DL-01 (1) Log Sheet

HOLE NO. T1-B1 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	55.0 m	ELEVATION	773.05 m
SITE	T-1 dam site	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	86.3% (3.0-55.0 m)	DATE	FROM 4/17 TO 4/29, '83	DRILLED	R. QUEZADO	LOGGED	K. TSUJI

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CLASS	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	FRACTURE
	0.50	772.55	Top soil		Sandy clay						
	1		Debris (Dark grey)		Mixture of strongly weathered amphibolite pebble and plastic clay.						
	2										
	3										
4/17	4										
	5		Extremely weathered amphibolite (yellowish grey - greenish grey)		3.0-5.6m: weathered amphibolite associated with grey clay loose and soft.	D					
	6				5.6-9.0m: altered grey clay predominant, accompanied with extremely weathered amphibolite.						
4/18	7				6.8-9.0m: fragmental core.						
	8				Down to 9.0m: no water drill.						
	9	9.00	764.05								
	10				Fragmental core.						
	11		Weathered amphibolite (greenish black)		Hard but very cracky crack stained in brown.	D					
	12										
	13	13.00	760.05								
	14		Aphanitic amphibolite		Fresh but horizontal cracks develop, crack stained.	CL					
4/19	14.50	758.55			Excavation depth for full dam.						
	15										
	16				Fresh and hard rock.	CM					
	17		Aphanitic amphibolite (greenish black)		Long cylindric core.						
	18				Crack dips 10° and 85°, but tight.						
	19									14.2 (1.8x10^{-4} cm/s)	
	20				Crack partly filled with quartz thin vein.	CH					
4/20	20.40	752.65			20.0m: slightly altered.						
	21		Foliated amphibolite (black)		Coarse grained crystalline amphibolite, white plagioclase predominant.						
	22				Foliated plane dips 15° to 20°.						
	22.80	750.25	Altered amph. (pale green)		Slightly altered amphibolite.						
	23.45	749.60	Foliated amph.		Fresh and hard, crack stained.						
	24.20	748.85	Altered amph. (pale green)		Slightly altered.	CM				5.6 (7.2x10^{-5} cm/s)	
	24.95	748.10	Aphanitic amphibolite (greenish black)		Fresh and hard, crack stained in brown.						
4/21	26										
	26.40	746.65	Altered amph.		Slightly altered, with many calcite vein.						
	26.85	746.25			Fresh and hard.						
	28		Aphanitic amphibolite (greenish black)		27.5m: slightly altered.	CH				2.1 (2.7x10^{-5} cm/s)	
	29				29.0-30.2m: strongly foliated with a dip of 20° ± .						
	30										

LOG POINT - N

HOLE NO.

*RQD = Rock Quality Designation. RQD = Total length of cylindric cores longer than 10 cm / Total core length × 100%
*LUGEON VALUE = Loss in water injection rate per meter at 10 kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-01 (2) Log Sheet

HOLE NO. T1-B1 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADING	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
4/22	31		Aphanitic amphibolite (greenish black)		Fresh & hard. 30.75-31.4m: crack stained in brownish yellow.	CH	31.70m				2.1 (2.1×10^{-5} cm/s)	
	32											
	32.70	740.35										
	33		Altered amphibolite		Slightly altered & crushy zone associated with grey clay.							
	33.45	739.65										
	34											
4/25	35		Aphanitic amphibolite (greenish black)		Fresh & hard. 34.2-34.6m: very crushy. 38.6-43.8m: crack stained in yellowish brown 37.6-38.8 : short cylindric core crack dips 30° & 50°.	CM					9.0 (1.2×10^{-4} cm/s)	
	36											
	37											
	38										12.2 (1.6×10^{-4} cm/s)	
	39					CH						
	40	40.00	733.05									
4/26	41	41.00	Altered amphibolite (dull brown)		Slightly altered & very crushy zone.	CL						
	42	42.25	Aphanitic amphibolite (greenish black)		Fresh & hard. 41.15-42.15m: vertical crack with calcite vein.							
		42.75	730.30	Altered amphibolite		Slightly altered & very crushy zone.						
	43										10.3 (1.3×10^{-4} cm/s)	
	44											
	45		Aphanitic amphibolite (greenish black)		Fresh & hard. Cracks develop with a dip of 36° to 45°. Cracks are tight.							
4/27	46											
	47											
	48										8.6 (1.1×10^{-4} cm/s)	
	48.30	724.95										
	49	49.30	724.75	Altered amphibolite		Slightly altered zone.	CH					
	50											
4/28	51											
	52		Aphanitic amphibolite (greenish black)		Fresh & hard. Crack develops with tight contact.							
	53										10.7 (1.3×10^{-4} cm/s)	
	54											
4/29	55	55.00	718.65									

HOLE NO.

LOG FORM-C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

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DL-02 (1) Log Sheet

HOLE NO. T1-22 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vogaros Hydroelectric Development Project			DEPTH	40.0 m	ELEVATION	757.59 m
SITE	T-1 dam site	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	66.1% (8.25-40.0 m)	DATE	FROM 5/3 TO 5/27,'83	DRILLED	P.QUEZADO	LOGGED	K. TSUJI

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEGREE
	4.50	753.09	Debris (dark yellow)		Plastic clay accompanied by a little weathered amphibolite pebble.						
5/3	8.25	749.34	Extremely weathered amphibolite (dark green)		Completely weathered amphibolite sandy clay associated with weathered rock fragments. 5.5-5.8m: sandy weathered amphibolite. To downward core rock fragmen.						
	13.10	744.49	Weathered amphibolite (bluish black)		Weathered schistosed amphibolite. schistosity dips 35°. Micro-crystalline amphibolite. Fragment and sheet cylindric core. Crack with clay sem. 9.05-9.25 altered zone associated with grey clay.	D					
					Altered zone with grey clay.	D					
5/9	13.45	744.14	Altered amphibolite		Excavation depth for fill dam.						
5/10	18.10	739.49	Coarse crystalline amphibolite (spotted)		Slightly weathered coarse grained crystalline amphibolite (diorite). Plagioclase is slightly weathered. Cracks are tight. Sharp contact with underlying rock with a dip of 35°.	CM				15.0 (2.0x10⁻⁴cm/s)	
	24.20	733.39	Aphanitic amphibolite (bluish black)		Slightly weathered micro crystalline amphibolite. Crack develops between 18.5-20.9m cracks are tight. As a whole massive fresh hard rock from 20.0 to 24.20m. Long cylindric core. 21.0-24.0m: schistosed amphibolite crack develops and stained in yellow.					8.9 (2.2x10⁻⁵cm/s)	
5/11	28.15	729.44	Schistosed amphibolite (bluish black)		Slightly weathered schistosed amphibolite. 24.2-30.0m: cracky fragmental core. 28.2-28.5m: micro-crystalline massive amphibolite.	CL				21.3 (2.6x10⁻⁵cm/s)	
	28.45	729.19	Altered amphibolite		Altered associated grey clay.						
	30.00	727.59	Schistosed amphibolite		Slightly weathered schistosed amphibolite. Cracky, fragmental core.					8.7(1.3x10⁻⁴cm/s)	

BORING NO.

LOG POINT 1

*RQD = Rock Quality Designation. RQD = Total length of cylindric core longer than 10 cm / Total core length x 100%
*LUGEON VALUE = Loss in water injection rate pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-02 (2) Log Sheet

HOLE NO. T1-B2 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CLASSIFICATION	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
5/15 5/26	31 32 33 34 35 36 37 38 39 40.00	717.59	micro crystalline amphibolite (bluish black)		Massive, fresh & hard. Crack develops and stained in yellowish brown between 30.0 and 35.0m. 35.0-40.0m: rock better showing shor cylindric core. 36.2-36.5m: altered zone with some clay. 37.0-40.0m: cracks are tight, filled with white quartz or calcite vein. Partly schistosed dipping 30°.	CL CM	31.10m				8.7 (1.3×10^{-4} cm/s) 1.9 (2.6×10^{-5} cm/s)	

HOLE NO.

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

LOG YUKM-C

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DL-03 (1) Log Sheet

HOLE NO. T1-B3 SHEET NO. 1 OF 2

PROJECT				DEPTH		ELEVATION	
SITE		COORDINATE	: :	INCLINATION		DRILL RIG	
AVERAGE CORE RECOVERY		DATE	FROM TO	DRILLED		LOGGED	

STATIC	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DENSITY
	0.00	708.28	River gravel		Hard gravel accompanied by sandy silt (dull yellowish brown).						
			Weathered micro-crystalline amphibolite (greenish black)		Slightly weathered, hard & massive, weakly schistosed with a dip of 15°. Cracks develop & dip mostly 15° to 30°. Cracks stained in pale brown. Cracks stained in pale brown.	CL	3.15m				
	4.85	704.43			Excavation depth for fill dam.						
			Micro crystalline amphibolite (greenish black)		Fresh, hard & massive. As a whole short cylindric core with frequent cracks dipping 0° to 20°. Crack not stained, slight fine grained crystalline. 9.8m: weakly altered (in pale green)					10.0 (1.3×10^{-4} cm/s)	
	14.60	694.48			14.0-15.0m: weakly schistosed with low dip. 14.8-15.0m: weakly altered zone, epidote crystal observable.	CM				5.9 (7.8×10^{-5} cm/s)	
	15.00	694.28	Altered amphibolite								
			Micro crystalline amphibolite (greenish black)		Fresh and hard, but through the cores, very poor core recovery, probably due to frequent minor cracks and poor machine operation. 22.0-23.0m: Rock facies are same as overlying rock of 13° to 29°. Crack develops, short cylindric core					8.2 (1.1×10^{-4} cm/s)	
										8.1 (1.1×10^{-4} cm/s)	
	23.00	686.28	Micro crystalline amphibolite		Fresh & hard long cylindric core	CH				3.4 (4.5×10^{-5} cm/s)	

BORE HOLE NO.

LOG FORM-B

※RQD = Rock Quality Designation. RQD= Total length of cylindric cores longer than 10 cm / Total core length × 100%
※LUGEON VALUE is Lu as a water injection value pressured at 10kg/cm²
※DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-03 (2) Log Sheet

HOLE NO. TI-B3 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	REMARK GRADING	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	31		Micro crystalline amphibolite (greenish black)		Fresh, hard and massive rock, very good long cylindric core Crack dips 0° to 20° only. Crack not stained but tight.	CH				12.5 (1.7×10^{-4} cm/s)	
	32										
	33										
	33.70	675.58									
	34				Fresh and hard. Core: cylindric core or rock fragmen core.						
	35										
	36										
9/6	37		Micro crystalline amphibolite (greenish black)		37.0-39.5m: very poor core recovery due to crack & poor operation of machine.	CM				3.9 (5.1×10^{-4} cm/s)	
	38										
	39										
	40				40.5m: slightly altered with grey clay.						
	41										
	42									9.3 (1.2×10^{-4} cm/s)	
	43										
	44										
9/7	45.00	664.28									

HOLE NO.

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-04 (1) Log Sheet HOLE NO. TI-84 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	40.0 m	ELEVATION	754.03 m
SITE	TI dersite	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	Long year 34
AVERAGE CORE RECOVERY	70.1% (3.0-40.0 m)	DATE	FROM 6/10 TO 6/25,'83	DRILLED	R. CAEZADO	LOGGED	K. TSUJI

DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	REMARKS
	0.50	753.53	Top soil		Soft brown clay.					N-value : 23	
6/10	1		Debris (dull yellowish brown)		Loose, unconsolidated. No water drill, penetration sample.						
	2										
	3	2.95	751.08								
	4		Extremely weathered and altered amphibolite (light grey)		Slightly consolidated, weathered angular amphibolite fragment mixed with altered. Plastic grey clay. No water drill.	D					
	5										
	6										
6/11	7	7.00	747.03		Excavation depth for fill dam.						
	8		Micro-crystalline amphibolite (greenish black)		Slightly weathered and foliated with a dip of less than 10°. Sound and hard cylindric core.	CM					
	9										
		9.50	744.53							22.3 (29×10^{-4} cm/s)	
	10		Foliated amphibolite (dark grey)		Fresh and hard. Frequent core probably due to frequent cracks. Crack stained in brown.	CL					
	11										
6/13	12										
	13	13.15	740.88								
		13.50	740.53	Altered amphibolite	Shell fragment core.	D				21.6 (27×10^{-4} cm/s)	
	14										
	15		Foliated crystalline amphibolite (dark grey)		Fresh and hard. Very cracky. 14.5-15.3m: strongly foliated with a dip of less than 15°. Crack is open.	CL					
6/14	16										
	17	17.00	737.03								
		17.20	736.83	Altered amphibolite	Shell fragment core.	D					
	18	18.49	735.63	Foliated amphibolite	Slightly weathered and hard. Crack is open.	CL				11.0 (14×10^{-4} cm/s)	
		18.70	735.33	Altered amphibolite	Extremely altered with grey clay.	D					
	19										
	20										
	21		Micro-crystalline amphibolite (greenish black)		Fresh and hard. 20.3-21.8m: very cracky. Crack stained in light brown. 20.3-20.4m: slightly altered. 24.2-24.4m: medium grained foliated amphibolite, sharp contact = 0.	CM					
6/15	22										
	23										
	24									8.7 (11×10^{-4} cm/s)	
	25	25.00	729.03								
	26		Foliated amphibolite (greenish black)		Medium grained, fresh & hard. 25.8-27.3m: crack dips 65°-70°. 25.8-27.35m: crack stained in yellowish brown.		26.40				
	27										
6/16	28										
6/17	29									11.2 (15×10^{-4} cm/s)	
6/20	30	28.95	725.08	Altered amphibolite	Slightly altered, much calcite thin vein.						
		29.30	724.73	Micro-crystalline amphibolite	Aphanitic, hard & fresh.						

HOLE NO.

LOG NO(M-1)

RQD = Rock Quality Designation, RQD = (total length of cut whole cores longer than 10 cm / total core length) × 100%
LUGEON VALUE = Lugeon value under injection water pressure of 10kg/cm²
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-04 (2) Log Sheet

HOLE NO. TI-34 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER	CAVITY	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
6/22	31										11.2 (1.5×10^{-4} cm/s)	
	32				Fresh & hard. Aphanitic but weakly foliated with a dip of less than 20°. As a whole, crack develops, dipping 25° and 70°. 30.6-33.0ᵐ: short cylindric to fragment core. 33.0-49.0ᵐ: short cylindric core. 31.50ᵐ: slightly altered. 34.15ᵐ: aphanitic non-foliated massive amphibolite.							
	33		Micro-crystalline amphibolite (greenish black)			CM					11.5 (1.5×10^{-4} cm/s)	
	34											
	35											
6/23	36											
	37											
	38										2.8 (3.6×10^{-5} cm/s)	
	39											
6/24	40	49.00	714.03									

HOLE NO. ( )

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

LOG FORM-C

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DL-05 (1) Log Sheet HOLE NO. T2-B1 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	40.0 m	ELEVATION	752.60 m
SITE	El Torito T2 Dam left abutment	COORDINATE	: :	BOUNDING	Vertical	DRILL RIG	TDC-1G
AVERAGE CORE RECOVERY	81.8%	DATE	FROM 21 Jan TO 2 Feb. '83	DRILLED	KASEKARA, I.	LOGGED	TSUJI, K.

DATUM	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DIAMETER
	1.00	751.60	Top soil (light yellowish brown)		Loose, wet.					N-Value 6, 11, 15, 19, 21, 17	
			Decomposed amphibolite (greenish grey)		Decomposed into clay zone of foliated amphibolite. Sandy clay showing original texture of foliated amphibolite. 6.6-7.0m: very compact clay mixed with weathered rock fragments. 0-7.0m: no water drilling.	D				3.8×10⁻³ cm/s	
	7.00	745.60	Slightly weathered amphibolite (greenish grey)		Foliated bedded amphibolite. 7.0-8.0m: very cracky core composed of small rock fragments (1-3 cm). 8.0-9.0m: massive including black aphanitic amphibolite. 9.0-10.0m: very cracky due to fractured zone (3) 10.0m- As a whole, cracky due to fault (3) 10.52-11.0m: no core foliated plane dips 30°. 13.40-13.60m, 13.80-14.00m: weakly fractured & stained in clay. 14.0-14.30m: crack filled by thin quartz. 12.50-13.00m: black aphanitic amphibolite with thin calcite vein.	Cᴌ	water leak			12×10⁻³ cm/s 24.9 (34×10⁻⁴ cm/s)	
	15.00	737.60	Weathered amphibolite (greenish grey)		Possibly fractured part composed of cracky rock fragments. 15.4-15.7m, 16.2-16.6m crack dips 20°-30°. No water drill: 15.0-15.4m, 15.7-16.8m. Excavation depth for fill dam.					62.5 (8.6×10⁻⁴ cm/s)	
	17.00	735.60	Fresh aphanitic amphibolite (greenish grey)		Hard, fresh, massive rock. 19.00m-21.20m: long cylindric cores continue. 17.10-17.40m: foliated amphibolite boundary is sharp. 18.50m: weakly altered with calcite seam. 17.60m, 18.40m: weak fault plane.	Cᴍ					
	21.20	731.40	Weakly altered zone		Weakly altered, cracky & stained (fractured zone 2)					69.3 (9.6×10⁻⁴ cm/s)	
	21.90	730.70	Fresh aphanitic amphibolite (greenish grey)		As a whole fresh, hard & sound rock, partly cracks develop & are filled with calcite & chlorite film. 21.90-24.10m: massive very hard. 23.00-24.00m: cracks dip 30° & 60°. 24.00-25.00m: weakly foliated (greenish grey), foliated plane dips 20°. 24.10-25.30m cracky stained. 25.00-29.60m: very hard. 26.30-27.00m: cracks filled with white quartz film & dip mostly 60°-70°. 27.00-28.00m: cracky poor core recovery. 28.30-29.00m: weakly altered, very cracky.	Cᴌ				33.6 (4.6×10⁻⁴ cm/s)	
	23.60	723.00	Foliated amphibolite		Fresh hard.						
	30.00	722.60									

HOLE NO.

LOG (DIAM = 11)

RQD = Rock Quality Designation, RQD = (Total length of cylindric cores larger than 10 cm / Total core length) × 100%
LUGEON VALUE = Loss of water pressure (kg/cm²) per minute per meter
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-05 (2) Log Sheet

HOLE NO. T2-B1 SHEET NO. 2 OF 2

DATE	DEPTH (m)	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	31		Fresh aphanitic amphibolite (dark green)		Compact hard rock. 30.6-30.8m: cracks develop. 31.95-32.30m: weakly altered.							
1/31	32 32.00	720.60										
	33		Fresh foliated amphibolite (dark green & grey)		Minutely banded, hard & sound rock foliated plane dips 5°. Partly weakly altered & cracks develop. Weakly altered zone: 33.50-33.60m, 35.70-35.80m, 38.00-38.25m. 35.30-36.80m: cracks filled with thin calcite vein. Cracks develop at 38.00-39.00m & 39.50-39.80m.	CM	33.90m				5.9 (8.1×10⁻⁵ cm/s)	
	34											
	35											
2/1	36											
	37											
	38											
	39										> 100	
2/2	40 40.00	712.60										

HOLE NO.

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

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DL-06 (1) Log Sheet

HOLE NO. T2-B2 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	40.3 m	ELEVATION	711.54 m
SITE	T1 Torito T2 Dam, riverside	COORDINATE	: :	INCLINATION	Vertical	FULL NO.	TOC-1G
AVERAGE CORE RECOVERY	65.9%	DATE	FROM 5 Feb. TO 23 Feb. 83	DRILLED	MASKANA, I.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R. Q. D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	1.25	710.29	River Gravel (dark grey)		Unconsolidated, sub-rounded gravel mixed with sand.							
2/5	2.60	708.94	Weathered foliated amphibolite (greenish grey) Aphanitic amph.		Medium weathered. Foliated plane dips 15°, cracky with calcite net vein partly flaky.							
	4.00	707.54	Weathered foliated amphibolite (greenish grey)		Medium weathered, cracky with abundant calcite net vein, partly flaky major cracks dip 60°.						4.8×10⁻³cm/s	
2/14	7.60	703.94	Weathered aphanitic amphibolite (grey)		Medium weathered, but 5.00-6.00 section is fresh. 4.00-5.00m: crack develop. 6.50-7.50m: altered & very cracky. 6.70-7.00m: pale green epidote vein with a width of 0.5 cm, including pyrite.	CL					3.4×10⁻³cm/s	
2/15	10.80	707.74	Altered zone (grey)		Extremely altered zone, brecciated core composed of rock fragments & clay. 8.42-11.00m: no water drill. 8.30-8.42m: drilled water becomes grey, probably composed of altered clay. No core: 7.65-8.42m, 9.90-9.45m. Excavation depth for fill dam.	D						
2/16	14.80	696.74	Foliated amphibolite (greenish grey)		Coarse-grained, crystalline foliated plane dips 15°-20°. As a whole hard & fresh. 12.8-14.8m: long cylindric cores. Cracks dip 50°-70° & are tight.						25.1 (3.5×10⁻⁴cm/s)	
	15.00	696.54				CM						
	18.70	692.84	Fresh foliated amphibolite (greenish grey)		Hard & sound rock. Foliated plane dips 25°. 17.0-18.70m: frequent thin alternation of the two amphibolites. 15.9-16.20m: slightly altered. 16.50m: partly weakly altered.						> 100	
2/17	18.90	692.64	Aphanitic amph. fresh foliated amphibolite		Sharp boundary. Hard & sound rock.							
	19.75	691.79										
	19.90	691.64	Aphanitic amph. Foliated amphibolite (greenish grey)		Sharp boundary. Fresh & hard rock, micro-banded.							
2/18	21.15	690.39										
	23.60	687.94	Altered zone (greenish grey)		Core recovery is very poor, possibly composed of mixture of cracky rock fragments & clay thin net vein of epidote jewels. 23.30-23.60m No core: 22.30-22.55m, 22.8-22.25m	D					7.3 (1.0×10⁻⁴cm/s)	
2/19	28.25	683.29	Alternation of aphanitic amphibolite & foliated amphibolite		Hard & fresh rock but cracky. 27.50m: epidote thin vein. 25.00-28.00m: short cylindric cores continue. 28.25m: calcite crystal vein.	CL					7.0 (1.0×10⁻⁴cm/s)	
2/20			Aphanitic amphibolite (greenish grey)		Hard & fresh rock but cracky short cylindric cores continue.							

LOG NO. 2

LOG NO. 1

RQD = Rock Quality Designation. RQD = Total length of cylinder core longer than 10 cm / Total core length × 100%
LUGEON VALUE = 1 lu = 1 cubic meter core pressure of 10kg/cm²
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-06 (2) Log Sheet HOLE NO. T2-B2 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CLASSIFICATION	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	STRENGTH
2/21	31		Aphanitic amphibolite (greenish grey)		As a whole hard & fresh rock but cracks with an angle of 50°-65° develop. 31.00-31.70m: weakly altered zone. 31.70-31.85m: no core. 32.0-33.0m: short cylindric cores continue. 35.00-35.50m: no core.	CL				4.5 (6.3×10^{-5} cm/s)	
	32										
	33										
	34										
	35										
	36	36.55	675.05								
	37		Altered zone (greenish grey)		Strongly altered into cracky small rock fragments & clay, therefore, core recovery is very poor. Slime sample: 37.0-37.3m & 38.3-38.5m. No core: 36.50-37.00m, 36.00-36.40m, 37.70-38.00m.	D				68.9	
2/22	38										
	39	39.20	672.35								
2/23	40	39.30	671.25		Aphanitic amphibolite (greenish grey)						
					Cracky hard & fresh rock.	CL					

HOLE NO.

LOG FORM C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

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DL-07 (1) Log Sheet HOLE NO. T2-83 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	40.0 m	ELEVATION	752.09 m
SITE	El Torito T2 Dam Right abut- ment	COORDINATE	: :	INCLINA	Vertical	DRILL RIG	TOC-1G
AVERAGE CORE RECOVERY	96.5%	DATE	FROM 18 Jan TO 2 Feb.'83	DRILLED	OCHIAI, T.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	0.40	751.69	Top soil (brown)		Loose, including plant root.						
	1									N-value 20 19 34 26	
	2				In-situ decomposed into clay ore of foliated amphibolite.					2.6×10⁻⁴ cm/s	
	3		Decomposed amphibolite (greenish grey + yellow)		0.4-3.5m: mostly light yellowish brown, plastic clay.						
1/28	4				Below 3.5m: sandy silt (not so plastic) including rock fragments o weathered amphibolite.						
1/29	5		2.0-5.7m pale brown 11.6-11.7		5.0-5.6m: mixture of decomposed cla & rock fragments, mostly clay.						
	6				Below 5.7m: minute stripe texture of foliated amphibolite remains.	D					
	7										
1/30	8										
	9										
1/31	10										
	11				10.0-10.3m: No core.						
	12				10.3-12.5m: strongly weathered rock						
	12.60	739.49			6-12.6m: no water drilling. Excavation depth for drill dam.					30×10⁻⁵ cm/s	
1/24	13		Weathered amphibolite (greenish grey)		Rock bedd, foliated amphibolite.	Cᴌ					
	14				13.0-15.9m: partly weakly altered, fragile, easy to break by finger.						
	15.00	737.09									
	16				15.9-19.8m: hard, fresh cylindric cores continue.						
	17				Foliated plane dips 25°-30°.						
1/25	18				Most cracks in parallel with foliated plane which is weakly stained or filled with calcite (quartz) thin vein.	Cᴍ				60.4 (8.3×10⁻⁴ cm/s)	
	19				18.8-19.1m: greenish grey aphanitic amphibolite showing sharp boundary.						
1/26	20		Fresh foliated amphibolite		19.1-19.7m: weakly altered, compose of fragile rock fragments (1-2 cm).						
	21				19.8-25.0m: as a whole fresh, hard cylindric cores continue.						
	22				Foliated plane dips 35°, cracks develop with two directions of 30° & 60°.		21.90m escape of drill water			58.3 (8.0×10⁻⁴ cm/s)	
1/27 1/28	23					Cʜ					
	24										
	25				25.0-25.3m: cracks partly filled with calcite thin vein (0.5 cm).						
	26				Cracks mostly stained in pale brown						
	27				27.3-27.8m: weakly altered, very cracky.						
	28				28.2-28.5m: cracky.					30.1 (4.1×10⁻⁴ cm/s)	
1/29	29				Cracks develop with a dip of 70°-80°.						
	30					Cᴌ					

HOLE NO.

LOG FORM-15

RQD = Rock Quality Designation, RQD= Total length of cylindric cores longer than 10 cm / Total core length × 100%
LUGEON VALUE = Loss in water injection under pressure of 10kg/cm²
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DI-07 (2) Log Sheet

HOLE NO. T2-53 SHEET NO. 2 OF 2

DATE	DEPTH (m)	ELEVATION (m)	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	REMARKS
1/30	31		Foliated amphibolite (dull greenish grey)		Vertical cracks develop. Cracks stained in brown down to 49.0° in depth. Hard & soft in weathered rock. 32.0-33.0°: cracks filled with thin calcite vein, short cylindric cores. 33.0-34.0°: Foliated plane dips 25° in parallel with cracks. 34.9-35.0°: cracky, slightly altered along the cracks.	CM	3.22			10.2 (1.4×10^{-4} cm/s)	
	32										
	33										
	34										
1/31	35	35.00	712.02								
	36		Aphanitic amphibolite (grey)		Cracks stained in brown. Some cracks filled with thin calcite vein, partly altered along the cracks. Hard and fresh rock.	CH				2.4 (3.3×10^{-5} cm/s)	
	37										
2/1	38	38.80	713.29								
	39		Altered zone (yellowish grey)		Easily broken by a blow of hammer.	CL					
1/2	40	40.00	712.09		Foliated plane dips 25° in parallel with cracks.	CH					

HOLE NO.

LOG FORM-C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-08 (1) Log Sheet

HOLE NO. T2-B4 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	40.4 m	ELEVATION	713.09 m
SITE	El Torito T2 Dam, riverside	COORDINATE	: :	DIRECTION	Vertical	DRILL RIG	TOC-1G
AVERAGE CORE RECOVERY	90.0%	DATE	FROM 2/5 TO 2/23, '83	DRILLED	OCHIAI, T.	LOGGED	ISUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	1.00	712.09	River gravel (brownish grey)		Unconsolidated, sub-angular gravel mixed with sand. Excavation depth for fill 1m.						
	3.00	710.09	Foliated amphibolite (greenish grey)		Slightly altered, medium hard cracks develop, filled with calcite thin set vein. Coarse grained crystalline.	CM	50.60 m 14.50 m				
2/5	3.80	709.29	Altered zone (greenish grey)			CL					
2/7			Foliated amphibolite (greenish grey)		As a whole fresh & hard rock. 3.80-5.00m: slightly altered & crack. Cracky zone: 6.30-7.90m. 5.00-6.00m: vertical cracks develop partly filled with thin clay.	CM					
2/14	7.90	705.19								> 100	
2/15			Alteration of fresh foliated amphibolite & aphanitic amphibolite (greenish grey)		Frequent thin alteration of aphanitic amphibolite & foliated amphibolite. Foliated plane dips 25°, hard. 8.00-9.00m: cracks partly filled with calcite thin vein. 9.00-14.90m: long cylindric cores continue associated with high angle crack (50°-60°). 13.90-14.90m: foliated plane dips 25°.	CH				49 (6.8×10⁻⁴ cm/s)	
2/16	14.00	699.09	Weakly altered zone (greenish grey)		Composed of flaky chips, partly including altered clay, showing oily luster.						
	15.00	698.09	Aphanitic amphibolite (greenish grey)		Fresh & hard rock. Long cylindric cores continue. associated with cracks with an angle of 30°-60°.					15.1 (2.1×10⁻⁵ cm/s)	
2/17	17.90	695.19									
	19.90	693.19	Weakly altered zone (greenish grey)		Composed of rock fragments & green altered clay. Cracks dip 60°-70°. Rock fragments are breakable by a blow of hammer.	CL					
	20.30	692.79	Aphanitic amphibolite		Fresh & hard rock.	CM					
2/19			Foliated amphibolite (greenish grey)		20.0-25.0m: hard but slightly weathered rock. Cracky zone: 21.80-22.50m, 22.50-23.15m, 23.80-24.50m. Foliated plane dips 25°. 25.0-29.70m: As a whole fresh & hard rock associated with cracky zone of 26.30-26.55m. 28.40-29.70m: cracks dip 60°-70°. Foliated plane dips 20°-25°.	CL				13.1 (1.8×10⁻⁵ cm/s)	
						CM				8.5 (1.2×10⁻⁵ cm/s)	
2/20						CL					

LOG FORM-II

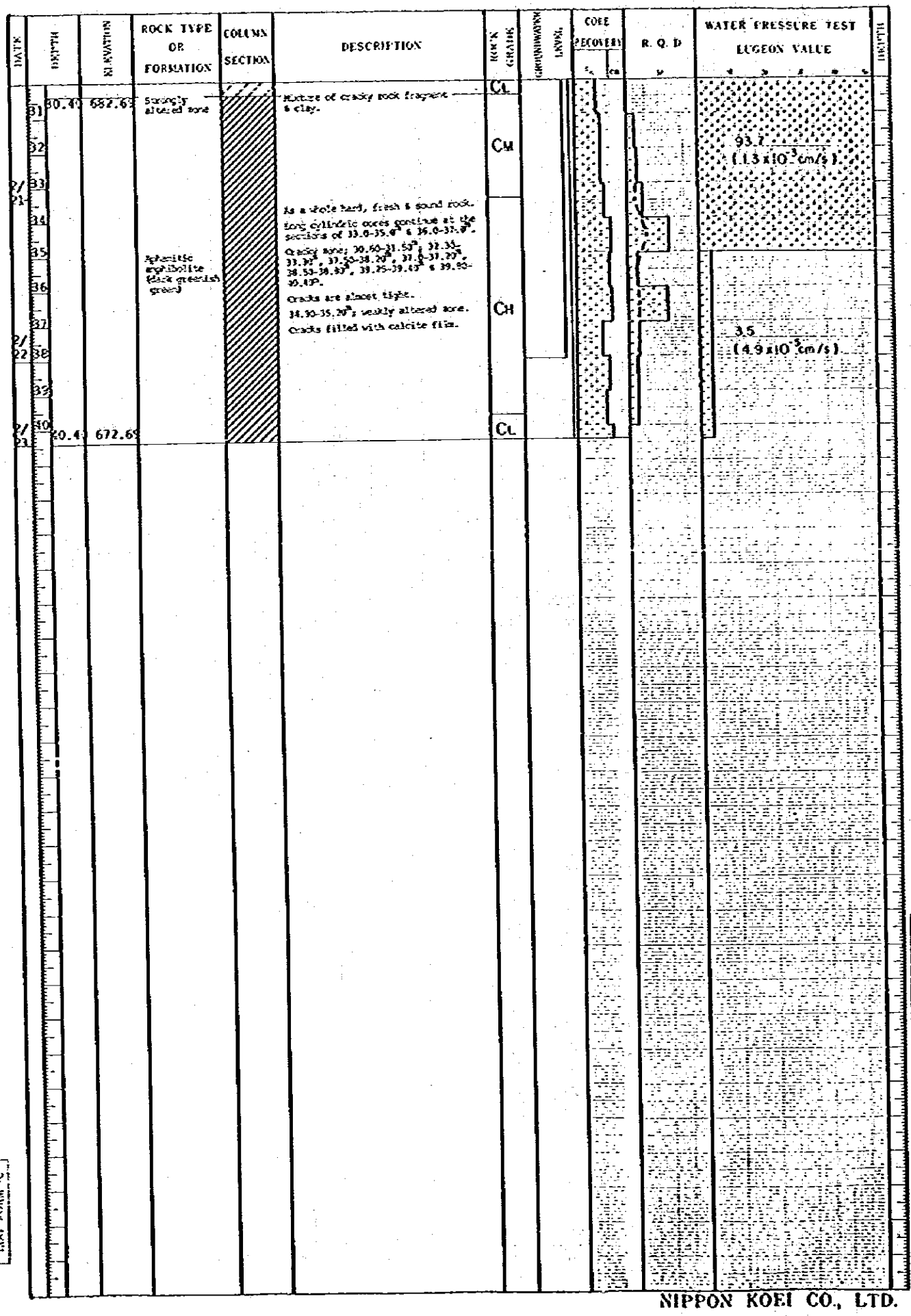
HOLE NO.

* RQD = Rock Quality Designation, RQD = Total length of cylindric cores longer than 10 cm / Total core length × 100%
* LUGEON VALUE = l/m/min under injection water pressure of 10kg/cm²
* DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-08 (2) Log Sheet

HOLE NO. 72-04 SHEET NO. 2 OF 2



HOLE NO.

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-09 (1) Log Sheet

HOLE NO. TPA-1 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	36.0 m	ELEVATION	746.44 m
SITE	El Torito T-3 Saddle dam site	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	75.3% (5.0-36.0 m)	DATE	FROM 3/14 TO 3/22, '83	DRILLED	R. QUEZADA	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY % / cm	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DRILLING
	0.45	745.99	Top soil								
3/14	1				0.45-3.0m; stiff plastic clay, containing coarse sand (dull olive).						
	2										
	3				3.0-5.8m; stiff plastic clay, homogeneous (yellowish brown); the above shows high ratio of water content.						
	4										
	5		Debris								
	6				5.8-6.8m; plastic clay accompanied by weathered aphibolite (yellowish brown).						
	7				6.45-7.55m; dark brown hard (paleosoil ?).						
	8										
	9				8.0-9.15m; plastic clay with high water content associated with weathered rock fragments (reddish brown).						
	10				9.15-11.4m; very homogeneous plastic clay (light yellow).						
	11				5-tube was obtained by re-drill.		11.20m (3/22)				
	11.40	735.04									
	12				In-place weathered aphibolite completely weathered, showing original texture.						
	13		Completely weathered aphibolite (grey)		Probably very cranky, crack filled with thick clay seam.						
	14				11.8-12.15m; no core.						
	15				14.8-15.55m; hard rock						
	16				Down to 14.8m no water drill.						
	16.75	729.69									
3/15	17		Altered aphibolite (yellowish olive)		Altered clay with fine sand.						
	17.55	728.89									
	18										
	19										
	20				Completely weathered lava clay, partly rock pieces.						
	21		Weathered aphibolite & gabro (black)		Stiff plastic clay, micaceous.	D					
	22				No core; 21.6-22.2m, 22.5-23.8m, 24.8-24.85m.						
	23				22.4-22.5m; hard fragment core.						
3/16	24				23.8-24.85m; small weathered fragment core.						
	24.85	721.53			Down to 24.85m; no water drill.						
	25										
	26				Scistose altered aphibolite rock fragment, filled with grey altered clay.						
3/17	27		Altered aphibolite (black to grey)		24.85-25.8m; hard rock fragment micro-crystalline gabro micaceous, altered.						
	28										
	29										
	30										

Excavation depth for core material

N-value

LOG POINT-11

HOLE NO.

RQD = Rock Quality Designation. RQD = Total length of cylindrical cores longer than 10 cm / Total core length x 100%
LUGEON VALUE = 1 l/m x water pressure over packer of 10kg/cm²
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-09 (2) Log Sheet

HOLE NO. TPA-1 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CREATIC	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	30.40	716.0	Altered anph.		Altered clay with rock fragments.	D					
8/ 18	31										
8/ 19	32		Gabbro (black)		Fresh gabbro, cracky fragment core.	CL					
	33	33.10	713.34								
		33.50	712.94	Altered anph.	Altered clay with rock. No water drill.	D					
	34										
8/ 21			Gabbro (black)		Fresh gabbro, cracky fragment core, very poor core recovery.	CL					
	35	35.10	711.34								
8/ 22	36	36.00	710.44	Amphibolite (grey)	Fresh and hard, cylindric core foliated plane dips 79°.	CM					
	37										
	38										
	39										
	40										

HOLE NO.

LOG FORM C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

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DL-10 Log Sheet

HOLE NO. T4-B1 SHEET NO. 1 OF 1

PROJECT	El Torito-Los Vegaños Hydroelectric Development Project			DEPTH	30.0 m	ELEVATION	699.93
SITE	T4 weir site	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	52.8%	DATE	FROM 7/8 TO 7/19,'83	DRILLED	J. ENERIO	LOGGED	K. TSUJI

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DRILLING
7/8	4.50	695.43	Decomposed into clay of gneiss (light reddish brown-pale ivory)		In-situ completely weathered gneiss still plastic clay.	D					
	6.50	693.43	Extremely weathered gneiss		Cuttings only taken (medium sand) probably extremely weathered gneiss.						
	11.00	688.93	Weathered gneiss (Brownish white)		Extremely foliated gneiss weathered fragment core coarse-grained crystalline rock associated with decomposed clay. Crack stained in brown. Excavation depth for fill dam.						
7/9	14.50	685.43	Weathered gneiss (White brown stained)		Weathered gneiss, coarse, grained crystalline rock. Extremely foliated dipping 30°. Crack is open & stained.	CL				23.1 (2.9×10^{-4} cm/s)	
7/10	18.25	681.68	Gneiss (Bluish white)		Fresh and hard rock. Schistosity dips 30°. Crack dips 35° and 75°. Crack is open and slightly stained. Long cylindric core.	CM					
7/11	23.00	676.93	Fractured zone (?)		18.25-20.9^m: no core. 20.9-21.6^m: cuttings sample only. 21.6-22.8^m: no core. Probably fractured clayey zone due to fault.	D	20.00^m				
7/13	30.00	669.93	Gneiss (Bluish white)		Fresh and hard. Extremely foliated dipping 30°. 23.10^m: Black micro-crystalline sericolite dike. 23.8-25.5^m: long cylindric core. 25.5-30.0^m: short cylindric to fragmental core, crack develops, crack is tight including dark inclusion. 28.1-28.5^m: fractured.	CM				7.3 (9.4×10^{-5} cm/s)	

LOG POINT-15

HOLE NO.

*RQD's Rock Quality Designation. RQD = Total length of cylindric cores longer than 10 cm / Total core length × 100%
*LUGEON VALUE at 1 min in water injection water pressure of 10 kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-11 Log Sheet

HOLE NO. T4-B2 SHEET NO. 1 OF 1

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	30.0 m	ELEVATION	669.28 m
SITE	T4 weir site	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	30.2%	DATE	FROM 6/27 TO 7/3,'83	DRILLED	J. ENERIO	LOGGED	K. TSUJI

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY m	R. Q. D	WATER PRESSURE TEST LUGEON VALUE	REMARKS
	0.00						0.00m					
6/27	4.50	664.78	River gravel (pale brown - greyish green)		Loose, unconsolidated sand and gravel (pebble-cobble size). Excavation depth for low weir foundation.							
6/28	10.50	658.78	Weathered gneiss (greenish grey)		Slightly weathered gneiss coarse grained crystalline rock (very cracky). Very poor core recovery.	CL						
6/29	14.00	655.28	Fractured gneiss (?) (greenish grey)		Clayey part probably due to fracture and alteration. 12.0-12.2m, 12.5-13.0m, 13.0-13.2m, 13.3-13.5m: soft grey clay. Very poor core recovery.	D						
	14.30	654.98	Gneiss		Fragment core sampled.	CL						
	20.00	649.28	Fractured gneiss (?) (greenish grey)		No core: clayey part probably due to fracture and alteration. Very poor core recovery. 18.0-18.15m: fragment core sampled.	D						
6/30			Gneiss (greenish white)		Fresh and hard. Short cylindric core or fragment core. No core: 20.50-21.0m, 24.3-25.0m, 25.2-25.5m, 27.2-28.0m, 28.2-28.5m, 29.0-30.0m. Coarse grained crystalline rock, schistosity dips 35°.	CM					107 (1.4x10⁻⁴cm/s)	
6/31	25.20	644.08	Fractured Gneiss (?)		No core, probably cracky or clayey zone due to fracture.	D						
7/2	26.90	643.38	Gneiss (greenish white)		Fresh and hard. 27.0-29.0m: short cylindric core coarse grained crystalline rock schistosity dips 30°. 29.0-30.0m: slightly altered.	CM					13 (1.7x10⁻⁵cm/s)	
7/3	30.00	639.28										

HOLE NO.

LOG FORM-A

* R.Q.D = Rock Quality Designation. R.Q.D = Total length of cylindric core longer than 10 cm / Total core length x 100%
* LUGEON VALUE = Loss in water injection rate pressure of 10kg/cm²
* DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-12 (1) Log Sheet

HOLE NO. TP-31 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaños Hydroelectric Development Project			DEPTH	37.0 m	ELEVATION	705.71 m
SITE	Los Vegaños Penstock line	COORDINATE	: :	DIRECTION	Vertical	DRILL RIG	Long year 34
AVERAGE CORE RECOVERY	31.3% (13.0-37.0 m)	DATE	FROM 6/8 TO 6/15, '83	DRILLED	J. ENERIO	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	REMARKS
6/8	1.00	704.71	Top soil (dark brown)		Plastic clay with small rock fragment.						
			Decomposed green rock (greenish grey)		In-place completely decomposed into clay like of green rock. Mixture of weathered green rock associated with clay and sand. Below 5.4m: weathered rock getting hard.	D					
			Duarte formation		Below 10.8m: colored in dark brown. 12.65m: Excavation depth for penstock foundation.						
6/9	12.60	693.11			Down to 12.6m: drive to be sampled.						
			Completely weathered green rock (yellowish brown) Duarte formation		Completely weathered rock-fragment with clay sample. All small fragment core. Crack stained in dull brown poor core recovery.	D					
	18.00	687.11									
6/10			Weathered green rock (greyish green) Duarte formation		18.0-37.0m: colored in greyish green to greenish black or dark green. Moderately weathered fragment core. Hydrothermic volcanic rock origin. Crack open and contains. Clay seam. Poor core recovery due to fragment crack.	Cl					
6/11							2.25m (6/6)				
6/13											

N-value: 12, 17, 20, 25, 35, 25, 25, 25, 36, 27, 28, 22, 30, 24, 30, 27, 36, 35, 35, 32, 43, 38, 29, 42, 44, 32

HOLE NO.

LOG FORM 11

RQD = Rock Quality Designation, RQD = Total length of all solid core longer than 10 cm / Total core length × 100%
LUGEON VALUE = Loss in water injection under pressure of 10kg/cm²
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-12 (2) Log Sheet

HOLE NO. TP-81 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	REMARKS
	31 31.00	674.71	Weathered green rock		Fragment core, colored in greyish green.						
	32										
	33										
	34		Green rock (Black green) Diorite formation		Fresh and hard rock. Micro-crystalline, volcanic rock. Crack upon and stained. Below 34.8m, cylindric, sound rock.	CH					
6/14	35										
	36										
6/15	37 67.00	668.71									

HOLE NO. ( )

LOG FORM-C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DLr-13 (1) Log Sheet

HOLE NO. TP-B3 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	32.75 m	ELEVATION	609.31 m
SITE	Los Veganos Penstock line	COORDINATE	: :	INCLINATION	Vertical	DRILL MC	Craelius Diamond 44
AVERAGE CORE RECOVERY	39.4% (5.0-32.75 m)	DATE	FROM 5/4 TO 5/31,'83	DRILLED	J.SOTO/ENERPIO	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	HOLE GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	0.45	608.86	Top soil		Brown soft clay						
5/4	4.88	604.43	Debris		Unconsolidated plastic clay accompanied by weathered rock fragment. Colored in greenish grey (1.35-3.65m), 3.15-1.20m (dark yellowish brown (0.45-1.35m, 2.75-3.5m). Down to 4.88m; Drive tube sampled. 2.15-3.05 No sample.					4 9 15 18 20 22 33 34 45 N-Value	
5/10	7.35	601.96	Strongly weathered green rock (argreen)		Extremely weathered (phyritic volcanic rock origin) very cracky stained in dark brown, fragment core. Excavation depth for penstock foundation.	D					
5/14	16.50	592.81	Weathered green rock (greish green)		Weathered & moderately hard cracky, crack stained in dark brown. Weathered fragment associated with in-place decomposed clay. 14.15-14.65m: no water drill, slightly altered clay. Below 15.8m, degree of weathering decrease.	D					
5/25	17.00	592.31	Slightly altered zone		Rock fragment with altered clay.	D					
	17.50	591.81	Altered zone		Altered zone, sandy clay, no water drill.						
	20.00	589.81	Slightly altered green rock (pale greish green)		Fragment core, crack stained in brown. Partly accompanied by clay.						
5/26			Green rock (greenish grey)		Fresh and hard, fragment core aphanitic green rock. Crack develops, stained in light brown. From 23.0m: short cylindric core.	CL					
5/27 5/28					26.0-27.0m: sound cylindric core. 26.5-26.8m: porphyritic rock vein. Colored in pale green intrusive, dipping 40°.	CM					

LOG FORM 14

HOLE NO.

*RQD = Rock Quality Designation. RQD= Total length of cylindric cores longer than 10 cm / Total core length x 100%
*LUGEON VALUE = Loss of water injection water pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DLr-13 (2) Log Sheet

HOLE NO. TP-83 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	REMARKS
	31 31.00	578.33	Green rock (greenish grey)		Fresh and hard, but cracky fragment core.	CM					
5/ 31	32 32.75	576.58	Green rock (greenish grey)		Fresh and hard cylindric core.	CH	No ground water				

HOLE NO.

LOG FORM - C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-14 (1) Log Sheet

HOLE NO. DL-14 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	38.5 m	ELEVATION	543.21 m
SITE	Los Veganos Power house	COORDINATE	: :	BOREHOLE	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	27.0%	DATE	FROM 3/15 TO 5/17, '83	DRILLED	J. ENERIO	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
3/15	1		Old river terrace deposit (greenish grey)		loose, unconsolidated deposit sub-angular gravel.						
	2				2.1-2.8m: grey sandy clay.						
	3										
	4				3.5-5.5m: sub-rounded gravel various kinds of rocks green rock, diorite.						
3/15	5										
3/16	6				5.5-6.0m: boulder of green rock.						
3/16	7										
3/16	8										
	9										
3/16	10	9.75			Excavation depth for power house foundation.		10.00m (5/17)				
	11	533.46									
	12										
3/16	13		Weathered green rock (greyish green)		Moderately weathered very poor core recovery, probably cracky rock, probably suitable for power house foundation.						
3/16	14				Totally fragment core crack stained in black.						
	15				14.6-17.2m: no core.	D					
	16										
3/17	17	17.20									
	18	526.01									
	19				Fresh and hard.						
	20				Crack open & stained cracky rock, very poor core recovery.						
3/17	21		Green rock (greyish green)		20.45-20.80m: long cylindric core. Quartz veinlets: 20.5m and 20.8m. 21.7m: contains pyrite crystal.	CL					
	22										
	23										
3/4	24										
	25	25.00									
	26	518.21	Fractured zone of green rock (grey)		25.8-25.1m: fractured grey clay with rock fragments.						
	27				25.1-29.5m: No core, probably fractured clayed zone.	D					
3/5	28										
	29										
	29.50	513.71	Schistosed green rock		Schistosed plane dips 80°.	CL					

HOLE NO. DL-14

* RQD = Rock Quality Designation. RQD = Total length of cylindric cores longer than 10 cm / Total core length × 100%
* LUGEON VALUE = 1 cm³ water injection rate per minute at 10kg/cm²
* DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-14 (2) Log Sheet

HOLE NO. TOK-1 SHEET NO. 2 OF 2

DATE	LENGTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CREATIVE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	UNIT WT.
	31										
	32				Extremely schistosed, equivelent to green schist partly.						
	33		Schistosed green rock (greenish black)		Schistosed plane dips 20°.						
5/16	34				33.5m: quartz vein < 1 cm thickness.	Cm					
	35				33.6-34.0m: flaky sample.						
	36				34.0m: slightly altered, containing pyrite.						
	37				36.0-37.0m: extremely schistosed schistosed plane dips 20° in parallel with dominant crack flaky sample.						
5/17	38	38.50	504.71		38.0-38.5m: no core.						

HOLE NO. ( )

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

LOG FORM C

DL-15 **Log Sheet**

HOLE NO. TOS-2 SHEET NO. 1 OF 1

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	20.0 m	ELEVATION	545.68 m
SITE	Los Veganos No.1 Power house	COORDINATE	: :	DIRECTION	Vertical	DRILL MC	Longyear 34
AVERAGE CORE RECOVERY	26.3%	DATE	FROM 2/24 TO 3/10, '83	DRILLED	J. ENERIO	LOGGED	TSUJI, K.

DATUM	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	CASING
	7.75	537.93	Old river terrace deposit (greenish grey)		Loose, unconsolidated deposit subangular-subround gravel rock variety: green rock, diorite green schist. No core: 20.0-20.5m Excavation depth for power house foundation.						
	20.00	525.68	Weathered green rock (greenish grey)		Hard but moderately weathered crack open & stained in brown fragment core. Aphanitic green rock. Very poor core recovery. 9.00m: altered zone with clay. 9.25-19.25m; 18.9-20.0m: No core. Very cracky but probably sound rock for power house foundation.	CL	11.05m (3/10)				

HOLE NO.

LOG: POWER 16

*R.Q.D = Rock Quality Designation. R.Q.D= Total length of cylindrical cores longer than 10 cm / Total core length x 100%
*LUGEON VALUE is Lu = water injection rate (l/min) / pressure (kg/cm²)
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-16 (1) Log Sheet

HOLE NO. LP-B1 SHEET NO. 1 OF 2

PROJECT	El Torito-los Veganos Hydroelectric Development Project			DEPTH	40.0 m	ELEVATION	716.70 m
SITE	Los Veganos No. 1 Surge Tank	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TDC-1G
AVERAGE CORE RECOVERY	77.8% (13.0-40.0 m)	DATE	FROM 8/3 TO 8/6, '83	DRILLED	MAEKAWA, I.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CHIATE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	1				Homogeneous plastic clay.							
	2				High content of water.							
	3				Shows color in bright reddish brown.							
	4		Overburden debris									
	5											
	6				Rather stiff plastic clay.							
	7	7.00	709.70		Low content of water.							
					Pale reddish brown.							
	8		Decomposed tuffaceous limestone (yellow-reddish brown)		In-place decomposed zone slightly silty clay, plastic.							
	9											
	10				Including weathered rock fragment.	D						
8/3	11	11.00	705.70									
	12		Weathered tuffaceous limestone (greenish grey)		Fragment core, partly clayey poor core recovery.							
	13	13.00	703.70		Down to 13.0m: Drive sample taken.							
	14				13.0-15.0m: moderately weathered.							
	15				Below 15.0m: fresh & hard rock with thin calcite network veinlets.	CL						
	16				Crack stained in pale brown.							
	17				15.0-25.0m: short cylindric core.							
8/4	18											
	19				17.0m: excavation depth for surge tank foundation.	CM						
	20		Tuffaceous limestone (greenish grey)									
	21											
	22					CL						
	23											
	24					CM						
	25											
8/5	26				25.0-29.0m: very short to fragment core.							
	27					CL						
	28											
	29											
	30											

N-value: 7, 8, 9, 10, 10, 21, 23, 14, 17, 17, 18

HOLE NO.

LOG FORM-B

*RQD = Rock Quality Designation. RQD = Total length of cylindric cores longer than 10 cm / Total core length x 100%
*LUGEON VALUE = Loss of water injection rate pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-16 (2) Log Sheet

HOLE NO. L2-31 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CREVICE	GROUNDWATER LEVEL	CORE RECOVERY %	R Q D %	WATER PRESSURE TEST LUGEON VALUE	REMARKS
5/6	31		Siliceous limestone (greenish grey)		Fresh and hard rock with calcite veinlet. Short cylindric core with fragment core.						
	32										
	33										
	34	34.00				CM					
8/7	35	682.70	Limestone (grey)		Short cylindric to fragment core. Core recovery decreases.						
	36										
	37				36.6-39.8m: slightly weathered rock. Crack stained in pale brown.						
	38										
	39				39.8-39.2m, 39.23-39.33m: core (no core).		No ground water				
8/	40	40.00	676.70								

HOLE NO.

( )

LOG FORM C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-17 Log Sheet

HOLE NO. VQ-B1 SHEET NO. 1 OF 1

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	30.0 m	ELEVATION	553.50 m
SITE	Los Vegaros No.1 Penstock	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	CRAELIJO-42
AVERAGE CORE RECOVERY	47.4% (7.0-30.0 m) Line	DATE	FROM 7/14 TO 8/1, '83	DRILLED	J. SOTO	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	0.90	552.60	Top soil		Reddish brown plastic clay							
			Debris (dark yellowish brown)		Clay associated with weathered limestone breccia (unconsolidated).						N = value 5, 4, 11, 12, 25, 17, 19, 25	
7/14	3.60	549.90			Down to 3.60m: drive tube sampled.							
			Weathered limestone (yellowish grey)		Strongly weathered limestone cracky, poor core recovery. 6.80m: excavation depth for penstock foundation. From 5.65 to 6.80m: drive tube sampled.	D					25, 23, 21	
	6.80	546.70										
			Weathered limestone (grey)		Moderately weathered limestone.	CL						
7/15	10.00	543.50			9.9-10.0m: certain grey clay.							
			Limestone (dark grey - black)		Fresh and hard rock. Crack open and stained. Mostly fragment core, partly no water drill. 15.5-16.0m, 17.5-18.0m: partly including grey silt with limestone fragment. 16.0-25.0m: poor core recovery. 17.5m: grey silt, probably filling material in cave or cutting.	CL						
7/21	20.00	533.50										
	21.00	532.50	Weathered calcareous limestone		Dark brown, very cracky, small chip sample including clay seam.	D						
7/22			Limestone (black)		Fresh and hard rock. 21.0-25.0m: short cylindric to fragment core.	CL						
7/26					Below 25.0m: short cylindric core with calcite vein. Crack stained in yellowish brown. Below 26.5m: long cylindric core continues.	Cu						
8/1	30.00	523.50					No ground water					

LOG FORM-15

HOLE NO.

*RQD = Rock Quality Designation. RQD = Total length of cylindric core longer than 10 cm / Total core length x 100%
*LUGEON VALUE = Loss in water injection under pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-18 **Log Sheet**

HOLE NO. 3B-B3 SHEET NO. 1 OF 1

PROJECT	El Torito-Los Vegaños Hydroelectric Development Project			DEPTH	20.0 m	ELEVATION	495.35 m
SITE	Los Vegaños No. 2 Power House	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TDC-1G
AVERAGE CORE RECOVERY	81.0%	DATE	FROM 6/5 TO 6/11,'83	DRILLED	OCHIAI, T.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	REMARKS
	0										
	1	1.00 494.35	Top soil (dark brown)		Soft, loose soil with limestone fragment.						
	2										
6/5	3		Weathered marl (black)		Strongly weathered, very cracky and fragment core.						
	4				Crack stained in brown.	D				51.3 (6.7×10^{-3} cm/s)	
					Very poor core recovery.						
6/6	5	5.00 490.35			Calcite vein dips 35°.						
	6		Marl (black)		Slightly weathered, hard rock fragment to short cylindric core.						
	7	7.00 488.35			Crack coated with calcite.	CL				34.8 (4.7×10^{-3} cm/s)	
	8				Fresh and hard rock with calcite veinlets of a few millimeter thick.						
6/7	9				Crack stained in brown down to 10.0m.						
6/8	10										
	11				Crack dips 40° & horizontal.						
	12				Generally short cylindric core.					28.3 (3.8×10^{-3} cm/s)	
6/9	13		Marl (black)		Slightly weathered zone: 11.0-13.0m, 15.5-17.0m.	CM	12.60m				
	14										
	15										
	16										
	17										
6/10	18									27.5 (3.8×10^{-3} cm/s)	
	19										
6/11	20	20.00 475.35									

HOLE NO.

LOG FORM-15

* RQD = Rock Quality Designation. RQD = (Total length of cylindric core longer than 10 cm / Total core length) × 100%
* LUGEON VALUE = Lm/min under injection water pressure of 10kg/cm²
* DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-19 (1) Log Sheet

HOLE NO. VI-81 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	60.0 m	ELEVATION	534.53 m
SITE	VI dacite (left abut)	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TDC-1G
AVERAGE CORE RECOVERY	85.6%	DATE	FROM 7/14 TO 7/23, '83	DRILLED	NAKADA, I.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	0.40		Top soil		Brown, including plant root.						
7/14	1 2 3 4 5 6		Debris (Mild olive - grey)		Limestone breccia debris, loose & unconsolidated. Rock: limestone & green tuff.					7.8×10⁻³ cm/s	
	6.20	528.33									
	6.70	527.83			Brown silt with rock fragment.						
	7.10	527.43			Grey silt with rock fragment.						
	7.60	526.93			Reddish brown plastic clay.						
	8.50	526.03			Brown silt with small limestone fragment.					probably over 1×10⁻³ cm/s	
7/15	9 10.00	524.53			Grey silt with small fragment of limestone. Down to 10.0m: no water drill.						
	0.50	524.03	Weathered limestone			D					
7/16	11 12 13		Weathered limestone (grey)		Crushy fragment occ. 13.5-11.0m, 12.6-12.15m: core crack contains clay seam. Excavation depth for fill dam.	CL				> 100	
7/16	13.40	521.13									
	14 15 16 17 18 19 20 21 22 23		Tuffaceous or sandy siliceous limestone (greenish grey)		Fresh and hard rock. Crack stained in brown with weathered fills coating of less than 5 mm in thickness. Crack dips 30° in parallel with calcite thin vein (probably equivalent to bedding plane). Partly includes small black lens, dipping 30° (Lens <2 cm thick, 1-2 cm long). Mostly tuffaceous or sandy siliceous limestone.	CM				48.6 (6.7×10⁻⁴ cm/s)	
						CL					
7/19	23.20	511.33				CM				34.1 (4.7×10⁻⁴ cm/s)	
	24 25		Limestone (grey)		Slightly weathered, pure limestone. 23.7-25.6m: very crushy, crack stained in yellowish brown.	CL					
7/20	25.60	508.93									
22	26.00	508.53	Core		Filled with foreign material (grey clay)						
	27 28 29 30		Limestone (black)		27.0-30.0m: fresh and hard rock. 25.6-26.0m: very crushy. 26.0-27.0m: crushy, very much stained in brown to yellow.	CM CH				6.6 (9.1×10⁻⁵ cm/s)	

HOLE NO.

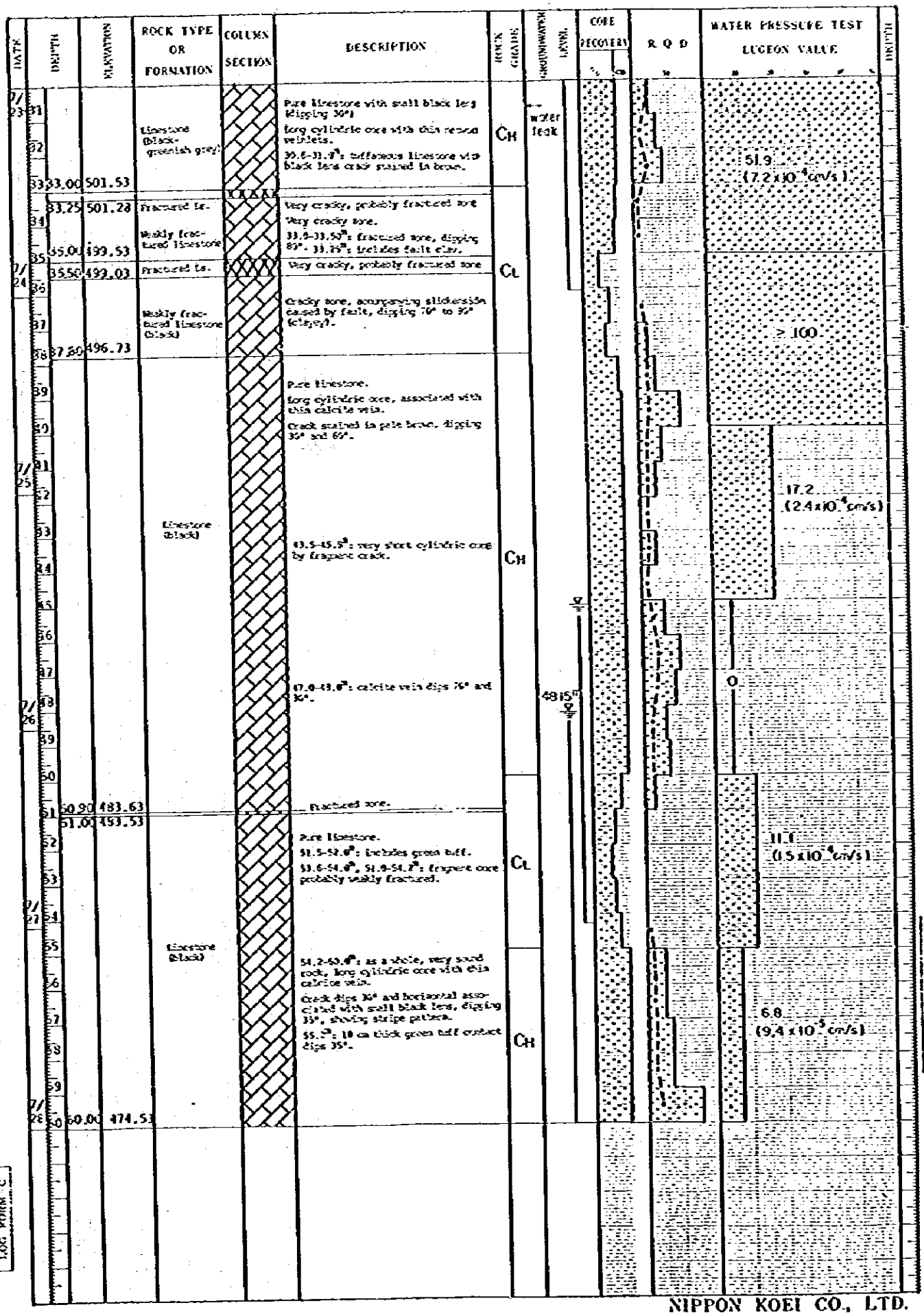
LOG FORM-4

*RQD is Rock Quality Designation. RQD = Total length of cylindrical core longer than 10 cm / Total core length × 100%
*LUGEON VALUE is Lu = a water injection test pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-19 (2) Log Sheet

HOLE NO. VI-31 SHEET NO. 2 OF 2



LOG FORM C

NIPPON KOEI CO., LTD.
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DL-20 (1) Log Sheet

HOLE NO. VI-B2 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaños Hydroelectric Development Project			DEPTH	50.0 m	ELEVATION	514.22 m
SITE	VI dacsite (left abut)	COORDINATE	: : °	BOUNDING	Vertical	DRILL RIG	TOC-16
AVERAGE CORE RECOVERY	93.7%	DATE	FROM 6/6 TO 6/23,'83	DRILLED	MAEKAWA, I.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	REMARKS
6/	0.50	513.72	Top soil		Pale red plastic clay.							
6	1				Unconsolidated, loose.							
	2				0.5-1.5m: plastic clay associated with rock fragments. Clay is dominant.							
	3				1.5-5.0m: mixture of clay and rock fragments (green tuff & limestone).						9 8.5 N-value 34	
6/ 7	4											
	5				Loss to 6.50m: no water drill.							
			Debris (pale brown - grey)		5.0-10.0m: rock debris (grey).							
6/ 8	6						water leak					
	7											
6/ 9	8											
	9											
	10											
	11				Unconsolidated, loose terrace deposit composed of rock fragment & sand and silt. (Pale brown)							
6/ 10	12											
6/ 11	13											
	14											
	15				Excavation depth for fill dam.							
	15.50	498.72										
	16				Fresh and hard rock accompanied by thin calcite network veinlets, dipping 30° in parallel with bedding plane (ave. 2-3 cm thick).	CM					> 100	
	17											
	18											
	19				Crack stained in pale brown.							
6/ 12	20				18.9-20.0m: crack dips approx. 30° in parallel with bedding plane.							
	21		Limestone (light grey)		Partly slightly altered: 19.1-20.2m, 20.9-21.1m, 21.9m, 26.2-26.3m, 27.6-27.8m.							
	22				Well-holded, including calcite vein of less than 5 mm in thickness.							
	23										212 (29.10 kg/cm²)	
	24						water leak					
6/ 13	25					CH						
	26	26.00	488.22				water leak					
	27				Fresh & hard rock including black lens dipping 33° in parallel with bedding plane.						> 100	
6/ 14	28		Siliceous limestone (greenish grey)									
	29											
	30											

HOLE NO. ____

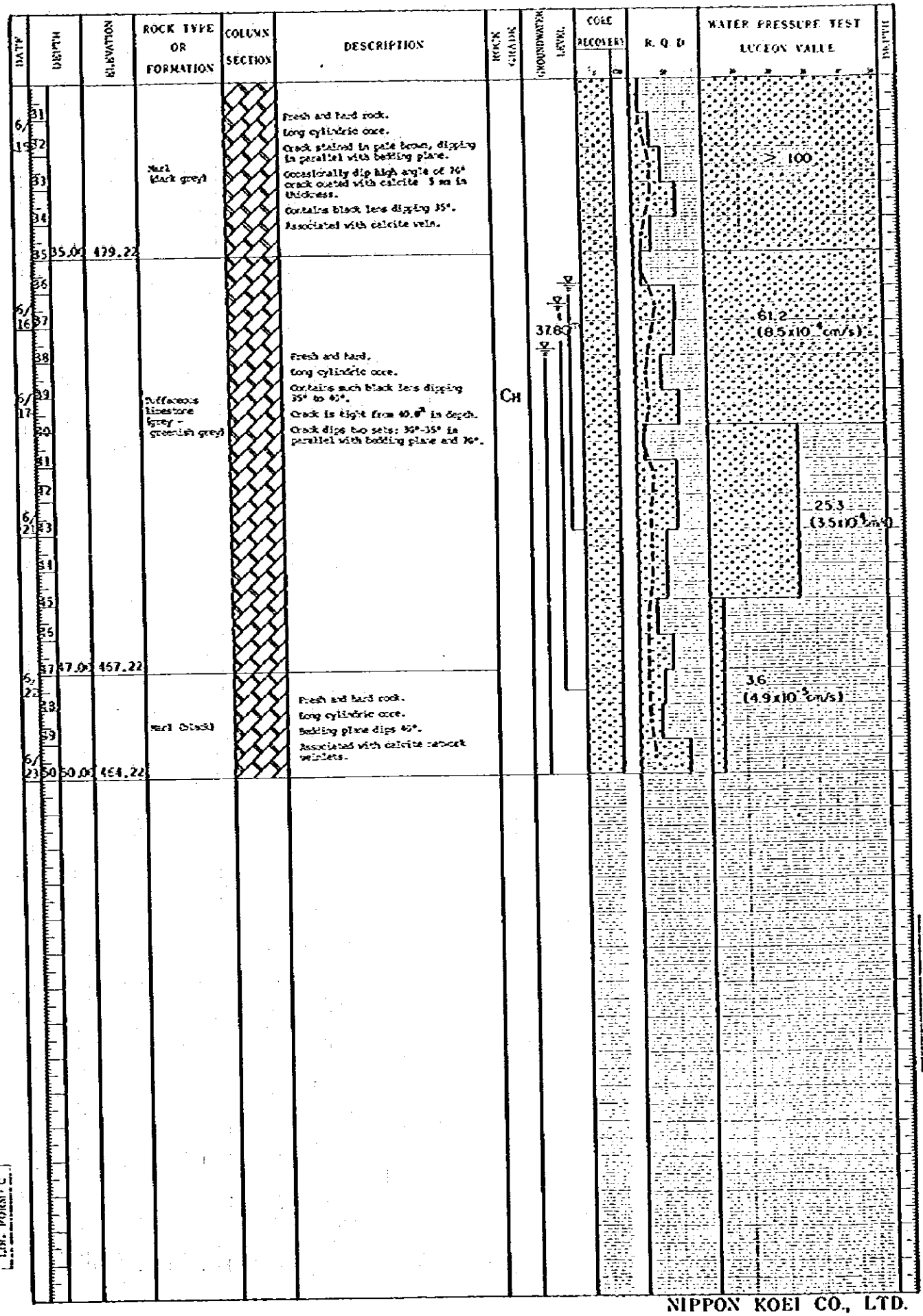
LOG FORM-B

* RQD is Rock Quality Designation. RQD= Total length of cylinder core larger than 10 cm / Total core length × 100%
* LUGEON VALUE is the water injection rate quantity of 10kg/cm²
* DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-20 (2) Log Sheet

HOLE NO. V1-B2 SHEET NO. 2 OF 2



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DL-21 (1) Log Sheet

HOLE NO. V1-B3 SHEET NO. 1 OF 3

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	70.0 m	ELEVATION	488.52 m
SITE	V-1 dansite (riverside)	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TDC-1G
AVERAGE CORE RECOVERY	94.9%	DATE	FROM 3/1 TO 3/17, '83	DRILLED	MAEKAWA, I.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	WEATHERING	LEVEL	CORE RECOVERY %	CORE RECOVERY m	R.Q.D m	WATER PRESSURE TEST LUGEON VALUE m	PERMEABILITY
3/1	1		Present river gravel (yellow brown - grey)		Unconsolidated, loose deposit. 0.9-1.8m: gravel-bearing sand. 1.8-3.6m: various kinds of gravel (green rock & gneiss). ~5.1m: pebble - granule gravel accompanied by silt. ~5.3m: gravel (limestone). ~5.55m: sand (grey). ~6.30m: silt accompanied by gravel (grey).	-	DO					5.3×10⁻³cm/s	
3/2	6.80	481.72	Weathered diffaceous limestone		Very crushy (greenish grey).	D						9.7×10⁻³cm/s	
	7.50	481.02			Excavation depth for fill dam.								
	8				As a whole hard and fresh rock including calcite vein-let veinlets. 8.0-9.0m, 9.3-9.5m: weakly altered partly sheared zone dipping 60°. Crushy zone: 7.50-10.0m, 13.0-15.0m 11.7-11.8m: sand.	CM						8.2×10⁻³cm/s	
	20				General cracks dip 50° and 60°, includes calcite hair veinlets. Dipping vertical and 50° - 60°.								
3/4	1											2.7×10⁻³cm/s	
	2												
	3												
	4												
	5												
	6												
	7				16.4-17.2m: slightly altered, dipping vertical. 18.0-22.0m: fresh & very sound rock. Down to 30m crack is tight, no stained in brown.							16 (2.2×10⁻⁵cm/s)	
	8												
	9		Diffaceous limestone (greenish grey - greish green)			CH							
3/5	90												
	1												
	22				22.1-22.35m: slightly altered zone. 22.8-23.0m: sheared schistose zone, re-consolidated. 23.0-25.0m: contains black thin lens. 22.8-25.0m: slightly altered, dipping 50°-60°. Associated with frequent calcite thin veinlets. 25.3-31.37m: contains black thin lens.							0	
	3												
	4												
3/6	5												
	6												
	7												
	8											0	
	9												
3/7	0												

HOLE NO.

LOG FORM-A

RQD = Rock Quality Designation. RQD = Total length of cylindric core longer than 10 cm / Total core length × 100%
LUGEON VALUE = Loss in water pressure (kg/cm²) per meter of test section per minute
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-21 (2) Log Sheet

HOLE NO. VI-B3 SHEET NO. 2 OF 3

DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CREATIC	CORE RECOVERY	R Q D	WATER PRESSURE TEST LUGEON VALUE
31.87	456.65	Tuffaceous limestone (greenish grey)		Fresh & hard rock. Long cylindric core.				
35.00	453.52	Green tuff (greenish green)		Calcareous fresh and hard rock with calcite network veinlets. Crack stained in brown. Long cylindric core, bedding plane dips 60°, including black lens.	CH			13.6 (1.9×10^{-4} cm/s)
		Marl (black)		Fresh and hard rock aphanitic, dense, massive, long cylindric core. Associated with hair network calcite veinlets. Crack stained in brown. Bedding plane dips 60°, in parallel with calcite vein. Black slate lens 1-10 cm thick.	B			0 3.6 (4.9×10^{-5} cm/s)
44.60	443.92							
45.50	443.02	Tuffaceous limestone		Fresh & hard rock with thin black slate lens dipping 60°.				
		Limestone (black - dark grey)		Fresh and hard rock. Not crystalline, aphanitic with such thin calcite veinlets, dipping 50°-60°, in parallel with crack. Crack stained in yellowish brown. Partly cracks: 45.0-45.65°, 49.2-49.6°, 50.25-51.0°. Below 51.0 to 70.0° very sound, long cylindric cores are continuing.	CH B			14.5 (2.0×10^{-4} cm/s) 31.9 (4.4×10^{-4} cm/s) 1.6 (2.2×10^{-5} cm/s) 5.5 (7.5×10^{-5} cm/s)

HOLE NO.

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-21 (3) Log Sheet

HOLE NO. VI-81 SHEET NO. 3 OF 3

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CREVICING	GROUNDWATER LEVEL	CORE RECOVERED %	CORE RECOVERED cm	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	REMARKS
8/27	70.00	418.52	Limestone (Tk-St)		Fresh and hard rock slightly, dense, and not crystalline associated with calcite network vein.	B					0	

HOLE NO.

LOG FORM C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-22 (1) Log Sheet

HOLE NO. VI-84 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	50.0 m	ELEVATION	539.41 m
SITE	VI dacsite (right abut)	COORDINATE	: :	DIRECTION	Vertical	DRILL RIG	TOC-16
AVERAGE CORE RECOVERY	79.0%	DATE	FROM 6/24 TO 7/11, '83	DRILLED	SAKAKA, I.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
6/26	1				Unconsolidated and soft plastic clay with rock fragment. Down to 7.8m: no water drill.							
	2											
	3										8.1x10⁻⁴ cm/s	
	4				Debris (yellowish brown)							
	5											
	6											
	7											
	8	7.80	531.61								5.5x10⁻⁴ cm/s	
	9	9.50	529.91		Decomposed green rock (yell. brown)							
6/27	10	10.60	528.81		Down to 9.5m: no water drill.	D						
	11				Extremely weathered green rock schistosed plane dips 40°.							
	12				Strongly weathered schistosed green rock, fragment core; cracks open & stained in black. Crack dips 30° to 45°.						51.4 (7.1x10⁻⁴ cm/s)	
	13											
	14				Weathered schistosed green rock (greenish grey - greenish brown)	Cl						
6/28	15											
	16											
	17	17.00	522.41		Excavation depth for fill dam.		water leak					
	18				Slightly weathered schistosed green rock. Short cylindric core (17.0-20.0m). Schistosed plane dips 25°. Is a whole very crushy and fragment core (20.0-21.0m). Crack stained in reddish brown. Quartz vein: 20.5-21.5m & 23.0-24.0m (1 cm wide). 24.0-25.0m: weakly fractured crack with oily luster. 29.0-30.0m: short cylindric core. 29.0-30.0m: contains quartz vein, 1 cm wide, weakly folded.	Cm		9	10		> 100	
6/29	19											
	20											
	21											
7/1	22										16 (2.2x10⁻⁴ cm/s)	
	23											
	24				Schistosed green rock (dark green)	Cl						
	25											
	26											
7/2	27						water leak				11.3 (1.6x10⁻⁴ cm/s)	
	28											
	29											
	30					Cw						

HOLE NO.

LOG PATTERN - 11

*RQD = Rock Quality Designation. RQD= Total length of all core runs longer than 10 cm / Total core length x 100%
*LUGEON VALUE = Lu = q/p = water injection rate/ pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-22 (2) Log Sheet

HOLE NO. VI-84 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CLASSIFICATION	WEATHERING	LOSS	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
7/6	31				Fresh and hard. Cracky and shoot cylindric core. Schistosed plane dips 20° to 30°, associated with thin quartz vein (ave. 2 cm in thickness). Crack dips 20°. Down to 31.8m: crack is open. Below 31.8m: crack is tight.							5.2 (7.1x10⁻⁵cm/s)	
	32												
	33		Schistosed green rock (dark green)										
	34												
7/7	35					Cм							
	36												
	37												
	37.30	502.11			Fractured, with oily luster.								
	38	37.50	501.91	Schistosed green rock (dark green)		Fresh and hard. Sheet cylindric core.						1.7 (2.3x10⁻⁵cm/s)	
7/8	39	39.10	500.31			Fractured with oily luster.							
	39.20	500.21				Fresh and hard micro-folded, but cracky due to schistosity. Crack dips 25° to 30° in parallel with schistosed plane. Contains thin quartz vein. Partly includes small pyrite crystal. Below 43.8m: extremely schistosed and micro-folded.							
	40												
	41						Cн						
	42												
	43											1.8 (2.5x10⁻⁵cm/s)	
	44		Schistosed green rock (dark green)										
7/9	45												
	46												
	47						Cм						
	47.90	491.51										1.1 (1.5x10⁻⁵cm/s)	
7/10	48	48.00	491.41	Green schist. (dark green)		Extremely schistosed, broken to flaky with oily luster surface.	CL						
	49	49.00	490.41	Schistosed green rock (dark green)		Fresh and hard.							
7/11	50	50.00	489.41			Sheet cylindric core.							

HOLE NO.

LOG FORM - C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-23 (1) Log Sheet

HOLE NO. VI-26 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	55.40 m	ELEVATION	439.39 m
SITE	VI dersite (riverside)	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TDC-1G
AVERAGE CORE RECOVERY	71.7%	DATE	FROM TO	DRILLED	OSHIAI, T.	LOGGED	TSUJI, K.

DEPTH	ELEVATION	ROCK TYPE OR FORMATION	DESCRIPTION	ROCK GRADE
0			Unconsolidated, loose.	
4.80	434.59	Marl (grey)	Slightly weathered, short cylindric core.	CL
5.50	433.89		Moderately, oxidizing altered clay.	
			Very cracky.	
			Short cylindric core & brecciated fragment core.	
			Poor core recovery.	
			Associated with calcite veinlets (micro-faults), thin vein of max. 5 mm thick.	
			Calcite thin veinlets dip 40°.	CL
		Tuffaceous limestone (greyish green)	18.1-18.5^{m}: no core.	
			From 20.0-23.4^{m}: water pressure tests were not performed, because packer could not fit on cracky rock.	
			23.0-23.5^{m}: accompanied by rock altered clay.	
			25.5-26.4^{m}: no core.	
			Below 26.4^{m}: fresh, hard and cylindric core.	
			Crack dips 35° in parallel with calcite veinlets.	
				CM

WATER PRESSURE TEST LUGEON VALUE	DEPTH
1.6×10^{-3} cm/s	
0	
0	
0	

BORING NO.

LOG FORM 11

RQD = Rock Quality Designation. RQD = Total length of cylindric cores longer than 10 cm / Total core length × 100%
LUGEON VALUE = Lm m water injection rate pressure of 10kg/cm²
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-23 (2) Log Sheet

HOLE NO. YI-55 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADING	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	PERMEABILITY
	32.90	456.49	Tuffaceous limestone (greyish green)		Fresh but very cracky. Short cylindric core including much black slate lens. Crack dips 10° and 70° to 80°, accompanied by chlo altered clay.	CM					
			Altered zone		Contain grey clay.						
	33.20	456.19	Tuffaceous limestone		Fresh but very cracky.						
	34.40	454.99									
	35.05	454.34	Altered zone (grey)		Contain grey clay, crack dips 90°.						
			Tuffaceous limestone (greyish green)		Fresh but very cracky, fragment core (35.3-42.9m). 37.6-39.0m: calcite veinlets, dip 35°, in parallel with crack. Below 42.9m: cylindric core. Fresh and hard rock with thin calcite setback vein, dipping 35° to 40°, in parallel with predominant cracks. Calcite vein, not 5 mm wide. Cracky zone: 41.3-41.5m, 41.5-41.8m, 42.5-42.7m, 43.1-43.3m, 49.9-50.0m, 50.0-41.0m.	CL				1.0 (1.3×10^{-5}cm/s)	
	50.50	438.83	Altered zone		Contain grey clay, cracky.	CM				0	
	50.90	438.49	Tuffaceous limestone		Fresh and hard, short cylindric core.						
	51.80	437.59	Altered zone		Contain grey clay, cracky.						
	52.00	437.39	Tuffaceous limestone (greyish green)		Fresh and hard, short cylindric core. Crack develops and dips 30° to 40°, in parallel with calcite vein.					0	
	55.40	433.99									

HOLE NO. ( )

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-24 (1) Log Sheet

HOLE NO. V3-B1 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Vegaros Hydroelectric Development Project			DEPTH	35.0 m	ELEVATION	490.97 m
SITE	V3 weir site (right abut)	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TDC-1G
AVERAGE CORE RECOVERY	89.9%	DATE	FROM 6/14 TO 6/25,'83	DRILLED	OCHIAI, T.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
6/14	1.00	489.97	Top soil		Dark brown soft, unconsolidated.							
	1.70	488.27	Debris		Grey rock fragment of limestone & tuff.							
	3.80	487.17	Weathered marl (black)		Fragment core, very cracky. 3.8-3.30m: no core. Excavation depth for fill dam.	CL					8.9x10^{-4}cm/s	
6/15					Fresh and hard rock with calcite network vein and associated with small black lens dipping 35°-40°. Crack dips 35°-40° and stained in black.	CH					49 (6.8x10^{-5}cm/s)	
6/16			Marl (black)		14.5-15.3m: very cracky. Crack stained in brown, dipping 45°.	CM CL					35 (4.9x10^{-5}cm/s)	
					16.90							
6/21					18.0-20.0m: cracky.	CM					93 (1.3x10^{-4}cm/s)	
					Cracky zone: 20.3-20.5m, 23.2-23.6m, 23.5-24.0m, 24.5-25.1m crack is open. 25.0-25.6m: slightly altered.	CH					0	
6/22	26.10	464.87										
			Green tuff (greyish green)		Fresh and hard rock with calcite network vein and black lens crack is open. 25.1-25.7m: weakly altered. Cracky zone: 28.7-29.0m, 29.5-29.7m.	CM	water-tight				>100	
6/23	35.0											

HOLE NO.

LOG POINT N

*RQD = Rock Quality Designation. RQD= Total length of cylindric cores larger than 10 cm / Total core length x 100%
*LUGEON VALUE = Loss in water injection test pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-24 (2) Log Sheet

HOLE NO. V3-B1 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADING	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	31										
	32		Green tuff (greyish green)		Slightly weathered. As a whole, crashy crack stained in black.	CL					
	33				Rock associated with thin calcite vein with black lens dipping 30°-40°.	CM				≥ 100	
6/24	34										
6/25	35	35.00	455.97								

HOLE NO. ( )

LOG FORM-C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-25 (1) Log Sheet

HOLE NO. V3-B2 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	50.0 m	ELEVATION	523.07 m
SITE	V3 weir site (left abut)	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TOC-10
AVERAGE CORE RECOVERY	88.5% (5.5-50.0 m)	DATE	FROM 6/28 TO 7/12, '83	DRILLED	OCHIAI, T.	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DRILLING
6/28	5.50		Weathered soil (yellowish brown)		Plastic clay. 4.6-5.0m: clay accompanied by rock. down to 5.5m: no water drill.						N-value 12 9 5 0 16 42 61 8.6x10⁻⁴cm/s	
6/29	9.50		Debris (grey - greenish grey)		Breccia associated with clay rock fragment of 10-30 cm sub-angular) tuff, andesite and marl. 7.7-8.4m: no core. Excavation depth for fill dam.							
7/1	15.00		Weathered marl (black)		11.2-13.7m: core extremely cracky and poor core recovery.	D CL					12x10⁻³cm/s	
7/5			Marlitic marl (black-grey)		Fresh and hard rock with rebook calcite vein. Crack stained in brown and dipping 25° to 30°. Below 18.0m: calcite vein getting less. As a whole cracky, crack stained in brown. Below 20.0m: marl with small black lens, dipping 50°. Crack stained in dark brown, dipping 50° to 90°. 23.8-30.0m: very sound, long cylindric core, partly cracky (23.2-23.5m, 27.0-27.6m). 25.0-30.0m: frequent crack spaced 5 to 10 cm apart.	CM CL CH					17.6 (2.4x10⁻⁴cm/s) 97.5 (1.4x10⁻³cm/s) >100	
7/7												

LOG POINT - 11

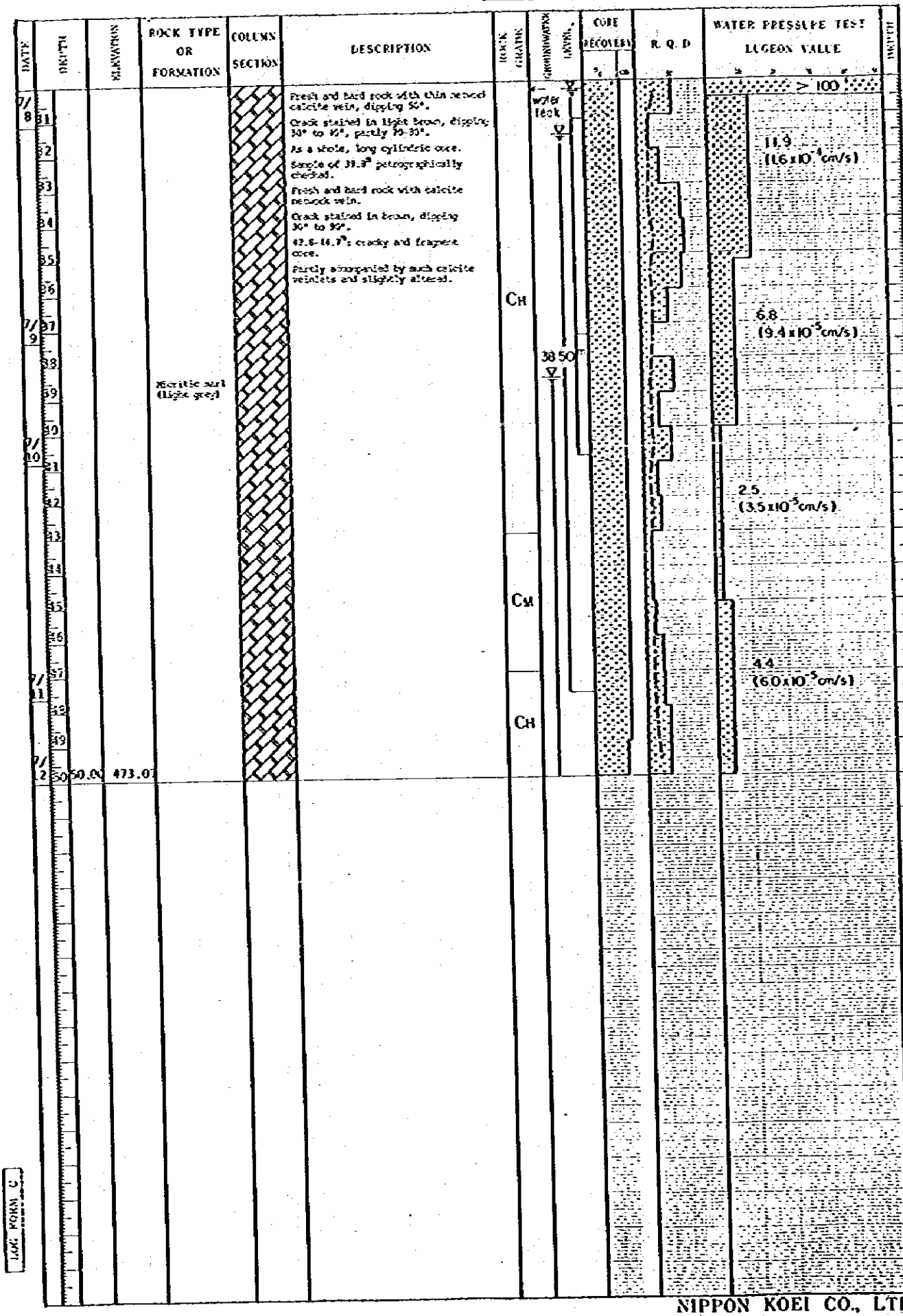
ON EAGLE

*RQD = Rock Quality Designation. RQD = Total length of cylindrical cores longer than 10 cm / Total core length x 100%
LUGEON VALUE = Loss of water pressure (kg/cm²) per minute per meter of test length
DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-25 (2) Log Sheet

HOLE NO. V3-B2 SHEET NO. 2 OF 2



LOG FORM C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-26 (1) Log Sheet

HOLE NO. VT-B1 SHEET NO. 1 OF 2

PROJECT	El Toriito-Los Veganos Hydroelectric Development Project			DEPTH	55.0 m	ELEVATION	541.90 m
SITE	Boca de Tireo, No.2 Surge	COORDINATE	: :	DIRECTION	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	Tank 60.1% (10.0-55.0 m)	DATE	FROM 6/8 TO 7/28,'83	DRILLED	Boca de la Rosa	LOGGED	TSUJI, K.

DATUM	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D m	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	PERMEABILITY
	3.15	538.75	Debris (reddish-yellowish brown)		0.0-2.8m: plastic clay colored in reddish brown. 2.8-3.15m: plastic clay associated with weathered green rock colored in dark yellowish brown.								
	9.30	532.60	Decomposed lava clay of green rock (grey and dark yellowish brown)		Extremely weathered, decomposed rock, containing plastic clay rather high ratio of water content, colored in dark grey to dark, yellowish brown. Below 7.0m: weathered rock without decomposed clay, low ratio of water content, colored in grey. Down to 9.30m: drive tube sampled.	D						N-value	
	15.30	526.60	Weathered green rock (grey to dark green)		Weathered, decomposed rock, soft. 9.30-13.8m: weathered, micro-porphyritic andesite (dark green). Fragment core accompanied by weathered clayey rock. 13.8-15.3m: fragment core associated with weathered clayey rock. Down to 15.3m: mostly no water drill. Excavation depth for surge tank foundation.	D							
	21.80	520.10	Weathered green rock (grey to dark green)		Weathered rock. Small fragment core, crosby crack stained in brown, partly contains clay vein.	CL							
	24.30	517.60	Fractured zone (dark yellowish brown)		Fractured and clayey zone of green rock, mixture of fractured clay and weathered rock (fault). No water drill.	D							
	25.20	516.70	Altered zone (light grey)		Grey to white clayey zone, accompanied by altered rock fragment.								
			Altered dolerite (greenish black)		Weakly altered green rock open crack, fragment core, partly containing altered clay. 29.8m: short cylindric core.	CL							

HOLE NO.

LOG NUMBER

- R.Q.D = Rock Quality Designation. R.Q.D= Total length of cylindric cores longer than 10 cm / Total core length x 100%
- LUGEON VALUE = Loss in water injection rate per meter of 10 kg/cm²
- DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-26 (2) Log Sheet

HOLE NO. VT-81 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	WEATHERING GRADING	GROUNDWATER LEVEL	CORE (RECOVERY) %	CM	R Q D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
6/15	31		Altered Dolerite (greenish black)		Hard but moderately weathered short cylindric core. Micro porphyritic green rock. Crack stained in pale brown, crack dips 50° to 60°.	Cl						
6/16	32											
	33											
	34	34.00	507.90									
6/24	35				Fresh and hard. Long cylindric core with cracks dipping 80° to 90°. 34.0-36.8m: very sound rock, but crack stained in brownish black. Micro-porphyritic, dense.							
	36										15.3 (2.0×10^{-4} cm/s)	
6/25	37											
	38											
6/27	39		Dolerite (Black green)			Cm						
6/29	40											
6/30	41										18.1 (2.4×10^{-4} cm/s)	
7/2	42											
7/3	43											
7/4	44											
7/22	45											
	46	46.00	435.90									
	47				Fresh and hard rock. Short cylindric to fragment core, micro-porphyritic, dense. 47.1 to 49.7m: containing quartz vein veinlets. Crack dips 70° to 90°. Crack stained in black, partly showing slickenside. Sample at 52.85m in depth petrographically microscoped.							23.7 (3.1×10^{-4} cm/s)	
7/23	48											
7/24	49											
7/25	50		Altered dolerite (Black green)			Cl						
	51											
	52										29.7 (3.9×10^{-4} cm/s)	
7/27	53											
	54											
7/28	55	55.00	486.9				No ground water					

HOLE NO.

LOG FORM C

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

DL-27 (1) Log Sheet

HOLE NO. VIP-1 SHEET NO. 1 OF 2

PROJECT	El-Torito-Los Veganos Hydroelectric Development Project			DEPTH	50.0 m	ELEVATION	495.24 m
SITE	Boca de Tireo No.2 Penstock line	COORDINATE	: :	BOREHOLE	Vertical	DRILL MS	Longyear 34
AVERAGE CORE RECOVERY	36.9% (3.15-50.0 m)	DATE	FROM 5/4 TO 6/6,'83	DRILLED	B.de la Rosa	LOGGED	TSUJI, K.

DATUM	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	SAMPLE
	1		Debris (Silt yellow brown)		Weathered plastic clay abongenial angular weathered rock fragment.						
	2				Down to 3.15m: drive tube sampled.						
	3				Excavation depth for penstock foundation.						
		3.15	492.09								
	4				Aphanitic andesite, fragment core, grady (particle ø3-4 cm).						
	5				Partly including clay in crack which is stained in brown.						
	6				Poor core recovery.						
	7				Rock is hard.						
	8				Suitable for penstock foundation.						
	9					CL					
5/4	10		Weathered green rock (greenish grey)								
	11										
	12										
	13										
	14										
5/5	15										
		16.00	479.24								
	17				Extremely altered into clay accompanied by remaining andesite (?) fragment.						
	18				Probably loosely cemented part.						
5/6	19				Colored in Whole 20.0-21.0m, 22.0-29.8m Purple 21.0-22.0m Light grey to white 16.0-20.0m						
	20				Strongly altered zone 15.0-23.0m 25.0-29.8m.						
5/10	21				Moderately altered 23.0-25.0m.						
	22										
	23		Extremely altered zone (pale greenish grey to white)			D					
	24										
5/11	25										
	26										
	27										
	28										
	29										
	30										
5/12	31				Down to 29.8m: no water drill						
		29.80	465.44	Quartz rock	Porphyritic	CL					

LOG POINT-5

BORE HOLE NO. VIP-1

*RQD = Rock Quality Designation. RQD = Total length of cylindric cores longer than 10 cm / Total core length × 100%
*LUGEON VALUE = l/min·m under injection water pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO

DL-27 (2) Log Sheet

HOLE NO. VTP-1 SHEET NO. 2 OF 2

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CREATING	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	30.80	464.44	Green rock (black)		Porphyritic green rock.						
5/16	31.00	464.24	Altered zone		Strongly altered (pale greenish grey)	Cl					
	31.80	463.44	Green rock		Porphyritic green rock.						
02	32.37	462.94	Fractured zone		Clay associated with brecciated marl.	D					
			Marl		Fragment core only with a diameter of less than 1 cm.	Cl					
5/18	34.30	463.44	Fractured zone (grey red purple)		Clay associated with brecciated marl. No water drill.	D					
5/19	35.30	459.94	Marl								
	35.50	459.74	Fractured zone (grey red purple)		Fractured clay accompanied by marl. No water drill.						
5/20	37.00	422.24	Marl (black)		Weathered, cracky, fragment core only. 38.6-38.7m: strongly altered zone. Sample at 37.6m in depth petrographically microscopied.	Cl					
5/24	50.00	419.24	Fractured zone		Mixture of rock fragments & silt.						
5/25	50.30	418.94	Marl (black)		Micro-crystalline marl or calcareous siltstone with thin network calcite vein. Crack stained in brown, dipping 50° to 60°. Below 43.15m: short cylindric core continues. Fresh and hard, but cracky with moderate core recovery. 49.85m: black slate, including pyrite crystal.	Cm	47.02m (6/6)				
5/31											
6/1											
6/2	60.00	409.24									

HOLE NO. ( )

NIPPON KOEI CO., LTD.
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DL-28 (1) Log Sheet

HOLE NO. VTP-2 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	50.0 m	ELEVATION	379.89 m
SITE	Boca de Tireo No.2 Penstock line	COORDINATE	: :	DIRECTION	Vertical	DRILL RIG	Longyear 34
AVERAGE CORE RECOVERY	57.0%	DATE	FROM 4/12 TO 4/28,'83	DRILLED	B.de la Rosa	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK CLASS	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DEPTH
4/12	4.00	375.89	Decomposed green rock (grey)		Strongly weathered rock of green rock, soft. Silt accompanied by weathered rock fragment. Crack contains clay vein. Excavation depth for penstock foundation.	D						
4/13	10.00	369.89	Weathered green rock (dull green)		Porphyritic andesite (?) origin green rock, pulverized fragment core. Cracky. Crack stained in brown Poor core recovery. 9.0-9.5m: strongly altered zone with grey clay colored in pale greyish green.	CL						
	10.50	369.39	Altered zone (greenish grey)		Strongly altered, soft, no water drill	D						
	12.50	367.39	Green rock (dark green)		Weathered fragment core.	CL						
4/14			Altered zone (greenish grey)		Strongly altered soft, altered probably sulphate alteration. Grey clay accompanied by rock fragment. No water drill.	D	5.60m					
	18.00	361.89										
4/15			Altered zone (dark green)		Moderately altered fragment core.							
	19.50	360.39										
4/16			Green rock (dark green)		Fresh and hard rock. Porphyritic green rock. Generally long cylindric, sound rock. Crack dips 0° to 50°. Below 21.0m, crack tight, not stained. Contains plagioclase crystal.	Cu						
4/18												

HOLE NO.

LOG POINT -15

*RQD = Rock Quality Designation. RQD= Total length of cylindric core longer than 10 cm / Total core length x 100%
*LUGEON VALUE = Water in cubic meter per minute at 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
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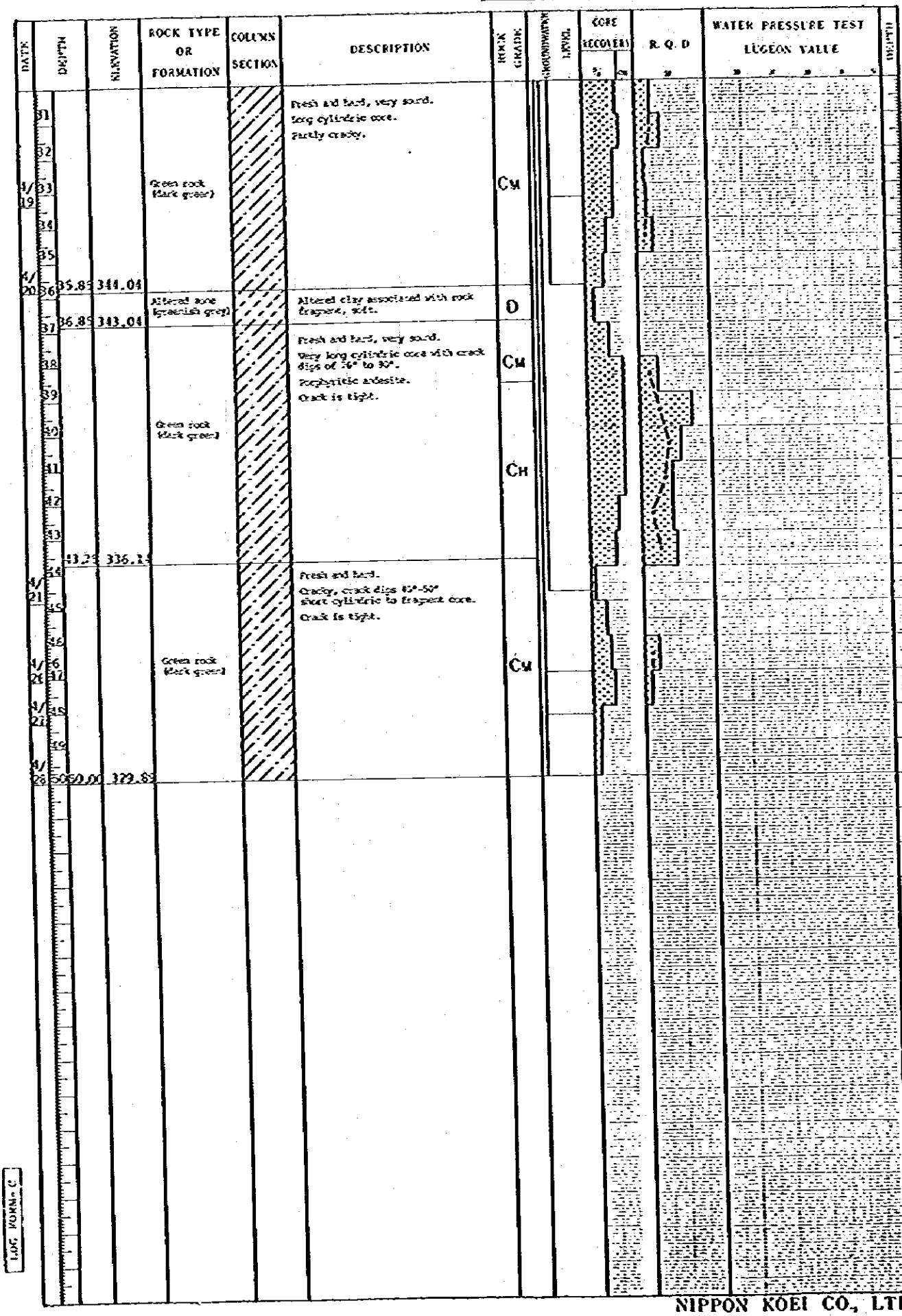
DL-28 (2) Log Sheet

HOLE NO. VP-2 SHEET NO. 2 OF 2



HOLE NO.

LOG FORM-C

NIPPON KOEI CO., LTD.
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DL-29 Log Sheet

HOLE NO. VC-1 SHEET NO. : OF 1

PROJECT	El Torito-Los Vegaños Hydroelectric Development Project			DEPTH	23.8 m	ELEVATION	345.51 m
SITE	Boca de Tigre, No. 2 Power house	COORDINATE	: :	BORING	Vertical	DRILL RIG	
AVERAGE CORE RECOVERY	46.4%	DATE	FROM 3/16 TO 3/25, '83	DRILLED	B.de la Rosa	LOGGED	TSUJI, K.

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY cm	R.Q.D %	R.Q.D cm	WATER PRESSURE TEST LUGEON VALUE	TESTED
3/16	1				Unconsolidated, loose gravel sub-angular to sub-rounded. Rock: Ignim. tuff, limestone green rock, diorite, etc.								
	2												
	3												
	4				3.8 silt with gravel. 4.3								
3/17	5												
	6												
	7				7.3 7.4								
	8		Old river terrace deposit (dark grey)										
	9												
	10				10.5 silt with sand. 11.0								
	11												
3/18	12												
	13				boulder gravel.								
	14												
3/19	15												
	16												
3/22	17						17.30m (3/22)						
	18				18.5 Site by water drill. Excavation depth for power house foundation.								
	19	19.30	326.21										
	20				fresh and hard. Aphanitic. Short cylindric core. Crack tight.	Cm							
3/21	21												
	22												
	23												
3/25	24	23.8	321.71										

Green rock (black)

LOG POINT H

*RQD = Rock Quality Designation. RQD = Total length of cylindric core larger than 10 cm / Total core length x 100%
*LUGEON VALUE = l/m/min under injection water pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
CONSULTING ENGINEERS, TOKYO.

BORING NO.

DL-30 Log Sheet

HOLE NO. BCH-2 SHEET NO. 1 OF 1

PROJECT	El Torito-Los Veganos Hydroelectric Development Project			DEPTH	24.25 m	ELEVATION	348.36 m
SITE	Boca de Titeo, No. 2 Power House	COORDINATE	: :	DIRECTION	Vertical	DRILL MC	
AVERAGE CORE RECOVERY	19.0%	DATE	FROM 3/30 TO 4/8, '83	DRILLED	B. de la Rosa	LOGGED	TSUJI, K.

RUN No.	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	CORE RECOVERY m	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	REMARKS
1	1				Loose, unconsolidated gravel sub-angular to sub-rounded. Rock: Reddish purple tuff limestone green rock, etc. 0.8-3.0^{m}: relatively pebble size dominant. 3.0-8.0^{m}: relatively cobble size dominant.							
2	2											
3	3											
4	4											
5	5											
6	6											
3/30	7		Old river terrace deposit (gravel)									
	8				8.0 Silt 8.2							
3/31	9											
	10											
	11				11.05 Silt 11.6							
4/4	12											
	13											
	14											
	15						16.06^{m}					
4/15	16											
	17											
	18											
	19				18.5 Silt with gravle gravel. Excavation depth for power house foundation.							
	19.50	328.86					19.80^{m}					
	20				Hard and fresh. Porphyritic andesite origin, green rock, containing quartz vein. Cylindric core continues.							
4/6	21											
	22		Green rock (gravel)			CM						
4/7	23											
4/8	24											
	24.25	324.11										

HOLE NO.

NIPPON KOEI CO., LTD.
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* R.Q.D = Rock Quality Designation. R.Q.D = Total length of cylindrical core pieces over 10 cm / Total core length x 100%
* LUGEON VALUE = Lugeon value injection water pressure of 10kg/cm^{2}
* DEPTH and ELEVATION are in meter

DL-31 (1) Log Sheet

HOLE NO. VT-B2 SHEET NO. 1 OF 2

PROJECT	El Torito-Los Voganos Hydroelectric Development Project			DEPTH	39.8 m	ELEVATION	552.43 m
SITE	Surge Tank for PH No. 2	COORDINATE	: :	INCLINATION	Vertical	DRILL RIG	TOC-1G
AVERAGE CORE RECOVERY	70.65%	DATE	FROM 9/8 TO 10/22,'83	DRILLED	LUIS	LOGGED	NISHIOKA, S

DATE	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	LENGTH
9/8	1				Reddish brown, clayey soil, product of intensive weathering of bedrock.			65			
	2							70			
	3							75			
	4		Residual soil					65			
	5							67			
	6					D		77			
	7	7.00	545.43					60			
9/14	8				Soft or friable. Recovering samples are entirely fragments and sandy clay.			70			
	9		Decomposed tuff					60			
	10							80			
	11	11.50	540.93					55			
	12				Recovering samples are green coloured, coarse grained, hard and fragmental.			70			
	13				15.90^{m}-16.20^{m} soft.			70			
9/15	14				Cylindric cores are recovered, though short and separated.			50			
9/16	15				Below 16.20^{m}, cracky.			100			
	16		Reshaped tuff		Cores are fragmental.	Cl		90			
	17				Cracks are water-washed.			100			
9/17	18							90			
	19							70			
9/19	20	20.00	532.43					60			
	21				Badly fractured and hydrothermally altered.			100			
9/20	22				Recovering samples are fine rock fragments and sandy particles.			50			
	23		Fractured tuff		Most severely fractured in 22^{m}-23^{m}.	D		50			
	24							20			
9/22	25	25.00	527.43					70			
	26				Gradually improving to cracky hard rock.			95			
	27				Many cylindric cores are recovered below 27^{m} for the most part separated in length of 3 to 6 cm.			95			
	28							95			
	29		Tuff		Cracky.	CM		100			
	30							100			

HOLE NO. VT-B2

LOG POWER 1/1

*R.Q.D = Rock Quality Designation. R.Q.D = Total length of cylindric cores longer than 10 cm / Total core length x 100%
*LUGEON VALUE = 1 min. water injection rate per pressure of 10kg/cm^{2}
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
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DL-31 (2) Log Sheet

HOLE NO. VT-B2 SHEET NO. 2 OF 2

PROJECT				DEPTH		ELEVATION	
SITE		COORDINATE	: :	INCLINATION		DRILL RIG	
AVERAGE CORE RECOVERY		DATE	FROM TO	DRILLED		LOGGED	

DATUM	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY (%)	R.Q.D	WATER PRESSURE TEST LUGEON VALUE	DATUM
	31				From 31m, gradually changes to purple fine tuff. Generally fractured, except 33.2m-33.7m Recovering cores are fragments, 5 cm to 1 cm in size. Below 35m, cylindric cores are recovered, except for 36.4-36.7m, 38.4-38.9m and 39.3-39.8m short cores are fragments of 1 cm. Slight foliation appears in 32-33m.			90			
	32							90			
	33							92			
	34							92			
	35		Tuff			CM		91			
	36							90			
	37							80			
	38							80			
	39							95			
	39.8	512.63						80			

HOLE NO.

LOG FORM-B

*RQD = Rock Quality Designation, RQD = Total length of cylindric cores longer than 10 cm / Total core length x 100%
*LUGEON VALUE = Flow in water injection under pressure of 10kg/cm²
*DEPTH and ELEVATION are in meter

NIPPON KOEI CO., LTD.
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DL-32 Log Sheet

HOLE NO. VOY-3 SHEET NO. 1 OF 1

PROJECT	El Torito-Los Voganos Hydroelectric Development Project			DEPTH	25.5 m	ELEVATION	377.12 m
SITE	Powerhouse No. 2	COORDINATE	: :	DIRECTION	Vertical	DRILL RIG	TOC-16
AVERAGE CORE RECOVERY	91.37%	DATE	FROM TO	DRILLED	UGS	LOGGED	NISHIOKA, S.

DATUM	DEPTH	ELEVATION	ROCK TYPE OR FORMATION	COLUMN SECTION	DESCRIPTION	ROCK GRADE	GROUNDWATER LEVEL	CORE RECOVERY %	R.Q.D %	WATER PRESSURE TEST LUGEON VALUE	DEPTH
	0.20	376.92	Top soil Gravel deposit		Sub-angular gravels of diorite, dacite, amphibolite and schist. 1-15 cm in diameter.					N-value SPT	
	4.90	372.22	Intensively weathered andesite		Brown colored. Cores are fragmental; some flaky, less than 2 cm in size.	D					
	7.40	369.72	Andesite		Fresh, hard. Cores are fragmental up to 7.8m. Below 7.8m, rocks are massive, though recovering cores are very often broken due to vertical joint along which the borehole is sunk. Actual rock condition is better than indicated by R.Q.D. Vertical crack is open.	CH					
	25.5	351.63			Below 25m, slightly fractured with silicon-sides on cracks. Samples are 0.5 cm to 7 cm in size. Cracks at 5 cm intervals or less, tightly closed.	Cu					

HOLE NO.

LOG NO.

*RQD is Rock Quality Designation. RQD = (total length of cylindrical cores longer than 10 cm) / (total core length) × 100%
*LUGEON VALUE is l/min/m under injection water pressure of 10 kg/cm²
*DEPTH and ELEVATION are in meters

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