7m well consolidated and fractured.						
	226.25	SILT. Brown to yellowish brown mottled with gray. Well consolidated.						
	227.00	SILT WITH F. SAND. Brown. Normal grading. 229.75–230.2m containing calcareous nodule. 230.2–230.4m fractured, brownish gray.						○ B-28C
	230.40	SILT. Yellowish brown. Moderately consolidated. Fractured.						
	233.00	SILT. Yellowish brown. Expansive.						
	234.15	SILT. Yellowish brown. Moderately consolidated.						
	237.80	SILT WITH F. SAND. Reddish brown to brown mottled with gray. Well consolidated.						
	238.00	SANDY SILT. Yellowish brown mottled with gray.						

LITHOLOGIC LOG OF SITE-B



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS: C-14	CORE ANALYSIS: Diatom	CORE ANALYSIS: Foraminifera	CORE ANALYSIS: Cl concent.	SOIL TEST: Disturbed	SOIL TEST: Undisturbed
	240.25	SILT. Reddish brown mottled with gray. Fractured.						
	241.70	SILT. Yellowish brown. Red patches scattered. Slickenside. 243.0–243.65m red patches (dia.=0.1 to 0.3cm) concentrated.		●	●	●		
	244.00	SILT. Yellowish brown. Moderately consolidated. Fractured.						
	250.45	SILT. Dark brown mottled with gray. Fractured.						
	253.00	CLAY. Red mottled with gray. Relatively soft. 253.0–253.4m reddish brown. 253.4–254m fractured.		●				
	255.70	Core loss.						
	256.87	SILT. Reddish brown mottled with gray. Well consolidated.						○ B-29C
	258.55	SILT. Yellowish brown. Calcareous nodules at 258.6m and 258.85m.						
	259.00	SANDY SILT. Yellowish brown. Normal grading. Well consolidated.						
	260.00	F. SAND WITH SILT. Yellowish brown.						
	260.75	F. TO M. SAND WITH SILT. Brown. Loose core.					● B-29S	
	262.00	M. TO C. SAND WITH SILT. Brownish to light gray. 263.45–263.7m containing subrounded gravel.						
	263.90	COARSE SAND. Brown. Loose core.					● B-30S	
	265.00	SILTY F. SAND. Yellowish brown.						
	265.23	SILT WITH F. SAND. Reddish brown mottled with gray. With nodule.		●	●	●		
	266.15	F. SAND WITH SILT. Brown. Upper portion is silty.						
	267.65	M. TO C. SAND. Brownish gray. Loose core.						
	268.00	F. SAND WITH SILT. Brownish gray.						
	269.00	M. TO C. SAND WITH SILT. Brownish gray. With granule. Loose core.						
	269.35	F. SAND WITH SILT. Brownish gray. 269.9–270.0m with granule.						
	270.00	M. TO C. SAND. Brownish gray. Loose core.					● B-31S	
	270.90	F. SAND WITH SILT. Brownish gray. Normal grading.						
	271.70	M. TO C. SAND. Brownish gray. Loose core.						
	272.90	F. SAND WITH SILT. Yellowish brown. Containing biotite fragments.						
	273.40	F. TO M. SAND WITH SILT. Yellowish brown. Trace of gravel.						
	273.70	M. TO C. SAND WITH SILT. Brown. Loose core.					● B-32S	
	275.00	C. SAND WITH GRANULE. Brown. Trace of rounded pebble.						
	275.60	SILT WITH GRAVEL. Yellowish brown. Calcareous gravel, max dia.=5cm.						
	276.00	SILT WITH F. SAND. Yellowish to reddish brown. Fractured.						
	278.00	Core loss.						○ B-30C
	278.55	SANDY SILT. Yellowish brown.						
	279.65	F. TO M. SAND WITH SILT. Yellowish brown.						

LITHOLOGIC LOG OF SITE-B



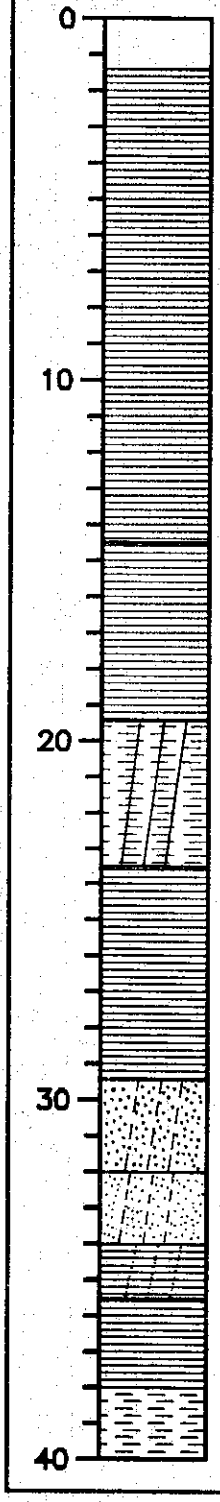
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
280	280.50	M. SAND WITH SILT. Yellowish brown. Loose core.
	281.83	SILT WITH F. SAND. Yellowish brown to greenish gray. Loose core. 281.83–282.0m containing calcareous nodule.
	283.15	Core loss.
	284.35	SILT. Brown. 284.35–284.7m with gravel (dia.=0.5 to 2cm).
	285.75	CLAY. Reddish brown. 285.75–287.0m, 287.3–288.0m fractured.
	288.25	SILT. Yellowish brown.
	288.90	SILT WITH F. SAND. Brown to brownish gray mottled with gray. 289.7–289.85m with carbonized materials. 289.85–290.0m nodule.
290	290.18	CLAY WITH GRAVEL. Brownish gray. Gravel dia.=0.5 to 1cm.
	290.70	SILT WITH F. SAND. Trace of nodules and carbonized fragments.
	292.14	Core loss.
	293.00	SILTY F. SAND. Brown mottled with gray. Laminated. Trace of nodules.
	294.68	Core loss.
	295.00	F. TO C. SAND WITH SILT. Yellowish brown.
	295.65	SILT. Brown to reddish brown. 295.65–296.0m with nodules.
	296.86	SILT WITH F. SAND. Brown. Reverse grading.
	297.56	V.F. SAND WITH SILT. Brownish gray. Soft core.
	298.13	Core loss.
	298.52	SANDY SILT. Yellowish brown to brownish gray. Well sorted.
300	300.00	(End of bore hole).
310		
320		

SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●		B-3S	
				B-4S	

A. GEOLOGIC DESCRIPTION

A.3 Lithologic Log of Site-C

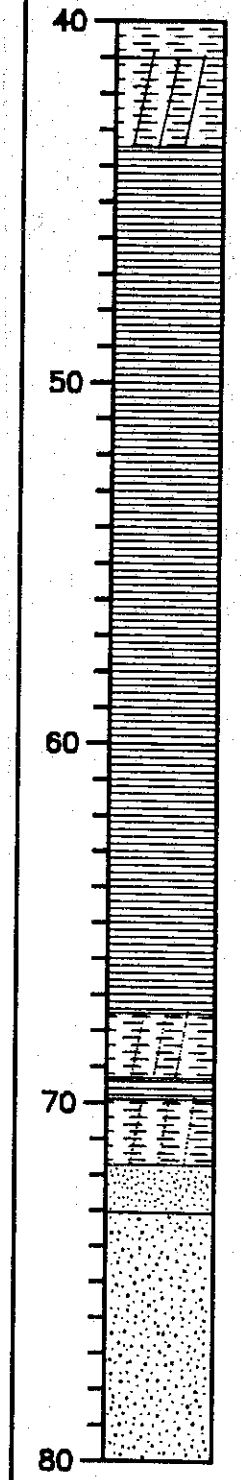
LITHOLOGIC LOG OF SITE-C



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	0.00	TOP SOIL (CLAY). Dark gray. Soft. Highly organic.
	1.40	CLAY. Dark gray. Very soft. High water content. Trace of shell fragments and organic materials. Trace of sand block.
	14.50	CLAY. Greenish gray to light green. Homogeneous. Trace of calcareous materials.
	19.45	CLAYEY SILT. Yellowish brown to light gray. Very stiff. Irregularly containing light gray clay. Trace of fine sand.
	23.50	CLAY. Yellowish brown. Stiff. Homogeneous. Irregularly containing fine sand block. Trace of mica fragments.
	29.45	SILTY M. SAND. Brownish gray. Dense. Poor sorted. Irregularly containing clay.
	32.00	SILTY F. SAND. Brownish gray. Dense. Partly containing silt block.
	34.00	SANDY CLAY. Brown. Stiff.
	35.50	CLAY. Brown. Very stiff. Partly sandy. Trace of granule and pebble (dia.=0.2 to 0.5cm).
	38.00	SILT. Grayish brown. Very stiff. Homogeneous. Partly containing sand block. Trace of mica fragments.

SAMPLE						
CORE ANALYSIS				SOIL TEST		
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed	
●					○ C-1T	
	●	●			○ C-2T	
					○ C-3T	
					○ C-4T	
	●	●			○ C-5T	
	●	●	●		○ C-6T	
					○ C-7D	
	●	●				
					○ C-8D	
	●			● C-1S		
				● C-2S	○ C-9D	
				● C-3S	○ C-10D	

LITHOLOGIC LOG OF SITE-C

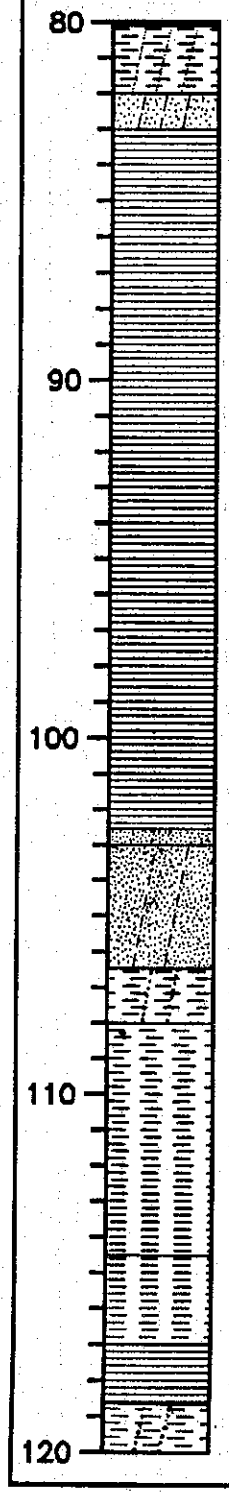


DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	41.00	CLAYEY SILT. Brownish gray. Stiff. Trace of sand.
	43.45	CLAY. Brown to gray. Stiff to very stiff.
	60.00	CLAY. Yellowish brown.
	67.50	SANDY SILT. Light gray to yellowish brown.
	69.30	CLAY. Gray.
	69.90	SANDY SILT. Gray.
	71.70	FINE SAND. Greenish gray.
	73.05	F. TO M. SAND. Brown. Loose core.

SAMPLE

CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●	●		C-11D
					C-12D
					C-13D
	●	●			
					C-14C
					C-15C
	●	●	●		C-16C
					C-17C
				C-4S	
				C-5S	
				C-6S	
				C-7S	
				C-8S	
				C-9S	
				C-10S	
				C-11S	

LITHOLOGIC LOG OF SITE-C



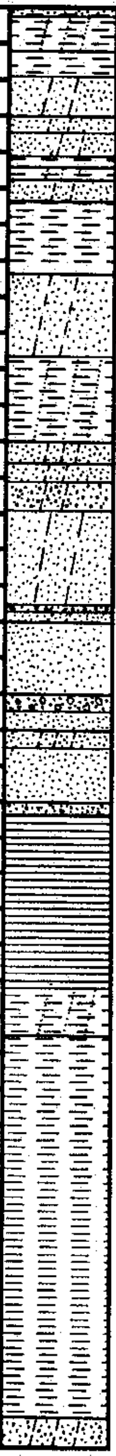
DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	80.10	SANDY SILT. Gray to greenish gray.
	82.00	SILTY F. SAND. Yellowish brown.
	83.00	CLAY. Yellowish brown to brown.
	94.00	CLAY. Reddish brown.
	95.80	CLAY. Light to yellowish gray.
	102.55	V.F. SAND WITH SILT. Gray to brownish gray. 102.6–102.7m loose.
	103.00	V.F. SAND WITH SILT. Gray. Loose core. 106.0–106.43m silty.
	108.43	SILT WITH V.F. SAND. Yellowish gray. Loose core.
	108.00	SILT. Brown to yellowish brown mottled with gray. Trace of calcareous nodules. 113.25–113.45m cemented limestone. 111.0–112.25m fractured.
	114.50	SILT. Reddish brown to red.
	117.00	CLAY. Yellowish brown. 117.3–117.6m containing consolidated oxidized materials.
	118.65	SILT WITH F. SAND. Yellowish brown mottled with gray.

SAMPLE

CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●			
		●	●		
					C-18C
	●	●	●		
					C-19C
				C-12S	

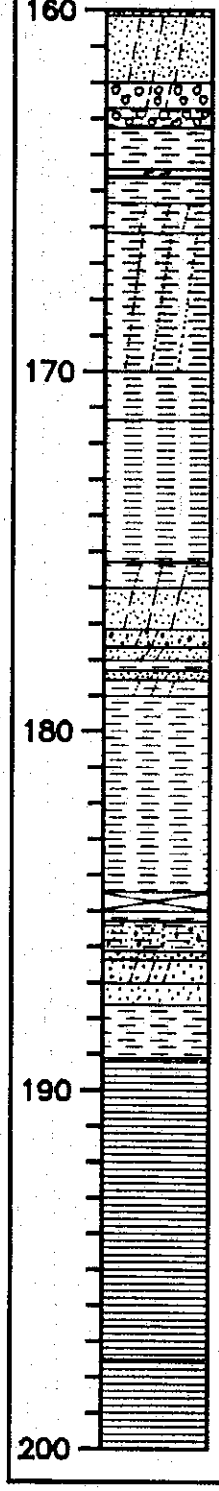
LITHOLOGIC LOG OF SITE-C

Depth scale (m): 120, 130, 140, 150, 160



BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION	SAMPLE: CORE ANALYSIS (C-14 / Diatom / Foraminifera / Cl concent.)	SAMPLE: SOIL TEST (Disturbed / Undisturbed)
120.25	SANDY SILT. Yellowish brown to brownish gray. 120.4–120.6m trace of gravel.		
121.20	SILT. Yellowish gray to yellowish brown.	Diatom ●, Foraminifera ●	
121.90	F. TO V.F. SAND WITH SILT. Yellowish brown to gray.		
123.00	F. SAND WITH SILT. Brown. Loose core.		
123.45	F. SAND WITH SILT. Brownish gray mottled with gray.		
124.10	SILT. Yellowish to reddish brown.		
124.40	SANDY SILT. Reddish to yellowish brown.		
124.75	F. SAND WITH SILT. Light gray to brown.		
125.36	SILT. Gray to yellowish brown. 127.0–127.2m fine sand.		
127.35	FINE SAND WITH SILT. Yellowish brown. Normal grading.		
129.65	SANDY SILT. Yellowish brown.		
132.00	SILTY F. SAND. Yellowish brown.		Undisturbed ○ C-20C
132.60	F. SAND WITH SILT. Brownish gray. Loose core.		
133.10	F. TO M. SAND WITH SILT. Brownish gray. 133.3m containing gravel (max. dia.=2cm).		Disturbed ● C-13S
133.90	F. SAND WITH SILT. Brownish gray. Loose core. 134.7m subrounded gravel (dia.=1.5cm) contained.		
136.52	M. TO C. SAND WITH SILT. Brownish gray.		
136.72	M. SAND WITH SILT. Brownish gray.		
137.00	FINE SAND. Brownish gray. Loose core.		Disturbed ● C-14S
139.00	M. SAND TO GRANULE. Brownish gray. Loose core. Trace of gravel.		
139.47	FINE SAND. Brownish gray. Loose core.		
140.00	SILTY F. SAND. Yellowish brown. 140.0–140.1m with gravel.		
140.50	FINE SAND. Brownish gray. Loose core.		Disturbed ● C-15S
142.00	F. TO M. SAND WITH SILT. Brownish gray. Trace of granule. Loose.		
142.35	CLAY. Brownish gray mottled with gray. 143.4m, 143.8m slickenside, 45 deg. dip.	Diatom ●, Foraminifera ●, Cl concent. ●	Undisturbed ○ C-21C
147.00	SANDY SILT. Brownish gray to gray. 147.5–147.62m, 147.8–147.9m, 148.28–148.5m limestone.		
148.50	SILT. Brownish gray mottled with gray. Trace of gravel. Black patches scattered up to 150.0m. 153.0–155.0m, 157.45–157.6m, 157.6–159.1m calcareous, hard.		
159.15	SILTY F. TO C. SAND. Yellowish brown mottled with gray. Normal grading. 159.75–160.0m containing granule.		

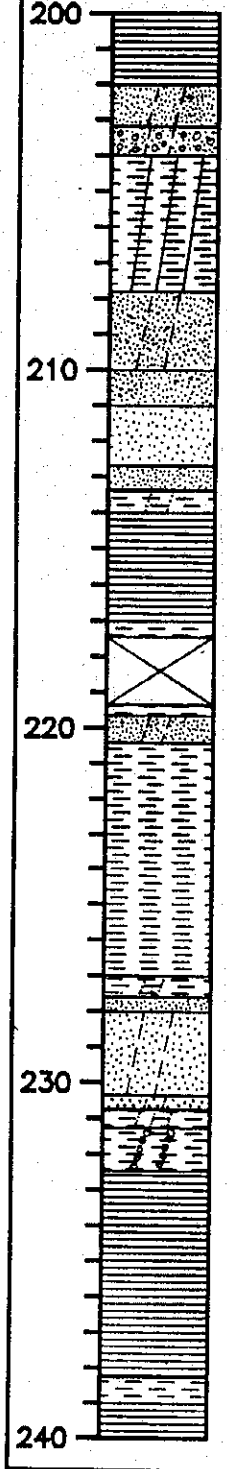
LITHOLOGIC LOG OF SITE-C



BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
160.15	SILTY F. SAND. Brownish gray. Loose core.
162.00	GRAVEL WITH SILT. Brownish gray. Subrounded to angular. Dia.=2cm.
162.70	SILT WITH GRAVEL. Brown. More gravelly in upper portion.
163.25	SILT. Brown. Reverse grading. Moderately consolidated.
164.40	CLAY WITH GRAVEL. Brown. Subangular, calcareous (dia.=0.5 to 3cm).
164.85	SILT. Brown mottled with gray. Well consolidated.
165.33	SANDY SILT. Brown. With m. to c. sand. Poor sorted.
166.15	SANDY SILT. Brown. Loose core. 169.9–170.0m silt with f. sand. Trace of gravel.
170.00	SILT. Yellowish brown mottled with gray. 170.7–170.75m, 170.85–171.0m cemented like limestone.
171.35	SILT. Reddish brown mottled with gray. Partly well consolidated.
175.30	SANDY SILT. Yellowish brown. Normal grading.
176.00	SILTY F. SAND. Yellowish brown mottled with gray.
177.16	M. TO C. SAND WITH SILT. Yellowish brown. Trace of granule.
177.65	F. SAND WITH SILT. Yellowish brown.
178.00	SILT. Yellowish gray.
178.57	SILTY F. SAND. Brownish gray. Loose core.
179.00	SANDY SILT. Yellowish brown mottled with gray.
	SILT. Brownish gray mottled with gray. 181.6–181.9m, 182.2–182.3m, 182.55–182.65m, 183.45–183.95m well consolidated like limestone.
184.45	Core loss.
185.00	SILT. Yellowish brown.
185.28	SILT WITH F. TO M. SAND. Yellowish brown.
186.12	M. SAND WITH SILT. Brownish gray. Loose core.
186.35	SILTY M. TO F. SAND. Gray to yellowish brown.
187.00	M. TO F. SAND. Yellowish brown. Reverse grading.
187.80	SILT. Yellowish brown mottled with light gray.
189.10	CLAY. Yellowish brown mottled with gray. Partly well consolidated. 193.15m calcareous nodule. 193.5–194m slickenside, 45 deg. dip.
195.00	CLAY. Reddish brown. Fractured. Slickenside.
197.30	CLAY. Yellowish brown mottled with gray. Partly well consolidated. Trace of oxidized Fe and Mg nodules.

SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
				● C-18S	
	●	●			○ C-22C
				● C-17S	
				● C-18S	
	●	●	●		
					○ C-23C

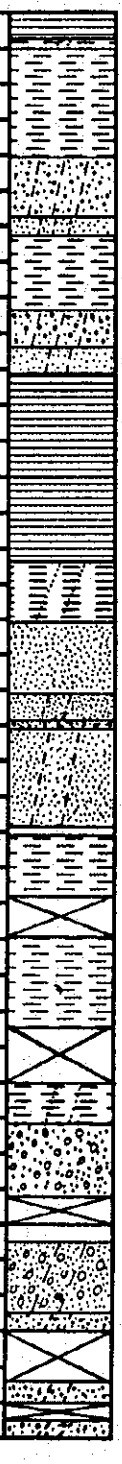
LITHOLOGIC LOG OF SITE-C



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
	202.00	V. F. SAND WITH SILT. Yellowish brown. Loose core.
	203.18	F. SAND TO GRANULE WITH SILT. Yellowish gray. Trace of gravel.
	204.00	CLAYEY SILT. Yellowish brown mottled with gray.
	207.80	V.F. SAND WITH SILT. Brownish gray. 207.8–209.95m loose core. 209.95–210.0m silt.
	210.00	V.F. SAND. Gray. Well sorted.
	211.00	FINE SAND. Yellowish gray. Loose core.
	212.70	V.F. SAND. Brownish gray.
	213.35	SILT WITH V.F. SAND. Gray to yellowish gray.
	214.00	CLAY. Gray to brownish gray. Moderately consolidated. 216.65–216.75m containing calcareous nodules (dia.=1 to 3cm).
	217.00	SILT. Light gray. Well consolidated.
	217.45	Core loss.
	219.35	SILT. Gray to brownish gray.
	219.65	V.F. SAND WITH SILT. Brownish gray. Loose core.
	220.42	SILT. Gray to yellowish gray. 222.55–222.8m, 223.6–223.65m containing nodules. 225.2–225.5m well consolidated limestone.
	227.00	SILT WITH V.F. SAND. Gray to yellowish gray. Normal grading.
	227.58	V.F. SAND. Yellowish brown.
	228.00	SILTY F. SAND. Yellowish brown. Loose core. 230.0–230.35m sandy silt.
	230.35	M. TO V.C. SAND WITH SILT. Gray to yellowish gray. Poor sorted.
	230.75	SANDY SILT. Yellowish brown.
	231.25	SILT WITH GRANULE. Light to yellowish gray. 231.25–231.55m, 232.15–232.35m granule rich.
	232.45	CLAY. Gray to yellowish gray. 235.6–235.8m, 237.7–237.85m oxidized black nodule. 234.55–234.6m, 235.85–236.0m, 236.55–236.6m limestone.
	238.25	SILT. Yellowish gray. 238.25–238.45m well consolidated.
	238.9	238.9–239.0m silt with sand.
	239.00	CLAY. Yellowish brown to gray. Containing calcareous nodules.

SAMPLE						
CORE ANALYSIS				SOIL TEST		
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed	
	●					
		●				
					○ C-24C	
				● C-19S		
				● C-20S		
	●	●	●			
					○ C-25C	
				● C-21S		

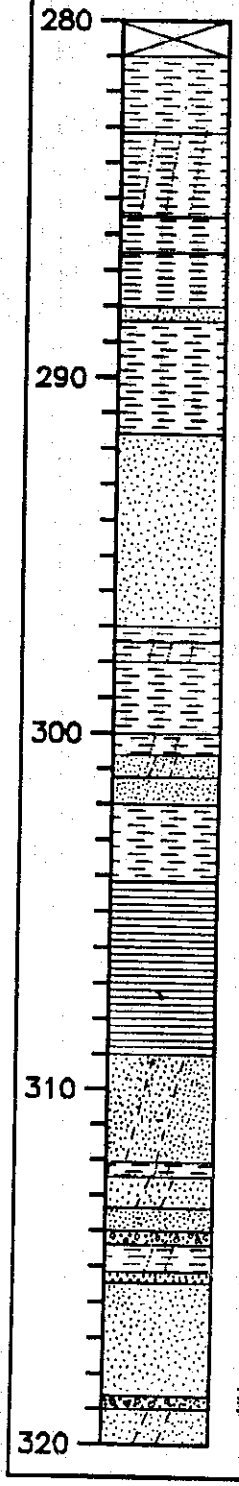
LITHOLOGIC LOG OF SITE-C



DEPTH (m)	BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
240	240.70	SILT WITH V.F. SAND. Brownish gray. Loose core.
	241.00	SILT. Yellowish brown to gray. Trace of calcareous nodules. 241.5–242.8m mottled with reddish brown.
	244.05	SILTY F. TO C. SAND. Light gray. Poor sorted. 244.9–245.0m containing granule. 245.0–245.75m with gravel.
	245.75	SILTY F. SAND. Yellowish brown.
	246.26	SILT. Yellowish brown to gray.
	248.35	SILTY F. TO M. SAND. Light to yellowish gray.
	248.40	F. TO V.F. SAND WITH SILT. Brownish gray. Loose core.
250	250.12	249.5–250.12m V.F. sand with silt. CLAY. Yellowish brown to gray. Containing calcareous nodules.
	253.00	CLAY. Reddish brown mottled with gray. Partly consolidated. Fractured.
	255.35	SILT WITH V.F. SAND. Yellowish brown. Normal grading.
	257.10	V.F. TO F. SAND. Gray to brownish gray. 258.7–259.0m fine sand. Loose core.
	259.10	V.F. SAND WITH SILT. Dark gray. Loose core.
260	259.65	F. TO M. SAND WITH SILT. Brownish gray. Loose core.
	260.10	V.F. SAND WITH SILT. Dark brownish gray. Loose core.
	262.85	CONGLOMERATE. Brownish gray. Gravel is angular, max. dia.=2cm.
	263.10	SILT. Yellowish brown mottled with gray. Well consolidated.
	264.80	Core loss.
	265.92	SILT. Yellowish brown mottled with gray. Well consolidated like mudstone.
	268.45	Core loss.
270	270.00	SILT WITH F. SAND. Light to yellowish gray.
	271.15	M. SAND TO GRANULE. Light gray to yellowish brown. Containing gravel (dia.=0.5 to 1cm).
	273.20	Core loss.
	274.00	F. SAND TO GRANULE WITH SILT. Trace of gravel (max. dia.=3cm).
	274.50	Core loss.
	276.50	F. TO C. SAND WITH SILT. Yellowish brown. Trace of gravel.
	277.00	Core loss.
	278.40	F. TO C. SAND WITH SILT. Gray to brownish gray.
	279.00	Core loss.
	279.50	M. TO C. SAND WITH SILT. Yellowish brown. Trace of granule.
280	280.00	Core loss.

SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●			○ C-26C
				● C-22S	
				● C-23S	
				● C-24S	
				● C-25S	

LITHOLOGIC LOG OF SITE-C

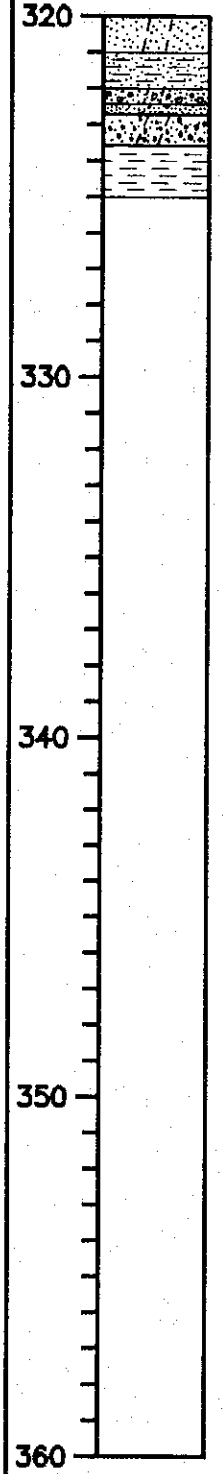


BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
280.00	Core loss.
281.00	SILT. Yellowish brown mottled with gray.
283.15	SANDY SILT. Yellowish brown. Well consolidated. Trace of white to gray patches (dia.=0.1 to 0.3cm).
285.50	SILT. Reddish brown to gray. Well consolidated.
286.50	SILT. Reddish brown mottled with gray. Well consolidated.
288.00	F. SAND WITH SILT. Poor sorted.
288.40	SILT. Yellowish brown mottled with gray. Slickenside.
291.60	FINE SAND. Dark yellowish brown. Loose core.
297.00	SILT. Brownish gray.
297.45	SANDY SILT. Gray to brownish gray. 297.6-297.8m with granule.
298.00	SILT. Gray to brownish gray. Well consolidated. Trace of calcareous nodules.
300.00	SILT WITH V.F. SAND. Yellowish gray. Soft core.
300.60	V.F. TO F. SAND WITH SILT. Light yellowish gray.
301.25	V.F. SAND. Dark brownish gray. Loose core.
302.00	SILT. Yellowish brown to gray.
304.15	CLAY. Reddish to yellowish brown mottled with gray. Containing well consolidated nodules.
309.00	V.F. SAND WITH SILT. Dark brown. Loose core.
312.05	SILT WITH V.F. SAND. Yellowish gray.
312.47	F. SAND WITH SILT. Gray to yellowish gray.
313.35	V.F. SAND. Brown. Loose core.
314.00	C. SAND TO GRANULE WITH SILT. Light gray. Poor sorted.
314.40	SILT WITH F. SAND. Gray to yellowish gray. Well consolidated.
315.15	M. SAND WITH SILT. Light gray.
315.45	FINE SAND. Brown to dark brownish gray. Loose core.
318.63	M. SAND TO GRANULE. Gray. Poor sorted. Soft core.
319.00	F. SAND WITH SILT. Brown.

SAMPLE

CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
	●	●	●		○ C-27C
					○ C-28C
				● C-26S	
				● C-27S	
				● C-28S	
	●	●	●		
				● C-29S	
				● C-30S	

LITHOLOGIC LOG OF SITE-C

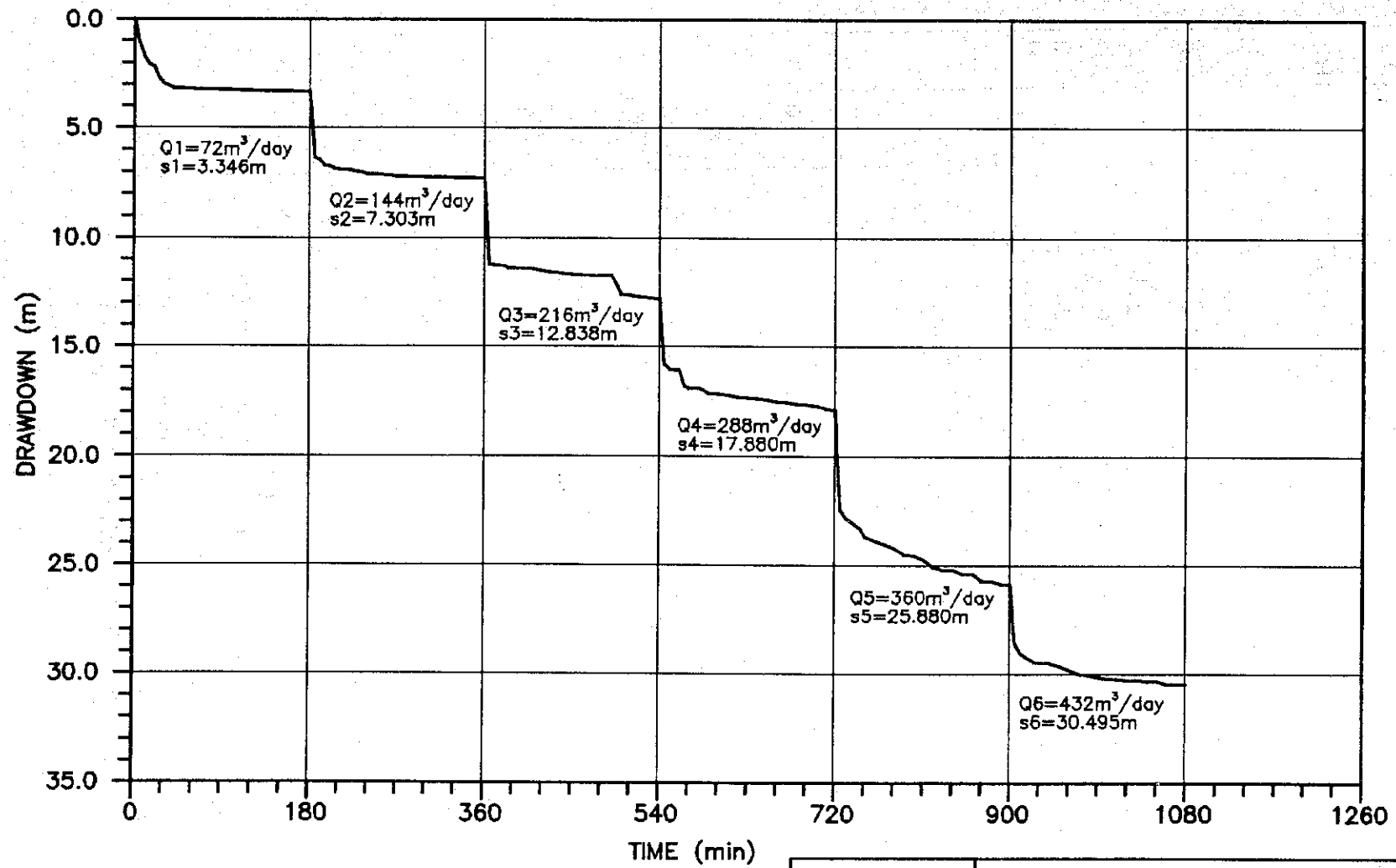


BOUNDARY DEPTH (m)	GEOLOGIC DISCRIPTION
321.00	F. SAND AND SILT ALTERNATION. Brown. Sand is loose.
322.00	F. SAND TO GRANULE WITH SILT. Light gray.
322.42	V.F. SAND WITH SILT. Brownish gray. Loose core.
322.70	F. TO M. SAND WITH SILT. Light brown. 323.1-323.4m with gravel.
323.55	SILT. Gray to yellowish gray. Well consolidated.
325.00	(End of bore hole).

SAMPLE					
CORE ANALYSIS				SOIL TEST	
C-14	Diatom	Foraminifera	Cl concent.	Disturbed	Undisturbed
				C-31S	

B. PUMPING TESTS

B.1 Pumping tests results of Site-A

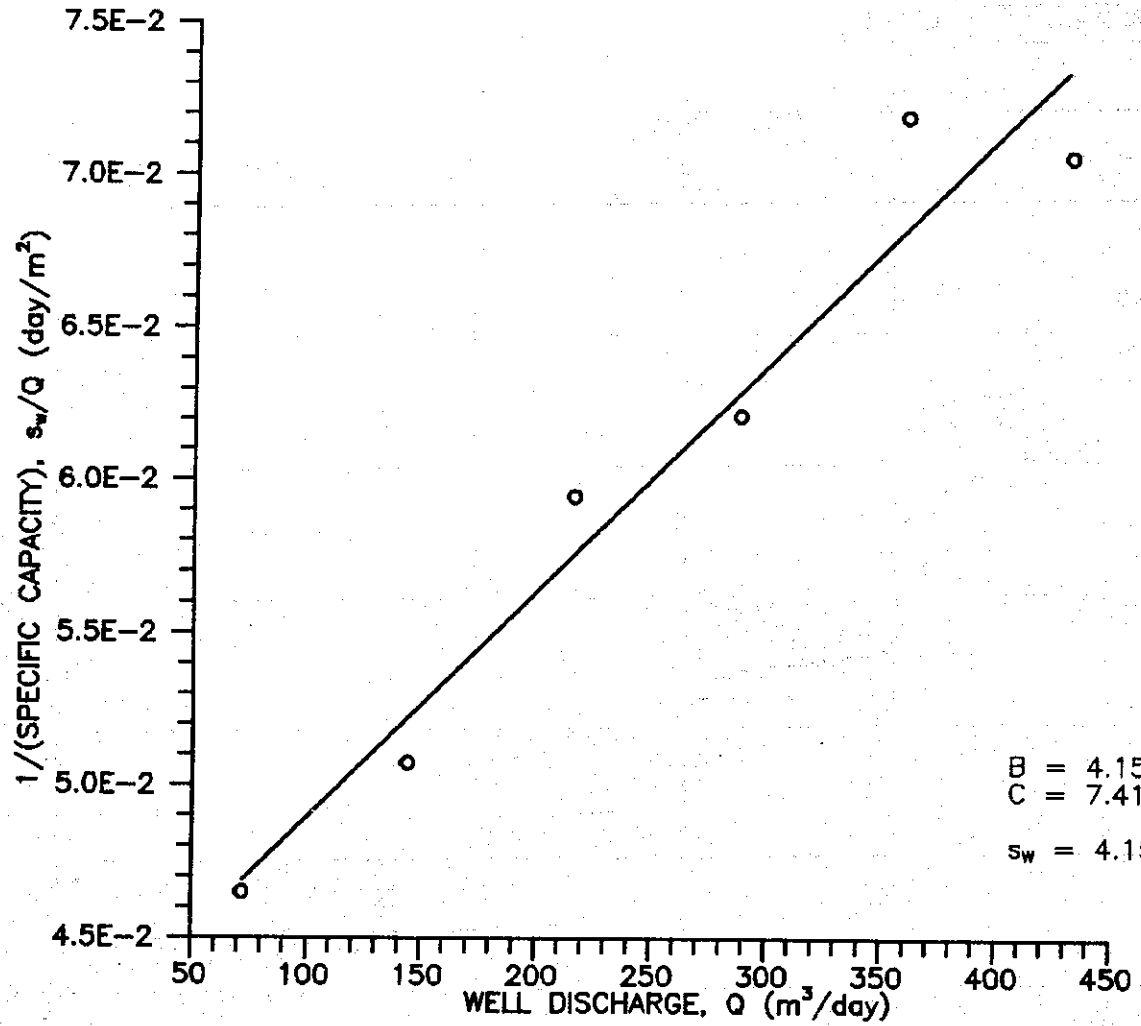


STEP-DRAWDOWN TEST AT JICA A-2 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.

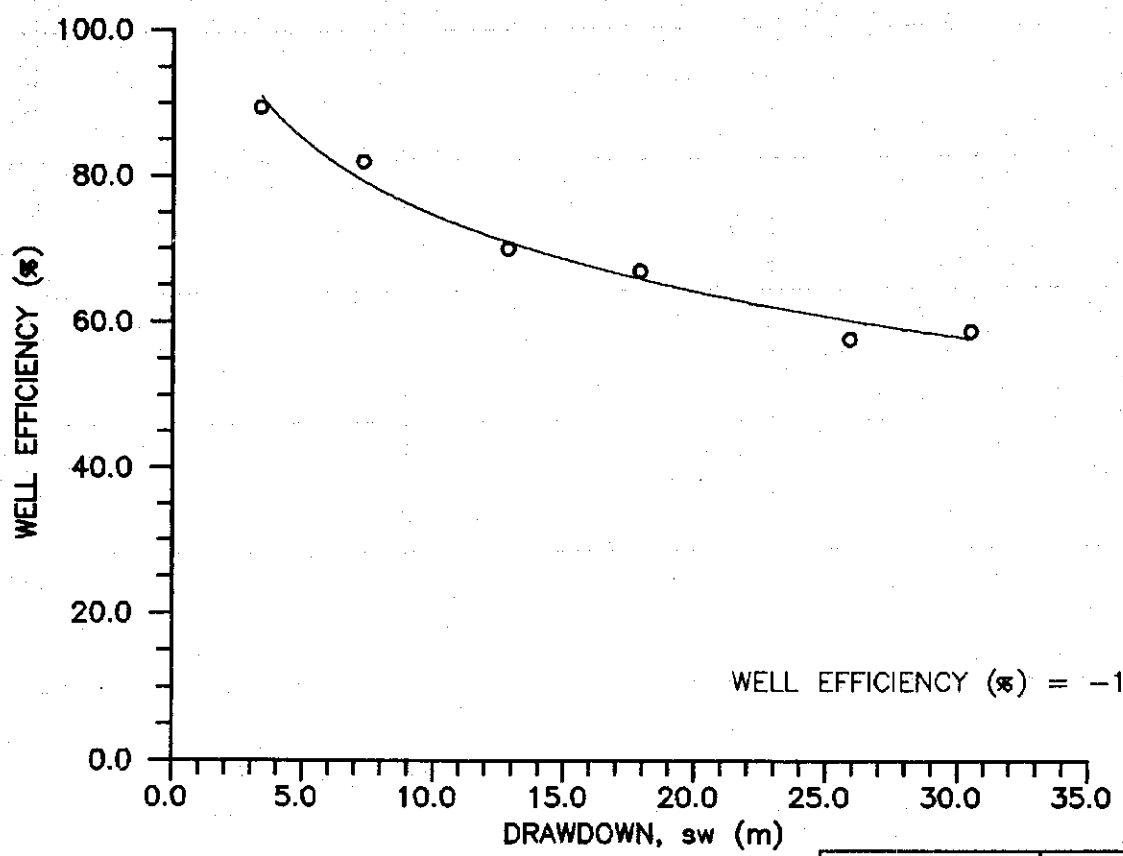
B.1-1



DETERMINATION OF B AND C FROM STEP-DRAWDOWN TEST (JICA A-2 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

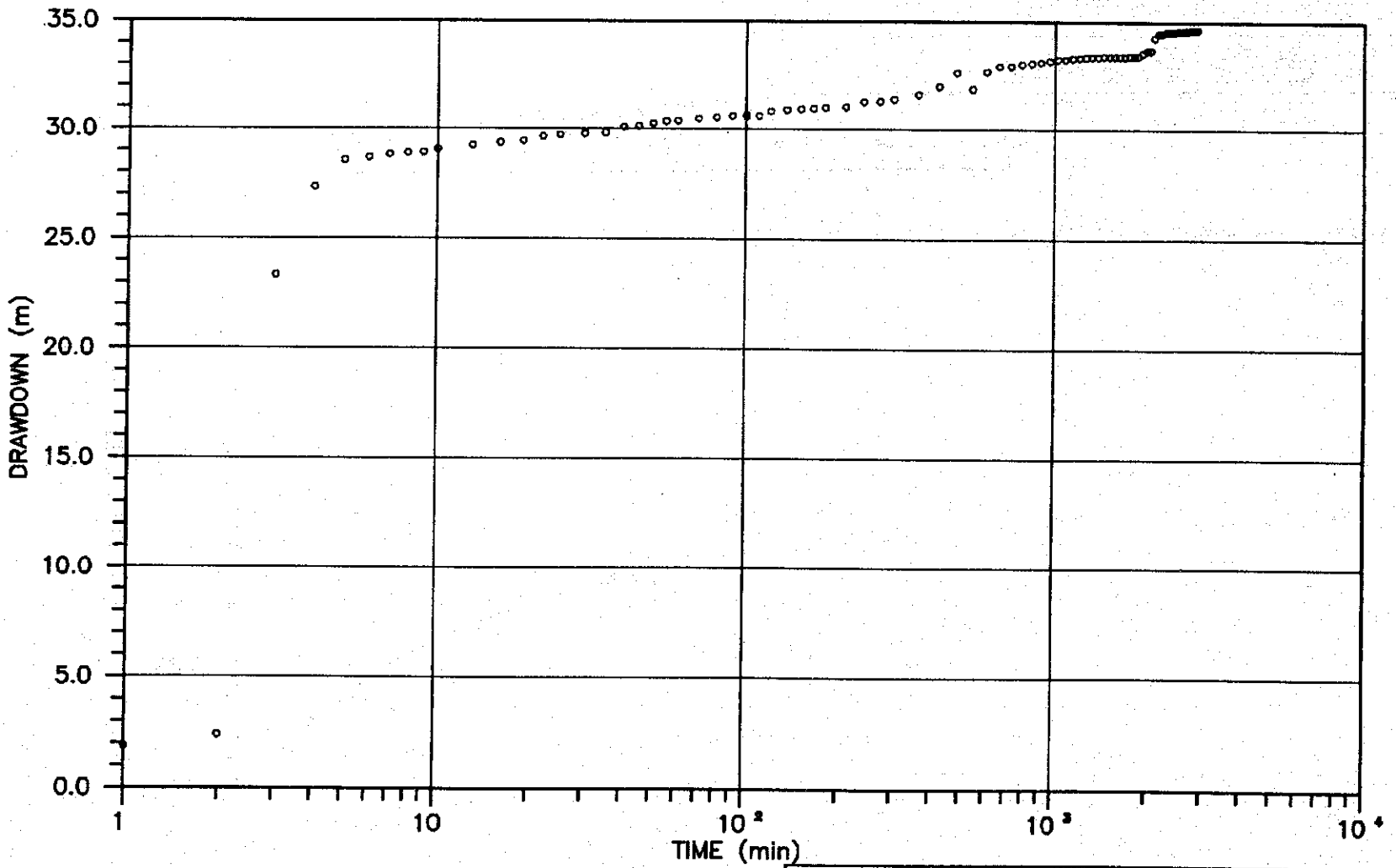
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



VARIATION OF WELL EFFICIENCY WITH DRAWDOWN (JICA A-2 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.

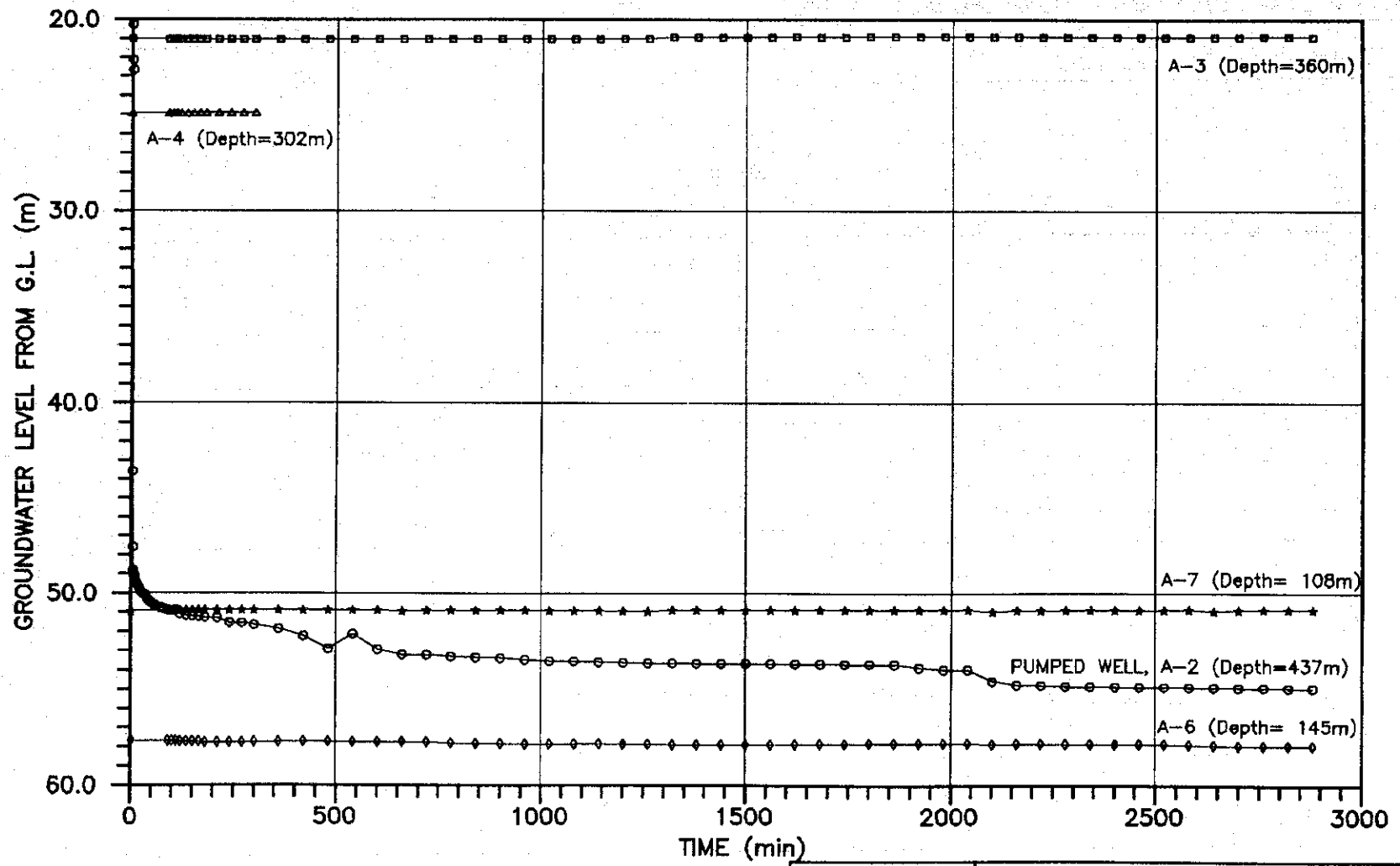


LOCATION	: SITE-A (LAT KRABANG)	DATE	: 25-27 MAY, 1993
UTM GRID	: 879215	DISCHARGE	: 360 m^3/day (250.0 l/min)
WELL DEPTH	: 437.00m		
SCREEN DEPTH	: 428.19-436.495m	STATIC W.L.	: 20.292 m
SCREEN LENGTH	: 8.305m	WELL RADIUS	: 0.1016m

CONTINUOUS PUMPING TEST AT JICA A-2 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.

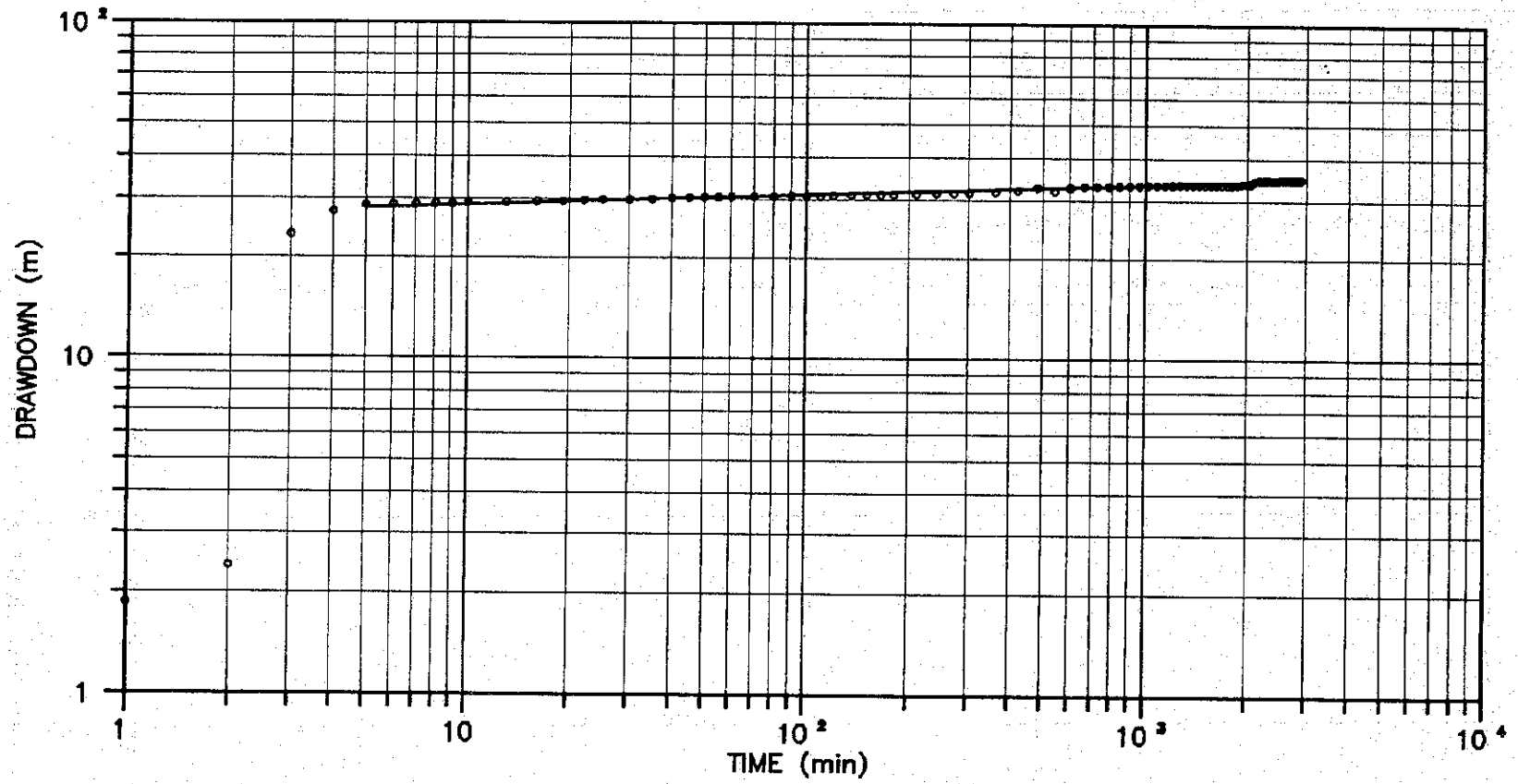


DATE : 25-27 MAY, 1993
PUMPED WELL : JICA A-2 WELL
DISCHARGE : 360 m^3/day
(250 l/min)

GROUNDWATER LEVEL CHANGES DURING CONTINUOUS PUMPING TEST AT JICA A-2 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



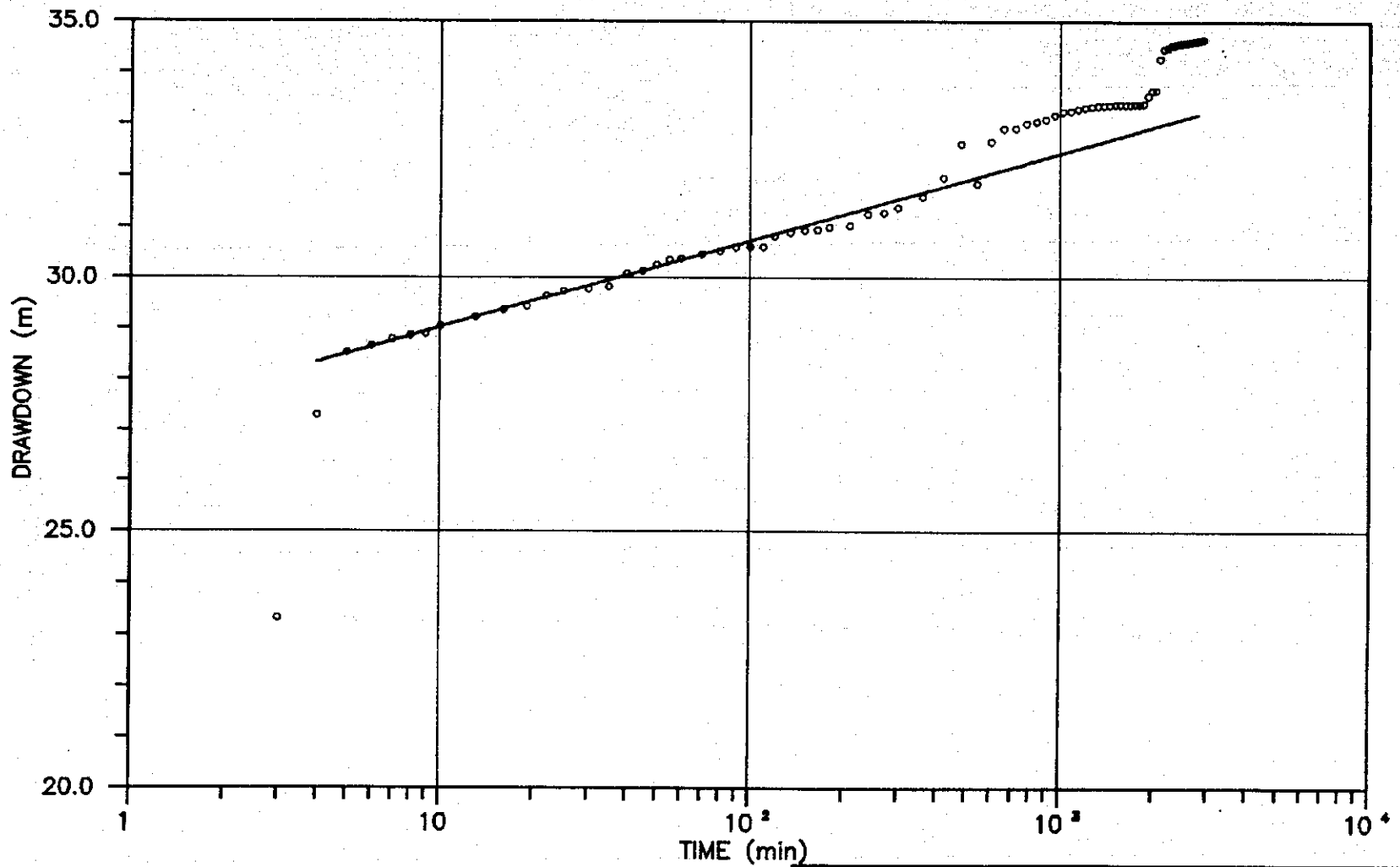
—— COMPUTED DRAWDOWN
○○○○○ MEASURED DRAWDOWN

RESULT
T = 29.3 m^2/day
S = 7.73E−12
SD = 3.53E−01 m

THEIS TYPE−CURVE MATCHING
(JICA A−2 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



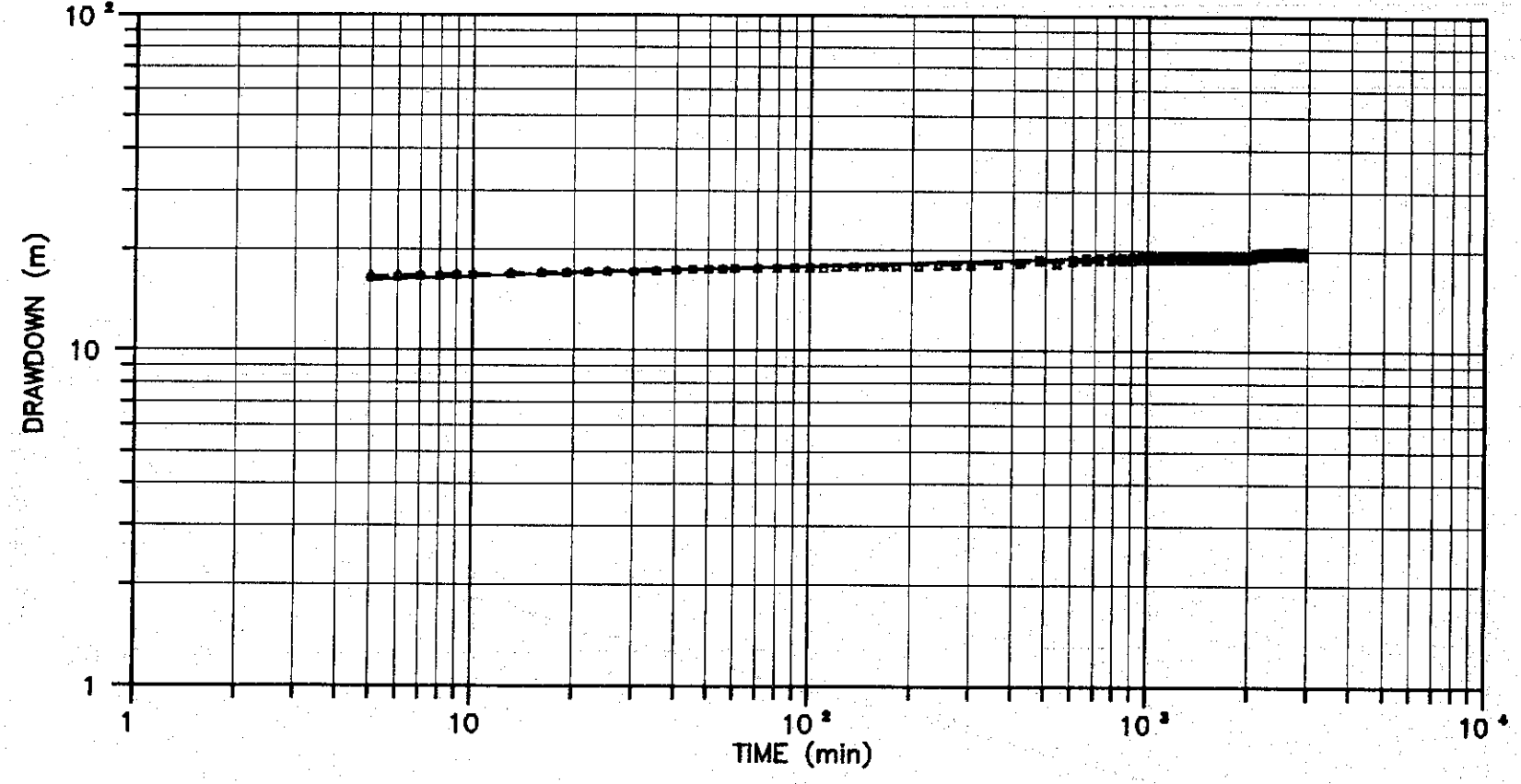
○○○○○ MEASURED DRAWDOWN
—— FITTED LINE

RESULT
Δs = 1.704E−01 m
T = 38.7 m²/day
S = 5.49E−16

COOPER−JACOB METHOD ANALYSIS
(JICA A−2 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



RESULT
CORRECTED DRAWDOWN 1
T = 50.8 m²/day
S = 1.34E−11
SD = 2.04E−01 m

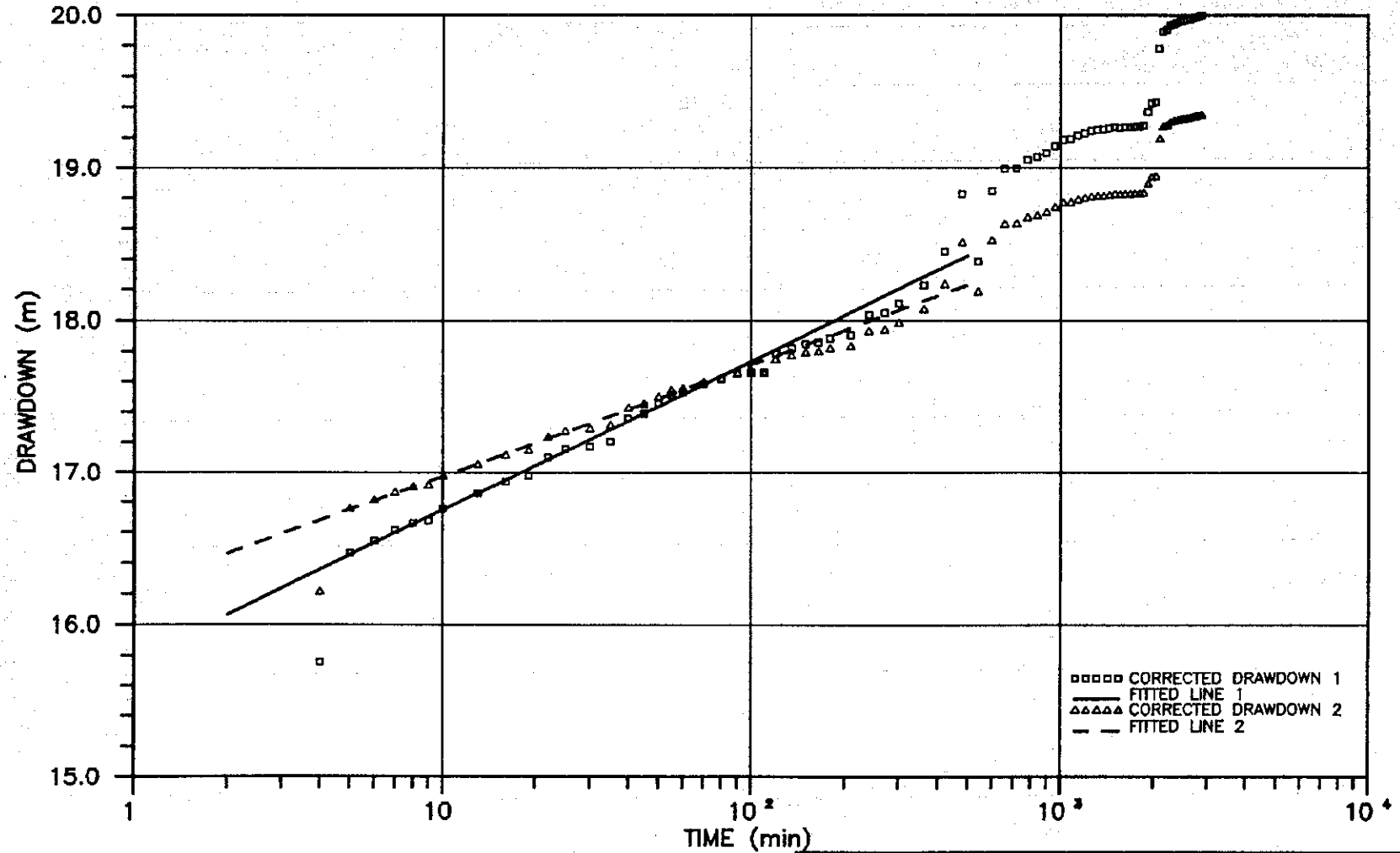
CORRECTED DRAWDOWN 2
T = 69.5 m²/day
S = 1.93E−16
SD = 1.43E−01 m

□□□□□ CORRECTED DRAWDOWN 1
——— COMPUTED DRAWDOWN 1
△△△△△ CORRECTED DRAWDOWN 2
— — COMPUTED DRAWDOWN 2

THEIS TYPE−CURVE MATCHING USING CORRECTED DRAWDOWN (JICA A−2 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



RESULT

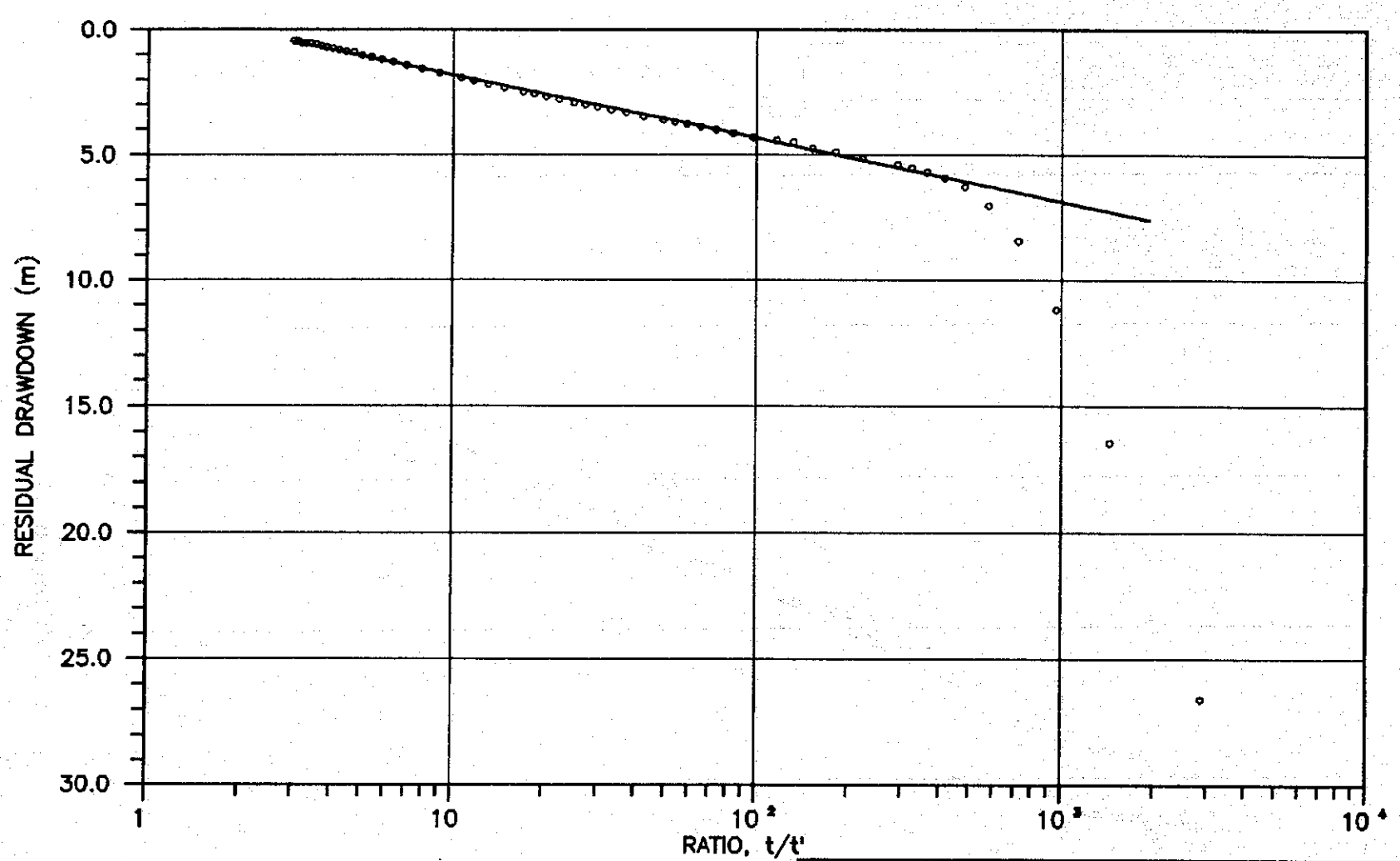
CORRECTED DRAWDOWN 1
Δs = 9.834E−01 m
T = 67.0 m^2/day
S = 9.43E−16

CORRECTED DRAWDOWN 2
Δs = 7.381E−01 m
T = 89.3 m^2/day
S = 1.37E−21

COOPER−JACOB METHOD ANALYSIS USING CORRECTED DRAWODOWN (JICA A−2 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



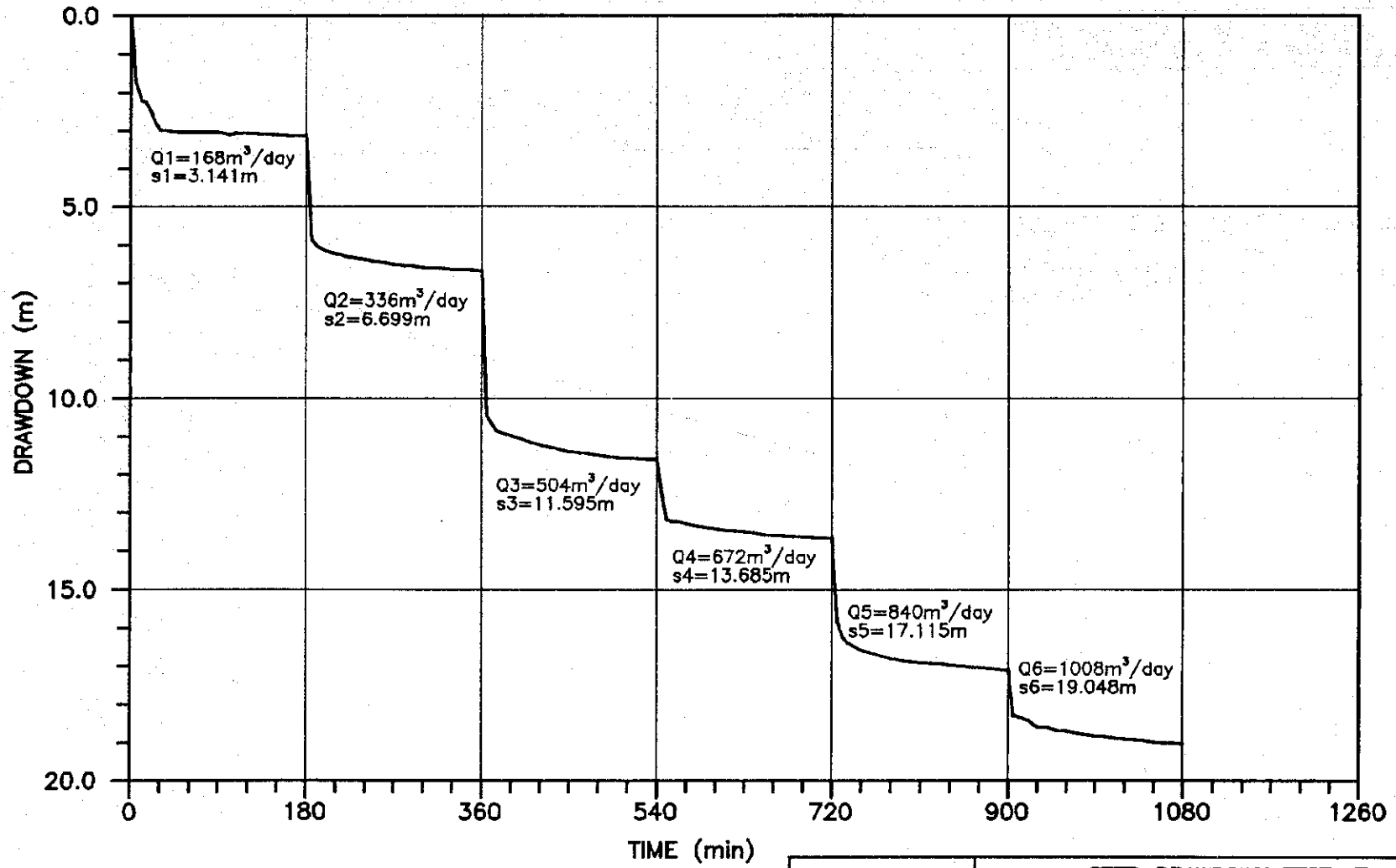
ooooo MEASURED DATA
——— FITTED LINE

RESULT
Δs' = 2.528E+00 m
T = 26.06 m²/day

RECOVERY METHOD ANALYSIS
(JICA A-2 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

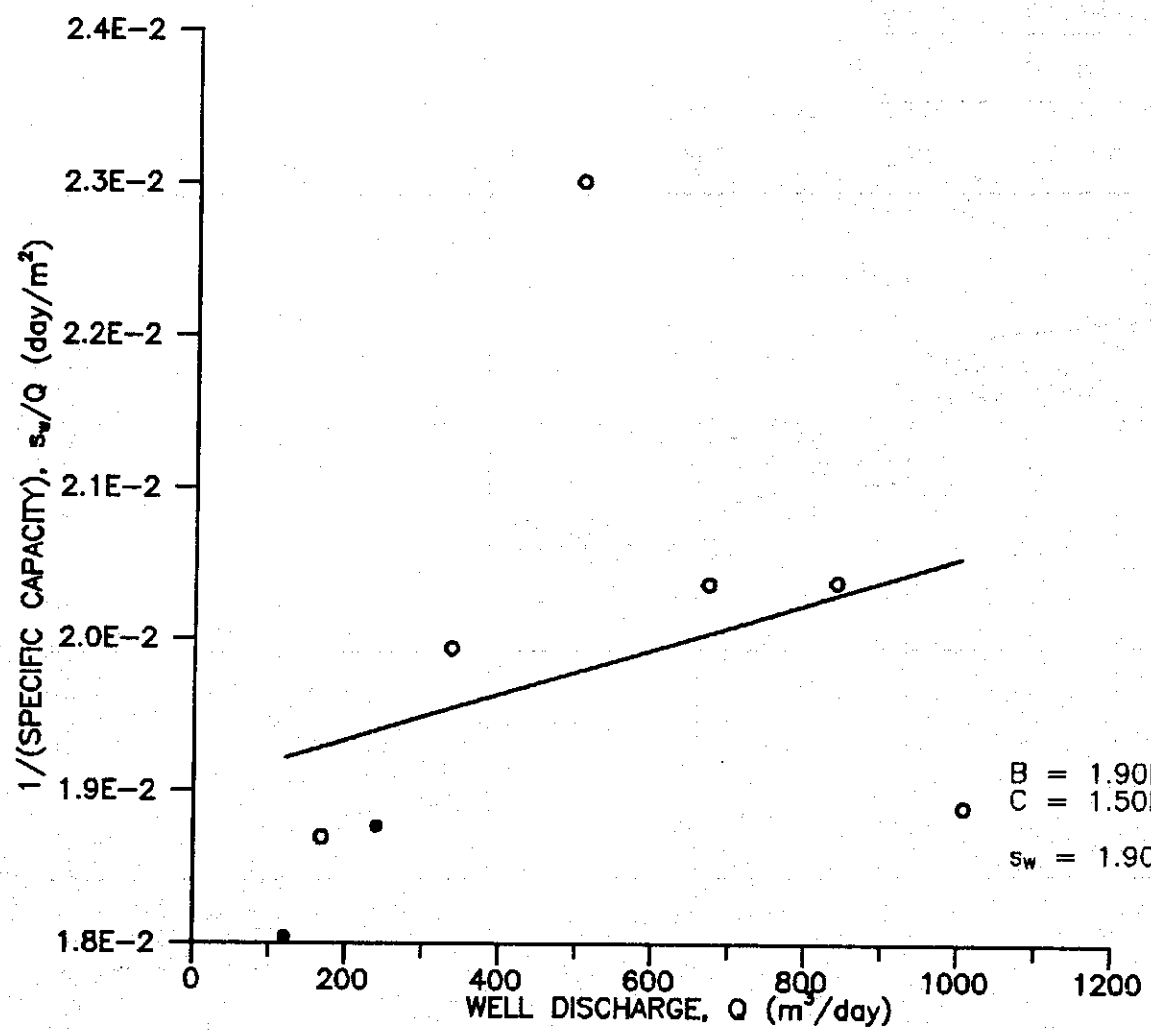
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



STEP-DRAWDOWN TEST AT JICA A-3 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

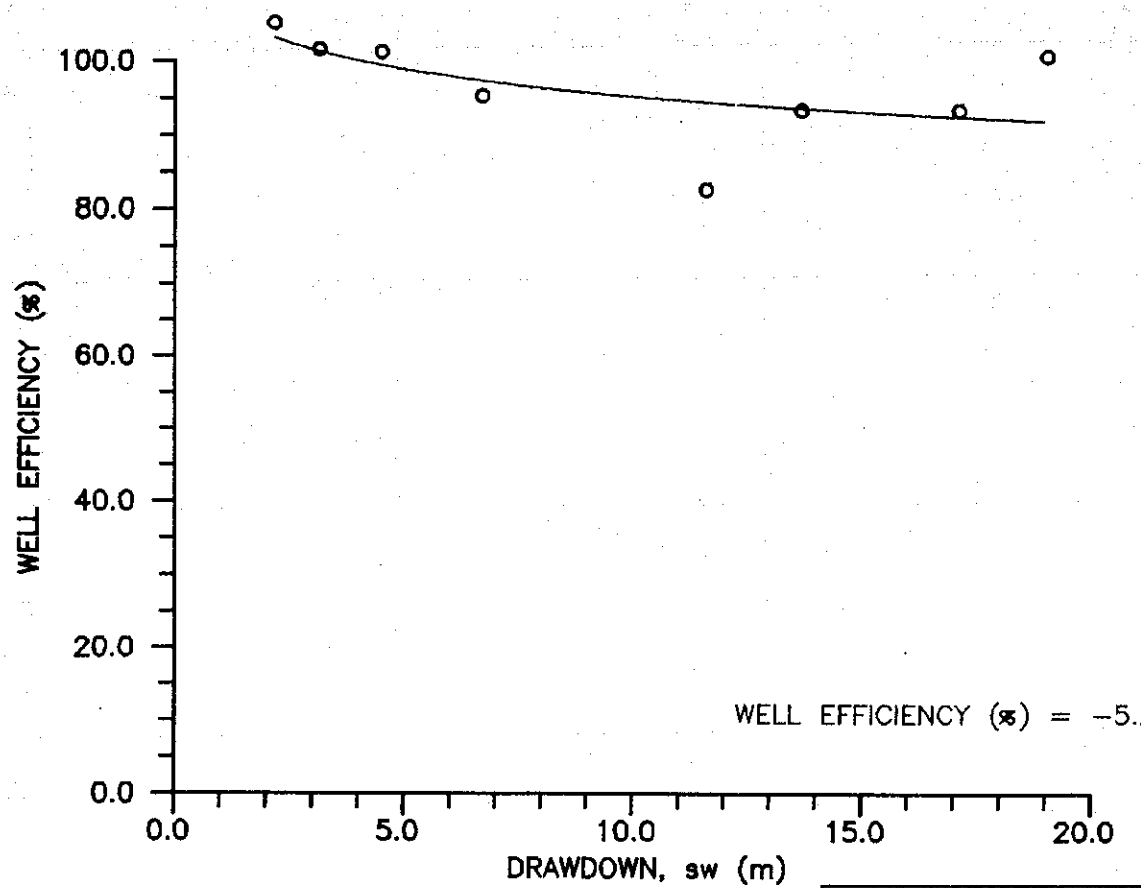
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



DETERMINATION OF B AND C FROM STEP-DRAWDOWN TEST (JICA A-3 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

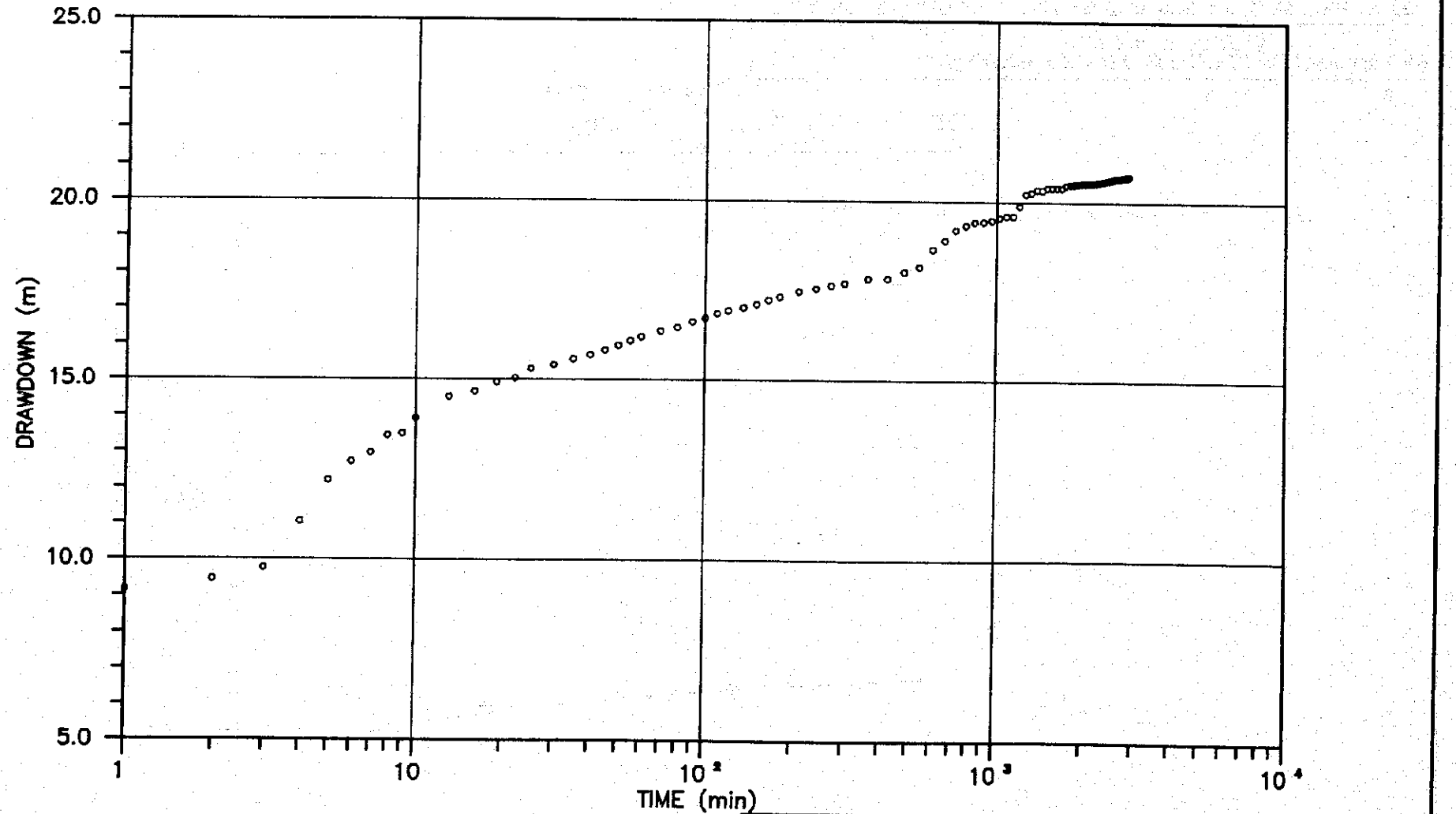
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



VARIATION OF WELL EFFICIENCY WITH DRAWDOWN (JICA A-3 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.

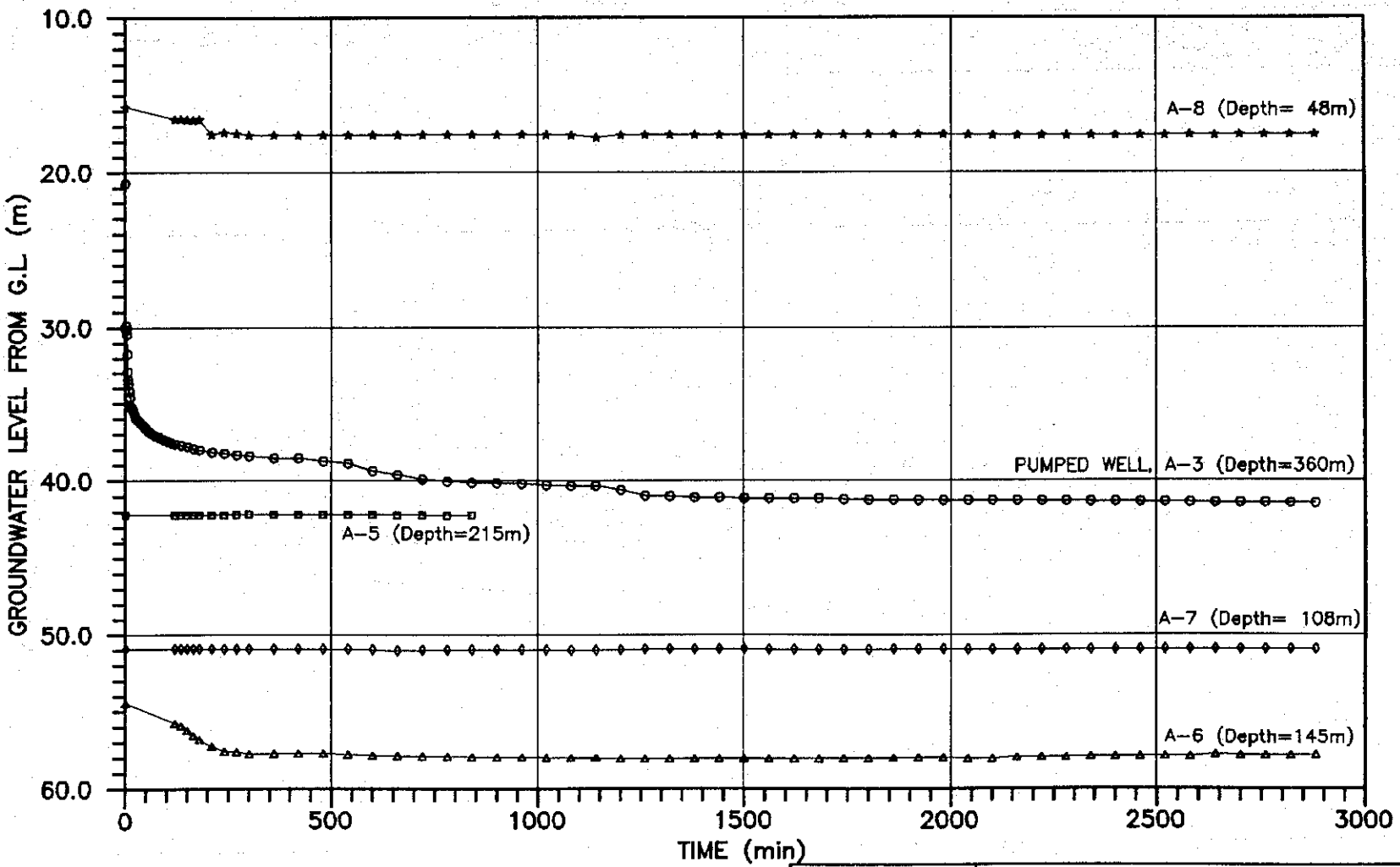


LOCATION	: SITE-A (LAT KRABANG)	DATE	: 21-23 MAY, 1993
UTM GRID	: 879215	DISCHARGE	: 1008 m^3/day (700.0 l/min)
WELL DEPTH	: 360.00m		
SCREEN DEPTH	: 351.19-359.495m	STATIC W.L.	: 20.725 m
SCREEN LENGTH	: 8.305m	WELL RADIUS	: 0.1016m

CONTINUOUS PUMPING TEST
AT JICA A-3 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.

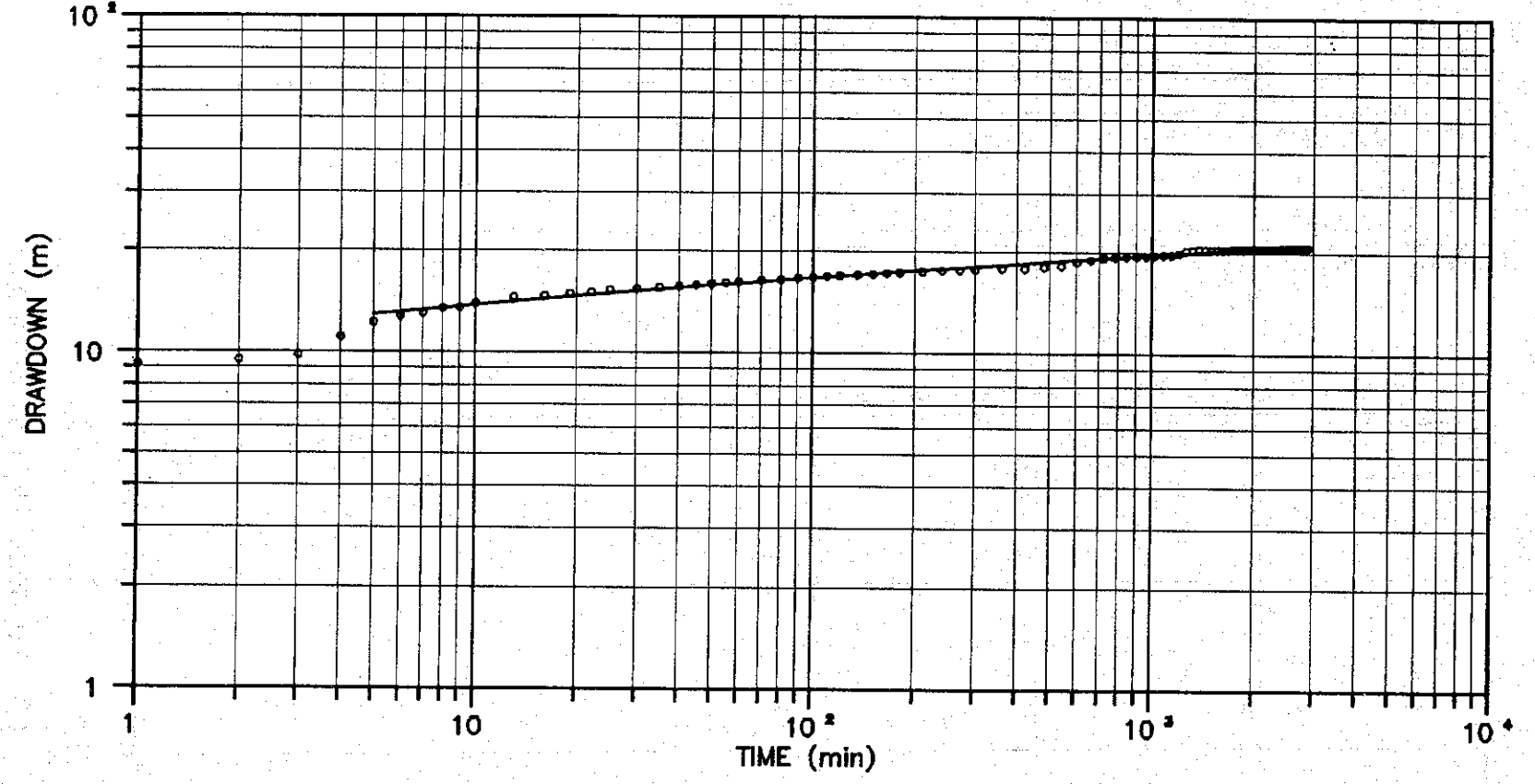


DATE : 21-23 MAY, 1993
PUMPED WELL : JICA A-3 WELL
DISCHARGE : 1008 m^3/day
(700 l/min)

GROUNDWATER LEVEL CHANGES DURING CONTINUOUS PUMPING TEST AT JICA A-3 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



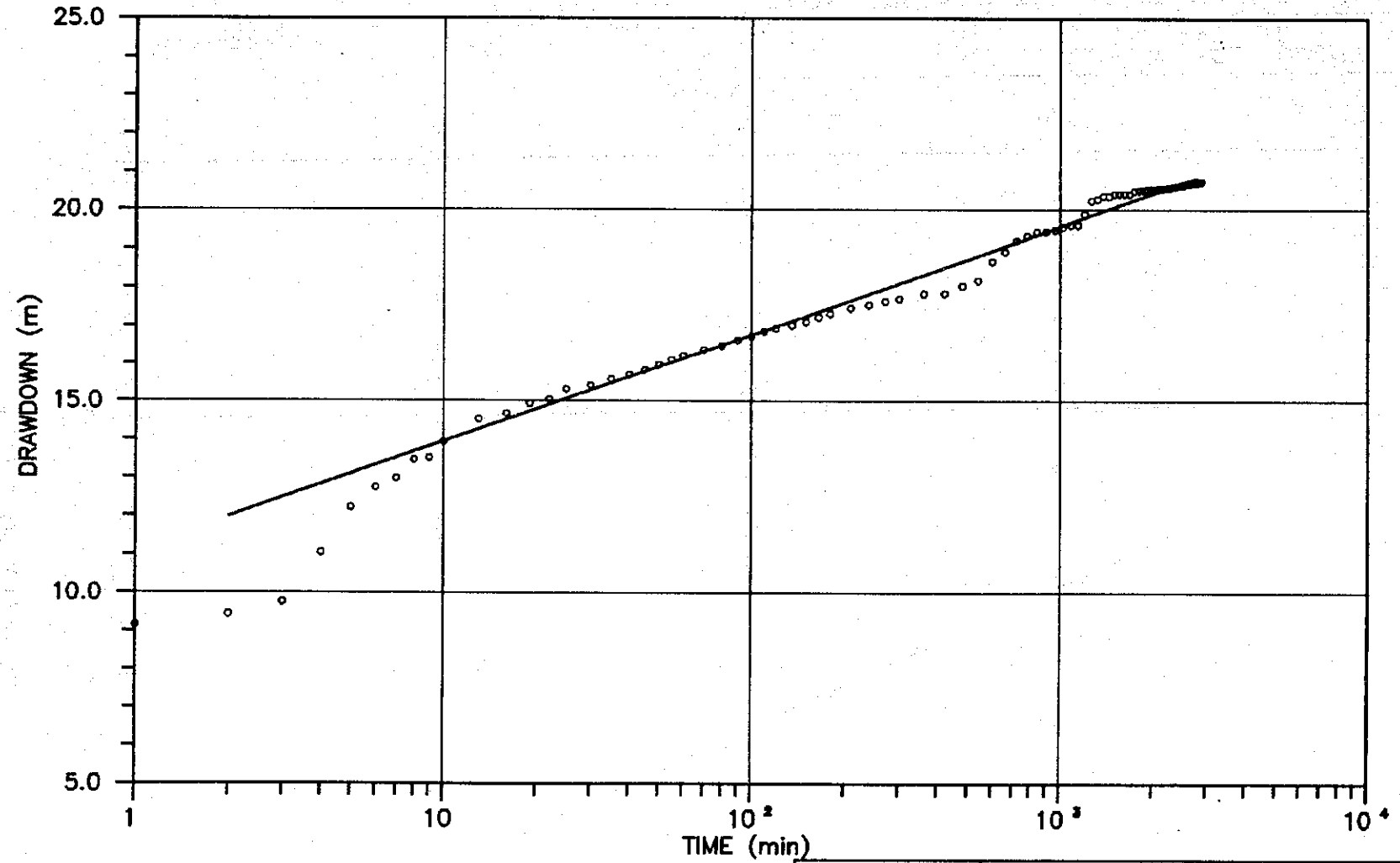
—— COMPUTED DRAWDOWN
ooooo MEASURED DRAWDOWN

RESULT
T = 63.7 m²/day
S = 1.71E-03
SD = 2.46E-01 m

THEIS TYPE-CURVE MATCHING
(JICA A-3 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

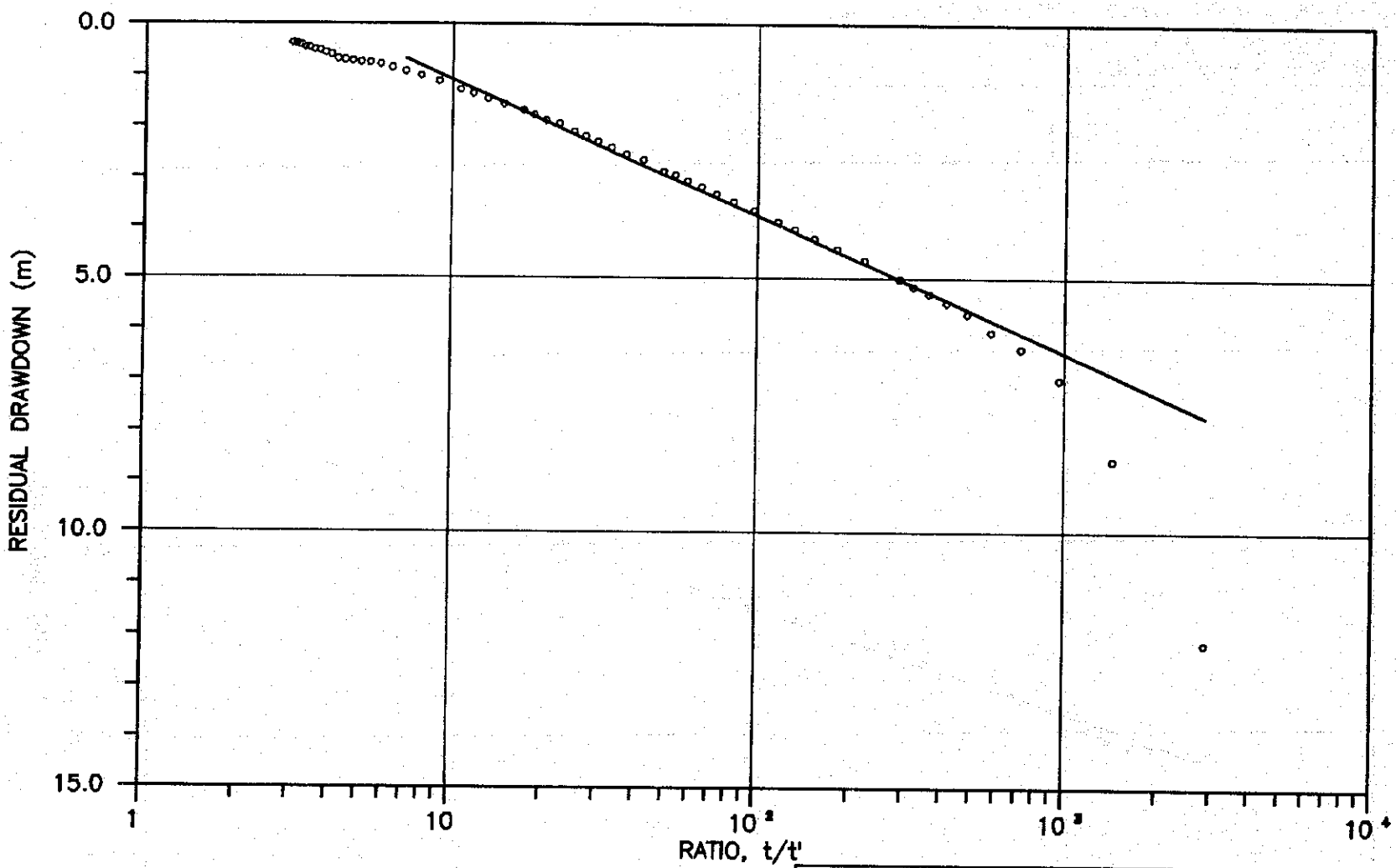
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



COOPER–JACOB METHOD ANALYSIS
(JICA A–3 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



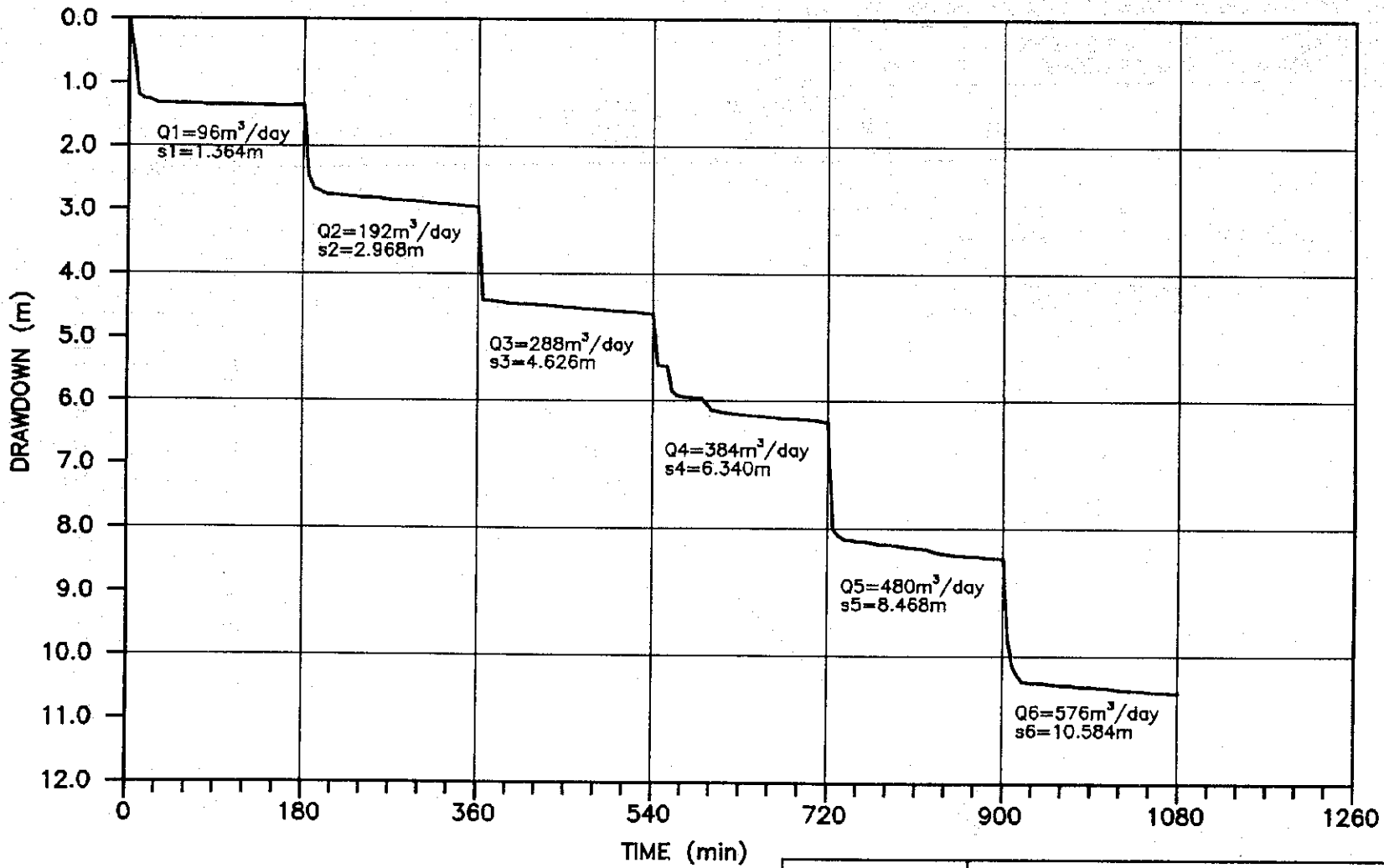
ooooo MEASURED DATA
—— FITTED LINE

RESULT
Δs' = 2.687E+00 m
T = 68.7 m²/day

RECOVERY METHOD ANALYSIS
(JICA A-3 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

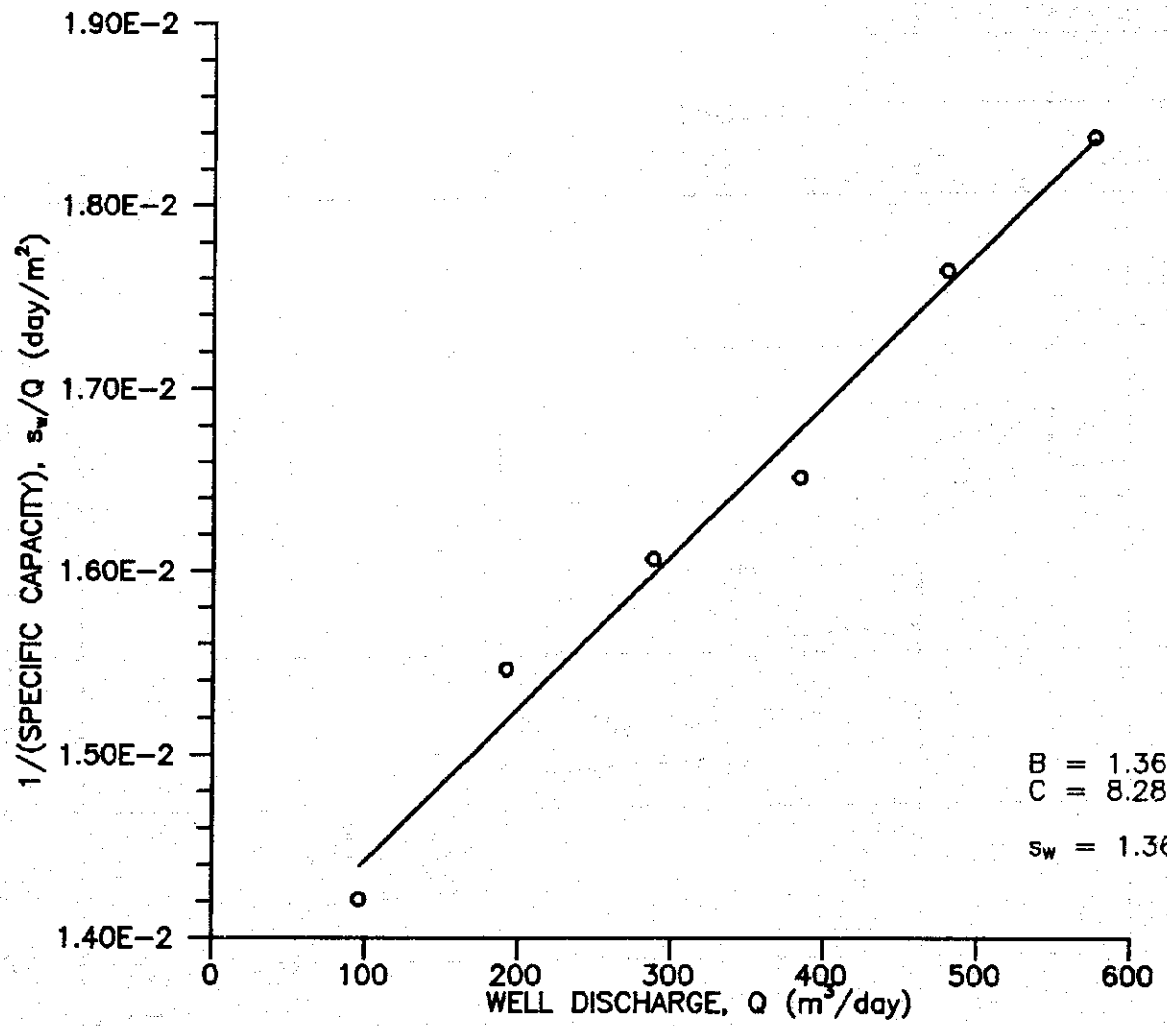
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



STEP-DRAWDOWN TEST AT JICA A-4 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

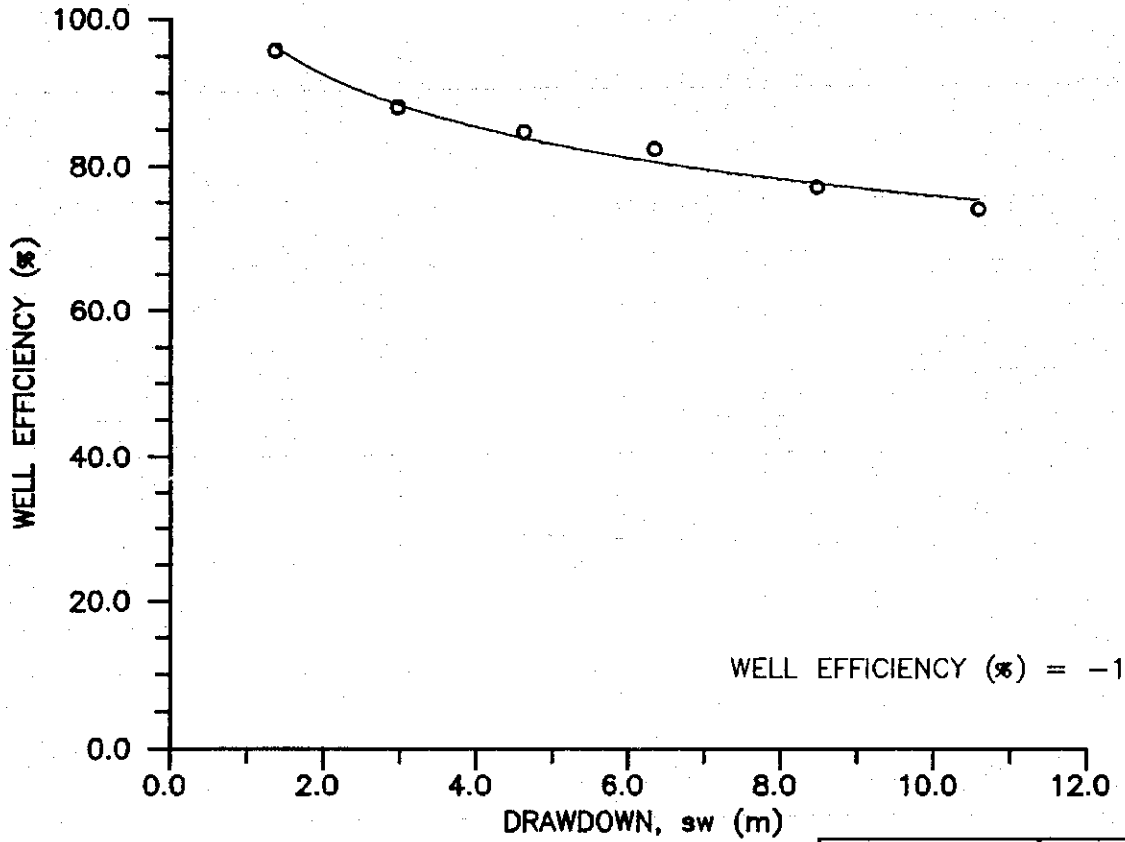
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



DETERMINATION OF B AND C FROM STEP-DRAWDOWN TEST (JICA A-4 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

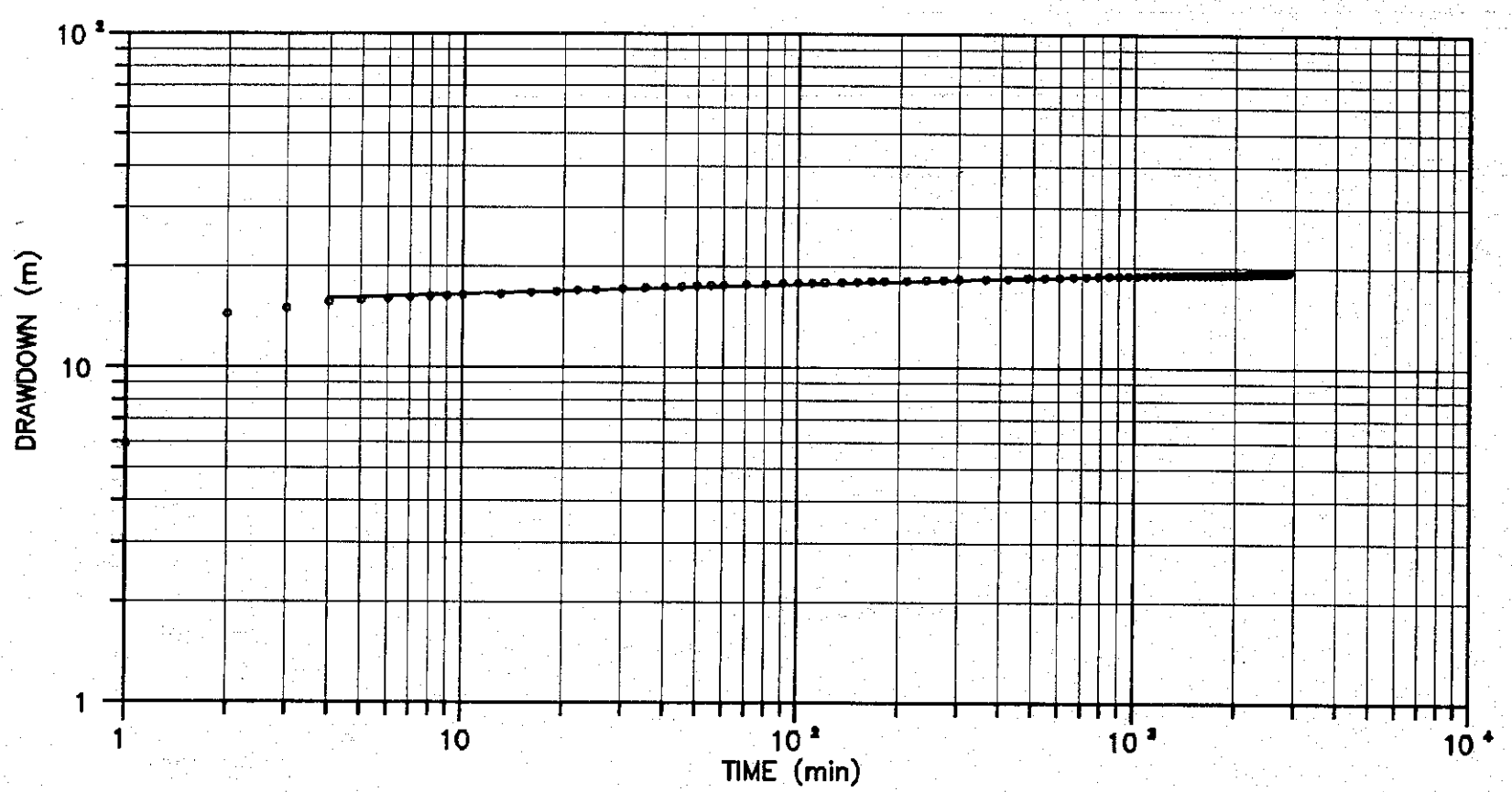
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



VARIATION OF WELL EFFICIENCY WITH DRAWDOWN (JICA A–4 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



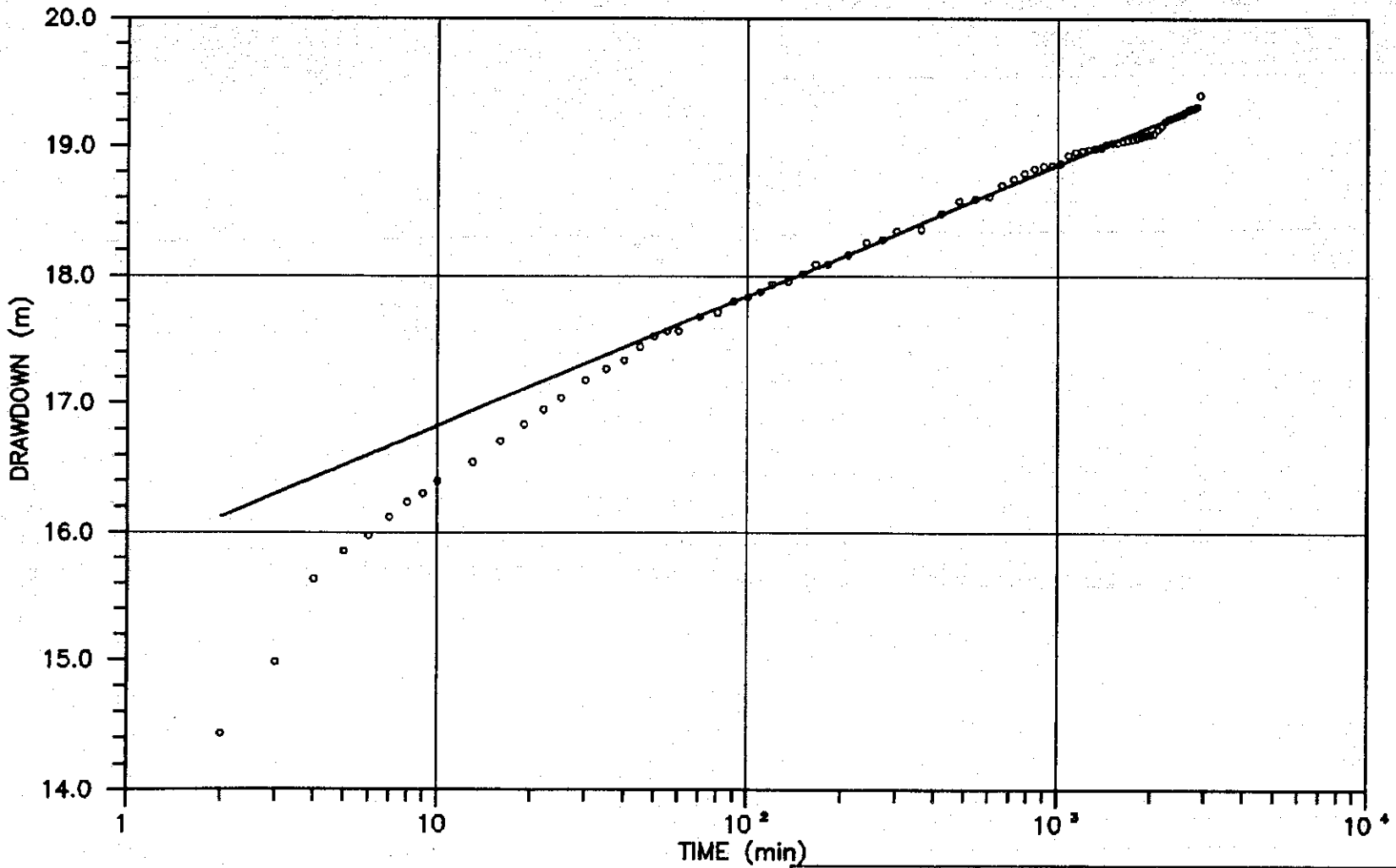
—— COMPUTED DRAWDOWN
○○○○○ MEASURED DRAWDOWN

RESULT
T = 157.5 m^2/day
S = 1.96E-12
SD = 1.17E-01 m

THEIS TYPE-CURVE MATCHING
(JICA A-4 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

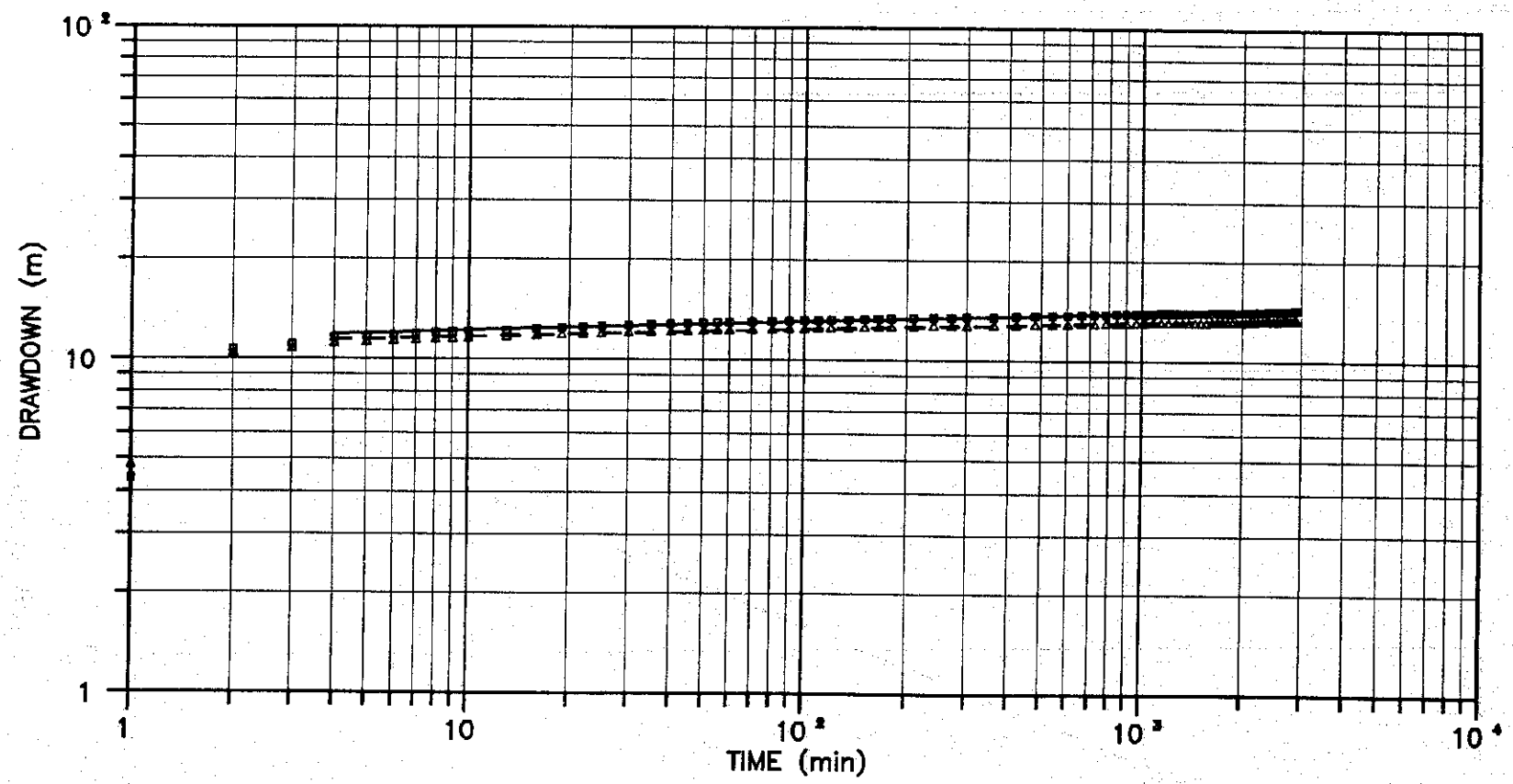
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



COOPER–JACOB METHOD ANALYSIS
(JICA A–4 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



RESULT

CORRECTED DRAWDOWN 1
T = 212.9 m^2/day
S = 2.66E−12
SD = 8.70E−02 m

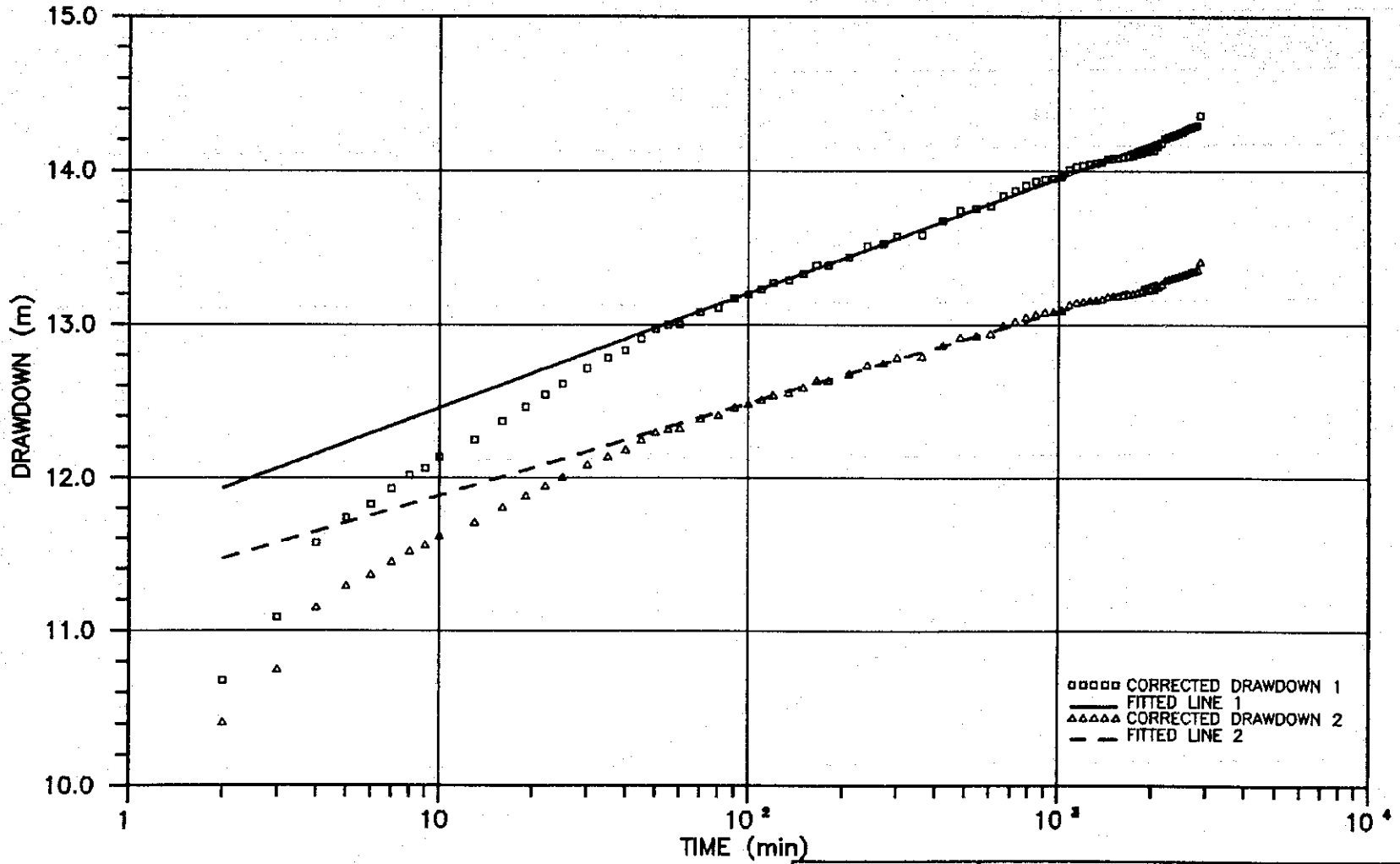
CORRECTED DRAWDWON 2
T = 263.6 m^2/day
S = 8.38E−15
SD = 7.30E−02 m

□□□□□ CORRECTED DRAWDOWN 1
——— COMPUTED DRAWDOWN 1
△△△△△ CORRECTED DRAWDOWN 2
— — COMPUTED DRAWDOWN 2

THEIS TYPE−CURVE MATCHING USING CORRECTED DRAWDOWN (JICA A−4 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



RESULT

CORRECTED DRAWDOWN 1
Δs = 7.485E-01 m
T = 246.5 m²/day
S = 8.55E-15

CORRECTED DRAWDOWN 2
Δs = 6.006E-01 m
T = 307.2 m²/day
S = 7.62E-18

COOPER-JACOB METHOD ANALYSIS USING CORRECTED DRAWDOWN (JICA A-4 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

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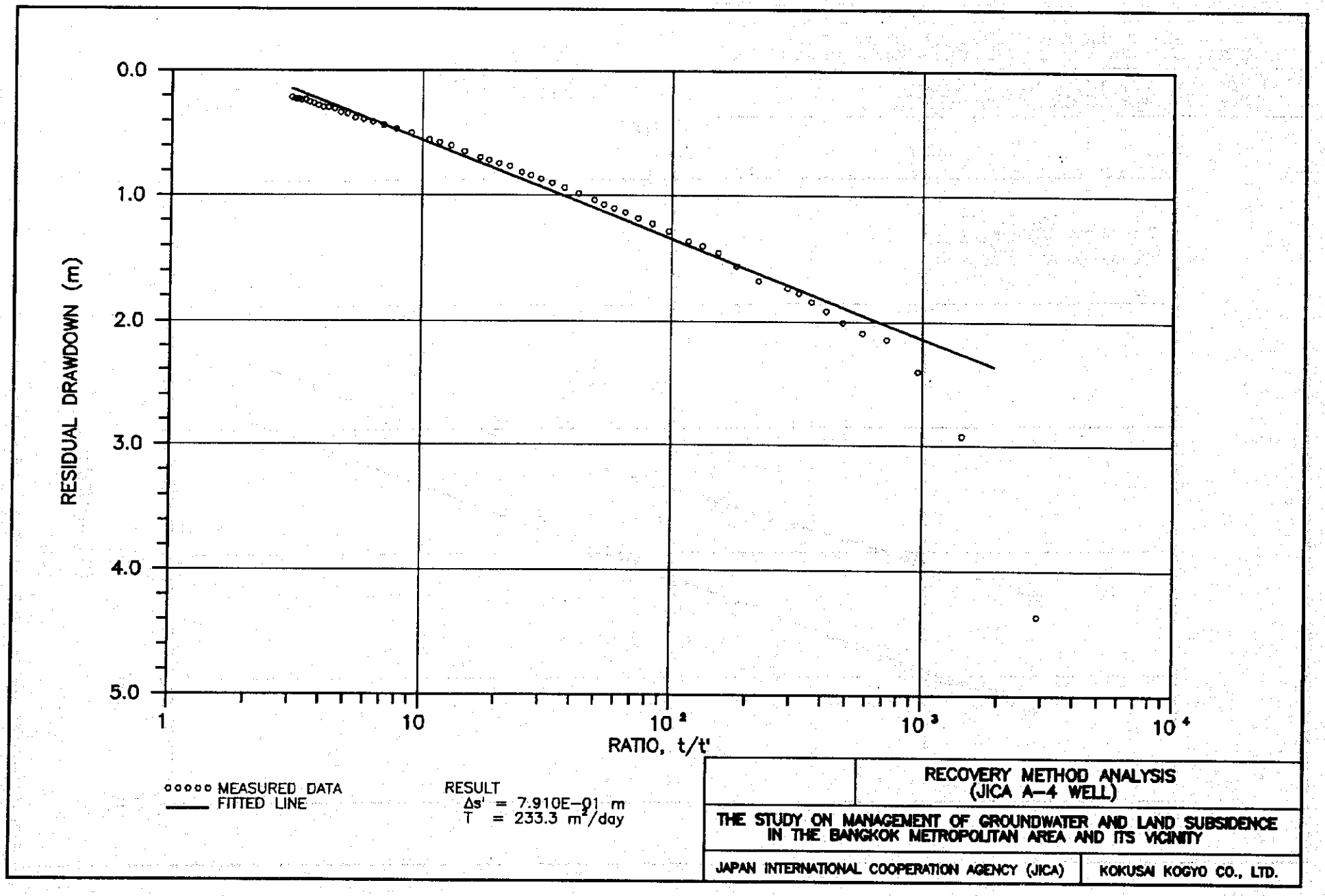
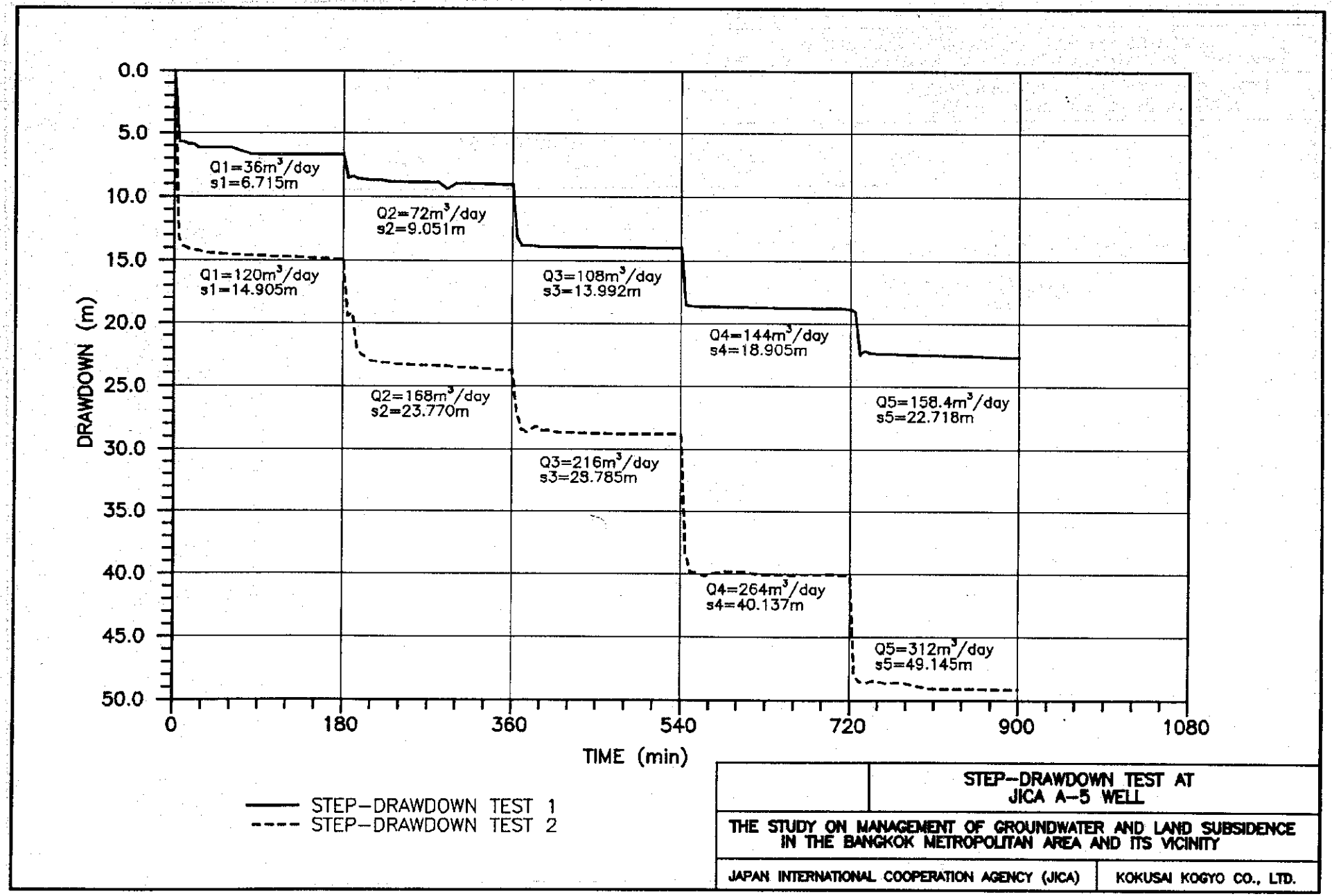
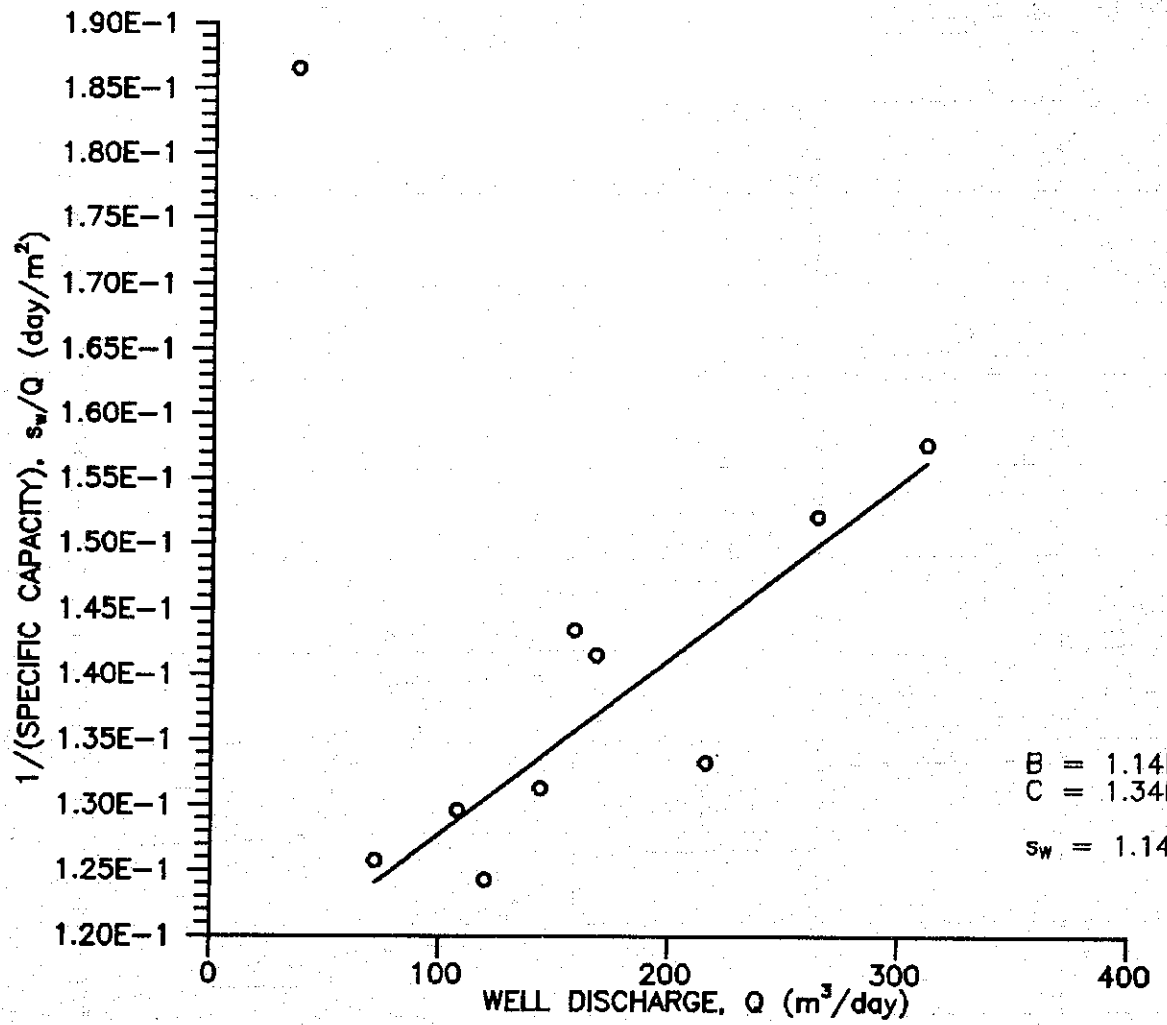

0.0
1.0
2.0
3.0
4.0
5.0
RESIDUAL DRAWDOWN (m)
1
10
10 ²
10 ³
10 ⁴
RATIO, t/t'
MEASURED DATA
FITTED LINE
RESULT
Δs' = 7.910E-01 m
T = 233.3 m²/day
RECOVERY METHOD ANALYSIS
(JICA A-4 WELL)
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
KOKUSAI KOGYO CO., LTD.



STEP-DRAWDOWN TEST AT JICA A-5 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

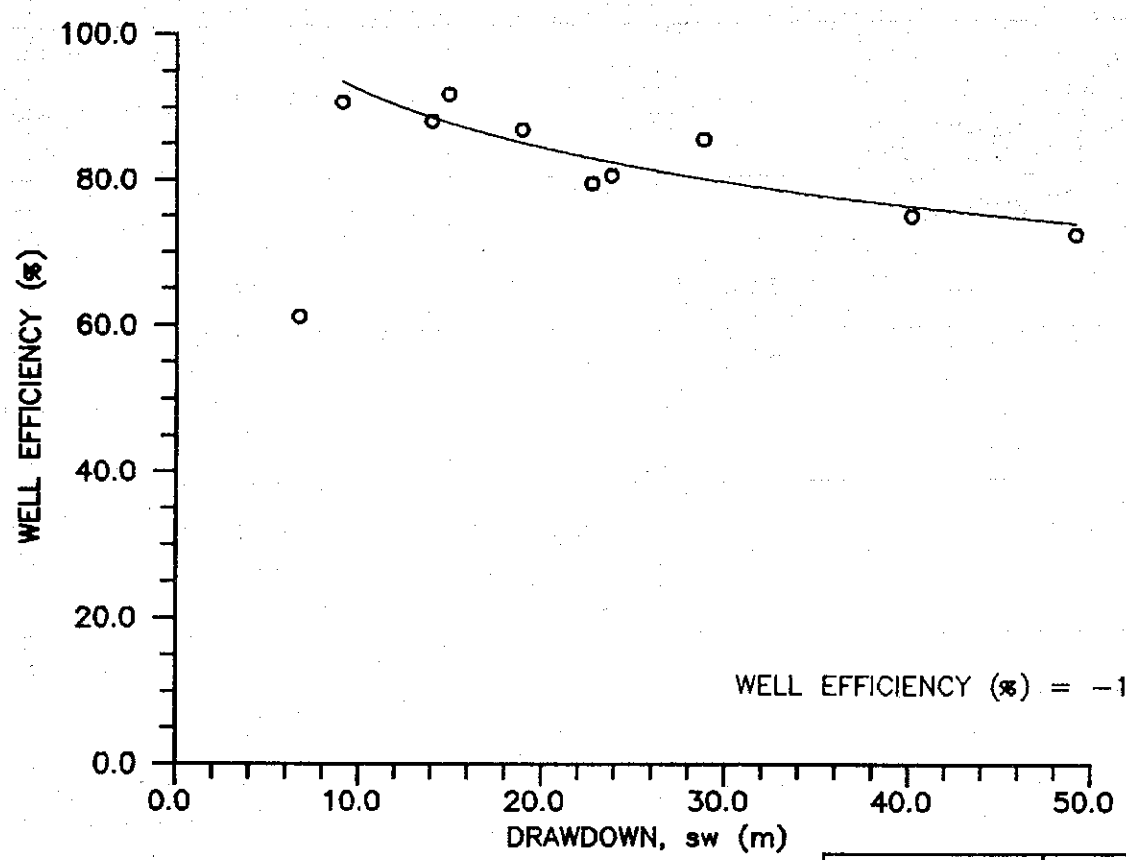
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



DETERMINATION OF B AND C FROM STEP-DRAWDOWN TEST (JICA A-5 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



VARIATION OF WELL EFFICIENCY WITH DRAWDOWN (JICA A–5 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

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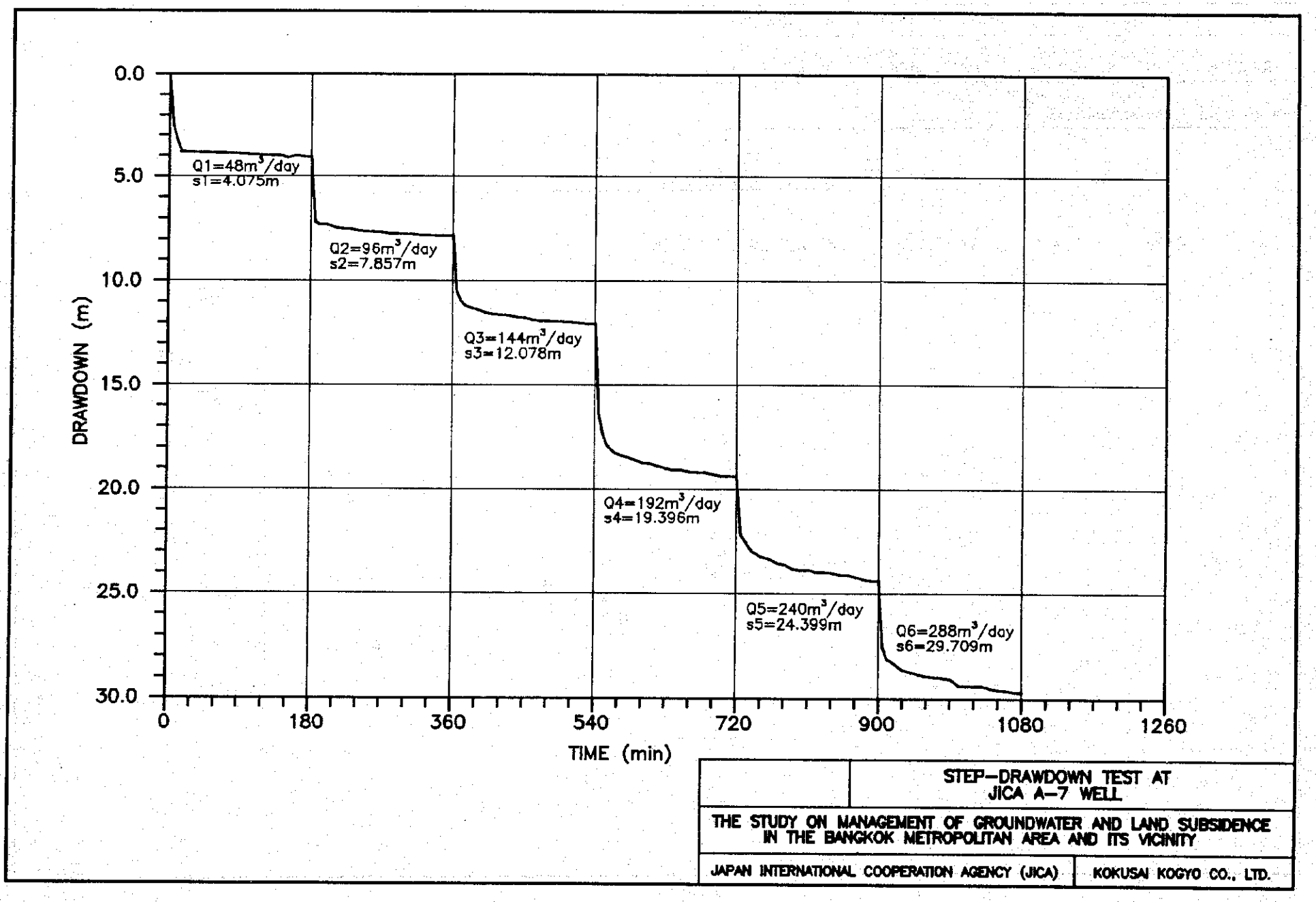
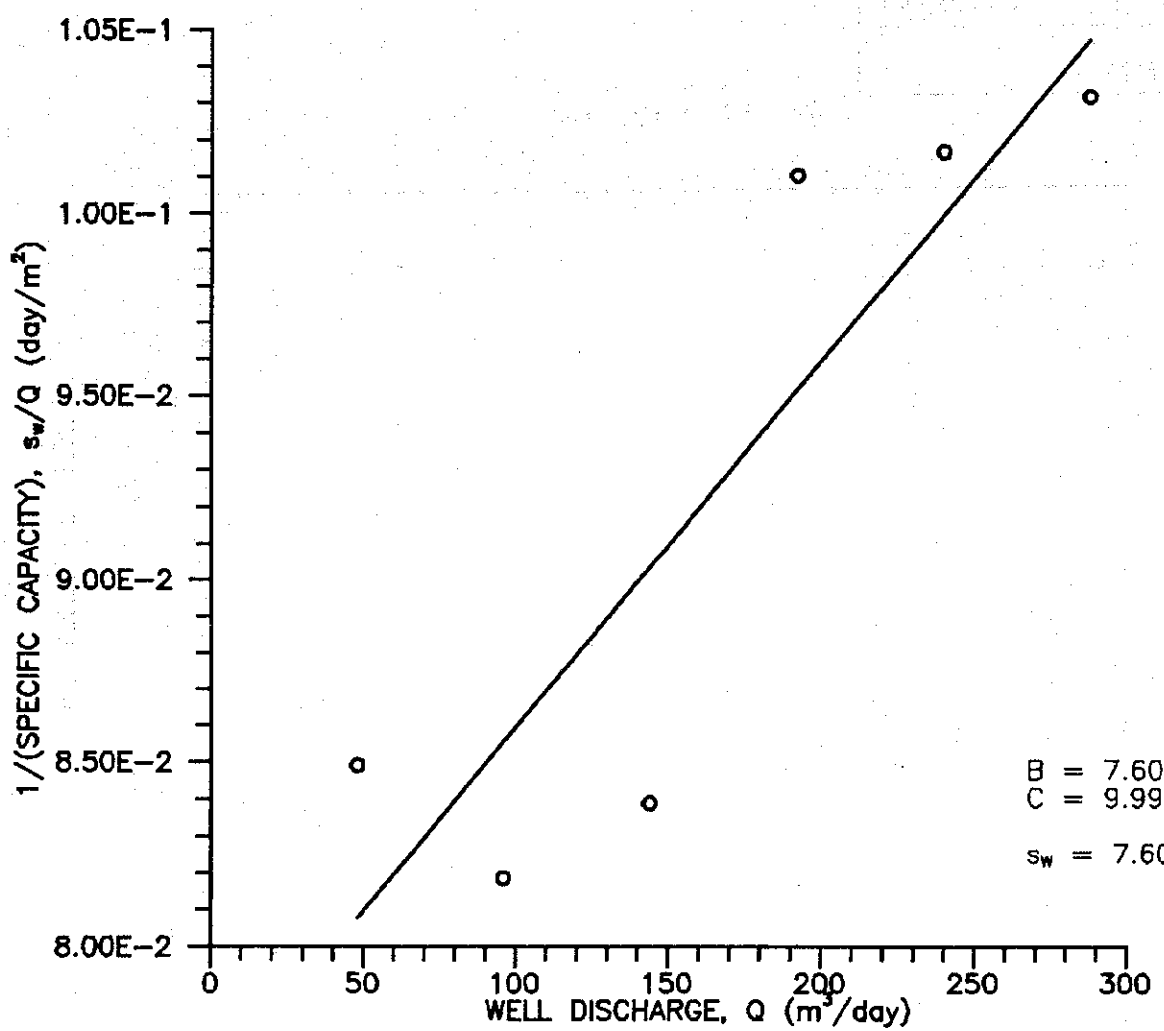


STEP-DRAWDOWN TEST AT JICA A-7 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

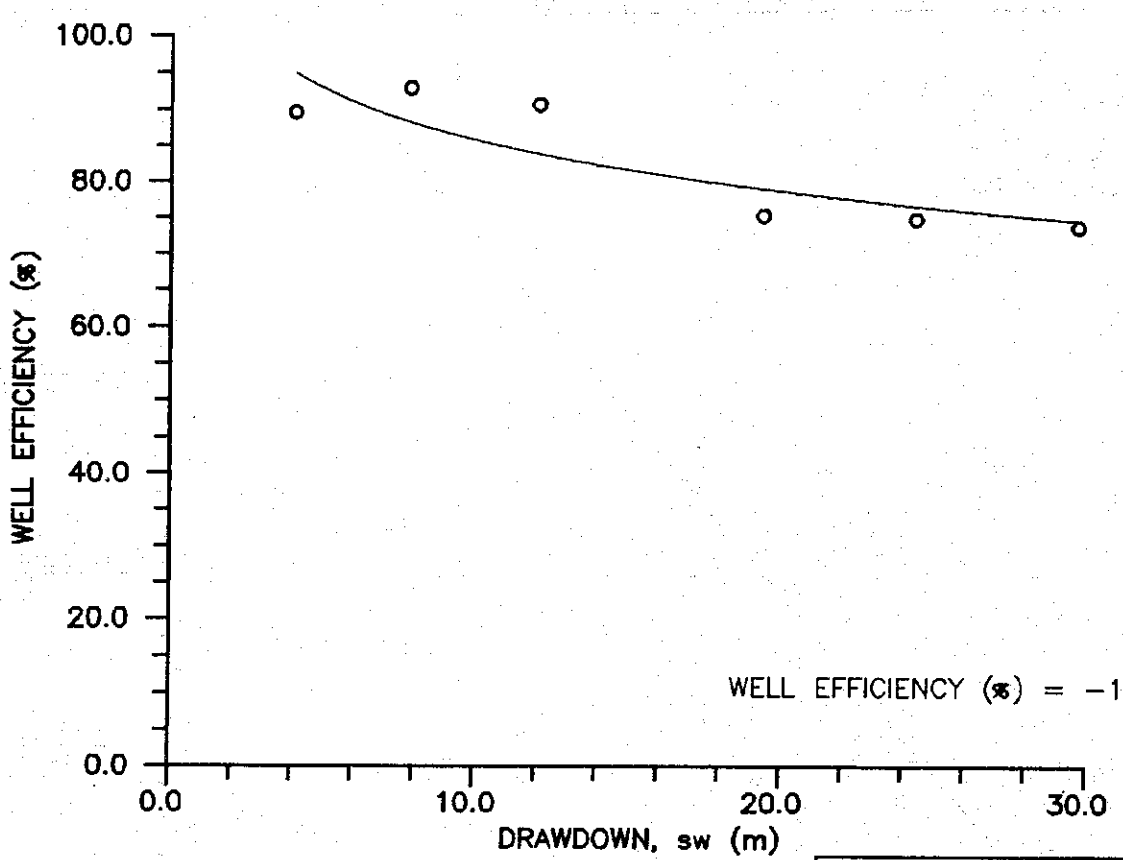
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



DETERMINATION OF B AND C FROM STEP-DRAWDOWN TEST (JICA A-7 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



VARIATION OF WELL EFFICIENCY WITH DRAWDOWN (JICA A-7 WELL)

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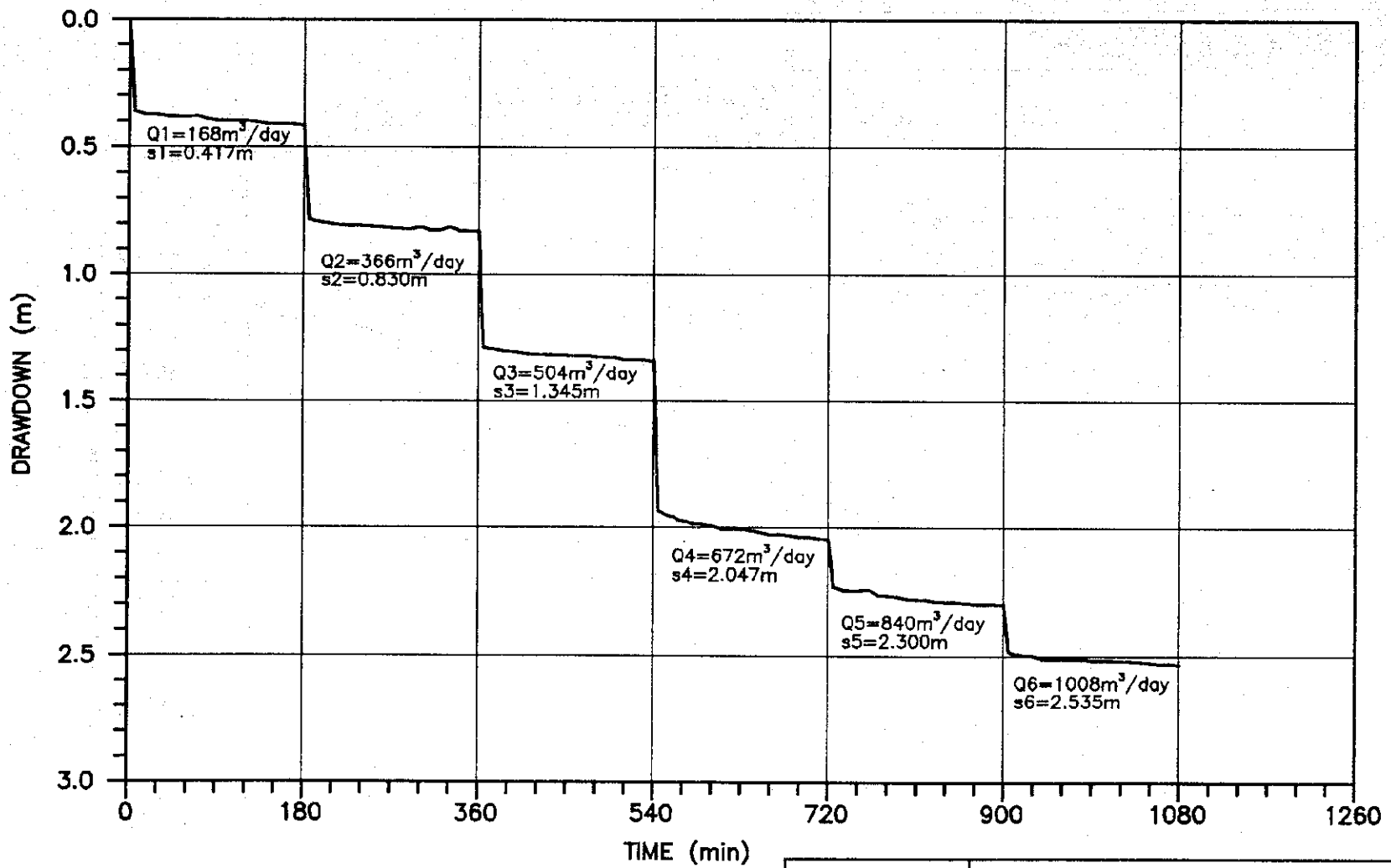
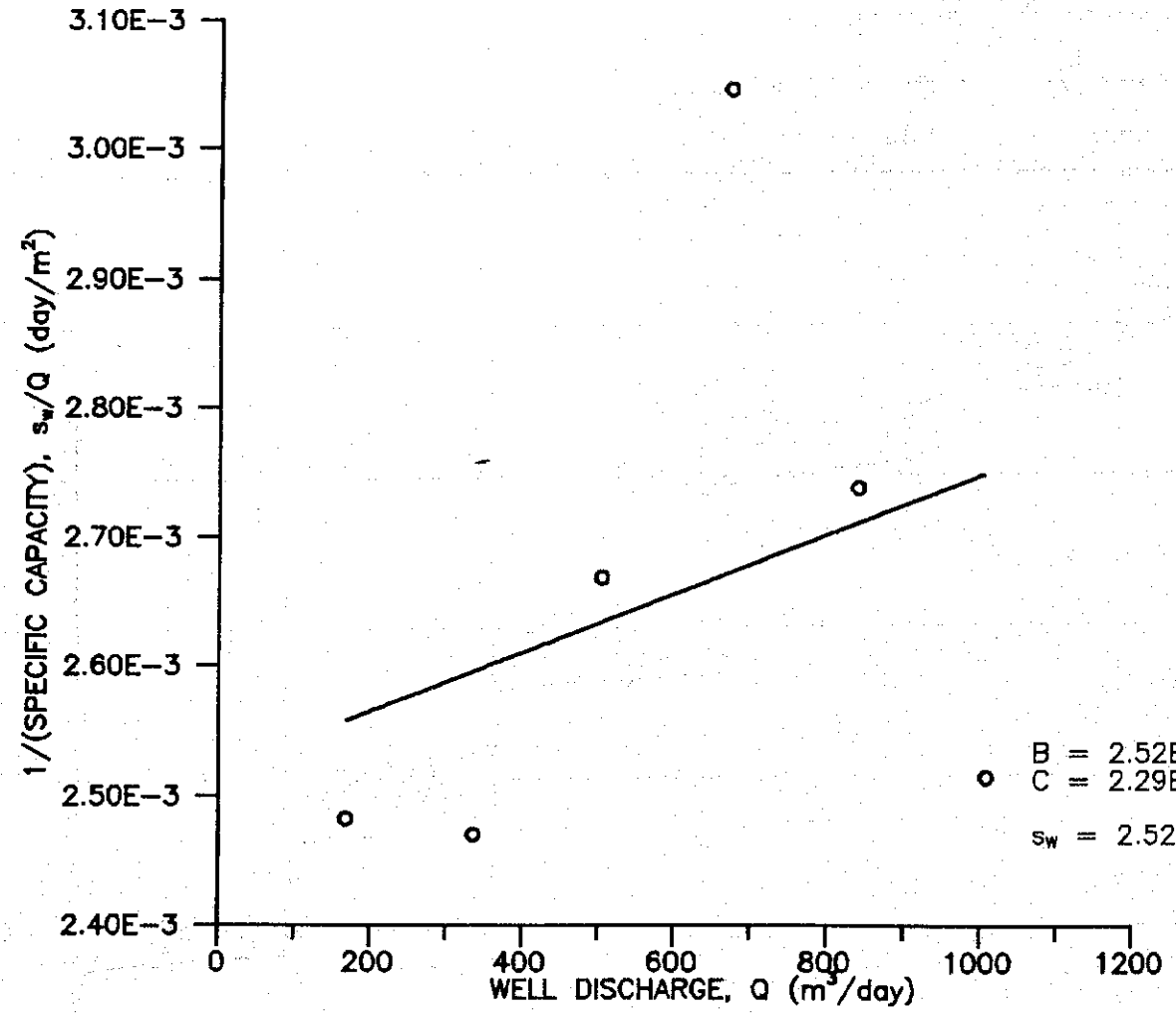


STEP-DRAWDOWN TEST AT JICA A-8 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) | KOKUSAI KOGYO CO., LTD.



DETERMINATION OF B AND C FROM STEP-DRAWDOWN TEST (JICA A-8 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

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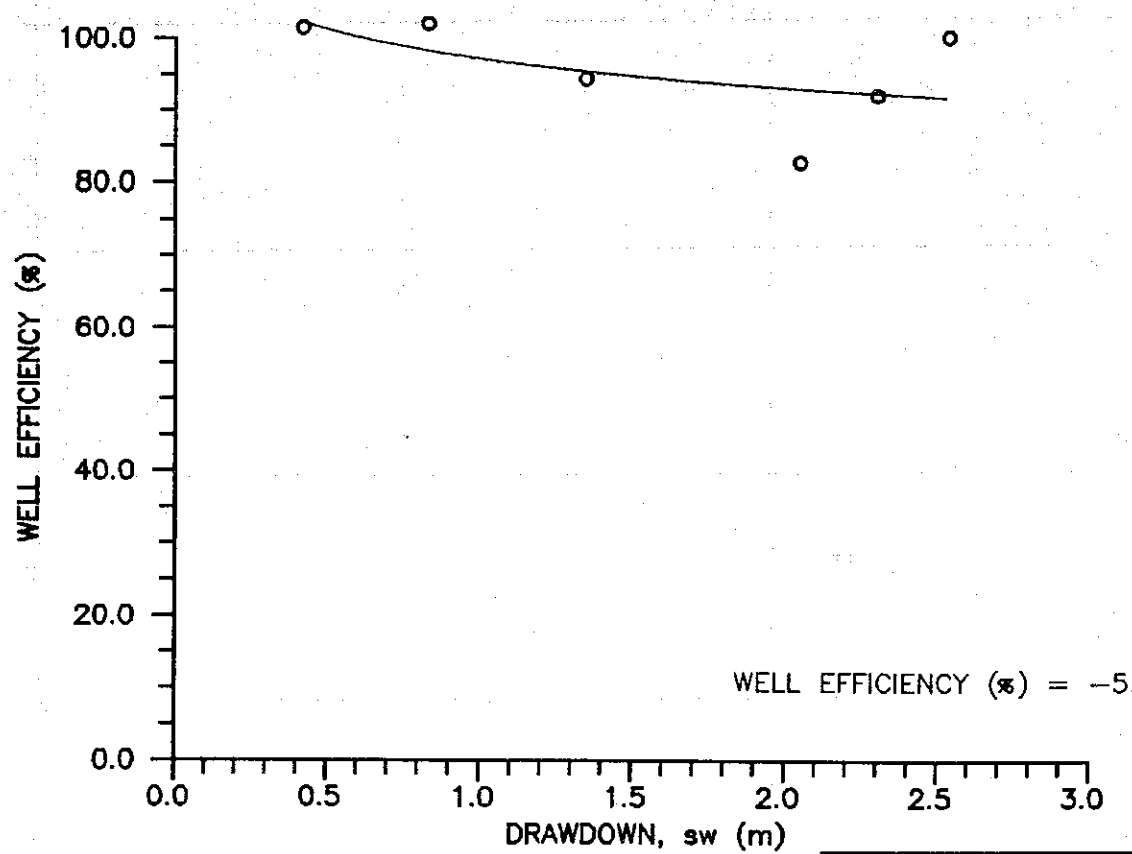

VARIATION OF WELL EFFICIENCY WITH DRAWDOWN (JICA A–8 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

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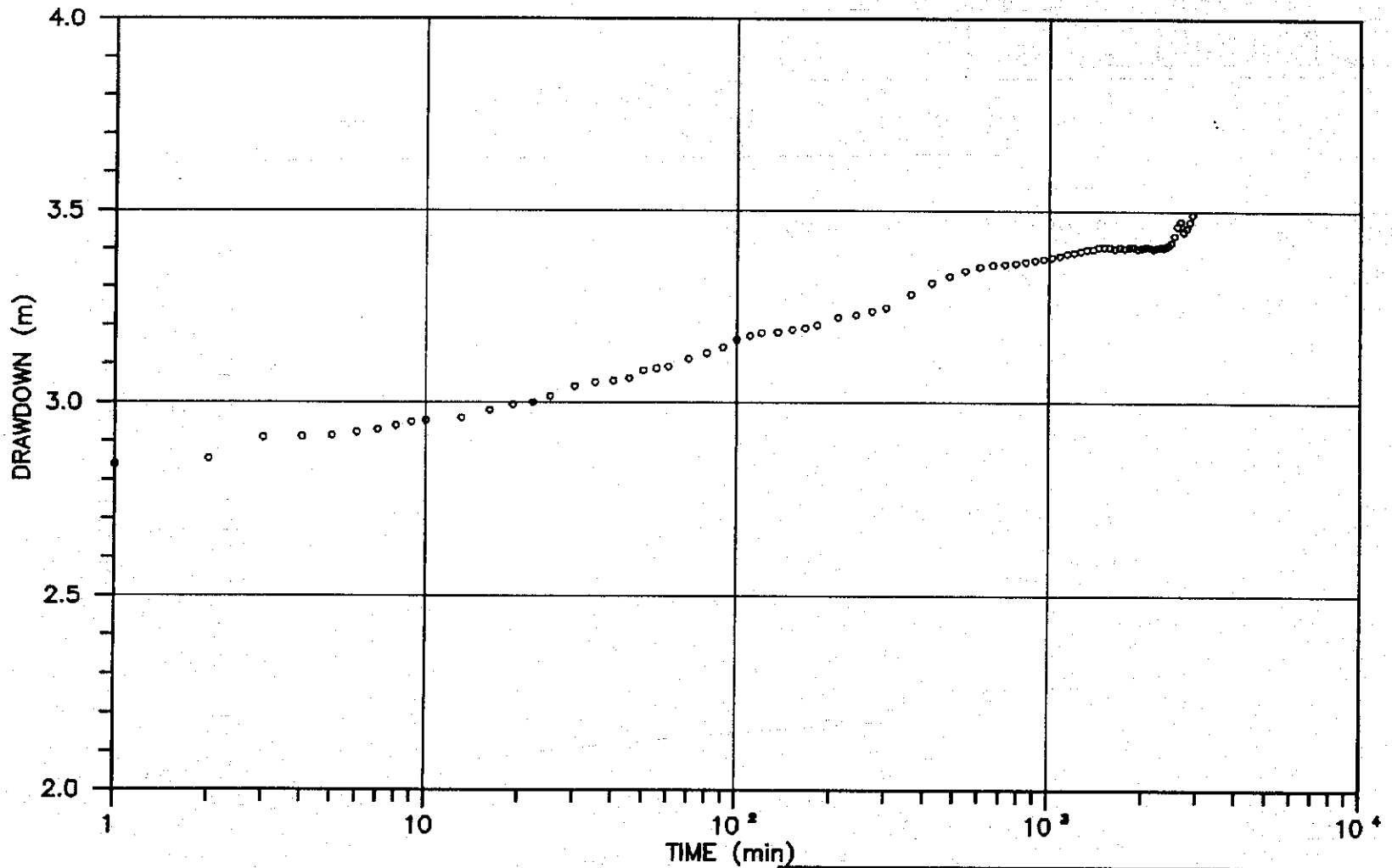

LOCATION	: SITE-A (LAT KRABANG)	DATE	: 31-02 JUN, 1993
UTM GRID	: 879215	DISCHARGE	: 1020 m^3/day (708.3 l/min)
WELL DEPTH	: 48.00m		
SCREEN DEPTH	: 41.96-47.495m	STATIC W.L.	: 17.560 m
SCREEN LENGTH	: 5.535m	WELL RADIUS	: 0.1016m

CONTINUOUS PUMPING TEST AT JICA A-8 WELL

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

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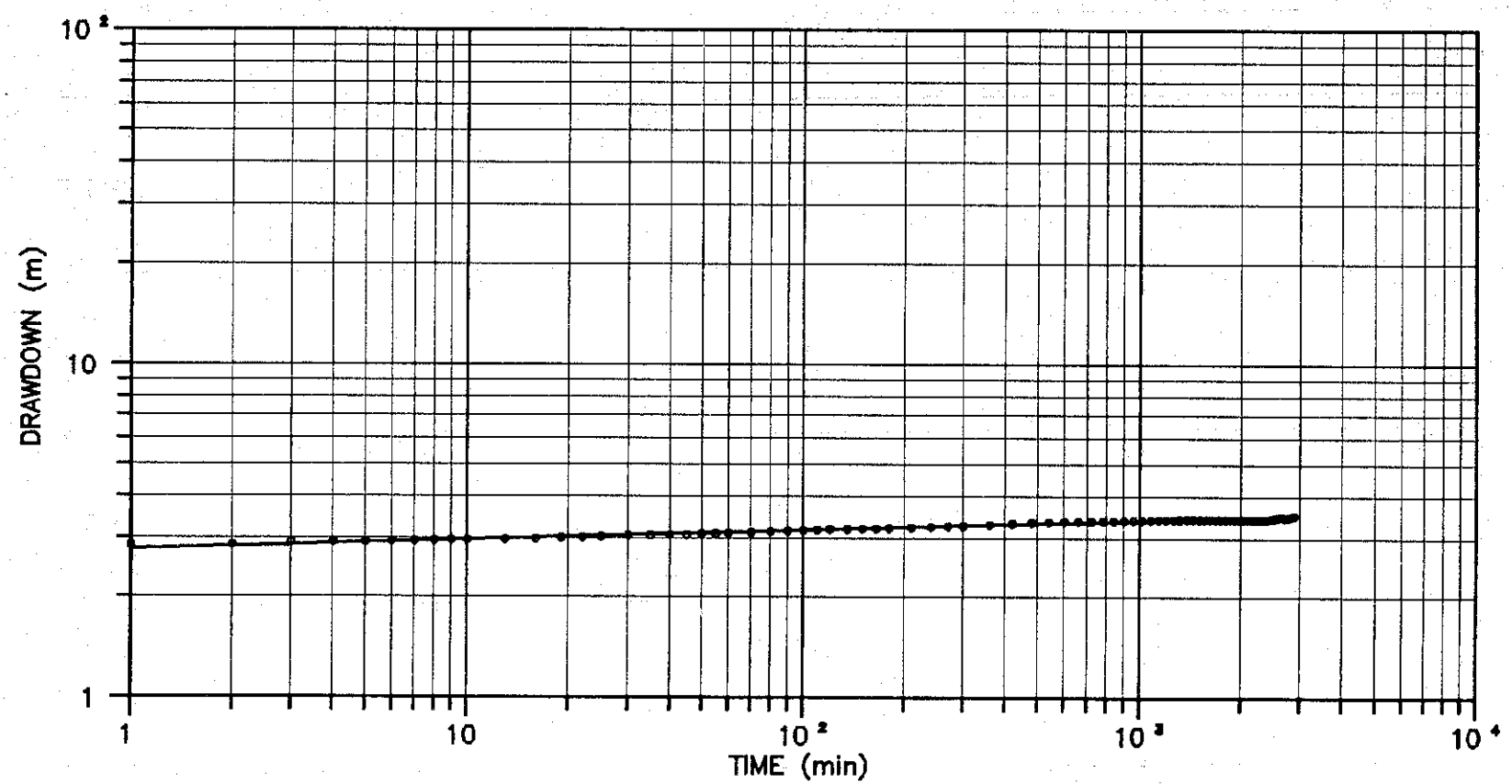

—— COMPUTED DRAWDOWN
ooooo MEASURED DRAWDOWN

RESULT
T = 942.4 m^2/day
S = 1.63E-12
SD = 2.17E-02 m

THEIS TYPE-CURVE MATCHING
(JICA A-8 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

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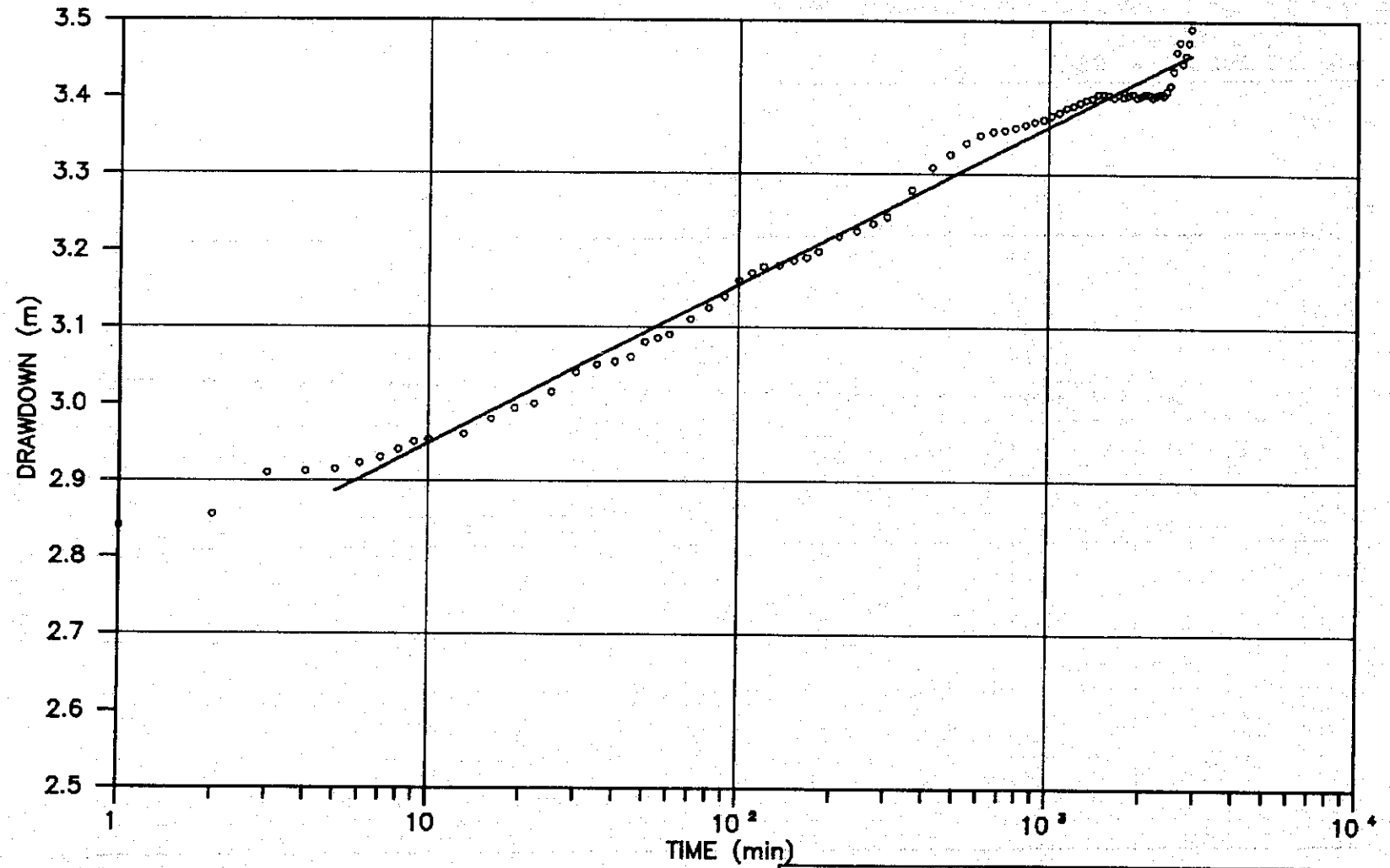

COOPER-JACOB METHOD ANALYSIS
(JICA A-8 WELL)

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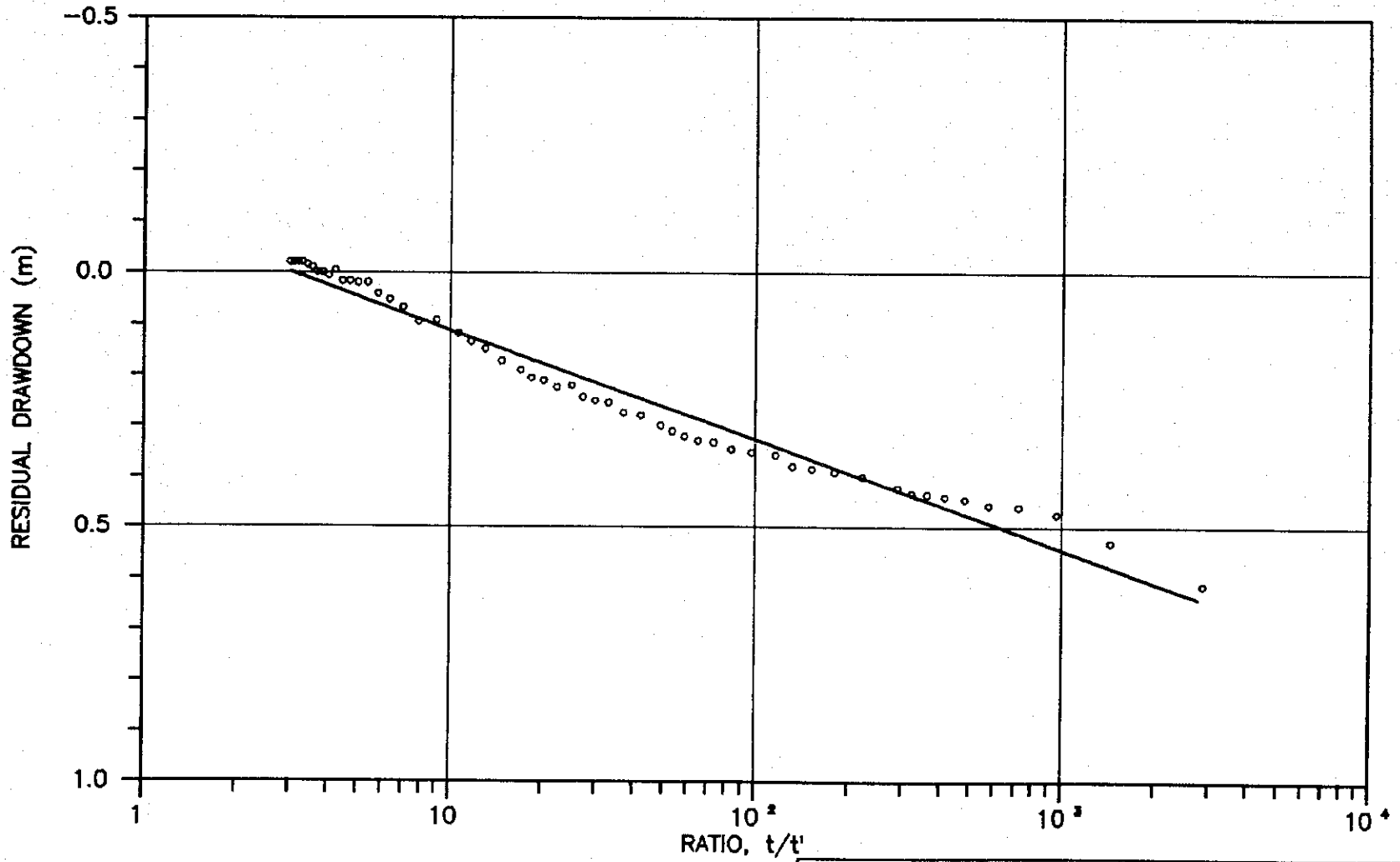

RECOVERY METHOD ANALYSIS
(JICA A-8 WELL)

THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY

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