ATTACHMENT

1. Objective

The objective of the Project is to construct water supply systems for IKKs in Sulawesi Island in order to provide sufficient and safe water and improve the standard of living of the inhabitants.

2. Executing Agency

The Directorate General of Human Settlements of the Ministry of Public Works of the Government of Indonesia is responsible for the administration and implementation of the Project.

3. Project Sites

Both parties have confirmed to conduct a basic design study on 23 IKKs located in the Provinces of Central Sulawesi, Southeast Sulawesi and South Sulawesi as shown in ANNEX 1, with the schedule as shown in ANNEX 2.

However, the sites of the Project originaly requested by the Government of Indonesia were 61 IKKs. Therefore, Indonesian side has strongly requested succeeding Grant Aid Project on the rural/IKKs water supply in Sulawesi Island, and the team has promissed to convey the request to the Government of Japan.

4. Design Criteria of the Water Supply System

The design criteria of the water supply system are as shown in ANNEX 3.

5. Grant Aid Programme

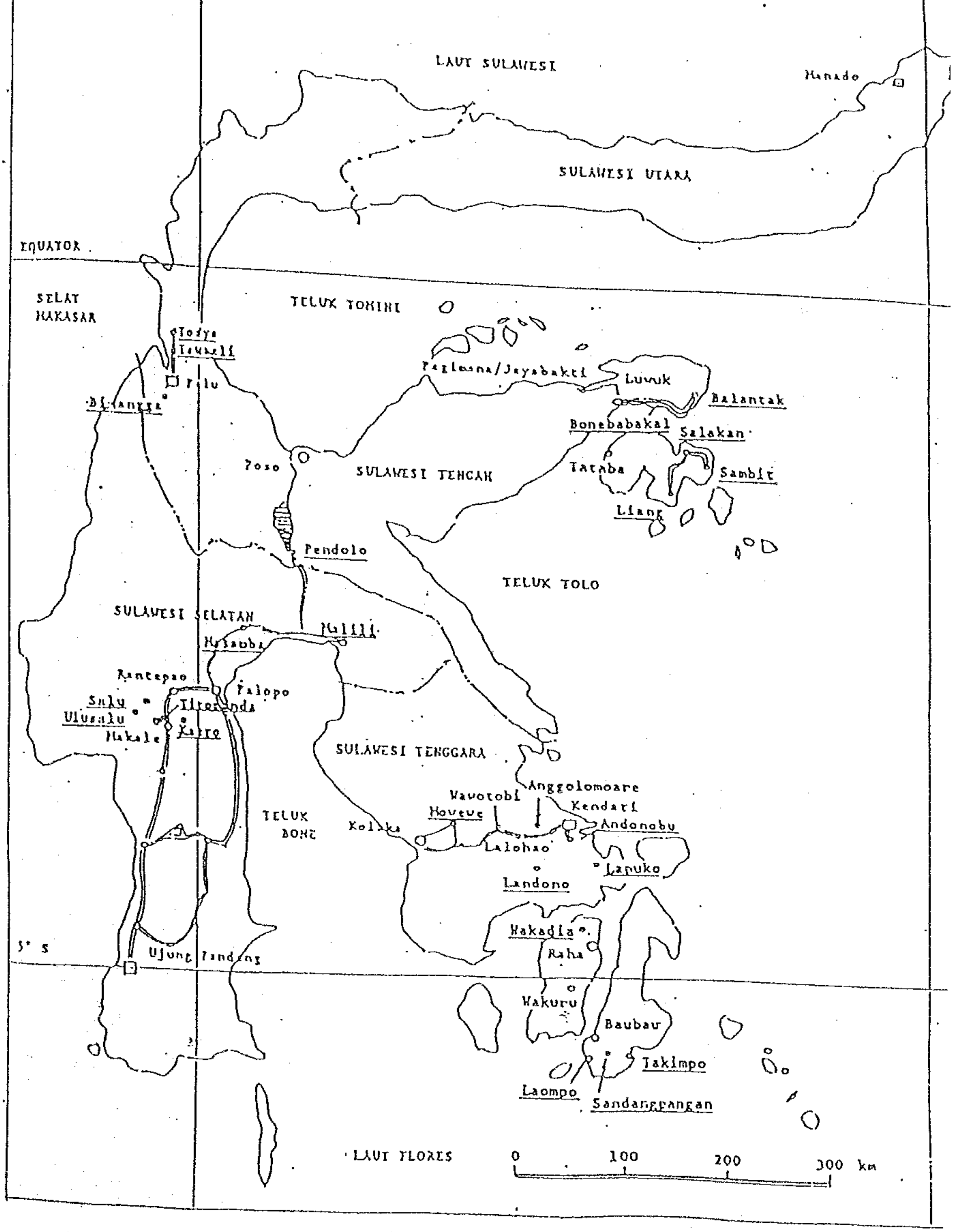
1) The Indonesian side has understood the system of Japan's Grant Aid Programme and the principle for the use of Japanese consulting firm and contractor for the implementation of the Project.

2) The team has confirmed the necessity of the Project and the desire of the Government of Indonesia to realize the Project as soon as possible. Therefore, the team promised to the Indonesian side to convey the above desire to the Government of Japan.

3) The Government of Indonesia will take necessary measures as shown in ANNEX 4 on condition that the Grant Aid by the Government of Japan would be extended to the Project.

ANNEX 1 Project Sites Conducted Basic Design Study

23 IKKs with underline have been conducted a basic design study.



ANNEX 2 OVERALL SCHEDULE FOR THE BASIC DESIGN STUDY

Major Items / Year / Month	1990							
	May	June	July	August	September	October	November	December
1. Field Survey								
Discussion upon Inception	△ Inception Report							
Exchange of Minutes of Meeting	▲							
Field Survey & Data Collection								
2. Basic Design								
Plan and Design of Facilities								
Cost Estimates								
Preparation of Draft Final Report								
3. Submission of Draft Final Report Explanation and Discussion on the Result of Study					△—△			
4. Field Survey								
5. Preparation of Final Report								
6. Submission of Final Reprot								△

Legend: ▬ Field Survey in the Indonesia; ▭ Basic Design and preparation of Final Report in Japan; △—△ Report Submission & Discussion; ▲ Exchange of Minutes of Meeting

ANNEX 3 Design criteria of the water supply system of the Project

1. Population served is 50% - 100% of the total population in each Project site.(*)

2. Supply level of public taps is 30 lcd.

3. Supply level of house connections is 90 lcd.

4. Ratio of population served by public taps is 20% - 50%. (*)

5. Ratio of population served by house connections is 80% - 50%.(*)

6. Water allocation for non-domestic demand is 5%.

7. Water allocation for leakage in the system and losses is 15%.

8. Factor for maximum day is 1.1.

9. Factor for peak hour is 1.5.

10. Population served by one public tap is 100.

11. Population served by one house connection is max 10.

12. Target year is 10 years future.

(*) : The ratio should be defined based on the socio-economic and technical condition on each Project site.

ANNEX 4 Necessary measures to be taken by the Government of Indonesia

1. To aquire possession of land and structures which are needed for the implementation of the Project

2 To secure water rights

3. To clear the sites of the Project when needed

4. To provide facilities for distribution of electricity leading up to the sites, if necessary

5. To ensure prompt unloading tax exemption and customs clearance of the Project goods at the port of disembarkation

6. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of Indonesia and stay therein for the performance of their work

7. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Indonesia with respect to the supply of the products and services under the verified contracts

8. To maintain and use properly and effectively the facilities constructed under the Grant Aid

9. To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the execution of the Project

MINUTES OF DISCUSSIONS ON THE PROJECT

FOR THE RURAL/IKKs WATER SUPPLY IN SULAWESI ISLAND

IN THE REPUBLIC OF INDONESIA

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct a basic design study on the Project for the Rural/IKKs Water Supply in Sulawesi Island (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA"). JICA sent to the Republic of Indonesia the study team headed by Mr. Tsunao Usami, Director, Planning Division, Planning Department, Kanagawa Water Supply Authority, from 7th May to 20th June, 1990.

As a result of the study, JICA prepared a draft final report and dispatched a team headed by Mr. Tsunao Usami to explain and discuss it from 23rd September to 12th October, 1990.

Both parties had a series of discussions on the report and agreed to recommend to their respective governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

Jakarta, 27th September, 1990

Mr. Tsunao Usami Team Leader Draft Final Report Explanation Team, JICA	Ir. Soenarjono Danoedjo Director General Directorate General of Human Settlements (Cipta Karya) Ministry of Public Works

Attachment

1. The Indonesian side principally agreed to the basic design proposed in the Draft Final Report.

2. Both parties confirmed that the basic design of the 22 project sites was made in the report. The Team explained that there is a possibility that the Government of Japan may not allocate the sufficient budget to implement the whole of 22 project sites due to the financial situation.

3. The Indonesian side requested that Pendolo in Central Sulawesi is to be reserved as a project site.

4. The Indonesian side has understood Japan's Grant Aid System and confirmed that the necessary measures will be taken by the Indonesian side as mentioned in the ANNEX on condition that the Grant Aid by the Government of Japan be extended to the project.

5. The Indonesian side will ensure the provision of the necessary budget for the project cost to be borne by the Government of Indonesia.

6. The Final Report (10 copies in English) will be submitted to the Indonesian side by the end of November, 1990.

7. This minutes of meeting is one as a whole not separable from the report.

ANNEX <u>Undertakings of the Government of Indonesia</u>

1. To acquire possession of land and structures which are needed for the implementation of the Project

2. To secure water rights

3. To clear the sites of the Project

4. To provide facilities for distribution of existing electricity leading up to the sites

5. To maintain the access road for construction of water supply facilities and for transportation of construction materials

6. To restore the pavement of the road where the pipes have been laid.

7. To ensure prompt unloading tax exemption and customs clearance of the Project goods at the port of disembarkation

8. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contracts such facilities as may be necessary for their entry into the Republic of Indonesia and stay therein for the performance of their works

9. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Indonesia with respect to the supply of the products and services under the verified contracts

10. To prepare all site offices for the consultant and the contractor during the project implementation

11. To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the execution of the Project

APPENDIX 5: Country Data and Design Data

APPENDIX 5-1

Examination for Design Hourly Water Demand

Present Population (Regional data)

Desa/Kel \ Item	Population	Population in Service area
1. South Sulawesi		
1-1 ULUSALU	(1990)	
Ralte	806	658
Rea	654	334
Tangaratte	614	626
Pattan	589	481
Rabung	462	100
Sub total	3,125	2,199
1-2 SALU	(1989)	
Kalindunga	860	430
Sarre	871	436
Sp. Bungin	997	499
Nonongan	400	400
Sub total	3,128	1,765
1-3 KAERO	(1990)	
Turunan	683	546
Suwaya	714	572
Tuwamete	664	531
Bau	386	309
Pasang	392	314
Sub total	2,839	2,272
1-4 TIROMANDA	(1990)	
Awa	534	534
Lalikan Tarondon	774	619
Solo	524	419
Sub total	1,832	1,572

Desa/Kel \ Item	Population	Population in Service area
1-5 MALILI	(1990)	
Raskap	1,748	1,748
Malili	3,002	3,002
Baruga	2,284	300
Sub total	7,034	5,050
1-6 MASAMBA	(1990)	
Bone	3,367	3,367
Kapuna	2,008	1,603
Bolebo	1,685	800
Kasimbong	2,611	2,611
Sub total	9,671	8,381
2. Central Sulawesi		
2-1 TOAYA	(1990)	
Toaya	3,710	2,217
2-2 BINANGGA	(1989)	
Binangga	1,575	1,260
Padende	643	514
Sibedi	882	706
Baliase	628	502
Boya Boliase	332	266
Porame	1,015	812
Balane	784	627
Sub total	5,859	4,687
2-3 TAWAELI	(1989)	
Panau	2,732	1,309
Baiya	2,635	2,108
Lambara	2,046	1,072
Pantoloan	3,786	3,028
Sub total	11,199	7,517

Desa/Kel \ Item	Population	Population in Service area
2-4 PENDOLO	(1989)	
Pendolo	2,168	2,168
2-5 BONE BOBAKAL	(1990)	
Bone Bobakal	466	466
Lomba	664	502
Sub total	1,130	968
2-6 SAMBIUT	(1990)	
Sambiut	769	769
Abason	888	888
Tone	394	394
Sakay	433	433
Bolonan	365	365
Sobonan	256	256
Sub total	3,105	3,105
2-7 BLANTAK	(1990)	
Balantak	2,269	2,269
Mamping	459	459
Padang	132	132
Sub total	2,860	2,860
2-8 SALAKAN	(1990)	
Salakan	654	654
Baka	628	628
Bongganan	876	876
Sub total	2,158	2,158

Desa/Kel \ Item	Population	Population in Service area
2-9 LIANG	(1990)	
Liang	863	863
Seleati	553	553
Bajo	601	601
Sub total	2,017	2,017
3. Southeast Sulawesi		
3-1 LANDONO	(1990)	
Landono I	1,205	1,205
Tridana Mulia	1,789	1,789
Amotowo	641	0
Sub total	3,635	2,994
3-2 ANDUONOHU	(1990)	
Anduonohu	3,845	3,460
3-3 MOWEWE	(1990)	
Mowewe I	1,469	1,469
Mowewe II	1,749	1,749
Sub total	3,218	3,218
3-4 WAKADIA	(1990)	
Wakadia	1,956	1,956
3-5 LAOMPO	(1990)	
Laompo	2,076	2,076
Busoa	1,115	937
Sub total	3,191	3,013
3-6 LAPUKO	(1990)	
Lapuko	2,367	2,300

Desa/Kel \ Item	Population	Population in Service area
3-7 SANDANGPANGAN	(1990)	
	2,408	2,408
3-8 TAKIMPO	(1990)	
Bana Bungi	3,308	3,000
Lapanda	2,341	500
Takimpo	1,733	1,733
Sub total	7,382	5,233
Total	91,837	75,518

Design hourly water demend

Project area	desing population served in 2000	dairy average water demand (m³/day)	dairy maximum water demand (m³/day)	hourly maximum water demand (m³/hr)
1. South Sulawesi				
1-1 ULUSALU				
Ralte	692	52	57	7.1
Rea	350	26	29	3.6
Tangaratte	659	49	54	6.7
Pattan	505	38	41	5.1
Rabung	105	8	9	1.1
Sub total	2,311	173	190	23.5
1-2 SALU				
Kalindunga	455	34	37	4.7
Sarre	461	34	38	4.9
Sp. Bungin	527	39	43	5.5
Nonongan	422	31	34	4.3
Sub total	1,865	138	152	19.7
1-3 KAERO				
Turunan	574	43	47	4.7
Suwaya	601	45	49	4.9
Tuwamete	558	41	45	4.5
Bau	325	24	27	2.7
Pasang	330	24	27	2.7
Sub total	2,388	177	195	19.4
1-4 TIROMANDA				
Awa	561	42	45	5.8
Lalikan Tarondon	651	48	53	6.8
Solo	440	32	36	4.6
Sub total	1,652	122	134	17.3

Project area	desing population served in 2000	dairy average water demand (m³/day)	dairy maximum water demand (m³/day)	hourly maximum water demand (m³/hr)
1-5 MALILI				
Raskap	2,205	162	178	17.2
Malili	3,787	279	307	29.7
Baruga	378	28	31	3.0
Sub total	6,370	469	516	50.0
1-6 MASAMBA				
Bone	4,248	351	386	37.3
Kapuna	2,022	167	183	17.7
Bolebo	1,009	83	92	8.9
Kasimbong	3,293	272	299	28.9
Sub total	10,572	873	960	92.8
2. Central Sulawesi				
2-1 TOAYA	3,026	228	251	25.5
2-2 BINANGGA				
Binangga	1,775	131	144	12.7
Padende	724	53	59	5.2
Sibedi	994	73	80	7.0
Baliase	707	52	57	5.0
Boya Boliase	374	27	30	2.6
Porama	1,144	84	93	8.2
Balane	882	65	71	6.2
Sub total	6,600	485	534	46.9
2-3 TAWAELI				
Panau	1,843	136	149	16.1
Baiya	2,968	218	240	26.0
Lambara	1,511	111	122	13.2
Pantoloan	4,262	314	346	37.5
Sub total	10,584	779	857	92.8

Project area	desing population served in 2000	dairy average water demand (m³/day)	dairy maximum water demand (m³/day)	hourly maximum water demand (m³/hr)
2-4 PENDOLO	—	—	—	—
2-5 BONE BOBAKAL				
Bone Bobakal	561	43	47	5.9
Lomba	607	46	51	6.3
Sub total	1,168	89	98	12.2
2-6 SAMBIUT				
Sambiut	928	70	77	8.0
Abason	1,072	82	88	9.2
Tone	476	36	40	4.2
Sakay	523	40	44	4.6
Bolonan	440	33	37	3.9
Sobonan	309	23	26	2.7
Sub total	3,748	284	312	32.6
2-7 BALANTAK				
Balantak	2,739	202	223	24.3
Mamping	554	41	45	4.9
Padang	159	12	13	1.4
Sub total	3,452	265	281	30.6
2-8 SALAKAN				
Salakan	789	60	66	6.5
Baka	758	58	63	6.2
Bongganan	1,058	80	89	8.7
Sub total	2,605	198	218	21.4
2-9 LIANG				
Liang	1,042	79	87	10.4
Seleati	668	51	56	6.7
Bajo	725	55	61	7.3
Sub total	2,435	185	204	24.5

Project area	desing population served in 2000	dairy average water demand (m^3/day)	dairy maximum water demand (m^3/day)	hourly maximum water demand (m^3/hr)
3. Southeast Sulawesi				
3-1 LANDONO				
Landono I	1,693	126	138	15.2
Tridana Mulia	2,514	186	205	22.5
Sub total	4,207	312	343	37.7
3-2 ANDUONOHU	4,862	360	396	39.8
3-3 MOWEWE				
Mowewe I	2,476	183	201	18.2
Mowewe II	2,948	217	239	21.6
Sub total	5,424	400	440	39.8
3-4 WAKADIA				
Wakadia	2,467	184	201	19.7
Industrial Park	2,000	148	163	16.0
Sub total	4,467	331	364	35.7
3-5 LAOMPO				
Laompo	2,652	197	217	23.2
Busoa	1,197	89	98	10.5
Sub total	3,849	286	315	33.7
3-6 LAPUKO	3,323	240	264	27.5
3-7 SANDANGPANGAN	3,076	230	253	31.6
3-8 TAKIMPO				
Bana Bungi	3,382	281	309	36.2
Lapanda	639	47	52	6.1
Takimpo	2,215	163	179	20.9
Sub total	6,686	491	540	63.2

APPENDIX 5-2

Water Quality Data

Water quality data
(Ragional data)

Project area		ULUSALU	SALU	KAERO
Water source		Kondongan	Lemo	Salambu
Sampling data		14th May, 1990	16th May, 1990	12th May, 1990
Weather		fine	fine	fine
temp of sample (℃)		23	23.5	23
PH		7.5	7.5	7.5
Turbidity as kaoline		1.5	Nil	Nil
Colon bacillus	acitive	○	○	○
	inactive			
	no detection			
Total Hardness (mg/ℓ 、$CaCO_3$)		–	–	–
Alkalinity (mg/ℓ)		–	–	–
Fe (〃)		Nil	Nil	Nil
Cr (〃)		〃	0	0
Zn (〃)		–	–	–
Ca (〃)		8	8	50.4
Mg (〃)		14.58	4.86	23.81
Mn (〃)		0	0	0
F (〃)		0.4	0.4	0.6
SO_4 (〃)		0	0	0
$C\ell$ (〃)		14.2	16.33	18.46
NH_4-N		Nil	Nil	Nil
NO_3-N		Nil	Nil	Nil
NO_2-N		Nil	Nil	Nil
Remark				

Water quality data

Project area		TIROMANDA	MALILI	MASAMBA
Water source		Parino	Karebbe	———
Sampling data		15th May, 1990	14th May, 1990	
Weather		rain	rain	
temp of sample (℃)		19	23	
PH		7.5	7.5	
Turbidity as kaoline		0	0	
Colon bacillus	acitive	○	○	
	inactive			
	no detectio		0	
Total Hardness (mg/ℓ 、$CaCO_3$)		–	76.79	
Alkalinity (mg/ℓ)		–	–	
Fe (〃)		Nil	Nil	
Cr (〃)		0	0	
Zn (〃)		–	–	
Ca (〃)		20.8	–	
Mg (〃)		13.12	–	
Mn (〃)		0	0	
F (〃)		0.4	0.4	
SO_4 (〃)		0	0	
Cℓ (〃)		12.78	21.3	
NH_4 −N		1.0	Nil	
NO_3 −N		Nil	Nil	
NO_2 −N		Nil	Nil	
Remark				

Water quality data

Project area		YOAYA	BINANGGA	TAWAELI
Water source		Kayadongo	Kurondo	Rubo
Sampling data		26th May, 1990	29th May, 1990	28th May, 1990
Weather		rain	fine	fine
temp of sample (℃)		27	24	28
PH		7.2	7.5	7.2
Turbidity as kaoline		0	0	0
Colon bacillus	acitive	○		○
	inactive		○	
	no detectio			
Total Hardness (mg/ℓ 、$CaCO_3$)		110	170	110
Alkalinity (mg/ℓ)		144.19	177.67	92.26
Fe (〃)		0.2	Nil	0.1
Cr (〃)		0	0	0
Zn (〃)		0.09	0.07	0.05
Ca (〃)		–	–	–
Mg (〃)		–	–	–
Mn (〃)		0.05	0	0
F (〃)		0.22	0.22	0.3
SO_4 (〃)		0.023	0.023	0.047
Cℓ (〃)		1.5	0.5	4.0
NH_4 −N		Nil	Nil	0.4
NO_3 −N		Nil	Nil	Nil
NO_2 −N		Nil	Nil	Mil
Remark				

Water quality data

Project area		PENDOLO	BONE BOBAKAL	SUMIUT
Water source		Lake Poso	Lomba	Moang
Sampling data		15th May, 1990	31th May, 1990	4th June, 1990
Weather		fine	fine	fine
temp of sample (℃)		32	24	27
PH		8	7.2	7.5
Turbidity as kaoline		0	0	0
Colon bacillus	acitive			
	inactive	○		
	no detectio		○	○
Total Hardness (mg/ℓ 、 $CaCO_3$)		–	200	45
Alkalinity (mg/ℓ)		–	141.63	144.52
Fe (〃)		Nil	Nil	Nil
Cr (〃)			0	0
Zn (〃)		–	0.05	0.05
Ca (〃)		8.8	–	–
Mg (〃)		9.23	–	–
Mn (〃)		0	0	0
F (〃)		0.4	0.37	0.28
SO_4 (〃)		0	0.015	0.03
Cℓ (〃)		17.4	1.0	2.5
NH_4 – N		Nil	Nil	Nil
NO_3 – N		Nil	Nil	Nil
NO_2 – N		Nil	Nil	Mil
Remark				

Water quality data

Project area		BALANTAK	SALAKAN	LIANG
Water source		Di Matana	———	Koilo
Sampling data		1st June, 1990		5th June, 1990
Weather		rain		fine
temp of sample (℃)		25		26
PH		7.0		7.5
Turbidity as kaoline		0		1
Colon bacillus	acitive			
	inactive			○
	no detectio	○		
Total Hardness (mg/ℓ 、$CaCO_3$)		265		125
Alkalinity (mg/ℓ)		217.60		98.78
Fe (〃)		Nil		Nil
Cr (〃)		0		0
Zn (〃)		0.05		0.06
Ca (〃)		–		–
Mg (〃)		–		--
Mn (〃)		0		0
F (〃)		0.33		0.13
SO_4 (〃)		0.013		0.013
Cℓ (〃)		2.50		2.50
NH_4 – N		Nil		Nil
NO_3 – N		Nil		Nil
NO_2 – N		Nil		Nil
Remark				

Water quality data

Project area		LANDONO	ANDUONOHU	MOWEWE
Water source		―――	Matanggonawa	Molloka
Sampling data			25th June, 1990	28th June, 1990
Weather			fine	fine
temp of sample (℃)			27	25
PH			7.5	6.3
Turbidity as kaoline			1	1
Colon bacillus	acitive		○	○
	inactive			
	no detectio			
Total Hardness (mg/ℓ 、$CaCO_3$)			299	252
Alkalinity (mg/ℓ)			–	–
Fe (〃)			Nil	0.3
Cr (〃)			–	–
Zn (〃)			0	0
Ca (〃)			–	–
Mg (〃)			–	–
Mn (〃)			0	–
F (〃)			0	0
SO_4 (〃)			0	0
$C\ell$ (〃)			16	0
NH_4-N			Nil	Nil
NO_3-N			Nil	Nil
NO_2-N			Nil	Nil
Remark			TDS : 360	TDS : 240

Water quality data

Project area		WAKADIA	LAOMPO	LAPUKO
Water source		Rawa	Kalangona	Lunggayropa
Sampling data		1st June, 1990	6th June, 1990	26th May, 1990
Weather		rain	fine	rain
temp of sample (℃)		26.5	25	25
PH		7.2	7.5	7
Turbidity as kaoline		0	1.5	0
Colon bacillus	acitive			○
	inactive	○	○	
	no detectio			
Total Hardness (mg/ℓ 、$CaCO_3$)		299	286	288
Alkalinity (mg/ℓ)		–	–	–
Fe (〃)		Nil	Nil	0.2
Cr (〃)		–	0	0
Zn (〃)		0	0	0
Ca (〃)		–	–	–
Mg (〃)		–	–	–
Mn (〃)		–	–	–
F (〃)		0	0	0
SO_4 (〃)		0	6	33
$C\ell$ (〃)		21	12	46
NH_4-N		0.3	Nil	Nil
NO_3-N		Nil	Nil	Nil
NO_2-N		Nil	Nil	Mil
Remark		TDS : 320	TDS : 380	TDS : 500

Water quality data

Project area		SANDANGPANGAN	TAKIMPO	
Water source		Rano	Labeonpangule	
Sampling data		4th June, 1990	5th June, 1990	
Weather		rain	fine	
temp of sample (℃)		26	25	
PH		7	8.5	
Turbidity as kaoline		0	0	
Colon bacillus	acitive			
	inactive	○	○	
	no detectio			
Total Hardness (mg/ℓ 、$CaCO_3$)		287	291	
Alkalinity (mg/ℓ)		—	—	
Fe (〃)		Nil	Nil	
Cr (〃)		—	—	
Zn (〃)		0	0	
Ca (〃)		—	—	
Mg (〃)		—	—	
Mn (〃)		—	—	
F (〃)		0	0	
SO_4 (〃)		3	11	
Cℓ (〃)		16	25	
NH_4 −N		Nil	0.5	
NO_3 −N		Nil	0.1	
NO_2 −N		Nil	Nil	
Remark		TDS : 360	TDS : 240	

APPENDIX 5-3

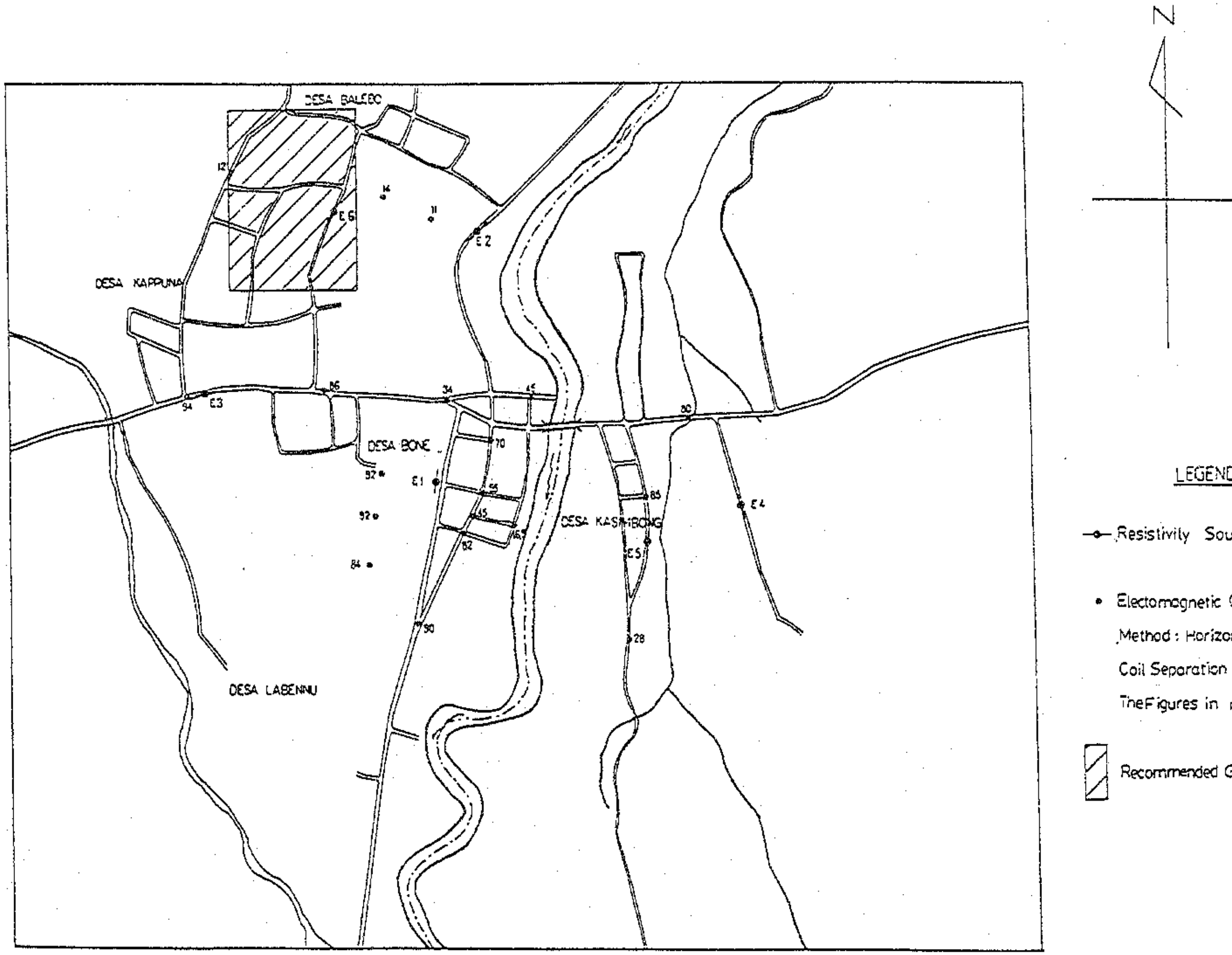
Hydrogeology of Well Sites

Interpretation Results of the Resistivity Sounding

Masamba

Unit	Specific Resistivity [Ω-m]	Depth [m]	Lithology
A	300 - 2000 (approximation)	5 - 10	• To be composed of fluvial sand and gravel in wet condition.
B	60 - 300	10 - 30	• To be composed of pebble to sandy silt in saturated.
C	240 - 1350	15 - 40	• To be composed of gravel in saturated.
D	15 - 153	30 - 60	• To be composed of clayey material.
E	600 - 2000	40 - 85	• To be composed of boulder or volcanic rocks of the Masamba Volcanic Sequence
F	108	60 - 70	• To be composed of intercalary sand to silt, or intercalary tuff breccia of the Masamba Volcanic Sequence
G	10 - 7	below 60 - 85	• To be composed of clay to silt, or tuff breccia of the Masamba Volcanic Sequence.

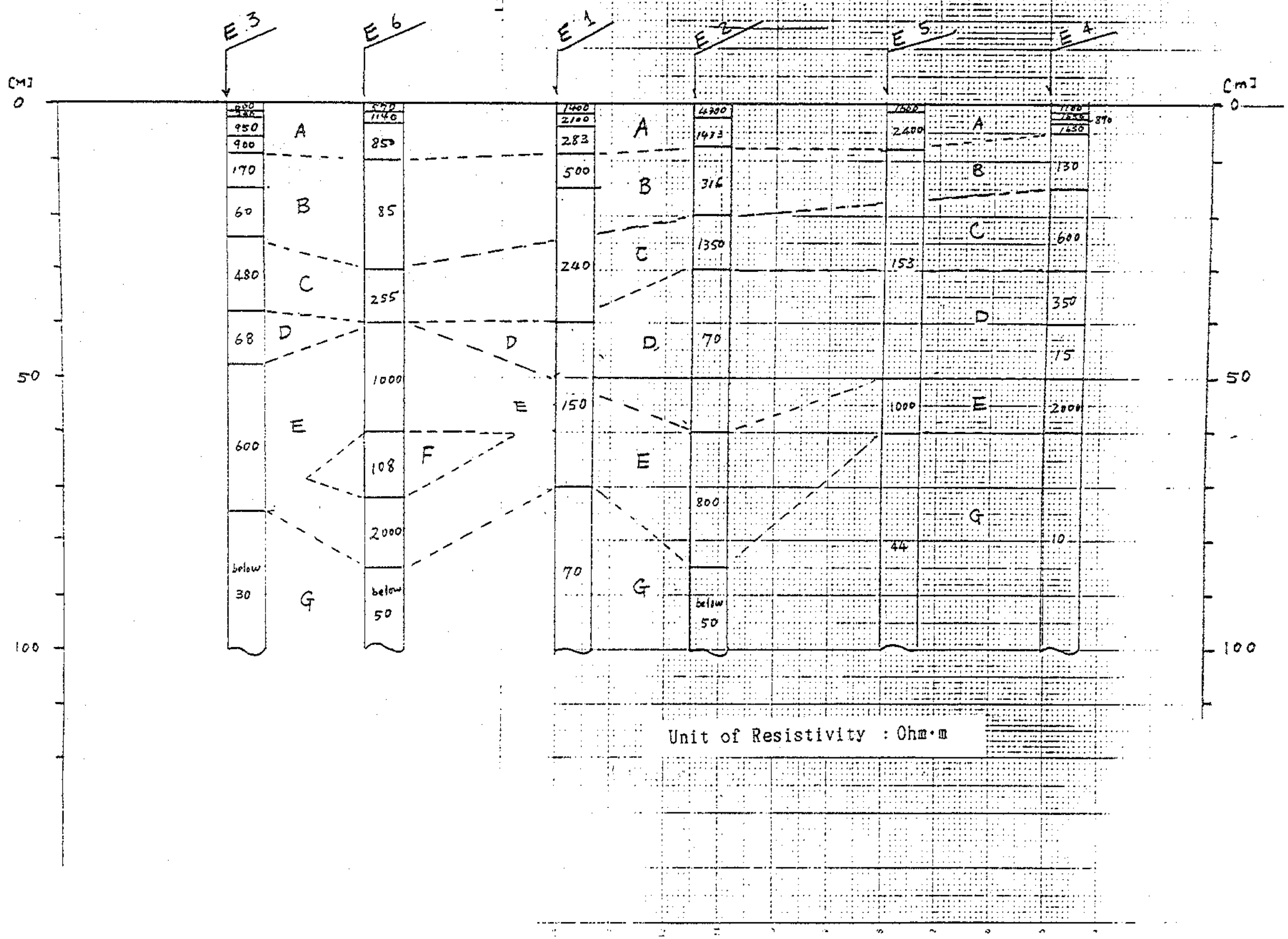
Recommended Groundwater Development Area
in Masamba

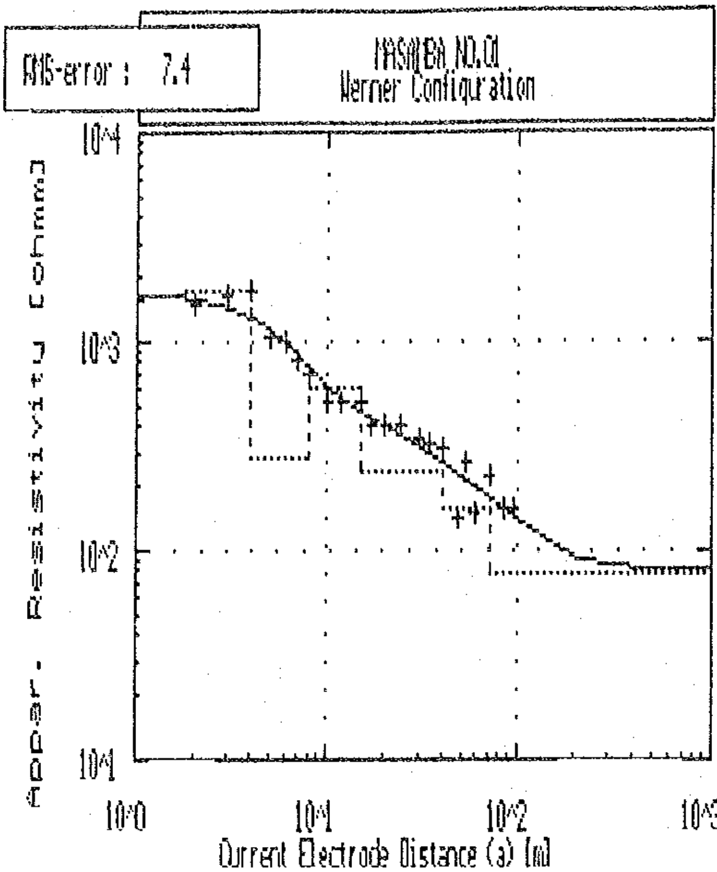


LEGEND

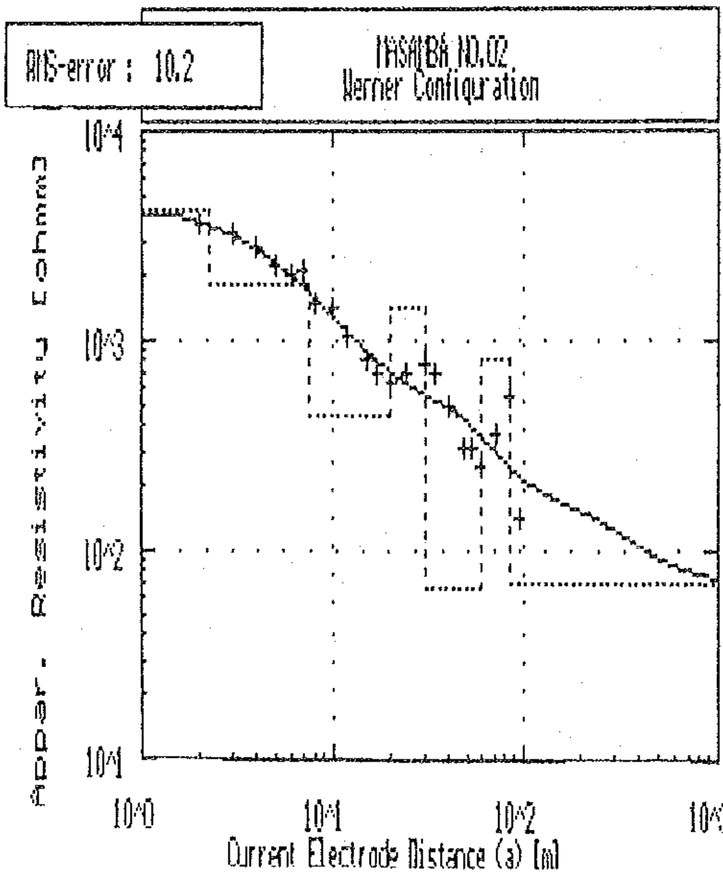
- Resistivity Sounding Point
- Electromagnetic Conductivity Measurement Point
  - Method : Horizontal Dipoles
  - Coil Separation : 40m
  - The Figures in mmhos/m
- Recommended Groundwater Development Area

Resistivity Correlation of Masamba

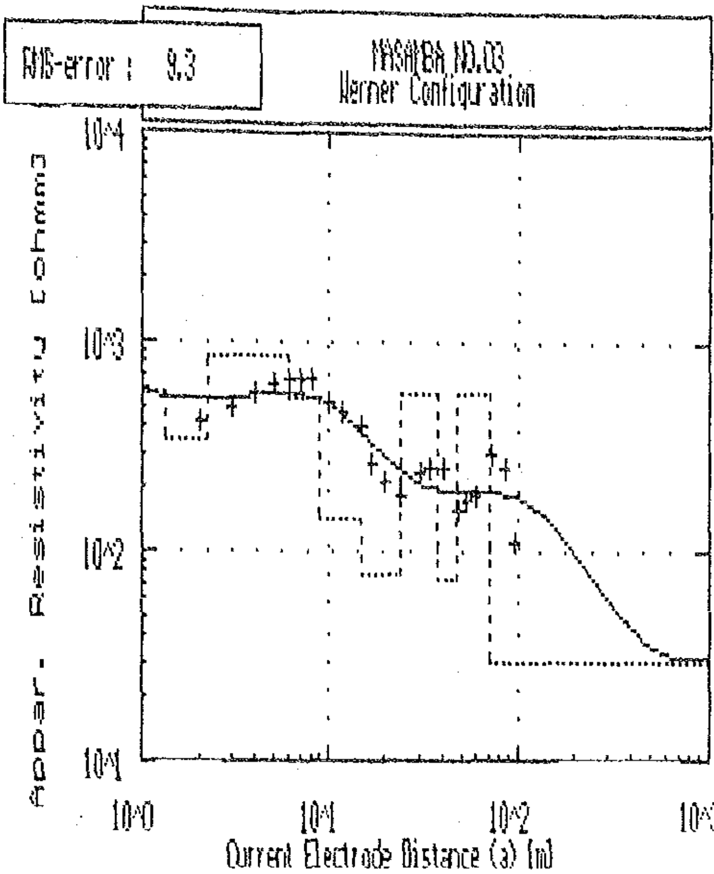




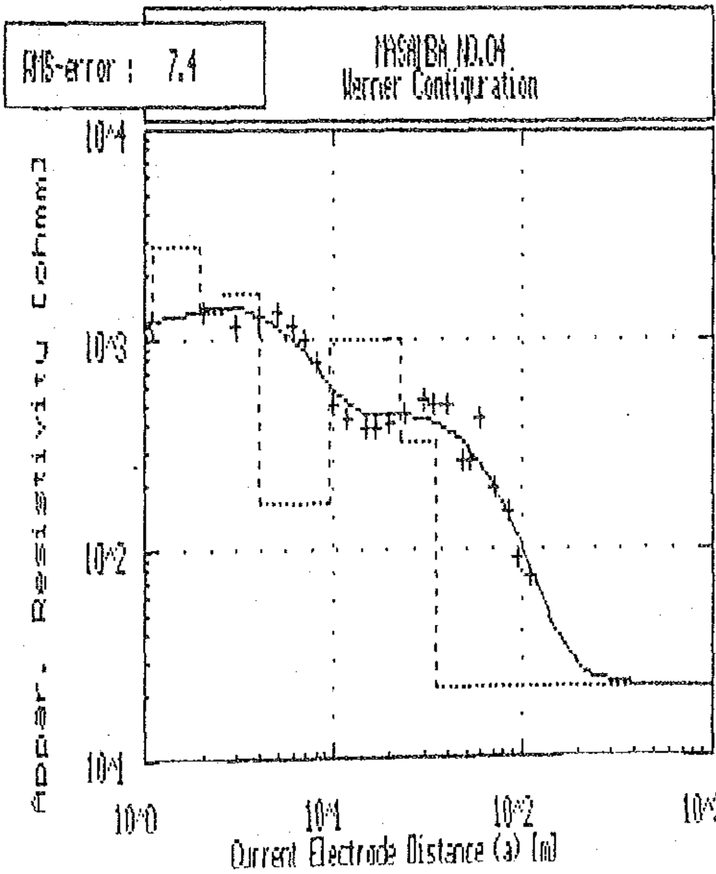
No	Res	Thick	Depth
1	1668.7	1.8	1.8
2	1765.5	2.2	4.0
3	278.2	4.0	8.0
4	588.4	7.0	15.0
5	237.8	25.0	40.0
6	160.5	31.5	71.5
7	79.4	-.-	-.-



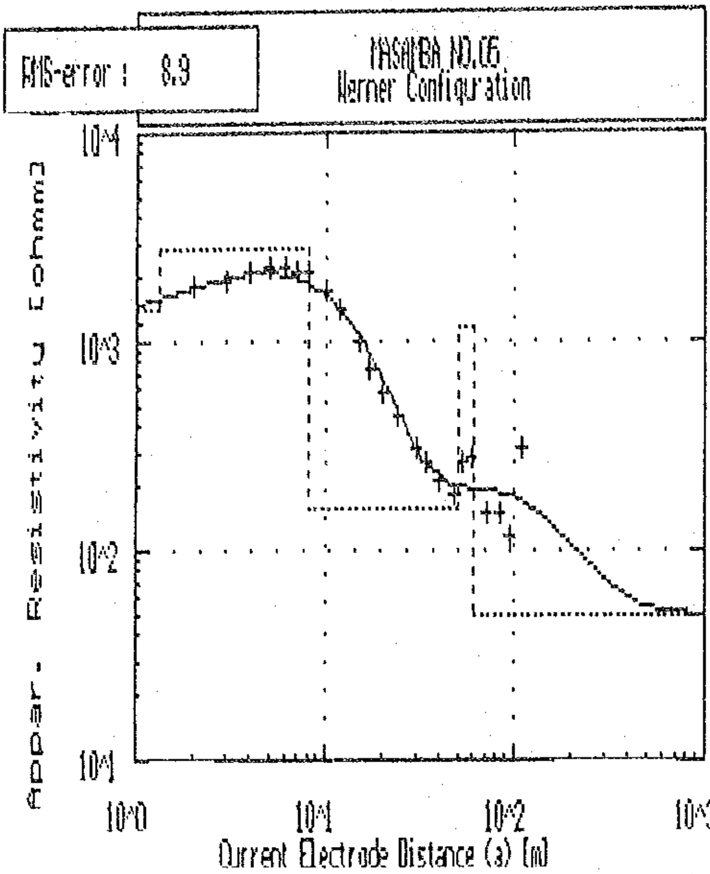
No	Res	Thick	Depth
1	4142.0	2.3	2.3
2	1830.4	5.3	7.6
3	445.9	12.4	20.0
4	1434.2	10.0	30.0
5	67.3	29.9	59.9
6	829.3	25.6	85.5
7	70.9	-.-	-.-



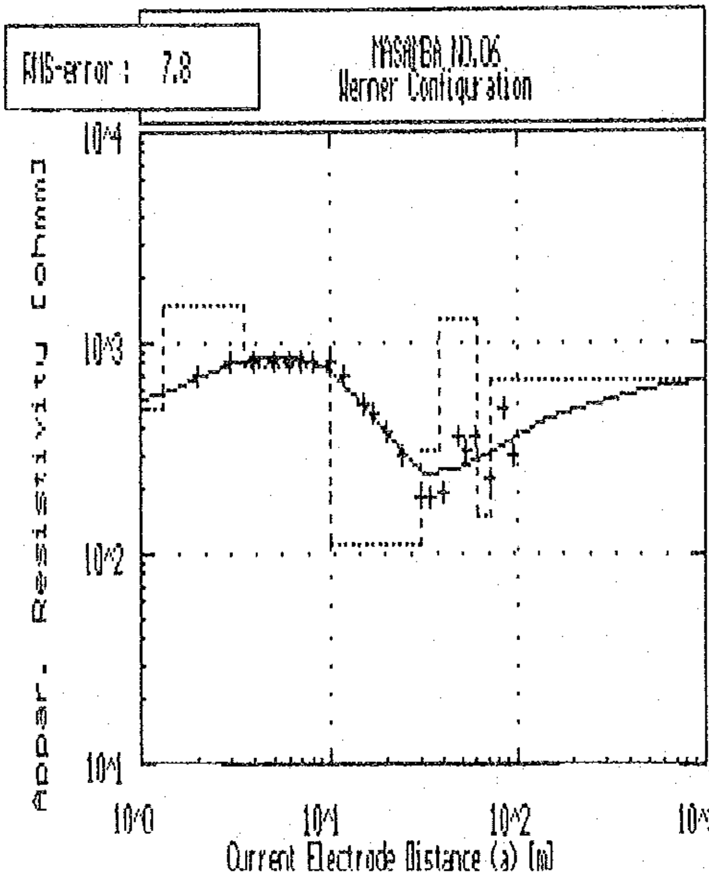
No	Res	Thick	Depth
1	575.4	1.3	1.3
2	345.9	0.9	2.2
3	875.3	3.8	6.0
4	548.7	3.0	9.0
5	139.6	6.0	15.0
6	78.1	9.0	24.0
7	563.0	14.0	38.0
8	73.5	9.3	47.3
9	561.1	22.1	69.4
10	29.5	-.-	-.-



No	Res	Thick	Depth
1	1063.0	1.1	1.1
2	2829.7	0.9	1.9
3	1360.0	0.6	2.5
4	1657.3	1.4	4.0
5	170.3	5.4	9.4
6	1011.3	13.6	23.0
7	332.0	11.6	34.6
8	21.3	-.-	-.-



No	Res	Thick	Depth
1	1401.3	1.3	1.3
2	2807.2	6.7	8.0
3	162.2	42.0	50.0
4	1184.2	11.8	61.8
5	49.1	-.-	-.-



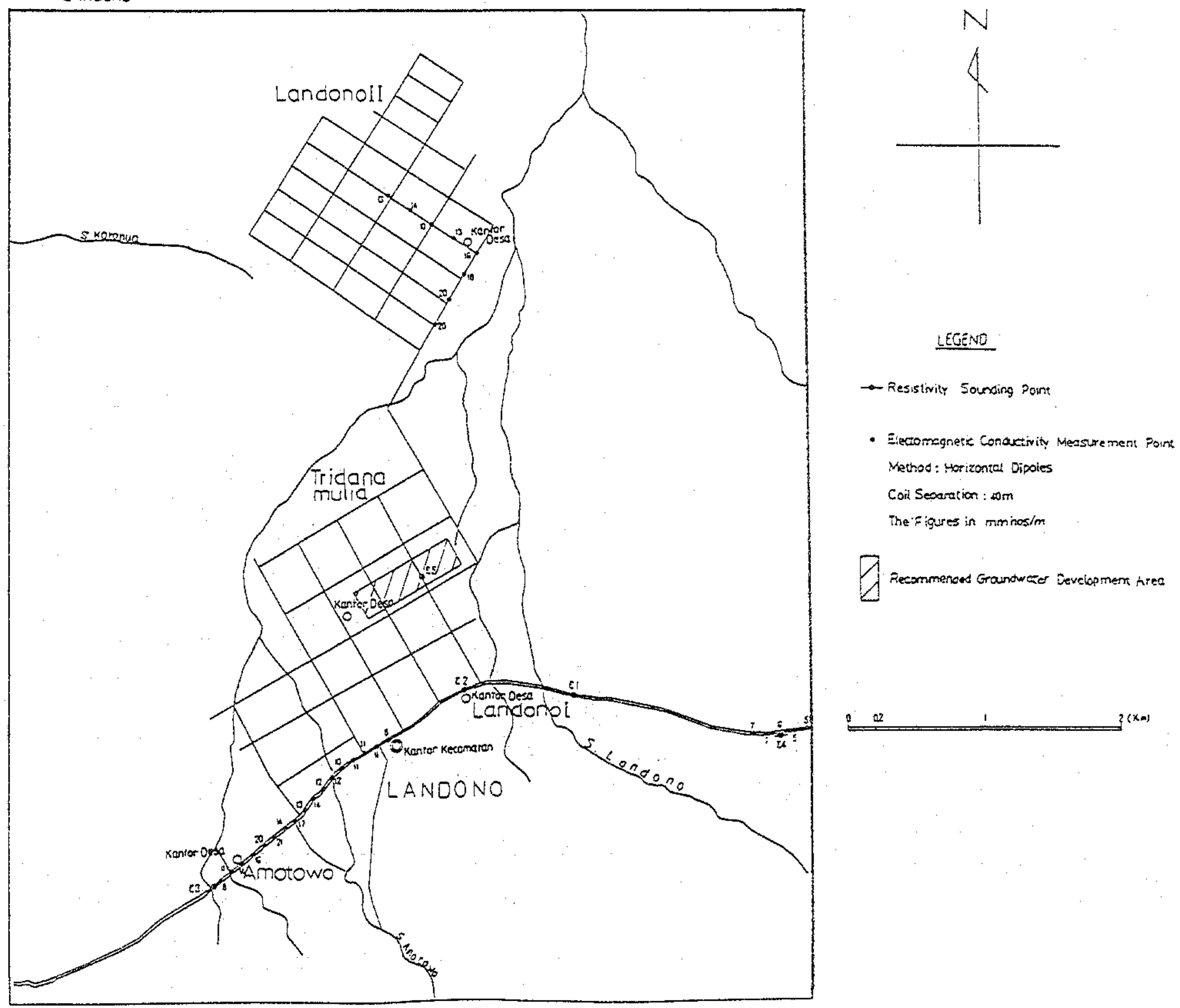
No	Res	Thick	Depth
1	484.9	1.3	1.3
2	1518.1	2.2	3.5
3	761.6	6.5	10.0
4	113.1	20.0	30.0
5	302.4	8.9	38.9
6	1283.6	23.4	62.3
7	147.7	11.1	73.5
8	678.3	-.-	-.-

Interpretation Results of the Resistivity Sounding

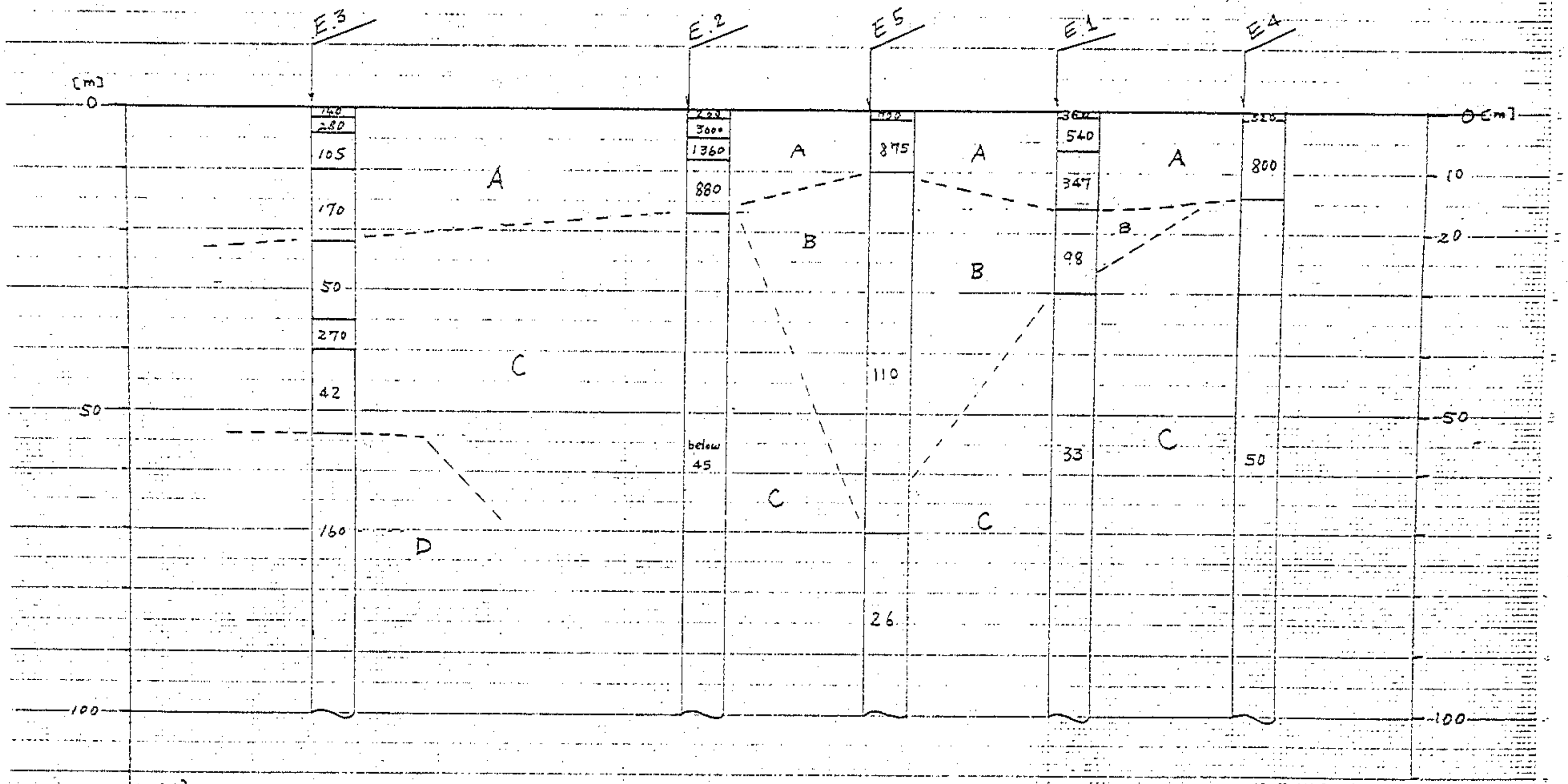
Landono

Unit	Specific Resistivity [Ω-m]	Depth [m]	Lithology
A	300 - 900 (approximation)	10 - 17	• To be composed mainly of fluvial gravel and sand in wet to saturated condition.
B	98 - 110	10 - 70	• To be maid up of pebble to sand in saturated condition. • developing thick northward.
C	26 - 50	below 10 - 20	• To be composed of silt and silty sand with intercalary sand and pebble beds.
D	160	below 44	• To be composed of gravel with intercalary silt and sand. • developing in the western part.

Recommended Groundwater Development Area
in Landono



Resistivity Correlation of Landono

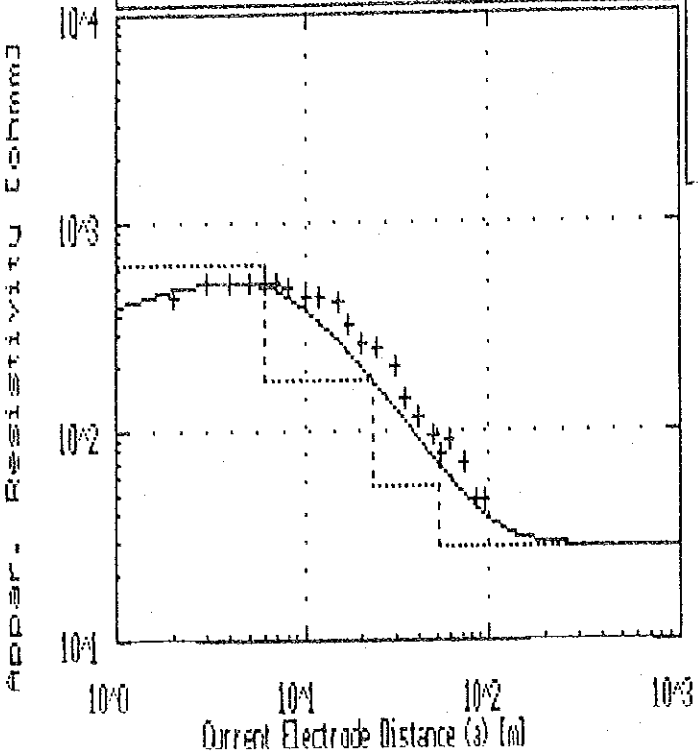


Unit of Resistivity : Ohm·m

RMS-error : 10.6

LANDCNO NO.01
Werner Configuration

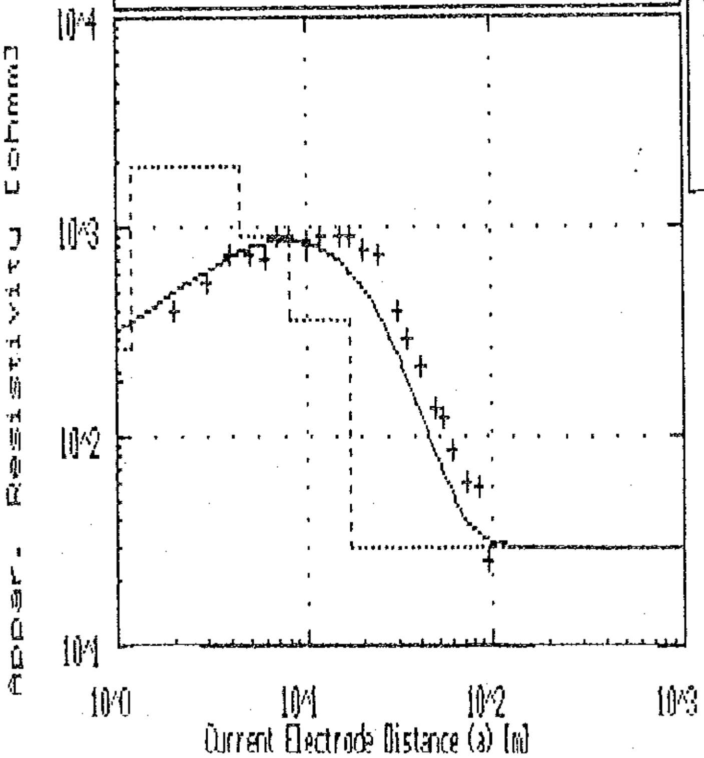
No	Res	Thick	Depth
1	342.9	0.8	0.8
2	629.6	5.4	6.2
3	177.4	16.2	22.4
4	54.6	30.0	52.4
5	27.5	-.-	-.-

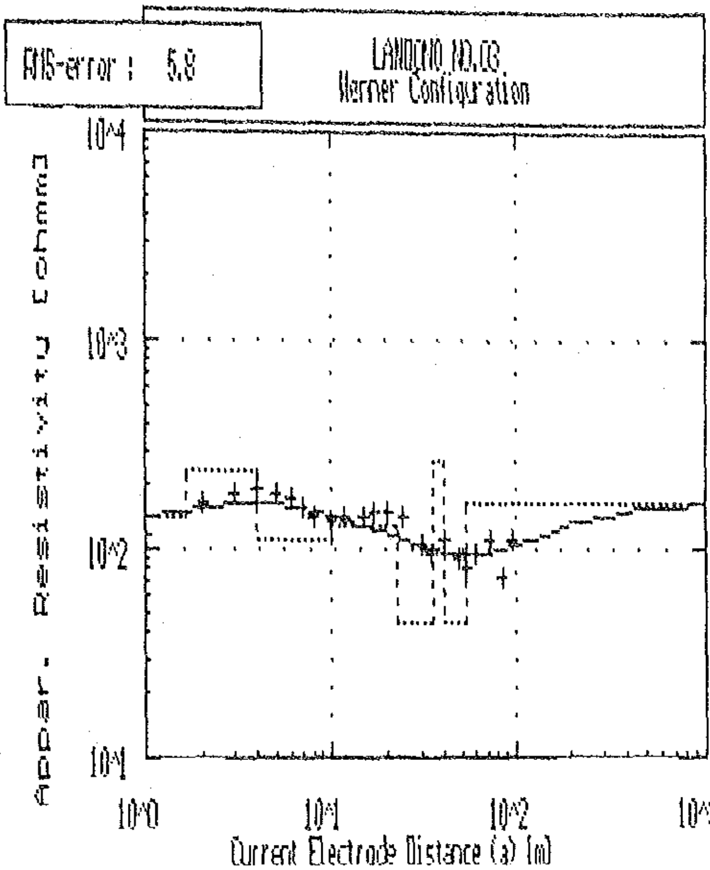


RMS-error : 16.9

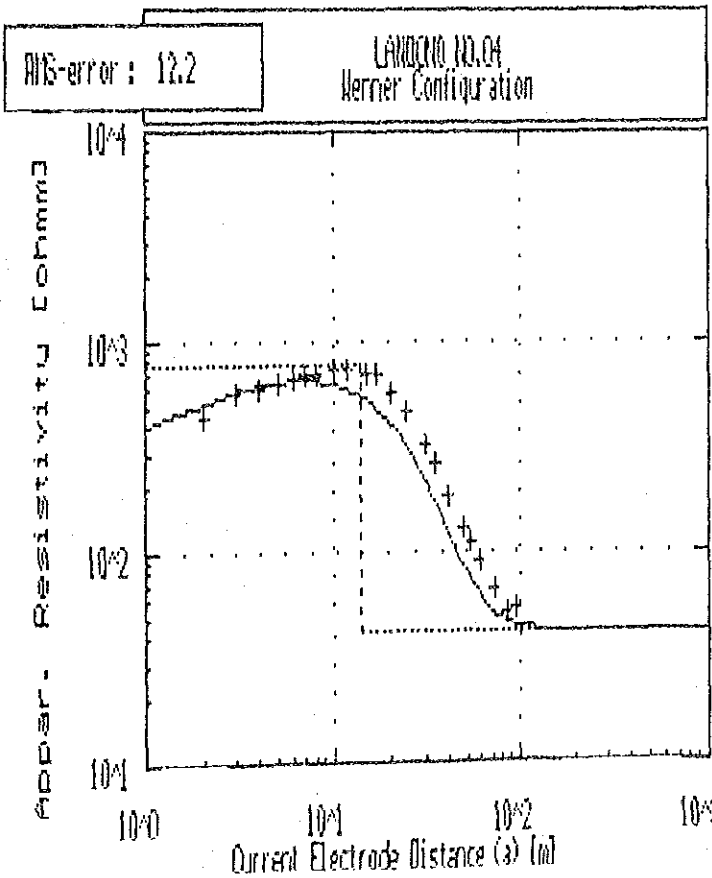
LANDCNO NO.02
Werner Configuration

No	Res	Thick	Depth
1	261.1	1.2	1.2
2	1923.2	3.3	4.5
3	912.4	3.5	8.0
4	362.3	9.0	17.0
5	23.0	-.-	-.-

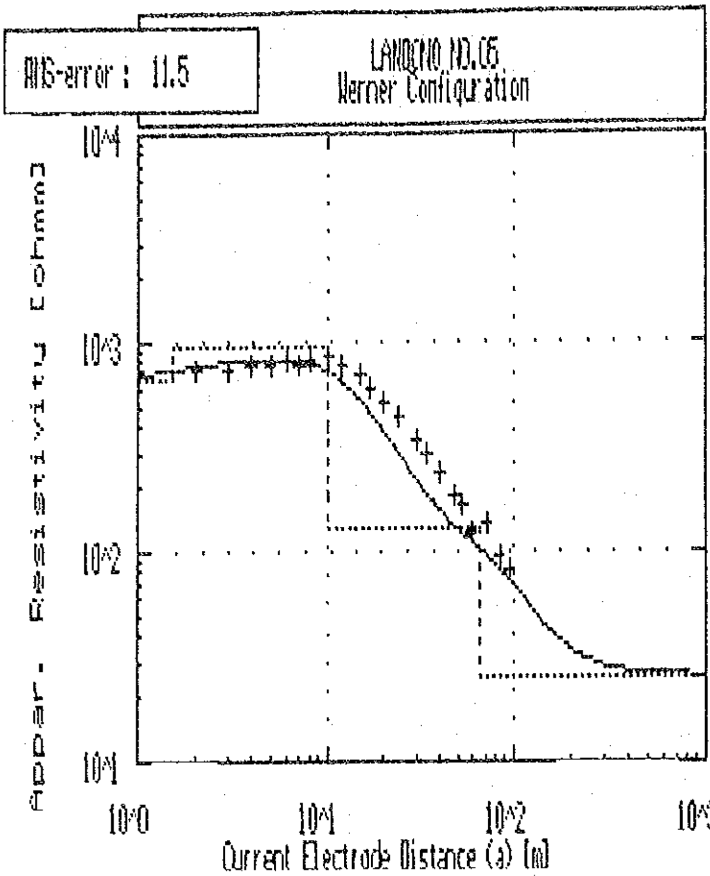




No	Res	Thick	Depth
1	140.2	1.6	1.6
2	242.1	2.4	4.0
3	111.7	6.0	10.0
4	131.6	12.0	22.0
5	43.9	13.0	35.0
6	263.8	4.3	39.9
7	43.2	13.7	53.6
8	168.9	-.-	-.-



No	Res	Thick	Depth
1	352.9	1.0	1.0
2	777.0	13.0	14.0
3	42.0	-.-	-.-



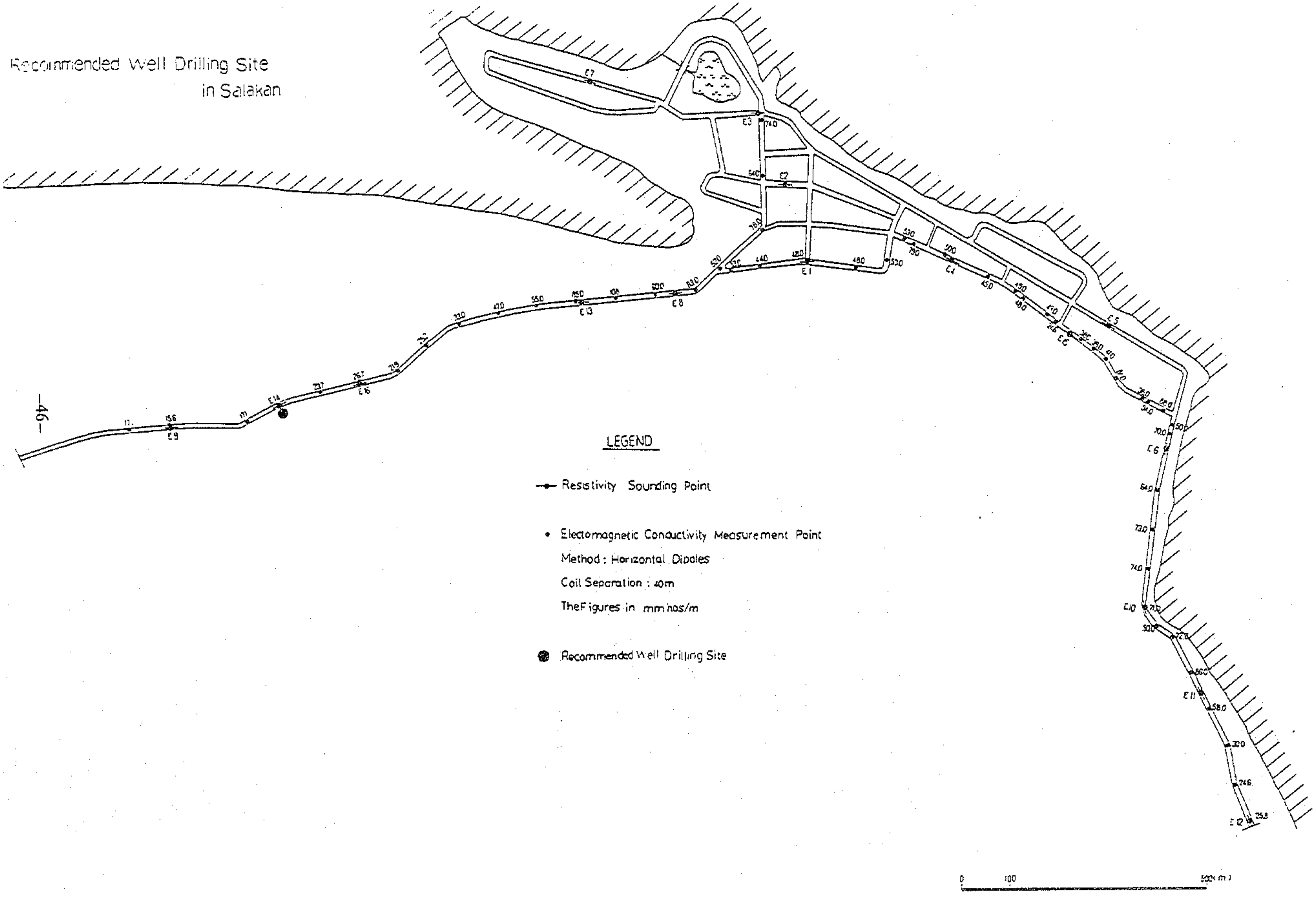
No	Res	Thick	Depth
1	673.6	1.5	1.5
2	974.2	8.5	10.0
3	123.3	55.8	65.8
4	25.4	-.-	-.-

Interpretation Results of the Resistivity Sounding

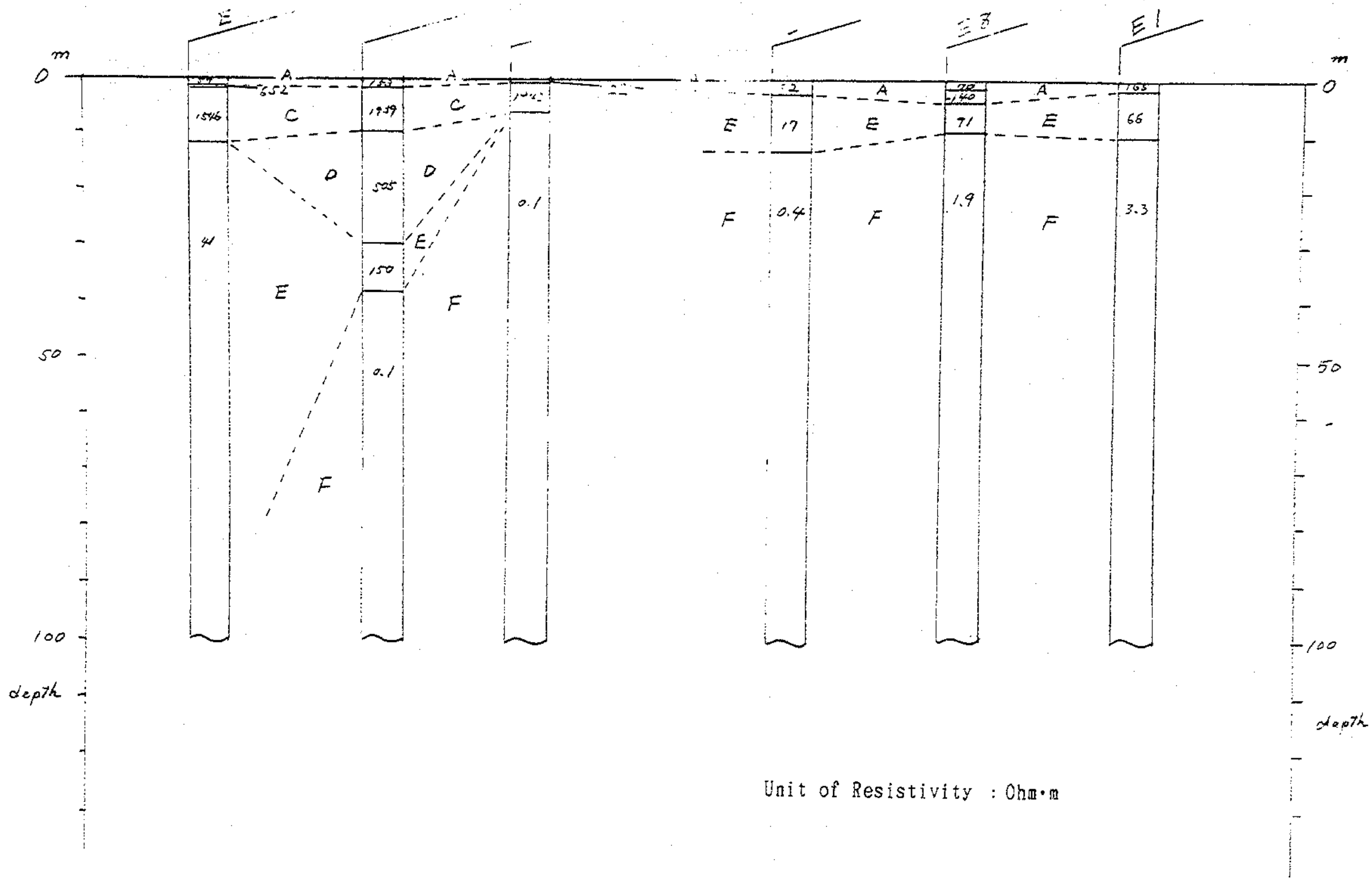
Salakan

Unit	Specific Resistivity [Ω-m]	Thickness [m]	Lithology
A	20 - 300	0 - 2	top soil or alluvial deposits
B	300 - 700	0 - 3	weathered limestone (chalk)
C	1500 - 3500	0 - 10	limestone (chalk) in wet condition
D	500 - 600	0 - 20	limestone (chalk) in fresh water
E	10 - 300	0 - 20	limestone (chalk) in brackish water
F	0 - 6	∞	limestone (chalk) in salt water

Recommended Well Drilling Site
in Salakan



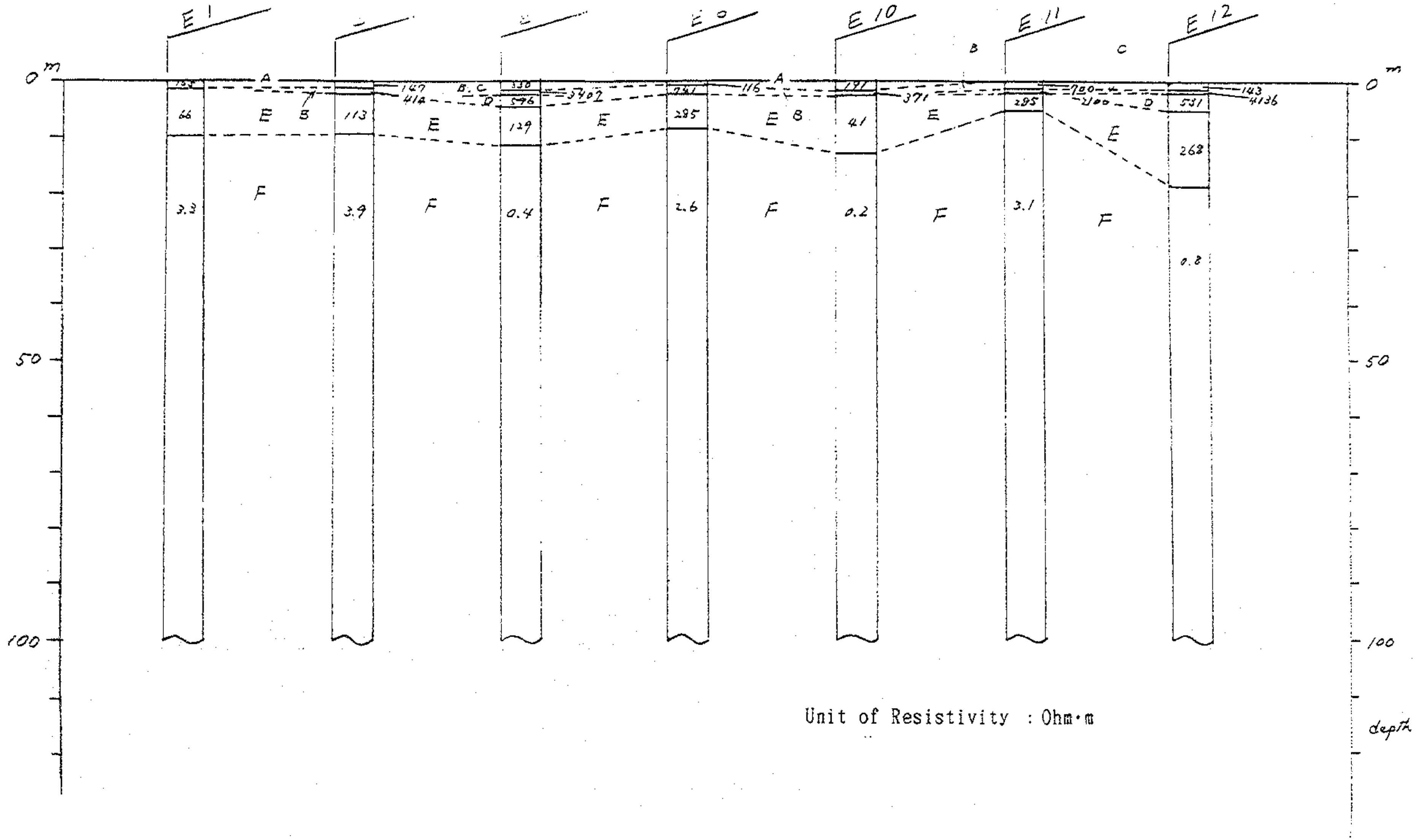
Resistivity Correlation of Salakan (1/3)



Unit of Resistivity : Ohm·m

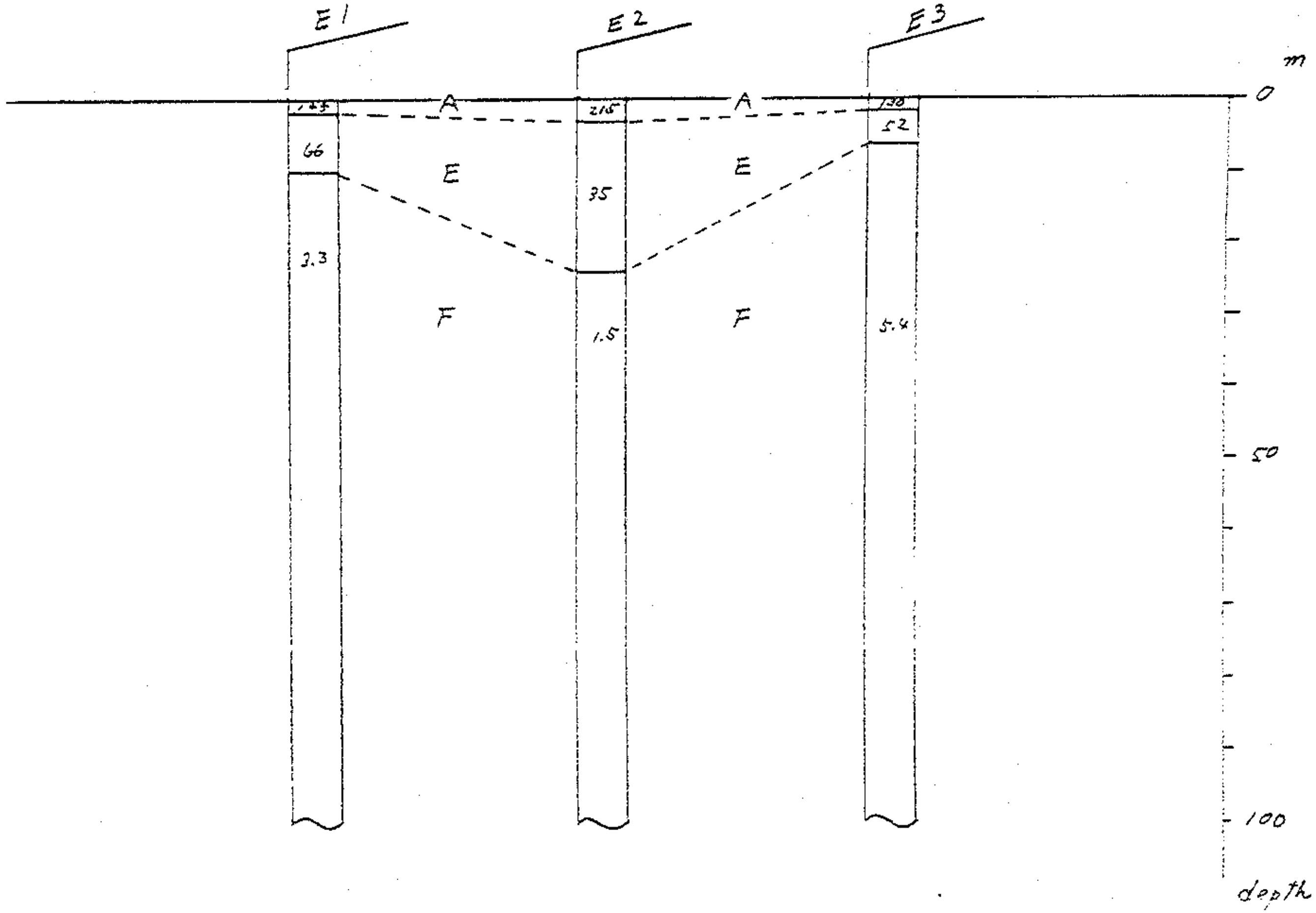
Resistivity Correlation of Salakan (2/3)

2/3

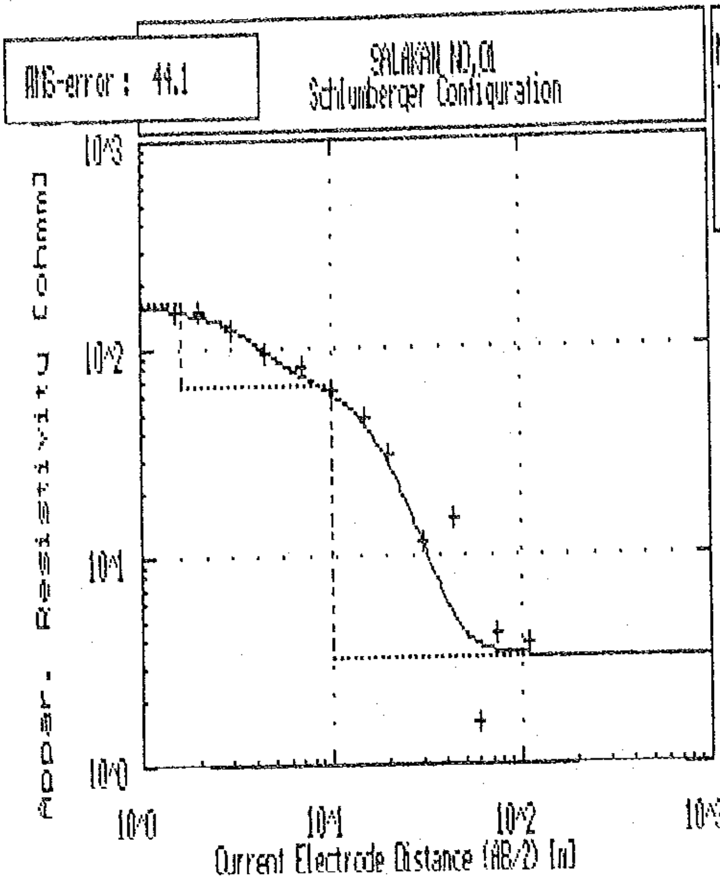


Resistivity Correlation of Salakan (3/3)

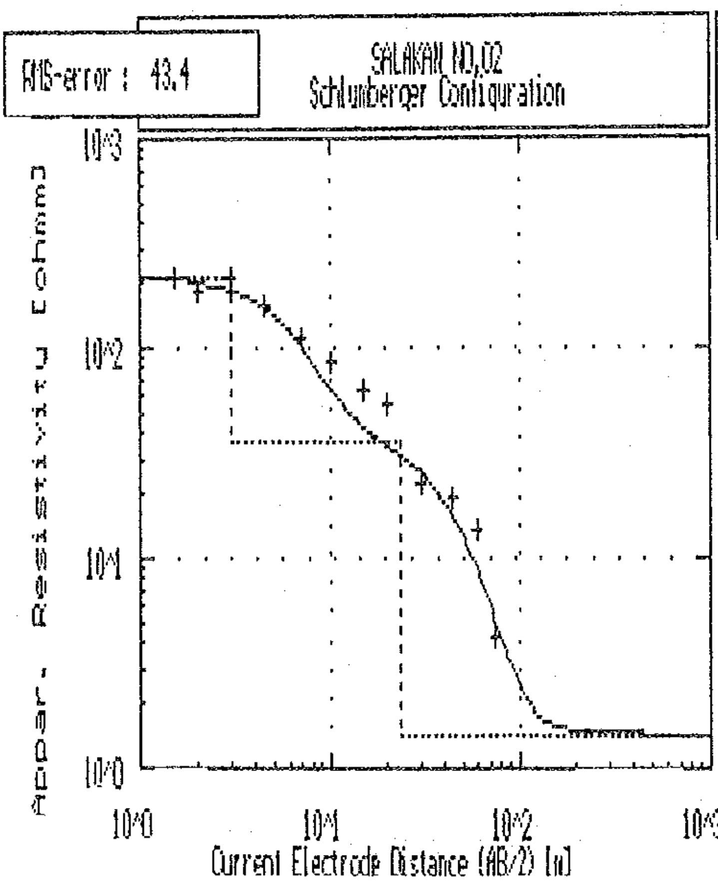
/3



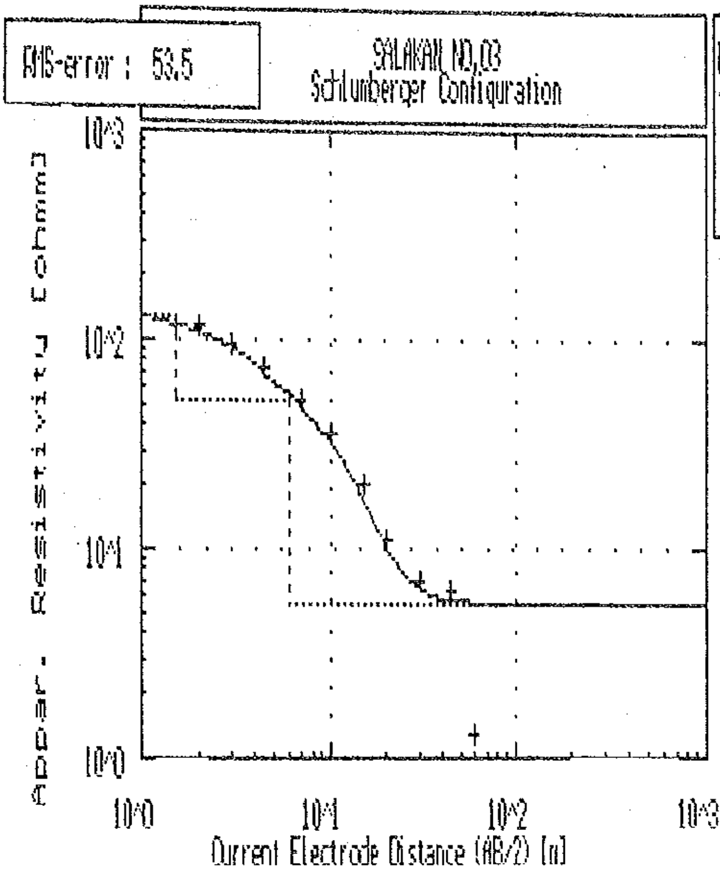
Unit of Resistivity : Ohm·m



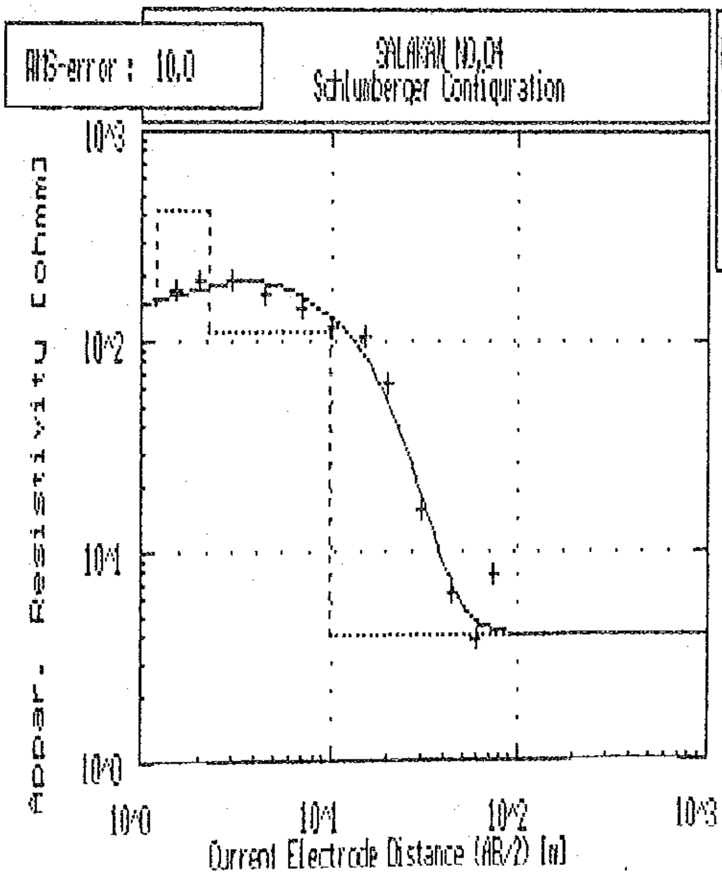
No	Res	Thick	Depth
1	165.0	1.6	1.6
2	66.0	8.4	10.0
3	3.3	-.-	-.-



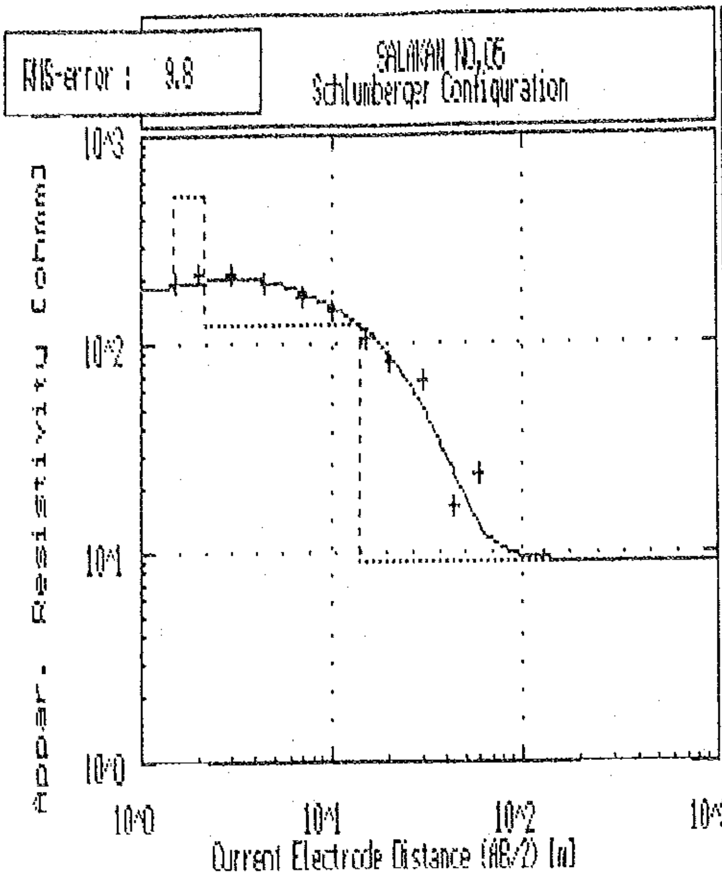
No	Res	Thick	Depth
1	215.0	3.0	3.0
2	35.4	20.7	23.6
3	1.5	-.-	-.-



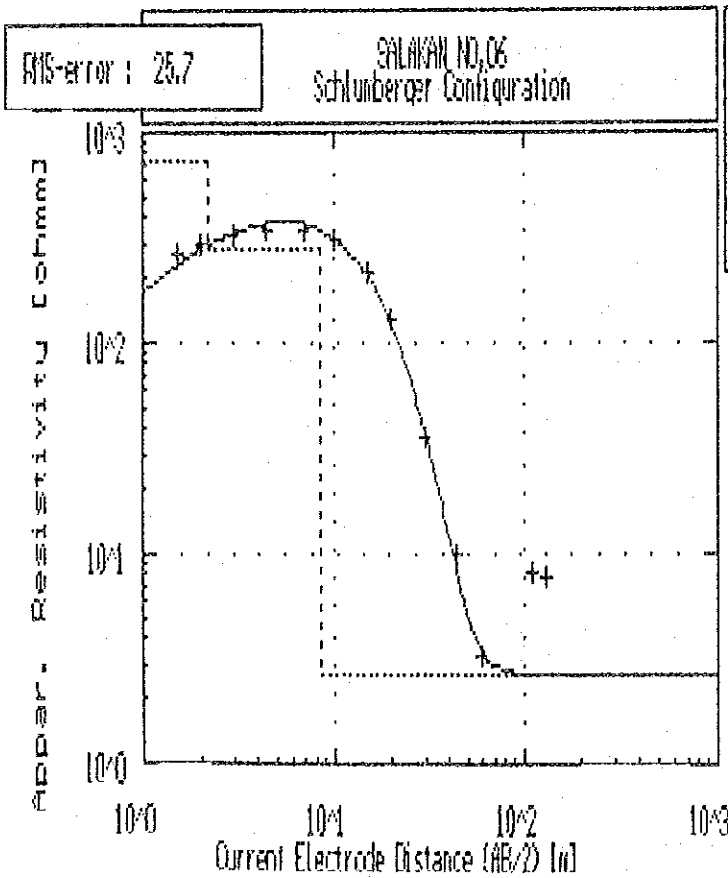
No	Res	Thick	Depth
1	130.0	1.5	1.5
2	52.0	4.5	6.0
3	5.4	-.-	-.-



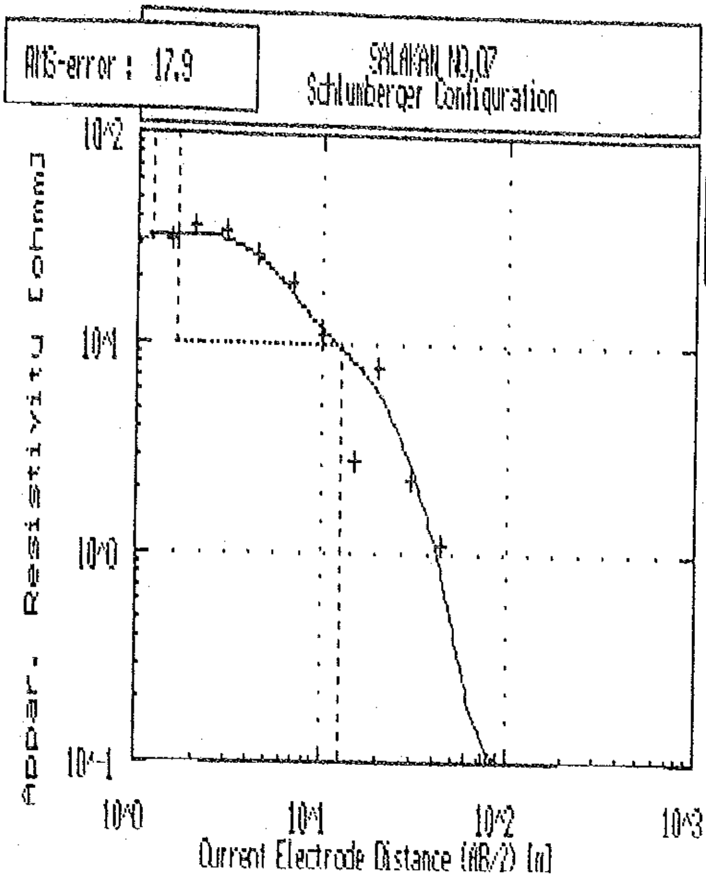
No	Res	Thick	Depth
1	147.2	1.2	1.2
2	414.0	1.0	2.2
3	113.3	7.5	9.7
4	3.9	-.-	-.-



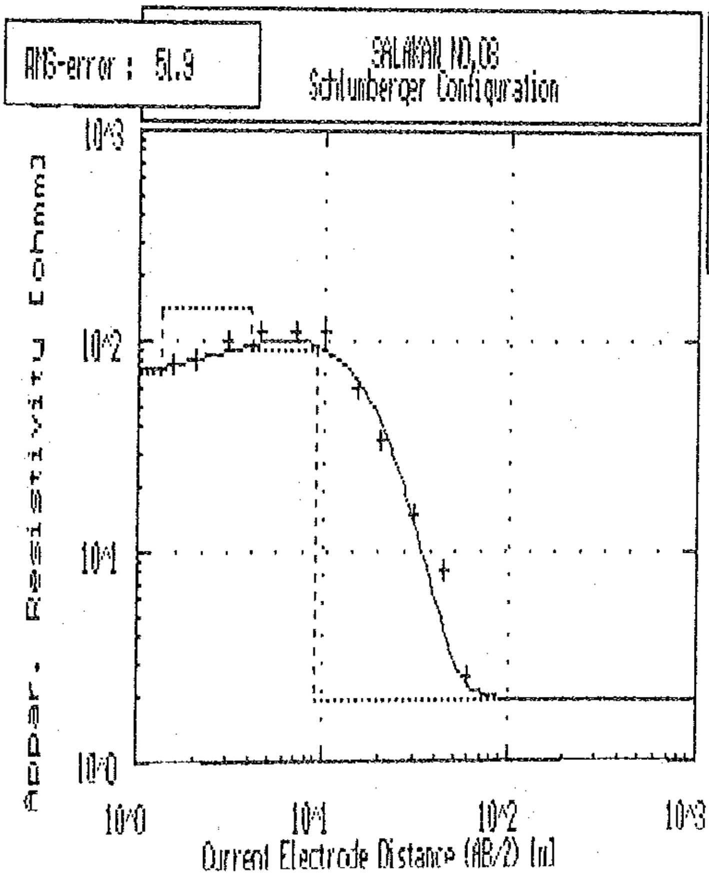
No	Res	Thick	Depth
1	181.6	1.5	1.5
2	516.0	0.7	2.2
3	121.3	11.5	13.6
4	9.0	-.-	-.-



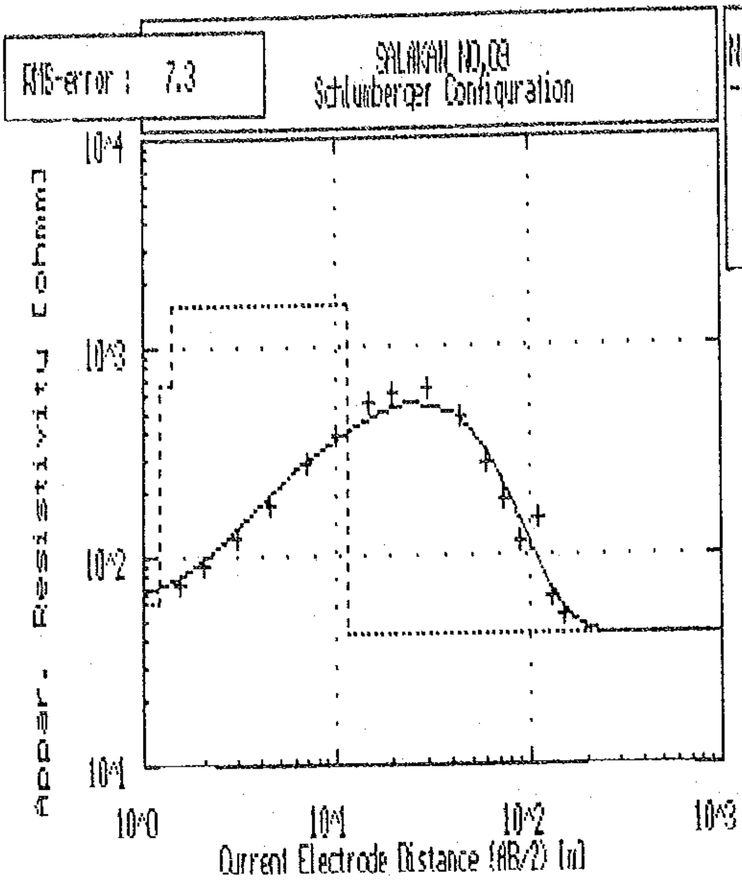
No	Res	Thick	Depth
1	111.5	0.5	0.5
2	741.2	1.7	2.2
3	284.5	6.4	8.6
4	2.6	-.-	-.-



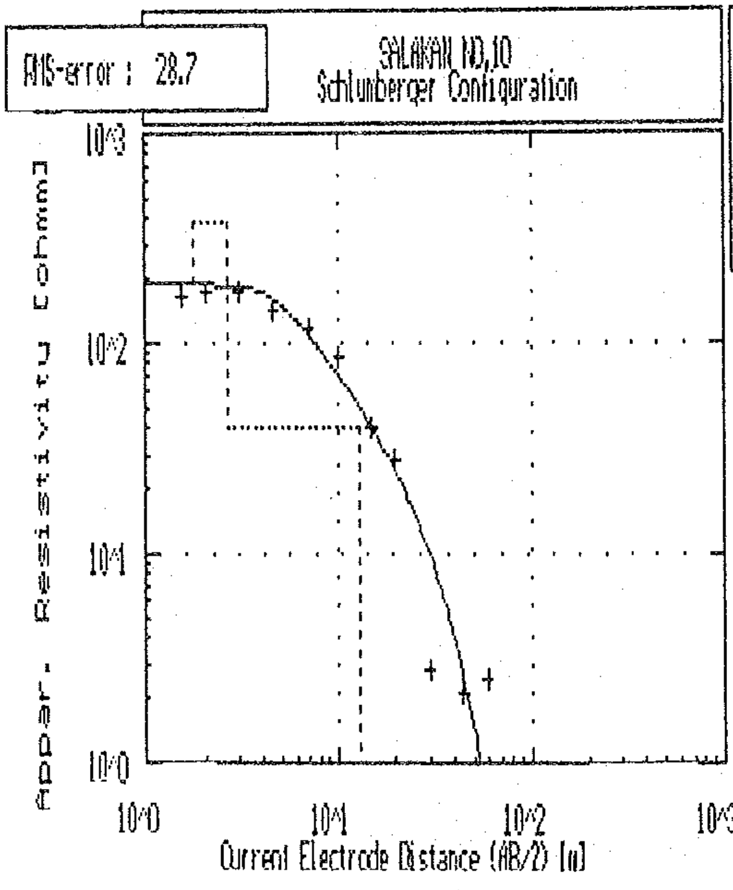
No	Res	Thick	Depth
1	30.7	1.2	1.2
2	102.6	0.4	1.6
3	9.9	11.1	12.7
4	0.1	-.-	-.-



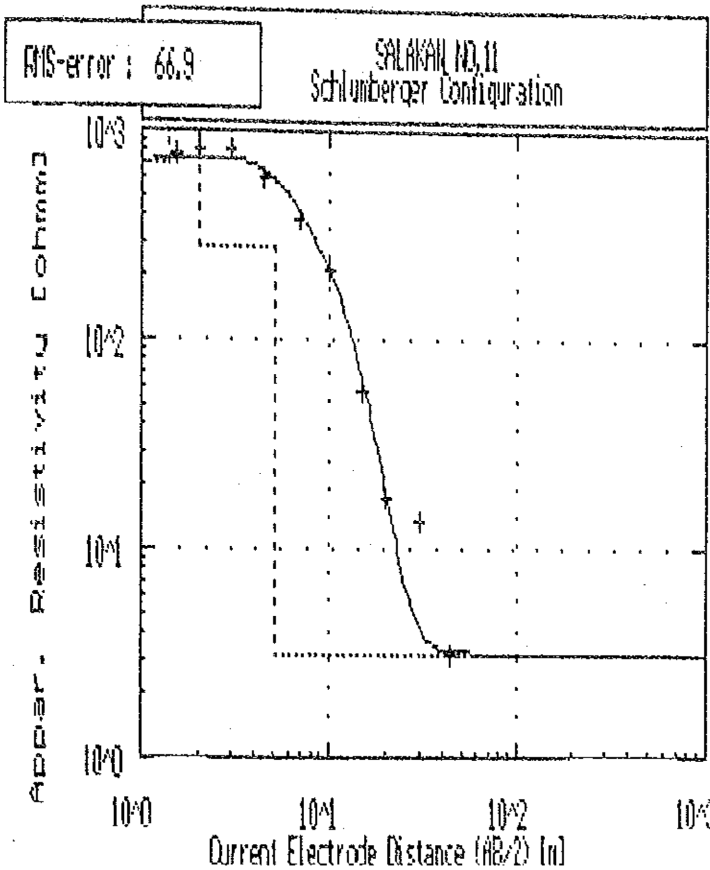
No	Res	Thick	Depth
1	70.0	1.3	1.3
2	140.0	2.7	4.0
3	91.0	5.1	9.1
4	1.9	-.-	-.-



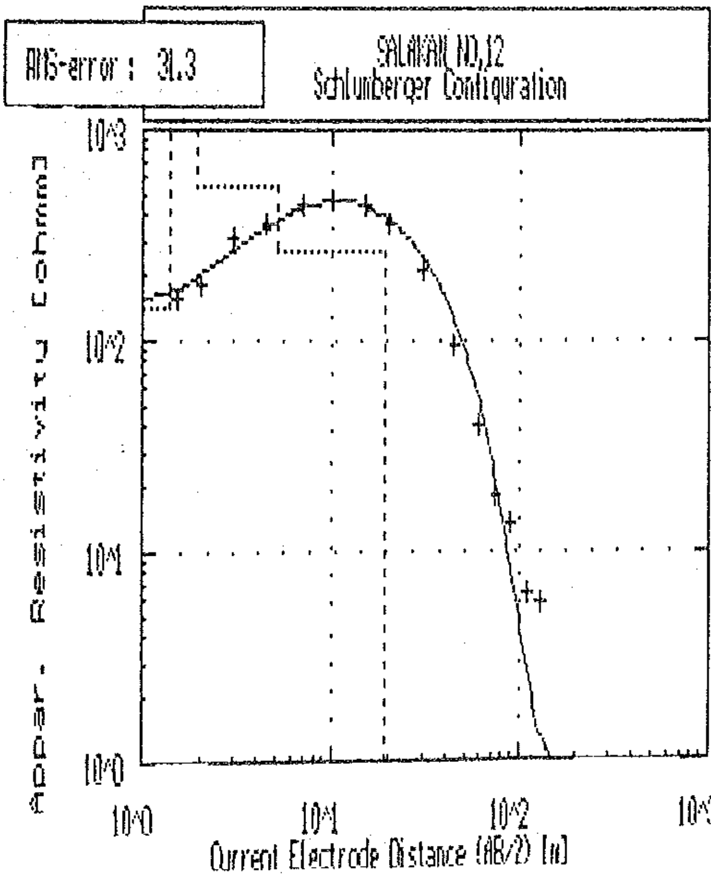
No	Res	Thick	Depth
1	59.3	1.2	1.2
2	652.4	0.2	1.4
3	1546.4	10.1	11.5
4	41.1	-.-	-.-



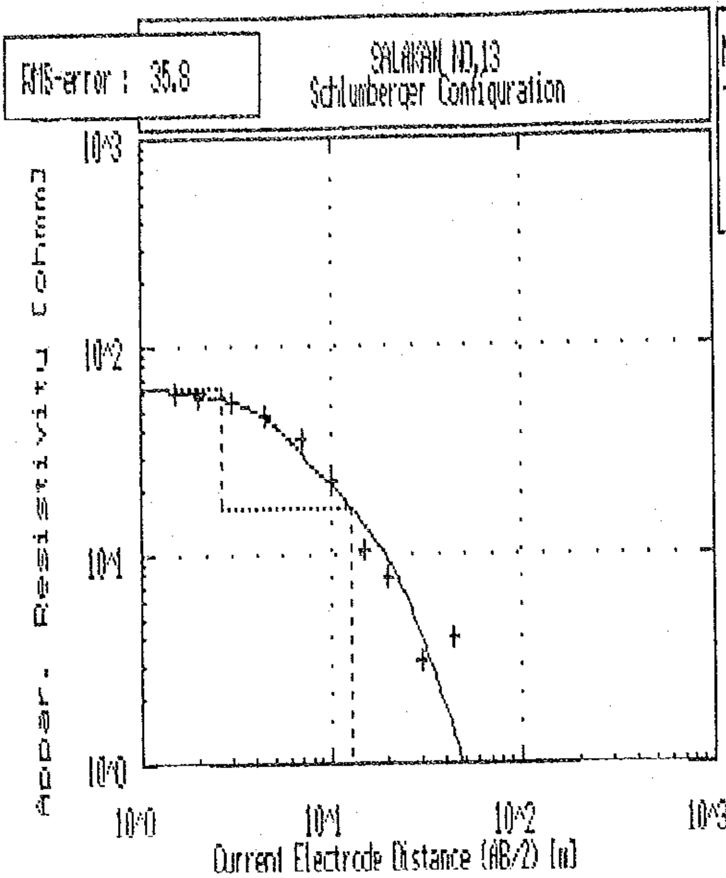
No	Res	Thick	Depth
1	191.4	1.8	1.8
2	371.1	0.8	2.6
3	40.7	10.4	13.0
4	0.2	-.-	-.-



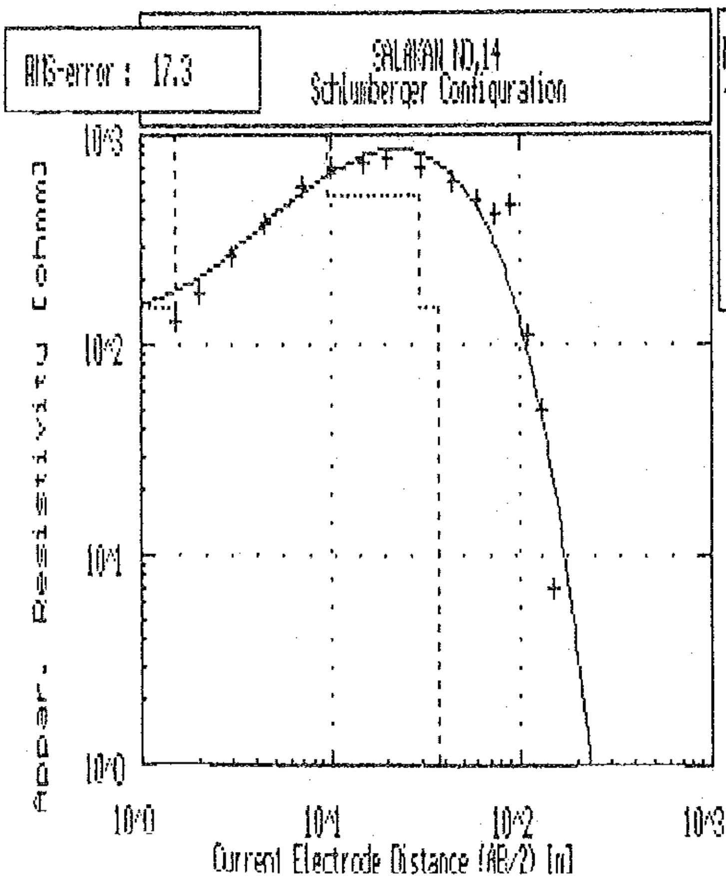
No	Res	Thick	Depth
1	700.0	1.4	1.4
2	2100.0	0.6	2.0
3	285.0	3.2	5.2
4	3.1	-.-	-.-



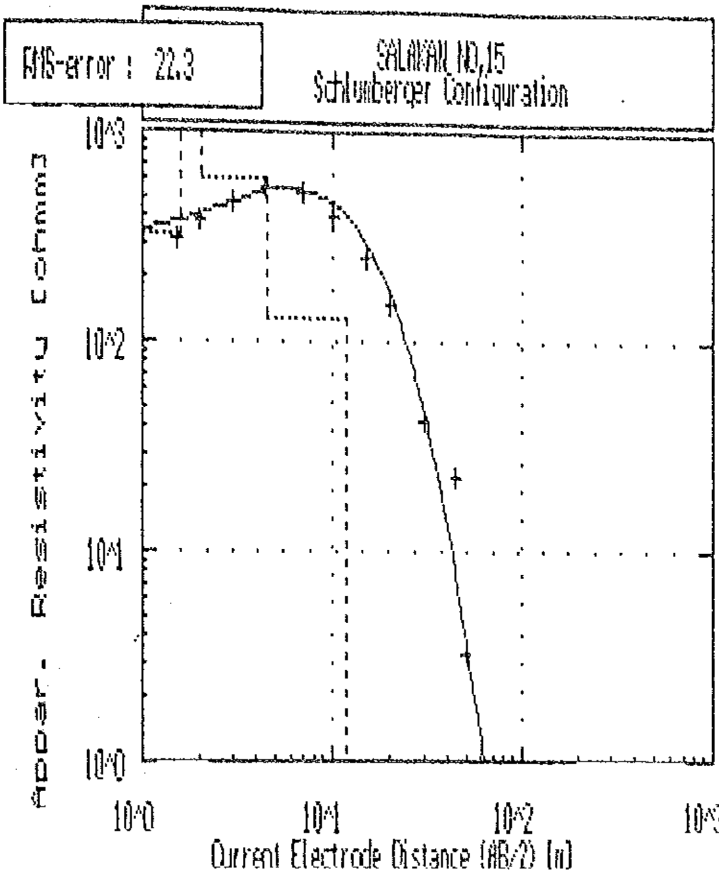
No	Res	Thick	Depth
1	143.3	1.4	1.4
2	4135.8	0.5	1.9
3	531.2	3.2	5.1
4	268.3	13.6	18.7
5	0.8	-.-	-.-



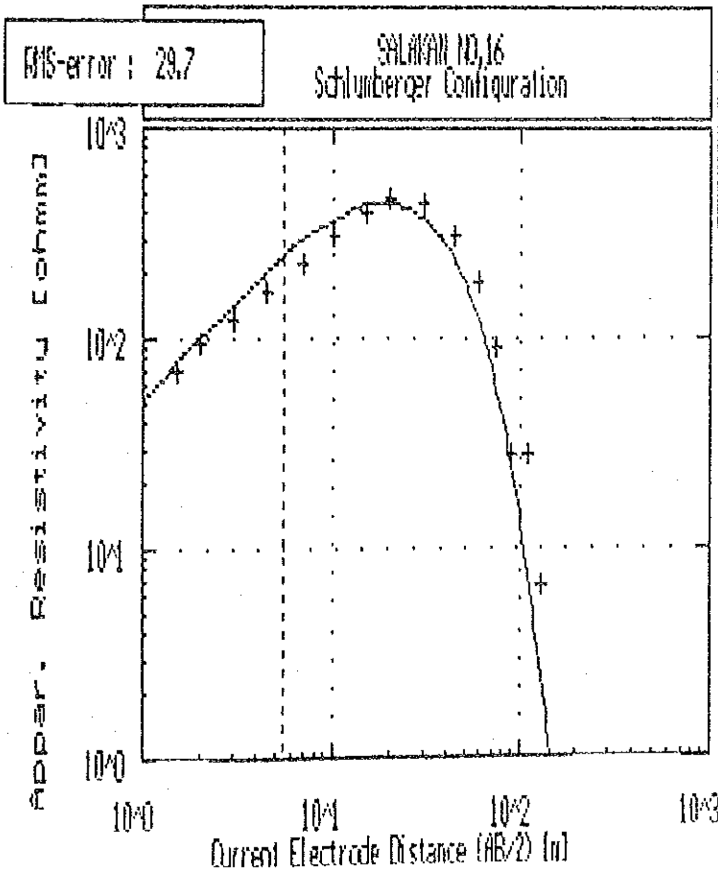
No	Res	Thick	Depth
1	62.4	2.6	2.6
2	16.7	10.0	12.7
3	0.4	-.-	-.-



No	Res	Thick	Depth
1	152.7	1.5	1.5
2	1938.7	8.0	9.5
3	505.0	19.9	29.4
4	150.1	8.4	37.8
5	0.1	-.-	-.-



No	Res	Thick	Depth
1	330.1	1.6	1.6
2	3406.5	0.5	2.1
3	595.9	2.5	4.6
4	128.7	7.1	11.7
5	0.4	-.-	-.-

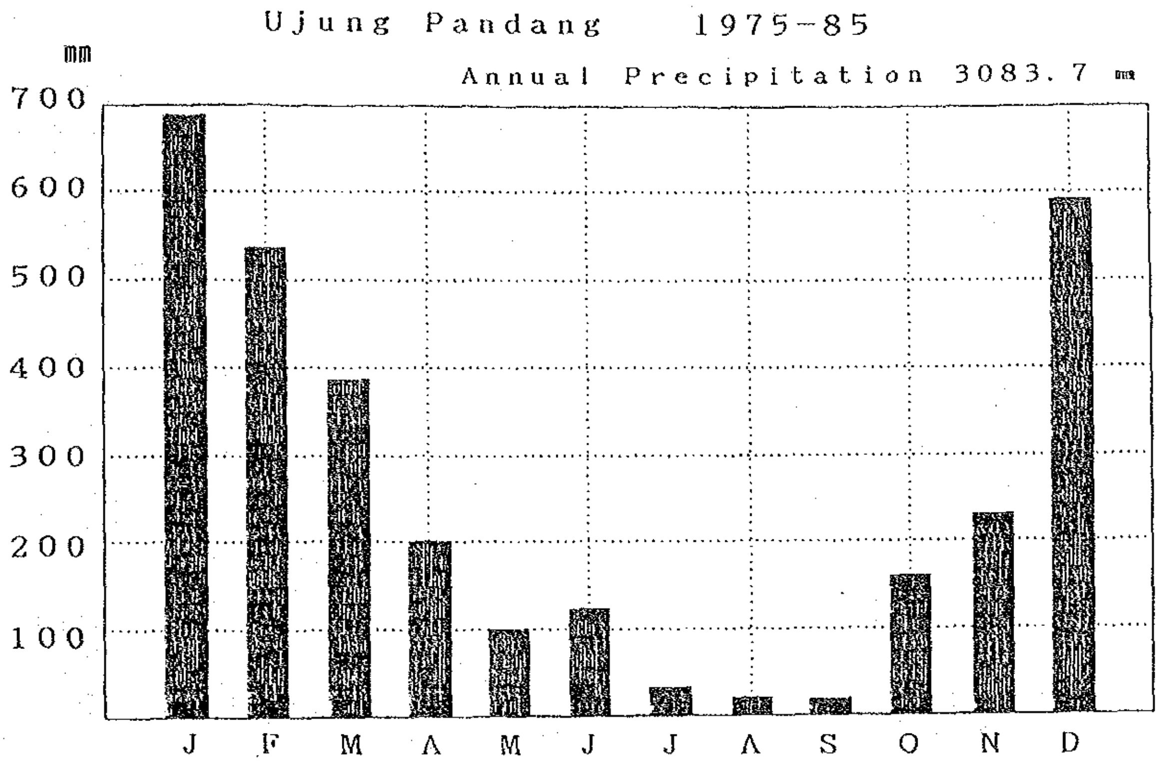


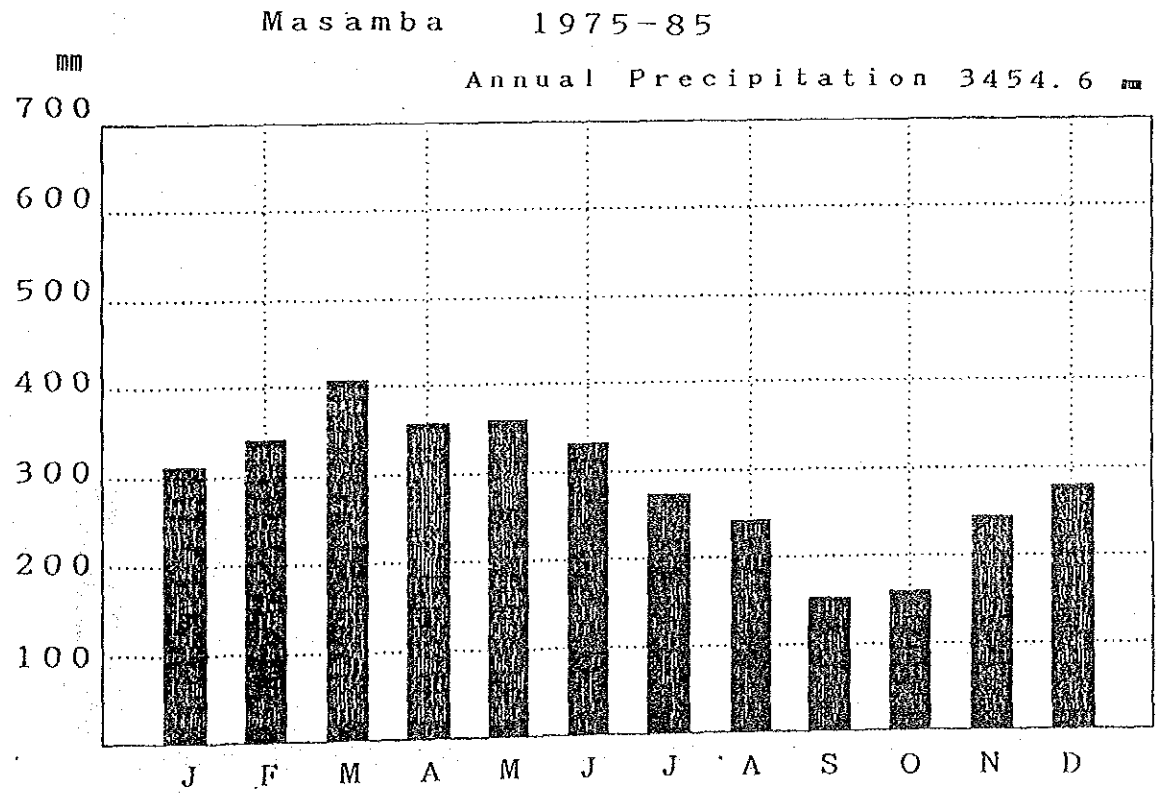
No	Res	Thick	Depth
1	22.2	0.4	0.4
2	1941.7	5.1	5.6
3	0.1	-.-	-.-

APPENDIX 5-4

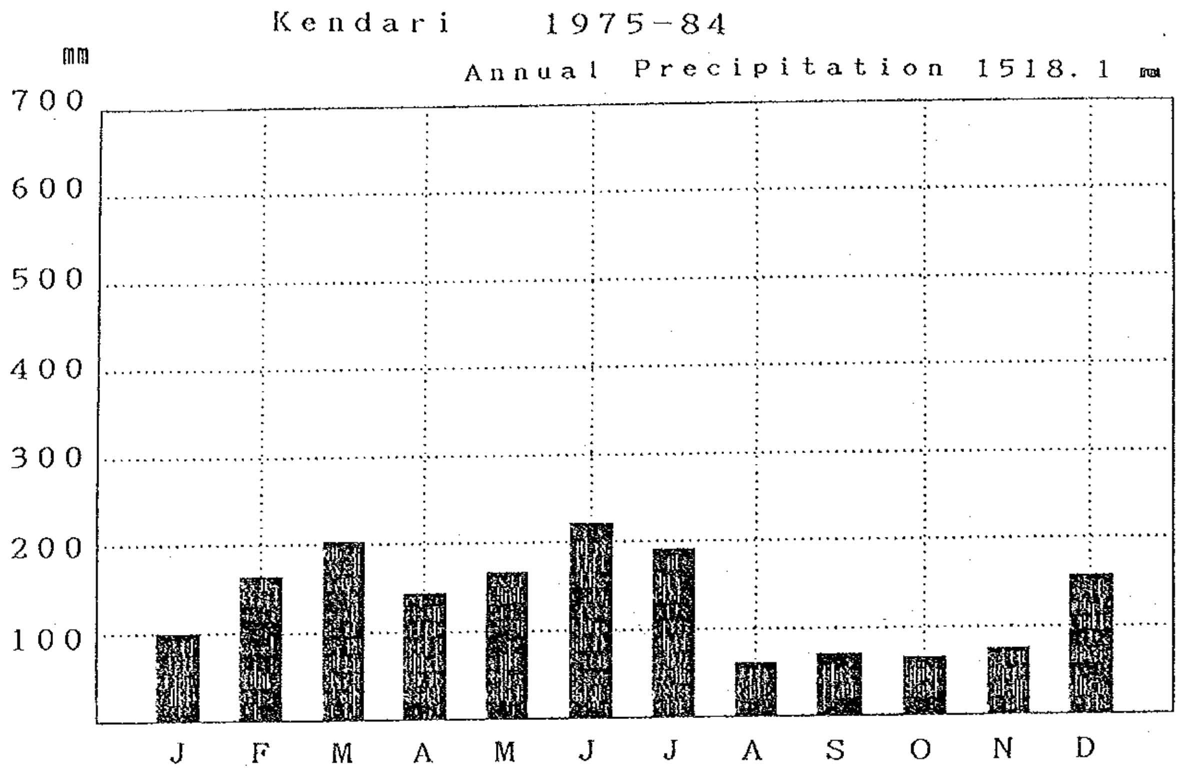
Monthly Average Rainfall

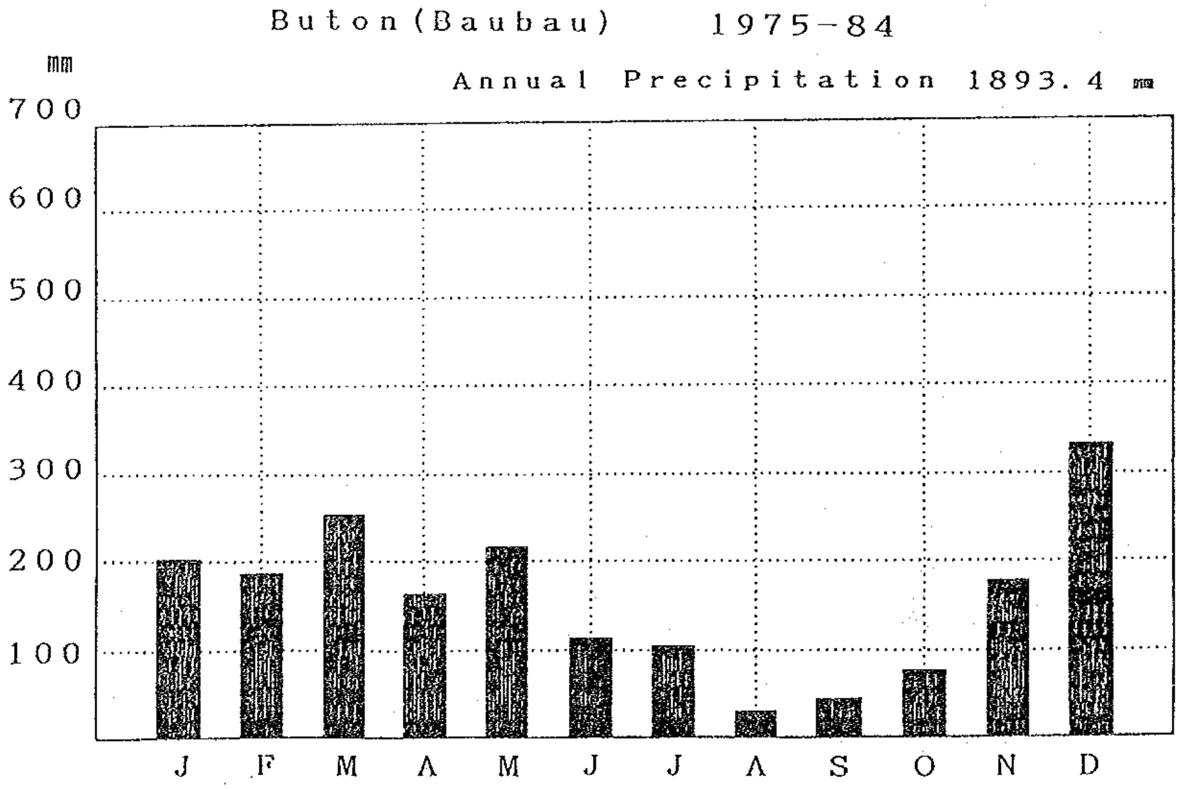
(Ujung Pandang/Masamba)



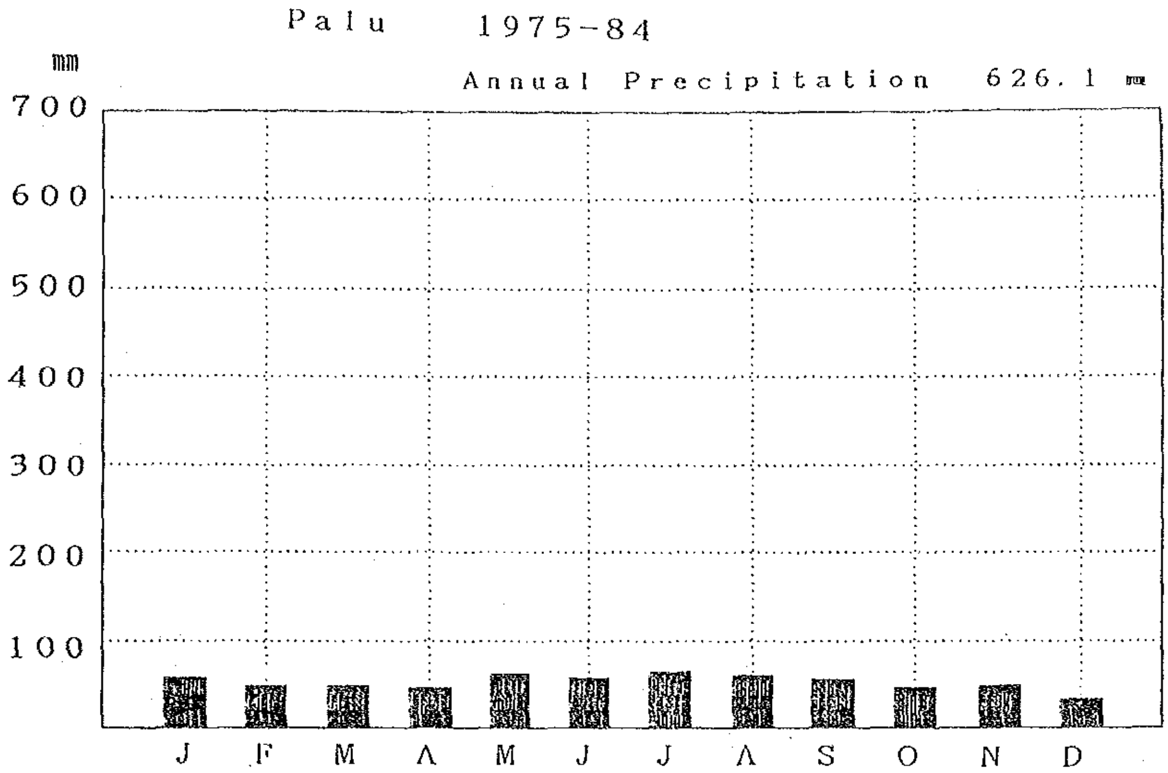


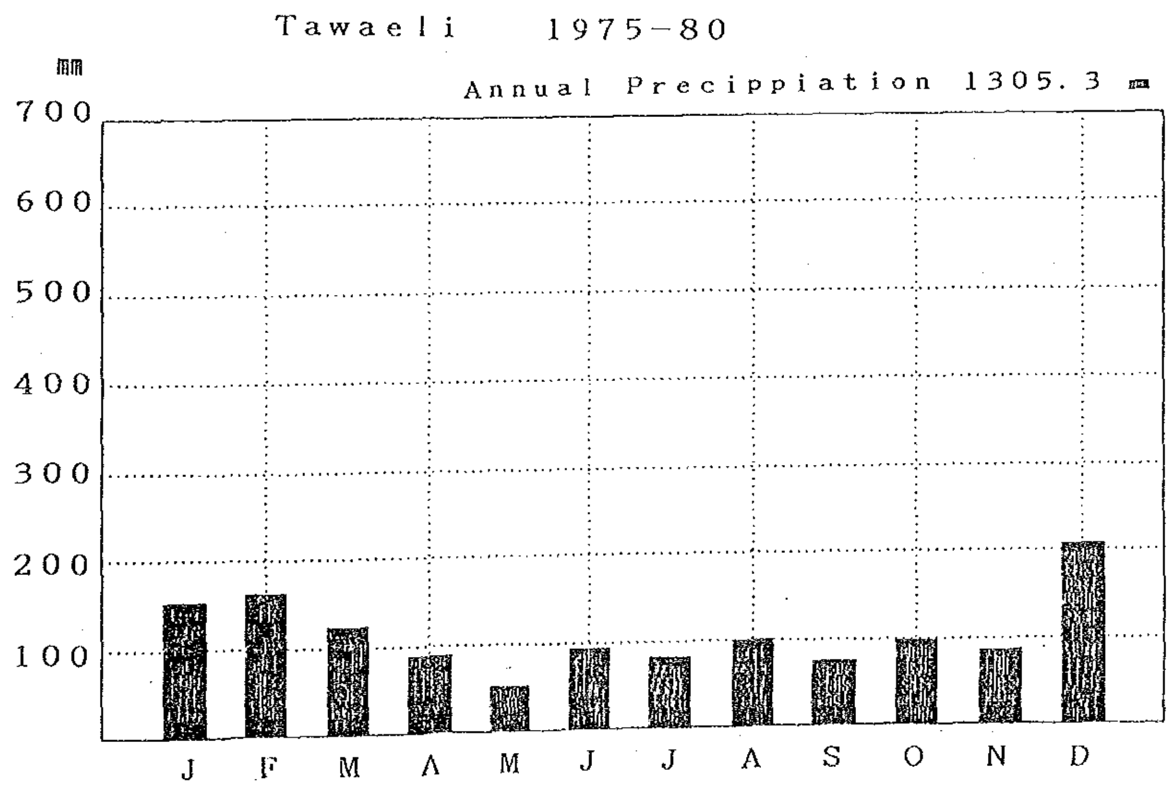
(Kendari/Buton)



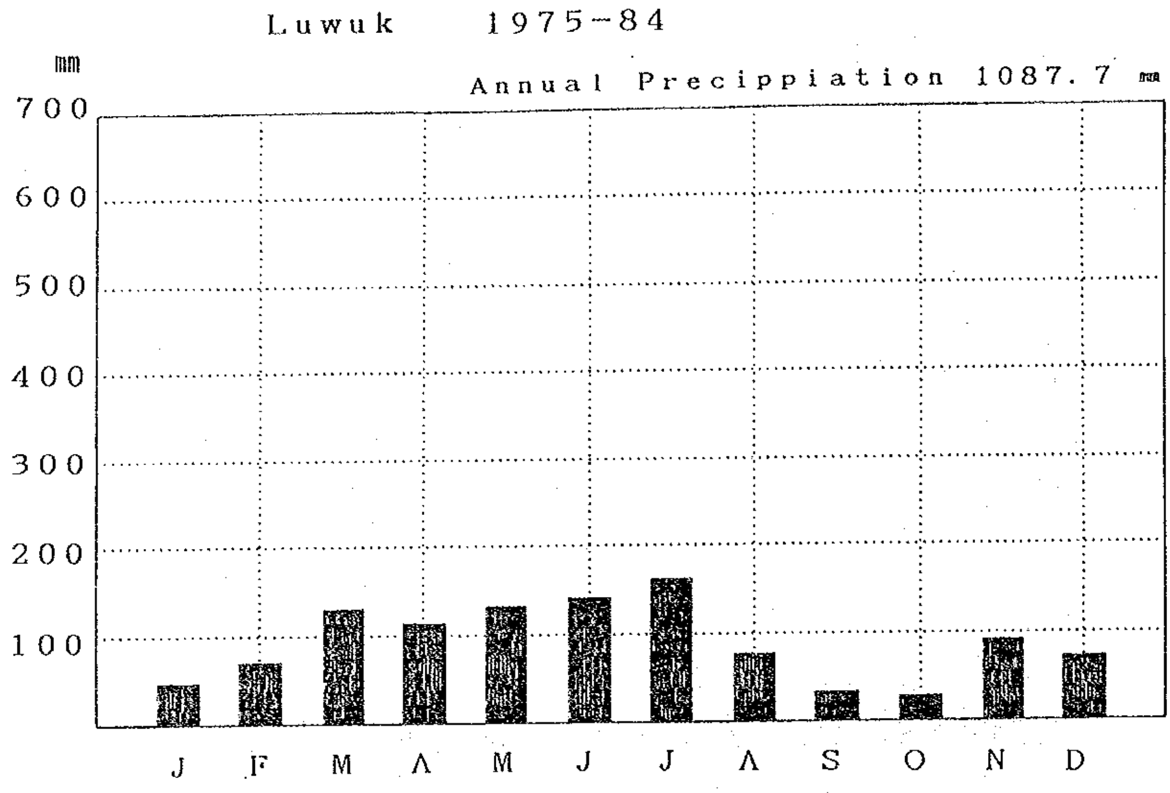


(Palu/Tawaeli)





(Luwuk)


Luwuk 1975-84
mm
Annual Precippiation 1087.7 mm
700
600
500
400
300
200
100
J
F
M
A
M
J
J
A
S
O
N
D

APPENDIX 5-5

Results of Hydraulic Calculation

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	(ULUSALU)	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
2	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
3	INTAKE	0	500.0								500.0		
4	RESERVOIR	26(IN)	355.5	1344.8	GSP	51	2.2	1.09	27.2	36.6	463.4	107.9	144.5
5													
6		26(OUT)	353.5										
7											353.5		
8		29	348.4	122.3	GSP	102	6.5	0.8	6.9	0.8	352.7	4.3	5.1
9	PRESSURE	45 (IN)	298.3	731.3	GSP	76	6.5	1.45	29	21.2	331.5	33.2	55.2
10	BREAKING	45 (OUT)	298.3								298.3		
11		65	246.5	1182.4	GSP	102	6.2	0.76	6.3	7.4	290.9	44.4	51.8
12		72	242.4	771.2	PVC	81.4	4.8	0.93	11.8	9.1	281.8	39.4	55.9
13		73	241.2	134.1	PVC	57	4.8	1.9	67.1	9	272.8	31.6	57.1
14		74	238.7	175.9	PVC	57	4.8	1.9	67.1	11.8	261.0	22.3	59.6
15		75	238.1	38.0	PVC	57	4.8	1.9	67.1	2.5	258.5	20.4	60.2
16		4+700	236.1	200.0	PVC	57	2.9	1.15	26.4	5.3	253.2	17.1	62.2
17		77	230.6	249.1	PVC	57	2.0	0.79	13.3	3.3	249.9	19.3	67.7
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
29	SALU	BRANCH	G.L.	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
30	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
31	INTAKE	1	500.0								500.0		
32	RESERVIR	29(IN)	382.2	771.1	GSP	38	1.8	1.6	78.8	60.8	439.2	57.0	117.8
33													
34	RESERVOIR	29(OUT)	380.2										
35											380.2		
36		37	335.7	446.8	GSP	76	5.4	1.2	20.6	9.2	371.0	35.3	44.5
37		43	333.2	513.0	PVC	57	1.3	0.52	6	3.1	367.9	34.7	47.0
38		59	357.2	809.1	PVC	57	1.1	0.44	4.4	3.6	364.3	7.1	23.0
39													
40		37				76					371.0		
41		77	321.6	1356.5	PVC	81.4	4.1	0.79	8.8	11.9	359.1	37.5	11.6
42		92	315.1	1231.8	PVC	57	2.7	1.07	23.2	28.6	330.5	15.4	65.1
43		103	315.8	725.6	PVC	57	1.2	0.48	5.2	3.8	326.7	10.9	64.4
44													
45													
46													
47													
48													
49													
50													
51													
52													
53													
54													
55													
56													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
57	KAERO	BRANCH	G.L.	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
58	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
59	INTAKE	0	500.0								500.0		
60	RESERVOIR	30(IN)	462.8	1863.0	GSP	76	2.3	0.51	4.2	7.8	492.2	29.4	37.2
61													
62		30(OUT)	460.8										
63											460.8		
64		40	430.1	1134.7	GSP	157	5.4	0.28	0.6	0.7	460.1	30.0	30.7
65		48	429.0	730.8	PVC	99.4	4.6	0.6	4.1	3	457.1	28.1	31.8
66		58	429.2	816.4	PVC	99.4	3.8	0.49	2.9	2.4	454.7	25.5	31.6
67		68	416.2	1095.7	PVC	81.4	2.4	0.47	3.3	3.6	451.1	34.9	44.6
68		76	429.2	720.3	PVC	57	1.1	0.44	4.4	3.2	447.9	18.7	31.6
69		89	420.5	1182.9	PVC	57	0.8	0.31	2.4	2.8	445.1	24.6	40.3
70		92	405.0	488.2	PVC	35.2	0.3	0.31	4.2	2.1	443.0	38.0	55.8
71													
72													
73													
74													
75		89				57					445.1		
76		93	419.2	35.0	PVC	35.2	0.5	0.52	10.7	0.4	444.7	25.5	41.6
77		94	418.7	135.0	PVC	35.2	0.3	0.31	4.2	0.6	444.1	25.4	42.1
78													
79		93				35.2					444.7		
80		99	417.0	253.1	PVC	35.2	0.3	0.31	4.2	1.1	443.6	26.6	43.8
81													
82													
83													
84													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
85	MASAMBA	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
86	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
87													
88	ELEVATED												
89	TANK(500.0)	0(OUT)	515.8								515.8		
90		7	487.1	1702.1	PVC	180.8	25.8	1.02	5.5	9.4	506.4	19.3	28.7
91		8	487.1	139.7	PVC	144.6	20.9	1.29	11	1.5	504.9	17.8	28.7
92		9	485.2	149.4	PVC	99.4	9.6	1.25	16.1	2.4	502.5	17.3	30.6
93		10	485.5	87.5	PVC	99.4	9.6	1.25	16.1	1.4	501.1	15.6	30.3
94		11	487.9	92.0	PVC	99.4	9.6	1.25	16.1	1.5	499.6	11.7	27.9
95		12	487.9	80.0	GSP	102	8.0	0.99	10.2	0.8	498.8	10.9	27.9
96		13	487.9	82.2	PVC	99.4	8.0	1.04	11.5	0.9	497.9	10.0	27.9
97		14	487.9	94.8	PVC	99.4	8.0	1.04	11.5	1.1	496.8	8.9	27.9
98		15	488.4	282.4	PVC	99.4	5.6	0.73	6	1.7	495.1	6.7	27.4
99													
100													
101		8				144.6					504.9		
102		22	484.8	776.4	PVC	99.4	10.0	1.3	17.4	13.5	491.4	6.6	31.0
103													
104													
105		7				180.8					506.4		
106		16	485.4	252.7	PVC	81.4	7.1	1.38	24.4	6.2	500.2	14.8	30.4
107		25	487.9	255.7	PVC	81.4	4.4	0.85	10.1	2.6	497.6	9.7	27.9
108													
109													
110													
111		14				99.4					496.8		
112		33	488.6	408.9	PVC	35.2	0.4	0.42	7.1	2.9	493.9	5.3	27.2
113													
114		15				99.4					495.1		
115		34	487.4	285.9	PVC	57	1.7	0.67	9.8	2.8	492.3	4.9	28.4
116													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
117	TOAYA	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
118	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
119	INTAKE	0	500.0								500.0		
120		9(IN)	492.1	718.0	GSP	102	2.9	0.36	1.6	1.1	498.9	6.8	7.9
121	RESERVOIR												
122		9(OUT)	490.1										
123											490.1		
124		22	461.5	2435.0	GSP	157	7.1	0.37	1	2.4	487.7	26.2	28.6
125		23	457.9	165.0	PVC	57	7.1	2.81	138.5	22.9	464.8	6.9	32.2
126		25	450.8	322.7	PVC	35.2	0.5	0.52	10.7	3.5	461.3	10.5	39.3
127													
128		22				157					487.7		
129		26	458.4	257.6	PVC	81.4	6.6	1.28	21.3	5.5	482.2	23.8	31.7
130		30	451.0	500.0	PVC	35.2	0.5	0.52	10.7	5.4	476.8	25.8	39.1
131													
132		22				81.4					487.7		
133		32	456.4	406.5	PVC	57	3.2	1.27	31.7	12.9	474.8	18.4	33.7
134		33	456.1	100.0	PVC	57	2.8	1.11	24.8	2.5	472.3	16.2	34.0
135													
136		26				81.4					482.2		
137		34	455.7	141.5	PVC	57	6.6	2.61	121	17.1	465.1	9.4	34.4
138		37	438.3	711.8	PVC	57	1.1	0.44	4.4	3.1	462.0	23.7	51.8
139													
140		23				57					464.8		
141		38	455.8	266.2	PVC	35.2	0.6	0.62	15	4	460.8	5.0	34.3
142													
143		32									474.8		
144		39	461.1	255.0	PVC	35.2	0.5	0.52	10.7	2.7	472.1	11.0	29.0

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
145	MALILI	BRANCH	G.L.	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
146	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
147	INTAKE	-1	515.0								515.0		
148	RESERVOIR	0(IN)	503.0	50.0	GSP	76	6.0	1.34	25	1.3	513.7	10.7	12.0
149													
150		0(OUT)	501.0										
151											501.3		
152		50	482.8	7923.2	PVC	226.2	13.9	0.35	0.6	4.8	496.5	13.7	18.2
153		56	481.7	1415.3	PVC	144.6	13.5	0.83	4.9	6.9	489.6	7.9	19.3
154		63	480.0	1132.1	PVC	144.6	9.1	0.57	2.4	2.7	486.9	6.9	21.0
155		64	481.8	36.8	PVC	144.6	9.1	0.57	2.4	0.1	486.8	5.0	19.2
156		65	481.6	49.8	PVC	144.6	9.1	0.57	2.4	0.1	486.7	5.1	19.4
157		66	481.3	110.0	PVC	144.6	9.1	0.57	2.4	0.3	486.4	5.1	19.7
158		67	481.6	142.3	PVC	144.6	9.1	0.57	2.4	0.3	486.1	4.5	19.4
159		69	481.6	208.5	PVC	144.6	9.1	0.57	2.4	0.5	485.6	4.0	19.4
160													
161													
162													
163													
164													
165													
166													
167													
168													
169													
170													
171													
172													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
173	BALANTAK	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
174	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
175	INTAKE	0	500.0								500.0		
176	RESERVOIR	10(IN)	402.9	504.3	GSP	51	3.3	1.63	57.7	29.1	470.9	68.0	97.1
177													
178		10(OUT)	400.9								400.9		
179		18	387.6	353.3	GSP	102	8.5	1.05	11.4	4	396.9	9.3	13.3
180		23	382.4	544.9	PVC	144.6	8.1	0.5	1.9	1	395.9	13.5	18.5
181		26	381.4	603.7	PVC	99.4	7.9	1.03	11.2	6.8	389.1	7.7	19.5
182		28	374.9	427.6	PVC	99.4	6.8	0.88	8.5	3.6	385.5	10.6	26.0
183		40	355.7	2210.2	PVC	99.4	6.1	0.8	7	15.5	370.0	14.3	45.2
184		44	356.7	636.7	PVC	81.4	0.9	0.17	0.5	0.3	369.7	13.0	44.2
185													
186		18				102					396.9		
187		45	392.2	128.1	PVC	57	0.2	0.08	0.2	0	396.9	4.7	8.7
188													
189													
190													
191													
192													
193													
194													
195													
196													
197													
198													
199													
200													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
201	LAPUKO	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
202	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
203	INTAKE	0	500.0								500.0		
204	ELEVATED	26(IN)	493.3	1427.7	GSP	157	3.1	0.16	0.2	0.3	499.7	6.4	6.7
205	TANK(473.3)												
206		26(OUT)	491.3								491.3		
207		27	469.8	88.5	GSP	102	7.6	0.94	9.2	0.8	490.5	20.7	21.5
208		35	474.4	1133.8	PVC	144.6	7.1	0.44	1.5	1.7	488.8	14.4	16.9
209		36	472.4	144.1	PVC	81.4	7.1	1.38	24.4	3.5	485.3	12.9	18.9
210		40	471.5	347.9	PVC	81.4	2.6	0.5	3.8	1.3	484.0	12.5	19.8
211													
212		27				102					490.5		491.3
213		42	469.5	268.7	PVC	35.2	0.4	0.42	7.1	1.9	488.6	19.1	21.8
214													
215		35				144.6					488.8		
216		48	480.6	1000.0	PVC	57	0.6	0.23	1.4	1.4	487.4	6.8	10.7
217													
218		36				81.4					485.3		
219		51	470.4	106.1	PVC	35.2	0.5	0.52	10.7	1.1	484.2	13.8	20.9
220													
221													
222													
223													
224													
225													
226													
227													
228													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
229	TAWAELI	BRANCH	G.L.	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
230	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
231	INTAKE	0	500.0								500.0		
232	RESERVOIR	8(IN)	494.7	648.0	PVC	180.8	9.9	0.38	0.9	0.6	499.4	4.7	5.3
233		8(OUT)	492.7								492.7		
234		13	480.8	737.0	PVC	226.2	25.8	0.64	1.8	1.3	491.4	10.6	11.9
235		22	457.4	1573.8	PVC	226.2	25.1	0.62	1.7	2.7	488.7	31.3	35.3
236		23	456.3	246.4	PVC	180.8	23.9	0.94	4.7	1.2	487.5	31.2	36.4
237		4+500	453.0	1294.8	PVC	180.8	17.7	0.69	2.7	3.5	484.0	31.0	39.7
238		28	453.2	354.8	PVC	144.6	15.4	0.94	6.2	2.2	481.8	28.6	39.5
239		30	454.3	381.6	PVC	144.6	13.4	0.82	4.8	1.8	480.0	25.7	38.4
240		31	455.1	273.8	PVC	144.6	12.3	0.75	4.1	1.1	478.9	23.8	37.6
241		38	470.4	1079.3	PVC	144.6	9.6	0.59	2.6	2.8	476.1	5.7	22.3
242		39	469.7	188.0	PVC	144.6	6.9	0.42	1.4	0.3	475.8	6.1	23.0
243		40	469.9	157.0	PVC	99.4	4.5	0.59	4	0.6	475.2	5.3	22.8
244		41	472.3	794.2	PVC	99.4	0.2	0	0	0	475.2	2.9	20.4
245													
246		22				144.6					488.7		
247		46	458.2	863.6	PVC	57	1.3	0.52	6	5.2	483.5	25.3	34.5
248													
249													
250													
251													
252													
253		28				144.6					481.8		
254		50	456.4	491.0	PVC	57	1.5	0.59	7.8	3.8	478.0	21.6	36.3
255													
256													
257													
258													
259													
260													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
261	BONEBOBAKAL	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
262	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
263													
264	RESERVOIR												
265													
266		14(OUT)	532.3								532.3		
267		28	486.7	1242.8	PVC	88.4	3.4	0.56	4.2	5.2	527.1	40.4	45.6
268		32	487.3	522.0	PVC	57	1.6	0.63	8.8	4.6	522.5	35.2	45.0
269		33	488.1	263.6	PVC	57	1.6	0.63	8.8	2.3	520.2	32.1	44.2
270		37	487.2	365.5	PVC	57	1.6	0.63	8.8	3.2	517.0	29.8	45.1
271		40	487.4	339.1	PVC	35.2	0.2	0.21	2	0.7	516.3	28.9	44.9
272													
273													
274													
275													
276		33				57					520.2		
277		50	500.5	183.8	PVC	57	1.6	0.63	8.8	1.6	518.6	18.1	31.8
278		52	500.1	394.8	PVC	35.2	0.2	0.21	2	0.8	517.8	17.7	32.2
279													
280													
281													
282													
283													
284													
285													
286													
287													
288													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
289	SAMBIUT	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
290	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
291	INTAKE	0	500.0								500.0		
292	RESERVOIR	13(IN)	489.3	625.9	GSP	102	3.6	0.44	2.3	1.4	498.6	9.3	10.7
293													
294		13(OUT)	487.3								487.3		
295		21	429.6	558.4	GSP	76	9.1	2.02	54	30.2	457.1	27.5	57.7
296		30	426.3	1042.5	PVC	99.4	5.4	0.71	5.6	5.8	451.3	25.0	61.0
297		34	427.3	877.2	PVC	81.4	3.2	0.62	5.6	4.9	446.4	19.1	60.0
298		39	425.5	912.5	PVC	81.4	1.9	0.37	2.1	1.9	444.5	19.0	61.8
299		41	426.8	1054.6	PVC	57	0.8	0.31	2.4	2.5	442.0	15.2	60.5
300													
301		21									457.1		
302		42	427.0	59.4	GSP	76	3.8	0.84	10.7	0.6	456.5	29.5	60.3
303		45	427.3	561.4	PVC	81.4	3.8	0.74	7.7	4.3	452.2	24.9	60.0
304		52	430.0	1101.3	PVC	81.4	2.6	0.5	3.8	4.2	448.0	18.0	57.3
305													
306													
307													
308													
309													
310													
311													
312													
313													
314													
315													
316													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
317	SALAKAN	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
318	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
319											476.0		
320													
321													
322	RESERVOIR	1(OUT)	503.8								503.8		
323		12	468.2	1419.8	PVC	99.4	5.9	0.77	6.6	9.4	494.4	26.2	35.6
324		13	467.4	189.1	PVC	81.4	5.9	1.14	17.3	3.3	491.1	23.7	36.4
325		15	466.5	238.8	PVC	81.4	5.9	1.14	17.3	4.1	487.0	20.5	37.3
326		19	466.7	696.6	PVC	57	1.8	0.71	10.9	7.6	479.4	12.7	37.1
327													
328		12				99.4					494.4		
329		22	467.2	150.0	PVC	81.4	5.9	1.14	17.3	2.6	491.8	24.6	36.6
330		23	466.0	200.0	PVC	81.4	5.9	1.14	17.3	3.5	488.3	22.3	37.8
331		26	465.1	200.0	PVC	81.4	2.4	0.47	3.3	0.7	487.6	22.5	38.7
332		27	465.0	16.0	PVC	57	2.4	0.95	18.6	0.3	487.3	22.3	38.8
333		29	466.0	363.9	PVC	35.2	1.0	1.04	38.5	14	473.3	7.3	37.8
334													
335													
336													
337													
338													
339													
340													
341													
342													
343													
344													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
345	MOWEWE	BRANCH	G.L.	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
346	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
347													
348	ELEVATED												
349	TANK(512.8)	R(OUT)	523.8								523.8		
350		11	512.8	50.0	PVC	144.6	11.1	0.68	3.4	0.2	523.6	10.8	11.0
351		7	508.2	686.4	PVC	144.6	10.5	0.65	3.1	2.1	521.5	13.3	15.6
352		6	506.7	232.6	PVC	99.4	7.2	0.94	9.5	2.2	519.3	12.6	17.1
353		5	506.7	343.8	PVC	81.4	6.0	1.16	17.9	6.2	513.1	6.4	17.1
354		3	505.2	366.8	PVC	81.4	4.9	0.95	12.3	4.5	508.6	3.4	18.6
355		14	495.0	1420.5	PVC	81.4	2.0	0.38	2.3	3.3	505.3	10.3	28.8
356													
357		R				144.6					523.8		
358		15	513.8	50.0	PVC	81.4	2.0	0.38	2.3	0.1	523.7	9.9	10.0
359		17	516.2	395.0	PVC	57	0.7	0.28	1.9	0.8	522.9	6.7	7.6
360													
361		7				144.6					521.5		
362		18	508.4	95.3	PVC	81.4	2.0	0.38	2.3	0.2	521.3	12.9	15.4
363		19	510.6	250.7	PVC	57	0.7	0.28	1.9	0.5	520.8	10.2	13.2
364													
365		6				99.4					519.3		
366		20	509.6	368.1	PVC	57	1.2	0.48	5.2	1.9	517.4	7.8	14.2
367													
368		5				81.4					513.1		
369		21	507.1	373.3	PVC	57	1.2	0.48	5.2	1.9	511.2	4.1	16.7
370													
371													
372													
373													
374													
375													
376													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
377	WAKADIA	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
378	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
379													
380	ELEVATED												
381	TANK(543.3)												
382		16(OUT)	564.3								564.3		
383		18	533.9	1166.4	PVC	144.6	9.9	0.61	2.8	3.3	561.0	27.1	30.4
384		29	537.5	1138.7	PVC	99.4	6.9	0.9	8.8	10	551.0	13.5	26.8
385		33	536.6	500.0	PVC	81.4	2.1	0.41	2.6	1.3	549.7	13.1	27.7
386													
387		29				99.4					551.0		
388		37	519.4	1000.0	PVC	81.4	4.4	0.85	10.1	10.1	540.9	21.5	44.9
389		2+800	516.8	1800.0	PVC	81.4	4.4	0.85	10.1	18.2	522.7	5.9	47.5
390													
391													
392													
393													
394													
395													
396													
397													
398													
399													
400													
401													
402													
403													
404													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
405	LANDONO	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
406	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
407													
408	ELEVATED												
409	TANK(500.0)												
410		0(OUT)	511.0								511.0		
411		12	466.9	2992.4	PVC	144.6	10.5	0.65	3.1	9.3	501.7	34.8	44.1
412		13	472.0	404.7	PVC	81.4	9.4	1.82	41	16.6	485.1	13.1	39.0
413		15	474.6	665.9	PVC	81.4	2.4	0.47	3.3	2.2	482.9	8.3	36.4
414													
415		12				144.6					501.7		
416		16	459.8	783.9	PVC	81.4	9.4	1.82	41	32.1	469.6	9.8	51.2
417													
418													
419		17									486.9		
420		18	463.1	665.4	PVC	57	1.2	0.48	5.2	3.5	483.4	20.3	47.9
421													
422													
423													
424													
425													
426													
427													
428													
429													
430													
431													
432													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
433	ANDONOHU	BRANCH	G.L.	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
434	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
435	INTAKE		500.0								500.0		
436	PUMP ST.		487.7	1250.0	GSP	157	4.6	0.23	0.4	0.5	499.5	11.8	12.3
437	ELEVATED												
438	TANK(505.0)	.-1(OUT)	526.0								526.0		
439		26	505.4	50.0	GSP	102	11.1	1.37	18.6	0.9	525.1	19.7	20.6
440		21	478.2	1415.9	PVC	144.6	7.4	0.45	1.6	2.3	522.8	44.6	47.8
441		17	477.5	1113.2	PVC	99.4	4.3	0.56	3.7	4.1	518.7	41.2	48.5
442		16	474.4	254.5	PVC	81.4	3.3	0.64	5.9	1.5	517.2	42.8	51.6
443		7	487.4	1723.0	PVC	81.4	2.4	0.47	3.3	5.7	511.5	24.1	38.6
444		5	493.6	411.5	PVC	81.4	1.9	0.37	2.1	0.9	510.6	17.0	32.4
445		0	505.3	1107.8	PVC	81.4	0.6	0.13	0.3	0.3	510.3	5.0	20.7
446		26	505.4	37.4	PVC	81.4	0.6	0.13	0.3	0	510.3	4.9	20.6
447													
448													
449													
450													
451		26				144.6					525.1		
452		30	492.6	720.2	PVC	35.2	0.6	0.62	15	10.8	514.3	21.7	33.4
453													
454													
455													
456													
457													
458													
459													
460													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
461	LIANG	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
462	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
463	INTAKE	0	500.0								500.0		
464	RESERVOIR	16(IN)	472.3	450.1	GSP	76	2.4	0.54	4.6	2.1	497.9	25.6	27.7
465													
466		16(OUT)	470.3								470.3		
467		26	427.6	299.9	GSP	76	6.8	1.51	31.5	9.4	460.9	33.3	42.7
468		28	425.8	106.6	PVC	81.4	6.4	1.24	20.2	2.2	458.7	32.9	44.5
469		31	426.4	396.2	PVC	81.4	6.4	1.24	20.2	8	450.7	24.3	43.9
470		33	428.5	68.2	PVC	81.4	3.9	0.76	8.1	0.6	450.1	21.6	41.8
471		37	426.0	312.7	PVC	57	2.4	0.95	18.6	5.8	444.3	18.3	44.3
472		40	442.1	392.5	PVC	57	0.5	0.2	1	0.4	443.9	1.8	28.2
473													
474		37				57					444.3		
475		49	424.9	255.4	GSP	51	2.0	0.99	22.8	5.8	438.5	13.6	45.4
476													
477		28				81.4					458.7		
478		47	426.1	120.7	PVC	35.2	0.2	0.21	2	0.2	458.5	32.4	44.2
479													
480													
481													
482													
483													
484													
485													
486													
487													
488													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
489	TAKIMPO	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
490	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
491													
492	ELEVATED												
493	TANK(511.0)												
494		19(OUT)	526.8								526.8		
495		1+100	500.5	630.9	PVC	144.6	17.6	1.08	8	5	521.8	21.3	26.3
496		31	508.3	780.2	PVC	144.6	17.6	1.08	8	6.2	515.6	7.3	18.5
497		36	508.2	640.5	PVC	144.6	7.6	0.47	1.7	1.1	514.5	6.3	18.6
498		37	508.3	25.6	PVC	99.4	5.9	0.77	6.6	0.2	514.3	6.0	18.5
499		39	508.3	183.5	PVC	81.4	3.0	0.58	5	0.9	513.4	5.1	18.5
500		40	507.6	146.8	PVC	81.4	3.0	0.58	5	0.7	512.7	5.1	19.2
501		42	503.4	216.6	PVC	57	1.4	0.56	6.9	1.5	511.2	7.8	23.4
502													
503													
504													
505													
506													
507													
508													
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510													
511													
512													
513													
514													
515													
516													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
517	SANDANGPANG	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
518	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
519													
520	RESERVOIR												
521													
522		15(OUT)	775.5								775.5		
523		17	745.7	276.1	PVC	81.4	8.8	1.71	36.3	10	765.5	19.8	29.8
524		19	746.0	239.1	PVC	81.4	6.7	1.3	21.9	5.2	760.3	14.3	29.5
525		23	742.1	215.8	PVC	81.4	4.2	0.81	9.2	2	758.3	16.2	33.4
526		47	730.8	2229.9	PVC	81.4	3.5	0.68	6.6	14.7	743.6	12.8	44.7
527													
528		17				81.4					765.5		
529		48	745.0	126.1	PVC	35.2	0.7	0.73	19.9	2.5	763.0	18.0	30.5
530													
531		17				81.4					765.5		
532		49	750.6	97.4	PVC	35.2	0.7	0.73	19.9	1.9	763.6	13.0	24.9
533													
534		19				81.4					760.3		
535		50	746.8	47.6	PVC	35.2	0.7	0.73	19.9	0.9	759.4	12.6	28.7
536													
537													
538													
539													
540													
541													
542													
543													
544													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
545	LAOMPO	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
546	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
547													
548	ELEVATED												
549	TANK(511.7)												
550		15(OUT)	522.4								522.4		
551		31	507.3	2274.9	PVC	144.6	9.4	0.58	2.5	5.7	516.7	9.4	15.1
552		41	503.3	2298.2	PVC	144.6	6.4	0.39	1.2	2.8	513.9	10.6	19.1
553		47	501.5	1098.0	PVC	81.4	3.2	0.62	5.6	6.1	507.8	6.3	20.9
554													
555													
556													
557													
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572													

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
573	TROMANDA-1	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
574	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
575	INTAKE	0	1000.0								1000.0		
576		72(IN)	919.3	2800.1	GSP	76	1.6	0.36	3.4	9.5	990.5	71.2	80.7
577	RESERVIOR												
578		72(OUT)	917.2										
579											917.2		
580	PRESSURE	85	883.7	559.5	GSP	76	4.8	1.07	25.8	14.4	902.8	19.1	33.5
581	BREAKING												
582											883.7		
583	PRESSURE	93	829.2	406.5	GSP	76	4.8	1.07	25.8	10.5	873.2	44.0	54.5
584	BREAKING												
585											829.2		
586	PRESSURE	96	754.1	218.3	GSP	51	4.8	2.37	180.2	39.3	789.9	35.8	75.1
587	BREAKING												
588											754.1		
589		99	717.1	215.8	GSP	76	4.6	1.02	23.9	5.2	748.9	31.8	37.0
590		104	687.1	364.6	GSP	51	3.9	1.93	122.8	44.8	704.1	17.0	67.0
591													
592	PRESSURE	127	499.1	988.8	GSP	51	3.5	1.73	100.5	99.4	604.7	105.6	255.0
593	BREAKING												
594											499.1		
595		133	452.3	207.7	GSP	51	2.5	1.24	53.9	11.2	487.9	35.6	46.8
596													
597	PRESSURE	149	404.7	427.8	GSP	38	1.6	1.43	99	42.4	445.5	40.8	94.4
598	BREAKING												
599											404.7		
600		162	361.2	554.1	GSP	51	1.4	0.69	18.4	10.2	394.5	33.3	43.5

HYDRAULIC CONDITION-5

	A	B	C	D	E	F	G	H	I	J	K	L	M
601	TROMANDA-2	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
602	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
603		165	356.7	161.6	PVC	35.2	0.5	0.52	16.7	2.7	391.8	35.1	48.0
604													
605		177	364.3	536.8	PVC	57	0.6	0.24	2.2	1.2	393.3	29.0	40.4
606													
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627													

HYDRAULIC CONDITION-5

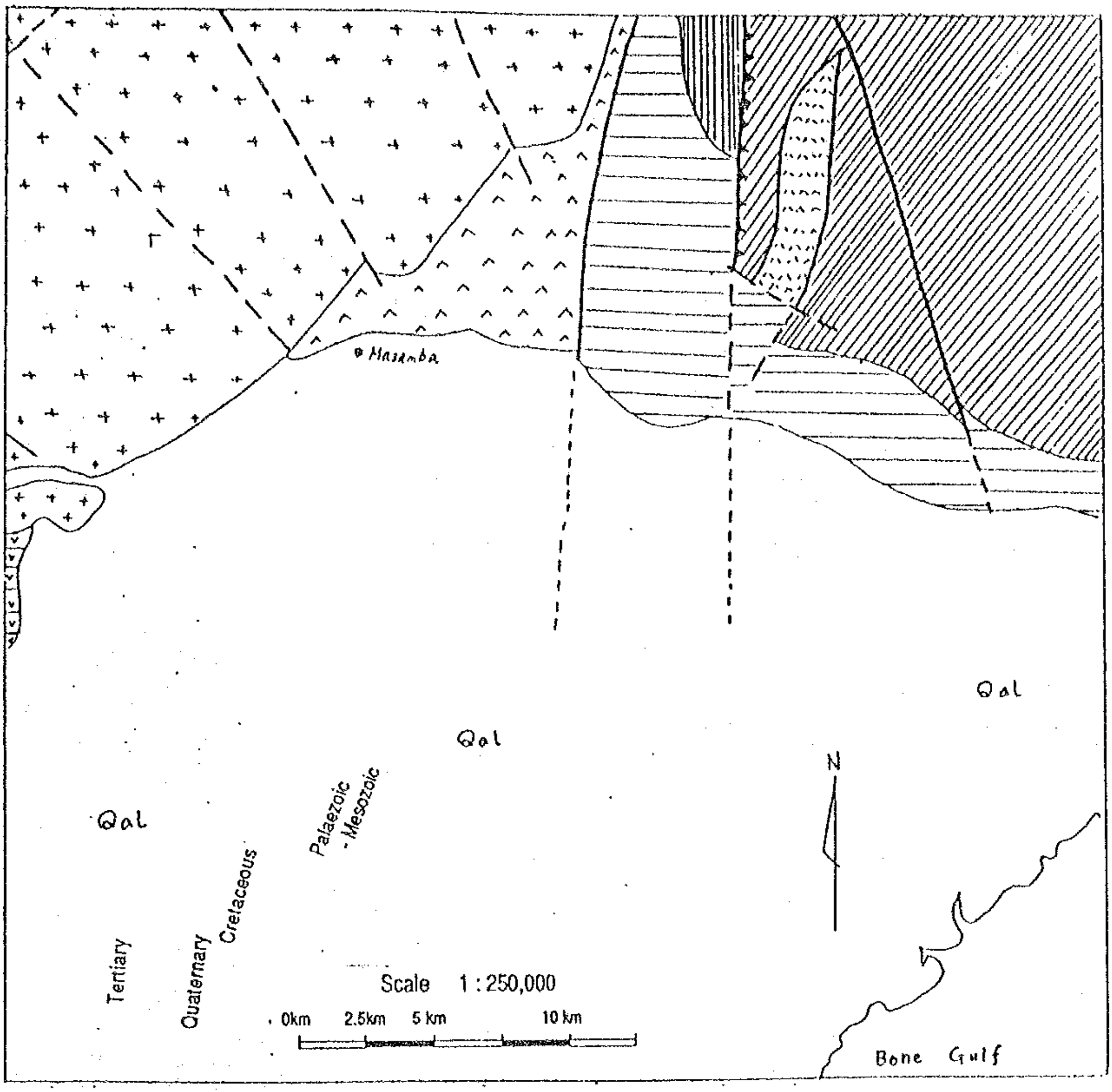
	A	B	C	D	E	F	G	H	I	J	K	L	M
628	BINNANGA-1	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
629	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
630	INTAKE	0	500.0								500.0		
631	RESERVOIR	14(IN)	472.9	1351.5	GSP	102	6.2	0.76	6.3	8.5	491.5	18.6	27.1
632													
633	RESERVOIR	14(OUT)	470.9								470.9		
634		17	440.6	579.5	PVC	144.6	13.0	0.8	4.6	2.7	468.2	27.6	30.3
635		20	431.8	211.0	PVC	81.4	11.3	2.19	57.7	12.2	456.0	24.2	39.1
636		23	382.4	798.8	PVC	81.4	11.3	2.19	57.7	46.1	409.9	27.5	88.5
637	PRESSURE	27(IN)	352.8	605.9	PVC	81.4	11.3	2.19	57.7	35	374.9	22.1	87.8
638	BREAKING	27(OUT)	352.8								352.8		
639		28	326.5	450.6	PVC	99.4	9.0	1.17	14.3	6.4	346.4	19.9	26.3
640		29	307.2	316.0	PVC	81.4	8.3	1.61	32.6	10.3	336.1	28.9	45.6
641		30	310.2	81.8	PVC	81.4	6.7	1.3	21.9	1.8	334.3	24.1	42.6
642		31	309.6	133.2	PVC	81.4	4.9	0.95	12.3	1.6	332.7	23.1	43.2
643		33	310.0	823.1	PVC	81.4	4.0	0.77	8.4	6.9	325.8	15.8	42.8
644		4+200	304.6	200.0	PVC	81.4	3.3	0.64	5.9	1.2	324.6	20.0	48.2
645		4+400	302.6	200.0	PVC	57	2.5	0.99	20.1	4	320.6	18.0	50.2
646		36	272.6	1577.8	PVC	57	1.9	0.75	12.1	19.1	301.5	28.9	80.2
647													
648		29				81.4					336.1		
649		39	312.3	1248.1	PVC	57	1.9	0.75	12.1	15.1	321.0	8.7	158.6
650		41	308.4	559.0	PVC	57	1.7	0.67	9.8	5.5	315.5	7.1	162.5
651													
652		29				81.4					336.1		
653		67	293.0	362.0	PVC	35.2	0.3	0.31	4.2	1.5	334.6	41.6	177.9
654													
655		17				144.6					468.2		
656		54	430.4	943.4	PVC	57	2.1	0.83	14.5	13.7	454.5	24.1	40.5
657		56	440.6	111.9	PVC	57	1.1	0.44	4.4	0.5	454.0	13.4	30.3
658													
659													

	A	B	C	D	E	F	G	H	I	J	K	L	M
660	BINNANGA-2	BRANCH	G.L	LENGTH	Kind of	Diamet-	Quanti-	Veloci-	Gradi-	Friction	Hydraulic Water	Hydraulic	Static
661	LOCATION	No.	(m)	(m)	Pipe	er(mm)	ty(l/s)	ty(m/s)	ent(%)	Loss(m)	Level(m)	Head(m)	Head(m)
662		54				57					454.5		
663		58	419.5	177.6	PVC	35.2	0.3	0.31	4.2	0.7	453.8	34.3	51.4
664													
665		56				57					454.0		
666		61	438.5	264.1	PVC	35.2	0.3	0.31	4.2	1.1	452.9	14.4	32.4
667													
668		20				81.4					456.0		
669		62	433.3	200.0	PVC	35.2	0.7	0.73	19.9	4	452.0	18.7	37.6
670													
671													
672													
673													
674		30				81.4					334.3		
675		64	318.2	127.0	PVC	35.2	0.3	0.31	4.2	0.5	333.8	15.6	152.7
676													
677		30				81.4					334.3		
678		63	300.4	143.5	PVC	35.2	0.3	0.31	4.2	0.6	333.7	33.3	170.5
679													
680		31				81.4					332.7		
681		66	301.9	111.8	PVC	35.2	0.3	0.31	4.2	0.5	332.2	30.3	169.0
682													
683		31				81.4					332.7		
684		65	320.5	172.1	PVC	35.2	0.3	0.31	4.2	0.7	332.0	11.5	150.4

APPENDIX 5-6

Geological Maps

Geological Map of the central-eastern part of South Sulawesi P.



(after "Geological Map of Malili Quadrangle, Sulawesi," 1981)

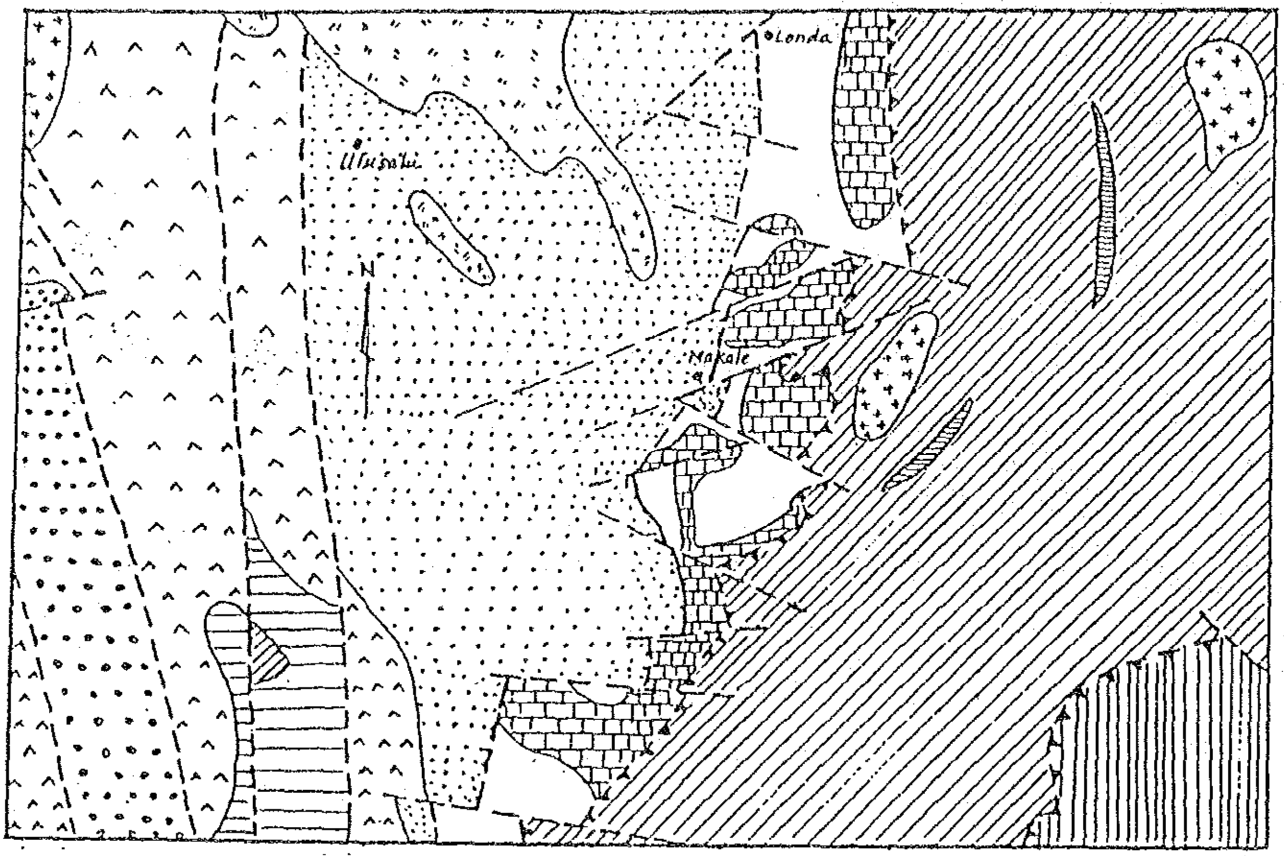
Legend

Age	Unit	Symbol	Description
Quaternary	Alluvial	Qal	Mud, clay, sand, pebble and gravel
Quaternary	Masamba Volcanic rocks		Volcanic breccia and basaltic to andesitic lava
Tertiary	Bone bone Formation		Alternation of lithic sandstone, conglomerate, marl and tuffaceous clay
Tertiary	Lamasi Volcanic rocks		Basaltic to andesitic lava and volcanic breccia.
Tertiary	Kambuno Granite		Granite and granodiorite
Cretaceous	Latimojong Formation		Slate, Phyllite, wacke, quartzite, limestone and siltstone with intercalary conglomerate and chert.
Palaeozoic - Mesozoic	Pompangeo Complex		Schist, gneiss, marble, serperntinite and quartzite
Palaeozoic - Mesozoic	Serpentinite Rocks		Serpentinite and picrite.

Fault

Thrust Fault

Geological Map of the central part of South Sulawesi province



(after "Geological Map of the Majene & Western Part of the Palopo Quadrangles," 1974)

Scale 1 : 250,000

0km 2.5km 5 km 10 km

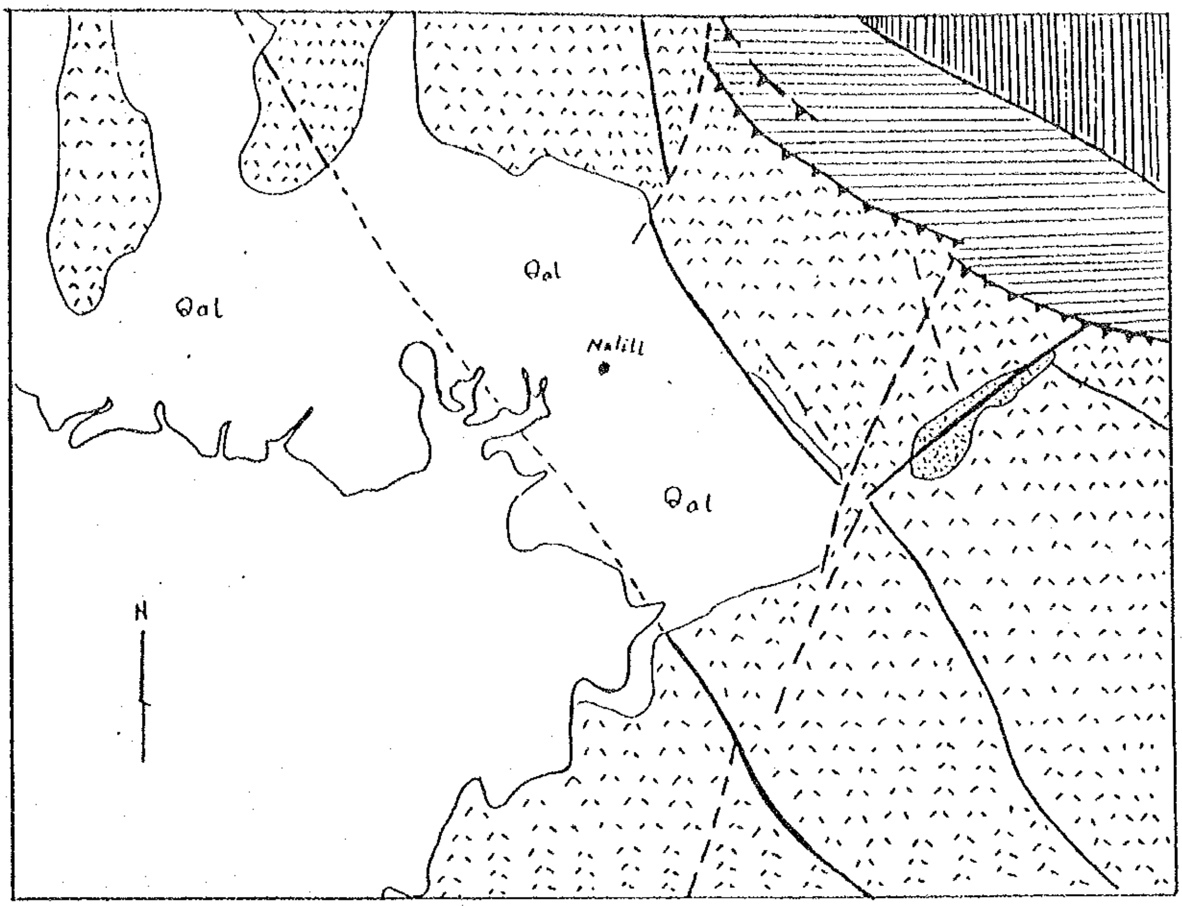
Legend

Age / Formation	Unit	Description
Quaternary	Tuff	biotite and pumice, white to light gray, soft and porus. poorly productive aquifers.
Tertiary – Makale Formation		sandstone conglomerate, siltstone and tuff with intercalarly lava flows. *poorly productive or no exploitable groundwater.*
Tertiary – Makale Formation	Conglomerate	*with a little glauconitic sandstone and shale, coquina and molluscs.* poorly productive or no exploitable groundwater.
Tertiary – Makale Formation	Lava flows	basaltic to audesitic, some pilllow lava, andesitic breccia. No exploitable growndwater.
Tertiary – Makale Formation		sandstone, conglomerate, siltstone and breccia with some turbidites poorly productive or no exploitable growndwater
Tertiary – Miocene – Miocene	Reefal Limestone	Moderate to high productive aquifers. *Groundwater flow is limited in fissures, fractures and solution channels*
Tertiary – Miocene	Marl	Low permeability, no exploitable groundwater
Tertiary – Eocene – Toraja Formation	Limestone in large lenses	Groundwater flow is limited in fissures
Tertiary – Eocene	Shale	reddish brown and gray marly shale and limestone, *quartzose sandstone and conglomerate with coal locally* No exploitable growndwater
Tertiary – Granodiorite		No exploit groundwater
Cretaceous – Latimojong Formation		moderately metamorphosed rocks, slate, phyllite, chert, marble, quartzite and silicified breccia *No exploitabnle groundwater*

Fault and Lineament

Thrust Fault

Geological Map of the eastern part of the South Sulawesi P.



(after "Geological Map of Malili Quadrangle," 1981)

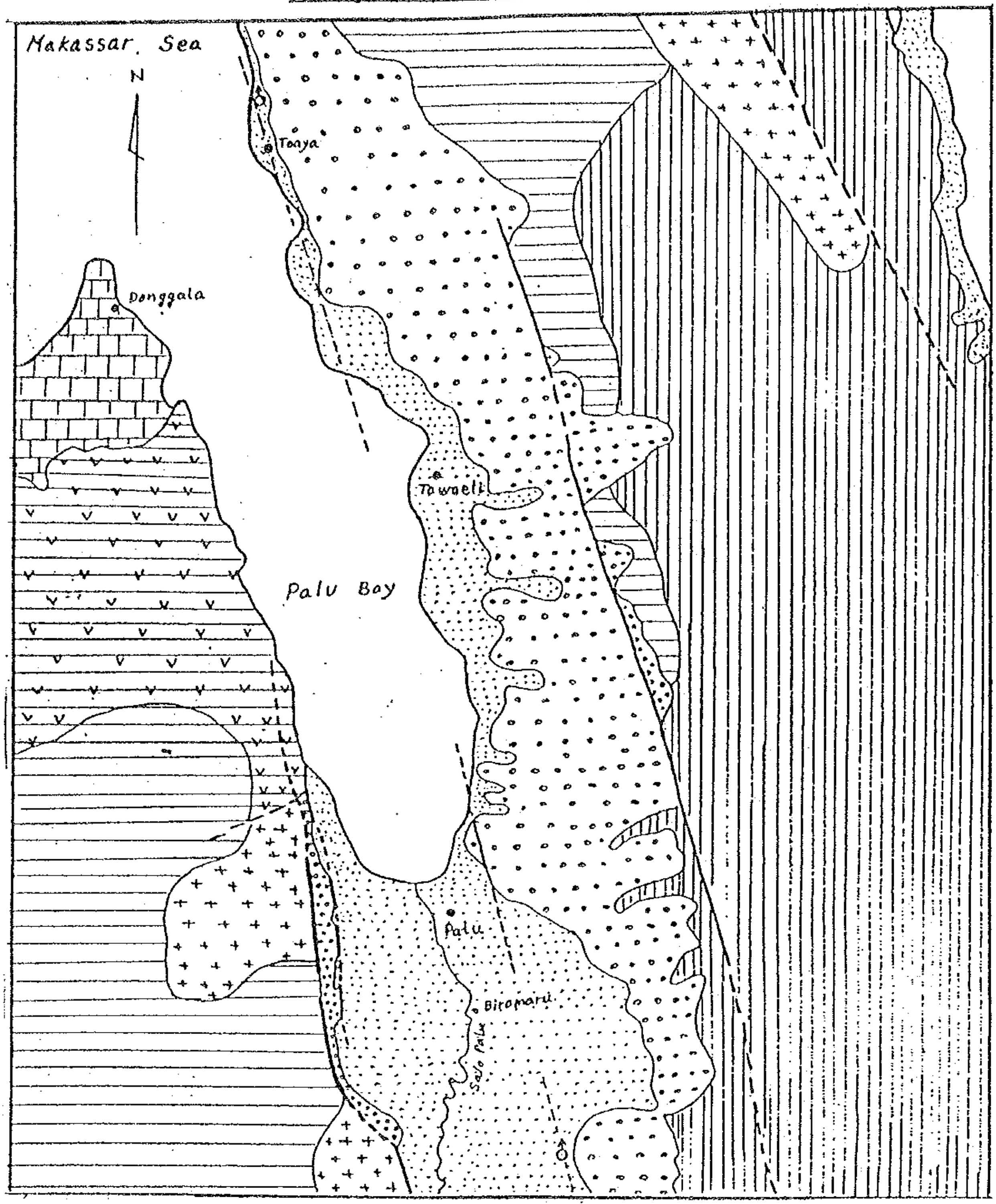
Scale 1 : 250,000

0km 2.5km 5 km 10 km

Legend

Age	Unit	Symbol	Description
Quaternary	Alluvial	Qal	Mud, clay, pebble and sand
Tertiary	Larona Formation		Sandstone, conglomerate, and claystone with intercalary tuff.
Cretaceous	Matano Formation		Crystalline limestone, calcilutite, marl, shale with chert and slate lenses.
Cretaceous	Wasponda Melange		Very exotic block of serpentinite, schist, amphybolite, metagabbro, metadolerite, foliated limestone in the martrix of red clay
Palaeozoic - Mesozoic	Ultrabasic Complex		Harzburgite, werhlite, websterite, serpentinite, dunite gabbro and diabase
	Fault		
	Thrust Fault		

Geological Map of the western part of central Sulawesi P.



(after "Reconnaissance Geological Map of Palu area," 1973)

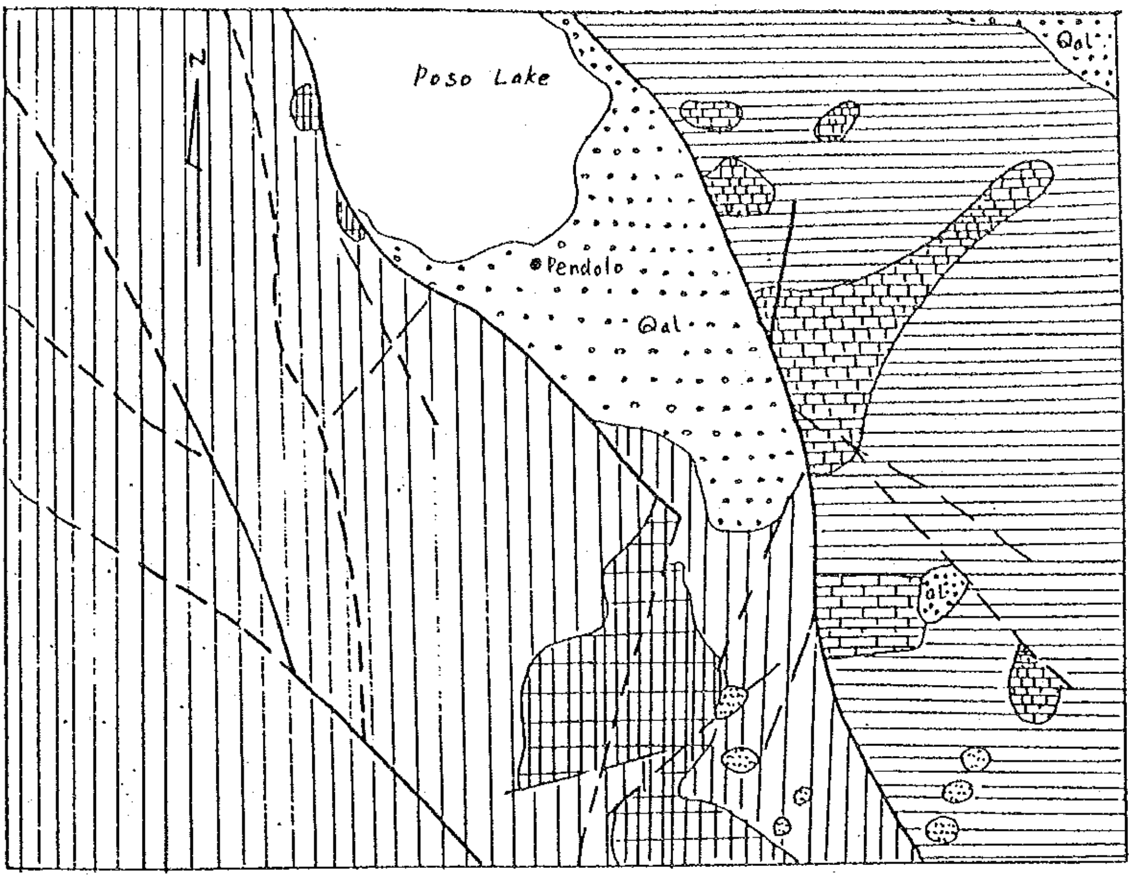
Scale 1 : 250,000

0km 2.5km 5 km 10 km

Legend

Age		Unit	Description
Quaternary		Alluvial coastal deposits	Gravel, sand and mud with coral limestone, Low to moderate permeability
Tertiary	Miocene	Celebes Mollase	Coral limestone and marl - Low to moderate permeability
Tertiary	Miocene	Celebes Mollase	Conglomerate, sandstone and mudstone - weakly consolidated - Low to moderate permeability
Tertiary	Eocene	Tinombo Formation	Volcanic Member - Basaltic volcanics of spilite, andesite, tuff, breccia and pillow lava - Low permeability
Tertiary	Eocene	Tinombo Formation	Shale, sandstone, conglomerate, limestone and chert with phyllite, slate and quartzite. - Low permeability
Palaeozoic		Metamorphic Complex	Mica schist, amphibolitic shist, gneiss and marble - Generally Impermeable
		Granit and Granodiorite	Impermeable

Geological Map of the central part of central Sulawesi P.



(after "Geologic Map of Malili Quadrangle," 1981)

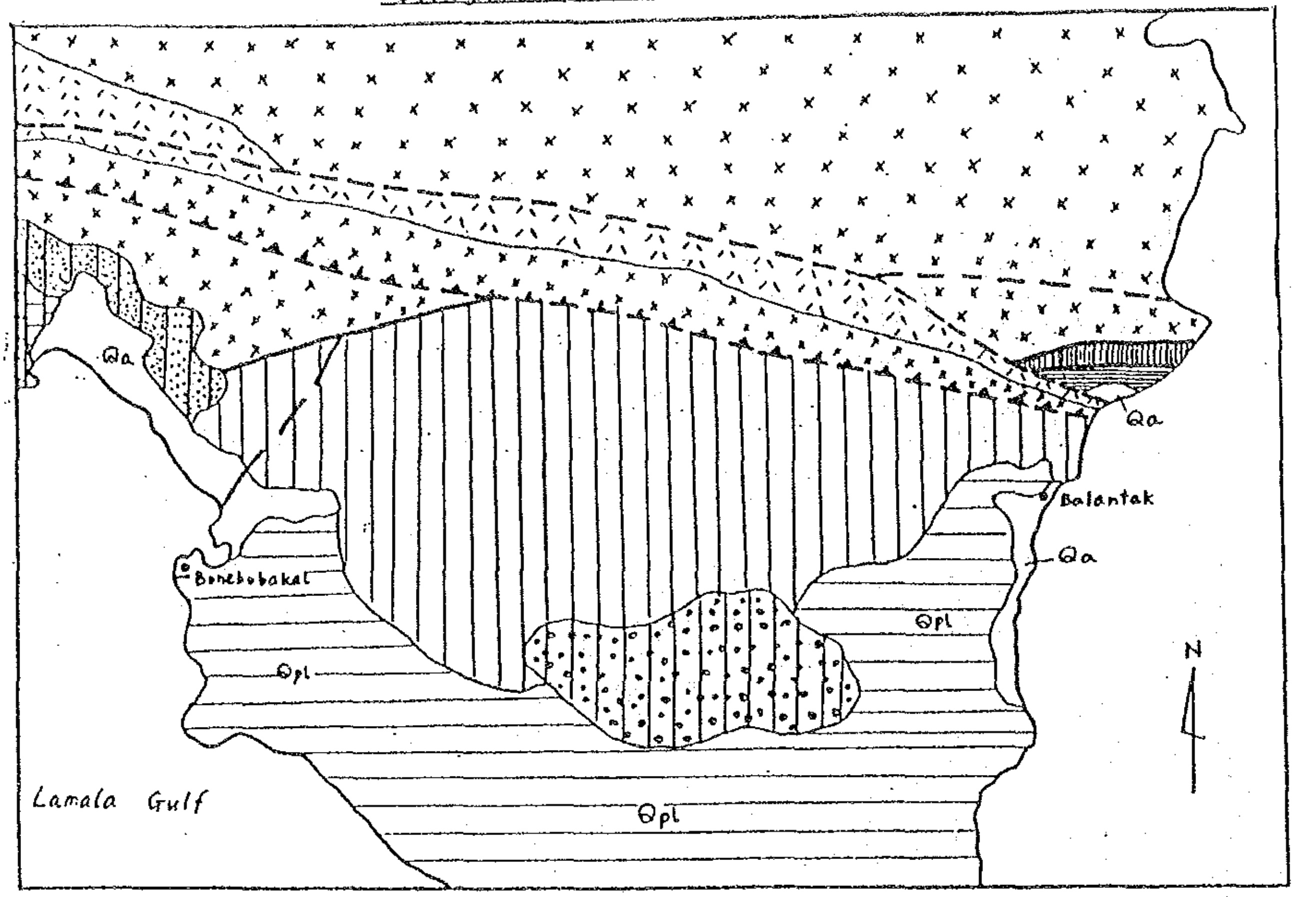
Scale 1 : 250,000

0km 2.5km 5 km 10 km

Legend

Age	Unit	Symbol	Description
Quaternary	Alluvial	Qal	Crystalline limestone and calcilutite, marl, shale with chert and slate lenses.
Cretaceous	Malano Formation		crystalline limestone and calcilutite, marl, shale with chert and slate lenses.
Cretaceous	Lamusa Formation		Slate, phyllite, meta sandstone, limestone
Palaeozoic - Mesozoic	Meta Limestone		Marble and foliated limestone
Palaeozoic - Mesozoic	Pompangeo Complex		Schist, gneiss, marble, serpenitinite and quartzite
Palaeozoic - Mesozoic	Serpentinite Rocks		Serpentinite or picrite
	Fault		

Geological Map of the eastern part of central Sulawesi Province



(after "Preliminary Geological map of the LUWUK Quadrangle," 1982)

Scale 1 : 250,000

0km 2.5km 5 km 10 km

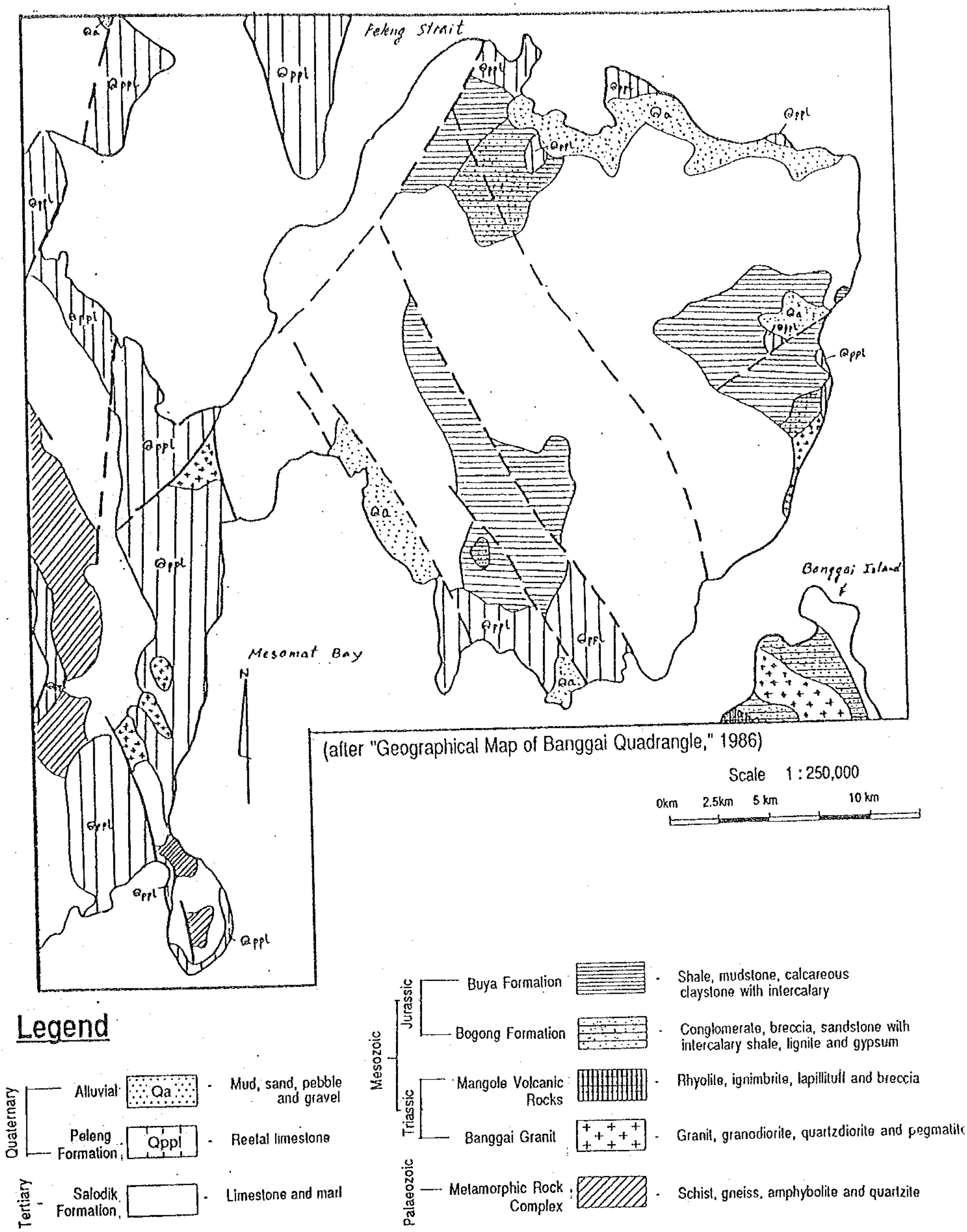
Legend

Era	Formation	Symbol	Description
Quaternary	Alluvial Deposits	Qa	Sand, pebble and mud High permeability in coarse-grained material and low in fine-grained material.
	Luwuk Formation	Qpl	Reefal limestone and minor marl Groundwater flow is limited in fissures, fractures and solution channels.
Tertiary	Batui Formation		Conglomerate, sandstone and marl
	Bongka Formation		Conglomerate, sandstone, claystone and limestone lenses.
	Poh Formation		Marl, limestone and minor sandstone Groundwater is limited in fissures, fractures and solution channels
			Limestone and minor sandstone Groundwater flow is limited in fissures, fractures and solution channels
Mesozoic	Luok Formation		Calcilutite, chert and cherty calcilutite
	Malic Complex		Gabbro, basalt and diorite
	Ultramafic Complex		Serpentinized ultramafic rocks
	Tetambahu Formation		Bedded limestone, marl, carcarenite and clayey limestone

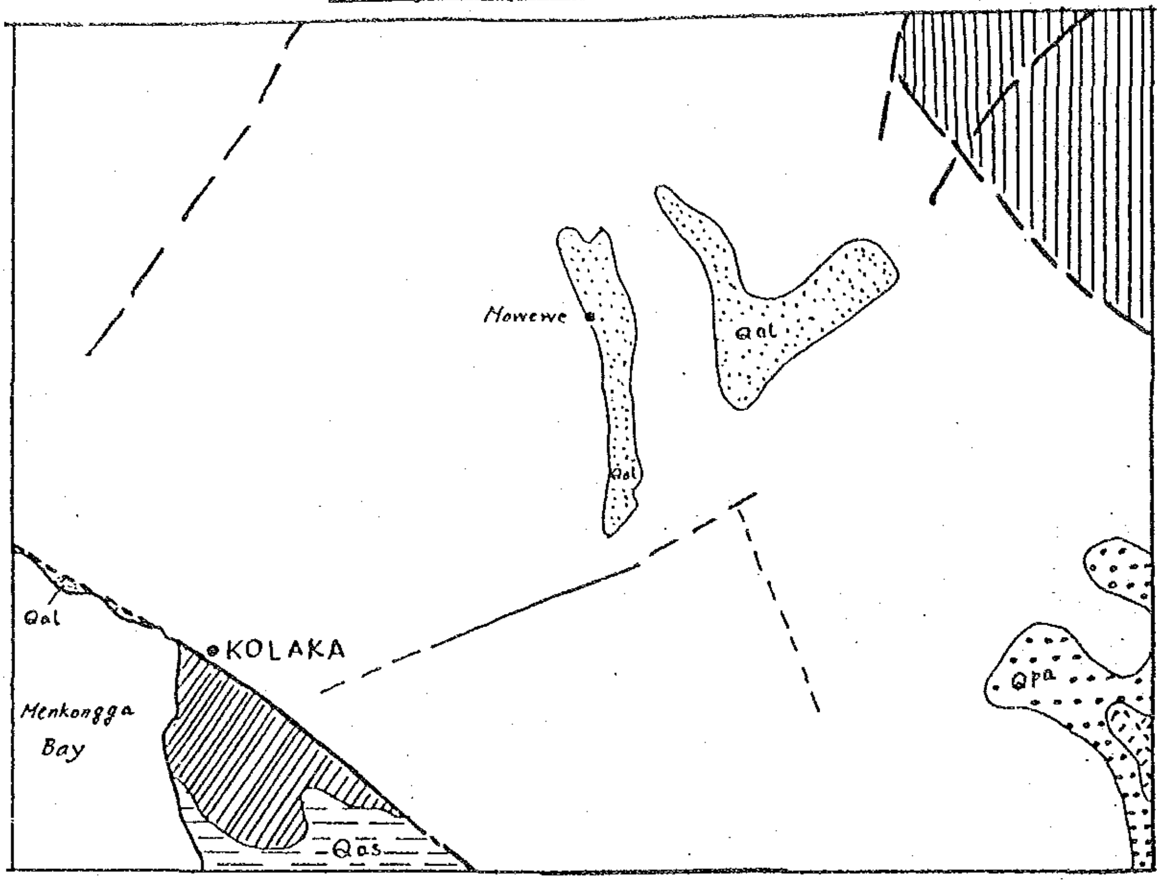
Fault

Thrust Fault

Geological Map of the eastern part of Peleng Islands



Geological Map of the western part of Southeast Sulawesi P.



(after "Geographical Map of Kolaka," 1982)

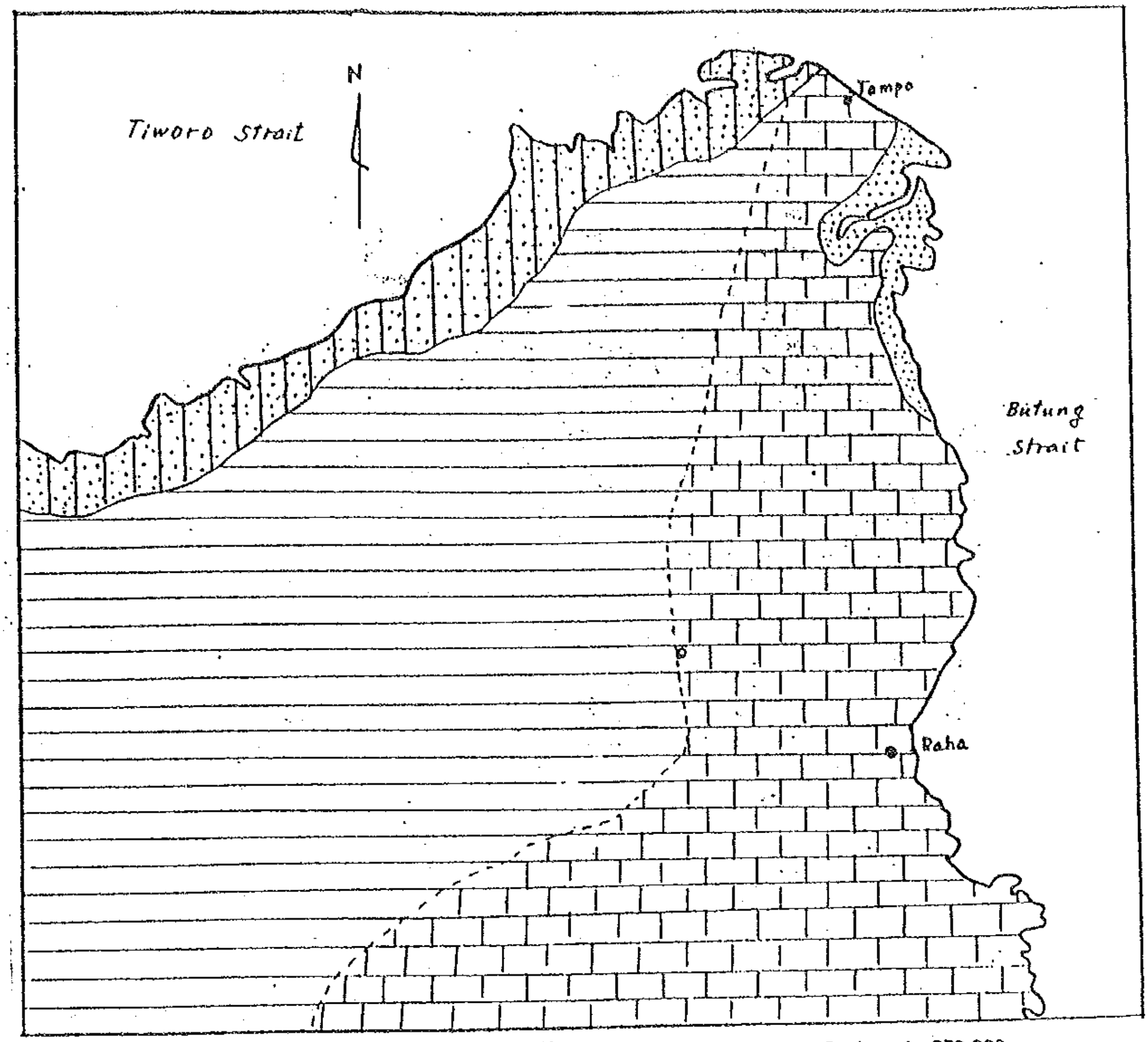
Scale 1 : 250,000

0km 2.5km 5 km 10 km

Legend

Quaternary	Alluvial Deposits	Qal	- Mud, clay, sand and gravel - Moderate to high permeability in coarse-grained material, low in fine-grained
	Swamp Deposits	Qas	- Clay and sand
	Alanga Formation	Qpa	- Conglomerate and sandstone-loose to semi consolidated. Generally low transmissibility and poor productive aquifers.
Mesozoic	Pompangeo Complex		- Mica schist, green schist glaucophane schist amphibolite schist, chlorite schist and jasperiodad chert.
	Ultramafic Complex		- Harzburgite, dunite, wherlite, serpentinite and magnesite.
Palaeozoic	Tomosi Metamorphics		- Slate, phyllite, some schists and meta sandstone. - Generally low permeability
	Mekongga Metamorphics		- Schist, gneiss and quartzite - Generally low permeability
	Fault		

Geological Map of the northern part of Muna



(after "Hydrogeological Map of Indonesia," 1986)

Scale 1 : 250,000

0km 2.5km 5 km 10 km

Legend

Quaternary

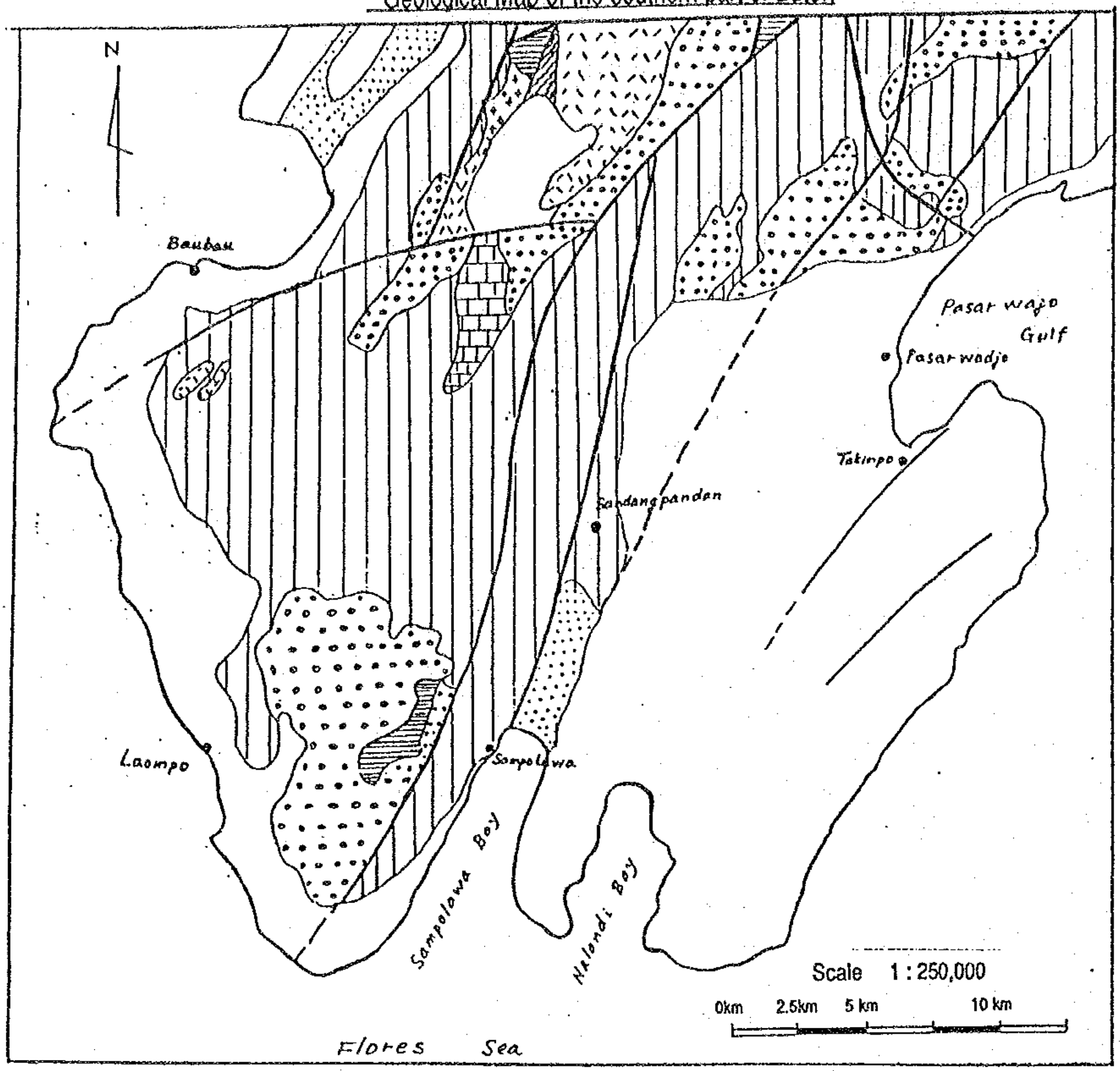
Alluvial
- Composed mainly of unconsolidated sand, silt and clay
- Locally moderately productive aquifers, thin and transmissibility, water table generally near surface.

Alluvial
- Composed mainly of unconsolidated sand, silt and clay
- Poorly productive aquifers overlying extensive productive aquifers. Low thickness and transmissibility, and overlying reefal limestone.

Reefal Limestone
- Calcified to various degrees, sandy limestone and marl
- Moderately productive aquifers
Groundwater flow is limited in fissures, fracture zones and solution channels. Well and spring discharge vary in an extremely wide range.

Reefal Limestone
- Calcified to various degrees, sandy limestone and marl.
- Highly productive aquifers
Groundwater flow is limited in fissures, fracture zones and solution channels. The water table is generally deep. Well yield and spring discharge vary in an extremely wide range.

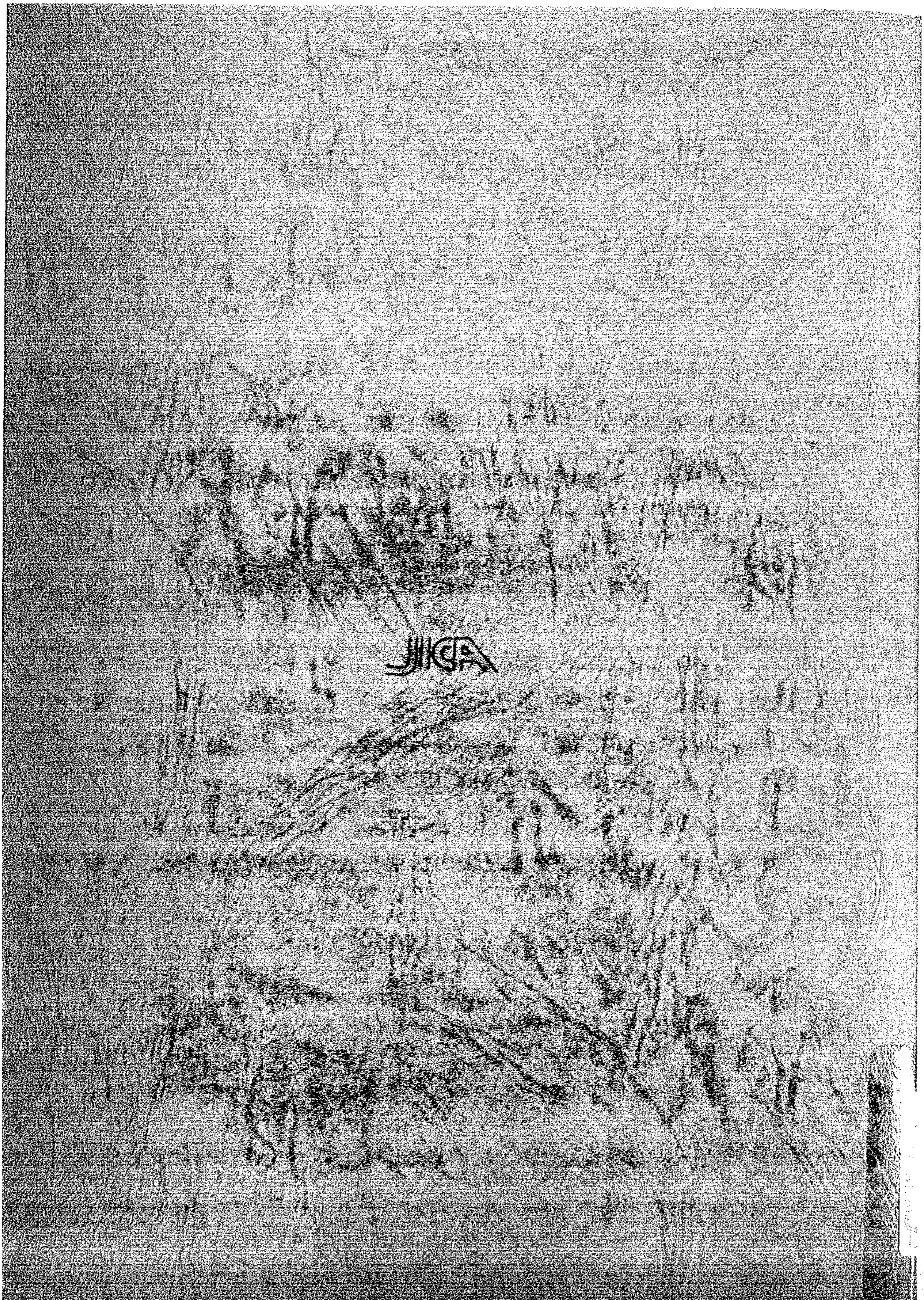
Geological Map of the southern part of Buton



(after "Hydrogeological Map of Indonesia," 1986)

Legend

Era	Unit	Description
Quaternary	Alluvial	composed mainly of unconsolidated sand, silt and clay; Generally low to moderate permeability
Quaternary	Reefal limestone	Calcified to various degrees, sandy limestone, amrl; Moderate to high permeability
Quaternary	Globigerina limestone	Composed mainly of globigerina limestone, marl and bedded limestone with asphalite and calcilutite occasionally
Tertiary	Turbidites	Conglomerate, pebby sandstone & turbidites consist of sandstone and siltstone; very low to moderate permeability; Moderate perameability
Tertiary	Reefal limestone	Coral reef limestone; Low to moderate permeability
Mesozoic	Terrigenous clastics	Flysch-like deposits consist of shale, sandstone and sandy limestone; Generally low permeability
Mesozoic	Crystalline schist	Micaceous quartzite alternating with phyllite and shale, and various type of shist; Generally low permeability
	Intermeadiate intrusive rocks	Medium-grained diorite; Low permeability
	Ultramafic rocks	Periodotite, serpentinite and metabasalt; Low permeability
	Fault	


JICA