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BEACH SANDS INVESTIGATION.

REPORT ON A DEPOSIT THREE MILES NORTH-NORTHWEST FROM LENNOX HEAD, NEW SOUTH WALES.

by

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DEPARTMENT OF SUPPLY AND DEVELOPMENT.

Bureau of Mineral Resources, Geology and Geophysics.

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REPORT ON A DEPOSIT THREE MILES NORTH-NORTHWEST FROM LENNOX HEAD, NEW SOUTH WALES.

Plans and sections of the deposit are included at the back of this report.

1. Introduction.

The deposits of heavy-mineral sands which are at present being exploited along the East Coast occur on or within a few hundred feet of the ocean beaches. The occurrence of this deposit at a distance of nearly 1⅛ miles from the beach suggests the possibility that other deposits may be found at some distance from the coast line. Of incidental interest is the possibility that the deposit, which presumably was formed by wave or surf action, may be at slightly higher level than the deposits adjacent to present day beaches.

2. The Locality of the Deposit.

A locality map and a plan of the area within which the deposit occurs are shown on Plate 1 at the back of this report. The deposit is 4 miles north-northwest from Lennox Head, and nearly 1⅛ miles from Seven Mile Beach. The area within which the deposit occurs is bounded on the east by the Seven Mile Beach and on the west by a steep scarp of basalt, approximately 3 miles from the beach. The area consists of several narrow northerly-trending sandy tracts separated by low-lying and swampy ground. The sandy tracts are arcuate shaped, like Seven Mile Beach, being concave towards the east. The most easterly and most elevated sandy tract comprises the dune area adjacent to Seven Mile Beach. The westermost sandy tract, which forms the eastern boundary of the Newrybar Swamp, rises in its northern portions to about 15 feet above high waterlevel: the other sandy tracts are much lower, being little above swamp level. The arcuate shaped sandy tracts appear to have been formed during an eastward recession of the beach line. They apparently represent successive beach lines formed by the development of sandspits northwards from the solid rock area adjacent to Lennox Head and the smaller area 2⅛ to 3 miles northwest from Lennox Head. The deposit of heavy minerals occurs in the north-western portion of the most westerly sand tract, at the foot of a basalt-capped sandstone hill, against which the sandy tract terminates.

3. Examination of the Deposit.

The deposit was sampled during the week ending 13th February, 1948, by boring to water level with a post-hole digger, from the northern end of the deposit to a point approximately 1300 feet southwards. The bore sites are shown on Plate 2 at the back of this report, and sections across the bore lines are shown on Plate 3. The datum for levels is the high water mark on Seven Mile Beach at 10 a.m., 12th February, 1948. It is probable that the high water mark was about a foot above actual high water level. Samples obtained from bores were dried and weighed, and their volumes were determined. Heavy mineral concentrates were separated from the samples by panning, and the weights and volumes of the concentrates were determined. The percentage composition of a composite sample of the concentrates was determined by grain counting.

4. Results.

(a) The origin of the Deposits. The sandy tract on which the deposit occurs developed as a sandspit in a northerly direction from the solid rock area 2⅛ to 3 miles north-west from Lennox Head. The sandspit progressed

towards the basalt-capped sandstone hill or spur approximately four miles north-northwest from Lennox Head, and eventually formed a sand-bar when its northerly tip reached the sandstone hill. Heavy minerals were concentrated on the beach (the eastern flank of the sand-bar) by the action of waves and surf during stormy weather, just as they are on present day beaches. The waves and surf swept in from the ocean, not parallel to the beach but slightly obliquely, viz. from a little south of east, and as a result the heavy mineral concentrates were gradually worked northwards along the beach. Towards the northern end of the beach, the northward movement of the heavy minerals was arrested partly by the hill of sandstone, and partly because of the fact that, due to the curvature, the northern portion of the beach had a trend somewhat east of north, i.e. parallel to the surf- and wave- line. Sand containing a considerable proportion of heavy minerals was apparently washed over the crest of the sand bar during stormy weather into the quiet water on the western side of the bar.

The level at which the deposit occurs suggests that the sea level may have been a few feet, but probably less than 5 feet, above the present sea level when the deposit was formed. The sections (Plate 3) show that the mineral bearing sands were washed over the underlying clay which stands, in the northern part of the deposit, at a height of at least 7 feet above present mean high water level. Seasonal high tides are up to 2 feet above mean high water, and in stormy weather, the level rises higher. Thus, deposits of heavy minerals, highly concentrated as in the "Seam" at the deposit which is being discussed, could well be formed at a height of a several feet above mean high water mark. It is questionable, however, whether any such deposit could form with its basal portion at least 7 feet above mean high water level.

(b) A Description of the Deposit. The deposit is underlain by a foot or so of white sand, and by clay or mud presumably derived from felspathic sandstones, which outcrop at the northern end of the sand-bar and which probably occur beneath the mud. At the base of the deposit is a varying thickness of sand (from 0 to 12 inches) which contains a comparatively high proportion of heavy minerals, and is spoken of locally as the "seam". In the tabulated data given below, the term "seam" has been retained for this comparatively high-grade portion of the deposit. The seam is overlain by a thickness of 4 to 7 feet of sand which though lower in grade, contains sufficient heavy minerals to warrant their exploitation. In the tabulated data below, this is referred to as the "Sand Overlying the Seam". The deposit is free from overburden except for a small area surrounding Bore No.12.

The boring has not extended to the western nor to the southern boundary of the deposit. It is thought that the grade of the deposit will decrease in each of these directions, but this opinion needs to be tested by further boring.

(c) Estimates of Quantities. The quantities of heavy mineral concentrates, and the grades of the mineral bearing sands are tabulated as follows:-

Table 1. Tonnages of Heavy Mineral Concentrates, Volumes and Average Thicknesses of Mineral-Bearing Sands and of Overburden, and Average grades of Mineral Bearing Sands:-

Table 1(a) : In the Seam.
Table 1(b) : Overlying the Seam.
Table 1(c) : Total.

Table 2. Tonnages of Heavy Mineral Concentrates, Volumes and Average Thicknesses of Mineral-Bearing Sands and of Overburden, and Average grade of Mineral Bearing Sands in Strip 1 Yard Wide Along Bore Lines :-

Table 2(a) : In the Seam.
Table 2(b) : Overlying the Seam.
Table 2(c) : Total.

Table 3. Tonnages of each of the Heavy Minerals:-

Table 3(a) : In the Seam.
Table 3(b) : Overlying the Seam.
Table 3(c) : Total.

The figures of Tables 1, 2 and 3 were derived from data tabulated in the Appendices as follows :-

Table A. Quantities of Heavy Minerals Intersected in Bores:-

Appendix 1. Table A : Seam.
Appendix 2. Table A : Sand Overlying Seam.

Table B. Weight of Mineral in 1 Yard Strip Along Bore Line :-

Appendix 1, Table B : Seam.
Appendix 2, Table B : Sand Overlying Seam.

Table C. Volume and Average Thickness of Mineral-Bearing Sand Along Bore Line :-

Appendix 1, Table C : Seam.
Appendix 2, Table C : Sand Overlying Seam.

Table D. Volume and Average Thicknessof Overburden Along Bore Line. The deposit is free from overburden except for a small area surrounding Bore No. 12. This is referred to in:-

Appendix 1, Table D : Seam.
Appendix 2, Table D : Sand Overlying Seam.

Table E. Average Weight of Heavy Mineral Concentrate per 1 Yard Strip Between Bore Lines, and Average Area of Longitudinal Section of Mineral Bearing Sands and of Overburden Between Boro Lines:-

Appendix 1, Table E : Seam.
Appendix 2, Table E : Sand Overlying Seam.

Table F. Total Weight of Heavy Mineral Concentrate, Total Volume of Mineral-Bearing Sands, and Total Volume of Overburden between Bore Lines :-

Appendix 1, Table F.: Seam.
Appendix 2, Table F : Sand Overlying Seam.

Table G. Average Thicknesses of Mineral-Bearing Sands and of Overburden:-

Appendix 1, Table G : Seam.
Appendix 2, Table G : Sand Overlying Seam.
Appendix 3, Table G : Total, Seam and Overlying Sand.

Table H. Percentage Compositions of Concentrates and Weights of Each of the Heavy Minerals :-

Appendix 1, Table H : Seam.
Appendix 2, Table H : Sand Overlying Seam.

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TABLE 1. (a).

TONNAGES OF HEAVY MINERAL CONCENTRATE, VOLUMES AND AVERAGE THICKNESSES OF MINERAL-BEARING SANDS AND OF OVERBURDEN, AND AVERAGE GRADES OF MINERAL-BEARING SANDS, IN THE SEAM.

AREA BETWEEN BORE LINES.	WEIGHT OF HEAVY MINERAL CONCENTRATE. (TABLE F.) TONS	VOLUME MINERAL-BEARING SANDS (TABLE F.) CUBIC YDS.	VOLUME OVER-BURDEN (TABLE F.) CUBIC YDS.	AVERAGE THICKNESS MINERAL-BEARING SANDS (TABLE G.) FEET	AVERAGE THICKNESS MINERAL-BEARING SANDS (TABLE G.) INCHES	AVERAGE THICKNESS OVER-BURDEN (TABLE G.) FEET	AVERAGE THICKNESS OVER-BURDEN (TABLE G.) INCHES	AVERAGE GRADE OF MINERAL-BEARING SANDS. LBS. OF HEAVY MINERAL CONCENTRATE PER CUB YD
1 and 2	152.5	194.3	SEE APPENDIX 1, NOTE AT TOP OF TABLE D.	0	6.8	SEE APPENDIX 1, NOTE AT TOP OF TABLE D.		1758.8
2 and 3	309.9	1288.2		0	11.7			538.9
3 and 4	150.6	660.8		0	11.0			510.8
4 and 5	86.6	151.8		0	3.6			1278.7
5 and 6	145.3	245.5		0	5.3			1326.0
TOTAL	844.9	2540.6		0	8.9			744.9

SAND OVERLYING SEAM.

TABLE 1. (b).

TONNAGES OF HEAVY MINERAL CONCENTRATE, VOLUMES AND AVERAGE THICKNESSES OF MINERAL-BEARING SANDS AND OF OVERBURDEN, AND AVERAGE GRADES OF MINERAL-BEARING SANDS, OVERLYING THE SEAM.

AREA BETWEEN BORE LINES.	WEIGHT OF HEAVY MINERAL CONCENTRATE. (TABLE F.) TONS	VOLUME: MINERAL-BEARING SANDS (TABLE F.) CUBIC YDS.	VOLUME: OVERBURDEN (TABLE F.) CUBIC YDS.	AVERAGE THICKNESS: MINERAL-BEARING SANDS (TABLE G.) FEET	AVERAGE THICKNESS: MINERAL-BEARING SANDS (TABLE G.) INCHES	AVERAGE THICKNESS: OVERBURDEN (TABLE G.) ✱ FEET	AVERAGE THICKNESS: OVERBURDEN (TABLE G.) ✱ INCHES	AVERAGE GRADE OF MINERAL-BEARING SANDS. LBS. OF HEAVY MINERAL CONCENTRATE PER CUB YD
1 and 2	542.8	6,927.9	SEE APPENDIX 2 TABLE D AND ADDENDUM TO TABLE E.	6	0.7	SEE APPENDIX 2 TABLE D AND ADDENDUM TO TABLE E.		175.5
2 and 3	920.4	12,078.8		4	8.5			170.7
3 and 6	2113.9	21,613.1		4	9.3			219.1
TOTAL	3577.1	40,619.8		4'	11.2"			197.2

✱ APPENDIX 3.

TOTAL MINERAL, SEAM AND OVERLYING SAND.

Data from Tables 1(a) and 1(b)

TABLE 1. (c).

TOTAL TONNAGES OF HEAVY MINERAL CONCENTRATE, VOLUMES AND AVERAGE THICKNESSES OF MINERAL-BEARING SANDS AND OF OVERBURDEN, AND AVERAGE GRADES OF MINERAL-BEARING SANDS.

AREA BETWEEN BORE LINES.		WEIGHT OF HEAVY MINERAL CONCENTRATE. (TABLE F.) # TONS	VOLUME MINERAL-BEARING SANDS (TABLE F.) # CUBIC YDS.	VOLUME OVER-BURDEN (TABLE F.) # CUBIC YDS.	AVERAGE THICKNESS MINERAL-BEARING SANDS (TABLE G.) ø FEET	AVERAGE THICKNESS MINERAL-BEARING SANDS (TABLE G.) ø INCHES	AVERAGE THICKNESS OVER-BURDEN (TABLE G.) FEET	AVERAGE THICKNESS OVER-BURDEN (TABLE G.) INCHES	AVERAGE GRADE OF MINERAL-BEARING SANDS. LBS. OF HEAVY MINERAL CONCENTRATE PER CUB YD
1 and 2.	Seam	152.5	194.3						
	Overlying Sand	542.8	6927.9						
	Total	695.3	7122.2	SEE NOTES THIS COLUMN TABLES 1(a) AND 1(b).	6	2.7	SEE NOTES THIS COLUMN TABLES 1(a) AND 1(b).		218.7
2 and 3.	Seam	309.9	1288.2						
	Overlying Sand	920.4	12078.8						
	Total	1230.3	13367.0		5	2.6			206.2
3 and 6.	Seam	150.6 + 86.6 + 145.3	660.8 + 151.8 + 245.5						
	Overlying Sand	2113.9	21613.1						
	Total	2496.4	22671.2		5	0.1			246.6
		4422.0	43160.4		5'	2.9"			229.5

Appendices 1 and 2. ø Appendix 3.

SEAM.

TABLE 2. (a) TONNAGES OF HEAVY MINERAL CONCENTRATE, VOLUMES AND AVERAGE THICKNESSES OF MINERAL-BEARING SANDS ~~AND OF OVERBURDEN~~, AND AVERAGE GRADE OF MINERAL-BEARING SANDS, IN ~~STRIP~~ OF SEAM ~~XXXXX~~ 1 YARD WIDE ALONG BORE LINES.

LINE	WEIGHT OF HEAVY MINERAL CONCENTRATE (TABLE B.)		VOLUME MINERAL-BEARING SANDS (TABLE C.)	VOLUME OVERBURDEN (TABLE D.)	AVERAGE THICKNESS MINERAL-BEARING SANDS (TABLE C.)	AVERAGE THICKNESS OVERBURDEN (TABLE D.)	AVERAGE GRADE OF MINERAL-BEARING SANDS.
	LBS.	TONS	CUBIC YDS.	CUBIC YDS.	FEET INCHES	FEET INCHES	LBS. OF HEAVY MINERAL CONCENTRATE PER CUBIC YARD.
1	8458.6		4.44	SEE APPENDIX 1, NOTE AT TOP OF TABLE D.	1 0	SEE APPENDIX 1, NOTE AT TOP OF TABLE D.	1903.1
2	1742.5		1.42		0 3		1229
3	10545.4		21.4		1 0		492.7
4	896		0.83		0 1.5		1074
5	4422		3.33		0 6.0		1327
6	2154.6		1.64		0 4.5		1295

SAND OVERLYING SEAM.

TABLE 2. (b). TONNAGES OF HEAVY MINERAL CONCENTRATE, VOLUMES AND AVERAGE THICKNESSES OF MINERAL-BEARING SANDS AND OF OVERBURDEN, AND AVERAGE GRADE OF MINERAL-BEARING SANDS, IN OVERLYING THE SEAM, IN A STRIP 1 YARD WIDE ALONG BORE LINES.

LINE	WEIGHT OF HEAVY MINERAL CONCENTRATE (TABLE G.)		VOLUME MINERAL-BEARING SANDS (TABLE C.)	VOLUME OVERBURDEN (TABLE D.)	AVERAGE THICKNESS MINERAL-BEARING SANDS (TABLE C.)	AVERAGE THICKNESS OVERBURDEN (TABLE D.)	AVERAGE GRADE OF MINERAL-BEARING SANDS.
	LBS.	TONS	CUBIC YDS.	CUBIC YDS.	FEET INCHES	FEET INCHES	LBS. OF HEAVY MINERAL CONCENTRATE PER CUBIC YARD.
LINE 1	15,875.0	7.08	76.33	Nil	6' 10.5"	Nil.	208.0
LINE 2	18, 867.2	8.42	121.61	Nil	5' 7.7"	Nil.	155.1
LINE 3	21,169.4	9.45	112.94	See Append. 2 Table D, and Addendum to Table E.	4' 0"	See Appendix 2, Table D, and Addendum to Table E.	187.4
LINE 6	19,544.9	8.72	75.0	Nil	6' 9"	Nil.	260.6

TOTAL MINERAL, SEAM AND OVERLYING SAND.

Data from Tables 2(a) and 2(b).

TABLE 2. (c)

TOTAL TONNAGES OF HEAVY MINERAL CONCENTRATE, VOLUMES AND AVERAGE THICKNESSES OF MINERAL-BEARING SANDS AND OF OVERBURDEN, AND AVERAGE GRADE OF MINERAL-BEARING SANDS, IN STRIP 1 YARD WIDE ALONG BORE LINES.

LINE	WEIGHT OF HEAVY MINERAL CONCENTRATE (TABLE G.)		VOLUME MINERAL-BEARING SANDS (TABLE C.)	VOLUME OVERBURDEN (TABLE D.)	AVERAGE THICKNESS MINERAL-BEARING SANDS (TABLE C.)		AVERAGE THICKNESS OVERBURDEN (TABLE D.)		AVERAGE GRADE OF MINERAL-BEARING SANDS. LBS. OF HEAVY MINERAL CONCENTRATE PER CUBIC YARD.
	LBS.	TONS	CUBIC YDS.	CUBIC YDS.	FEET	INCHES	FEET	INCHES	
1. Seam	8,458.6		4.44		1	0			
Sand	15,875.0		76.33		6	10.5			
Total	24,333.6	10.8	80.77		7	10.5			301.2
2. Seam	1,742.5		1.42	SEE	0	3	SEE		
Sand	18,867.2		121.61	THIS	5	7.7	THIS		
Total	20,609.7	9.2	123.03	COLUMN	5	10.7	COLUMN		167.5
3. Seam	10,454.4		21.40	TABLE	1	0	TABLE		
Sand	21,169.4		112.94	1(c).	4	0	1 (c).		
Total	31,623.8	14.1	134.34		5	0			235.4
6. Seam	2,154.6		1.64		0	4.5			
Sand	19,544.9		75.00		6	9			
Total	21,699.5	9.6	76.64		7	1.5			283.1

SEAM

TABLE 3. (a).

TONNAGES OF EACH OF THE HEAVY MINERALS IN THE SEAM

ESTIMATED FROM PERCENTAGE COMPOSITIONS DETERMINED BY GRAIN COUNTING

AREA BETWEEN BORE LINES.	TONNAGES OF HEAVY MINERAL CONCENTRATES.	PERCENTAGE COMPOSITIONS & TONNAGES OF HEAVY MINERALS.											
		MONAZITE		ZIRCON		RUTILE		ILMENITE		GARNET		OTHER MINERALS	
		%	TONS	%	TONS	%	TONS	%	TONS	%	TONS	%	TONS
TOTAL AREA (SEAM ONLY).	844.2	0.3	2.5	48.7	411.1	33.4	282.0	17.0	143.5	0.2	1.7	0.4	3.4

SAND OVERLYING SEAM.

TABLE 3. (b). TONNAGES OF EACH OF THE HEAVY MINERALS IN THE SAND OVERLYING THE SEAM.

ESTIMATED FROM PERCENTAGE COMPOSITIONS DETERMINED BY GRAIN COUNTING

AREA BETWEEN BORE LINES.	TONNAGES OF HEAVY MINERAL CONCENTRATES.	PERCENTAGE COMPOSITIONS & TONNAGES OF HEAVY MINERALS.											
		MONAZITE		ZIRCON		RUTILE		ILMENITE		GARNET		OTHER MINERALS	
		%	TONS	%	TONS	%	TONS	%	TONS	%	TONS	%	TONS
TOTAL AREA LINE 1 TO LINE 6.	3,577.1	0.3	10.7	48.7	1742	33.4	1194.8	17.0	608.1	0.2	7.2	0.4	14.3

TOTAL MINERAL, SEAM AND OVERLYING SAND.

Data from Tables 3(a) and 3(b).

TABLE 3. (c). TONNAGES OF EACH OF THE HEAVY MINERALS

ESTIMATED FROM PERCENTAGE COMPOSITIONS DETERMINED BY GRAIN COUNTING

AREA BETWEEN BORE LINES.	TONNAGES OF HEAVY MINERAL CONCENTRATES.	PERCENTAGE COMPOSITIONS & TONNAGES OF HEAVY MINERALS.											
		MONAZITE		ZIRCON		RUTILE		ILMENITE		GARNET		OTHER MINERALS	
		%	TONS	%	TONS	%	TONS	%	TONS	%	TONS	%	TONS
TOTAL AREA. LINE 1 TO LINE 6.													
SEAM	844.2	0.3	2.5	48.7	411.1	33.4	282.0	17.0	143.5	0.2	1.7	0.4	3.4
OVERLYING SAND	3577.1	"	10.7	"	1742	"	1194.8	"	608.1	"	7.2	"	14.3
TOTAL	4421.3	"	13.2	"	2153	"	1477	"	751.6	"	8.9	"	17.7

S E A M.

APPENDIX.1. TABLE A. QUANTITIES OF HEAVY MINERALS INTERSECTED IN BORES. - **SEAM.**

BORE NO. & R.L.	CO-ORDINATES FROM	SAMPLE NO. FIELD	SAMPLE NO. LABORATORY	DEPTH FROM	DEPTH TO	QUANTITY OF HEAVY MINERALS LBS PER CU. YD.	QUANTITY OF HEAVY MINERALS WT. PER CENT	THICKNESS OF SAMPLE (FT.) X (LBS. PER CU. YD).	REMARKS.
3.		1	L2513	0'0"	6'9	251	9.6	1694	
14.9'		2	L2514	6'9	7'3	652	22.7	326	SEAM.
		3	L2515	7'3	8'9	2320	65.0	3480	
9.		1	L2523	0'0	5'9	238	9.0	1369	
13.4'		2	L2524	5'9	6'3	1229	37.6	615	SEAM.
13.		1	L2529	0'0	4'6	319	11.7	1436	
9.7'	SEE	2	L2530	4'6	6'0	660	22.2	990	SEAM.
		3	L2531	6'0	6'6	285	9.4	143	
14.	PLAN.	1	L2532	0'0	6'6	118	4.5	767	
14.4'		2	L2533	6'6	7'6	364	13.5	364	SEAM.
18.		1	L2538	0'0	5'3	570	20.3	3015	
10.2'		2	L2539	5'3	5'6	1074	34.0	269	SEAM.
20		1	L2541	0'0	6'0	289	9.9	1734	
12.7'		2	L2542	6'0	7'0	1327	41.7	1327	SEAM.
22.		1	L2544	0'0	6'6	301	11.1	1957	
		2	L2545	6'6	7'3	1295	41.0	972	SEAM.

SEAM.

APPENDIX 1. TABLE B. **PAGE 1.**

WEIGHT OF MINERAL IN 1 YARD STRIP ALONG BORE LINE.

(FOR SEAM).

BORE NOS.	LBS. OF MINERAL PER SQ. YD. AT BORE. (FROM TABLE A.)	AVERAGE LBS. WEIGHT OF MINERAL PER SQ. YD. ~~PER~~ ALONG ~~BETWEEN BORES~~ LINE	WIDTH OF ~~XXXXX~~SEAM(APPROX.) (FROM TABLE A.)	WEIGHT OF MINERAL In 1 YD. STRIP ~~XXXX~~ ALONG LINE ~~XXXXXXXXXX~~ (LBS)
LINE 1. 3	$\frac{3806}{3}$ = 1268.7	634.4	$\frac{40}{3}$ = 13.3	8458.6
TOTAL FOR LINE 1.				8458.6
LINE 2. 9	$\frac{615}{3}$ = 205	102.5	17	1742.5
TOTAL FOR LINE 2.				1742.5
LINE 3. 12 to 13.	$\frac{1132}{3}$ = 377.3 (Bore 13 only).	188.6	8	1508.8
13.	$\frac{1132}{3}$ = 377.3	$\frac{498.6}{2}$ = 249.3	33.3	8309.9
14.	$\frac{364}{3}$ = 121.3			
14 to 15.	$\frac{364}{3}$ = 121.3 (Bore 14 only).	60.6	12	727.2
TOTAL FOR LINE 3.			53.3	10545.4

SEAM.

APPENDIX. TABLE B. PAGE 2. WEIGHT OF MINERAL IN 1 YARD STRIP ALONG BORE LINE.

BORE NOS.	LBS. OF MINERAL PER SQ. YD. AT BORE. (FROM TABLE A.)	AVERAGE LBS. WEIGHT OF MINERAL PER SQ. YD. ~~BE~~ ALONG ~~XXXXXXXXXXXX~~ LINE.	~~DISTANCE BETWEEN BORES~~ WIDTH (YDS) OF SEAM (EST.) (FROM TABLE A.)	WEIGHT OF MINERAL In 1 YD. STRIP BE-- TWEEN BORES (LBS)
LINE 4.				
18	$\frac{269}{3}$ = 89.7	44.8	$\frac{60}{3}$ = 20	896.
LINE 5.				
20	$\frac{1327}{3}$ = 442.3	221.1	$\frac{60}{3}$ = 20	4422.

SEAM.

APPENDIX. TABLE B. PAGE 3.

WEIGHT OF MINERAL IN 1 YARD STRIP ALONG BORE LINE.

BORE NOS.	LBS. OF MINERAL PER SQ. YD. AT BORE. (FROM TABLE A.)	AVERAGE LBS. WEIGHT OF MINERAL PER SQ. YD. ~~BE~~ ON LINE ~~TWEEN BORES~~	WIDTH OF SEAM. DISTANCE ~~BETWEEN BORES~~ (YDS) (FROM TABLE A.)	WEIGHT OF MINERAL In 1 YD. STRIP BETWEEN BORES (LBS)
LINE 6.				
22	$\frac{972}{5}$ = 324	162	13.3	2154.6
TOTAL FOR LINE 6.				2154. 6.

SEAM.

APPENDIX 1. TABLE C. VOLUME AND AVERAGE THICKNESS OF MINERAL-BEARING SAND IN SEAM, ALONG BORE LINE.

BORE NO.	THICKNESS (TABLE A.) AT BORE (ALONG BORE LINE.)	AV. WIDTH OF SEAM. BETWEEN BORES (TABLE A.)		AREA OF LONGITUDINAL SECTION OF SEAM BETWEEN BORES.		COMPLETE BORE LINE AV. THICKNESS		VOLUME OF 1YD. STRIP
	INCHES	INCHES	FEET	FEET	SQ. FEET	SQ. YDS.	FEET	INCHES	CUBIC YDS.
LINE 1. Bore 3.	24	12	1.0	40	40	4.44	1.0	12.0	4.44
LINE 2. Bore 9.	6	3	0.25	51	12.8	1.42	0.25	3.0	1.4
LINE 3. Bore 12	-	12	1.0	24	24	2.7			
13	24								
13	24	18	1.5	100	150	16.7			
14	12								
14	12	6	0.5	36	18	2.0			
15	-								
TOTAL				160	192	21.4	1.0	12.0	21.4

SEAM.

APPENDIX. 1. TABLE C. VOLUME AND AVERAGE THICKNESS OF MINERAL-BEARING SAND IN SEAM / ALONG BORE LINE.

BORE NO.	THICKNESS (TABLE A.) AT BORE (ACROSS SEAM) / WIDTH OF SEAM. INCHES	AV. THICKNESS (TABLE A.) INCHES	AV. THICKNESS (TABLE A.) FEET	DISTANCE BETWEEN BORES (TABLE A.) FEET	AREA OF LONGITUDINAL SECTION OF SEAM, BETWEEN BORES SQ. FEET	AREA OF LONGITUDINAL SECTION OF SEAM, BETWEEN BORES SQ. YDS.	COMPLETE BORE LINE AV. THICKNESS FEET	COMPLETE BORE LINE AV. THICKNESS INCHES	COMPLETE BORE LINE VOLUME OF JYD. STRIP CUBIC YDS.
LINE 4.									
18.	3	1.5	0.125	60	7.5	0.83	0.125	1.5	0.83
LINE 5.									
20.	12	6.0	0.5	60	30.0	3.33	0.5	6.0	3.3

SEAM.

APPENDIX. 1. TABLE C. VOLUME AND AVERAGE THICKNESS OF MINERAL-BEARING SAND ALONG BORE LINE.

(ALONG BORE LINE) WIDTH OF SEAM.

BORE NO.	THICKNESS (TABLE A.) AT BORE	AV. [illegible]		[illegible] (TABLE A.)	AREA OF LONGITUDINAL SECTION OF SEAM. [illegible]		COMPLETE BORE LINE AV. THICKNESS		VOLUME OF 1YD. STRIP
	INCHES	INCHES	FEET	FEET	SQ. FEET	SQ. YDS.	FEET	INCHES	CUBIC YDS.
LINE 6.									
BORE 22.	**9**	**4.5**	**0.37**	**40**	**14.8**	**1.64**	**0.37**	**4.5**	**1.6**

MOST of the sand overlying the seam contains heavy minerals in sufficient quantities to warrant exploitation. Calculations of the quantities of this sand, and of the heavy minerals contained in it are given in Appendix 2.

APPENDIX 1. TABLE D.

VOLUME AND AVERAGE THICKNESS OF OVERBURDEN ALONG BORE LINE.

BORE NO.	THICKNESS (TABLE A.) AT BORE	THICKNESS (TABLE A.) AVERAGE BETWEEN BORES	DISTANCE BETWEEN BORES (TABLE A.)	AREA OF LONGITUDINAL SECTION BETWEEN BORES.		COMPLETE BORE LINE. AVERAGE THICKNESS	COMPLETE BORE LINE. VOLUME OF 1YD STRIP
	FEET	FEET	FEET	SQUARE FEET	SQUARE YARDS	FEET	CUBIC YARDS

SEAM.

APPENDIX 1. TABLE. E.

AVERAGE WEIGHT OF HEAVY MINERAL CONCENTRATE PER 1 YARD STRIP BETWEEN BORE LINES, AND AVERAGE AREA OF LONGITUDINAL SECTION OF MINERAL-BEARING SEAM BETWEEN BORE LINES.

LINES	ADJOINING BORE LINES			AVERAGE BETWEEN BORE LINES.		
	WEIGHT OF MINERAL PER 1 YARD STRIP. FROM TABLE B. LBS.	AREA OF LONGITUDINAL SECTION OF MINERAL-BEARING SEAM. FROM TABLE C. SQ. YARDS	OVERBURDEN FROM TABLE D. SQ. YARDS	WEIGHT OF MINERAL PER 1 YARD STRIP. LBS.	AREA OF LONGITUDINAL SECTION OF MINERAL-BEARING SEAM. SQ. YARDS	OVERBURDEN SQ. YARDS
1 2	8458.6 1742.5	4.4 1.4		5100.5	2.9	
2 3	1742.5 10545.4	1.4 21.4		6143.9	11.4	
3 4	10545.4 896.0	21.4 0.8	SEE NOTE AT TOP OF TABLE D.	5720.7	11.2	SEE NOTE AT TOP OF TABLE D.
4 5	896.0 4422.0	0.83 3.33		2659.0	2.08	
5 6	4422.0 2154.6	3.33 1.64		3288.3	2.48	

SEAM.

APPENDIX 1. TABLE F.

TOTAL WEIGHT OF HEAVY MINERAL CONCENTRATE, TOTAL VOLUME OF MINERAL-BEARING SEAM, AND TOTAL VOLUME OF OVERBURDEN BETWEEN BORE LINES.

BORE LINES (TABLE A.)				WT. OF HEAVY MIN. CONC.		VOL. OF MINERAL-BEARING SEAM.		VOL. OF OVERBURDEN	
DESIGNATION	WIDTH OF SEAM.	DISTANCE BETWEEN	AREA BETWEEN	AV. PER 1 YD. STRIP (TABLE E.)	TOTAL BETWEEN LINES	AV. AREA OF LONGITUDINAL SECTION. (TABLE E.)	VOL. BETWEEN BORE LINES.	AV. AREA OF LONG. SECTION (TABLE E.)	VOL. BETWEEN BORE LINES.
Y	YDS.	YDS.	SQ. YDS.	LBS.	TONS	SQ. YDS.	CU. YDS.	SQ. YDS.	CU. YDS.
LINES 1	13.3								
2	17	67	1015.0	5100.5	152.5	2.9	194.3		
2	17								
3	53.3	113	3972.0	6143.9	309.9	11.4	1288.2		
3	53.3							SEE NOTE	
4	20.0	59	2162.3	5720.7	150.6	11.2	660.8	AT TOP	
4	20.0							OF TABLE	D.
5	20.0	73	1460.0	2659.0	86.6	2.08	151.8		
5	20.0								
6	13.3	99	1648.4	3288.3	145.3	2.48	245.5		
TOTAL			10257.7	844.2			2540.6		

&

S E A M.

APPENDIX. 1. TABLE G.

AVERAGE THICKNESSES OF MINERAL-BEARING SEAM.

BORE LINES (TABLE F.)		VOLUME (TABLE F.)		AVERAGE THICKNESS.	
DESIGNATION.	AREA BETWEEN LINES	MINERAL-BEARING SEAM	OVERBURDEN	MINERAL-BEARING SANDS	OVERBURDEN
	SQUARE YARDS	CUBIC YARDS	CUBIC YARDS	FEET INCHES	FEET INCHES
LINE 1. 2.	1015.0	194.3		6.8"	
2. 3.	3972.0	1288.2		11.7"	
3. 4.	2162.3	660.8	SEE NOTE AT TOP OF TABLE D.	11.0"	SEE NOTE AT TOP OF TABLE D.
4. 5.	1460.0	149.6		3.6"	
5. 6.	1648.4	242.5		5.3"	
	10257.7	2535.4		8.9"	

SEAM.

APPENDIX 1. TABLE H. PERCENTAGE COMPOSITIONS OF CONCENTRATES AND WEIGHTS OF EACH OF THE HEAVY MINERALS.

≠ From Table E.

LINE	LABORATORY DETERMINATIONS						TONS (LBS.) OF MINERAL IN 1 YD. STRIP ALONG BORE LINE						
	Mon.	Zir.	Rut.	Ilmen.	Gar.	Others	Total Conc.≠	Monazite	Zircon	Rutile	Ilmen.	Garnet	Others
Composite for Area. (Seam Only).	0.3	48.7	33.4	17.0	0.2	0.4	844.2	2.5	411.1	282.0	143.5	1.70	3.40

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE A. **PAGE 1.** QUANTITIES OF HEAVY MINERALS INTERSECTED IN BORES.

BORE NO. & R.L.	CO-ORDINATES FROM	SAMPLE NO. FIELD	SAMPLE NO. LABORATORY	DEPTH FROM	DEPTH TO	QUANTITY OF HEAVY MINERALS LBS PER CU. YD.	QUANTITY OF HEAVY MINERALS WT. PER CENT	THICKNESS OF SAMPLE (FT.) X (LBS. PER CU. YD).	REMARKS.
1. 16.0'	-	-	-	0	3'	-	-	-	SOIL.
2. 12.6'	-	1	L2512	0'	7'	197	7.5	1379	
3. 14.9'	-	1	L2513	0'	6'9"	251	9.6	1694	
		2	L2514	6'9"	7'3"	652	22.7	326)	) SEAM.
		3	L2515	7'3"	8' 9"	2320	65.0	3480)	
4. 16.0	-	1	L2516	0'	7'	135	3.5	945	
5. 14.4	-	1	L2517	0'	6'6"	278	10.2	1807	
		2	L2518	6'6"	7'	662	23.1	331	
		3	L2519	8'	8'3"	2890	73.5	723	
6. 2.9'	-	1	L2520	0'	4'	119	4.0	476	
7. 7.2'	-	1	L2521	0'	4'	186	6.9	744	
8. 11.3'	-	1	L2522	0'	7'	118	4.4	823	

APPENDIX. 2. TABLE A. **PAGE 2.**

QUANTITIES OF HEAVY MINERALS INTERSECTED IN BORES.

BORE NO. & R.L.	CO-ORDINATES FROM	SAMPLE NO. FIELD	SAMPLE NO. LABORATORY	DEPTH FROM	DEPTH TO	QUANTITY OF HEAVY MINERALS LBS PER CU. YD.	QUANTITY OF HEAVY MINERALS WT. PER CENT	THICKNESS OF SAMPLE (FT.) X (LBS. PER CU. YD).	REMARKS.
9. 13.4'	SEE MAP.	1	L2523	0	5'9"	238	9.0	1369	
		2	L2524	5'9"	6'3"	1229	37.6	615	---SEAM.
10. 15.3'		1	L2525	0	7'3"	130	4.9	943	
11. 10.4'		1	L2526	0	5'	219	8.1	1095	
		2	L2527	5'	6'3"	488	17.4	610	
12. 4.2'		1	L2528	1'6"	2'3"	163	6.1	123	
13. 9'7"		1	L2529	0	4'6"	319	11.7	1433	
		2	L2530	4'6"	6'0"	660	22.2	990	) SEAM
		3	L2531	6'	6'6"	285	9.4	143	)
14. 14.4'		1	L2532	0	6'6"	118	4.5	767	
		2	L2533	6'6"	7'6"	364	13.5	364	---- SEAM.
15. 16.4'		1	L2534	0	7'6"	29	1.2	218	
16. 17.7'		1	L2535	0	8'9"	45	1.8	393	
		2	L2536	8'9"	9'9"	216	15.4	216	

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE A. **PAGE 3.** QUANTITIES OF HEAVY MINERALS INTERSECTED IN BORES.

BORE NO. & R.L.	CO-ORDINATES FROM **SEE MAP.**	SAMPLE NO. FIELD	SAMPLE NO. LABORATORY	DEPTH FROM	DEPTH TO	QUANTITY OF HEAVY MINERALS LBS PER CU. YD.	QUANTITY OF HEAVY MINERALS WT. PER CENT	THICKNESS OF SAMPLE (FT.) X (LBS. PER CU. YD).	REMARKS.
17. 15.2'		1	L2537	0	7'	114	4.5	798	
18. 10.2'		1	L2538	0	5'3"	570	20.3	3013	
		2	L2539	5'3"	5'6"	1074	34.0	269 --- SEAM.	
19. 15.2'		1	L2540	0	7'6"	74	2.9	555	
20. 12.7'		1	L2541	0	6'	289	9.9	1734	
		2	L2542	6'	7'	1327	41.7	1327 --- SEAM.	
21. -		1	L2543	0	6'6"	283	10.0	1840	
22. -		1	L2544	0	6'6"	301	11.1	1957	
		2	L2545	6'6"	7'3"	1295	41.0	972 --- SEAM.	
23. -		1	L2546	0	7'6"	175	6.4	1313	
-	-	-	L2547	0	8'	429	15.6	3432	~~Overburden~~ at workings.
-	-	-	L2548	8'	9'6"	1253	39.4	1880	Seam at workings.

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE B. **PAGE 1.** WEIGHT OF MINERAL IN 1 YARD STRIP ALONG BORE LINE.

BORE NOS.	LBS. OF MINERAL PER SQ. YD. AT BORE. (FROM TABLE A.)	AVERAGE LBS. WEIGHT OF MINERAL PER SQ. YD. BETWEEN BORES.	DISTANCE BETWEEN BORES (YDS) (FROM TABLE A.)	WEIGHT OF MINERAL In 1 YD. STRIP BETWEEN BORES (LBS)
LINE 1.				
2	$\frac{1379}{3} = 460$	$\frac{1025}{2} = 512.5$	$\frac{50}{3}$	8541.7
3	$\frac{1694}{3} = 565$			
3	$\frac{1694}{3} = 565$	$\frac{880}{2} = 440$	$\frac{50}{3}$	7333.3
4	$\frac{945}{3} = 315$			
TOTAL FOR LINE.				15875.0
LINE 2.				
6	$\frac{476}{3} = 158.7$	$\frac{406.7}{2} = 135.6$	$\frac{44}{3}$	1988.8
7	$\frac{744}{3} = 248$			
7	$\frac{744}{3} = 248$	$\frac{523.3}{2} = 261.6$	$\frac{50}{3}$	4360
8	$\frac{826}{3} = 275.3$			
8	$\frac{826}{3} = 275.3$	$\frac{731.6}{2} = 365.8$	$\frac{50}{3}$	6096.7
9	$\frac{1369}{3} = 456.3$			
9	$\frac{1369}{3} = 456.3$	$\frac{770.6}{2} = 385.3$	$\frac{50}{3}$	6421.7
10	$\frac{943}{3} = 314.3$			
TOTAL FOR LINE.				18867.2

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE B. **PAGE 2.** WEIGHT OF MINERAL IN 1 YARD STRIP ALONG BORE LINE.

BORE NOS.	LBS. OF MINERAL PER SQ. YD. AT BORE. (FROM TABLE A.)	AVERAGE LBS. WEIGHT OF MINERAL PER SQ. YD. BETWEEN BORES.	DISTANCE BETWEEN BORES (YDS) (FROM TABLE A.)	WEIGHT OF MINERAL In 1 YD. STRIP BETWEEN BORES (LBS)
LINE 3.				
12	$\frac{123}{3} = 41$	$\frac{519.6}{2} = 259.6$	18	4672.8
13	$\frac{1436}{3} = 478.6$			
13	$\frac{1436}{3} = 478.6$	$\frac{734.2}{2} = 367.1$	$\frac{100}{3}$	12236.6
14	$\frac{767}{3} = 255.6$			
14	$\frac{767}{3} = 255.6$	$\frac{255.6}{2} = 127.8$	$\frac{100}{3}$	4260.0
15	Low grade.			
TOTAL FOR LINE				21169.4
LINE 6.				
21	$\frac{1840}{3} = 613.3$	$\frac{1255.6}{2} = 627.8$	$\frac{50}{3}$	10463.3
22	$\frac{1957}{3} = 652.3$			
22	$\frac{1957}{3} = 652.3$	$\frac{1089.9}{2} = 544.9$	$\frac{50}{3}$	9081.6
23	$\frac{1313}{3} = 437.6$			
TOTAL FOR LINE				19544.9

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE C. **PAGE 1.**

VOLUME AND AVERAGE THICKNESS OF MINERAL-BEARING SAND ALONG BORE LINE.

BORE NO.	THICKNESS (TABLE A.) AT BORE	AV. BETWEEN BORES		DISTANCE BETWEEN BORES. (TABLE A.)	AREA OF LONGITUDINAL SECTION BETWEEN BORES.		COMPLETE BORE LINE AV. THICKNESS		VOLUME OF 1YD. STRIP
	INCHES	INCHES	FEET	FEET	SQ. FEET	SQ. YDS.	FEET	INCHES	CUBIC YDS.
LINE 1.									
2	84	82.5	6.87	50	343.5	38.17			
3	81								
3	81	82.5	6.87	50	343.5	38.17			
4	84								
TOTAL				100	687.0	76.33	6.87	82.5	76.33
LINE 2.									
6	48	48	4.0	44	176.0	19.55			
7	48								
7	48	66	5.5	50	275.0	30.55			
8	84								
8	84	76.5	6.37	50	318.5	35.39			
9	69								
9	69	78	6.5	50	325.0	36.11			
10	87								
TOTAL				194	1094.5	121.61	5.64	67.7	121.61

SAND OVERLYING SEAM.

APPENDIX 2. TABLE C. **PAGE 2.** VOLUME AND AVERAGE THICKNESS OF MINERAL-BEARING SAND ALONG BORE LINE.

BORE NO.	THICKNESS (TABLE A.) AT BORE INCHES	AV. BETWEEN BORES INCHES	AV. BETWEEN BORES FEET	DISTANCE BETWEEN BORES. (TABLE A.) FEET	AREA OF LONGITUDINAL SECTION BETWEEN BORES. SQ. FEET	SQ. YDS.	COMPLETE BORE LINE AV. THICKNESS FEET	INCHES	VOLUME OF 1YD. STRIP CUBIC YDS.
LINE 5.									
12	9	31.5	2.62	54	141.48	15.72			
13	54								
13	54	66	5.5	100	550.0	61.11			
14	78								
14	78	39	3.25	100	325.0	36.11			
15	Low grade.								
TOTAL				254	1016.48	112.94	4.00	48.0	112.94
LINE 6.									
21	78	78	6.5	50	325.0	36.11			
22	78								
22	78	84	7.0	50	350.0	38.89			
23	90								
TOTAL				100	675.0	75.0	6.75	81	75.0

SAND OVERLYING SEAM.

APPENDIX 2. TABLE D. PAGE 1.

VOLUME AND AVERAGE THICKNESS OF OVERBURDEN ALONG BORE LINE.

BORE NO.	THICKNESS (TABLE A.) AT BORE	AVERAGE BETWEEN BORES	DISTANCE BETWEEN BORES (TABLE A.)	AREA OF LONGITUDINAL SECTION BETWEEN BORES.		COMPLETE BORE LINE. AVERAGE THICKNESS	VOLUME OF 1YD STRIP
	FEET	FEET	FEET	SQUARE FEET	SQUARE YARDS	FEET	CUBIC YARDS
LINE 1.							
2	0'0"						
3	0'0"						
3	0'0"						
4	0'0"						
TOTAL		NO OVERBURDEN.					
LINE 2.							
6	0'0"						
7	0'0"						
7	0'0"						
8	0'0"						
8	0'0"						
9	0'0"						
9	0'0"						
10	0'0"		&				
TOTAL		NO OVERBURDEN.					

SAND OVERLYING SEAM.

APPENDIX 2. TABLE D. **PAGE 2.**

VOLUME AND AVERAGE THICKNESS OF OVERBURDEN ALONG BORE LINE.

BORE NO.	THICKNESS (TABLE A.) AT BORE	AVERAGE BETWEEN BORES	DISTANCE BETWEEN BORES (TABLE A.)	AREA OF LONGITUDINAL SECTION BETWEEN BORES.		COMPLETE BORE LINE. AVERAGE THICKNESS	VOLUME OF 1YD STRIP
	FEET	FEET	FEET	SQUARE FEET	SQUARE YARDS	FEET	CUBIC YARDS
LINE 3.							
12	1.5						
		0.75	54	40.5	4.5	0.75	4.5
13	0.0						
13	0.0						
14	0.0						NIL.
14	0.0						
		Probably a slight overburden.					
15	Low grade.						&
TOTAL		OVERBURDEN ONLY AT ENDS OF BORE LINE.					
LINE 6.							
21	0.0						
22	0.0						
22	0.0						
23	0.0						
TOTAL		NO OVERBURDEN.					

SAND OVERLYING SEAM.

APPENDIX. 2 TABLE. E.

AVERAGE WEIGHT OF HEAVY MINERAL CONCENTRATE PER 1 YARD STRIP BETWEEN BORE LINES, AND AVERAGE AREA OF LONGITUDINAL SECTION OF MINERAL-BEARING SANDS AND OF OVERBURDEN BETWEEN BORE LINES.

LINES	ALONG BORE LINES			AVERAGE BETWEEN BORE LINES.		
	WEIGHT OF MINERAL PER 1 YARD STRIP. FROM TABLE B. LBS.	AREA OF LONGITUDINAL SECTION OF MINERAL-BEARING SANDS FROM TABLE C. SQ. YARDS	OVERBURDEN FROM TABLE D. SQ. YARDS	WEIGHT OF MINERAL PER 1 YARD STRIP. LBS.	AREA OF LONGITUDINAL SECTION OF MINERAL-BEARING SANDS SQ. YARDS	OVERBURDEN SQ. YARDS
1.	15875	76.53	SEE ATTACHED SHEET AND TABLE D.	17371.1	98.97	SEE ATTACHED SHEET AND TABLE D.
2.	18867.2	121.61				
2.	18867.2	121.61		20018.3	117.27	
3.	21169.4	112.94				
3.	21169.4	112.94		20357.1	93.97	
6.	19544.9	75.0				

APPENDIX 2. TABLE E. ADDENDUM

CALCULATION OF OVERBURDEN.

Assume a constantwidth of overburden between line 3 and line 2, and between line 3 and line 6.

From Table D.

Area of longitudinal section at line 3 = 4.5 sq. yds.

Average area of longitudinal section between lines 3 and 2, and between lines 3 and 6 = $\frac{4.5}{2}$ sq. yds.

Total length = 990 feet.

Volume = $\frac{990}{3} \times \frac{4.5}{2}$ cu. yds. = 742.5 cu. yds.

This is probably too high a figure, and would be reduced if further boring were done between lines 3 and 2, and between lines 3 and 6.

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE F.

TOTAL WEIGHT OF HEAVY MINERAL CONCENTRATE, TOTAL VOLUME OF MINERAL-BEARING SANDS AND TOTAL VOLUME OF OVERBURDEN BETWEEN BORE LINES.

BORE LINES (TABLE A.)				WT. OF HEAVY MIN. CONC.		VOL. OF MINERAL-BEARING SANDS		VOL. OF OVERBURDEN	
DESIG-NATION	LENGTH	DISTANCE BETWEEN	AREA BETWEEN	AV. PER 1 YD. STRIP (TABLE E.)	TOTAL BE-TWEEN LINES	AV. AREA OF LONGI-TUDINAL SECTION. (TABLE E.)	VOL. BETWEEN BORE LINES.	AV. AREA OF LONG. SECTION (TABLE E.)	VOL. BETWEEN BORE LINES.
Y	YDS.	YDS.	SQ. YDS.	LBS.	TONS	SQ. YDS.	CU. YDS.	SQ. YDS.	CU. YDS.
LINES 1. 2.	33.33 64.67	70	3430.0	17371.1	542.8	98.97	6927.9	SEE TABLE D AND ADDENDUM TO TABLE E.	
2. 3.	64.67 84.67	103	7691.0	20018.3	920.4	117.27	12078.8		
3. 6.	84.67 33.33	230	13570	20357.1	2113.9	93.97	21613.1		
TOTAL			24691		3577.1		40619.8		

&

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE G. AVERAGE THICKNESSES OF MINERAL-BEARING SANDS AND OF OVERBURDEN.

BORE LINES (TABLE F.)		VOLUME (TABLE F.)		AVERAGE THICKNESS.			
DESIGNATION.	AREA BETWEEN LINES	MINERAL-BEARING SANDS	OVERBURDEN	MINERAL-BEARING SANDS		OVERBURDEN	
	SQUARE YARDS	CUBIC YARDS	CUBIC YARDS	FEET	INCHES	FEET	INCHES
LINE 1. " 2.	3430	6927.9	SEE TABLE D AND ADDENDUM TO TABLE E.	6'	0.7"	SEE TABLE D AND ADDENDUM TO TABLE E.	
" 2. " 3.	7691	12078.8		4'	8.5"		
" 3. " 6.	13570	21613.1		4'	9.3"		
TOTAL.	24691	40619.8		4'	11.2"		

TOTAL SEAM AND OVERLYING SAND.

APPENDIX. 3. TABLE G.

AVERAGE THICKNESSES OF MINERAL-BEARING SANDS AND OF OVERBURDEN.

	BORE LINES (TABLE F.) #	VOLUME (TABLE F.) ø		AVERAGE THICKNESS.			
DESIGNATION.	AREA BETWEEN LINES	MINERAL-BEARING SANDS	OVERBURDEN	MINERAL-BEARING SANDS		OVERBURDEN	
	SQUARE YARDS	CUBIC YARDS	CUBIC YARDS	FEET	INCHES	FEET	INCHES
1 and 2.	3430.0	194.3 plus 6927.9 = 7122.2	SEE NOTES THIS COLUMN APPENDICES 1 AND 2.	6'	2.7"	SEE NOTES THIS COLUMN APPENDICES 1 AND 2.	
2 and 3.	7691.0	1288.2 plus 12,078.8 = 13367.0		5'	2.6"		
3 and 6.	13570.0	660.8 plus 149.6 plus 242.5 plus 21,613.1 = 22,666.0		5'	0.1"		
TOTAL.	24691	43,155.2		5'	2.9"		

Appendix 2. ø Appendices 1 and 2.

SAND OVERLYING SEAM.

APPENDIX. 2. TABLE H: PERCENTAGE COMPOSITIONS OF CONCENTRATES AND WEIGHTS OF EACH OF THE HEAVY MINERALS.

/ From Table E.

LINE	LABORATORY DETERMINATIONS						WEIGHT (TONS PER CHAIN.) OF MINERAL IN 1 YD. STRIP ALONG BORE LINE						
	Mon.	Zir.	Rut.	Ilmen.	Gar.	Others	Total Conc:/	Monazite	Zircon	Rutile	Ilmen.	Garnet	Others
TOTAL AREA.	0.3	48.7	33.4	17.0	0.2	0.4	3677.1	10.7	1742.0	1194.8	608.1	7.2	14.3

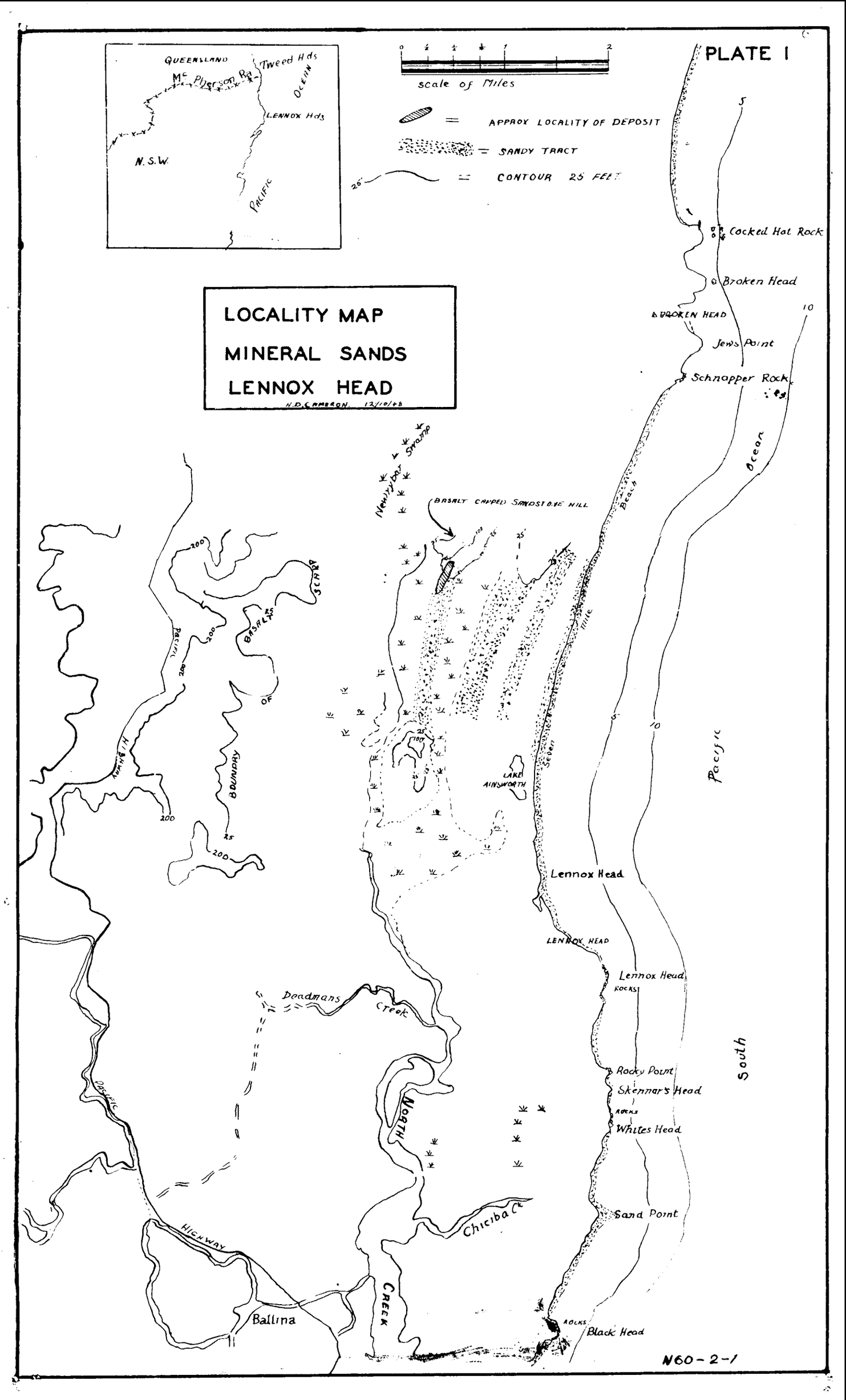


PLATE 1
QUEENSLAND
Tweed Hds
Mc Pherson Ra
OCEAN
LENNOX Hds
N.S.W.
PACIFIC
scale of Miles
0 ¼ ½ ¾ 1 2
= APPROX LOCALITY OF DEPOSIT
= SANDY TRACT
= CONTOUR 25 FEET
LOCALITY MAP
MINERAL SANDS
LENNOX HEAD
N.D.CAMERON 12/10/68
Cocked Hat Rock
Broken Head
BROKEN HEAD
Jews Point
Schnapper Rock
Ocean
Newrybar Swamp
BASALT CAPPED SANDSTONE HILL
Beach
Mile
SCHERP
BASALT
PERIA
HIGHWAY
BOUNDARY
OF
LAKE AINSWORTH
SEDEN
Lennox Head
LENNOX HEAD
Lennox Head
ROCKS
Pacific
South
Deadmans Creek
NORTH
Rocky Point
Skennar's Head
ROCKS
Whites Head
Chicibah
Sand Point
HIGHWAY
Ballina
CREEK
ROCKS
Black Head
N60-2-1

PLATE 2

MINERAL SANDS Co.

LENNOX HEAD.

REFERENCE.

PROBABLE LIMIT OF SEAM.

CONTOURS. —5'—

SWAMP.

EDGE OF SWAMP.

BORE HOLE & NO OF BORE. ⊙16

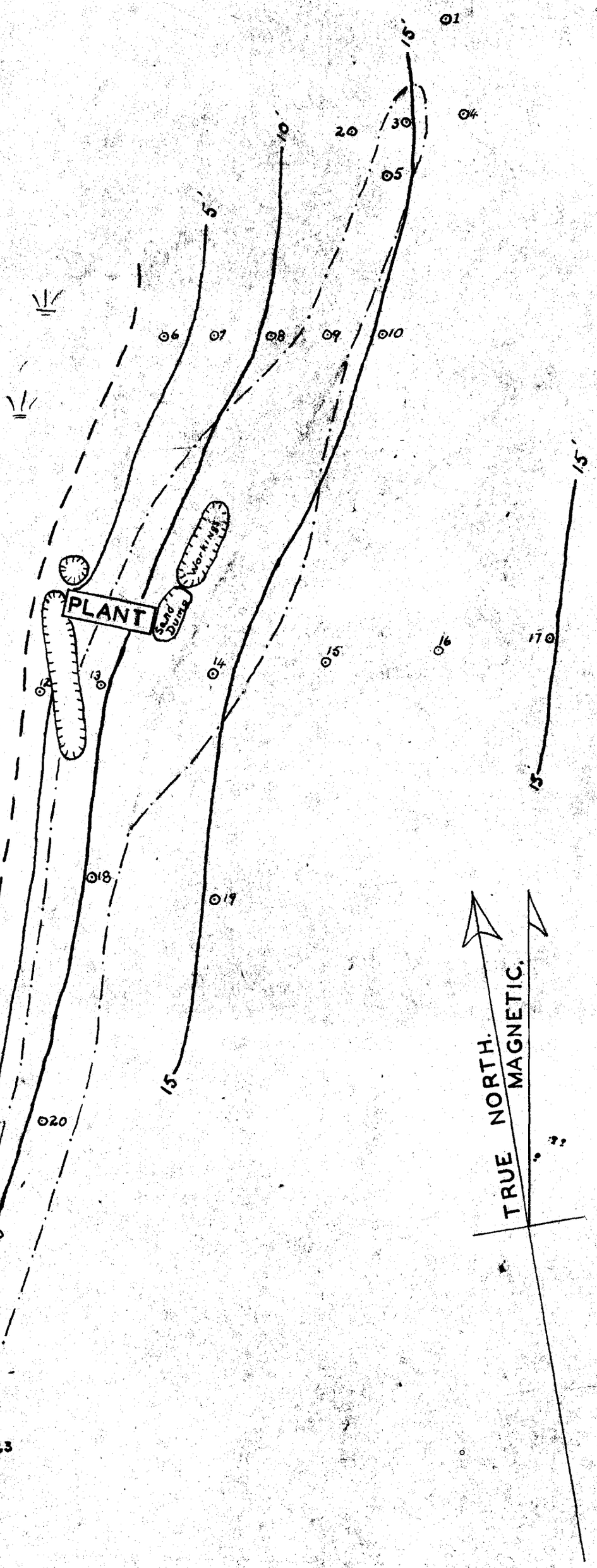
DEPRESSIONS.

SCALE

0 50 100 200 300 400 Feet

BY

T. D. DIMMICK & D. J. McGARRY, FEB. 1948.



N60-2-1A

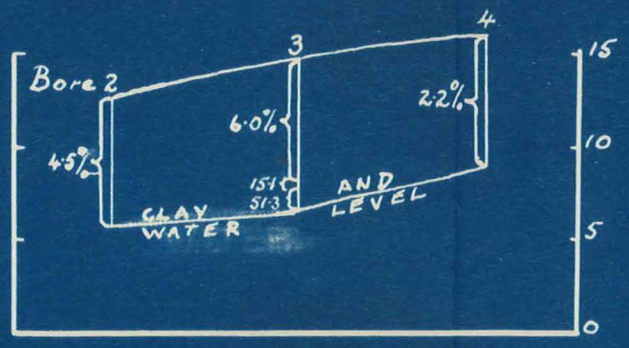
SECTIONS OF DEPOSIT, MINERAL SANDS CO., LENNOX HEAD, N.S.W.

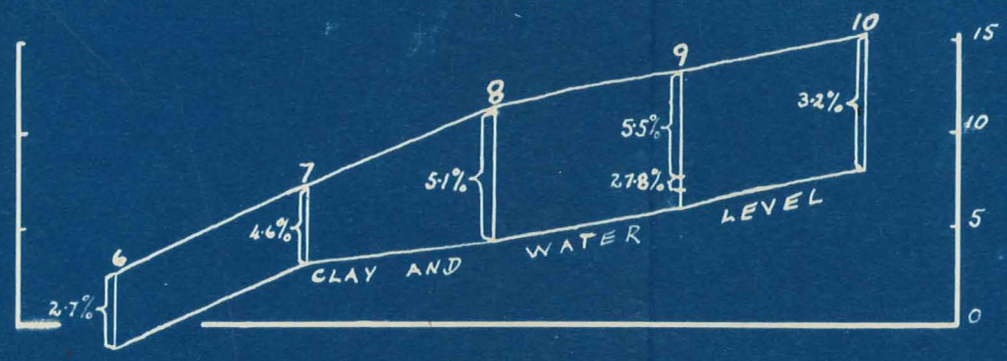
PLATE 3

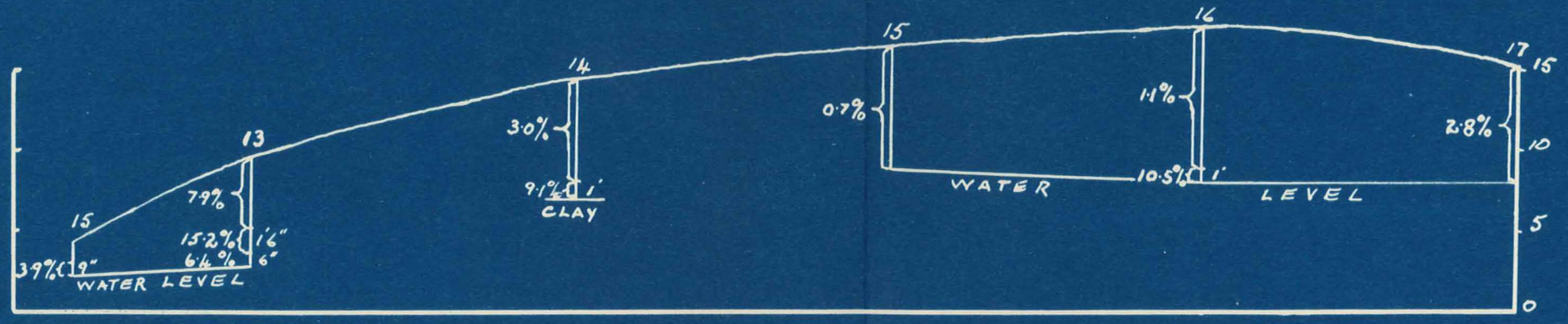
SCALE IN FEET.

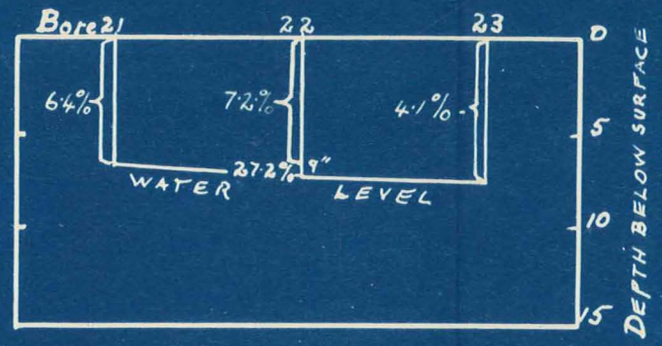
VERT. 0 5 10 20

HORIZ. 0 25 50 100









HEIGHTS EXCEPT THOSE OF BORES 21., 22., 23., ARE **ABOVE** HIGH WATER MARK AT 10.A.M. 12.2.48.

ALL PERCENTAGES ON THIS PLAN ARE BY VOLUME.

N60-2-1B