A-4.2.3(7) Original Print-Out of VES Data and Analytical Results, No.13 & No.14

No.13

```
MODEL:    5 LAYERS
RESISTIVITIES:
   3.53E+01   7.56E+02   1.21E+02   7.16E+01   3.89E+03
THICKNESSES:
   1.79E+00   4.67E+00   1.61E+02   8.94E+01
   SPACING      DATA       CALC      % ERROR
   5.00E+00   8.59E+01   9.77E+01    -2.100
   6.00E+00   1.04E+02   1.03E+02     1.765
   9.00E+00   1.36E+02   1.40E+02    -3.054
   1.40E+01   1.89E+02   1.87E+02     1.282
   2.00E+01   2.27E+02   2.19E+02     3.485
   2.70E+01   2.38E+02   2.45E+02    -3.139
   3.50E+01   2.48E+02   2.36E+02     4.685
   4.50E+01   2.21E+02   2.25E+02    -1.994
   6.00E+01   2.07E+02   2.03E+02     2.201
   8.00E+01   1.70E+02   1.77E+02    -3.874
   1.00E+02   1.53E+02   1.60E+02    -1.447
   1.30E+02   1.47E+02   1.47E+02    -0.804
   1.70E+02   1.48E+02   1.41E+02     3.417
   2.20E+02   1.43E+02   1.41E+02     1.542
   2.70E+02   1.49E+02   1.45E+02     2.729
   3.50E+02   1.52E+02   1.57E+02    -3.582
   4.50E+02   1.74E+02   1.65E+02    -5.710
   6.00E+02   2.37E+02   2.33E+02     1.500
   8.00E+02   3.11E+02   3.05E+02     3.512
   1.00E+03   3.86E+02   3.78E+03     2.127
   1.25E+03   4.71E+02   4.68E+02     0.709
   1.50E+03   5.47E+02   5.56E+02    -1.582
SCHL ARRAY,  22 DATA POINTS, DATA = NO.13/Smoothing'
RMS LOG ERROR =    1.24E-02, ANTILOG YIELDS     2.904E %
```

No.14

```
MODEL:    4 LAYERS:
RESISTIVITIES:
   9.48E+01   3.53E+01   2.46E+02   1.01E+04
THICKNESSES:
   2.47E+01   2.18E+01   1.75E+02
   SPACING      DATA       CALC      % ERROR
   5.00E+00   8.31E+01   9.47E+01   -12.288
   6.00E+00   8.92E+01   9.47E+01    -5.803
   9.00E+00   9.46E+01   9.44E+01     0.174
   1.40E+01   9.95E+01   9.35E+01     6.404
   2.00E+01   1.02E+02   9.15E+01    11.669
   2.70E+01   9.20E+01   8.83E+01     4.230
   3.50E+01   8.70E+01   8.42E+01     3.367
   4.50E+01   7.70E+01   7.99E+01    -3.663
   6.00E+01   7.47E+01   7.74E+01    -3.532
   8.00E+01   7.93E+01   8.11E+01    -1.971
   1.00E+02   9.03E+01   8.91E+01     1.416
   1.30E+02   1.07E+02   1.05E-02     1.579
   1.70E+02   1.31E+02   1.27E+02     3.007
   2.20E+02   1.56E+02   1.54E+02     1.341
   2.70E+02   1.80E+02   1.81E+02    -0.325
   3.50E+02   2.18E+02   2.24E+02    -2.719
   4.50E+02   2.58E+02   2.80E+02    -6.130
   6.00E+02   3.45E+02   3.67E+02    -5.872
   8.00E+02   5.00E+02   4.82E+02     3.779
   1.00E+03   6.40E+02   5.95E+02     7.503
   1.25E+03   7.81E+02   7.84E+02     6.254
   1.50E+03   8.80E+02   8.42E+02    -4.530
SCHL ARRAY,  22 DATA POINTS, DATA = NO.14
RMS LOG ERROR =    2.36E-02, ANTILOG YIELDS     5.590E %
```

APPENDIX A-4.3
Exploration Drilling Works

A-4.3.1(1) Specification of JICA Bore Holes

BORE HOLE IDENTIFICATION N J D - 1	District Southern Region
UTM Grid E 0 1 8 8 0 N 2 0 2 6 5	Locality Al-Nagha, 3 km north of Hallat Al-Rakah junction, 150km north of Salalah, westside of highway
Map NE40-5D Scale 1:100,000	
Photo 0047C'1"5 Scale 1:60,000	Date of Completion 18/ 3/1988
Ground Level (m) 282	Total Drilled Depth (m) 402.3
Static Water Level/Date (m above Ground) 0.42 19/ 3/1989	Drilled Diameter(")/Depth (m) 17 1/2 0- 10 12 1/4 10-182 8 3/4 182-280 6 280-400 3 1/2 400-402.3
Ground Water EC (μS/cm) /Temp.(℃) /Date 2020 36.1 13/ 3/1989	Casing Diameter (")/Depth (m) 13 3/8 0- 9.7 9 5/8 0-180.95 7 0-278.47
	Open Hole (") /Depth (m) 6 278.47-400 3 1/2 400 -402.3

Lithological Data

Depth (m)	Formation	Lithology
0- 31	Dammam	Limestone / Marl
31-139	Rus	Gypsum/Limestone/Marl
139-267	Upper UER	Limestone / Marl
267 ~	Lower UER	Limestone

A-4.3.1(2) Specification of JICA Bore Holes

BORE HOLE IDENTIFICATION N J D − 2	District Southern Region
UTM Grid E 0 1 8 7 7 N 2 0 2 6 4	Locality Al-Nagha, 3 km north of Hallat Al-Rakah Junction, 150km north of Salalah, westside of highway
Map NE40-5D Scale 1:100,000	
Photo 0047C'17E Scale 1:60,000	Date of Completion 18/ 8/1988
Ground Level (m) 282	Total Drilled Depth (m) 353.28
Static Water Level/Date (m above Ground) 0.53 19/ 3/1989	Drilled Diameter(")/Depth (m) 26 0- 10 17 1/2 10-158 12 1/4 158-270 8 1/2 270-283 7 5/8 283-350 3 1/2 350-353.28
Ground Water EC (μS/cm) /Temp.(℃) /Date 2020 36.3 18/ 3/1989	Casing Diameter (")/Depth (m) 18 5/8 0- 10 13 3/8 0-158.3 9 5/8 54.55-269.83
	Open Hole (") /Depth (m) 8 1/2 270-283 7 5/8 283-350 3 1/2 350-353.28

Lithological Data Depth (m)	Formation	Lithology
0- 27	Dammam	Limestone / Marl
27-139	Rus	Gypsum/Limestone/Marl
139-267	Upper UER	Limestone / Marl
267～	Lower UER	Limestone

A-4.3.1(3) Specification of JICA Bore Holes

BORE HOLE IDENTIFICATION N J D − 3	District Southern Region
UTM Grid E 0 1 8 7 7 N 2 0 2 6 4	Locality Al-Nagha, 3 km north of Hallat Al-Rakah Junction, 150km north of Salalah, westside of highway
Map NE40-5D Scale 1:100,000	
Photo 0047C'175 Scale 1:60,000	Date of Completion 22/ 8/1988
Ground Level (m) 283	Total Drilled Depth (m) 350
Static Water Level/Date (m above Ground) -0.2 19/ 3/1989	Drilled Diameter(″)/Depth (m) 17 1/2 0- 10 12 1/4 10-157 8 1/2 157-270 6 270-350
Ground Water EC (μS / cm) /Temp.(℃) /Date 2040 36.1 22/ 8/1989	Casing Diameter (″)/Depth (m) 13 3/8 0- 10 9 5/8 0-156.74 7 50.44-269.50
	Open Hole (″) /Depth (m) 6 269.50-350.0

Lithological Data

Depth (m)	Formation	Lithology
0- 28	Dammam	Limestone / Marl
28-139	Rus	Gypsum/Limestone/Marl
139-265	Upper UER	Limestone / Marl
265--	Lower UER	Limestone

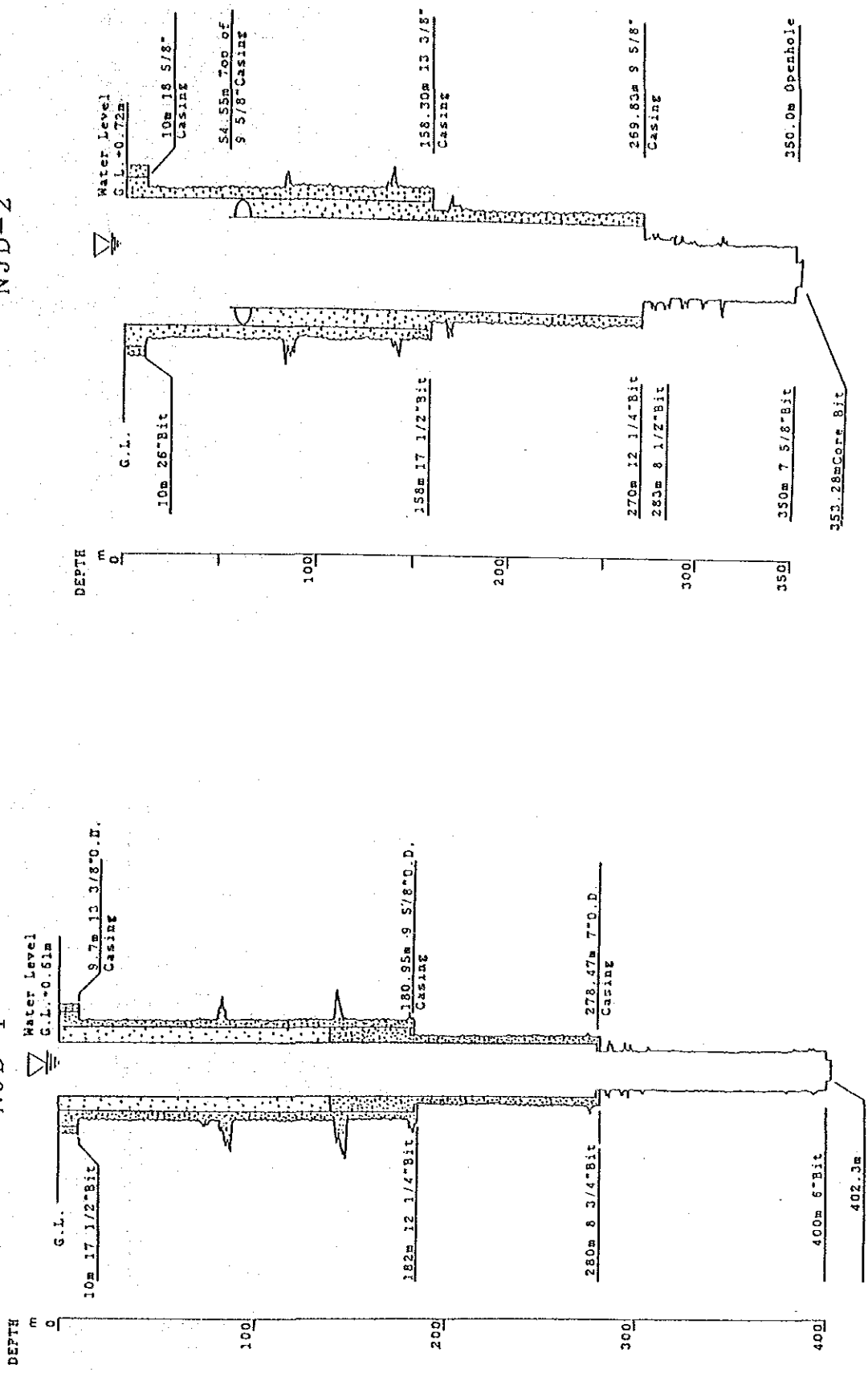
A-4.3.1(4) Specification of JICA Bore Holes

BORE HOLE IDENTIFICATION WJD-41	District Southern Region
UTM Grid E 0 1 8 8 8 N 2 0 2 5 8	Locality Al-Nagha, 3 km north of Haliat Al-Rakah junction, 150km north of Salalah, westside of highway
Map NE40-5D Scale 1:100,000	
Photo 0047'175 Scale 1:60,000	Date of Completion 17/ 2/1989
Ground Level (m) 284	Total Drilled Depth (m) 350.0
Static Water Level/Date (m above Ground) -1.04 19/ 3/1989	Drilled Diameter(")/Depth (m) 26 0- 10 17 1/2 10-175 12 1/4 175-272 8 1/2 272-350
Ground Water EC (μS/cm) /Temp.(℃) /Date 2190 36.2 17/10/1988	Casing Diameter (")/Depth (m) 18 5/8 0- 10 13 3/8 0-174.88 9 5/8 33.64-271.29
	Open Hole (") /Depth (m) 8 1/2 271.29-350.0

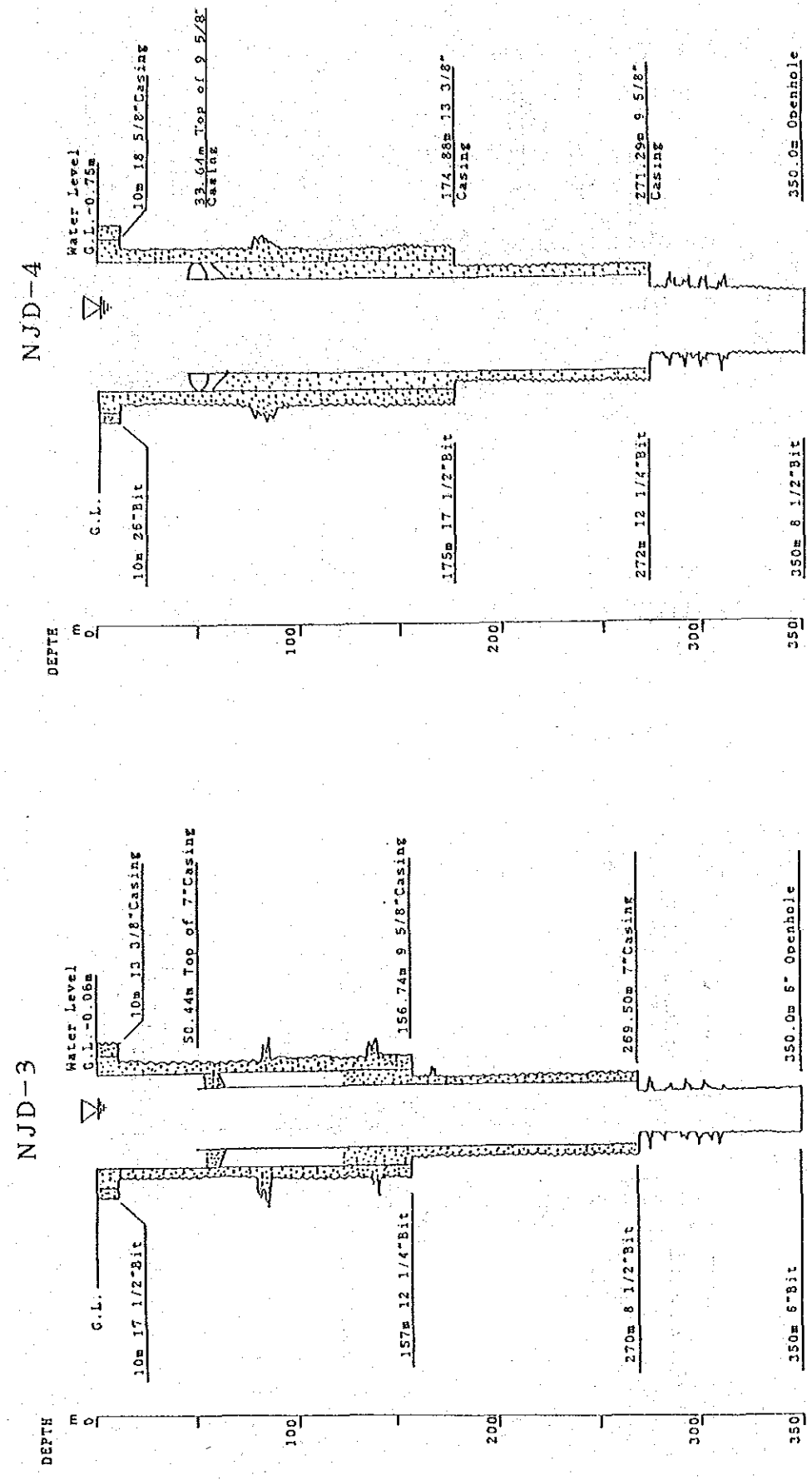
Lithological Data

Depth (m)	Formation	Lithology
0- 33	Dammam	Limestone / Marl
33-142	Rus	Gypsum/Limestone/Marl
142-267	Upper UER	Limestone / Marl
267~	Lower UER	Limestone

A-4. 3. 2 (1) Structure of JICA Bore Holes



A-4. 3. 2(2) Structure of JICA Bore Holes



A-4. 3. 3 (3) Geological Column of JICA Bore Hole, NJD-3

Calcareous material. Calcite present.

LOWER UMM ER RAD

320 - 330

330 - 350

Light olive grey limestone with grey (dark and light) and little light brown limestone.

Olive grey limestone with white coloured limestone.

300 310 320 330 340 350

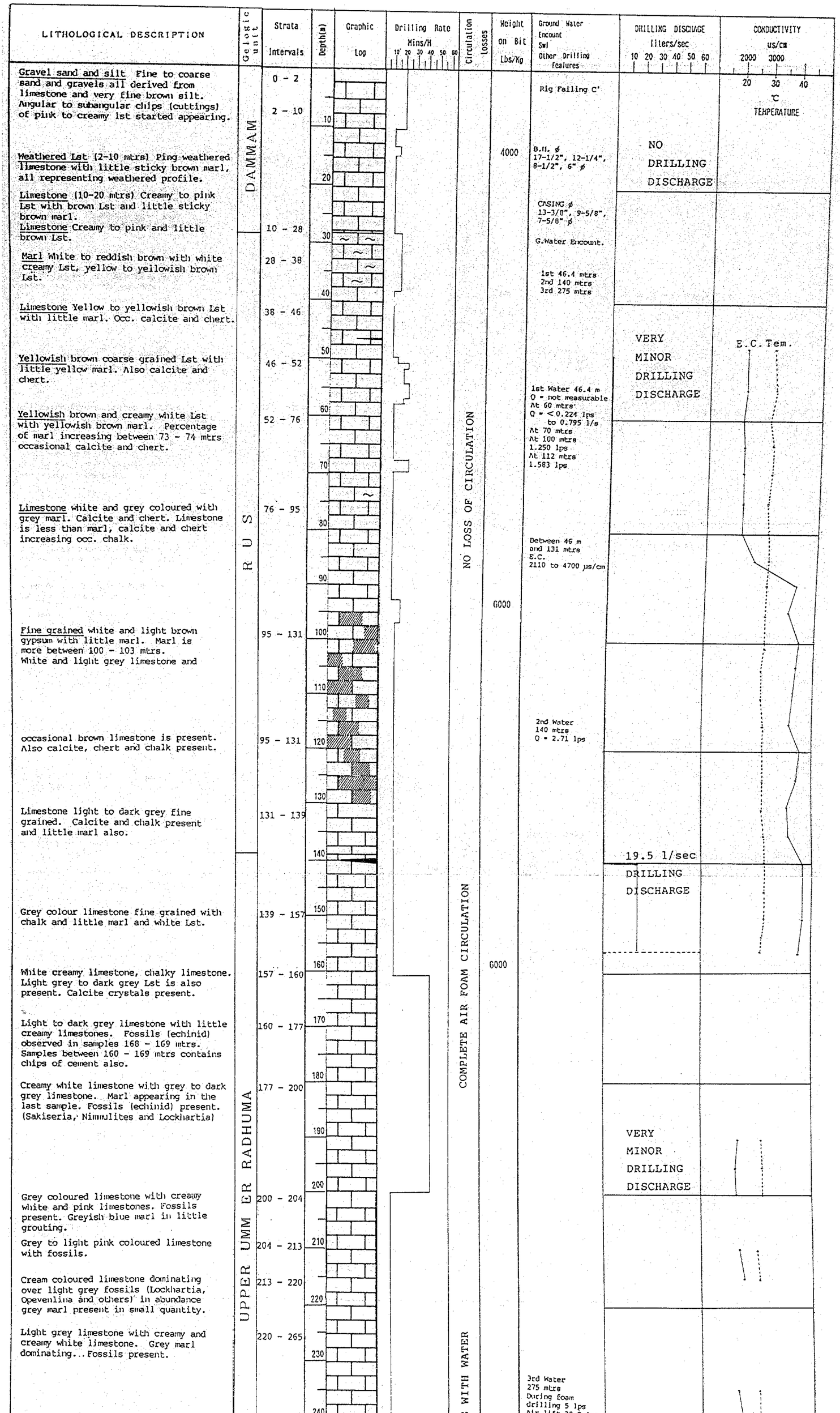
TV Log

PARTIAL INTERMITTENT LOSS OF

6000

F.C. after Well development = 1990 to 2030 µs/cm

A-4. 3. 3(3) Geological Column of JICA Bore Hole, NJD-3



and little marl also.

Grey colour limestone fine grained with chalk and little marl and white Lst.

139 - 157

White creamy limestone, chalky limestone. Light grey to dark grey Lst is also present. Calcite crystals present.

157 - 160

Light to dark grey limestone with little creamy limestones. Fossils (echinid) observed in samples 160 - 169 mtrs. Samples between 160 - 169 mtrs contains chips of cement also.

160 - 177

Creamy white limestone with grey to dark grey limestone. Marl appearing in the last sample. Fossils (echinid) present. (Sakiseria, Nummulites and Lockhartia)

177 - 200

UPPER UMM ER RADHUMA

Grey coloured limestone with creamy white and pink limestones. Fossils present. Greyish blue marl in little grouting.

200 - 204

Grey to light pink coloured limestone with fossils.

204 - 213

Cream coloured limestone dominating over light grey fossils (Lockhartia, Opevenlina and others) in abundance grey marl present in small quantity.

213 - 220

Light grey limestone with creamy and creamy white limestone. Grey marl dominating... Fossils present.

220 - 265

Olive colour limestone fossiliferous, with light creamy limestone. Silica (as chert) with calcite crystals. Fossils in abundance (Altispera, Opevenlina and Lockhartia, etc.).

220 - 265

Deep olive grey limestone with creamy limestone with fossils and occ. white limestone.

Dark grey and dark olive limestone with chert. Fossils in abundance.

265 - 290

LOWER UMM ER RADHUMA

Olive grey to pale grey limestone fossiliferous with chalk and carbonaceous material. Calcite present.

290 - 320

Light olive grey limestone with grey (dark and light) and little light brown limestone.

320 - 330

Olive grey limestone with white coloured limestone.

330 - 350

140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350

TV Log

COMPLETE AIR FOAM CIRCULATION

PARTIAL INTERMITTENT LOSS OF CIRCULATION FROM 278 MTRS TILL LAST DRILLING WITH WATER

6000

6000

6000

3rd Water 275 mtrs During foam drilling 5 lps Air lift 30.9 lps

E.C. (275 mtrs) 2000 to 2520 µs/cm (240 mtrs)

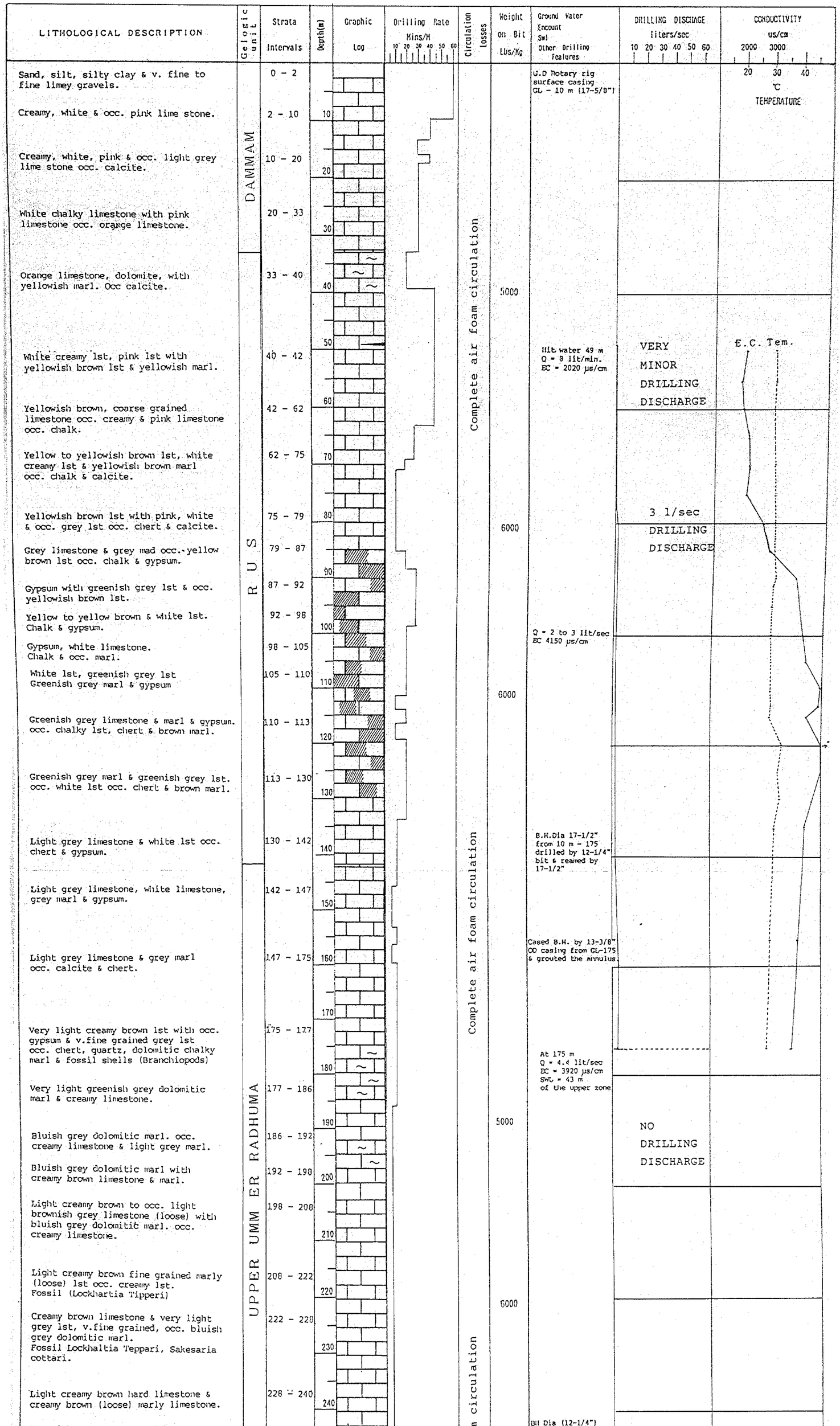
E.C. after Well development = 1990 to 2030 µs/cm

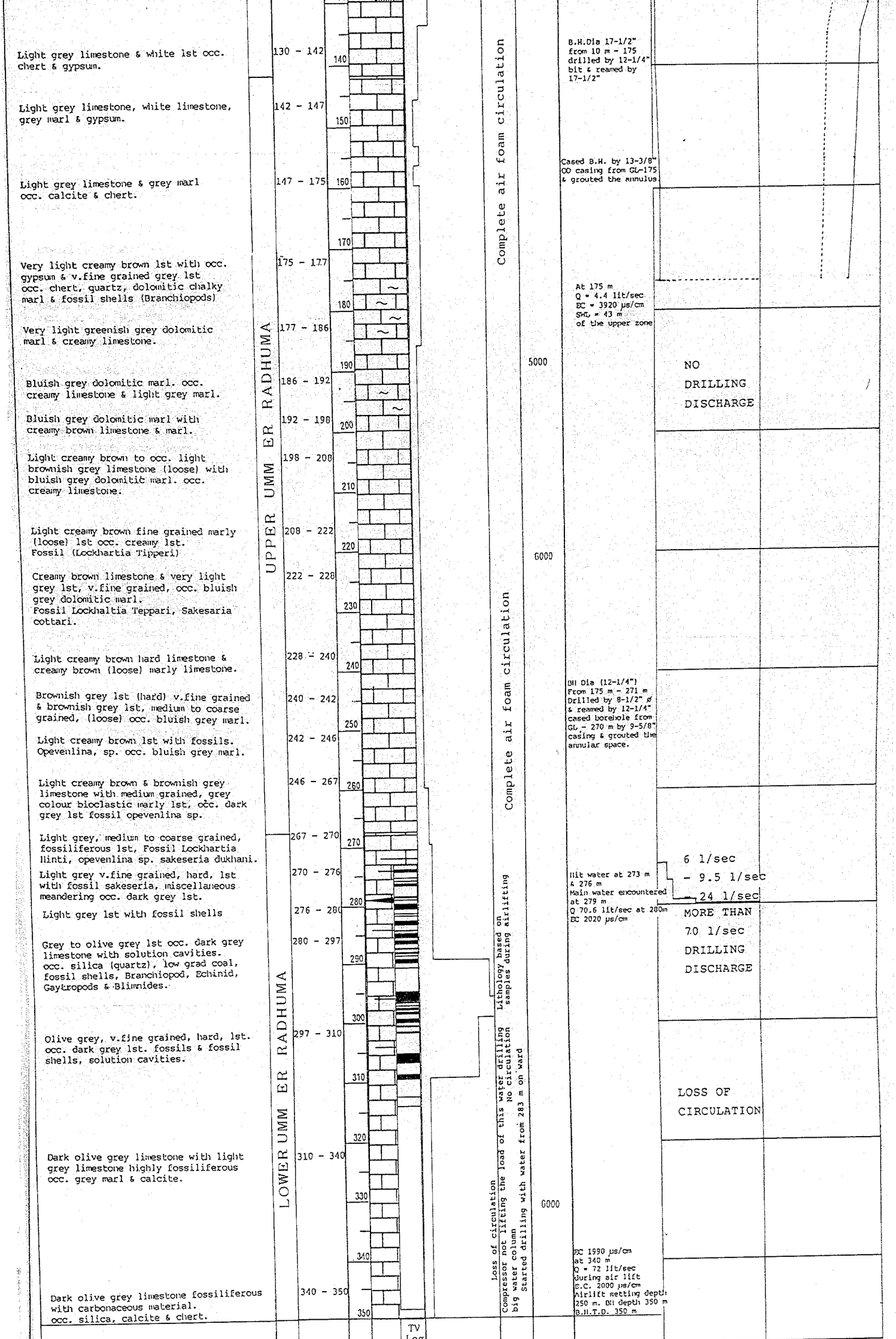
19.5 l/sec DRILLING DISCHARGE

VERY MINOR DRILLING DISCHARGE

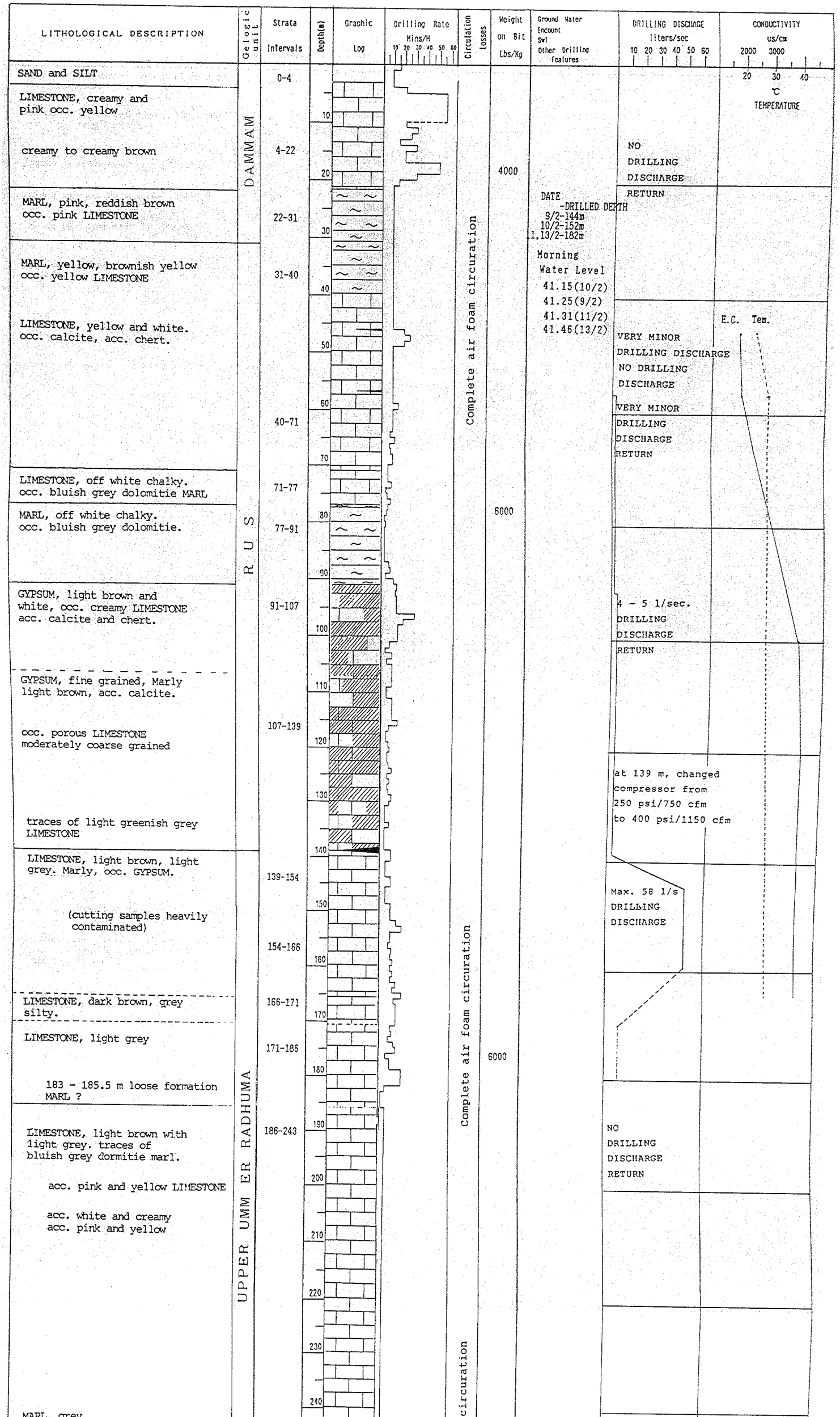
DRILLING DISCHARGE MORE THAN 22 l/sec

A-4. 3. 3(4) Geological Column of JICA Bore Hole, NJD-4




Light grey limestone & white lst occ. chert & gypsum.
130 - 142
Light grey limestone, white limestone, grey marl & gypsum.
142 - 147
Light grey limestone & grey marl occ. calcite & chert.
147 - 175
Very light creamy brown lst with occ. gypsum & v.fine grained grey lst occ. chert, quartz, dolomitic chalky marl & fossil shells (Branchiopods)
175 - 177
Very light greenish grey dolomitic marl & creamy limestone.
177 - 186
Bluish grey dolomitic marl. occ. creamy limestone & light grey marl.
186 - 192
Bluish grey dolomitic marl with creamy brown limestone & marl.
192 - 198
Light creamy brown to occ. light brownish grey limestone (loose) with bluish grey dolomitic marl. occ. creamy limestone.
198 - 208
Light creamy brown fine grained marly (loose) lst occ. creamy lst. Fossil (Lockhartia Tipperi)
208 - 222
Creamy brown limestone & very light grey lst, v.fine grained, occ. bluish grey dolomitic marl. Fossil Lockhaltia Teppari, Sakesaria cottari.
222 - 228
Light creamy brown hard limestone & creamy brown (loose) marly limestone.
228 - 240
Brownish grey lst (hard) v.fine grained & brownish grey lst, medium to coarse grained, (loose) occ. bluish grey marl.
240 - 242
Light creamy brown lst with fossils. Opevenlina, sp. occ. bluish grey marl.
242 - 246
Light creamy brown & brownish grey limestone with medium grained, grey colour bioclastic marly lst, occ. dark grey lst fossil opevenlina sp.
246 - 267
Light grey, medium to coarse grained, fossiliferous lst, Fossil Lockhartia Hinti, opevenlina sp. sakeseria dukhani.
267 - 270
Light grey v.fine grained, hard, lst with fossil sakeseria, miscellaneous meandering occ. dark grey lst.
270 - 276
Light grey lst with fossil shells
276 - 280
Grey to olive grey lst occ. dark grey limestone with solution cavities. occ. silica (quartz), low grad coal, fossil shells, Branchiopod, Echinid, Gayteropods & Blimnides.
280 - 297
Olive grey, v.fine grained, hard, lst. occ. dark grey lst. fossils & fossil shells, solution cavities.
297 - 310
Dark olive grey limestone with light grey limestone highly fossiliferous occ. grey marl & calcite.
310 - 340
Dark olive grey limestone fossiliferous with carbonaceous material. occ. silica, calcite & chert.
340 - 350
UPPER UMM ER RADHUMA
LOWER UMM ER RADHUMA
130
140
150
160
170
175
180
177
186
190
192
198
200
208
210
222
220
228
230
240
242
246
250
260
267
270
276
280
297
290
300
310
320
310
330
340
350
TV Log
Complete air foam circulation
Complete air foam circulation
Lithology based on samples during airlifting
Loss of circulation
Compressor not lifting the load of this water drilling
No circulation
big water column
Started drilling with water from 283 m on ward
5000
6000
6000
B.H.Dia 17-1/2" from 10 m - 175 drilled by 12-1/4" bit & reamed by 17-1/2"
Cased B.H. by 13-3/8" OD casing from GL-175 & grouted the annulus
At 175 m
Q = 4.4 lit/sec
EC = 3920 µs/cm
SWL = 43 m
of the upper zone
NO DRILLING DISCHARGE
BH Dia (12-1/4")
From 175 m - 271 m
Drilled by 8-1/2" ø & reamed by 12-1/4" cased borehole from GL - 270 m by 9-5/8" casing & grouted the annular space.
lit water at 273 m & 276 m
Main water encountered at 279 m
Q 70.6 lit/sec at 280m
EC 2020 µs/cm
6 l/sec
- 9.5 l/sec
- 24 l/sec
MORE THAN 7.0 l/sec DRILLING DISCHARGE
LOSS OF CIRCULATION
EC 1990 µs/cm
at 340 m
Q = 72 lit/sec
during air lift
E.C. 2000 µs/cm
Airlift setting depth
250 m. BH depth 350 m
B.H.T.D. 350 m

A-4.3.3(1) Geological Column of JICA Bore Hole, NJD-1



LIMESTONE, light brown with light grey, traces of bluish grey dormitie marl.

acc. pink and yellow LIMESTONE

acc. white and creamy
acc. pink and yellow

MARL, grey

LIMESTONE, light creamy brown. olive grey, bluish grey Marl.

LIMESTONE, dark olive grey. occ. white and creamy.

occ. carbonaceous material
acc. calcite

occ. chalky

LIMESTONE, pale grey and dark grey
LIMESTONE, olive grey and pale grey

dark grey

LIMESTONE, light olive grey
occ. white
light brownish grey

LIMESTONE, greenish grey
occ. white.

UPPER UMM ER RADHU

LOWER UMM ER RADHUMA

186-243

243-244

244-252

252-267

267-303

303-308

308-341

341-367

367-400

190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410

TV Log

Comp

Complete air foam circuration

Mixed stiff foam circuration materials and aquagel

30%-10% circuration

6000

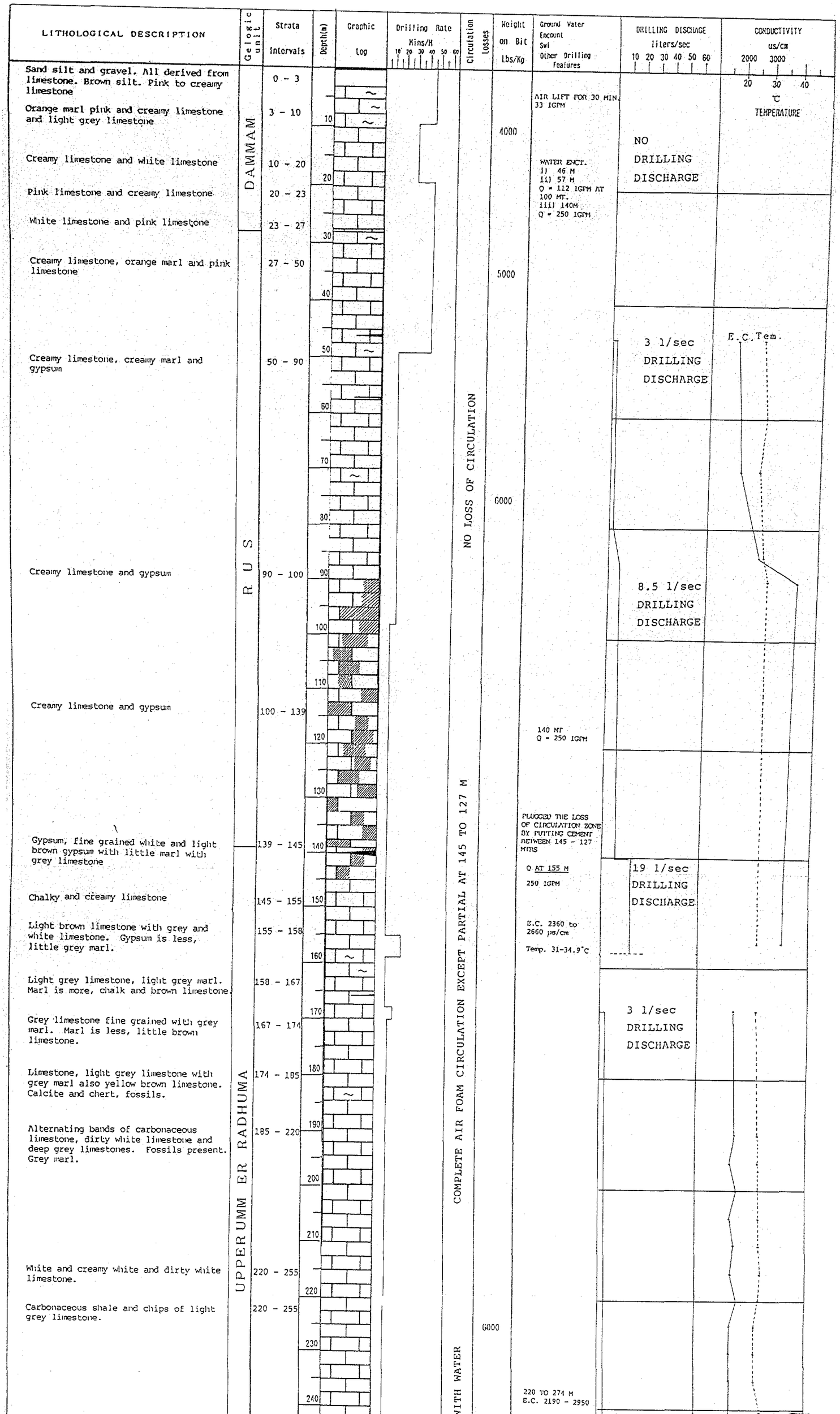
6000

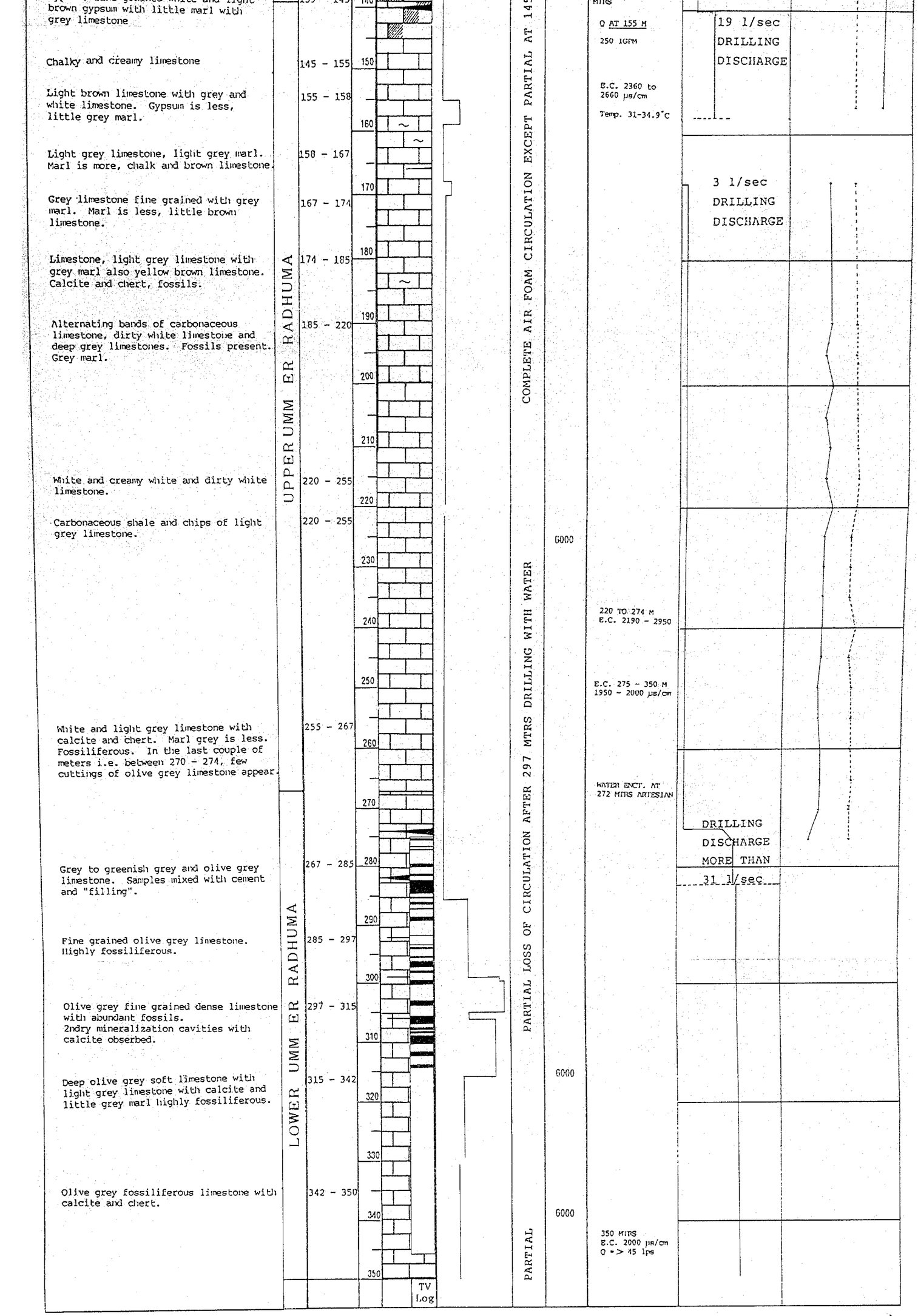
NO DRILLING DISCHARGE RETURN

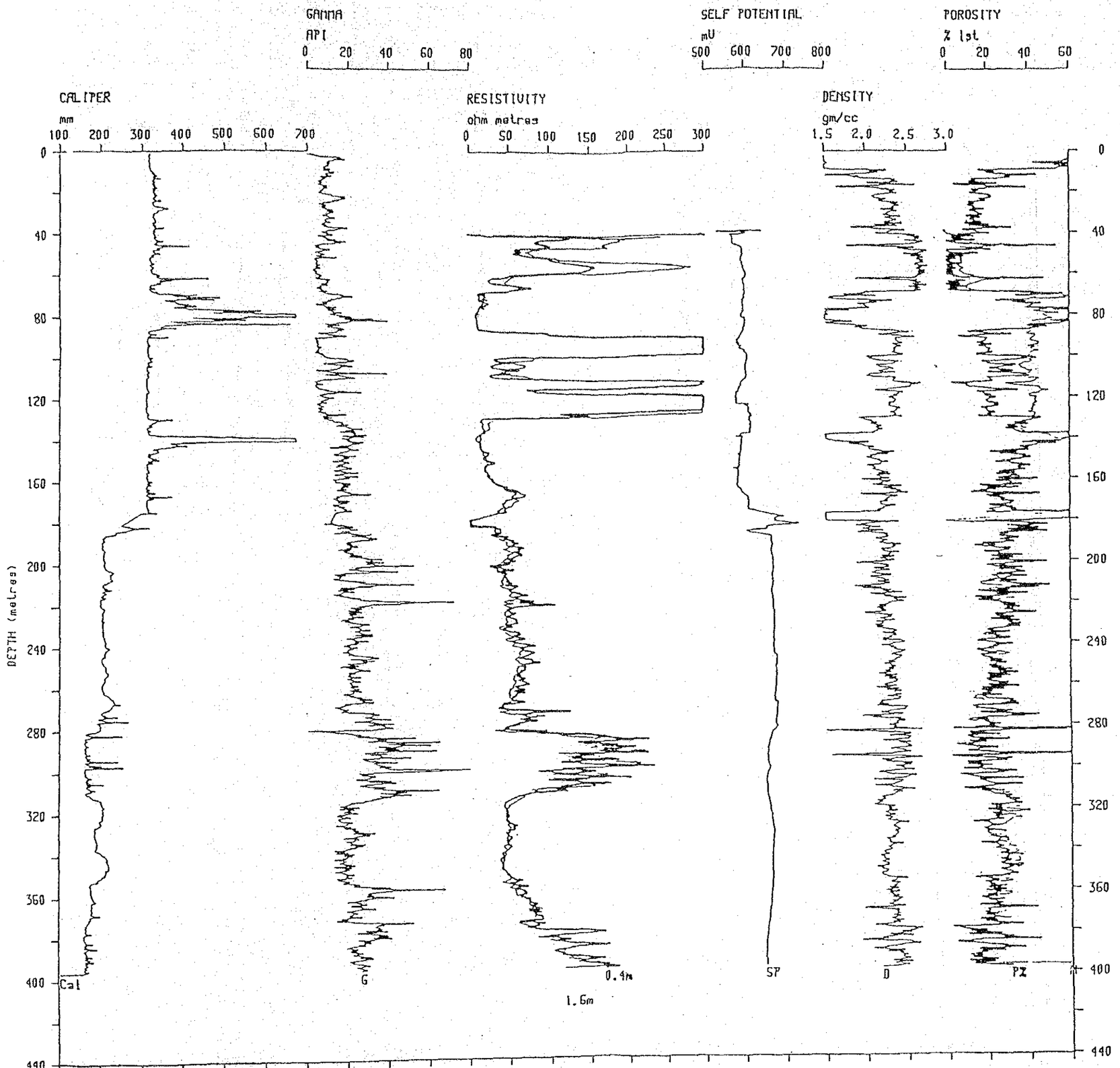
6 - 9.5 l/s DRILLING DISCHARGE

DRILLING DISCHARGE MORE THAN 45 l/s. 350 psi compressor pressure at 283 m. Drilled using water after 7"- 279 m casing, encountered loss circulation at 283 m. Mixed stiff form with loss circuration materials and aquagel. 30% - 10% circuration

A-4.3.3(2) Geological Column of JICA Bore Hole, NJD-2




brown gypsum with little marl with grey limestone
Chalky and creamy limestone
145 - 155
Light brown limestone with grey and white limestone. Gypsum is less, little grey marl.
155 - 158
Light grey limestone, light grey marl. Marl is more, chalk and brown limestone.
158 - 167
Grey limestone fine grained with grey marl. Marl is less, little brown limestone.
167 - 174
Limestone, light grey limestone with grey marl also yellow brown limestone. Calcite and chert, fossils.
174 - 185
Alternating bands of carbonaceous limestone, dirty white limestone and deep grey limestones. Fossils present. Grey marl.
185 - 220
White and creamy white and dirty white limestone.
220 - 255
Carbonaceous shale and chips of light grey limestone.
220 - 255
UPPER UMM ER RADHUMA
White and light grey limestone with calcite and chert. Marl grey is less. Fossiliferous. In the last couple of meters i.e. between 270 - 274, few cuttings of olive grey limestone appear.
255 - 267
Grey to greenish grey and olive grey limestone. Samples mixed with cement and "filling".
267 - 285
Fine grained olive grey limestone. Highly fossiliferous.
285 - 297
LOWER UMM ER RADHUMA
Olive grey fine grained dense limestone with abundant fossils. 2ndry mineralization cavities with calcite obserbed.
297 - 315
Deep olive grey soft limestone with light grey limestone with calcite and little grey marl highly fossiliferous.
315 - 342
Olive grey fossiliferous limestone with calcite and chert.
342 - 350
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
TV Log
COMPLETE AIR FOAM CIRCULATION EXCEPT PARTIAL AT 14
PARTIAL LOSS OF CIRCULATION AFTER 297 MTRS DRILLING WITH WATER
PARTIAL
6000
6000
6000
MTRS
Q AT 155 M
250 IGPM
E.C. 2360 to 2660 µs/cm
Temp. 31-34.9°C
220 TO 274 M
E.C. 2190 - 2950
E.C. 275 - 350 M
1950 - 2000 µs/cm
WATER ENCT. AT 272 MTRS ARTESIAN
350 MTRS
E.C. 2000 µs/cm
Q => 45 lps
19 l/sec
DRILLING
DISCHARGE
3 l/sec
DRILLING
DISCHARGE
DRILLING
DISCHARGE
MORE THAN
31 l/sec



A-4. 3. 4 (1)

Geophysical Bore Hole Log

NJD-1

Logging Schedule

Temperature/Conductivity
Caliper Gamma SP
0.4m & 1.6m Resistivity
Compensated Density
Compensated Neutron
Flow Down & Up

Date Logged

12/2, 27/2, 9/3 & 15/3/88

Remarks

Gamma, Neutron and Density logs diameter corrected
Data from three logging sessions merged at 180m and 280m
Logging datum: surface casing top

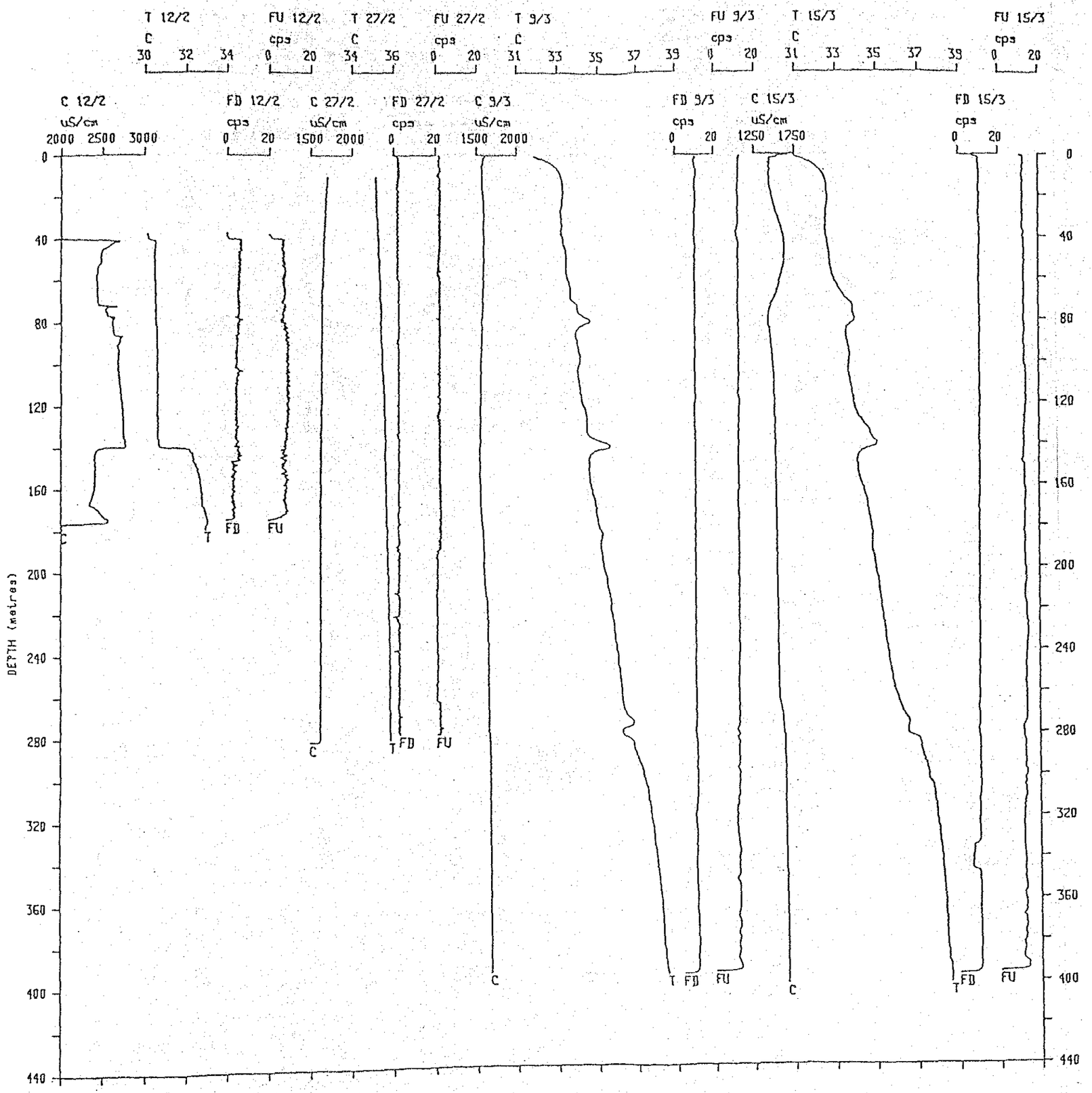
N.B. See separate sheets for fluid logs

Well Reference

NJD-1

Interval plotted 0-400m

Plot 1 of 10 Scale 1:2000



A-4.3.4(2)

Geophysical Bore Hole Log

NJD-1

Logging Schedule

Temperature/Conductivity
Caliper Gamma SP
0.4m & 1.6m Resistivity
Compensated Density
Compensated Neutron
Flow Down & Up

Date Logged

12/2, 27/2, 9/3 & 15/3/88

Remarks

Conductivity logs temp.
corrected to standard
25 degC

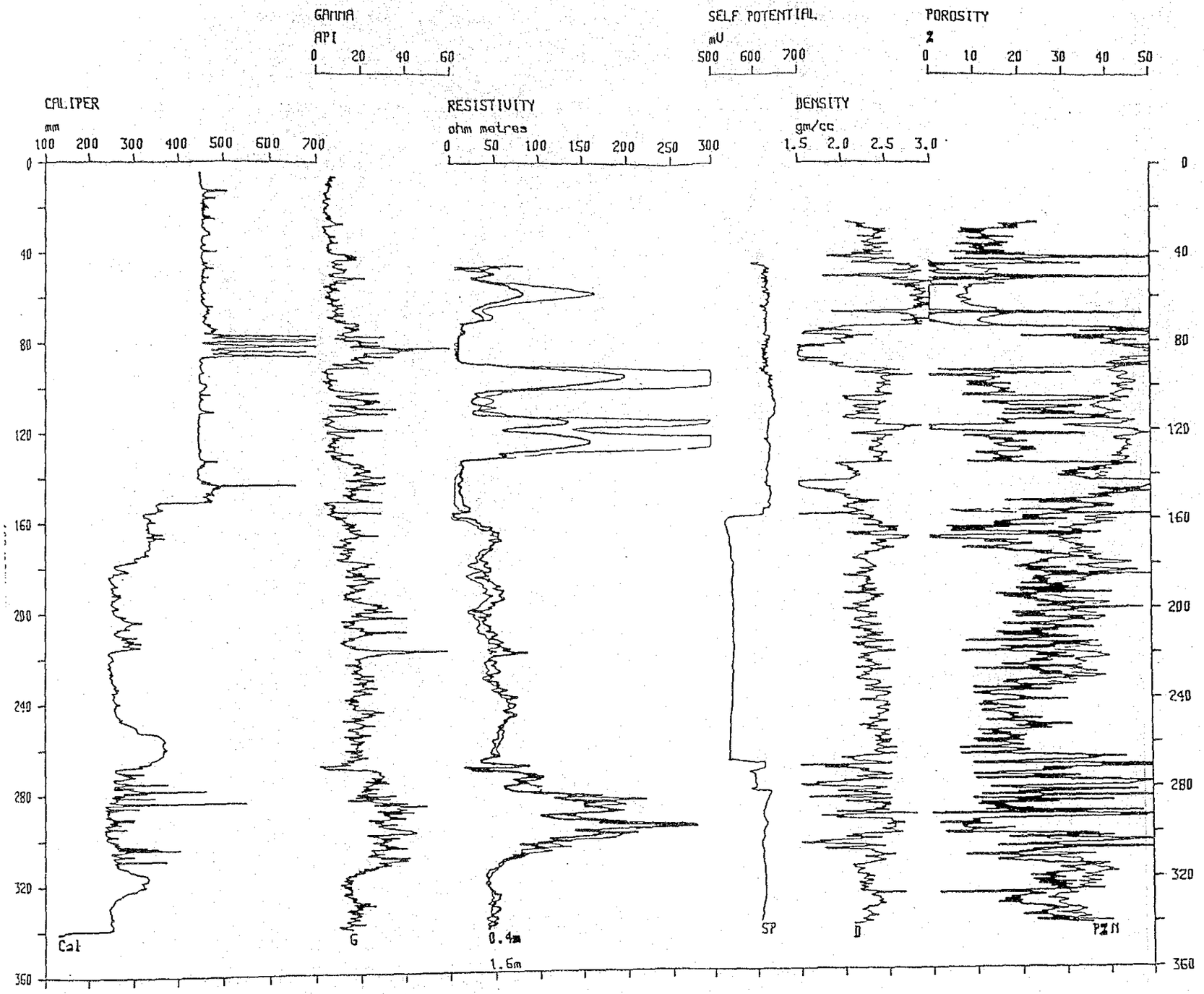
Logging datum: surface
casing top

N.B. See separate sheets
for formation logs

Well Reference
NJD-1

Interval plotted 0-400m

Plot 6 of 10 Scale 1:2000



A-4.3.4(3)

Geophysical Bore Hole Log

NJD-2

Logging Schedule

Caliper, Gamma
E-log
Density
Porosity
Temperature, Conductivity
Flow

Date Logged

30/6 - 7/8/88

Remarks

Gamma corrected for borehole diameter

Density corrected for borehole diameter

Porosity corrected for borehole diameter

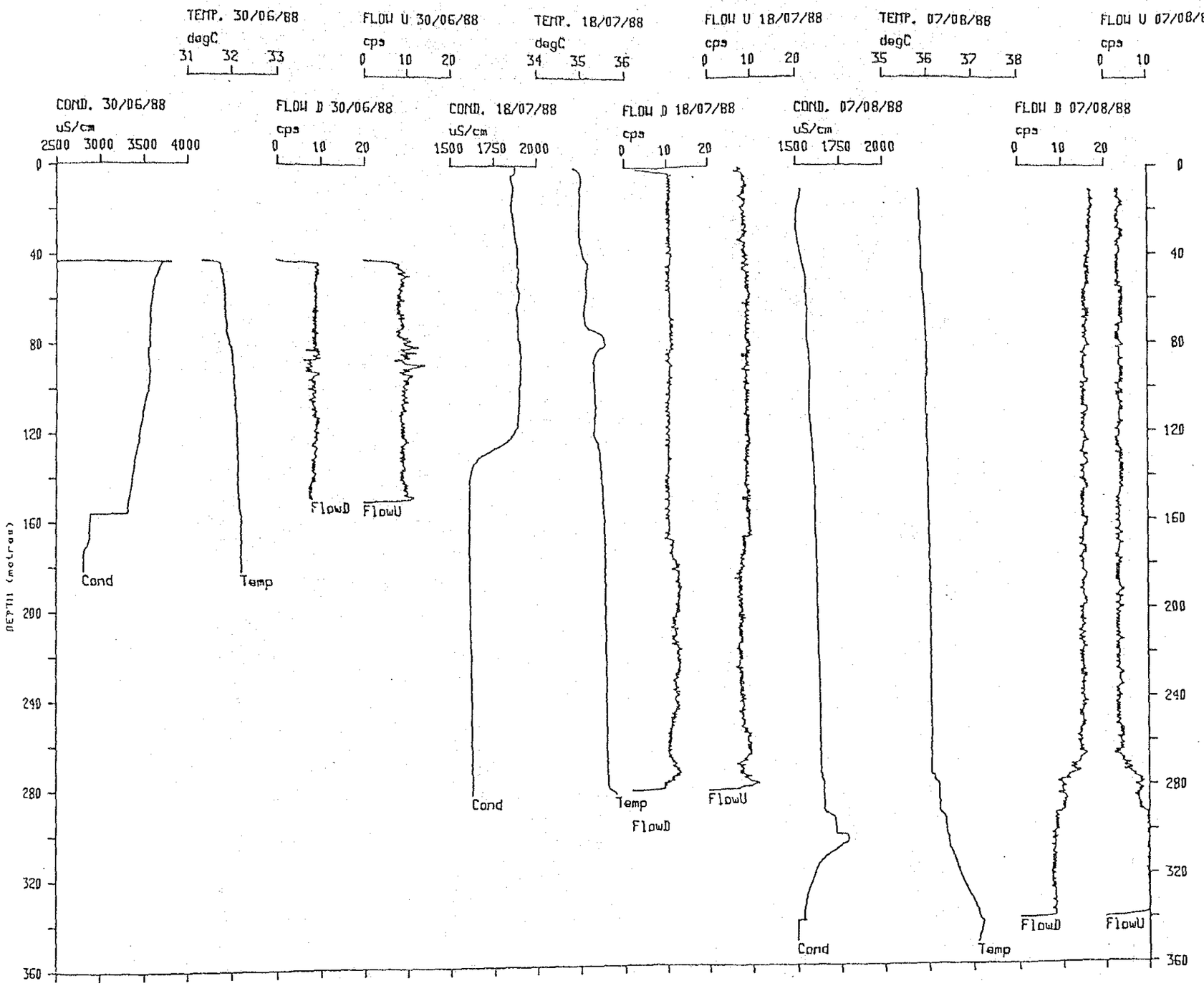
Fluid logs presented separately

Well Reference

NJD-2

Interval plotted 0 - 350 m

Plot 1 of 1 Scale 1:2000



A-4. 3. 4 (4)

Geophysical Bore Hole Log

NJD-2

Logging Schedule

Caliper, Gamma
E-log
Density
Porosity
Temperature, Conductivity
Flow

Date Logged

30/6 - 7/8/88

Remarks

Logged 30 June 1988
Total depth 155m
No casing

Logged 17 July 1988
Total depth 283m
Casing to 158m

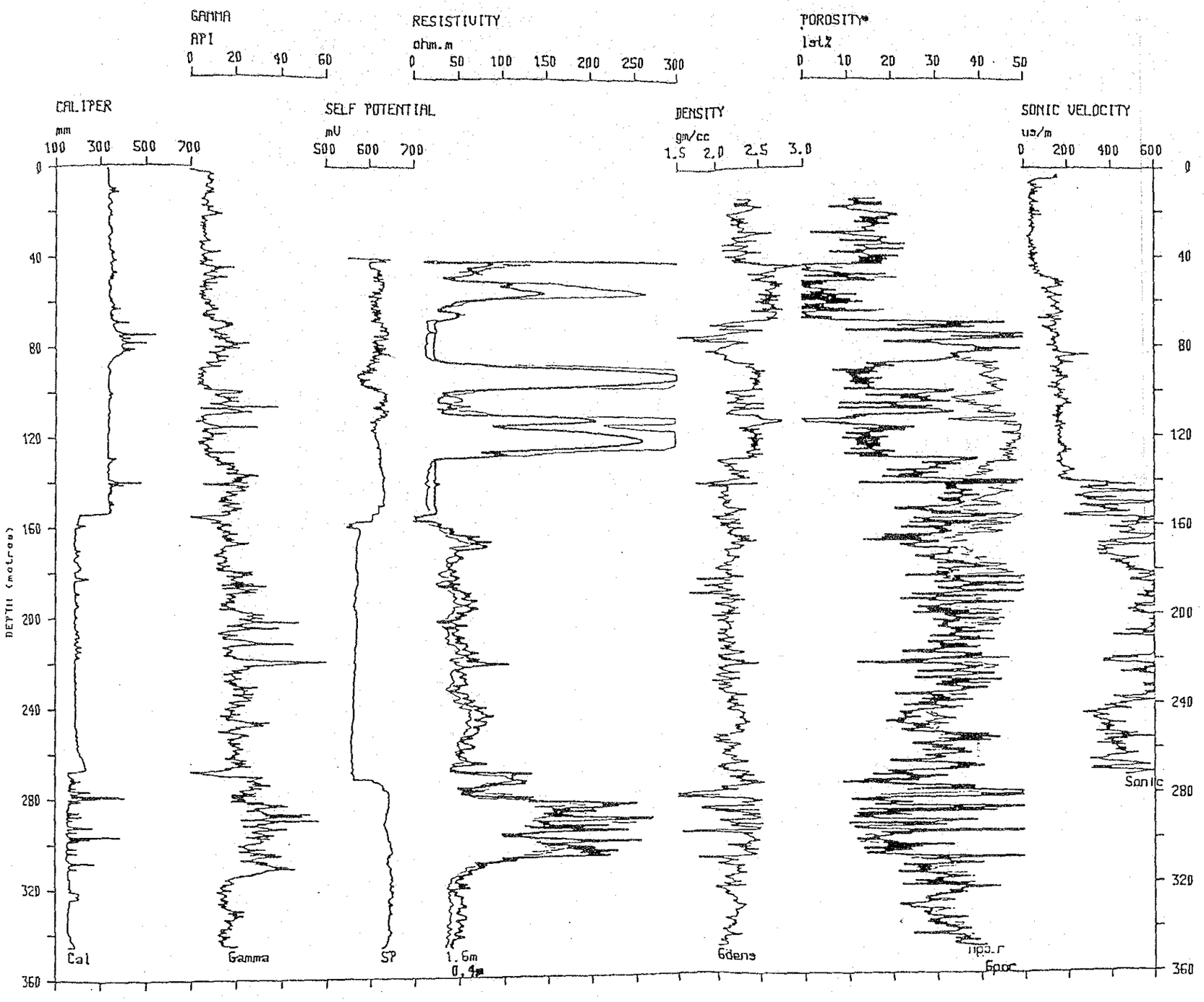
Logged 17 August 1988
Total depth 350m
Casing to 270m

Well Reference

NJD-2

Interval plotted 0 - 350 m

Plot 1 of 1 Scale 1:2000



A-4.3.4(5)

Geophysical Bore Hole Log

NJD-3

Logging Schedule

Temperature, Conductivity
Caliper, Gamma
Neutron, Sonic
Density
E-log
Flow

Date Logged

15/7 - 13/8/88

Remarks

Gamma, Density, Porosity and Sonic corrected for borehole diameter.

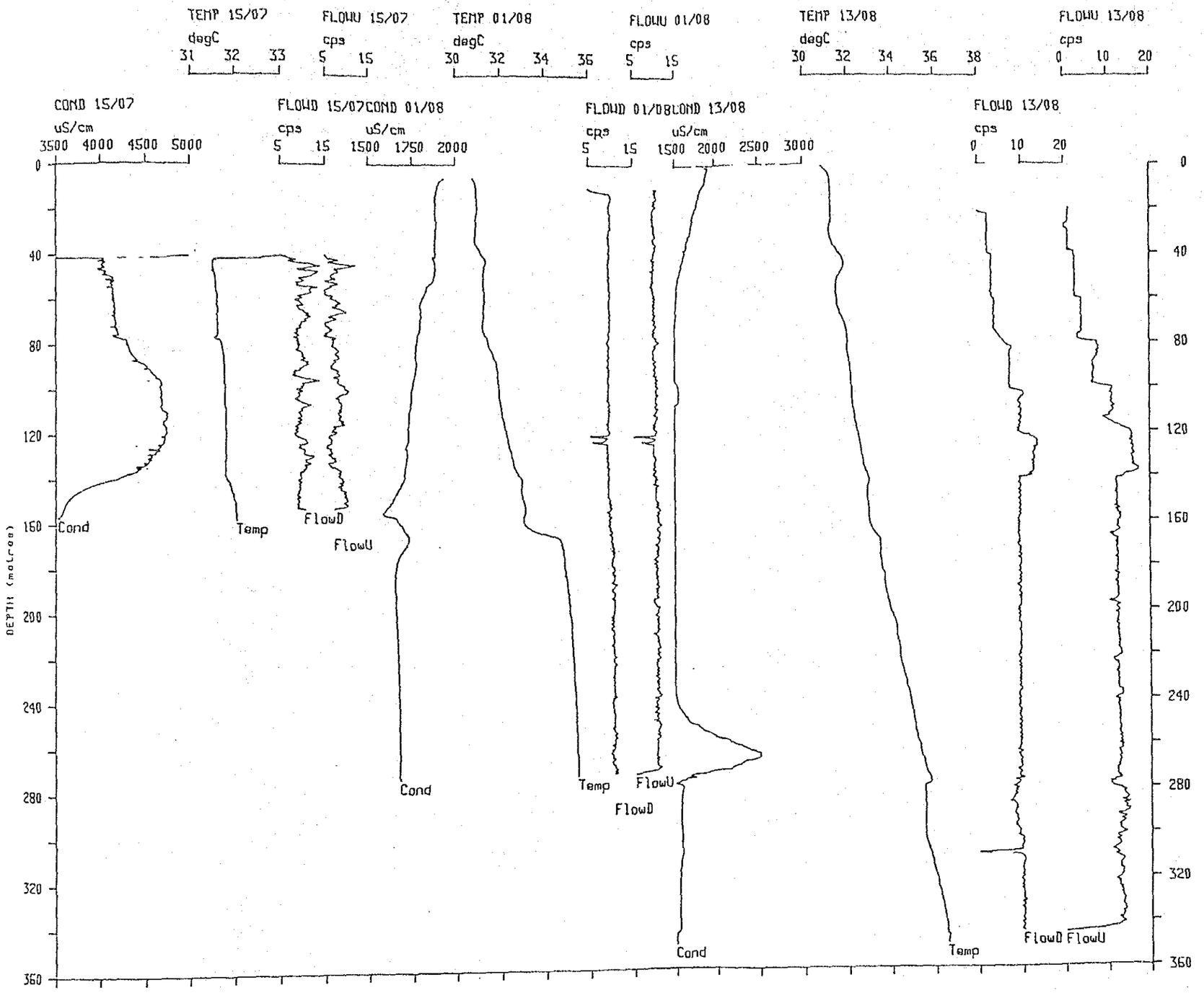
Fluid logs presented separately.

Well Reference

NJD-3

Interval plotted 0 to 360m

Plot 1 of 1 Scale 1:2000



A-4.3.4(6)

Geophysical Bore Hole Log

NJD-3

Logging Schedule

Temperature, Conductivity
Caliper, Gamma
Neutron, Sonic
Density
E-log
Flow

Date Logged

15/7 - 13/8/88

Remarks

Conductivities corrected to standard 25 degC.

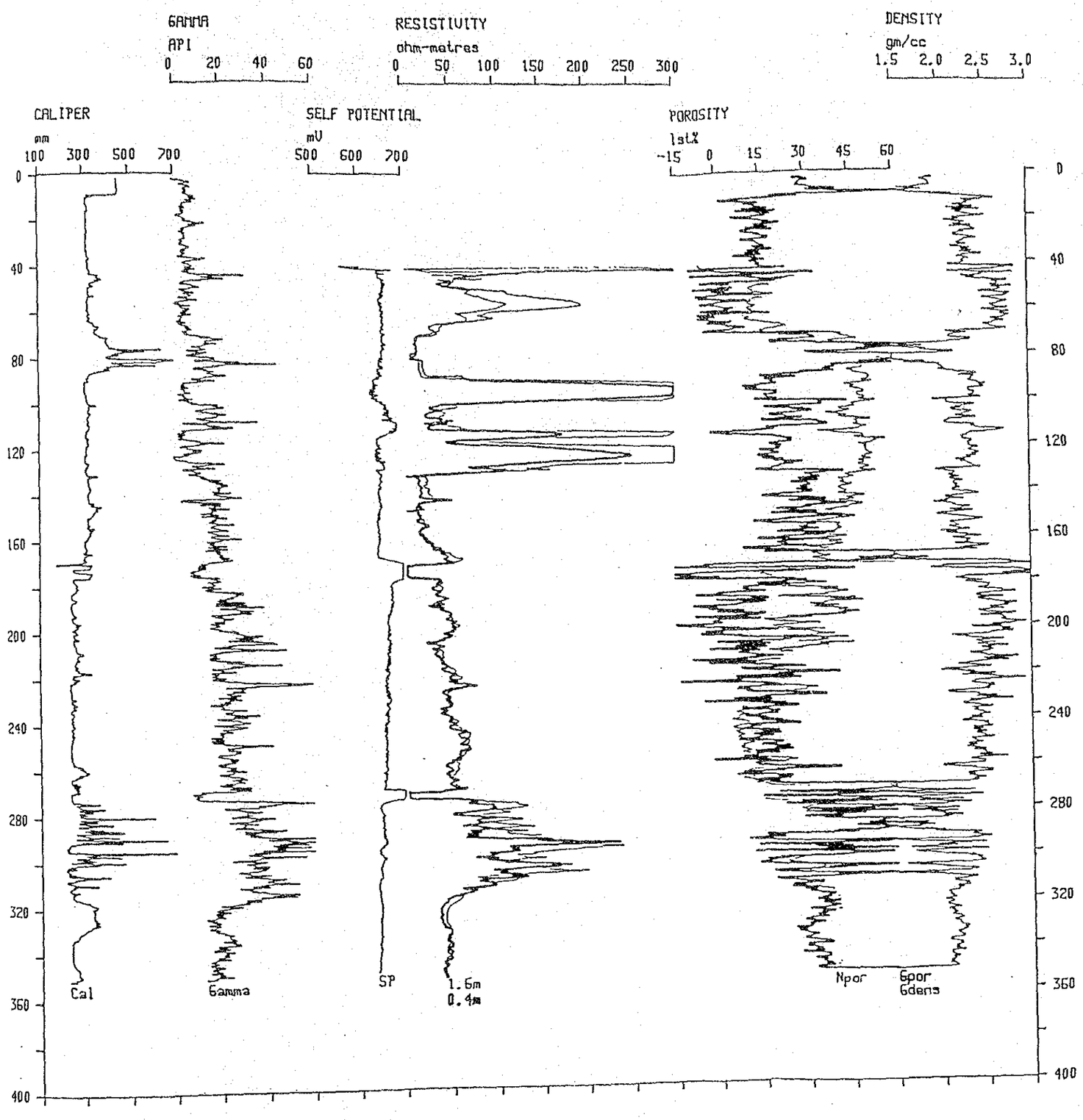
Logging dates as shown above columns.

Well Reference

NJD-3

Interval plotted 0 to 360m

Plot 1 of 1 Scale 1:2000



A-4.3.4(7)

Geophysical Bore Hole Log

NJD-4

Logging Schedule

Conductivity, Temperature;
Caliper, Natural Gamma;
0.4m/1.6m Resistivity, SP;
Gamma-Gamma Density;
Neutron Porosity;
Flowmeter.

Date Logged

5/9, 23/9 & 9/10/88

Remarks

Gamma, Density and Neutron logs are corrected for borehole diameter.

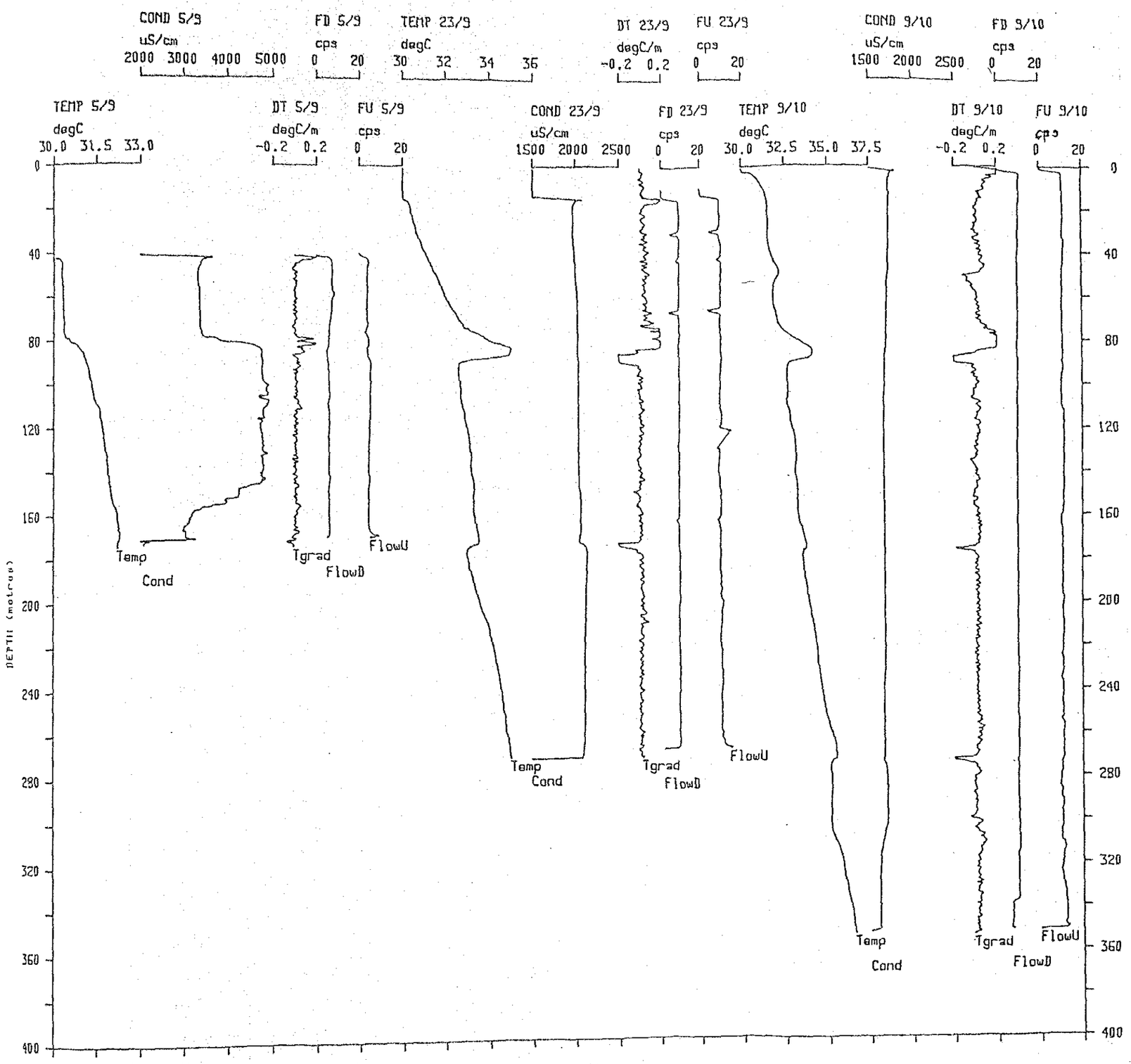
Fluid logs presented separately.

Well Reference

NJD-4

Interval plotted 0 to 360m

Plot 2 of 6 Scale 1:2000



A-4. 3. 4 (8)

Geophysical Bore Hole Log

NJD-4

Logging Schedule

Conductivity, Temperature;
Caliper, Natural Gamma;
0.4m/1.6m Resistivity, SP;
Gamma-Gamma Density;
Neutron Porosity;
Flowmeter.

Date Logged

5/9, 23/9 & 9/10/88

Remarks

Conductivity corrected to standard 25 degC.

Formation logs presented separately

Well Reference

NJD-4

Interval plotted 0 to 360m

Plot 1 of 6 Scale 1:2000

A-4. 3. 5 (1) Pumping Test Data of JICA Bore Holes

Sheet 1 - 1

Location : NJD-1, Al- Nagha, Nejd

Type of Test : Step Discharge (1)

Test Date/Period : 88/ 3 /12

Pumping Well : NJD-1 (6"ϕ)

Pumping Rate : 2.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : - m

Reference Level : 0.92m above ground

Initial Water Level from Ref. : -1.03m

Final Water Level from Ref. : -0.96m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	-0.05	660	
0.5	-	50	-0.05	720	
1	+0.05	60	-0.05	780	
1.5	-	70	-0.05	840	
2	+0.05	80	-0.06	900	
2.5	-	90	-0.06	960	
3	+0.05	100	-0.06	1080	
3.5	-	120	-0.07	1200	
4	+0.05	140		1320	
5	+0.05	160		1440	
6	+0.05	180		1560	
7	+0.05	200		1740	
8	+0.05	220		1920	
9	+0.04	240		2100	
10	+0.04	270		2280	
12	+0.03	300		2520	
14	+0.03	330		2760	
16	+0.02	360		3000	
20	+0.01	390		3240	
25	0.00	450		3600	
30	-0.02	510		3960	
35	-0.04	570		4200	

A-4.3.5(2) Pumping Test Data of JICA Bore Holes

Location : NJD-1, Al- Nagha, Nejd

Type of Test : Step Discharge (2)

Test Date/Period : 88/3/12

Pumping Well : NJD-1 (6"φ)

Pumping Rate : 4.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : - m

Reference Level : 0.92m above ground

Initial Water Level from Ref. : -0.96m

Final Water Level from Ref. : -1.13m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	-0.07	40	0.10	660	
0.5	-	50	0.10	720	
1	+0.08	60	0.10	780	
1.5	-	70	0.10	840	
2	+0.07	80	0.10	900	
2.5	-	90	0.10	960	
3	0.07	100	0.10	1080	
3.5	-	120	0.10	1200	
4	0.08	140		1320	
5	0.08	160		1440	
6	0.08	180		1560	
7	0.09	200		1740	
8	0.09	220		1920	
9	0.09	240		2100	
10	0.09	270		2280	
12	0.09	300		2520	
14	0.09	330		2760	
16	0.09	360		3000	
20	0.09	390		3240	
25	0.09	450		3600	
30	0.10	510		3960	
35	0.10	570		4200	

A-4.3.5(3) Pumping Test Data of JICA Bore Holes

Location : NJD-1, Al- Nagha, Nejd

Type of Test : Step Discharge(3)

Test Date/Period : 88/3/12

Pumping Well : NJD-1 (6"ϕ)

Pumping Rate : 6.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : - m

Reference Level : 0.92m above ground

Initial Water Level from Ref. : -1.13m

Final Water Level from Ref. : -1.34m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.10	40	0.30	660	
0.5	—	50	0.30	720	
1	0.31	60	0.31	780	
1.5	—	70	0.31	840	
2	0.30	80	0.31	900	
2.5	—	90	0.31	960	
3	0.30	100	0.31	1080	
3.5	—	120	0.31	1200	
4	0.29	140		1320	
5	0.29	160		1440	
6	0.29	180		1560	
7	0.29	200		1740	
8	0.29	220		1920	
9	0.29	240		2100	
10	0.29	270		2280	
12	0.29	300		2520	
14	0.29	330		2760	
16	0.29	360		3000	
20	0.30	390		3240	
25	0.30	450		3600	
30	0.30	510		3960	
35	0.30	570		4200	

A-4. 3. 5 (4) Pumping Test Data of JICA Bore Holes

Location : NJD-1, Al- Nagha, Nejd

Type of Test : Step Discharge (4)

Test Date/Period : 88/3/12

Pumping Well : NJD-1 (6"ϕ)

Pumping Rate : 8.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : - m

Reference Level : 0.92m above ground

Initial Water Level from Ref. : -1.34m

Final Water Level from Ref. : -1.65m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.31	40	0.59	660	
0.5	—	50	0.60	720	
1	0.60	60	0.60	780	
1.5	—	70	0.60	840	
2	0.58	80	0.61	900	
2.5	—	90	0.61	960	
3	0.58	100	0.61	1080	
3.5	—	120	0.62	1200	
4	0.58	140		1320	
5	0.58	160		1440	
6	0.58	180		1560	
7	0.59	200		1740	
8	0.59	220		1920	
9	0.59	240		2100	
10	0.59	270		2280	
12	—	300		2520	
14	—	330		2760	
15	0.59	360		3000	
20	0.59	390		3240	
25	0.59	450		3600	
30	0.59	510		3960	
35	0.59	570		4200	

A-4.3.5(5) Pumping Test Data of JICA Bore Holes

Location : NJD-1, Al- Nagha, Nejd

Type of Test : Step Discharge (5)

Test Date/Period : 88/3/12

Pumping Well : NJD-1 (6"ϕ)

Pumping Rate : 10.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : - m

Reference Level : 0.92m above ground

Initial Water Level from Ref. : -1.65m

Final Water Level from Ref. : -2.04m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.62	40	0.97	660	
0.5	—	50	0.98	720	
1	0.95	60	0.99	780	
1.5	—	70	0.99	840	
2	0.94	80	0.99	900	
2.5	—	90	1.00	960	
3	0.94	100	1.01	1080	
3.5	—	120	1.01	1200	
4	0.95	140		1320	
5	0.95	160		1440	
6	0.95	180		1560	
7	0.95	200		1740	
8	0.95	220		1920	
9	0.95	240		2100	
10	0.95	270		2280	
12	0.96	300		2520	
14	0.96	330		2760	
16	0.96	360		3000	
20	0.96	390		3240	
25	0.96	450		3600	
30	0.97	510		3960	
35	0.97	570		4200	

A-4. 3. 5 (6) Pumping Test Data of JICA Bore Holes

Sheet 2-1

Location : NJD-1, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/3/13

Pumping Well : NJD-1 (6" ϕ)

Pumping Rate : 10.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : — m

Reference Level : 0.92m above ground

Initial Water Level from Ref. : −1.02m

Final Water Level from Ref. : −2.16m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.94	660	1.13
0.5	—	50	0.96	720	1.14 stop
1	1.18	60	0.96	780	
1.5	—	70	0.97	840	
2	0.95	80	0.97	900	
2.5	—	90	0.98	960	
3	0.93	100	0.98	1080	
3.5	—	120	1.00	1200	
4	0.93	150	1.01	1320	
5	0.92	160	—	1440	
6	0.91	180	1.02	1560	
7	0.90	210	1.03	1740	
8	0.90	220	—	1920	
9	0.90	240	1.04	2100	
10	0.90	270	1.04	2280	
12	0.91	300	1.05	2520	
14	0.93	330	—	2760	
16	0.93	360	1.06	3000	
20	0.93	420	1.06	3240	
25	0.93	480	1.07	3600	
30	0.93	540	1.08	3960	
35	0.94	600	1.10	4200	

A-4.3.5(7) Pumping Test Data of JICA Bore Holes

Location : NJD-1, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/3/13

Pumping Well : NJD-1 (6"φ)

Pumping Rate : 10.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : - m

Reference Level : 0.92m above ground

Initial Water Level from Ref. : -2.16m

Final Water Level from Ref. : -1.07m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	1.14	40	0.11	660	—
0.5	—	50	0.11	720	0.05
1	0.28	60	0.10	780	
1.5	—	70	0.10	840	
2	0.23	80	0.10	900	
2.5	—	90	0.10	960	
3	0.19	105	0.08	1080	
3.5	—	120	0.09	1200	
4	0.14	140	—	1320	
5	0.15	160	—	1440	
6	0.15	180	—	1560	
7	—	200	—	1740	
8	0.14	220	—	1920	
9	0.14	240	—	2100	
10	0.14	270	—	2280	
12	0.14	300	—	2520	
14	0.14	330	—	2760	
16	0.13	360	—	3000	
20	0.13	390	—	3240	
25	0.12	450	—	3600	
30	0.12	510	—	3960	
35	0.12	570	—	4200	

A-4.3.5(8) Pumping Test Data of JICA Bore Holes

Location : NJD-2. Al- Nagha. Nejd

Type of Test : Step Discharge (1) | Test Date/Period : 88/8/13

Pumping Well : NJD-2 (8 1/2" ϕ) | Pumping Rate : 11.4 ℓ/sec

Observation Well : NJD-2 | Inter-Well Distance : - m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : -0.90m | Final Water Level from Ref. : -1.17m

Time. t (min)	Drawdown. s (m)	t	s	t	s
0	0.00	40	0.26	660	
0.5	5.40	50	0.26	720	
1	1.86	60	0.26	780	
1.5	0.20	70	0.26	840	
2	0.10	80	0.26	900	
2.5	0.10	90	0.26	960	
3	0.70	100	0.26	1080	
3.5	0.00	120	0.27	1200	
4	0.25	140		1320	
5	0.30	160		1440	
6	0.33	180		1560	
7	0.25	200		1740	
8	0.27	220		1920	
9	0.35	240		2100	
10	0.35	270		2280	
12	0.27	300		2520	
14	0.27	330		2760	
16	0.27	360		3000	
20	0.26	390		3240	
25	0.26	450		3600	
30	0.26	510		3960	
35	0.26	570		4200	

A-4.3.5(9) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Step Discharge (2)

Test Date/Period : 88/8/13

Pumping Well : NJD-2 (8 1/2" ϕ)

Pumping Rate : 23.2 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : — m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : −1.17m

Final Water Level from Ref. : −2.12m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.27	40	1.23	660	
0.5	—	50	1.24	720	
1	—	60	1.25	780	
1.5	—	70	1.26	840	
2	1.40	80	1.27	900	
2.5	1.35	90	1.28	960	
3	1.2	100	1.29	1080	
3.5	1.11	120	1.22	1200	
4	1.14	140		1320	
5	1.15	160		1440	
6	1.15	180		1560	
7	1.15	200		1740	
8	1.15	220		1920	
9	1.16	240		2100	
10	1.16	270		2280	
12	1.17	300		2520	
14	1.17	330		2760	
16	1.18	360		3000	
20	1.19	390		3240	
25	1.20	450		3600	
30	1.00	510		3960	
35	1.22	570		4200	

A-4. 3. 5 (10) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Step Discharge (3)

Test Date/Period : 88/8/13

Pumping Well : NJD-2 (8 1/2" ϕ)

Pumping Rate : 34.8 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : - m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : -2.12m

Final Water Level from Ref. : -3.10m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	1.22	40	2.14	660	
0.5	1.80	50	2.14	720	
1	2.05	60	2.15	780	
1.5	2.05	70	2.16	840	
2	2.05	80	2.17	900	
2.5	2.06	90	2.18	960	
3	2.06	100	2.19	1080	
3.5	2.08	120	2.20	1200	
4	2.07	140		1320	
5	2.08	160		1440	
6	2.08	180		1560	
7	2.09	200		1740	
8	2.10	220		1920	
9	2.11	240		2100	
10	2.11	270		2280	
12	2.13	300		2520	
14	2.13	330		2760	
16	2.13	360		3000	
20	2.13	390		3240	
25	2.13	450		3600	
30	2.13	510		3960	
35	2.13	570		4200	

A-4. 3. 5 (11) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Step Discharge (4)

Test Date/Period : 88/8/13

Pumping Well : NJD-2 (8 1/2" ϕ)

Pumping Rate : 43.8 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : — m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : -3.10m

Final Water Level from Ref. : -4.07m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	2.20	40	3.17	660	
0.5	2.29	50	3.18	720	
1	2.90	60	3.19	780	
1.5	3.07	70	3.15	840	
2	3.11	80	3.14	900	
2.5	3.11	90	3.15	960	
3	3.12	100	3.15	1080	
3.5	3.12	120	3.17	1200	
4	3.1	140		1320	
5	3.13	160		1440	
6	3.14	180		1560	
7	3.13	200		1740	
8	3.13	220		1920	
9	3.13	240		2100	
10	3.13	270		2280	
12	3.14	300		2520	
14	3.13	330		2760	
16	3.14	360		3000	
20	3.15	390		3240	
25	3.15	450		3600	
30	3.16	510		3960	
35	3.17	570		4200	

A-4. 3. 5 (12) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Step Discharge (5)

Test Date/Period : 88/8/13

Pumping Well : NJD-2 (8 1/2" ϕ)

Pumping Rate : 62.3 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : - m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : -4.07m

Final Water Level from Ref. : -6.82m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	3.17	40	6.06	660	
0.5	5.80	50	6.08	720	
1	5.88	60	6.12	780	
1.5	5.92	70	6.14	840	
2	5.93	80	6.15	900	
2.5	5.94	90	6.16	960	
3	5.95	100	6.16	1080	
3.5	5.96	120	5.92	1200	
4	5.97	140		1320	
5	5.98	160		1440	
6	5.98	180		1560	
7	6.00	200		1740	
8	6.00	220		1920	
9	6.01	240		2100	
10	6.01	270		2280	
12	6.02	300		2520	
14	6.02	330		2760	
16	6.02	360		3000	
20	6.04	390		3240	
25	6.05	450		3600	
30	6.05	510		3960	
35	6.05	570		4200	

A-4. 3. 5 (13) Pumping Test Data of JICA Bore Holes

Sheet 4 - 1

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88／8／15－8／18

Pumping Well : NJD-2 (8 1/2"ϕ)

Pumping Rate : 62.3 ℓ／sec

Observation Well : NJD-2

Inter-Well Distance : － m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : －0.99m

Final Water Level from Ref. : －8.49m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	5.62	660	6.35
0.5	5.04	50	5.66	720	6.38
1	5.24	60	5.69	780	6.43
1.5	5.29	70	5.71	840	6.48
2	5.31	80	5.73	900	6.52
2.5	5.33	90	5.76	960	6.55
3	5.35	100	5.78	1080	6.61
3.5	5.36	120	5.81	1200	6.67
4	5.37	140	5.85	1320	6.71
5	5.39	160	5.89	1440	6.75
6	5.41	180	5.93	1560	6.79
7	5.42	200	5.96	1740	6.85
8	5.43	220	6.00	1920	6.90
9	5.44	240	6.03	2100	6.94
10	5.45	270	6.05	2280	7.03
12	5.47	300	6.08	2520	7.10
14	5.49	330	6.11	2760	7.16
16	5.50	360	6.15	3000	7.21
20	5.53	390	6.17	3240	7.27
25	5.55	450	6.21	3600	7.32
30	5.58	510	6.25	3960	7.43
35	5.60	570	6.29	4320	7.50 stop

A-4. 3. 5 (14) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/8/15 - 8/18

Pumping Well : NJD-2 (8 1/2" ϕ)

Pumping Rate : 62.3 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : 150 m

Reference Level : 1.63m above ground

Initial Water Level from Ref. : -1.07m

Final Water Level from Ref. : -3.64m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.63	660	1.39
0.5	0.205	50	0.67	720	1.425
1	0.24	60	0.705	780	1.48
1.5	0.27	70	0.75	840	1.53
2	0.30	80	0.775	900	1.56
2.5	0.31	90	0.79	960	1.60
3	0.335	100	0.81	1080	1.66
3.5	0.35	120	0.86	1200	1.70
4	0.36	150	0.91	1320	1.74
5	0.38	160	—	1440	1.79
6	0.395	180	0.94	1560	1.84
7	0.41	210	1.01	1740	1.90
8	0.425	220	—	1920	1.95
9	0.435	240	1.055	2100	2.00
10	0.445	270	1.09	2280	2.07
12	0.47	300	1.12	2520	2.175
14	0.486	330	—	2760	2.21
16	0.50	360	1.18	3000	2.27
20	0.53	420	1.23	3240	2.32
25	0.56	480	1.275	3600	2.39
30	0.585	540	1.315	3960	2.50
35	0.61	600	1.35	4320	2.57 stop

A-4. 3. 5 (15) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/8/15 - 8/18

Pumping Well : NJD-2 (8 1/2" ϕ)

Pumping Rate : 62.3 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : 750 m

Reference Level : 0.65m above ground

Initial Water Level from Ref. : -0.72m

Final Water Level from Ref. : -2.68m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.23	660	0.84
0.5	0.03	50	0.245	720	0.87
1	0.03	60	0.28	780	0.91
1.5	0.04	70	0.31	840	0.95
2	0.04	80	0.33	900	0.985
2.5	0.04	90	0.35	960	1.02
3	0.05	100	0.37	1080	1.10
3.5	0.05	120	0.41	1200	1.125
4	0.05	140	0.44	1320	1.145
5	0.06	160	0.47	1440	1.20
6	0.07	180	0.495	1560	1.245
7	0.07	200	0.52	1740	1.31
8	0.08	220	0.545	1920	1.35
9	0.095	240	0.57	2100	1.41
10	0.11	270	0.595	2280	1.47
12	0.12	300	0.62	2520	1.58
14	0.13	330	0.655	2760	1.63
16	0.14	360	0.675	3000	1.67
20	0.16	390	0.695	3240	1.72
25	0.18	450	0.73	3600	1.83
30	0.20	510	0.76	3960	1.90
35	0.21	570	0.80	4320	1.96 stop

A-4. 3. 5 (16) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/8/15-8/18

Pumping Well : NJD-2 (8 1/2" ϕ)

Pumping Rate : 62.3 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : - m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : -8.49m

Final Water Level from Ref. : -2.35m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	7.50	40	1.81	660	
0.5	4.31	50	1.78	720	
1	2.79	60	1.75	780	
1.5	1.28	70	1.72	840	
2	1.84	80	1.70	900	
2.5	2.11	90	1.68	960	
3	2.23	100	1.66	1080	
3.5	2.13	120	1.62	1200	
4	2.05	140	1.58	1320	
5	2.04	160	1.56	1440	
6	2.04	180	1.54	1560	
7	2.01	200	1.51	1740	
8	2.00	220	1.49	1920	
9	1.99	240	1.47	2100	
10	1.98	270	1.44	2280	
12	1.97	300	1.41	2520	
14	1.94	330	1.38	2760	
16	1.93	360	1.36	3000	
20	1.90	390		3240	
25	1.87	450		3600	
30	1.85	510		3960	
35	1.83	570		4200	

A-4.3.5(17) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/8/15-8/18

Pumping Well : NJD-2 (8 1/2"ϕ)

Pumping Rate : 62.3 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : 150m

Reference Level : 1.63m above ground

Initial Water Level from Ref. : -3.64m

Final Water Level from Ref. : -2.26m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	2.57	40	1.96	660	1.265
0.5	2.33	50	1.93	720	1.24
1	2.34	60	1.895	780	1.205
1.5	2.36	70	1.865	840	1.20
2	2.28	80	1.84	900	1.19
2.5	2.22	90	1.81	960	
3	2.205	100	1.79	1080	
3.5	2.205	120	1.75	1200	
4	2.21	150	1.705	1320	
5	2.19	160	-	1440	
6	2.175	180	1.61	1560	
7	2.165	210	1.575	1740	
8	2.155	220	-	1920	
9	2.14	240	1.54	2100	
10	2.13	270	1.52	2280	
12	2.11	300	1.495	2520	
14	2.095	330	-	2760	
16	2.08	360	1.440	3000	
20	2.055	420	1.41	3240	
25	2.025	480	1.37	3600	
30	2.005	540	1.33	3960	
35	1.98	600	1.285	4200	

A-4. 3. 5 (18) Pumping Test Data of JICA Bore Holes

Location : NJD-2, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery Test Date/Period : 88/8/15-8/18

Pumping Well : NJD-2 (8 1/2"φ) Pumping Rate : 62.3 ℓ/sec

Observation Well : NJD-3 Inter-Well Distance : 750m

Reference Level : 0.65m above ground

Initial Water Level from Ref. : -2.68m Final Water Level from Ref. : -1.82m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	1.96	40	1.705	660	1.12
0.5	1.94	50	1.68	720	1.10
1	1.93	60	1.65	780	1.10
1.5	1.91	70	1.63	840	1.10
2	1.90	80	1.62	900	
2.5	1.90	90	1.60	960	
3	1.90	100	1.58	1080	
3.5	1.89	120	1.54	1200	
4	1.89	140	1.51	1320	
5	1.875	160	1.49	1440	
6	1.86	180	1.46	1560	
7	1.85	200	1.44	1740	
8	1.84	220	1.42	1920	
9	1.84	240	1.40	2100	
10	1.83	270	1.37	2280	
12	1.82	300	1.34	2520	
14	1.81	330	1.31	2760	
16	1.80	360	1.29	3000	
20	1.78	390	1.27	3240	
25	1.76	450	1.23	3600	
30	1.74	510	1.18	3960	
35	1.72	570	1.15	4200	

A-4. 3. 5 (19) Pumping Test Data of JICA Bore Holes

Sheet 5 - 1

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Step Discharge (1)

Test Date/Period : 88/ 8 /20

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 5.0 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

Reference Level : 1.70m above ground

Initial Water Level from Ref. : -1.80m

Final Water Level from Ref. : -1.37m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	-0.40	660	
0.5	+1.10	50	-0.40	720	
1	+0.85	60	-0.41	780	
1.5	+0.27	70	-0.41	840	
2	+0.42	80	-0.42	900	
2.5	+0.12	90	-0.42	960	
3	+0.15	100	-0.42	1080	
3.5	+0.08	120	-0.43	1200	
4	-0.03	140		1320	
5	-0.01	160		1440	
6	-0.11	180		1560	
7	-0.10	200		1740	
8	-0.12	220		1920	
9	-0.15	240		2100	
10	-0.16	270		2280	
12	-0.22	300		2520	
14	-0.25	330		2760	
16	-0.26	360		3000	
20	-0.35	390		3240	
25	-0.38	450		3600	
30	-0.39	510		3960	
35	-0.40	570		4200	

A-4. 3. 5(20) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Step Discharge (2)

Test Date/Period : 88/8/20

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 10.0 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

Reference Level : 1.70m above ground

Initial Water Level from Ref. : -1.37m

Final Water Level from Ref. : -1.70m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	-0.43	40	-0.10	660	
0.5	+0.09	50	-0.10	720	
1	+0.02	60	-0.11	780	
1.5	-0.08	70	-0.11	840	
2	-0.1	80	-0.11	900	
2.5	-0.13	90	-0.10	960	
3	-0.13	100	-0.10	1080	
3.5	-0.13	120	-0.10	1200	
4	-0.13	140		1320	
5	-0.12	160		1440	
6	-0.12	180		1560	
7	-0.11	200		1740	
8	-0.11	220		1920	
9	-0.11	240		2100	
10	-0.11	270		2280	
12	-0.11	300		2520	
14	-0.11	330		2760	
16	-0.11	360		3000	
20	-0.11	390		3240	
25	-0.10	450		3600	
30	-0.10	510		3960	
35	-	570		4200	

A-4.3.5(21) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Step Discharge (3)

Test Date/Period : 88/8/20

Pumping Well : NJD-3 (6"φ)

Pumping Rate : 15.0 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

Reference Level : 1.70m above ground

Initial Water Level from Ref. : -1.70m

Final Water Level from Ref. : -2.24m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	-0.10	40	0.43	660	
0.5	+0.08	50	0.43	720	
1	+0.27	60	0.43	780	
1.5	0.28	70	0.44	840	
2	0.29	80	0.44	900	
2.5	0.34	90	0.44	960	
3	0.37	100	0.44	1080	
3.5	0.39	120	0.44	1200	
4	0.40	140		1320	
5	0.41	160		1440	
6	0.41	180		1560	
7	0.42	200		1740	
8	0.42	220		1920	
9	0.42	240		2100	
10	0.42	270		2280	
12	0.42	300		2520	
14	0.42	330		2760	
16	0.42	360		3000	
20	0.42	390		3240	
25	0.42	450		3600	
30	0.42	510		3960	
35	0.42	570		4200	

A-4. 3. 5 (22) Pumping Test Data of JICA Bore Holes

Location : NJD-8, Al- Nagha, Nejd

Type of Test : Step Discharge (4)

Test Date/Period : 88/8/20

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 20.0 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

Reference Level : 1.70m above ground

Initial Water Level from Ref. : -2.24m

Final Water Level from Ref. : -2.92m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	+0.44	40	1.12	660	
0.5	+0.88	50	1.12	720	
1	0.90	60	1.12	780	
1.5	0.95	70	1.12	840	
2	1.01	80	1.12	900	
2.5	1.04	90	1.12	960	
3	1.08	100	1.12	1080	
3.5	1.10	120	1.12	1200	
4	1.11	140		1320	
5	1.12	160		1440	
6	1.12	180		1560	
7	1.12	200		1740	
8	1.12	220		1920	
9	1.13	240		2100	
10	1.13	270		2280	
12	1.14	300		2520	
14	1.14	330		2760	
16	1.14	360		3000	
20	1.14	390		3240	
25	1.13	450		3600	
30	1.12	510		3960	
35	1.12	570		4200	

A-4. 3. 5 (23) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Step Discharge (5)

Test Date/Period : 88/8/20

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 25.0 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

Reference Level : 1.70m above ground

Initial Water Level from Ref. : -2.92m

Final Water Level from Ref. : -3.59m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	+1.12	40	1.79	660	
0.5	+1.78	50	1.79	720	
1	1.75	60	1.79	780	
1.5	1.75	70	1.79	840	
2	1.75	80	1.79	900	
2.5	1.76	90	1.79	960	
3	1.77	100	1.79	1080	
3.5	1.77	120	1.79	1200	
4	1.78	140		1320	
5	1.79	160		1440	
6	1.79	180		1560	
7	1.79	200		1740	
8	1.80	220		1920	
9	1.80	240		2100	
10	1.81	270		2280	
12	1.81	300		2520	
14	1.81	330		2760	
16	1.80	360		3000	
20	1.80	390		3240	
25	1.80	450		3600	
30	1.80	510		3960	
35	1.79	570		4200	

A-4. 3. 5 (24) Pumping Test Data of JICA Bore Holes

Sheet 6-1

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/8/21-8/22

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 25.0 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

Reference Level : 0.47m above ground

Initial Water Level from Ref. : -1.28m

Final Water Level from Ref. : -3.71m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	2.24	660	2.32
0.5	0.92	50	2.24	720	2.33
1	2.23	60	2.24	780	2.35
1.5	2.20	70	2.24	840	2.36
2	2.20	80	2.23	900	2.36
2.5	2.21	90	2.22	960	2.37
3	2.21	100	2.22	1080	2.38
3.5	2.22	120	2.22	1200	2.39
4	2.22	140	2.22	1320	2.42
5	2.24	160	2.23	1440	2.43 stop
6	2.24	180	2.23	1560	
7	2.25	200	2.24	1740	
8	2.25	220	2.24	1920	
9	2.25	240	2.25	2100	
10	2.25	270	2.25	2280	
12	2.25	300	2.25	2520	
14	2.24	330	2.26	2760	
16	2.24	360	2.26	3000	
20	2.24	390	2.27	3240	
25	2.24	450	2.28	3600	
30	2.24	510	2.29	3960	
35	2.24	570	2.30	4200	

A-4.3.5(25) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/8/21-8/22

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 25.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : 764 m

Reference Level : 1.63m above ground

Initial Water Level from Ref. : -1.82m

Final Water Level from Ref. : -2.245m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.09	660	0.29
0.5	0.00	50	0.10	720	0.305
1	0.00	60	0.115	780	0.325
1.5	0.004	70	0.12	840	0.335
2	0.005	80	0.13	900	0.345
2.5	0.01	90	0.14	960	0.35
3	0.012	100	0.145	1080	0.36
3.5	0.015	120	0.155	1200	0.38
4	0.018	140	0.165	1320	0.40
5	0.022	160	0.18	1440	0.425 stop
6	0.025	180	0.186	1560	
7	0.028	200	0.19	1740	
8	0.03	220	0.20	1920	
9	0.035	240	0.205	2100	
10	0.038	270	0.21	2280	
12	0.04	300	0.22	2520	
14	0.05	330	0.225	2760	
16	0.052	360	0.23	3000	
20	0.06	390	0.235	3240	
25	0.07	450	0.25	3600	
30	0.075	510	0.26	3960	
35	0.085	570	0.275	4200	

A-4.3.5(26) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/8/21-8/22

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 25.0 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : 750 m

Reference Level : 1.06m above ground

Initial Water Level from Ref. : -0.34m

Final Water Level from Ref. : -0.79m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.10	660	0.32
0.5	0.00	50	0.11	720	0.33
1	0.00	60	0.13	780	0.34
1.5	0.00	70	0.14	840	0.35
2	0.00	80	0.15	900	0.36
2.5	0.01	90	0.15	960	0.37
3	0.01	100	0.16	1080	0.38
3.5	0.01	120	0.17	1200	0.40
4	0.02	140	0.18	1320	0.42
5	0.02	160	0.20	1440	0.45 stop
6	0.03	180	0.205	1560	
7	0.03	200	0.21	1740	
8	0.04	220	0.22	1920	
9	0.04	240	0.225	2100	
10	0.05	270	0.23	2280	
12	0.05	300	0.24	2520	
14	0.06	330	0.245	2760	
16	0.06	360	0.25	3000	
20	0.07	390	0.255	3240	
25	0.08	450	0.27	3600	
30	0.09	510	0.28	3960	
35	0.10	570	0.30	4200	

A-4. 3. 5 (27) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/8/21-8/22

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 25.0 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

Reference Level : 0.47m above ground

Initial Water Level from Ref. : -3.71m

Final Water Level from Ref. : -1.26m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	2.43	40	0.18	660	-0.02
0.5	1.44	50	0.17	720	-0.02
1	-0.24	60	0.16	780	
1.5	0.22	70	0.16	840	
2	0.67	80	0.15	900	
2.5	0.52	90	0.14	960	
3	0.04	100	0.13	1080	
3.5	0.27	120	0.12	1200	
4	0.43	140	0.11	1320	
5	0.23	160	0.10	1440	
6	0.26	180	0.10	1560	
7	0.23	200	0.09	1740	
8	0.20	220	0.08	1920	
9	0.22	240	0.07	2100	
10	0.22	270	0.06	2280	
12	0.22	300	0.05	2520	
14	0.22	330	0.04	2760	
16	0.21	360	0.03	3000	
20	0.21	390	0.03	3240	
25	0.20	450	0.01	3600	
30	0.19	510	-0.01	3960	
35	0.18	570	-0.01	4200	

A-4. 3. 5 (28) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test ; Constant Discharge, Recovery

Test Date/Period : 88/8/21-8/22

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 25.0 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : 764 m

Reference Level : 1.63m above ground

Initial Water Level from Ref. : -2.245 m

Final Water Level from Ref. : -1.843 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.425	40	0.335	660	0.025
0.5	0.425	50	0.32	720	0.023
1	0.430	60	0.318	780	
1.5	0.428	70	0.295	840	
2	0.42	80	0.290	900	
2.5	0.418	90	0.28	960	
3	0.415	100	0.27	1080	
3.5	0.415	120	0.258	1200	
4	0.41	140	0.24	1320	
5	0.405	160	0.225	1440	
6	0.40	180	0.21	1560	
7	0.40	200	0.20	1740	
8	0.395	220	0.185	1920	
9	0.395	240	0.170	2100	
10	0.390	270	0.15	2280	
12	0.385	300	0.135	2520	
14	0.378	330	0.12	2760	
16	0.375	360	0.105	3000	
20	0.365	390	0.09	3240	
25	0.36	450	0.07	3600	
30	0.35	510	0.05	3960	
35	0.348	570	0.035	4200	

A-4. 3. 5(29) Pumping Test Data of JICA Bore Holes

Location : NJD-3, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/8/21-8/22

Pumping Well : NJD-3 (6"ϕ)

Pumping Rate : 25.0 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : 750m

Reference Level : 1.06m above ground

Initial Water Level from Ref. : -0.79m

Final Water Level from Ref. : -0.35m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.45	40	0.33	660	0.02
0.5	0.45	50	0.32	720	0.01
1	0.45	60	0.31	780	
1.5	0.44	70	0.305	840	
2	0.43	80	0.29	900	
2.5	0.43	90	0.285	960	
3	0.42	100	0.27	1080	
3.5	0.42	120	0.255	1200	
4	0.42	140	0.245	1320	
5	0.41	160	0.23	1440	
6	0.41	180	0.21	1560	
7	0.40	200	0.205	1740	
8	0.40	220	0.18	1920	
9	0.39	240	0.16	2100	
10	0.39	270	0.155	2280	
12	0.38	300	0.14	2520	
14	0.38	330	0.105	2760	
16	0.37	360	0.10	3000	
20	0.36	390	0.10	3240	
25	0.35	450	0.075	3600	
30	0.35	510	0.06	3960	
35	0.34	570	0.04	4200	

A-4. 3. 5 (30) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Step Discharge (1)

Test Date/Period : 88/10/11

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 10.1 ℓ/sec

Observation Well : NJD-4

Inter-Well Distance : - m

Reference Level : 1.87m above ground

Initial Water Level from Ref. : -2.63m

Final Water Level from Ref. : -2.74m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.095	660	
0.5	—	50	0.095	720	
1	0.55	60	0.095	780	
1.5	1.29	70	0.095	840	
2	0.22	80	0.10	900	
2.5	0.37	90	0.11	960	
3	0.29	100	0.11	1080	
3.5	0.42	120	0.11	1200	
4	1.00	140		1320	
5	0.29	160		1440	
6	0.26	180		1560	
7	0.13	200		1740	
8	0.14	220		1920	
9	0.14	240		2100	
10	0.13	270		2280	
12	0.09	300		2520	
14	0.09	330		2760	
16	0.09	360		3000	
20	0.09	390		3240	
24	0.09	450		3600	
30	0.09	510		3960	
35	0.09	570		4200	

A-4. 3. 5 (31) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Step Discharge (2)

Test Date/Period : 88/10/11

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 20.1 ℓ/sec

Observation Well : NJD-4

Inter-Well Distance : - m

Reference Level : 1.87m above ground

Initial Water Level from Ref. : -2.74m

Final Water Level from Ref. : -3.275m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.11	40	0.58	660	
0.5	0.62	50	0.58	720	
1	0.63	60	0.61	780	
1.5	0.46	70	0.62	840	
2	0.48	80	0.63	900	
2.5	0.53	90	0.63	960	
3	0.58	100	0.63	1080	
3.5	0.55	120	0.645	1200	
4	0.55	140		1320	
5	0.55	160		1440	
6	0.55	180		1560	
7	0.55	200		1740	
8	0.56	220		1920	
9	0.56	240		2100	
10	0.56	270		2280	
12	0.56	300		2520	
14	0.57	330		2760	
16	0.57	360		3000	
20	0.58	390		3240	
24	0.58	450		3600	
30	0.59	510		3960	
35	0.59	570		4200	

A-4. 3. 5 (32) Pumping Test Data of JICA Bore Holes

Location : NJD-4. Al- Nagha. Nejd

Type of Test : Step Discharge (3)

Test Date/Period : 88/10/11

Pumping Well : NJD-4 (8 1/2"ϕ)

Pumping Rate : 30.0 ℓ/sec

Observation Well : NJD-4

Inter-Well Distance : - m

Reference Level : 1.87m above ground

Initial Water Level from Ref. : -3.275 m

Final Water Level from Ref. : -4.05m

Time. t (min)	Drawdown. s (m)	t	s	t	s
0	0.645	40	1.33	660	
0.5	1.18	50	1.34	720	
1	1.23	60	1.35	780	
1.5	1.24	70	1.36	840	
2	1.26	80	1.37	900	
2.5	1.30	90	1.36	960	
3	1.30	100	1.39	1080	
3.5	1.29	120	1.42	1200	
4	1.29	140		1320	
5	1.295	160		1440	
6	1.30	180		1560	
7	1.30	200		1740	
8	1.305	220		1920	
9	1.31	240		2100	
10	1.32	270		2280	
12	1.33	300		2520	
14	1.34	330		2760	
16	1.34	360		3000	
20	1.33	390		3240	
24	1.32	450		3600	
30	1.32	510		3960	
35	1.33	570		4200	

A-4. 3. 5 (33) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Step Discharge (4)

Test Date/Period : 88/10/11

Pumping Well : NJD-4 (8 1/2"ϕ)

Pumping Rate : 39.9 ℓ/sec

Observation Well : NJD-4

Inter-Well Distance : - m

Reference Level : 1.87m above ground

Initial Water Level from Ref. : -4.05m

Final Water Level from Ref. : -4.945m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	1.42	40	2.226	660	
0.5	1.84	50	2.24	720	
1	1.97	60	2.26	780	
1.5	1.99	70	2.26	840	
2	2.01	80	2.265	900	
2.5	2.04	90	2.28	960	
3	2.09	100	2.29	1080	
3.5	2.12	120	2.315	1200	
4	2.16	140		1320	
5	2.165	160		1440	
6	2.17	180		1560	
7	2.175	200		1740	
8	2.18	220		1920	
9	2.185	240		2100	
10	2.19	270		2280	
12	2.20	300		2520	
14	2.205	330		2760	
16	2.205	360		3000	
20	2.205	390		3240	
24	2.207	450		3600	
30	2.22	510		3960	
35	2.22	570		4200	

A-4. 3. 5 (34) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Step Discharge (5)

Test Date/Period : 88/10/11

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 58.1 ℓ/sec

Observation Well : NJD-4

Inter-Well Distance : - m

Reference Level : 1.87m above ground

Initial Water Level from Ref. : -4.945 m

Final Water Level from Ref. : -6.85m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	3.315	40	4.09	660	
0.5	3.45	50	4.10	720	
1	3.96	60	4.12	780	
1.5	3.97	70	4.13	840	
2	3.975	80	4.15	900	
2.5	3.985	90	4.16	960	
3	4.00	100	4.19	1080	
3.5	4.01	120	4.22	1200	
4	4.02	140		1320	
5	4.028	160		1440	
6	4.07	180		1560	
7	4.085	200		1740	
8	4.09	220		1920	
9	4.10	240		2100	
10	4.09	270		2280	
12	4.085	300		2520	
14	4.085	330		2760	
16	4.085	360		3000	
20	4.09	390		3240	
24	4.09	450		3600	
30	4.08	510		3960	
35	4.09	570		4200	

A-4. 3. 5 (35) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2"ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-4

Inter-Well Distance : - m

Reference Level : 1.87m above ground

Initial Water Level from Ref. : -2.69m

Final Water Level from Ref. : -7.515 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	3.08	660	3.705
0.5	3.61	50	3.105	720	3.745
1	3.55	60	3.13	780	3.785
1.5	3.49	70	3.165	840	3.82
2	3.33	80	3.19	900	3.86
2.5	2.89	90	3.21	960	3.885
3	2.83	100	3.23	1080	3.925
3.5	2.93	120	3.275	1200	3.99
4	2.92	140	3.30	1320	4.02
5	2.93	160	3.33	1440	4.08
6	2.94	180	3.36	1560	4.125
7	2.95	200	3.395	1740	4.18
8	2.955	220	3.41	1920	4.22
9	2.97	240	3.43	2100	4.285
10	2.977	270	3.46	2280	4.36
12	2.99	300	3.49	2520	4.43
14	3.00	330	3.52	2760	4.50
16	3.01	360	3.59	3000	4.54
20	3.03	390	3.57	3240	4.575
24	3.053	450	3.56	3600	4.67
30	3.04	540	3.61	3960	4.76
35	3.06	600	3.65	4320	4.825 stop

A-4. 3. 5(36) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : 1147m

Reference Level : 1.63m above ground

Initial Water Level from Ref. : -1.035 m

Final Water Level from Ref. : -2.975 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.21	660	0.88
0.5	0.00	50	0.242	720	0.92
1	0.00	60	0.27	780	0.955
1.5	0.009	70	0.30	840	0.995
2	0.013	80	0.317	900	1.025
2.5	0.015	90	0.342	960	1.055
3	0.021	100	0.365	1080	1.105
3.5	0.025	120	0.397	1200	1.15
4	0.03	140	0.433	1320	1.19
5	0.04	160	0.46	1440	1.235
6	0.048	180	0.49	1560	1.275
7	0.055	200	0.515	1740	1.32
8	0.061	220	0.54	1920	1.365
9	0.07	240	0.565	2100	1.42
10	0.075	270	0.595	2280	1.49
12	0.09	300	0.625	2520	1.555
14	0.103	330	0.645	2760	1.62
16	0.113	360	0.675	3000	1.665
20	0.13	390	0.70	3240	1.70
24	0.148	450	0.74	3600	1.787
30	0.173	540	0.80	3960	1.87
35	0.193	600	0.835	4320	1.940 stop

A-4. 3. 5 (37) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : 1185m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : -1.045 m

Final Water Level from Ref. : -2.945 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0	40	0.19	660	0.84
0.5	0	50	0.215	720	0.875
1	0	60	0.245	780	0.92
1.5	0	70	0.27	840	0.955
2	0.005	80	0.29	900	0.99
2.5	0.005	90	0.315	960	1.015
3	0.01	100	0.335	1080	1.065
3.5	0.015	120	0.375	1200	1.115
4	0.02	140	0.405	1320	1.15
5	0.03	160	0.43	1440	1.20
6	0.035	180	0.46	1560	1.235
7	0.04	200	0.485	1740	1.28
8	0.045	220	0.505	1920	1.325
9	0.05	240	0.53	2100	1.38
10	0.055	270	0.56	2280	1.44
12	0.075	300	0.59	2520	1.515
14	0.085	330	0.615	2760	1.575
16	0.095	360	0.635	3000	1.625
20	0.115	390	0.66	3240	1.66
24	0.125	450	0.70	3600	1.745
30	0.155	540	0.76	3960	1.83
35	0.17	600	0.795	4320	1.90 stop

A-4. 3. 5(38) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : 530 m

Reference Level : 1.70m above ground

Initial Water Level from Ref. : -1.78m

Final Water Level from Ref. : -3.615 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	0.00	40	0.20	660	0.79
0.5	0.00	50	0.225	720	0.83
1	0.01	60	0.25	780	0.868
1.5	0.015	70	0.275	840	0.905
2	0.03	80	0.295	900	0.935
2.5	0.035	90	0.31	960	0.965
3	0.04	100	0.328	1080	1.015
3.5	0.045	120	0.365	1200	1.055
4	0.05	140	0.39	1320	1.095
5	0.06	160	0.415	1440	1.14
6	0.065	180	0.435	1560	1.18
7	0.075	200	0.465	1740	1.22
8	0.08	220	0.485	1920	1.265
9	0.085	240	0.505	2100	1.31
10	0.095	270	0.535	2280	1.382
12	0.105	300	0.56	2520	1.455
14	0.11	330	0.58	2760	1.51
16	0.12	360	0.610	3000	1.565
20	0.138	390	0.625	3240	1.60
24	0.155	450	0.665	3600	1.68
30	0.175	540	0.715	3960	1.77
35	0.188	600	0.755	4320	1.835 stop

A-4. 3. 5 (39) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-4

Inter-Well Distance : — m

Reference Level : 1.87m above ground

Initial Water Level from Ref. : -7.515 m

Final Water Level from Ref. : -3.755 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	4.825	40	1.645	660	1.085
0.5	—	50	1.61	720	1.065
1	3.14	60	1.58	780	
1.5	1.01	70	1.56	840	
2	1.52	80	1.54	900	
2.5	2.06	90	1.51	960	
3	2.27	100	1.49	1080	
3.5	1.74	120	1.45	1200	
4	1.61	140	1.42	1320	
5	1.72	160	1.39	1440	
6	1.77	180	1.37	1560	
7	1.76	200	1.35	1740	
8	1.82	220	1.33	1920	
9	1.79	240	1.31	2100	
10	1.775	270	1.275	2280	
12	1.77	300	1.255	2520	
14	1.75	330	1.23	2760	
16	1.745	360	1.21	3000	
20	1.73	390	1.19	3240	
24	1.705	450	1.155	3600	
30	1.68	540	1.12	3960	
35	1.66	600	1.10	4320	

A-4. 3. 5 (40) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-1

Inter-Well Distance : 1147m

Reference Level : 1.63m above ground

Initial Water Level from Ref. : -2.975 m

Final Water Level from Ref. : -2.163 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	1.94	40	1.755	660	1.15
0.5	1.94	50	1.725	720	1.128
1	1.94	60	1.70	780	
1.5	1.94	70	1.675	840	
2	1.935	80	1.645	900	
2.5	1.93	90	1.625	960	
3	1.925	100	1.605	1080	
3.5	1.925	120	1.565	1200	
4	1.92	140	1.53	1320	
5	1.91	160	1.50	1440	
6	1.905	180	1.475	1560	
7	1.90	200	1.45	1740	
8	1.895	220	1.425	1920	
9	1.885	240	1.405	2100	
10	1.875	270	1.365	2280	
12	1.865	300	1.345	2520	
14	1.855	330	1.315	2760	
16	1.845	360	1.295	3000	
20	1.83	390	1.275	3240	
24	1.815	450	1.24	3600	
30	1.79	540	1.20	3960	
35	1.775	600	1.175	4200	

A-4.3.5(41) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2"ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-2

Inter-Well Distance : 1185m

Reference Level : 1.64m above ground

Initial Water Level from Ref. : -2.945 m

Final Water Level from Ref. : -2.18m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	1.90	40	1.74	660	1.155
0.5	1.90	50	1.71	720	1.135
1	1.90	60	1.685	780	
1.5	1.90	70	1.66	840	
2	1.90	80	1.635	900	
2.5	1.90	90	1.61	960	
3	1.90	100	1.60	1080	
3.5	1.90	120	1.55	1200	
4	1.89	140	1.53	1320	
5	1.88	160	1.50	1440	
6	1.875	180	1.47	1560	
7	1.87	200	1.45	1740	
8	1.865	220	1.425	1920	
9	1.86	240	1.40	2100	
10	1.855	270	1.37	2280	
12	1.845	300	1.345	2520	
14	1.835	330	1.32	2760	
16	1.825	360	1.30	3000	
20	1.81	390	1.275	3240	
24	1.79	450	1.24	3600	
30	1.77	540	1.20	3960	
35	1.755	600	1.177	4200	

A-4. 3. 5 (42) Pumping Test Data of JICA Bore Holes

Location : NJD-4, Al- Nagha, Nejd

Type of Test : Constant Discharge, Recovery

Test Date/Period : 88/10/14-10/17

Pumping Well : NJD-4 (8 1/2" ϕ)

Pumping Rate : 51.1 ℓ/sec

Observation Well : NJD-3

Inter-Well Distance : - m

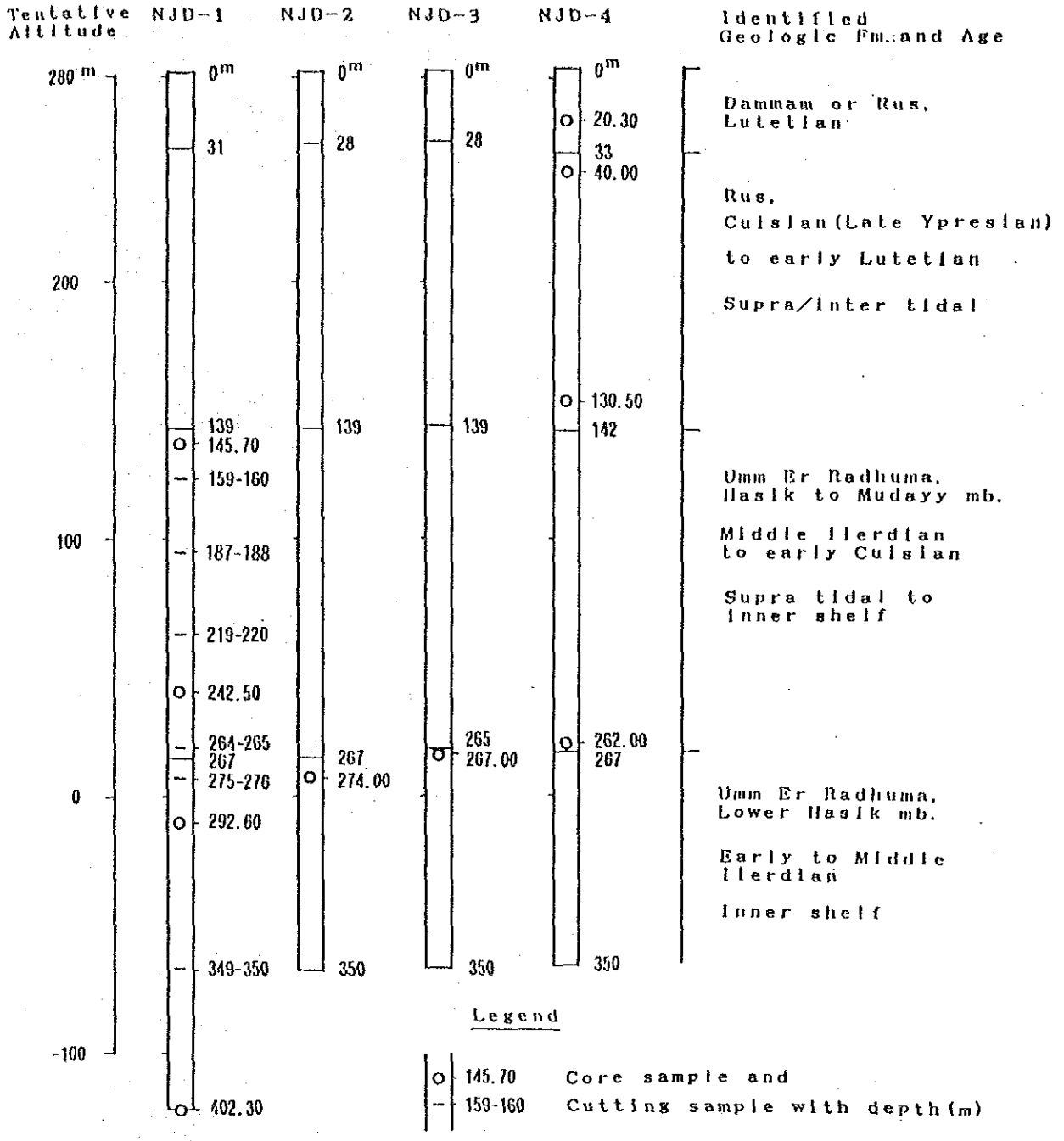
Reference Level : 1.70m above ground

Initial Water Level from Ref. : -3.615 m

Final Water Level from Ref. : -2.895 m

Time, t (min)	Drawdown, s (m)	t	s	t	s
0	1.835	40	1.665	660	1.138
0.5	1.835	50	1.64	720	1.115
1	1.838	60	1.62	780	
1.5	1.83	70	1.60	840	
2	1.82	80	1.578	900	
2.5	1.815	90	1.558	960	
3	1.81	100	1.545	1080	
3.5	1.805	120	1.51	1200	
4	1.80	140	1.485	1320	
5	1.792	160	1.455	1440	
6	1.785	180	1.43	1560	
7	1.78	200	1.405	1740	
8	1.773	220	1.39	1920	
9	1.768	240	1.37	2100	
10	1.762	270	1.338	2280	
12	1.755	300	1.315	2520	
14	1.745	330	1.285	2760	
16	1.735	360	1.27	3000	
20	1.72	390	1.255	3240	
24	1.708	450	1.22	3600	
30	1.69	540	1.18	3960	
35	1.678	600	1.155	4200	

A-4. 3. 6 Sampling Position of Micro-Paleontological Bore Hole Specimen



A-4. 3. 7 (1) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 145.70m CORE, THIN SECTION

KEY-WORDS : Micritic dolomcrite without fossils - undeterminable biostratigraphy - supratidal deposit - Umn er Radhuma Fm., Mudday mb. or base of the Rus Fm.

NAME : POROUS DOLOMICRITE

STRUCTURE : disturbed (bioturbation ?) and porous

TEXTURE : mudstone

CONSTITUENTS :

A. Lithophasis

one small phosphatic debris
locally some silicification

B. Biophasis

1. Flora

absent

2. Macrofauna

absent

3. Microfauna

3.1 Foraminifera

absent

3.2 Ostracoda

absent

BIOSTRATIGRAPHY : UNDETERMINABLE
(middle Ilerdian to early cuisian by comparison with our previous studies)

DEPOSITIONNAL ENVIRONMENT : supratidal deposit

FORMATION : UMM ER RADHUMA Formation , Mudayy member or base of the RUS Formation

A-4. 3. 7 (2) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 159-160m CUTTINGS, WASHING RESIDUE

KEY-WORDS : Washing residue from cutting - dolomite, chert, quartz - Scarce Sismondia echinid and gastropod - supratidal deposit - Umm er Radhuma Fm.: Mudday mb. -

---

NAME : WASHING RESIDUE FROM CUTTING SAMPLE

CONSTITUENTS :

A. Lithophasis

frequent micritic dolomite clasts
abundant dolomite crystals
rare clasts of chert
common small quartz probably from silica geodes beds

B. Biophasis

1. Flora

absent

2. Macrofauna

scarce echinid debris (spines) and small echinid *Sismondia*

one small gastropod internal mold

3. Microfauna

3.1 Foraminifera

absent

3.2 Ostracoda

absent

BIOSTRATIGRAPHY : UNDETERMINABLE
(middle Ilerdian to early Cuisian, by comparison with our previous studies)

DEPOSITIONNAL ENVIRONMENT : very restricted platform supratidal deposit

FORMATION : UMM ER RADHUMA Formation, MUDAYY member

A-4. 3. 7 (3) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 187-188m CUTTINGS, WASHING RESIDUE

KEY-WORDS : Washing residue from cutting - Lockhartia, Sakesaria foraminifera - early eocene : middle to late Ilerdian - restricted inner shelf- Umm er Radhuma Fm.: sommital part of the Hasik mb. or base of the Mudayy mb.-

---

NAME : WASHING RESIDUE FROM CUTTING SAMPLE

CONSTITUENTS :

A. Lithophasis
frequent limestone debris
some angulous fine quartz
frequent calcite

B. Biophasis

1. Flora
rare Dasycladacean algae

2. Macrofauna
some bryozoan debris
frequent echinid debris

3. Microfauna

3.1 Benthic Foraminifera

rare forms, including :

Sakesaria dukhani SMOUT
Lokhartia tipperi DAVIES
Lockartia hunti var. *pustulosa* SMOUT
Discorbidae
Cibicididae

3.2 Ostracoda

rare smooth forms

BIOSTRATIGRAPHY : EARLY EOCENE : MIDDLE TO LATE ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner shelf, restricted platform

FORMATION : UMM ER RADHUMA Formation, near the passage from the HASIK member to the MUDAYY member; also, sommital part of the Hasik member or base of the Mudayy member.

A-4. 3. 7 (4) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 219-220m CUTTINGS, WASHING RESIDUE

KEY-WORDS : Washing residue from cutting sample - *Miscellanea* foraminifera - early Eocene : middle Ilerdian - middle shelf - Umm er Radhuma Formation : Hasik mb. -

---

NAME : WASHING RESIDUE FROM CUTTING SAMPLE

CONSTITUENTS :

A. Lithophasis
- rare dolomite crystals
- rare calcite crystals
- rare argillite clasts
- scarce phosphatic small debris

B. Biophasis

1. Flora
absent

2. Macrofauna
frequent echinid debris (many spines)
rare pelecypod and gastropod debris

3. Microfauna

3.1 Benthic Foraminifera

rare and badly preserved, often strongly recrystallized, including :
- *Miscellanea miscella* d'ARCHIAC and HAIME
- *Sakesaria dukhani* SHOUT
- *Operculina ?* sp.(uncomplete test)
- Discordidae
- Cibicididae

3.2 Ostracoda

rare smooth forms

BIOSTRATIGRAPHY : EARLY EOCENE : MIDDLE ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner to middle shelf

FORMATION : UMM ER RADHUMA Formation ; HASIK member.

A-4. 3. 7 (5) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 242.50m CORE, THIN SECTION

KEY-WORDS : Biomicrite - Operculina foraminifera - early Eocene : middle Ilerdian - inner shelf - Umm er Radhuma Formation : Hasik member -

---

NAME : BIODOLOMICRITE WITH BENTHIC FORAMINIFERA

STRUCTURE : bedding marked by the orientation of the constituents

TEXTURE : wackestone

CONSTITUENTS :

A. Lithophasis
absent

B. Biophasis
badly preserved because of the recrystallization

1. Flora
absent in the thin section

2. Macrofauna

scarce echinid
rare pelecypod and gastropod debris

3. Microfauna

3.1 Benthic Foraminifera

frequent, including :

Operculina subgranulosa d'ORBIGNY
Operculina cf. *douvillei* DONCIEUX
Nummulites cf. *globulus* LEYMERIE
Sakesaria cotteri DAVIES
Lochartia sp.
Discorbidae
Cibicididae

3.2 Ostracoda
scarce forms

BIOSTRATIGRAPHY : MIDDLE ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner shelf

FORMATION : UMM ER RADHUMA Formation : HASIK member

A-4.3.7(6) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 264-265m CUTTINGS, WASHING RESTDUE

KEY-WORDS : Washing residue from cutting sample - *Miscellanea* foraminifera - early (to early middle ?) Ilerdian - inner shelf - Umm er Radhuma Formation : Hasik member -

---

NAME : WASHING RESIDUE FROM CUTTING SAMPLE

CONSTITUENTS :

A. Lithophasis

dolomite crystals
small muscovite (white mica) sheets
rare limestone clasts

B. Biophasis

1. Flora

Corallinacea Melobesia algae : *Archaeolithothamnium* sp.

2. Macrofauna

common echinid spines
rare gastropod
rare bryozoan and coral debris

3. Microfauna

3.1 Benthic Foraminifera

frequent, often abrarded forms, including:

Miscellanea miscella d'ARCHIAC and HAIME
Sakesaria cotteri DAVIES
Lockartia conditi (NUTTALL)
Kathina major SHOUT
Discorbidae
Eponididae
Cibicididae

3.2 Ostracoda
frequent reticulate and smooth forms

BIOSTRATIGRAPHY : EARLY EOCENE : EARLY (TO EARLY MIDDLE ?) ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner shelf

FORMATION : UMM ER RADHUMA Formation : Hasik member

A-4. 3. 7 (7) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 275-276m CUTTINGS, WASHING RESIDUE

KEY-WORDS : Washing residue from cutting sample - *Miscellanea* foraminifera - early Eocene : middle Ilerdian - inner shelf - Umm er Radhuma Formation : Hasik member -

---

NAME : WASHING RESIDUE FROM CUTTING SAMPLE

CONSTITUENTS :

A. Lithophasis
frequent grey limestone clasts
rare calcite
frequent dolomite crystals

B. Biophasis

1. Flora

rare Dasycladacean algae

2. Macrofauna

rare gastropod and pelecypod debris
frequent echinid spines

3. Microfauna

3.1 Benthic Foraminifera

frequent, including :
Miscellanea miscella d'ARCHIAC and HAIME
Sakesaria dukhani SNOUT
Kathina selveri SNOUT
Dictyokathina simplex SNOUT
Operculina sp.
Cibicididae
Discorbididae

3.2 Ostracoda
rare smooth forms

BIOSTRATIGRAPHY : EARLY EOCENE : MIDDLE ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner shelf

FORMATION : UMM ER RADHUMA Formation : Hasik member.

A-4. 3. 7 (8) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 292.60m CORE, THIN SECTION

KEY-WORDS : Argillaceous biomicrosparite - *Saudia* and *Miscellanea* foraminifera - early (to early middle ?) Ilerdian - inner shelf - Umm er Radhuma Formation : Hasik member -

---

NAME : ARGILLACEOUS BIOMICROSPARITE WITH BENTHIC FORAMINIFERA

STRUCTURE : bedded, shaly

TEXTURE : wackestone

CONSTITUENTS :

A. Lithophasis
absent

B. Biophasis

1. Flora
absent

2. Macrofauna

some small echinid debris
rare coral and rare pelecypod

3. Microfauna

3.1 Benthic Foraminifera

frequent forms, including :

Saudia labyrinthica GRIMSDALE
Dictyoconus indicus DAVIES
Miscellanea miscella d'ARCHIAC and HAIME
Lockhartia sp.
Sakesaria dukhani SMOUT
Sakesaria cotteri DAVIES
Eponididae
Discorbidae

3.2 Ostracoda
some smooth forms

BIOSTRATIGRAPHY : EARLY EOCENE : EARLY (TO EARLY MIDDLE ?) ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner shelf

FORMATION : UMM ER RADHUMA Formation : HASIK member

A-4. 3. 7 (9) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 349-350m CUTTINGS, WASHING RESIDUE

KEY-WORDS : Washing residue from cutting sample - *Miscellanea* foraminifera - Early Eocene : middle Ilerdian - inner shelf- Umm er Radhuma Formation : Hasik member -

---

NAME : WASHING RESIDUE FROM CUTTING SAMPLE

CONSTITUENTS :

A. Lithophasis
- rare calcite
- frequent limestone clasts
- some dolomite crystals
- fine-grained dolomite sandstone clasts

B. Biophasis

1. Flora
   - absent

2. Macrofauna
   - frequent echinid debris

3. Microfauna

3.1 Benthic Foraminifera

frequent, including :
- *Miscellanea miscella* d'ARCHIAC and HAIME
- *Miscellanea meandrina* (CARTER)
- *Sakesaria dukhani* SHOUT
- *Dictyokathina simplex* SHOUT
- *Lockhartia cf. hunti* SHOUT
- *Operculina* sp.
- Cibicididae
- Discorbidae

3.2 Ostracoda
- frequent smooth forms

BIOSTRATIGRAPHY : EARLY EOCENE : MIDDLE ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner shelf

FORMATION : UMM ER RADHUMA Formation : HASIK member

A-4. 3. 7 (10) Micropaleontology of JICA Bore Hole

SAMPLE NJD-1, 402.30m CORE, THIN SECTION

KEY-WORDS : Biomicrite - Algae and Dictyoconus foraminifera - Early (to early middle?) Ilerdian - inner shelf - Umm er Radhuma Formation : Hasik member -

---

NAME : BIOMICRITE WITH ALGAE AND BENTHIC FORAMINIFERA

STRUCTURE : bioturbated

TEXTURE : wackestone

CONSTITUENTS :

A. Lithophasis
absent

B. Biophasis

1. Flora
common Dasycladacean algae:
Cymopolia elongata DEFRANCE

2. Macrofauna
frequent and strongly recrystallized coral debris
some pelecypod and gastropod debris
rare echinid

3. Microfauna

3.1 Benthic Foraminifera

frequent, including :

Sakesaria cotteri DAVIES
Dictyoconus indicus DAVIES
Miscellanea miscella d'ARCHIAC and HAIME
Lockartia haimei (DAVIES)
Lockhartia sp.
Saudia labyrinthica GRIMSDALE
Kathina major SMOUT
Cribrogoesella sp.
Valvulina sp.
planty small Rotaliina forms(Discorbidae ...)

3.2 Ostracoda
rare

BIOSTRATIGRAPHY : EARLY EOCENE : EARLY (TO EARLY MIDDLE ?) ILERDIAN

DEPOSITIONNAL ENVIRONMENT : inner shelf

FORMATION : UMM ER RADHUMA Formation, Hasik member

A-4. 3. 7 (11) Micropaleontology of JICA Bore Hole

SAMPLE NJD-2, 274.00m CORE, THIN SECTION

KEY-WORDS : Wackestone - Miscellanea - Early to middle Ilerdian - inner shelf- Umm Er Radhuma Formation - Nasik Member

---

NAME : Biomicrosparite

STRUCTURE : Bioturbated

TEXTURE : Wackestone

CONSTITUENTS :

A. Lithophasis
Fecal pellets

B. Biophasis

1. Flora
Some Dasycladacean debris

2. Macrofauna
Common pelicypod debris
Frequent echinid debris (spines)
Frequent coral debris
Some small gastropods

3. Microfauna
3.1 Benthic Foraminifera
Saudia labyrinthica GRIMSDALE
Kathina selveri SMOUT
Miscellanea miscella d'ARCHIAC and HAIME
Lockhartia haimei DAVIES
Dictiokathina simplex SMOUT
Miscellanea miscella d'ARCHIAC and HAIME
Small Miliolids
Valvulinids

3.2 Planktonic foraminifera
absent

3.3 Ostracoda
rare

BIOSTRATIGRAPHY : Early to middle Ilerdian

DEPOSITIONNAL ENVIRONMENT : Inner shelf, subtidal zone

A-4. 3. 7 (12) Micropaleontology of JICA Bore Hole

SAMPLE NJD-3, 267.00m CORE, THIN SECTION

KEY-WORDS : Biomicrite - wackestone/packstone - no characteristic foraminifera - undefined age - restricted inner shelf Ummer Radhuma Formation-Hasik Member

---

NAME : Biomicrite

STRUCTURE : Bioturbated

TEXTURE : Wackestone to packstone

CONSTITUENTS :

A. Lithophasis
absent

B. Biophasis
Well sorted bioclastes (0,1 to 0,2 mm)

1. Flora

2. Macrofauna
Abundant small echinid debris
Some small coral debris

3. Microfauna
3,1 Benthic Foraminifera
common small hyaline (Discorbids, Ciblcidids)
Sakesaria Cotteri DAVIES

3,2 Planktonic foraminifera
absent

3,3 Ostracoda
common thin shells

BIOSTRATIGRAPHY : indeterminable

DEPOSITIONNAL ENVIRONMENT : Restricted inner shelf with anomalous salinity (intertidal or restricted subtidal zone)

A-4. 3. 7 (13) Micropaleontology of JICA Bore Hole

SAMPLE NJD-4, 20.30m CORE, THIN SECTION

KEY-WORDS : Dolomicrite - wackestone/mudstone - laminated algal nodules - supra or intertidal - Rus Formation.

NAME : Dolomicrite

STRUCTURE : Vacuolar

TEXTURE : Wackestone - mudstone

CONSTITUENTS :

A. Lithophasis — scarce small phosphatic debris
diagenetic gypsum cristals

B. Biophasis

1. Flora
Frequent laminated nodules (algal structure)

2. Macrofauna
Some small echinid debris

3. Microfauna
Absent

BIOSTRATIGRAPHY : indeterminable

DEPOSITIONNAL ENVIRONMENT : Restricted conditions of supratidal to intertidal facies

A-4. 3. 7 (14) Micropaleontology of JICA Bore Hole

SAMPLE NJD-4, 40.00m CORE, THIN SECTION

KEY-WORDS : Silicified calcarenite - recrystallized - no characteristic fauna- supra or intertidal - Rus Formation

---

NAME : Silicified sparite (calcarenite)

STRUCTURE : Crystalline

TEXTURE : Wackestone ? (recrystallization)

CONSTITUENTS :

A. Lithophasis
absent

B. Biophasis
Frequent and strongly recrystallized bioclastes

1. Flora
Absent or no preserved

2. Macrofauna
Some echinid debris are preserved
Others recrystallized debris (Pelecypod ? gastropod ?

3. Microfauna
Rare Benthic Foraminifera
Badly preserved Valvulinids

BIOSTRATIGRAPHY : Indeterminable

DEPOSITIONNAL ENVIRONMENT : Supra or intertidal zone
intertidal facies

A-4. 3. 7 (15) Micropaleontology of JICA Bore Hole

SAMPLE NJD-4, 130.50m CORE, THIN SECTION

KEY-WORDS : Dolosparite - evaporitic facies - diagenetic gypsum - no fauna - undefined age - Rus Formation

---

NAME : Gypsiferous dolosparite

STRUCTURE : Recrystallized, nodular

TEXTURE : Recrystallized

CONSTITUENTS :

A. Lithophasis
Diagenetic gypsum crystals

B. Biophasis
Absent or strongly recrystallized

1. Flora
absent

2. Macrofauna
absent

3. Microfauna
absent

BIOSTRATIGRAPHY : indeterminable

DEPOSITIONNAL ENVIRONMENT : Evaporitic facies
Supratidal zone

A-4. 3. 7 (16) Micropaleontology of JICA Bore Hole

SAMPLE NJD-4, 262.00m CORE, THIN SECTION

KEY-WORDS : Biomicrite - wackestone - Operculina - Ilerdian - Umm er Radhuma Formation - Hasik Member

---

NAME : Biomicrite with large foraminifera

STRUCTURE : Bioturbated

TEXTURE : Wackestone

CONSTITUENTS :

A. Lithophasis
absent

B. Biophasis
Abundant bioclastes

1. Flora
Very recrystallized Dasycladacean debris

2. Macrofauna
Some pelecypod or gastropod debris
Some echinid spines

3. Microfauna
3.1 Benthic Foraminifera
abundant, including :
Operculina exiliformis PAVLOVEC
Operculina cf. subgranulosa d'ORBIGNY
Sakesaria cotteri DAVIES (frequent)
Valvulinids
Cribrogoesella sp.
Lockhartia haimei DAVIES

3.2 Planktonic Foraminifera
absent

3.3 Ostracoda
absent

BIOSTRATIGRAPHY : Middle Ilerdian

DEPOSITIONNAL ENVIRONMENT : Inner shelf
Subtidal zone

APPENDIX A-4.6
Directory for the Conservation and the Development of the Nejd Groundwater

A-4.6.1 Field Data Sheet for Dauka Meteorological Station

Agriculture Development Project in the Nejd, JICA

Field Data Sheet for Dauka Met. Stn.

Date _____ Observer's Name _____

1. Open Entrance, Weather _____ Wind Direction _____
2. Wind Run [ ] km [ ] Time [ ] h [ ] m
3. Open Screen
4. [ ] Clamp Screen Door
5. Dry Bulb Temp. [ ] ℃ Supply Water to Wet Bulb.
6. Max. Temp [ ] ℃
7. [ ] Initialize Max.Thermometer
8. Min. Temp. [ ] ℃ Time [ ] h [ ] m
9. [ ] Initialize Min.Thermometer
10. Open Thermo-Hygrometer
11. [ ] Mark Chart
12. [ ] Turn off Pen-off Lever
13. Remove Drum
14. [ ] Write Date & Time on Chart
15. Remove Chart
16. [ ] Wind up Clock
17. Set New Chart
18. [ ] Write Date, Time, Station Name & Observer's Name on Chart
19. Write Pen-check Number [ ] If 8, Change Pen
20. Reset Drum
21. [ ] Set Time
22. [ ] Turn on Pen-off Lever
23. [ ] Mark Chart, Close Thermo-Hygrometer
24. [ ] Dry Bulb Temp. [ ] ℃, Wet Bulb Temp. [ ] ℃
25. Check Rain Gauge. If any Rain
    - 25-1 Go back to Screen
    - 25-2 Take out Measuring Cylinder
    - 25-3 Measure Rain [ ] mm
    - 25-4 Fill Sample Bottle with Rain Water
    - 25-5 Write Bottle No. [ ]
    - 25-6 Empty and Clean Cylinder
    - 25-7 Return Cylinder to Screen
26. [ ] Lock Screen
27. [ ] Lock Entrance

A-4.6.2 Data Filing Sheet for Dauka Meteorological Station

Agriculture Development Project in the Nejd, JICA

Filing Data Sheet

of Thermo-Hygrometer, at Dauka

Year

Date Mon , Day	0900LMT Temp.	0900LMT Humid.	Max. Temp.	Time	Min. Temp.	Time	Max. Humid.	Time	Min. Humid.	Time	Remarks
	℃	%	℃		℃		%		%		
/											
/											
/											
/											
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Calculation Sheet

Weekly Averaged Wind Speed

No.	Date(Di)	Accum Day (Ti)	Consec Difference (△Ti)	Wind Rum (Li)	Consec W.R.Diff.(△Li)	Averaged W.Speed(Vi)
i	MMddhhmm	$dd+\frac{hh}{24}+\frac{mm}{1440}$	$T_{i-1}-T_i$	L_i	$L_{i-1}-L_i$	$\frac{\triangle L_i}{\triangle T_i}\times 0.01157$
			day	km	km	m/sec

NEJD PROJECT : MAINTENANCE SCHEDULE OF HYDROLOGICAL OBSERVATION SYSTEM

DATE / FACILITY	
1.Dauka Met.	
*Every Thursday	
2.Obs. Wells	
*Every Fourth Sat.	
NJD-1	
NJD-3	
KM79,AF920700AA	
KM52,AF808848AA	
W.Ribkut, BE094486AA	
W.S.Dauka ZV099779AA	
3.NJD-3 Met.	
*Every Tenth Thur.	
a.Rain Gauge	
& Dry Batteries	
b.Pyranometer	
c.Anemometer	
*Every Fourth Thur.	
d.Battery(12V)	
Remarks	

A-4. 6. 4 Arabic Manual for JICA Meteorological Facilities in the Nejd

محطة الارصاد الجوية (NJS-3) Met. St.

- تتكون محطة الارصاد الجوية (NJS-3) الواقعة في منطقة الرياض المبنية من ثلاثة اجهزة حديثة (جهاز لقياس الرياح ANEMOMETER، جهاز لقياس قوة الاشعاع الشمسي PYRANOMETER وجهاز لقياس كمية هطول الامطار RAINGAUGE
- كل اجهزة الارصاد (الثلاثة) يتم فيها تسجيل المعلومات او تماثيلها على اوراق تسجيل مخصصة لذلك.
- يتم تغيير اوراق التسجيل لكل الاجهزة بعد كل عشرة ايام تقريباً.
- يتم تغيير البطارية الخاصة بجهاز ارصاد الرياح والشمس بعد كل اربعة ايام بعد شحنها تماماً.
- تغير البطاريات الصغيرة الخاصة بجهاز قياس المطر بعد عشرة ايام.
- يوجد لكل مقوك المحطة مفتاح واحد
- كيفية جمع المعلومات وتغيير وسائل جمع المعلومات موضحة في الصفحات التالية لكل جهاز.
- عند استخدام الاجهزة يجب اتباع الطرق العلمية في اخذ الحيطة والحذر والمحافظة على نظافة كل جهاز والتأكد من سلامته.

جهاز قياس الرياح .

ANEMOMETER (KDB - 300)

١. اسحب باب الجهاز من جهة اليسار الى الخارج (فتح الباب)

٢. اغلق ازرار التوصيل الكهربائي (٢، ٣)

٣. اسحب الباب الداخلي من جهة اليمين بالضغط على الاصبع الزر وتحريكه على العلبة باتجاهك .

٤. انزل الاقلام عن الورق برفع عمود الاقلام الى اعلى .

٥. اكتب على آخر علامة للاقلام (التاريخ، الوقت الفني، اسم المحطة، رقم RAWS، رقم الجهاز، مقياسها السرعة 35 M/S، chart speed 15 mm/h)

٦. تغيير ادوات التسجيل باتباع الآتي :-

١. بعد ان تلف الورق من اسفل البكرة العليا الى البكرة السفلى، تخرج البكرة السفلى من مكانها برفع المسمار على طرفيها الايمن والايسر، وتخرج الورق منها بسلك العلبة تماماً ثم يبقى الورق الملفوف الاصفر منفصلاً .

٢. اخرج العمود الملفوف وادخل فيه ورق جديد ثم اعيده الى موضعه ثم اسحب رأس الورق الجديد من تحت الاسطوانة العلوية حتى يظهر لنا رأس الورق ثم اسحب الورق وتأكد من ان سنتات (فتحات الورق الجانبية الكبيرة) الورق الكبيرة على سنين البكرة

٣. ادخل رأس الورق في البكرة السفلى تحت الورق الاصفر ولف الورق الاصفر بكامله حول ورق التسجيل وتأكد من ان يكون وجه الورقة للامام على البكرة السفلى بعد ان كان وجهها متجهاً على البكرة العليا) ثم اعيد البكرة الى موضعها .

١٠. تأكد من صحة سريان الحبر في الاقلام وذلك بوضع ورق نشاف (كلينكس) على رأس القلم فاذا لم يظهر سريان الحبر في القلم اسحب الحبر من انبوب القلم مستخدماً ترشيح الحبر وذلك بالضغط ودفع الهواء من القلم بواسطة الانبوبة الوسطية واذا لم يسرى الحبر بانتظام شكلاً معيناً يعني ذلك في انبوب القلم كما يجب الى حالة تكرر هذه العمليات حتى تتأكد تماماً من سريان الحبر

١١. اعد القوائم (حامل الاقلام) الاقلام بالحبر في كل مرة زيارة .

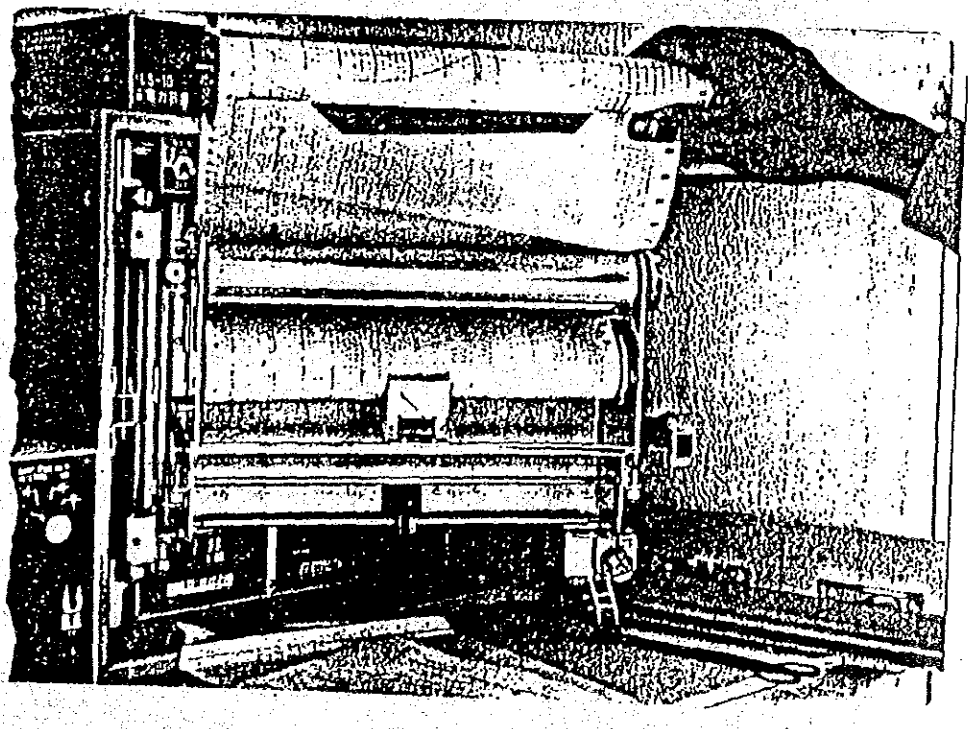
١٢. ثم تنزيل عمود الاقلام واضعاً علامة البداية مسجلاً على نقطة البداية (تاريخ اليوم، الوقت الفني، اسم المحطة، رقم الجهاز، 35 M/S، السرعة chart speed 15 mm/h)

١٣. افتح ازرار الكهرباء هكذا (٣ ثم ٢)

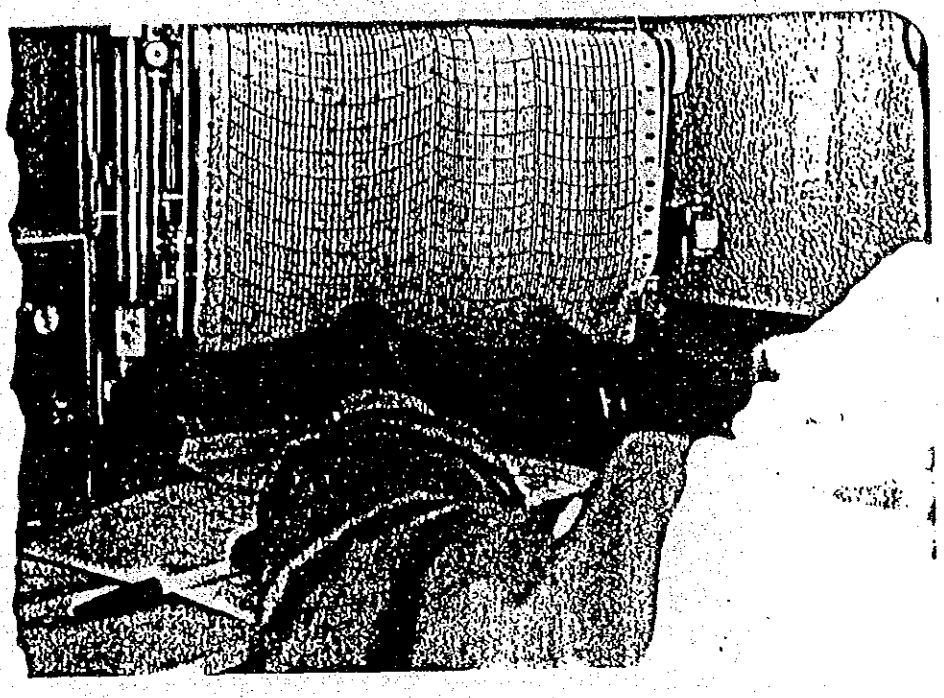
١٤. اعد الجهاز الى وضعه الطبيعي واغلق باب الجهاز .

AM－1

AM－2



AM−3



AM−4