COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1964/80

REGIONAL GEOLOGY - MARKHAM VALLEY - TERRITORY OF PAPUA AND NEW GUINEA (1:250,000 SHEET SB 55-10)

by

J.G. Best

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REGIONAL GEOLOGY - MARKHAM VALLEY -

Territory of Papua and New Guinea

SUMMARY

Farming and pastoral development, as well as increased standards of living of the indigenous people has created a demand for supplies of ground water in the Markham Valley. Some drilling has been carried out, to date on a "wild cat" basis; and a geophysical investigation of the ground water conditions is required to guide future drilling in the valley. Little is known of the structural history of the valley and it is suggested that, if possible, part of the investigation be directed to helping to solve this problem.

INTRODUCTION

This report has been prepared as a basis for a geophysical investigation of the ground water resources of the Markham Valley. It is only since World War II that farming and pastoral activities have been established in the valley west of the Erap River; and the building of a road along the valley to provide access to the rapidly developing highland areas has done much to foster this development. A number of properties have undertaken contract drilling to provide ground water supplies, and the drill holes have, so far, been sited only by intuition. It is felt that a survey to establish the extent of and depth to aquifers in this area will do much to foster the exploitation of ground water in the area.

LOCATION

The Markham River Valley is the eastern portion of a broad valley which trends west-north-west from the head of Huon Gulf (147°E, 6°45'S), the Ramu River drains the western portion of the valley. The distance from the Ramu/Markham divide to the eastern end of the valley is about 80 miles. The valley floor has an average width of about 6 miles, and ranges up to about 12 miles wide (see Plate 1).

ACCESS

Lae, the largest town on the New Guinea mainland, is at the eastern end of the Markham Valley. Overseas vessels regularly visit this port; and a daily air service operates to Australia via Port Moresby. A formed, unsealed road traverses the northern side of the valley as far as Gusap (in the Ramu end of the valley). Most of the major rivers on this route are now bridged. The Wau/Bulolo road branches south about 8 miles west of Lae; and the main highlands road joins the Markham Valley road about 8 miles east of Gusap (see Plate I). Minor roads to villages and farms branch off the road along the valley.

There are airstrips suitable for aircraft up to D.C.3 size at Nadzab, Kaiapit and Gusap (see Plate I).

TOPOGRAPHY

The Markham Valley is the eastern portion of the Ramu/Markham depression, a long, broad, flat floored valley, which is flanked, on the northern side by the high, rugged Finisterre/Saruwaged Range (ranging up to about 13,500 ft. above sea level), and on the southern side by the Kratke/Herzog Range (ranging up to about 12,000 ft. above sea level).

The valley is deeply alluviated and grades gently eastwards to sea level from the Ramu/Markham Divide (about 1400 ft. above sea level). The valley floor has a gentle slope to the south, and the Markham River drains along the edge of the foothills on the southern side of the valley. The Markham River is a large braided stream, and ranges up to a mile wide; it is not deeply incised, and its banks are commonly swampy.

Most of the streams draining into the Markham are heavily laden with alluvium, and have built up extensive piedmont deposits, particularly on the northern side of the valley. The northern tributaries debouch from the mountains via youthful valleys, and flow to the Markham River in braided channels which commonly fan out southwards across the valley (see Plate I); in general they are not deeply entrenched in the floor of the Markham Valley.

VEGETATION

West of Nadzab the valley is dominantly covered with grassland (mainly kangaroo and kunai grass) interspersed with small areas of savannah and rainforest. East of Nadzab the vegetation is dominantly rainforest, much of which has been cleared for cocoa plantations.

CLIMATE

The rainfall diminishes westwards along the valley; Lae has an average annual rainfall of about 200 inches, while at Kaiapit the rainfall is only about 90 inches per annum. West of Nadzab the South-East Monsoon (June to September) is the dry season, and the climate is hot and dry; east of Nadzab the period of the South-East Monsoon is humid and oppressive.

GEOLOGY

(i) Valley Floor

The floor of the Markham Valley is virtually completely alluviated, the only outcrop of basement is a small hill of Kaindi Metamorphics about 2 miles west of the mouth of the Erap River.

(ii) Southern Ranges

The mountains at the eastern end of the valley consist mainly of metamorphosed sediments (Kaindi Metamorphics); these rocks have been tightly folded and strike about north-north-east.

The Kaindi Metamorphics have been intruded by the Morobe Granodiorite, and there is an outcrop of granodiorite flanking the valley south of Nadzab.

Further west the Kaindi Metamorphics are overlain by Upper Tertiary sediments which have been moderately strongly folded, and have an overall north-west strike.

(?)Palaeozoic metamorphosed sediments form the mountains at the western end of the valley. These metamorphics have also been intruded by granodiorite, but the granodiorite does not flank the valley as it is overlain by Tertiary sediments to the north and east.

The Tertiary sediments are less competent than the metamorphics, and consequently there is a large embayment in the central portion of the southern side of the valley (see Plate I).

(iii) Northern Ranges

The (?)Palaeozoic and Mesozoic rocks do not crop out on the northern side of the valley. The ranges on the north side consist of Tertiary rocks, dominantly sediments, ranging from mudstone to conglomerate, strongly folded and faulted and trending west-north-west. The youngest rocks in this series, the Saffair Conglomerate, forms a festoon of foothills up to about 2,000 ft. high, along the central portion of the northern side of the valley. These rocks are folded, but have an overall dip to the north and are faulted against older Tertiary rocks forming the Finisterre/Saruwaged Range.

STRATIGRAPHY

The stratigraphy has been summarized in Table I.

STRUCTURE

The Ramu/Markham depression is generally considered to be a graben, however the large-scale flanking faults usually associated with this type of structure are not particularly evident in this area.

There is evidence of large-scale faulting along parts of the northern side of the valley, but rather than one large fault, it appears that a number of parallel and/or anastomosing faults formed the north side of the valley. On the southern side, the case for large-scale faulting is based mainly on topography, and the absence of the older rocks on the northern side of the valley. The evidence suggests that the depression has not resulted simply from subsidence of a linear block along large-scale parallel faults, but rather that its formation has been somewhat complex; and has resulted from several stages of faulting and differential uplift of the blocks on either side of the valley. Miocene limestone, now at an elevation of about 13,000 ft. above sea level, forming the crest of the Saruwaged Range demonstrates the amount of upthrust which has taken place on the northern side of the valley.

HYDROLOGY

The Markham River has a catchment area of about 5,000 square miles, over most of which the rainfall exceeds 100 inches per year. It is obvious that an enormous amount of water must drain through the valley; just how much is not known, nor is it known how much travels down the Markham River and how much travels through the alluvium flooring the valley.

The area requiring investigation for underground water lies west of the Erap River. In this area a number of farms and grazing properties are being established and assured water supplies are essential for their successful development. In addition, improved standards of living of the indigenous inhabitants of the valley has resulted in their desiring more conveniently located water supplies.

There are surface streams in the area, but most of them are so heavily charged with alluvium as to be unsuitable for use as a water supply, quite apart from the fact that the water would, in some places, have to be piped long distances.

TABLE I

STRATIGRAPHY

Age		Formation	Estimated Thickness	Lithology
Quaternary	Recent/Pleistocene Qa	Markham Beds	Unknown	Clay, silt, sand, gravel and boulder beds. Alluvial and piedmont deposits.
Tertiary	Pliocene Tps	Saffair Conglomerate	2,000 ft.	Clay, silt, sand, gravel and boulder beds, only partly lithified.
	Pliocene/Miocene Tm	Includes Mona and Moku Series on north side of valley	Unknown probably in excess of 30,000 ft.	Tm (south side of valley) shale, siltstone, calcareous siltstone, conglomerate, limestone, basalt and tuff. Mona Series - alternating well bedded marine, generally micaceous grey sandstone, shale, siltstone and conglomerate. Moku Series - greywacke, cherty argillite, and conglomerate. Highly disturbed, shattered and calcite veined, and intruded by basic igneous rocks.
Mesozoic	Cretaceous in part Mk	Kaindi Metamorphics	Unknown	Slate, phyllite, meta-greywacke, meta-conglomerate, marble.
(?)Palaeozoic	Pzm	Mainly Gneiss	Unknown	Black schistose siltstone, biotite andalusite schist, carbonaceous schist, quartzite, phyllite, quartz greywacke, calcarenite, calcareous siltstone, minor limestone.

Ground-water is the obvious answer to the problem and a number of bores have been sunk, most of them were successful, although some have been reported to have failed subsequently, (the cause of failure has not been definitely established, but it may have been only due to partial silting-up of the bore). Copies of the drillers logs are attached (Appendix I) and graphic logs have been prepared (Appendix II).

GEOPHYSICAL INVESTIGATION

Scope

A detailed geophysical investigation of the whole of the Markham Valley would be a long and expensive job. In view of this it is suggested that detailed investigations be centred on one or two areas which have already been bored to establish local aquifer conditions, and then to carry out traverses across the valley to provide a series of profiles.

The investigation of the ground-water conditions of the area is the major consideration, but it is requested that some thought be given to securing information which will assist in unravelling the structural history of the area.

Problems

Access - the northern side of the valley is readily accessible and traverses can easily be tied to that side of the valley. But on the south side the Markham River will have to be crossed to tie in the southern end of most traverses. The best method of crossing the river would be by canoe manned by natives with local knowledge.

Grassland - the kunai and kangaroo grass grows above head-height through much of the area; and as indiscriminate burning-off is forbidden, it will be necessary to hire native labour to cut traverse lines. It would undoubtedly be more satisfactory to hire a permanent labour line, rather than to depend on casual local labour for cutting traverse lines.

REFERENCES

MACKAY, N.J., 1958 - Geological report on a reconnaissance of the Markham and Upper Ramu Drainage Systems, New Guinea. Bur. Min. Resour. Aust., Record 1955/25 (Unpub.)

McMILLAN, N.J., and MALONE, E.J., 1960 - The geology of the eastern Central Highlands of New Guinea. Bur. Min. Resour. Aust., Rep. 48.

ONGLEY, M., 1939 - Review of the geology of the central and south-eastern part of Permit No. 2, Mandated Territory of New Guinea. Island Exploration Company Pty. Ltd., Rep. GN.

TERRAIN STUDY NO. 66, 1943 - Locality study of Ramu-Markham Valley with link to Madang. Allied Geographical Section, South-west Pacific Area (Unpub.).

APPENDIX I

Drill Logs of Water Bores in Markham Valley

The exact location of the bores is not given on the drillers log - only the name of the property or property holder is given - and there has not been time to locate the drill holes on the ground. The boundaries of and names of the properties are shown on Plate I.

29 August

Customer B.G.D. Ltd
Address "Lemon Plains" Lae

Location of Bore

Name or Number of Bore 10

Particulars of Strata

From	To	Feet	Strata
0	20	20	Gravel & clay
20	50	30	Gravel & Boulders
50	86	36	Clay & gravel
86	97	11	Clay & gravel Large stones
97	154	57	Clay & Gravel
154	170	16	Water Bearing gravel sand & stones
170	172	2	Clay.

General Particulars

Commenced	12th August	Completed	28th August
Contractor	TFS	Drillers	S Major
Clamps	nil	Other Materials	
Casing	171' 7"		
Casing Shoes	1. 6 inch shoe		

Water Beds

Depth from Surface - ft	154
Water rose to - ft from surface	147
Flow gal/day	
Supply gal/hr	700
Quality	potable

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Drawdown (feet)	Gallons per hour	Duration of test (hours) Bailer	Other
147	165	5	700	2	20
		Total hours for job	Final Depth		
		118	172		

Remarks

Water supply tested with 4" flush cap pump & engine running for 20 hrs straight, pumping rate 700 GPH. Last 2 ft. of bore not cased, may collapse (Reason). If cased, would yield. put slots in ~~casing in~~ casing in wrong location in water bed

Sgd. S Major

29 August 1963

Customer BGD. Location Name or Number

Address "Leron Plains" Tae of Bore of Bore 12

Particulars of Strata

From	To	Feet	Strata
0	1	1	Top soil
1	65	64	Gronel & stones
65	76	11	Clay & gronel
76	86	10	Water bearing sand.
86	104	18	Sand & gronel

General Particulars

Commenced	23rd Sept.	Completed	2nd Oct.
Contractor	TFS	Drillers	S Major
Clamps	—	Other Materials	
Casing	10 5' 2"		
Casing Shoes	1. 6" shoe		

Water Beds

Depth from Surface - ft	76						
Water rose to - ft from surface	72						
Flow gal/day							
Supply gal/hr	700						
Quality	Potable.						

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Draw down (feet)	Gallons per hour	Duration of test (hours) Boler	Other
72	90		700		12
		Total hrs for Job.	Final Depth		
		98	104ft.		

Remarks

30 ft. of casing slotted Casing slotted by. BGD Water supply tested with HD. pump head, 4 inch pump & 3½ L.P. S&C Engine. No drop in water level after being pumped for 12 hrs.

Sgt. S Major

31st Oct. 1963

Customer BGD.

Address "Leron Plains" Lae

Location of Bore

Name or Number of Bore 11

Particulars of Strata

From	To	Feet	Strata
0	2	2	Top soil
2	70	68	Gronel & large stones.
70	104	34	Clay & gronel
104	116	12	gronel
			"water bearing"
116	123	7	Clay & gronel.

General Particulars

Commenced	9th Sept. '63	Completed	18th Sept. '6
Contractor	T.F.S. Pty. Ltd.	Drillers	S. Major.
Clamps	—	Other Materials	
Casing	125 feet 7"		
Casing Shoes	1 x 6 inch.		

Water Beds

Depth from Surface - ft	86'		105'				
Water rose to - ft from surface			96'				
Flow gal/day			16,800				
Supply gal/hr			700				
Quality	potable		potable.				

Total flow on completion gal/day 16,800

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Draw down (feet)	Gallons per hour	Duration of test (hours) Boler	Duration of test (hours) other
96	110	—	700	1 hr.	20' Suppl.
			Final Depth		
			123'		

Remarks

Bottom 2 lengths of casing slot
(15'4" & 10'6")
Water supply tested with 4" H.D.
pump & 3½ H.P. S.H.C. engine.
Pumped for 20 hours, no drop
in supply.

Sgd. S Major.

18 Sept. 6

Customer DASE

Address ERAP LAE

Location of Bore ERAP

Name or Number of Bore 4

Particulars of Strata

From	To	Feet	Strata
80	93	13	Silt & fine gravel
93	110	17	Gravel & large stones
110	126	16	Silt & gravel & fine gravel
126	134	5	Coarse gravel. Water bearing.
134	140	6	Clay & gravel
140	142	2	Yellow clay.

General Particulars

Commenced	9th Dec. 1963	Completed	13 Dec. 1963
Contractor	TFS Hybld.	Drillers	SMajor
Clamps		Other Materials	
Casing			
Casing Shoes			

Water Beds

Depth from Surface - ft	90		126				
Water rose to - ft from surface			90				
Flow gal/day						...	
Supply gal/hr			600				
Quality	Potable						

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Drawdown (feet)	Gallons per hour	Duration of test (hours) Boiler	Other
90	130	Nil	600	1	
			Final Depth		
			142		

Remarks

Water level may drop back to 120 ft. Main supply of water at 126 ft.

Customer D.A.S.F

Address ERDP

Location of Bore

Name or Number of Bore 6

Particulars of Strata

From	To	Feet	Strata
30	36	6	Gravel + Clay
36	41	5	Water bearing gravel
41	50	9	Gravel + clay
50	52	2	Clay

General Particulars

Commenced	21st Nov, '63	Completed	25th Nov.
Contractor		Drillers	S. Major.
Clamps		Other Materials	
Casing	53 ft - 3 ins		
Casing Shoes	1 6"		

Water Beds

Depth from Surface - ft	36						
Water rose to - ft from surface	24						
Flow gal/day				—	—		
Supply gal/hr	600						
Quality	Potable						

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Drawdown (feet)	Gallons per hour	Duration of test (hours) Boiler	Other
24	36	"Nil	600	2	
			Final Depth		
	6	30			

Remarks

(Signed)

2.12.63

Customer T. T. Leahy — Location of Bore — Name or Number of Bore

Address "Marallumic Est." LAE

Particulars of Strata			
From	To	Feet	Strata
0	2	2	Top Soil
2	20	18	Grey Clay + Sand.
20	40	20	Gravel + Bands of Yellow Clay
40	57	17	Gravel + Grey Clay

General Particulars

Commenced	25th November	Completed	27th Nov.
Contractor		Drillers	
Clamps		Other Materials	Slotted
Casing	57 Feet.		Length
Casing Shoes	1 shoe.		Casing

Water Beds

Depth from Surface - ft	8		38					
Water rose to - ft from surface	8							
Flow gal/day								
Supply gal/hr	600		600	Min	Capacity of Bower			
Quality	Potable							

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Drawdown (feet)	Gallons per hour	Duration of test (hours) Bailer	Other
8	40	NIL	600	1	
			Final Depth		
		32	57ft.		

Remarks Water bearing strata from 8 feet to 55 feet.

C. Major (signed)
27th Nov. 1

T. T. Leahy (signed)
27/11/33

Customer D.A.S.F. Location Name or Number

Address ERAP LAE of Bore of Bore 2.

Particulars of Strata

From	To	Feet	Strata
37	39	2	Silt + Gravel
39	41	37	Sand + Gravel + Stones

General Particulars

Commenced	Nov., 11th	Completed	21 Nov.
Contractor	T.F.S.	Drillers	S. Major
Clamps		Other Materials	
Casing	Supplied by D.A.S.F.		
Casing Shoes			

Water Beds

Depth from Surface - ft	40ft		57ft				
Water rose to - ft from surface			40ft				
Flow gal/day							
Supply gal/hr			600				
Quality	Potable						

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feat)	Drawdown (feat)	Gallons per hour	Duration of test (hours) Boler	Other
40	70	Nil	600	1	
			Finial Depth	1 Feet Drilled	
		88	76 ft	39 ft.	

Remarks: Water level now at 40 feet will probably drop back to 56 feet where main supply of water is located.

S Major (Signed)
21st Nov. 63

(Signed)
21.11.63

Customer D.A. S. F

Address ERAP

Location of Bore ERAP

Name or Number of Bore 1

Particulars of Strata

From	To	Feet	Strata
70	90	20	Gravel and Stones
90	93	3	Water bed.
93	102	9	Clay
No casing to be charged.			

General Particulars

Commenced	4th November	Completed	6th November 1963
Contractor	T.E.S	Drillers	S. Major
Clamps		Other Materials	
Casing	101' 9"		
Casing Shoes			

Water Beds

Depth from Surface - ft	90 ft					
Water rose to - ft from surface	42 ft					
Flow gal/day						
Supply gal/hr	600 by baler test					
Quality	Potable					

Total flow on completion gal/day

Pumping test on completion

Standing water level from Surface (feet)	Pump level from surface (feet)	Draw down (feet)	Gallons per hour	Duration of test (hours) Boler	Other
42 ft	92 ft			1 hr	
			Final Depth		
		32 hours	102 ft		

Remarks Reconditioned Bore

Deepen from 70 feet to 102 feet

30 feet of water

It appears to be a good supply

Note: Extra work to be charged

Surging and developing bore 3 hours

Replace piping, rods etc. connect up mill, replace side in mill 6 hours.

S. Major

10.11.63

Customer W. JACKSON

Address P.O. Box 99 LAE P.N.G

Location of Bore

Name or Number of Bore 1

Particulars of Strata

From	To	Feet	Strata
0	3	3	Gravel
3	112	109	Clay and Gravel
112	132	20	Brown Clay
132	156	24	Clay and Gravel
156	184	28	Gravel (Water bearing)

General Particulars

Commenced	21st October,	Completed	31st October, 19
Contractor	T.E.S.	Drillers	S. Major
Clamps	Nil	Other Materials	
Casing	184 feet.		
Casing Shoes	1 6 inch		

Water Beds

Depth from Surface - ft	156		170				
Water rose to - ft from surface	154		154				
Flow gal/day							
Supply. gal/hr	300		600				
Quality	Potable						

Total flow on completion gal/day

Pumping Test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Drawdown (feet)	Gallons per hour	Duration of test (hours) Boiler	Or h.
154	170	Nil	600	1	
			Final Depth		
		103 hours	184		

Remarks Very good supply of water
Will stand heavy pumping
Please forward pumping
equipment as arranged to suit.
Including pipe and rods engine.
complete
unit ready to install

Note: Arrangements made by M Maloney.

S. Major
Dist. Mgr.

W. L. Jackson
31. 10. 63

Customer R. SINTER

Address P.O. Box 247 LAE

Location of Bore

Name or Number of Bore 1

Particulars of Strata

From	To	Feet	Strata
0	2	2	Top Soil
2	34	34	Clay + Gravel
34	39	3	Rock
39	55	26	Gravel + stones
55	76	21	Clay + Gravel
76	100	24	Sand + Clay
100	124	24	Clay + Gravel

General Particulars

Commenced	9th October '63	Completed	11th Oct. 1963
Contractor	T.F.S.	Drillers	S. Major
Clamps		Other Materials	
Casing	126 feet of 6 inch		
Casing Shoes	1 6" inch shoe		

Water Beds

Depth from Surface - ft							
Water rose to - ft from surface							
Flow gal/day							
Supply gal/hr							
Quality							

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Draw down (feet)	Gallons per hour	Duration of test (hours) Boiler	Duration of test (hours) other
			Final Depth		

Remarks Deep as customer wishes to go at present time

Will proceed further at some future date

No Water

S Major [signed]

11th Oct 63

R. Sinter [signed]

11th/10/63

Customer DISE

Address Lae

Location of Bore

Name or Number of Bore 3

Particulars of Strata			
From	To	Feet	Strata
40	60	20	Sand & gravel
60	66	6	Gravel & large stones
66	70	4	Water bearing gravel
70	80	10	Gravel & clay
80	84	4	Yellow clay

General Particulars			
Commenced	2nd Dec	Completed	7th Dec
Contractor	TFS Ltd	Drillers	S Major
Clamps		Other Materials	
Casing	54' 5"		
Casing Shoes	1 x 6 inch		

Water Beds

Depth from Surface - ft	46		66				
Water rose to - ft from surface	44		44				
Flow gal/day							
Supply gal/hr			600				
Quality	Potable						

Total flow on completion gal/day

Pumping test on completion

Standing Water level from Surface (feet)	Pump level from surface (feet)	Draw down (feet)	Gallons per hour	Duration of test (hours) Bailer	Other
44	65	Nil	600	1	
			Final Depth		
	59		84 ft.		

Remarks

Casing to be charged to BASE

19' 6" slotted length with above included on 10' solid length.

Sgd. S Major

7th Dec

APPENDIX II

Graphic drill logs

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ HOLE NO 11 R.L. _____

LOCATION B.C.D. Iease LERON PLAINS, MARKHAM VALLEY. ANGLE FROM HORIZONTAL 90° DIRECTION _____

		DEPTH & SIZE OF HOLE	L.O.G.	CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	
	Top Soil	2'				
	Gravel and large stones					
	Gravel and large stones	70'				
	Clay and gravel					
	Clay and gravel				Standing water level on completion of drilling.	
	Gravel — Water bearing	104'				
		116'				
		123'				

LOGGED _____

5 Major
9-9-63.
18-9-63

VERTICAL 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ HOLE NO 12 R.L. _____

LOCATION Levon Plains, Markham Valley. (B.S.D. Pty. Ltd. Lease) ANGLE FROM HORIZONTAL 70° DIRECTION _____

	Top soil	1'				
	Gravel and stones					
	Gravel and stones					
	Clay and gravel	65'				
	Sand (Water Bearing)	76'			Standing water level on completion of drilling.	
	Sand and Gravel	86'				
		104'				

FROM NO _____

DATE _____

LOGGED _____

LOGGED BY S.Major

COMMENCED 23-9-63

COMPLETED 2-10-63

VERTICAL SCALE 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO 1 R.L

LOCATION D.A.S.F. Lease, ERMP, Markham Valley. T.N.G. ANGLE FROM HORIZONTAL 90° DIRECTION

		DEPTH & SIZE OF HOLE	LOG	CORE RECOVERY	STRUCTURES JOINTS, SEAMS, FAULTS, CRUSHED ZONES	
		20				
		40				
		60				
		70'			-- Standing water level on completion of drilling.	
	Gravel and stones	80				
	Gravel and stones Water Bed.	90'				
		93'				
	Clay.	103'				

S Major
4-11-1963
6-11-1963

Bore reconditioned and deepenned from 70 ft. to 103 ft.

LOGGED

VERTICAL SCALE 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO 2 R.L

LOCATION D.A.S.F. LEASE, ERAP, MARKHAM VALLEY, T.N.G. ANGLE FROM HORIZONTAL 90° DIRECTION

0'

20'

37'

39' — — Standing water level on completion of drilling.

Silt and gravel

Sand gravel and stones.

Water bed.

56'

76'

Hole extended from 37 ft to 76 ft.

LOGGED

S Major

11-11-'63

VERTICAL 1" = 20 ft

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO 3 R.L.

LOCATION D.S.F. LEASE, EAAP, MARKHAM VALLEY. T.N.G. ANGLE FROM HORIZONTAL 90° DIRECTION

					STRUCTURES	

20'

40'

Gravel and Sand

Standing water level on completion of drilling.

60'

Gravel and large stones

66'

water bearing Gravel

70'

Gravel and clay

80'

Yellow clay

84'

S Major

2-12-63

7-12-63

LOGGED

VERTICAL SCALE 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ HOLE NO. 4 R.L. _____

LOCATION D.A.S.F. Lease, Erap, Markham Valley. T.N.G. ANGLE FROM HORIZONTAL 90° DIRECTION _____

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	LOG	LIFT & CORE RECOVERY	STRUCTURES. JOINTS VEINS, SEAMS FAULTS CRUSHED ZONES	
	Silt and fine gravel	80'				
		93'			Standing water level on completion of drilling.	
	Gravel and large stones	110'				
	Silt sand and fine gravel	126'				
	Coarse gravel Water bearing.	134'				
	Clay and gravel	140'				
	Yellow clay	142'				

DRILL NO. _____

TYPE _____

DRILLER 5 Major

COMMENCED 9-12-63

COMPLETED 13-12-63

LOGGED _____

VERTICAL SCALE 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO 6

DASF LEASE, ERAP, MARKHAM VALLEY TNG. ANGLE FROM HORIZONTAL 90° DIRECTION

Standing water level on completion of drilling.

30' Gravel and clay.

36' Water Bearing { Gravel

41' Gravel and clay

50' clay.

52'

5 Major
21-11-63
24-11-63

LOGGED

VERTICAL SCALE 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO. 1

Markham Valley.

Lease belonging To R. Ginter P.O. Box 247 Lae. ANGLE FROM HORIZONTAL 90° DIRECTION

	Top soil	2'				
	Clay and gravel	36'				
	Rock	39'				
	Gravel and Stones	55'				
	Clay and gravel	76'				
	clay and sand	100'				
	clay and gravel	124'				

No water at 124'

S Major

9-10-63

16-10-63

VERTICAL SCALE 1" = 30'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO 2 R.L.

MALAHANG PLANTATION LAE. ANGLE FROM HORIZONTAL 90° DIRECTION

Depth (ft)	Description	Remarks
0–2'	Top soil	
2'–18'	Gravel and clay	
18'–30'	Gravel and large stones	
30'–48'	Gravel and clay	Standing water level on completion of drilling.
48'–60'	Water bearing gravel	
60'–70'	Gravel sand clay and stones	
70'–80	Water bearing gravels.	

S MAJOR

20-1-64

31-1-64

LOGGED

VERTICAL SCALE 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT _____ HOLE NO 1 R.L. _____

LOCATION MALAHANG PLT. LAE. ANGLE FROM HORIZONTAL 90° DIRECTION _____

	DESCRIPTION	DEPTH IN FEET			STRUCTURE (JOINTS, VEINS, SHEAR ZONES, FAULTS, OR BEDDING)	
	Top Soil	2'				
	Gravel and clay	10'				
	Gravel and large stones	16'				
	Clay and gravel	30'				
	Sand, gravel and stones	36'				
	Clay and gravel				Standing water level on completion of drilling.	
	Clay gravel and larg stones	44'				
Water bearing.	Large stones	47'				
	Large stones	51'				
	Gravel and stones	58'				
	Fine gravel and sand	64'				
		70'				

LOGGED _____

S. MAJOR.

23-12-63

VERTICAL 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO — R.L —

T.J LEAHY LEASE, ERAP, MARKHAM VALLEY, INS. ANGLE FROM HORIZONTAL — 90° DIRECTION —

		DEPTH IN FEET			STRATIGRAPHIC SUCCESSION AND REMARKS	
	Top Soil	2'	SSS			
	Grey clay and sand.				Standing water level on completion of drilling.	Water bearing strata from 8' — 57'.
	Gravel and Bands of yellow clay	20'				
	Grey clay and gravel.	40'				
		57'				

S Major
25-11-63
27-11-63

LOGGED —

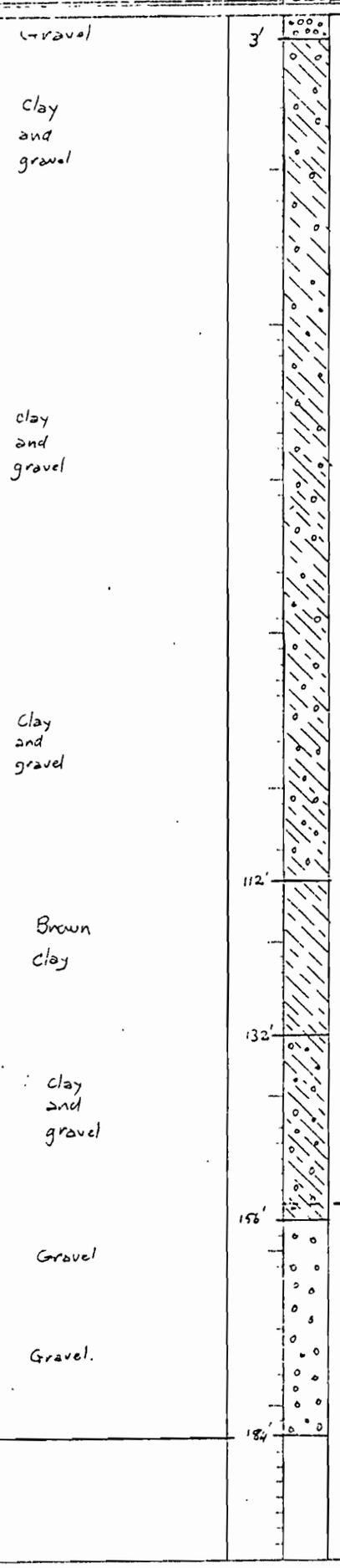
VERTICAL SCALE 1" = 20'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

HOLE NO. 1 R.L.

W Jackson's Lease, Leroy Plains, Markham Valley ANGLE FROM HORIZONTAL 90° DIRECTION



S Major
21-10-63
31-10-63

LOGGED

VERTICAL SCALE 1" = 30'

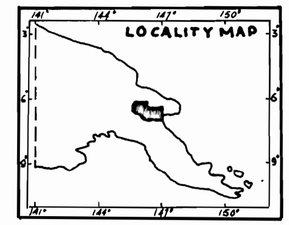
GEOLOGICAL MAP
MARKHAM RIVER VALLEY
T.P.N.G.

(based on map by N.J. MacKay - B.M.R. Rec 1955/25)

TN MN

Scale

4 0 4 8 12 Miles



Reference

CAINOZOIC

Recent

Qa — Alluvium (clay, silt, sand, cobbles, boulders)

TERTIARY

Pliocene

Saffair Conglomerate — Tps — Clay, silt, sand, cobbles boulders.

Miocene/Pliocene

Tu — Shale, siltstone, calcareous siltstone, conglomerate, limestone, basalt & tuff.

(?)MESOZOIC

Morobe Granodiorite — Mgm

Kaindi Metamorphics — MK — Slate, phyllite, meta-greywacke meta-conglomerate, marble.

(?)PALAEOZOIC

Ptg — Granodiorite.

Pzm — Metamorphics.

Geological boundary

Fault

45° Strike and dip of strata

Syncline

Anticline

Road

Airstrip

• 7016' Height in feet, datum mean sealevel

Property boundary

Bureau of Mineral Resources, Geology and Geophysics. September 1964

To accompany Record No 1964/80

B 55/A10/13

PNG B55-10-4

J.G. Best May 1964.