RB 52/136

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FLOWSHEET DESIGN AND SPECIFICATION OF PLANT EQUIPMENT FOR SAND DEPOSIT AT ROWLAND FLAT

by

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1. INTRODUCTION

Recommendations were made following a visit to the sand and gravel deposit of Mr. C. Hueppauff at Rowland Flat, that some tests be carried out on samples taken from the deposit, to enable equipment sizes for a treatment plant to be specified. Cost of this further work was estimated to be £50.

2. SUMMARY

Examination of samples from the deposit shows that minus 3/8-inch material falls close to Australian specifications for fine aggregate. The samples contained approximately 3 per cent. clay. A washing plant is recommended for such material to reduce the fines contents of the feed by approx. 5 per cent. and to ensure a product uniform in size distribution and colour.

The washing equipment specified is a single sand classifier. The deposit does not contain a large enough proportion of fine sand or deleterious material to warrant the installation of a cyclone for secondary sand production and final slime rejection. A finer grade of sand may be produced as required by adding a screen to the normal plant circuit.

3. TESTING OF SAMPLES

The three samples taken from the deposit were identified as follows: -

SAMPLE "A"

Taken from around the foot of the main gravel face, and estimated to be reasonably representative in size distribution of the exposed sand-gravel beds in this section of the deposit. Some ochre veins were included in the sample as being typical of the difficult material which could be encountered in a washing plant, therefore the sample was not necessarily representative in respect of colour.

SAMPLE "B"

Fine sand taken from near the stripped surface of the main sand face of the deposit, estimated to approximate the lowest grade sand that would be mined from the deposit by a minimum of over-burden removal.

SAMPLE "C"

Heavily stained sand of coarse grade, taken from the main sand face of the deposit.

Sizings of these samples are shown in Table 1.

TABLE 1: SIZING OF SAMPLES

Screen Fraction	Weight Per cent.		
	Sample A	Sample B	Sample C
+ 3/8-inch	21.5		
+ 3/16-inch	11.1	-	0.7
+ 7-Mesh	10.0	Trace	1.5
+ 14 "	10.6	0.2	10.7
+ 25 "	10.9	5.2	32.1
+ 52 "	18.5	42.6	35.1
+ 100 "	20.8	37.4	7.1
- 100 "	18.1	14.6	12.8
	100.0	100.0	100.0

Clay determinations carried out on the minus 3/8-inch fraction of sample "A", and on samples "B" and "C", showed 2.4, 3.4 and 3.0 per cent. clay respectively.

4. DISCUSSION

The size distributions of the three samples tested fall close to Australian specifications for fine aggregate. (As No. A77, 1957). This is represented graphically in figure 1.

However after blending, a washing plant is desirable for the treatment of such material to ensure a uniform product in regard to size distribution and coloration. A washing plant also allows the treatment of lower grade feed, thus eliminating the need for heavy overburden stripping.

By rejection of a small amount (5 to 10 per cent.) of minus 100-mesh material from a blended feed of the three samples tested, and screening off oversize material at 3/8-inch or 3/16-inch as desired, two grades of sand may be produced, both of which would conform to Australian specifications.

5. PLANT DESIGN

5.1 Estimation of Product Tonnages

By blending the two products at present being marketed as mined, namely a mixed coarse aggregate and a dry screened fine aggregate, with material typified by the samples A, B and C in the estimated proportions in which they occur (Table 3.), the products shown in Table 4 would be obtained.

TABLE 3: ESTIMATED FEED TO PLANT

	Tons/Day
Mixed Coarse Aggregate	
Mainly 2-inch to $^3/_8$-inch material, with about 10 per cent. minus $^3/_8$-inch.	90
Sample A - Dirty Gravel/Sand	
2-inch to $^3/_8$-inch gravel approx. 20 per cent. with 80 per cent. material from $^3/_8$-inch down to fine sand, ochre and clay.	40
Clean Fine Aggregate	
$^3/_8$-inch to 100-mesh material	30
Sample B - Dirty Fine Sand	
7-mesh sand right down to silt and clay.	25
Sample C - Dirty Coarse Sand	
$^3/_8$-inch sand containing ironstone agglomerates and clay.	15
	200

TABLE 4: ESTIMATED PLANT PRODUCTION

		Tons/Day
Gravel	Minus 3-inch plus $1^1/_2$-inch	15
	" $1^1/_2$-inch " $^3/_4$-inch	25
	" $^3/_4$-inch " $^3/_8$-inch	55
Coarse Sand	Minus $^3/_8$-inch to 5 per cent. passing 100-mesh	90
Fine Sand	Minus $^3/_{16}$-inch to 5 per cent. passing 100-mesh	From Coarse sand as required.
Reject	Plus 3-inch oversize	5
	clay and slimes	10
		200

5.2 Proposed Plant Layout

Layout of the proposed plant is shown in figure 2.

It is anticipated that plant feed can be delivered to the bin in a condition to allow feeding from the bin and trommel screening to be carried out without water addition. The double concentric trommel screens are designed to handle a feed of about 25 tons per hour of minus 3-inch material, producing two finished grades of coarse gravel.

Un dersize from the trommel screen is treated wet on a vibrating screen, normally run with a $^3/_8$-inch screen cloth. However, when it is desired to produce a finer sand product, a second deck of $^3/_{16}$-inch screen cloth may be added to the screen, and an extra product of minus $^3/_8$-inch plus $^3/_{16}$-inch material taken off. The one or two oversize fractions, depending on whether the screen is being run as a single or double deck, are taken off as finished products. Designed capacity of the screen at $^3/_8$-inch is approx. 16 ton/hour. Screen undersize at minus $^3/_8$-inch or minus $^3/_{16}$-inch is fed to a sand classifier for removal of fine material.

The ideal sand washing equipment would be a spiral classifier. However, because only a small amount of fine material has to be removed, it is probable that a drag classifier would do a satisfactory job, although having a lower capacity than a spiral of similar size. Designed capacity of both classifiers is approx. 12 tons/hour.

Classifier overflow is stored in a slime pond, return water for the plant being collected at a point away from the slime entry point.

The plant should be set out to enable gravity flow in all sections with the exception of primary feeding. Gravel and sand products may be transported to storage bins in open chutes at minimum slope of about 1 in 3. Classifier overflow may be directed to the slime dam in an open launder terminating in a small head tank and a delivery pipe with numerous discharge ports to assist in building up the slime dam bank evenly.

The only piping required for the plant is a $1^1/_2$-inch return water line. The pump is designed to return approx. 60 gallons/min. of which approximately 50 gallons/minute is used in water sprays on the vibrating screen. The remainder is fed to the sand classifier with the screen undersize, to give a classifier overflow containing about 7 . per cent. solids.

5.3 Equipment Sizes

The following sizes of equipment are recommended for the estimated proportions of the various products, at a plant feed rate of 200 tons per 8 hour day.

A. Bin

Capacity	200 tons
Dimensions	Approx. 16 ft. x 16 ft. x 10 ft. high.

Hand operated slide gate.

B Grizzly

Stationary bars set at 3-inch spacing, slope of approx. 1 in 3 for rejection of oversize.

C. Belt Feeder

18-inch wide rubberized canvas, approx. 15 ft. long to convey feed from bin to short chute feeding trommel.
Maximum slope 1 in 3.
Speed approx. 50 feet/min.

D. Trommel Screen

Double concentric screens; primary screen 3 ft. diameter by 6 ft. long. $1\frac{1}{2}$-inch dian eter round hole punched plate screen.
Secondary screen 4 ft. diameter by 5 ft. long, $\frac{3}{4}$-inch round hole punched plate screen.
Screens shaft mounted on radial arms.
Slope of screen approximately 1 in 10.
Speed of screen 20 r. p. m.
H. P. required 5, geared motor driving through Vee-belts.

E. Vibrating Screen

Double deck, each deck 3 ft. x 6 ft.
Woven wire $\frac{3}{8}$-inch and $\frac{3}{16}$-inch square aperture screens.
Slope of screen not more than 1 in 10, preferably flat.
Feed distribution box - full width of screen, and two rows of water sprays across screen.
H. P. required 5, driving unbalanced pulley vibrator through vee-belts.

F. Sand Classifier - Spiral

Spiral diameter 1ft. 6-inches.
2 ft. wide tank, 15 ft. lnng, settling pool 4 ft. wide and approx. 3 ft. 6-inches deep to bottom of weir bars.
Screw speed 40 r. p. m.
Slope of tank - approximately 1 in $2\frac{1}{2}$
H. P. required, 5, screw driven through vee-belt by geared motor.

Sand Classifier - Drag

2 ft. 6-inches wide tank 20 ft. long, settling pool 4 ft. wide at top, and 3 ft. 6-inches deep to bottom of weir bars.

Drainage length approximately 12 ft. at slope of 1 in 3.

Speed of flights - 40 feet/min.

Width of Flights 2 ft.

H. P. Required - 5.

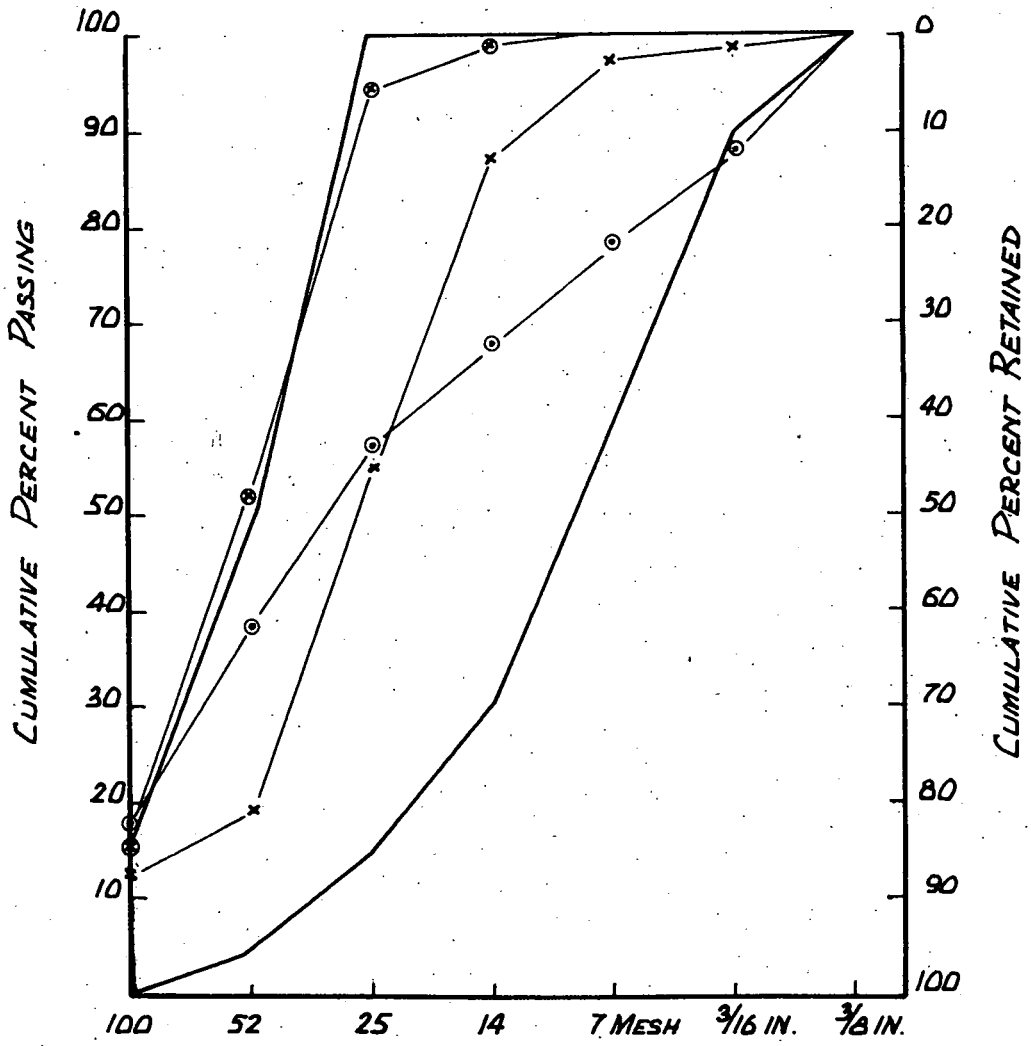
G. Water Return Pump

$1\frac{1}{2}$-inch centrifugalwater pump at 1440 r. p. m.

H. P. required - 1.

FIGURE.-1.

GRAPHICAL PRESENTATION OF SIZINGS



AUSTRALIAN SPECIFICATION FOR FINE AGGREGATE

SAMPLE A

SAMPLE B

SAMPLE C

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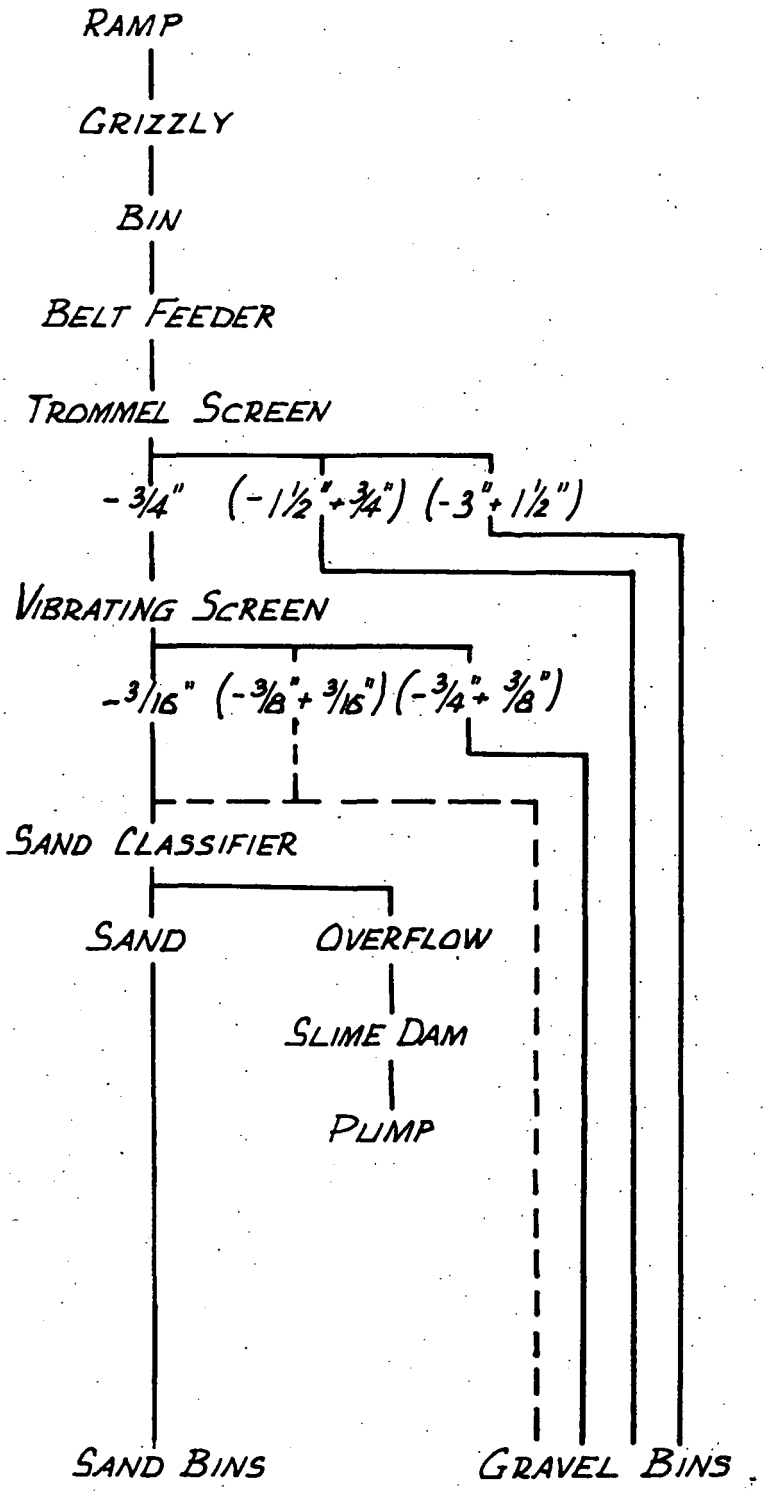
FIGURE.-2.

PROPOSED PLANT FLOWSHEET



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