DEPARTMENT OF MINES

South Australia

RESEARCH AND DEVELOPMENT BRANCH

METALLURGICAL SECTION

Report No. R.D. 14

"ESTIMATED COST OF BARYTES PRODUCTION S.A. BARYTES CO. LTD."

by

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SENIOR METALLURGIST

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ESTIMATED COST OF BARYTES PRODUCTION

S.A. BARYTES CO. LTD.

Abstract

Mineral dressing methods proposed for treatment of ore from S.A. Barytes Co. Ltd. are assessed, and estimates prepared for treatment costs at alternative sites. Port Augusta is recommended.

1. Summary.

Estimates have been prepared for capital and operating costs of a mill to treat barytes from Oraparinna (S.A. Barytes Co. Ltd.). The final produce is ground and bagged ready for marketing.

A gravity mill using jigs and a table is recommended for the beneficiation of the barytes.

Dry grinding of the concentrate is preferable to wet grinding and is cheaper.

It is conservatively estimated that half the output would be first grade, and half second grade market classification. This is partly dependent on mining methods adopted.

A mill located at Port Augusta requires the same capital as a mill located any further south, but has the lowest operating costs of the sites examined.

It is estimated that a mill could be established for a capital cost of £160,000 and produce 10,000 tons per year of barytes at Port Augusta for £10.11.0 per ton naked. Mining costs must be added to this amount.

Essential operating statistics are as follows.

Transport from Mine to Port Augusta.	12,500 tons per year crude barytes.
Power at Mill.	137 KW
Water.	12,500,000 gallons/year.
Manpower.	14 operators, 4 staff.

2. Introduction.

The South Australian Barytes Co. Ltd. has proposed erection of a mill for upgrading Oraparinna barytes to produce a ground bagged product ready for market.

This report details preliminary estimates for the costs of setting up and operating such a mill at various sites, namely Oraparinna, Hawker, Quorn, Pt. Augusta, Pt. Pirie, and Adelaide.

Costs estimated in this report include transport from the mine through to production of the finished product. This includes extra commitments that may be necessary, such as power supplies, housing required by mill labour, interest and depreciation.

However, cost of mining up to delivery to the mine bins, mine services, and the community resulting from mining operations are not included, and these costs must be added to the mill operating costs to arrive at the final production cost.

The mill has been designed with capacity to produce 10,000 tons of ground and bagged barytes a year. This is the market available estimated by S.A. Barytes Ltd. Preliminary layouts for both wet and dry grinding have been prepared. Estimates for these are included. A preliminary layout is also included showing a dry grinding mill at a site proposed by the Commonwealth Railways at their coal handling area.

3. Market Requirements.

The market in Australia appears to be for two main grades:

(i) "A" grade for the paint industry.

Here the main considerations are colour and a consistent product. The paint industry has generally been taking what it can get and is somewhat at the mercy of the supplier, but could obtain supplies from Germany and elsewhere if the standard of the local product deteriorated. They prefer a reflectance of about 92 on the "Bel" reflectometer but probably would accept a slightly lower figure if a consistent product was assured. Colour is important for light coloured paints. When pigments are added for the darker colours the barytes colour is not so critical. A product fine enough that not more than 0.5 per cent will stay on a 200 mesh screen is required. There appears to be no standard specification used in the industry.

(ii) "Intermediate" grade; used by the oil industry.

The requirement here is for a certain specific gravity, namely 4.2, and colour is of no consequence. Various grades of fineness are demanded. See Table No. 1 for specification.

There is also a market available in the rubber and paper industry.

The requirements of industry generally appear somewhat confused, apparently resulting from the fact that they are forced to take whatever is available. If however, a barytes industry is established, and assured quality products are produced, it is anticipated that probably four stock lines would be sufficient, namely two grades of fineness in both "A" grade and "Intermediate" grade.

The demand is estimated at 10,000 tons of ground barytes per year, 40 per cent of which will be A grade and the remainder B grade.

TABLE No. 1

BARYTES SPECIFICATIONS AND PRICES

Company	Grade	Specifications	Price per ton
S.N. Rodda & Co.	Superfine	0.1% max. + 300 mesh	A Grade £28. 2. 0 B Grade £18.17. 6
	Fine	0.1% max. + 200 mesh	A Grade £25. 2. 0 B Grade £16.17. 6
Caltex Oil Pty.Ltd.	Fine	None + 100 mesh 96% - 200 mesh 80% - 325 mesh	
Standard Oil (WA)		99% - 200 mesh 92-96% - 325 mesh	
Victorian firm.	Superfine		A Grade £26.15. 0 B Grade £19. 5. 0

4. Mining and Treatment

The proposal is to selectively mine two products.

(a) High class ore for production of "A" grade material.

(b) Second class ore to be combined with existing dump material for production of "Intermediate" grade material.

These products from selective mining would be carted separately week and week about. Road transport from mine to rail head would be by contract with owner-drivers and a rate of 70/- per ton has been assumed.

Trucks would normally load direct into rail trucks by means of a ramp. When rail trucks are not available a storage slab already existing could be used, and loading from there would be by front end loader.

This estimate has assumed the use of hopper bottom-dumping rail trucks, but if these are not available labour charges will be increased.

5. Selection of Mineral Dressing Method.

The report of the Department of Mines, MT 71 dealing with "The Recovery of Barytes from Dumps at Oraparinna" lists results by various treatment methods, namely:

(a) Heavy media separation.

(b) Jigging.

(c) Tabling.

(d) Flotation.

(e) Magnetic separation.

(f) Electrostatic separation.

Reasonable results were obtained by the first three methods only, which may be summarized as follows:

TABLE No. 2.

Mineral Dressing Summary

Treatment	Size of Feed	% Barytes	% Recovery
Heavy Media	Minus 1"	95.2	69.3
Jig	-¼"/+ 20 mesh	96.4	79.3
Table	-20 mesh from jig	98.3	52.6
Jig + table	-¼"	96.6	87.5
Feed		81	100

The test work was on dump material which is the reject from hand sorting of marketable material. Hence when run of mine ore is treated results can be expected to be generally better. Grade of ore reserves has been assumed to be 90 per cent in calculating tonnage mined to produce the required 10,000 tons per annum.

A gravity mill using jigs and a table has been selected for the following reasons:

(a) With Heavy Media Separation the main advantages are saving of power by avoiding excessive comminution of waste material, and savings in capital cost due to removal of material from the circuit at an early stage and so reducing the size of following units.

In this case only about 10 per cent of the feed will be rejected and the remainder must be finely ground for marketing. Heavy Media Separation when compared with jigs and tables under these conditions shows greater capital and operating costs and the grade and recovery of product is lower.

(b) Jigs according to test results give a lower grade than tables. However, as jigs have similar capital and operating costs and the coarser material is less contaminated with iron oxides, jigs have been selected. The product though not as high grade, should have a better colour and will permit rejection of contaminating rock at a larger size. Also if mining conditions alter it should give a more flexible plant that could be adapted to suit changes of feed.

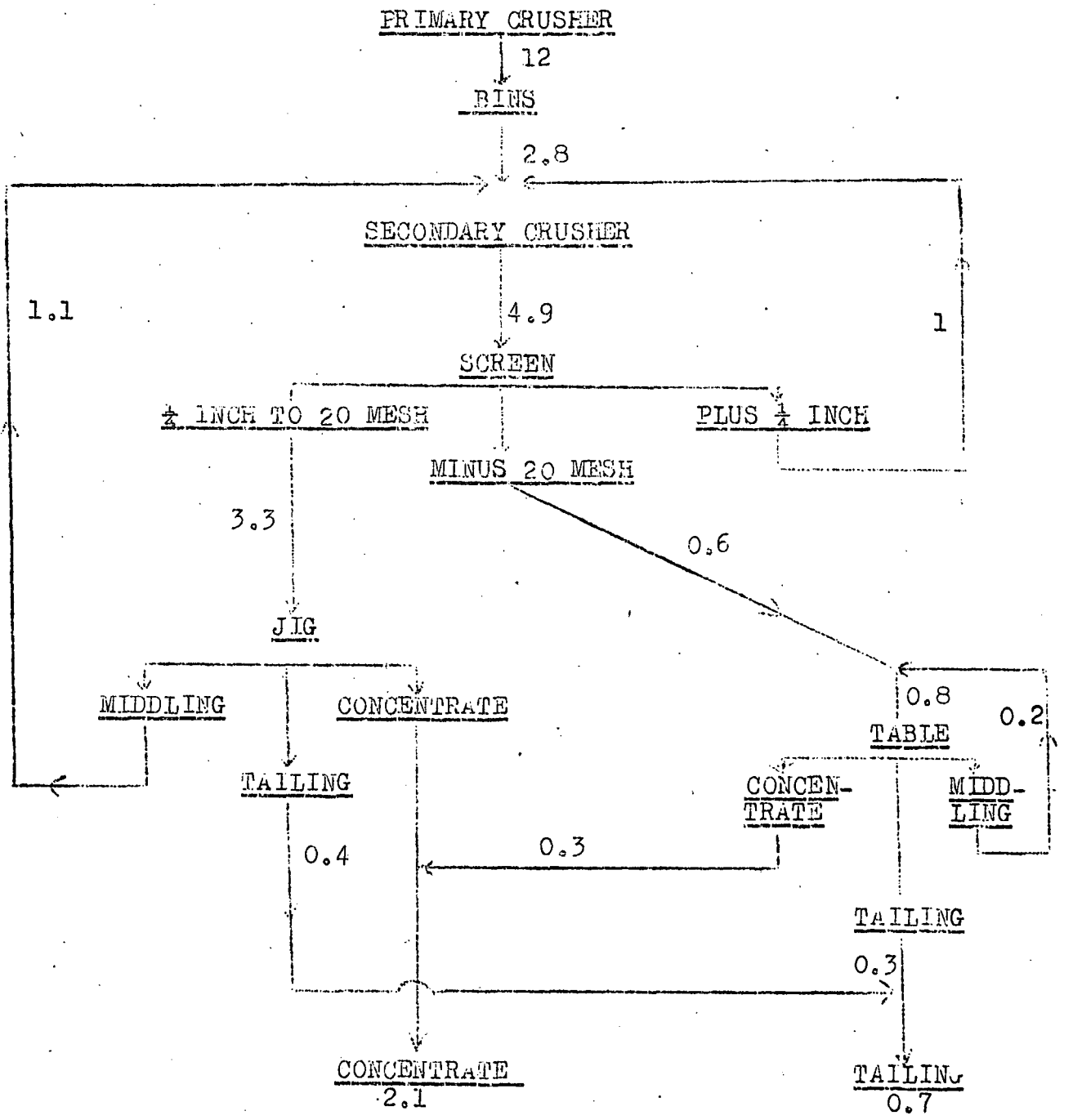
(c) A table is necessary to handle feed too fine for the jigs as these can only effectively separate within a limited size range. Middlings are shown returning to the feed but can be altered to suit conditions. It may well be that in operation a concentration of iron oxides will be obtained and this should be watched for and if present be diverted to the tailings for disposal.

A flow sheet based on recoveries indicated in the test work is shown in the following section.

6. Flowsheet showing Materials Balance.

6.1 Assumptions for material balance.

1. 12,500 tons/year mill feed.
2. Feed 90 per cent barytes.
3. Product 97 per cent barytes.
4. Recovery 87 per cent.
5. 48 working weeks per year, each of 5 days.



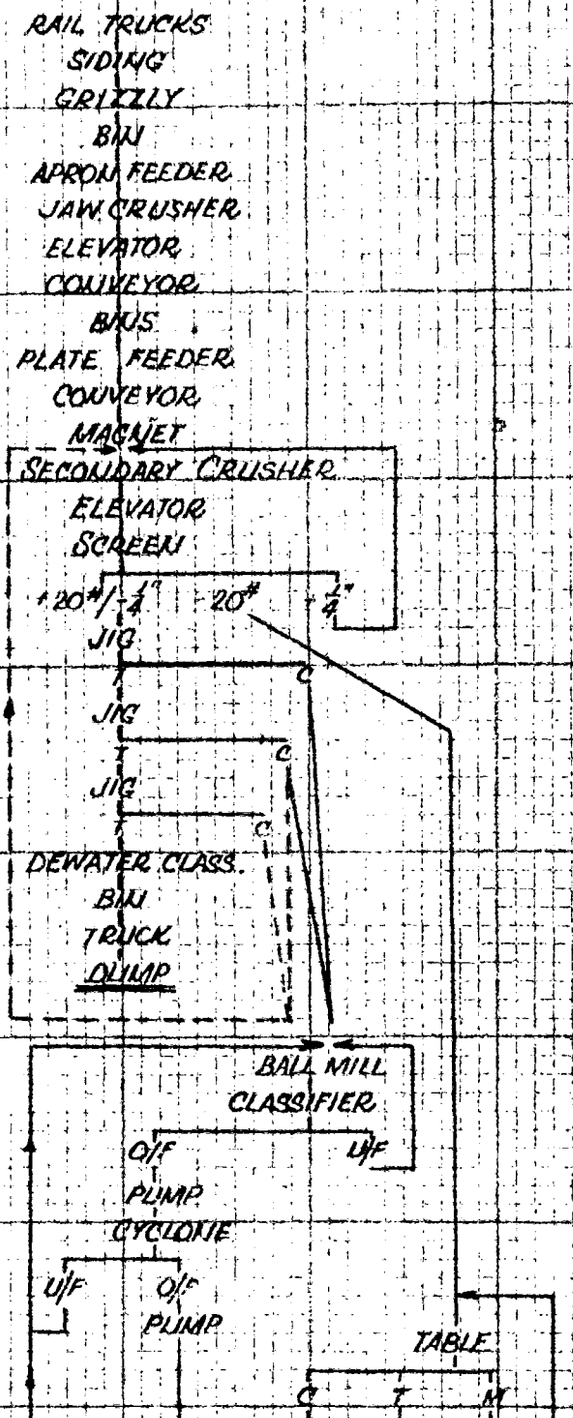
7. Grinding of Product.

7.1 Alternative Grinding Methods.

Subsequent to mineral dressing the product must be ground to market specifications. At present this is done at all Australian plants by dry methods. There have been statements in the technical press from time to time, that wet methods are cheaper. Detailed estimates of the cost of the final product by these alternative methods have been prepared.

The flow sheet of a mill using wet grinding is presented, with detailed purchase and installation costs. The horsepower, water, and operating costs are estimated. Similar details are described for a mill using dry grinding. These are for a site at Port Augusta. The final estimates are compared to show that dry grinding will produce a cheaper product.

WET GRINDING CIRCUIT - FLOWSHEET



12T HOPPER BOTTOM

8"

20T

20"

10"×20"

9"×5"×8" BUCKETS 16" SPACING DRUM Ø 24" 164 ft/m 11" 4 PLY

4 @ 150T STEEL

4 @ 30"

16" 3 PLY 75 ft/m 18" Ø DRUMS

PERMANENT

24" FINE BOWL SYMONS SHORT HEAD OR CYRASPHERE

6"×4"×4½" BUCKETS 6" SPACING DRUM Ø 15" 200 ft/m 8" 3 PLY

D-2D SWECO DOUBLE DECK 4" & 20"

16"×24" DENVER DUPLEX

" " "

" " "

DRAG TYPE

6T

1 @ 6T 54×100 FORD TIP TRUCK

7'×6' SILEX PEBBLE MILL

48" SPIRAL CLASSIFIER

2"/3" CENTRIFUGAL SAND

6" D.S.M. CYCLONE

2"/3" CENTRIFUGAL SAND

WEMCO DIESTER OR SIMILAR

1½" CENTRIFUGAL SAND

2/3 CENTRIFUGAL SAND

1½ CENTRIFUGAL SAND

2/3 CENTRIFUGAL WATER

30' SUBJECT TO TEST

D.4 MONO PUMP

8'×12'

D.4 MONO PUMP OR 1½" CENTRIFUGAL SAND

2 @ 8" Ø AMERICAN LEAF

3'×30' OIL FIRED KILN. INDIRECT HEATING

6" RECIPROCATING

2T LAWTON PNEUMATIC

12'×16'×8'

5" CENTRIFUGAL WATER

S.M.160.

7.2.2. Capital Costs.

	Equipment Cost	Installation	Total	H.P.
Ramp at Hawker		£1,000	£1,000	
Siding		9,000	9,000	
Grizzly	£148	52	200	
Bin	300	250	550	
Apron Feeder	2,300	100	2,400	5
Jaw Crusher	2,340	1,600	3,940	25
Elevator	1,500	300	1,800	10
Conveyor	350	100	450	2
Bins. 4	7,000	3,000	10,000	
Plate Feeders. 4	800	140	940	4
Conveyor.	1,200	200	1,400	7.5
Magnet	150	20	170	
Secondary Crusher	3,800	1,200	5,000	25
Elevator	600	160	760	7.5
Screen	1,600	80	1,680	5
Jigs. 3	3,000	150	3,150	3
Dewatering Classifier	800	120	920	2
Tails Bin.	250	130	380	
Ball mill.	12,000	2,400	14,400	150
Classifier	3,500	250	3,750	5
Pumps sand 2/3. 6	2,160	180	2,340	45
" 1½". 4	960	120	1,080	20
water 2/3. 2	460	100	560	40
" 5. 2	1,120	320	1,440	30
Cyclone.	240	40	280	
Table.	1,900	350	2,250	7.5
Thickener.	3,800	450	4,250	5
Monopumps 4.	960	120	1,080	20
Holding tank.	600	100	700	7.5
Filter.	4,800	700	5,500	40
Kiln.	3,400	1,400	4,800	5
Drag conveyor.	400	100	500	2
Bagging machine.	2,500	500	3,000	2
Roller conveyor.	300	30	330	
Motor truck.	2,240		2,240	
Fork Lift Truck	3,500		3,500	
Piping etc.	1,000	500	1,500	
Electrical.	5,250	750	6,000	6
Building and Site prep.	10,000	5,000	15,000	
Miscellaneous.	6,000	1,000	7,000	10
	£93,228	£32,012	£125,240	491

7.2.3. Power Requirements.

Installed horsepower = 491 H.P.

less duplicated = 68

423 H.P.

Crushing section = 42 H.P. operates on 4 shifts only.

= 42 x 4/15 = 11 H.P. continuous.

∴ total horsepower (installed) operating continuously

is equivalent to 423 - 31

392 H.P.

Assuming 70 per cent full load.

= 392 x 0.7 = 274 H.P. consumed.

= 274 x 746/1000 = 204 Kw.

∴ producing 2.1 tons/hour.

cost per ton for each 1d./Kwhr.

= 8/- per ton/Kwhr @ 1d.

7.2.4. Water Requirements.

Water losses in the plant are made up of-

(1) losses in products.

(11) evaporation.

Losses in products are due to-

(1) Fed to kiln at 85% solids @ 2.1 tons/hour.

= 30 galls/hour.

(11) Jig tailing.

0.4 tons per hour at 10% moisture.

= 10 gals/hour.

(111) Table slimes.

0.3 tons/hour @ 1% solids.

= 6670 gals/hour.

Assuming 66% recovery.

= 2,200 gals/hour.

Losses due to evaporation.

30' thickener @ 11 ft./year.

$= \frac{707 \times 11 \times 6.25}{365 \times 24}$ = 6 gals/hour.

say 10 gals/hour.

∴ total consumption = 2260 gals/hour.

@ 2.1 tons output = 1000 gals/ton. approx.

Water required in circuit.

(1) Jigs -

Test results required 8,500 gals/ton @ 3.3 tons/hour of feed.

= 28,000 gals/hour.

(11) Tables -

Assuming 2% solids in table feed, water required is 9,850 gals/hour.

Total water for beneficiation.

= 38,000 gals/hour.

= 630 gals/min.

Requires 5 inch pump.

7.2.5. Operating Costs.

Manpower requirements.

	Men.	Shifts.	Total.
Crushing.	1	2	2
Concentration.	1	3	3
Grinding.	1	3	3
Filter and kiln.	1	3	3
Bagging.	1	3	3
Loading.	1	2	2
Greaser.	1	1	1
Supervision	1	3	3
Superintendent.	1	1	1
			21

The crusher operators will only be required for about three shifts each per week and can be used for odd jobs for the remainder.

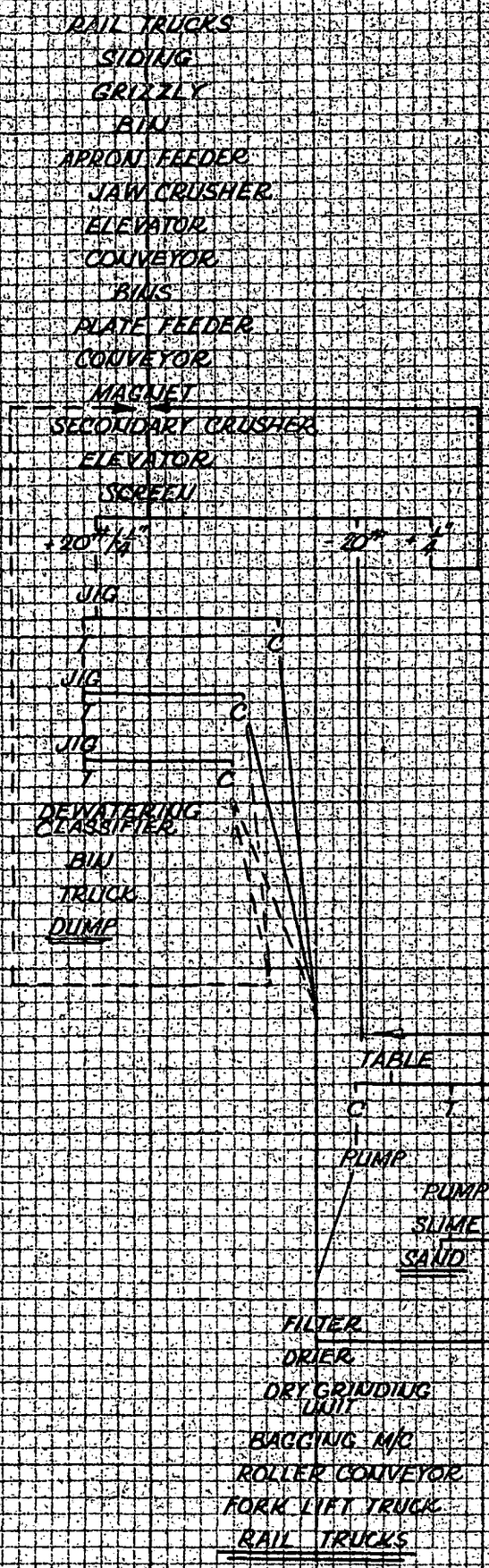
Wages.

17 men @ £16 week		= £272
Salaries	3 @ £19	57
	1 @ £30	30
		£359
200 tons/week		= £1.8/ton.
		= 36/- per ton.

Stores.

Crushing	1/3
Secondary crushing	2/-
Grinding	10/-
Filter	2/-
Kiln	10/-
Pumping	1/-
Sundries	5/6
	31/9

DRY GRINDING CIRCUIT



12T. HOPPER BOTTOM

8"

20T.

20"

10" × 20"

9" × 3" × 8" BUCKETS 16' SPACING DRUM Ø 24" 164 f/m 1 KAPU

16" 3 PLY 75 f/m 18" DIA DRUMS

4 @ 150' STEEL

4 @ 30"

16" 3 PLY 75 f/m 18" DIA DRUMS

PERMANENT

24' FINE BOWL SYMONS SHORTHEAD OR GIRASPHERE

6" × 4" × 4½"

D 20 SWECO DOUBLE DECK 4' × 20"

16" × 24" DENVER DUPLEX

"

"

"

DRAG TYPE

6'

1 @ 6' 34 × 100 FORD TIP TRUCK

No. 6 DIESTER OR SIMILAR

14" CENTRIFUGAL SAND

½ CENTRIFUGAL SAND

2/3 CENTRIFUGAL SAND

2/3 CENTRIFUGAL WATER

6' PAN TYPE FILTER

OIL FIRED FLASH DRIER

RAYMOND 3 ROLLER MILL WITH 6' DIA DOUBLE CONE MOVING VANE SEPARATOR, CYCLONES & DUST COLLECTOR

2T. LAWTON PNEUMATIC

12' × 16' × 8'

3" CENTRIFUGAL WATER

S.M. 159.

7.3.2. Capital Costs.

	Equipment Cost.	Installation	Total	H.P.
Ramp at Hawker.		£1,000	£1,000	
Siding.		9,000	9,000	
Grizzly.	£ 148	52	200	
Bin.	300	250	550	
Apron Feeder.	2,300	100	2,400	5
Jaw Crusher.	2,340	1,600	3,940	25
Elevator.	1,500	300	1,800	10
Conveyor.	350	100	450	2
Bins. 4	7,000	3,000	10,000	
Plate feeders. 4	800	140	940	4
Conveyor.	1,200	200	1,400	7.5
Magnet.	150	20	170	
Secondary Crusher.	3,800	1,200	5,000	25
Elevator.	600	160	760	7.5
Screen.	1,600	80	1,680	5
Jigs. 3	3,000	150	3,150	3
Dewatering Classifier.	800	120	920	2
Tails Bin.	250	130	380	
Pumps Sand 1½", 2	480	60	540	10
" 2/3". 2	720	60	780	15
Water. 2/3". 2	460	100	560	40
" 5" . 2	1,120	320	1,440	30
Table.	1,900	350	2,250	7.5
Truck.	2,240		2,240	
Filter.	5,600	1,500	7,100	40
Drier.	400	100	500	
Dry Grinding Unit.	11,990	3,000	14,990	85
Bagging m/c.	2,500	500	3,000	2
Roller conveyor.	300	30	330	
Forklift truck.	3,500		3,500	
Piping etc.	700	350	1,050	
Electrical.	5,000	700	5,700	6
Building & site prep.	10,000	5,000	15,000	
Miscellaneous	6,000	1,000	7,000	10
	£79,048	£30,672	£109,720	342

7.3.3. Power Requirements.

Installed horsepower = 342.

less duplicated 48

294 H.P.

Crushing Section = 42 H.P. operates on 4 shifts only.

= 11 H.P. continuous.

∴ total horsepower installed operating continuously

is equivalent to $294 - \frac{31}{263}$ H.P.

Assuming 0.7 full load.

= 263 x 0.7 = 184 H.P. consumed.

$= \frac{184 \times 746}{1,000}$ = 137 Kw.

∴ producing 2.1 tons/hour.

cost per ton for each 1d/Kwhr.

= 5/5d. per ton Kwhr @ 1d.

7.34 Water Requirements.

Water requirements are as shown for the wet grinding.

Consumption = 1,000 gals/ton.

7.3.5. Operating Costs.

Manpower requirements.

	Men	Shifts	Total
Crushing	1	2	2
Concentration	1	3	3
Grinding.	1	3	3
Bagging.	1	3	3
Loading.	1	2	2
Greaser.	1	1	1
Supervision	1	3	3
Superintendent.	1	1	1
			18

The crusher operators will only be required for about three shifts each per week and can be used for odd jobs for the remainder.

Wages.

14 men @ £16 week	=	£216
Salaries 3 @ £19		57
1 @ £30		30
		£303

200 tons/week = £1.515/ton.

= 30/4d. per ton of product.

Stores.

Crushing	1/3
Secondary crushing	2/-
Grinding.	18/-
Drying	1/-
Sundries	5/6
	27/9 per ton.

7.4 Comparison of Grinding Methods.

Table No. 3.

At Port Augusta	Dry	Wet.
Capital.	109,720	125,240
Manpower.	18	21
Water per day.	52,000	52,000
Power requirements.	260	389
Operating, portion	57/9	67/9

8. Alternative Sites.

8.1 Consideration is given to the effect of the site of the treatment plant on the final cost of the product. In some cases additional housing, power supply, water supply, etc. are necessary, thus increasing the capital costs, in each case the cost of power, water, etc., will vary. Sites considered are the mine Hawker, Quorn, Port Augusta, Port Pirie and Adelaide.

It has been assumed that dry grinding will be used.

8.2.1. Operating Costs for mill at Mine.

Accommodation must be provided this time for 18 men. It is assumed that the operators will be in barracks. and supervisors in houses.

4 houses @ £4,000	=	£16,000
7 cubicles @ £400		2,800
Mess & cookhouse extns.		3,300
Ablutions & laundry block.		3,300
		£25,400

A power house is required for some 300 horsepower at an estimated cost of £20,000.

Total capital required is.

Mill.	£109,720
Community.	25,400
Power house.	20,000
	£155,120
Operating account	50,000
	£205.120

Interest 7% on £265,120

= 28/8d. per ton

Depreciation 10% on £155,120

= 31/- per ton.

Cost of power at mine @ 6d. unit = 6 x 5/5d. = 32/6 ton

Total operating cost =

Interest	28/8
Depreciation	31/-
Wages	30/4
Power	32/6
Stores	27/9
Water 10/- per 1,000	10/-
Freight surcharge on stores.	1/9
	162/-

∴ cost at mine. 162/- ton.

F.O.R. at Hawker	=	232/- "	@ 70/- per ton cartage.
" at Pt. Augusta	=	247/- "	@ 15/- " " rail.
" at Pt. Pirie	=	256/9d."	@ 24/9 " " "
" at Adelaide	=	305/9d."	@ 73/9 " " "

8.2.2. Operating costs for mill at Hawker.

If the mill is established at Hawker accommodation could be found for the operators, but houses would be needed for the supervising staff. A powerhouse would also be needed.

Total capital required.

Mill	£109,720
Community	16,000
Powerhouse	20.000
	£145,720
Operating account	50,000
	£195,720

Interest 7% on £195,720

= 27/5d. per ton.

Depreciation 10% on £145,720

= 29/2d. per ton.

Power @ 5d. unit = 5 x 5/5d. = 27/1d. ton.

Total Operating Cost =

Interest	27/5
Depreciation	29/2
Wages	30/4
Power	27/1
Stores	27/9
Water 7/6 per 1000	7/6
Freight surcharge	1/4
	150/7

Freight to Hawker 77/- per ton of product.

∴ Cost at Hawker. = 227/7d. ton.
F.O.R. at Pt. Augusta = 242/7d. ton
" at Pt. Pirie = 252/4d. ton
" at Adelaide = 301/4d. ton.

8.2.3. Operating costs for mill at Quorn.

No housing is required at Quorn. The town electricity supply is 240 volt D.C. and this would necessitate the additional expenditure of approximately £6,000 on D.C. motors. A direct approach to the supply authority would be necessary to be sure they can supply the quantity of power required.

Capital costs =

Mill	£109,720
Increase for D.C. motors	6,000
	£115,720
Operating acc.	50,000
	£165,720

Interest 7% on £165,720 = 23/2.

Depreciation 10% on £115,720 = 23/2.

Cost of power = 5½d. unit = 29/4d. ton.

Total operating cost.

Interest	23/2.
Depreciation	23/2
Wages	30/4
Power @ 5½d. unit	29/4
Stores	27/9
Water 2/- per 1000	2/-
Freight surcharge.	1/3
	137/-

Road freight to Hawker	77/-	
Rail freight to Quorn	10/7	@ 9/9 per ton ore Hawker to Quorn.
Total cost at Quorn	224/7	

Cost at Quorn	224/7	@ 9/9 per ton ore Hawker to Quorn.
F.O.R. Pt. Augusta	230/1	ton @ 5/6 ton Quorn to Augusta.
" Pt. Pirie	241/7	" @ 17/- " " to Pirie.
" Adelaide	290/7	" @ 66/- " " " Adelaide

8.2.4. Operating costs for mill at Pt. Augusta.

No housing or power house required.

Capital cost.

Mill	£109,720
Operating acct.	50,000
	£159,720

Interest 7% on £159,720

= 22/5 ton

Depreciation 10% on £109,720

= 21/11 ton.

Operating cost.

Interest	22/5
Depreciation	21/11
Wages	30/4
Power @ 2d. unit	10/10
Stores	27/9
Water @ 3/- 1000 gals.	3/-
Freight surcharge	1/2
	117/5

Road freight to Hawker 77/- per ton of product.

Rail freight to Augusta 16/6 " " " "

215/11

∴ Total cost at Pt. Augusta = 210/11 ton
F.O.R. " " Pt. Pirie = 220/8 "
" " " Adelaide = 269/8 "

8/2.5. Operating costs for mill at Pt. Pirie.

Capital cost.

Mill	£109,720
Operating cost	50,000
	£159,720

Interest (asfor Pt. Augusta)

= 22/5d. ton.

Depreciation = 21/11d. "

Operating cost.

Interest	22/5
Depreciation	21/11
Wages	30/4
Power @ 2d. unit	10/10
Stores	27/9
Water @ 2/6 1000 galls.	2/6
Freight surcharge	1/2
	115/11d. ton

Road freight to Hawker 77/- per ton product.
Rail " " Pirie 27/3 " " "
221/2d. ton.

∴ Total cost at Pirie = 221/2 ton
F.O.R. " " Adelaide = 270/2 ton.

8.2.6. Operating costs for mill at Adelaide.

Capital costs, interest and depreciation as for Pt. Pirie.

Total Operating cost.

Interest.	22/5
Depreciation	21/11
Wages	30/4
Power @ 2d. unit	10/10
Stores	27/9
Water @ 1/6 1000 gals.	1/6
	114/9 ton.

Road freight to Hawker = 77/- ton of product.
Rail " " Adelaide = 81/1 " " "
272/10 ton.

∴ total cost at Adelaide is 272/10d. ton.

8.3 Comparison of sites.

It is necessary to compare the cost of the final product at each site, and also the cost of that product after transportation to Adelaide. It should be noted that shipments west or east may not be through Adelaide, Port Augusta appears to be the most favourable site.

Table No. 3

Alternative Sites.

Mill location	Cost per ton at Mine	Hawker	Augusta	Pirie	Adelaide
Mine	162/-	232/-	247/-	256/9	305/9
Hawker		227/7	242/7	252/4	301/4
Quorn			[illegible]	241/7	290/7
Pt. Augusta			210/11	220/8	269/8
Pt. Pirie				221/2	270/2
Adelaide					272/10

9. Conclusions.

Laboratory test work shows that gravity concentration is by far the best, and jigs plus tables give the highest grade and recovery of any method tried.

Dry grinding requires less capital and is cheaper to operate than wet grinding. The market has been developed with this type of product and no major benefits would result by use of a wet mill.

If the mill is located at the mine or Hawker increased capital charges are accrued to house personnel, establish a power house, etc. and with interest and depreciation charges, and increased costs of stores and power the price of the finished product is greater than if the mill is located at Pt. Augusta.

For a site south of Port Augusta increased rail freight on material ultimately rejected increases the price again.

Port Augusta has the advantages of an established community, cheap power, reticulated water, centrally located between the eastern and western states and is a sea port.

It is therefore recommended that a gravity mill with dry grinding be located at Port Augusta in preference to the alternatives covered in this report.

Before any plant is purchased the manufacturers recommendations as to size of equipment should be obtained as in some cases tests on the materials to be treated will be required.

APPENDIX.

List of Drawings

The drawings appended are as follows-

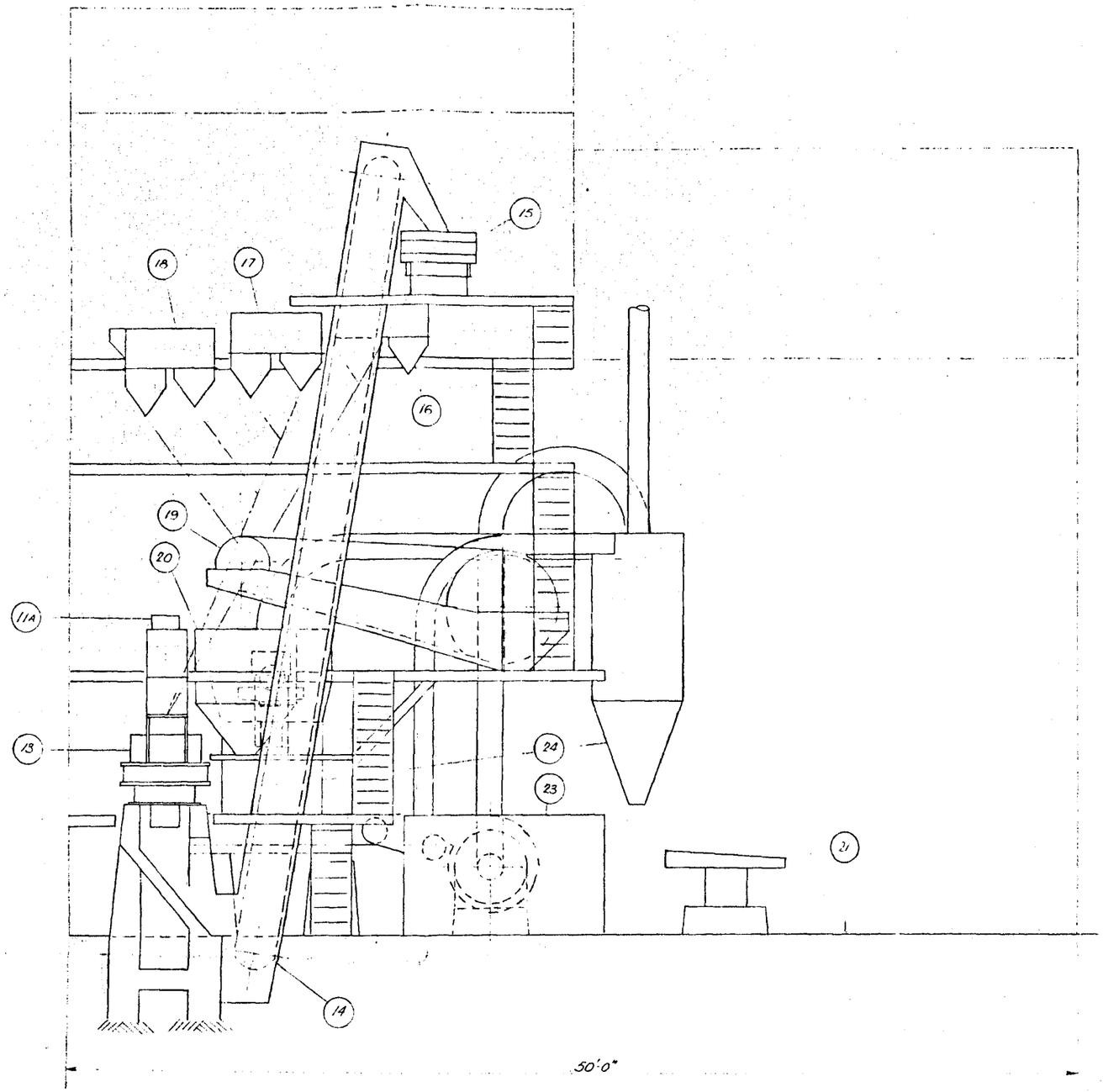
SM 140	Proposal No.1 - Wet Grinding -	Plan.
SM 141		Elevation.
SM 142		Elevation.
SM 147	Proposal No. 2 - Dry Grinding -	Plan
SM 148		Elevation.
SM 153	Proposal No. 2A - Dry Grinding -	Plan
SM 154		Elevation.
SM 155		Elevation.
SM 146		Elevation.

Notes on Drawings.

Proposal No. 1 shows a wet grinding mill laid out on a flat site.

Proposal No. 2 shows a dry grinding mill laid out on a flat site.

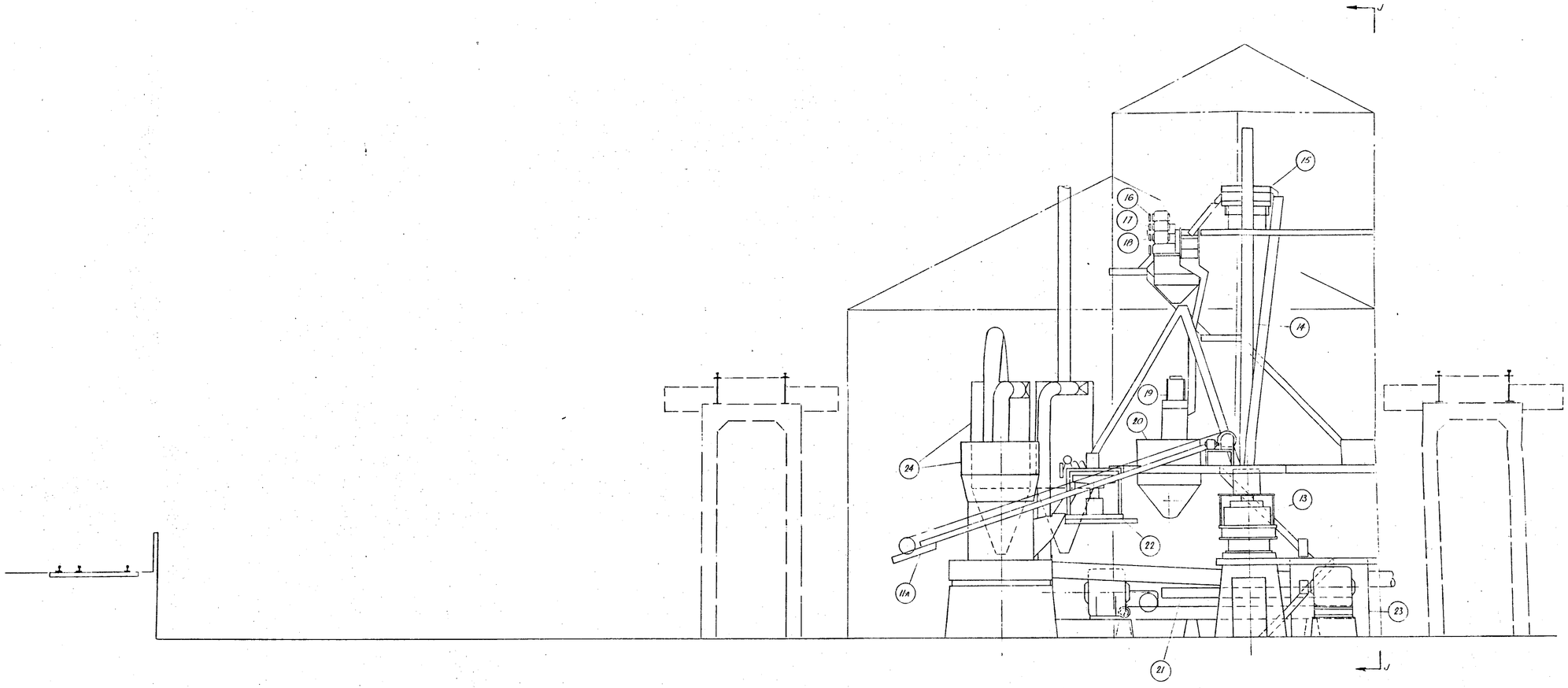
Proposal No. 2A shows a dry grinding mill laid out in the coal bunkers at the "round house" area of the Commonwealth Railways yards at Pt. August.



— ELEVATION JJ. —

S. A. DEPT. OF MINES

ELEVATION H.H	SM154	Rep. No.	R & D BRANCH			4" = 1'0" A
PLANT LAYOUT	SM153	D.M.	CONCENTRATION OF BARYTES — PROPOSAL No 2A DRY GRINDING			S.M. 155.
Associated Drawings	No.	Compiled from	S.A. BARYTES	SHEET 3 OF 4	Director of Mines	Date 5-7-55 FOLDER 11° RD 15



SECTIONAL ELEVATION 'HH'

SECONDARY CRUSHING & DRY GRINDING UNIT

100 mm 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 mm

STAEDTLER MARS 561 10-13 Made in England

65 1347

S.A. DEPARTMENT OF MINES

R & D BRANCH

CONCENTRATION OF BARYTES — PROP. No. 2A. DRY GRINDING

S.A. BARYTES — SHEET 2 of 4

ELEVATION JJ.	SM 153					Req. No.	Approved / Issued
PLANT LAYOUT	SM 153					D.M.	
						Compiled from	
Associated Drawing	No.	No.	Amendment	Exd.	Date		Director of Mines

Dr. J.R.GOBLE
Ckd. M.M.SOUTH
Ckd.
Exd.

Scale 1" = 1'-0"

S.M. 154.

Date 1-6-55

FOLDER No. RD.1A

A.

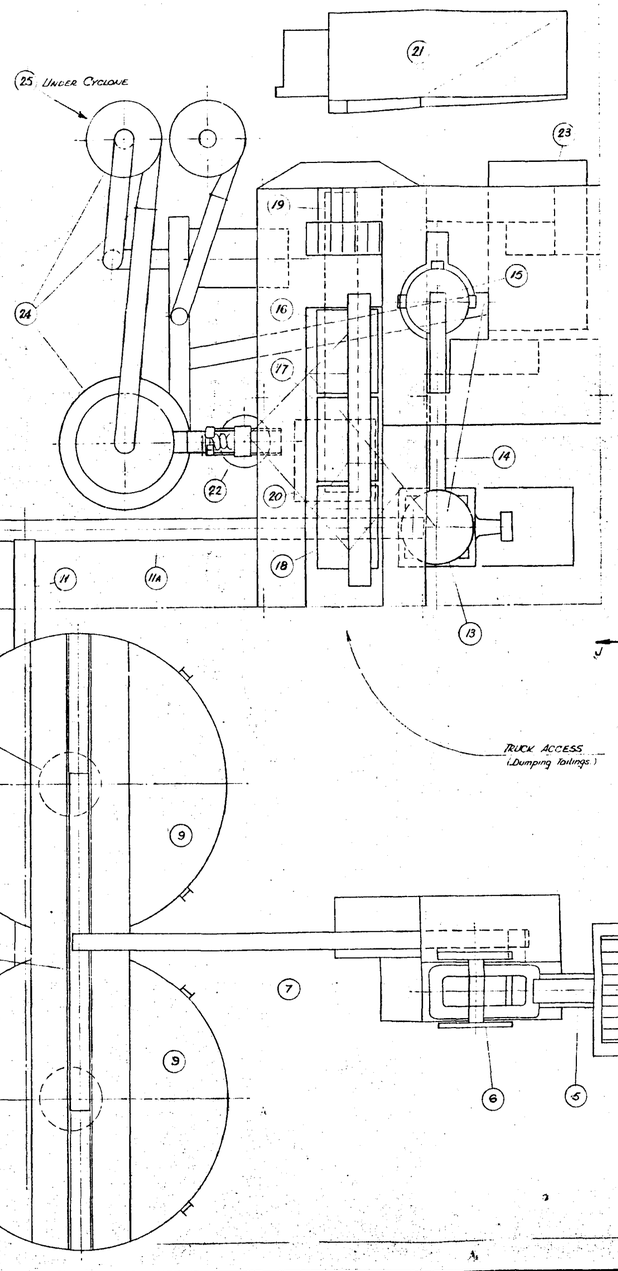
APPROX 90 BOUNDARY

TRUCK ACCESS →

AVAILABLE SPACE
In excess of 3600sq ft

PLANT LAYOUT

DRY GRINDING PROPOSAL N° 2
ADAPTED TO NORTH END OF
COMMONWEALTH RAILWAY
COAL BUNKER PORT AUGUSTER.



1 RAIL TRUCK
2 SIDING
3 GRIZZLY
4 BIN
5 APRON FEEDER
6 JAW CRUSHER
7 ELEVATOR
8 CONVEYOR
9 BINS
10 PLATE FEEDER
11 (11A) CONVEYOR
12 MAGNET
13 SECONDARY CRUSHER
14 ELEVATOR
15 SCREEN
+20 M/M 1/4 — -20 M/M 1/4
16 JIG
17 JIG
18 JIG
19 DEWATERING CLASSIFIER
20 BIN
TRUCK DUMP
21 TABL
C C PUMP
T PUMP
M PUMP
SLIME DAM
SAND
WATER PUMP
22 FILTER
23 DRIER
24 DRY GRINDING UNIT
25 BAGGING M/C
26 ROLLER CONVEYOR
27 FORK LIFT TRUCK
RAIL TRUCKS
WATER TANK
RETURN WATER PUMP

H
E
H
E
J

100mm 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500mm

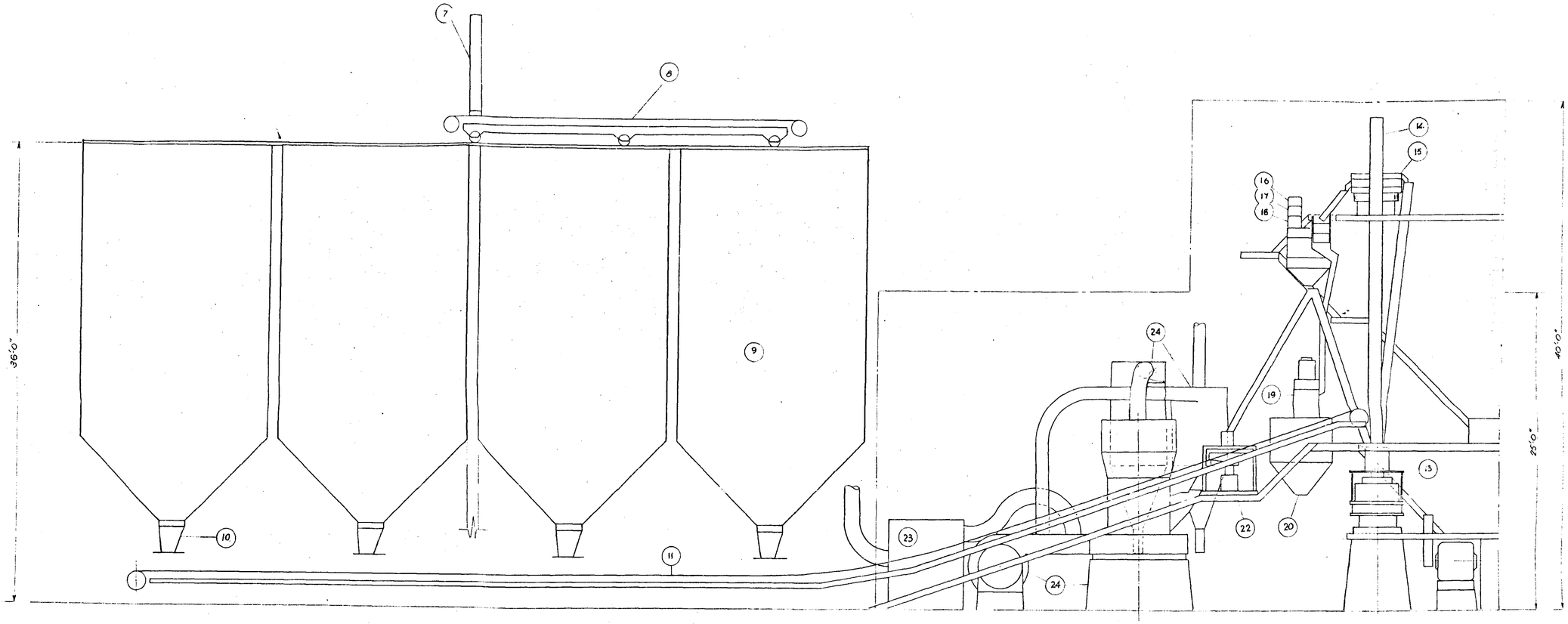
STAEDTLER MARS 50 70-13 Made in England

BS 1192

VIEW J.J.	SM155				Req. No.	S.A. DEPARTMENT OF MINES	Approved / Passed
VIEW H.H.	SM154				D.M.	R & D. BRANCH	
VIEW E.E.	SM146				Compiled from	CRUSHING & CONCENTRATION OF BARYTES — PROP. N° 2A. DRY GR.	
Associated Drawing	No.	No.	Amendment	Ext.	Date	S.A. BARYTES — SHEET 1 of 4	Director of Mines

Drn R. GOBLE
Tcd. M.M. SOUTH
Ckd
Ext.

Scale 1" = 1'-0"
S.M. 153.
Date 6-7-55
FOLDER N° RD 13.
A



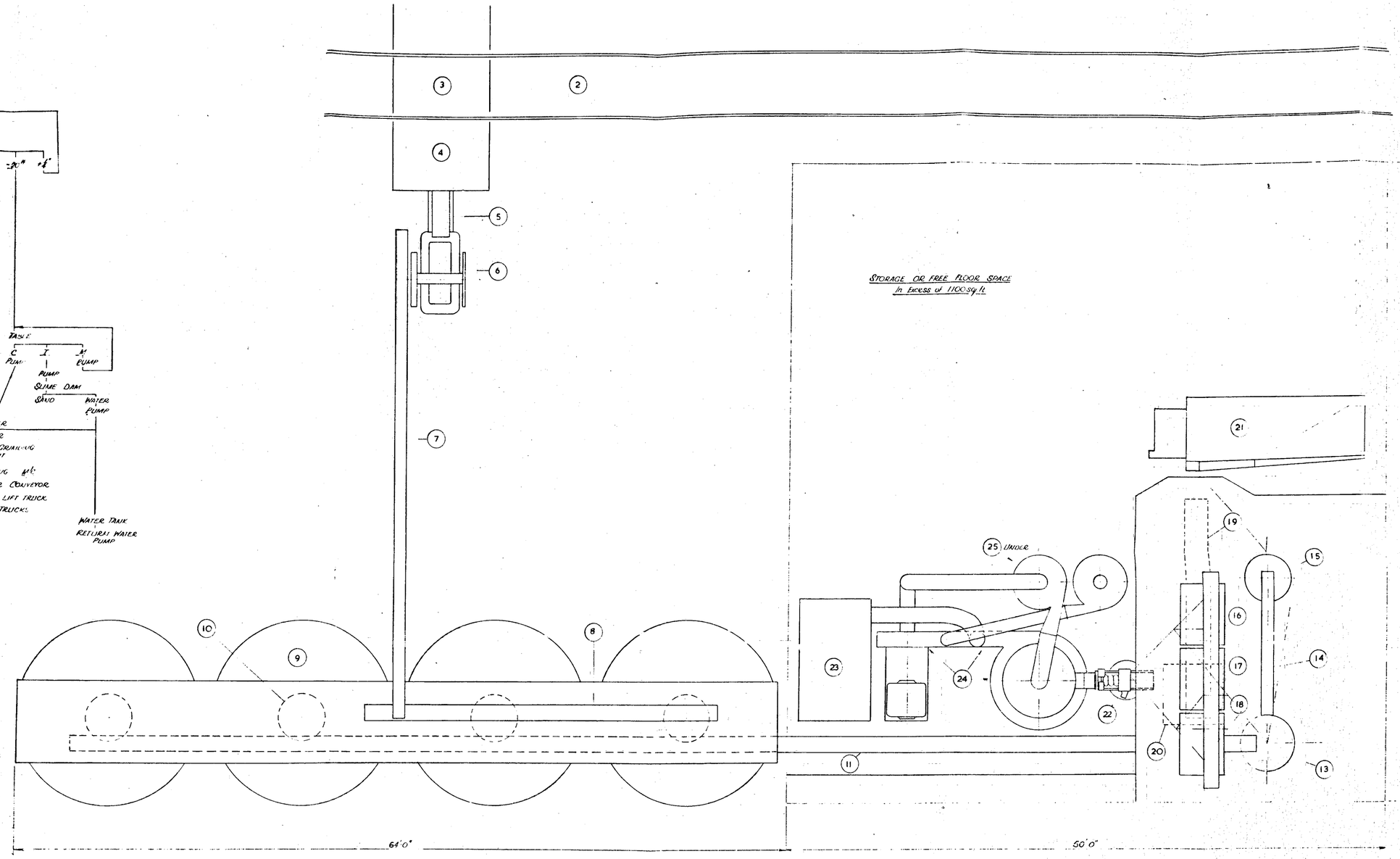
ELEVATION 'G'

					Req. No.	S.A. DEPARTMENT OF MINES	
					D.M.	RESEARCH & DEVELOPMENT	
PLAN OF PLANT LAYOUT SM 147					Compiled from	CRUSHING & CONC OF BARYTES – PROP N°2 DRY GRINDING.	
Associated Drawing	No.	No.	Amendment	Init.	Date	S A. BARYTES. SHEET- 2 of 2	

Approved	Passed		Scale 1" = 1'0"	A
		Dm. J.R.Cole	S.M. 148	
Director of Mines		Ckd. J.M.M.S.		
		Ext.	Date 26.3.55	Folder N° RD.9

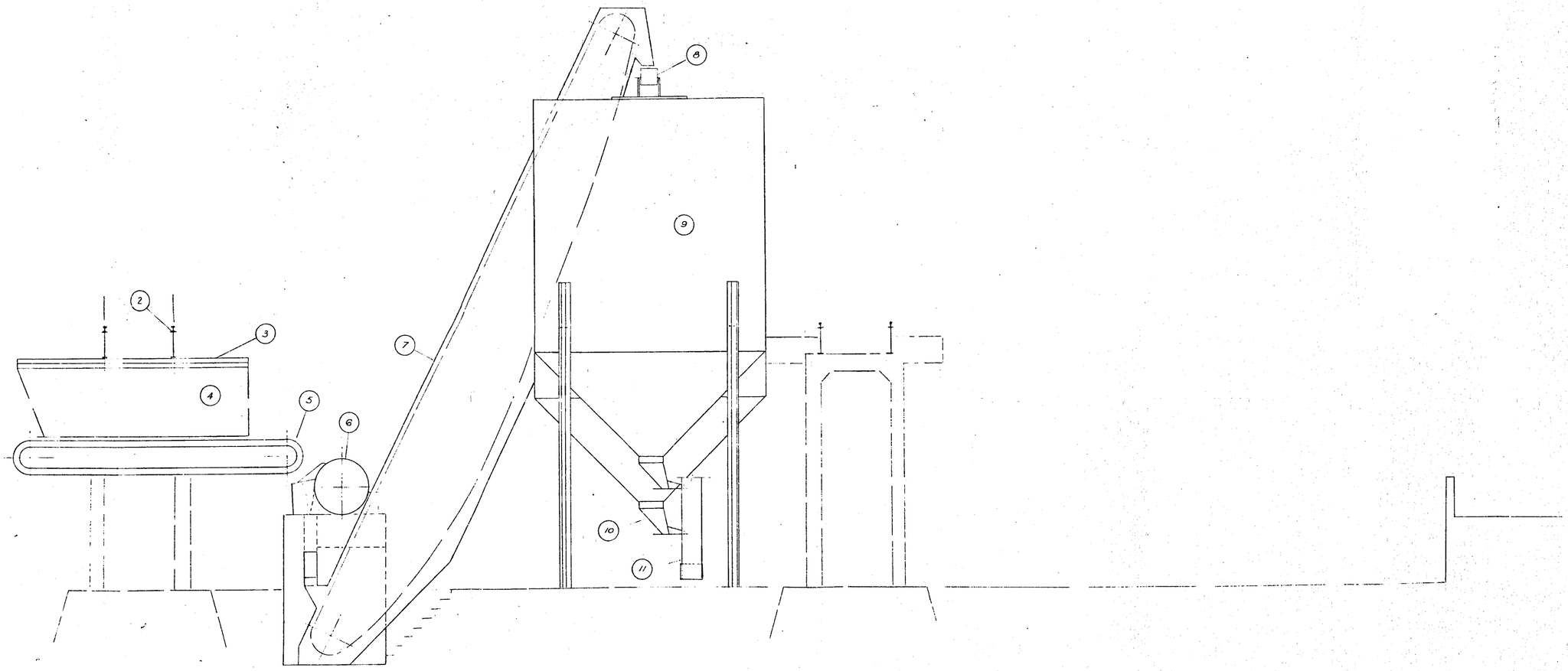
1. RAIL TRUCK
2. SIDING
3. GRIZZLY
4. BIN
5. APRON FEEDER
6. JAW CRUSHER
7. ELEVATOR
8. CONVEYOR
9. BINS
10. PLATE FEEDER
11. CONVEYOR
12. MAGNET
13. SECONDARY CRUSHER
14. ELEVATOR
15. SCREEN
16. JIG
17. JIG
18. JIG
19. DEWATERING CLASSIFIER
20. BIN TRUCK DUMP
21. FILTER
22. DRIER
23. DRY GRINDING UNIT
24. BAGGING
25. ROLLER CONVEYOR
26. FORK LIFT TRUCK
27. RAIL TRUCKS

TANK
C PUMP
I PUMP
A PUMP
SLIME DAM
SAND PUMP
WATER PUMP
WATER TANK
RETURN WATER PUMP



PLANT LAYOUT

S.A. DEPARTMENT OF MINES
RESEARCH & DEVELOPMENT
CRUSHING & CONC. OF BARYTES – PROP. No 2 - DRY GRINDING
S.A. BARYTES
SHEET 1 of 2
Director of Mines
ELEVATION G SM145
J. No.
I.M. Compiled from
Drn. J.R.GOULE
Cd. M.M.SMITH
Ckd.
Tr.
1/4" = 1'0"
S.M. 147.
26.5.55
FOLIO 1791 B
A



SECTIONAL ELEVATION 'EE'

CRUSHING & STORAGE SECTION

STAEDTLER MARS

S.A. DEPT. OF MINES

RESEARCH & DEVELOPMENT BRANCH

CRUSHING & STORAGE OF BARYTES ——— PROPOSAL No. 2A.

S.A. BARYTES. SHEET 4 OF 4

SECTIONAL ELEV JJ SM155.
" " HH SM154
PLANT LAYOUT SM163.

Compiled from

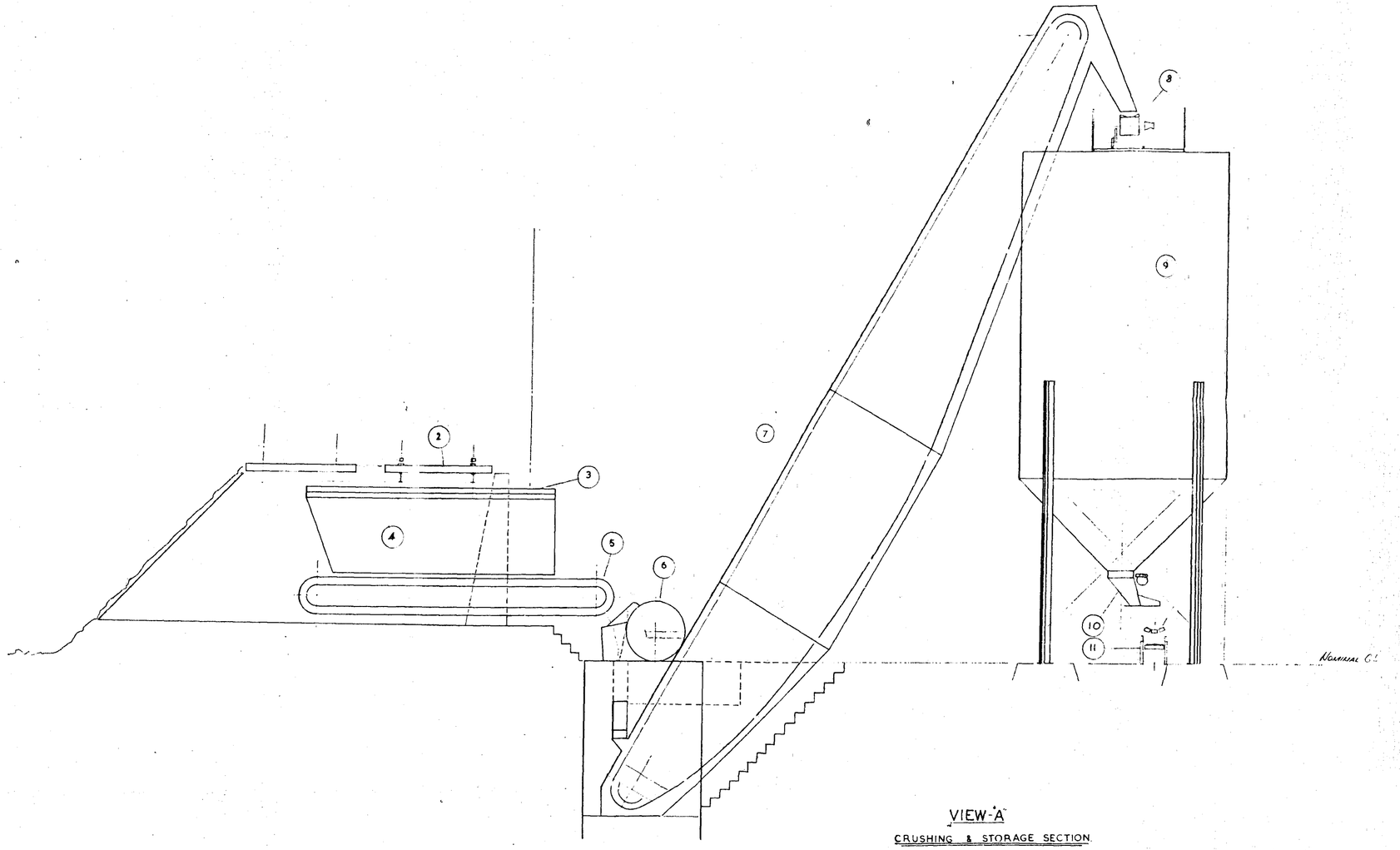
Director of Mines

J.R.COCKLE
Asst. Mining Engineer

1/2" = 1'0" A

S.M. 146.

20-5-55 FOLDER No. R.D.1



VIEW "A"

CRUSHING & STORAGE SECTION

S.A. DEPARTMENT OF MINES

RESEARCH & DEVELOPMENT

CRUSHING & ORE STORAGE — PROPOSAL No. 1.

S.A. BARYTES.

SHEET 3 OF 3

GENERAL ELEVATION B. SM141

PLANT LAYOUT SM140

Associated Drawing No.

Req. No.

D.M.

Compiled from

No. Amendment Exd. Date

Director of Mine.

J.R.COOK
MAY SOUTH

Exd.

1" = 1'0"

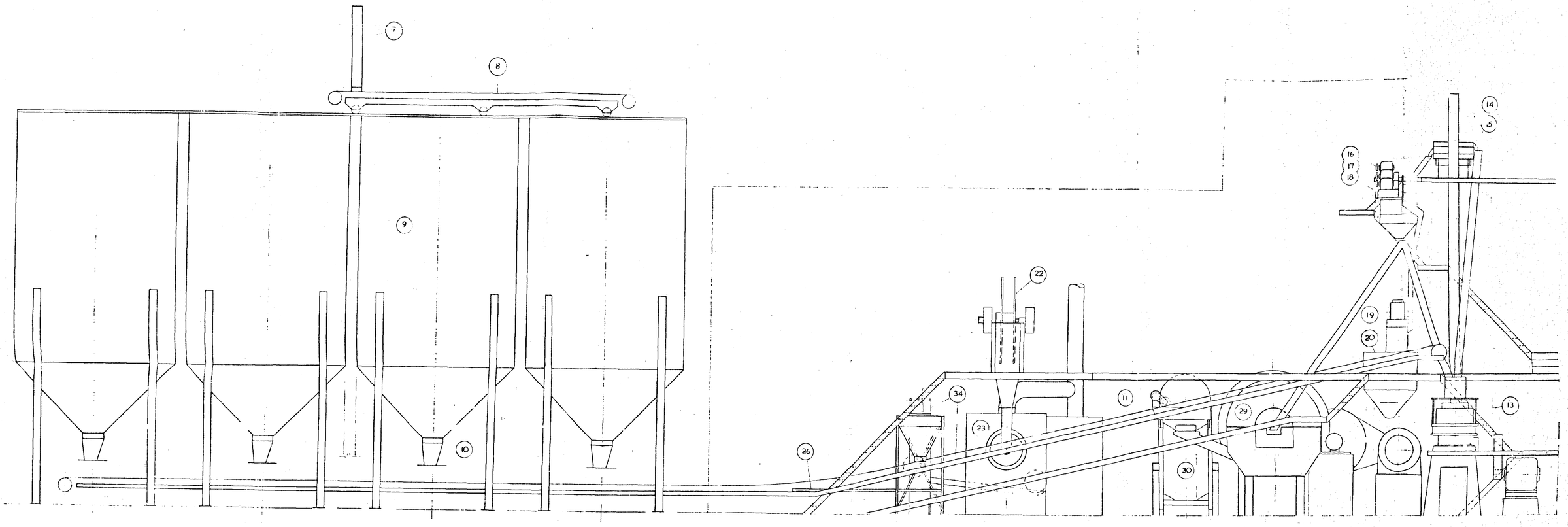
S.M. 142

A

Date 12-5-58

FOLDER L^M R.D.-3

STAEDTLER MARS



ORE STORAGE

STORAGE & LOADING

BAGGING

DRYING

WET GRINDING

SECONDARY CRUSHING & CONCENTRATION

ELEVATION.- B

STAEDTLER MARS

ELEV. CRUSHING SECTION SM142				Reg. No.	S.A. DEPARTMENT OF MINES	Approved	Passed
PLANT LAYOUT SM140				D.M.	RESEARCH & DEVELOPMENT		
				Compiled from	CRUSHING & CONC. OF BARYTES – PROP. No. 1 WET GRINDING.		
Tracing Prepared	No.	Amendment	Init.	Date	– S.A. BARYTES SHEET 2 of 3	Director of Mines	

J.R. DOBLE
M.H. SOUTH

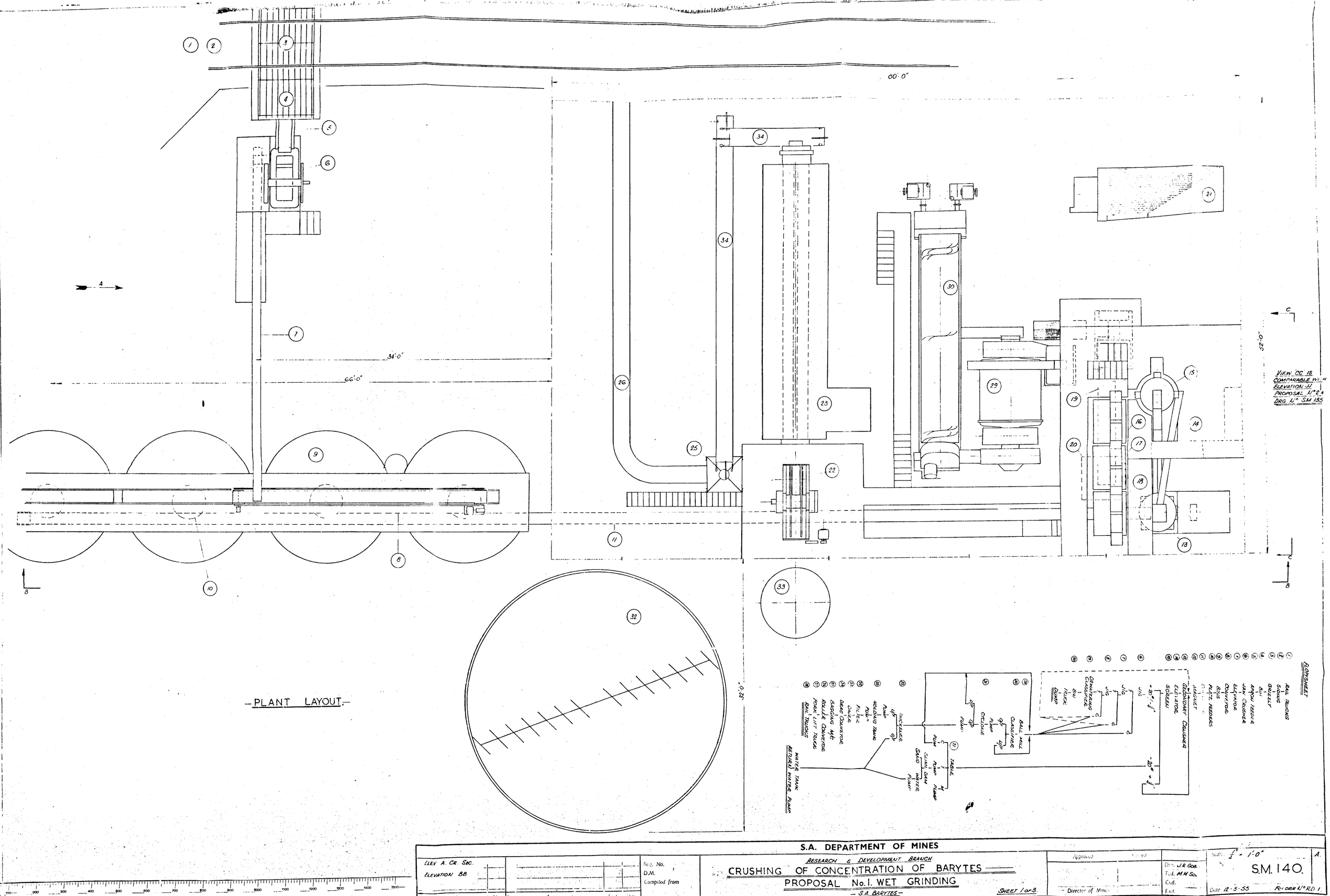
Scale 4' 1'0"

S.M. 141.

A

11-5-55

FOLDER No. RD 2



PLANT LAYOUT

STAEDTLER MARS

S.A. DEPARTMENT OF MINES

RESEARCH & DEVELOPMENT BRANCH

CRUSHING OF CONCENTRATION OF BARYTES

PROPOSAL No. 1. WET GRINDING

S.A. BARYTES

SHEET 1 of 3.

ELEV. A. CR. SEC.

ELEVATION BB

Sup. No.

D.M.

Compiled from

Associated Drawing | No. | Amendment | Init. | Date

Approved | Director of Mines

Drn. J.R.Goo.

Trd. M.H.Sc.

Ckd.

Exd.

Scale 1/2" = 1'-0"

A.

S.M. 140.

Date 12-5-55

Folder No. RD 1.