APPENDIX N: TSF CAPACITY REVIEW

Project No: 123-008 *File Reference: l_123-008_ppm exp_201902_lv*

11 March 2019

The Project Manager
SLR Consulting (Pty) Ltd
P.O. Box 1596
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2060
SOUTH AFRICA

Attention: Mrs A. Pheiffer

Pilanesberg Platinum Mine
Review Of Tailings Storage Facility Capacity

1. INTRODUCTION

Epoch Resources (Pty) Ltd have been requested to compile a memorandum outlining the remaining capacity on the Pilanesberg Tailings Storage Facility (TSF) in support of applications being submitted for a plant expansion. As part of the proposed expansion it is expected that the production of tailings may be increased by up to 65ktpm. While there may be a change in the nature of a small portion of the tailings stream (5ktpm) this is not expected to change the pollution potential of the overall tailings stream nor it's geotechnical characteristics.

2. TERMS OF REFERENCE

The terms of reference for the memorandum therefore call for an assessment of the remaining life of the TSF at deposition rates between the current (300ktpm) and proposed (365ktpm) rates of production.

3. TSF CAPACITY

The remaining capacity of the TSF has been evaluated using the current and envisioned deposition rate and detailed calculations and stage capacity curves contained in Appendix 1 of this memorandum.. The results of the evaluation are summarised in Table 1 and show that:

- As at end of October 2018, 31.24 Mt of tailings have been deposited to the PPM TSF.
- The TSF has a remaining capacity to accept tailings of 55.32 Mt (which is slightly above the known remaining resources as summarised in Table 1) comprising:
  - 48.373 Mt to the Main TSF if developed to a height of 1 141 m.a.m.s.l., approximately 29m above the current tailings elevation of 1 112 m.a.m.s.l., at a deposition rate of 320ktpm
  - 7.369 Mt to the Western TSF if developed to a height of 1 105 m.a.m.s.l., approximately 10m above the current tailings elevation of 1 095 m.a.m.s.l. at a deposition rate of 45ktpm

- The capacities described above would potentially be limited however by rate of rise constraints on the Main TSF in about 8 years, when the rate of rise would be expected to exceed the recommended maximum of 2.5m/yr at a tailings elevation of 1130 m.a.m.s.l. It is possible that at this stage the rate of tailings deposition may have to be curtailed, or additional capacity may be required, in the form of another TSF

The maximum allowable rate of rise will be dependant on the current status of the TSF as well as the material properties of the deposited material. the recommended value of 2.5m/y is based on previous project experience.

TABLE 1: PILANESBERG TAILINGS DAM LOM ASSESSMENT

Monthly Deposition Rate (ktpm)	Available Resource (as at End October 2018) (Mt)			Remaining Capacity (Mt)	Remaining Capacity (Years)	Rate of Rise (m/y)
	West Pit	East Pit	Total			
300	26.03	28	54.03	55.74	14.07	2.50
365	26.03	28	54.03	36.82	8.19	2.50
365	26.03	28	54.03	55.74	12.34	2.93

4. ALTERNATIVE TAILINGS STORAGE FACILITY AREA

Should the capacity of the Pilanesberg TSF be exceeded it is likely that additional tailings storage capacity would be constructed on Sedibelo Platinum Mines' adjacent Sedibelo or Magazynskraal lease areas.

5. CONCLUSIONS

Based on the review of the of the assessment, it can be concluded that while the Pilanesberg TSF has sufficient capacity to satisfy the life of mine tailings storage requirements, this is subject to rate of rise limitations. This implies that in approximately 8 years additional tailings storage capacity would have to be established if tailings production were to be sustained at 365ktpm.

6. RECOMMENDATIONS

Based on the evaluation of the TSF capacity as described above, it is recommended that the remaining capacity and operational performance of the TSF be monitored closely to facilitate planning for additional tailings storage capacity, should it be required.

It must be noted that the lead time between deciding to develop additional capacity and it's availability to accept tailings would be significant and should be considered in the planning process. It is suggested that for planning purposes allowance is made for a 30 month lead time comprising:

- Detailed design and permitting – 18 months
- Construction - 12 months t

We trust that the capacity assessment as outlined above is sufficient for your purpose. Please do not hesitate to contact us should additional information be required.

Yours faithfully,

Guy Wiid PrEng
for and on behalf of Epoch Resources (Pty) Ltd

APPENDIX 1 :CALCULATIONS

CLIENT	SEDIBELO PLATINUM
PROJECT	PPM OPERATIONS
PROJECT NUMBER	123-008
PROJECT DESCRIPTION	PILANESBERG TSF CAPACITY ASSESSMENT
DESCRIPTION OF CALCULATION	Summary
PROJECT MANAGER	GJ Wiid (PrEng No. 940269)

epoch resources

mine residue and environmental engineering consultants

1 SUMMARY

Description	Elevation (m.a.m.s.l.)	Remaining Storage Capacity (Mt)	Total Capacity (Mt)	Surplus / Deficit	Rate of Rise (m/y)
Design 2010	1,145	N/A	78.58	-6.69	2.22
TSF Conversion Design 2012	1,140	N/A	94.51	9.24	2.20
TSF Design 2018 - Revised Paddock Construction (Current Deposition rate of 320 ktpm)	1,140	54.93	86.17	0.90	2.25
TSF Possible Expansion Feasibility 2019 - Revised Deposition Tonnes (Increased Deposition to 365 ktpm)[1]	1,141	55.32	86.56	1.29	2.93

Total Required Storage 85.27 Mt

Notes:

1 The remaining capacity is 55.32 Mt but the rate of rise is a concern and will most likely result in less capacity being available

NAME	**L Venter**	**GJ Wiid (Pr.Eng) 940269**		
SIGNATURE				
DATE		**2019/03/11**		

CLIENT	SEDIBELO PLATINUM
PROJECT	PPM OPERATIONS
PROJECT NUMBER	123-008
PROJECT DESCRIPTION	PILANESBERG TSF CAPACITY ASSESSMENT
DESCRIPTION OF CALCULATION	DESIGN CRITERIA
PROJECT MANAGER	GJ Wiid (PrEng No. 940269)

epoch resources

mine residue and environmental engineering consultants

1 TAILINGS MATERIAL PROPERTIES AND ESTIMATED STORAGE REQUIREMETS

1.1 Estimate of Required Tailings Storage Capacity

			CURRENT			POSSIBLE EXPANSION		
			West Pit	**East Pit**	**Total**	**West Pit**	**East Pit**	**Total**
1.1.1	Ore Mined / Tailings Deposited up to December 2014 (Monitoring Data)	Mt	17.27		17.27	17.27		17.27
1.1.2	Remaining Ore as at January 2015	Mt	40.00	28.00	68.00	40.00	28.00	68.00
1.1.3	Less : Ore Mined / Tailings Deposited (Jan 2015 - Oct 2018) (Monitoring Data)	Mt	-13.97		-13.97	-13.97		-13.97
1.1.4	Required Tailings Storage Capacity	Mt	26.03	28.00	54.03	26.03	28.00	54.03
1.1.5	Tailings Deposition Rate	Mtpa	3.84			4.38		
1.1.6	Remaining Life of Facility	yrs	6.78	7.29	14.07	5.94	6.39	12.34
			85.27			85.27		
			Merensky	**UG2**	**Weighted Ave**	**Merensky**	**UG2**	**Weighted Ave**
1.17	Tailings Particle SG	t/m^3	3.20	3.60	3.29	3.20	3.60	3.29
1.1.8	Ore Split		78%	22%		78%	22%	
1.1.9	Tailings Production Rate (Current)	dry tpa	2,995,200	844,800	3,840,000	3,416,400	963,600	4,380,000
		dry tpm	320,000			365,000		
		tph solids	444			507		

2 VOLUMETRIC STORAGE REQUIREMENTS

2 Estimated In-Situ Dry Density and Volumetric Storage Requirements

2.1	Particle Specific Gravity	t/m^3	3.29
2.2	In-situ Void Ratio		1.00
2.3	In-situ Dry Density		1.64

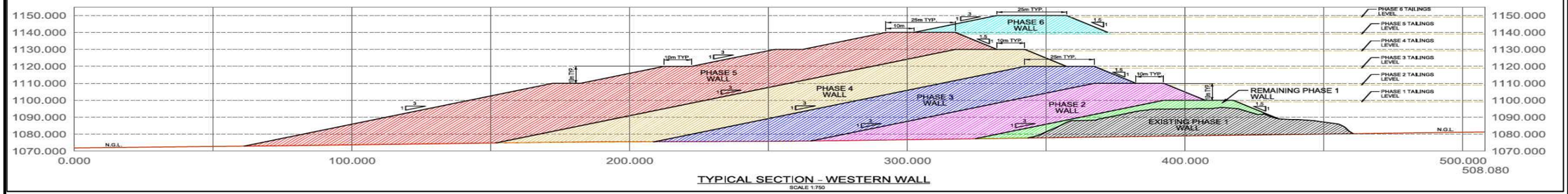
			Current	**Possible Expansion**
2.4	Annual Tailings Tonnes	tons	3,840,000	4,380,000
2.5	Annual Volume of Tailings	m^3	2,335,766	2,664,234

			West Pit	**East Pit**	**Total**
2.6	Total Tailings Production	tons	26,031,586	28,000,000	54,031,586
		m^3	15,834,298	17,031,630	32,865,928

NAME	**L Venter**	**GJ Wiid (Pr.Eng) 940269**		
SIGNATURE				
DATE		**2019/03/11**		

PILANESBERG HISTORIC DESIGN CAPACITY COMPARISON

Design 2010



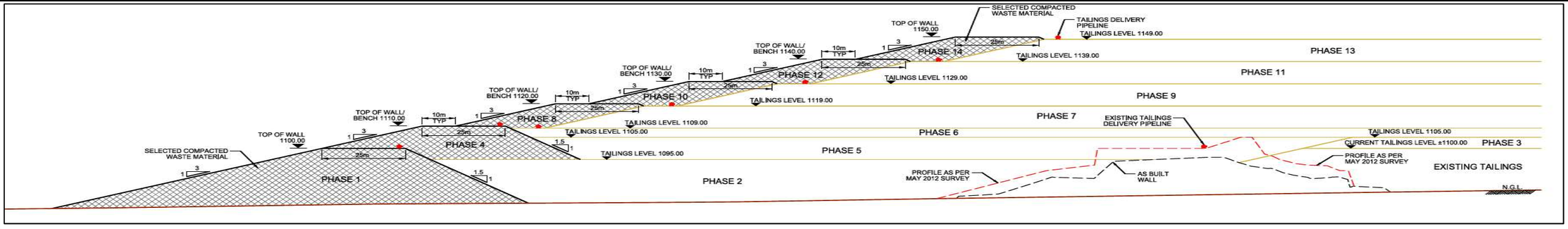
TYPICAL SECTION - WESTERN WALL
SCALE 1:750

Phase No.	Crest of Rock Wall m.a.m.s.l.	Tailings Elevation m.a.m.s.l.	Storage Capacity Mt	Rate of Rise m/y
1	1100	1095	3.53	4.02
2	1110	1105	14.53	2.18
3	1120	1115	30.81	2.05
4	1130	1125	47.40	2.11
5	1140	1135	63.35	2.22
6	1150	1145	78.53	2.32
TOTALS			78.53	

Notes:

1. Design based on downstream waste rock containment walls phase over 6 phases.
2. Design called for large quantities of waste rock to be hauled to site for the purpose of constructing the waste rock containement walls

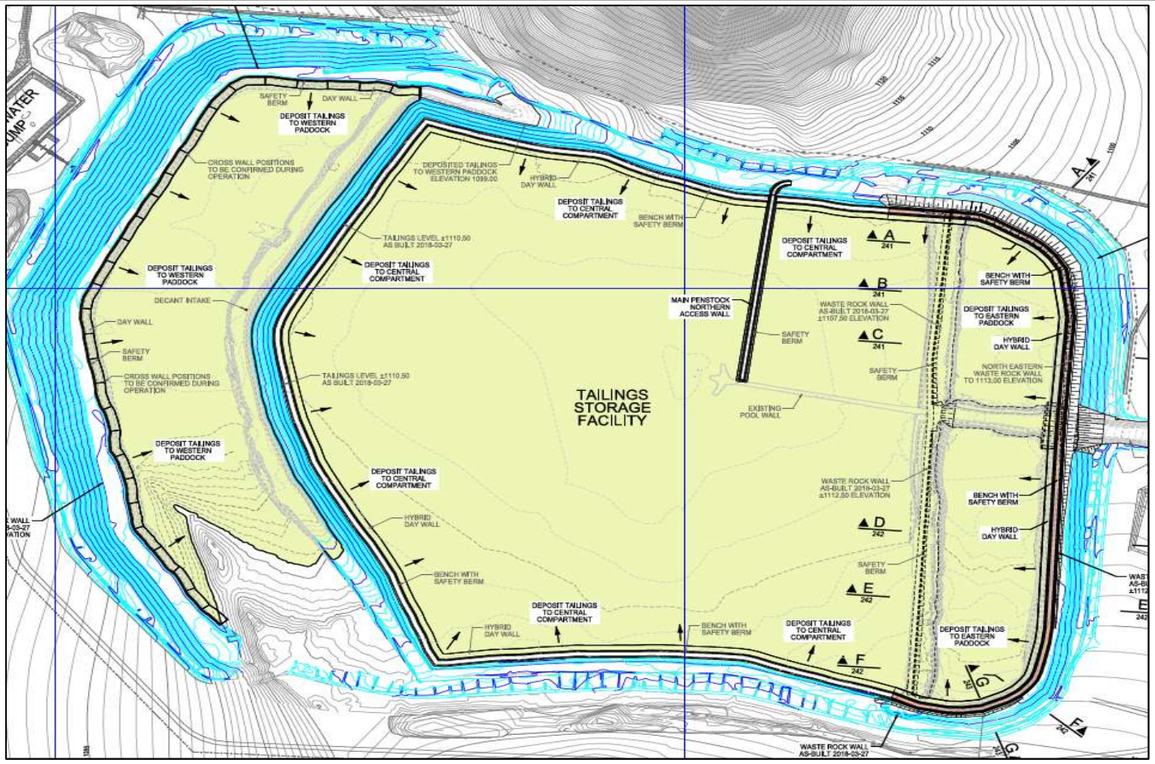
TSF Conversion Design 2012



Phase No.	Phased Depositional Area	Crest Elevation (m.a.m.s.l.)	Phased Capacity (Mt)	Cumulative Remaining Capacity (Mt)	Total Cumulative Storage Capacity (Mt)	Rate Of Rise (m/y)
0	Tailings Deposited to End Dec 2014	1,105	17.13	0	17.13	2.40
1	Western Paddocks	1,100	4.51	4.51	21.64	8.60
2	Eastern Paddocks	1,108	1.22	5.72	22.86	4.10
2	Central TSF and Eastern Paddocks Combined	1,110	7.74	13.47	30.60	1.50
2	Western Paddocks	1,110	4.45	17.91	35.05	7.50
3	Combined TSF	1,120	22.66	40.57	57.70	1.70
4	Combined TSF	1,130	28.54	69.11	86.24	1.90
6	Combined TSF	1,140	8.26	77.37	94.51	2.20
7	Combined TSF	1,150	14.45	91.82	108.96	2.60
	TOTAL		108.96	91.82	108.96	

PILANESBERG HISTORIC DESIGN CAPACITY COMPARISON

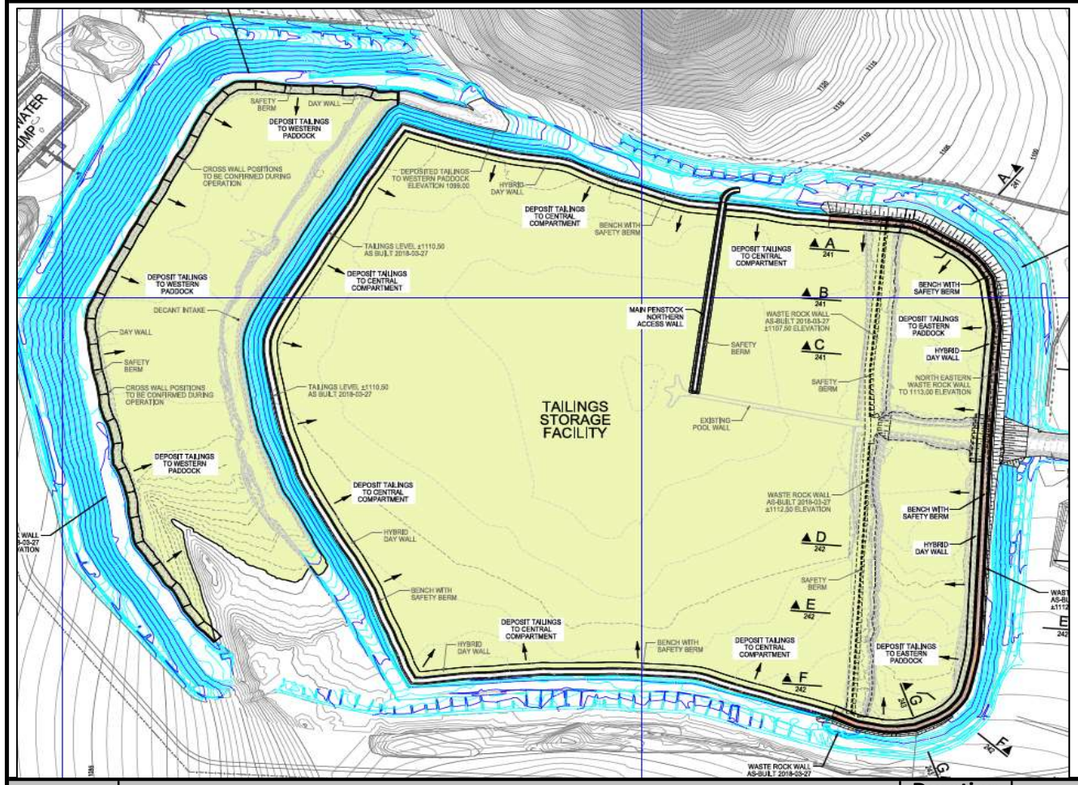
TSF Design 2018 - Revised Paddock Construction (Current Deposition rate of 320 ktpm)



Phase No.	Deposition Description	Duration (Months)	Elevation (m.a.m.s.l.)	Phased Capacity (Mt)	Cumulative Remaining Capacity (Mt)	Total Cumulative Storage Capacity (Mt)	Rate of Rise (M/y)
0	Tailings Deposited to End Oct 2018			31.24		31.24	
1	Fill Western Paddock To Elevation 10[illegible] 1099.5	4.95	1,099.5	1.58	1.58	32.82	8.50
2	Fill Eastern Paddock to 1106	2.12	1,106.0	0.68	2.26	33.50	17.70
3	Start Self Raising Western Paddock at 1m/y	5.46	1,100.0	0.24	2.51	33.74	1.00
4	Fill Eastern Paddock to 1113	5.46	1,113.0	1.75	4.25	35.49	12.50
5	Self Raise Combined Main TSF	171.07	1,140.0	46.17	50.42	81.66	2.25
5	Self Raise Western Paddock	171.07	1,107.5	4.51	54.93	86.17	1.00
Total		183.60					

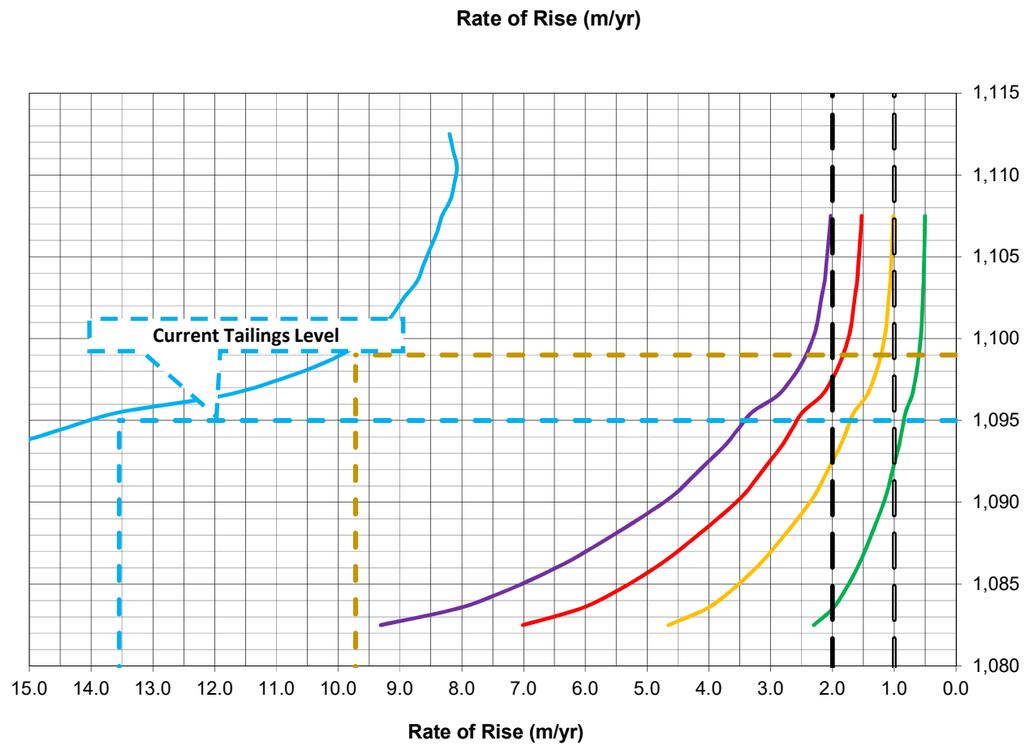
PILANESBERG HISTORIC DESIGN CAPACITY COMPARISON

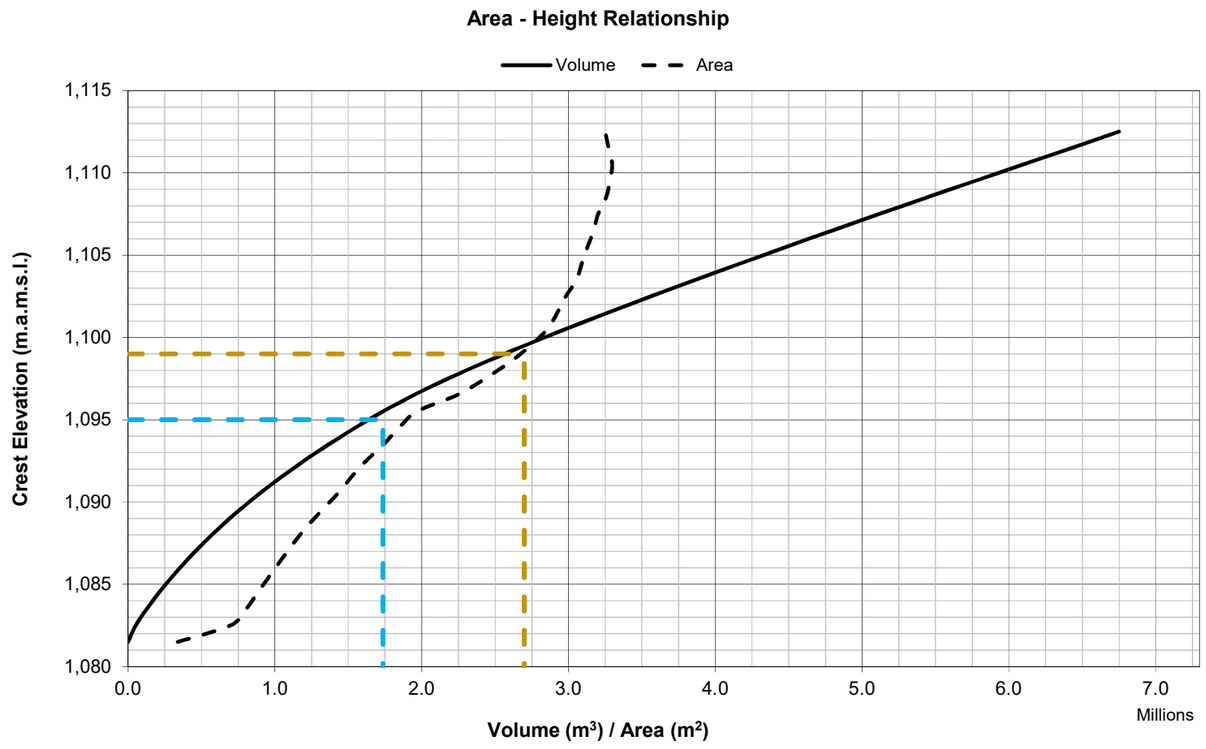
TSF Possible Expansion Feasibility 2019 - Revised Deposition Tonnes (Increased Deposition to 365 ktpm)



Phase No.	Deposition Description	Duration (Months)	Elevation (m.a.m.s.l.)	Phased Capacity (Mt)	Cumulative Remaining Capacity (Mt)	Total Cumulative Storage Capacity (Mt)	Rate of Rise (M/y)
0	Tailings Deposited to End Oct 2018			31.24		31.24	
1	Fill Western Paddock To Elevation 10[illegible] 1099.5	4.33	1,099.5	1.58	1.58	32.82	9.7
2	Fill Eastern Paddock to 1106	1.86	1,106.0	0.68	2.26	33.50	20.2
3	Start Self Raising Western Paddock at 1m/y	3.03	1,102.0	1.42	3.68	34.92	1.0
4	Fill Eastern Paddock to 1113	3.03	1,113.0	1.75	5.43	36.67	12.5
5	Self Raise Combined Main TSF	98.28	1,131.0	31.38	36.82	68.05	2.5
5	Self Raise Western Paddock	98.28	1,103.0	0.50	37.31	68.55	1.1
6	Self Raise Combined Main TSF	40.58	1,141.0	16.99	54.30	85.54	3.6
7	Self Raise Western Paddock	40.58	1,105.0	1.02	55.32	86.56	1.0
Total		148.08					

PILANESBERG PLATINUM TAILINGS STORAGE FACILITY
STAGE CAPACITY RELATIONSHIP FOR THE WESTERN PADDOCK



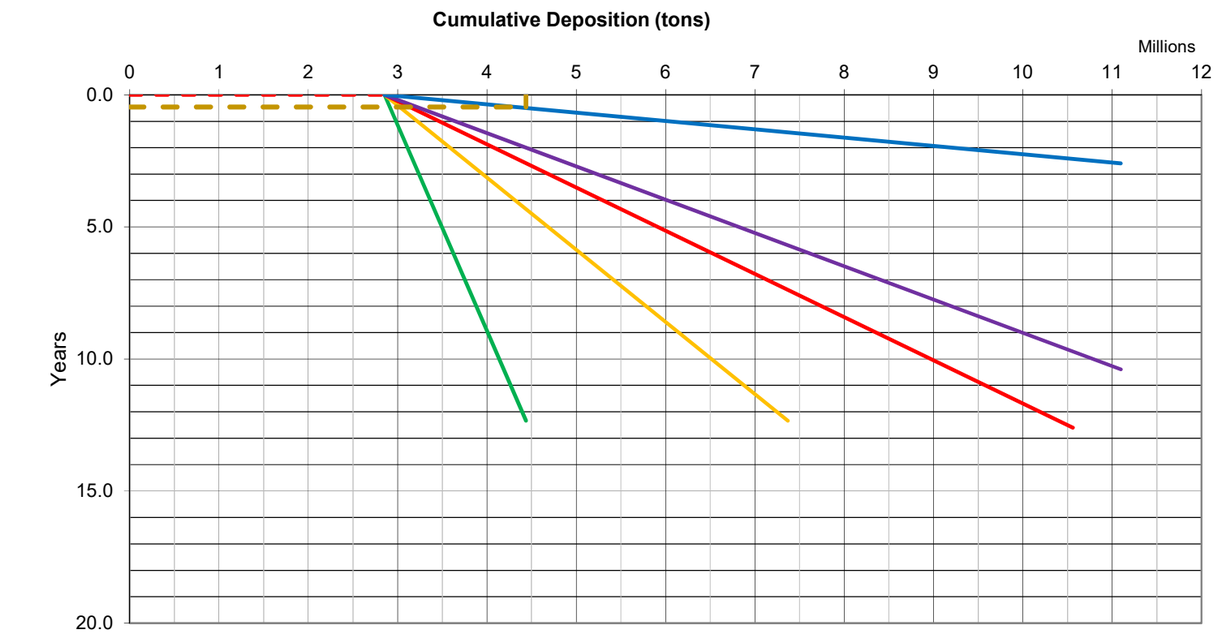


SUMMARY INFORMATION

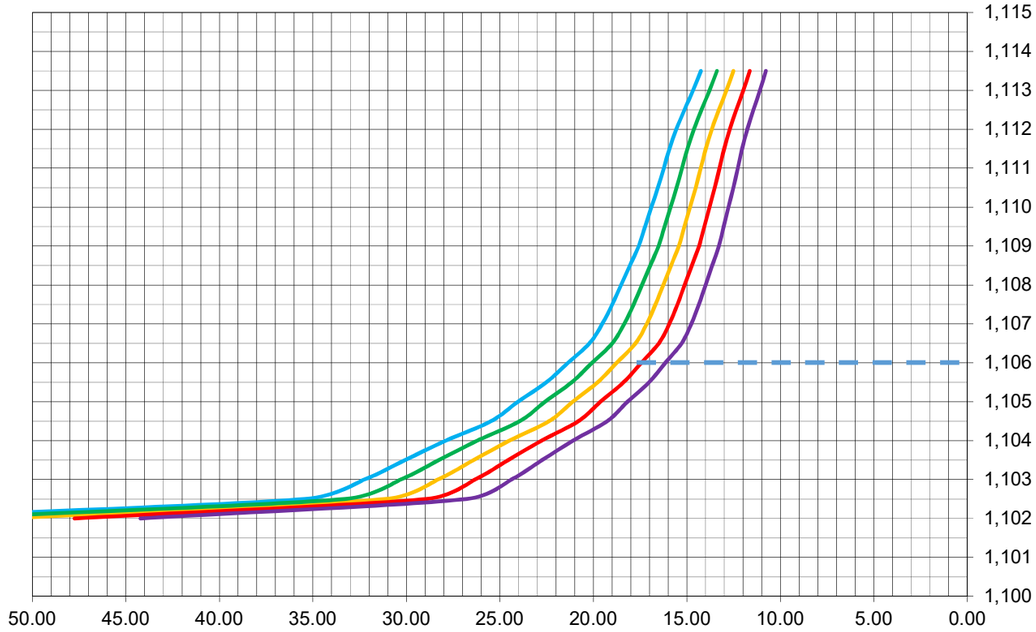
Ave In-Situ Dry Density	1.6	t/m^3	Rate of Rise Limits	2	Upper
Crest Elevation	1112.50	m.a.m.s.l.		1	Lower
Storage Capacity	11,096,196	dry tons			

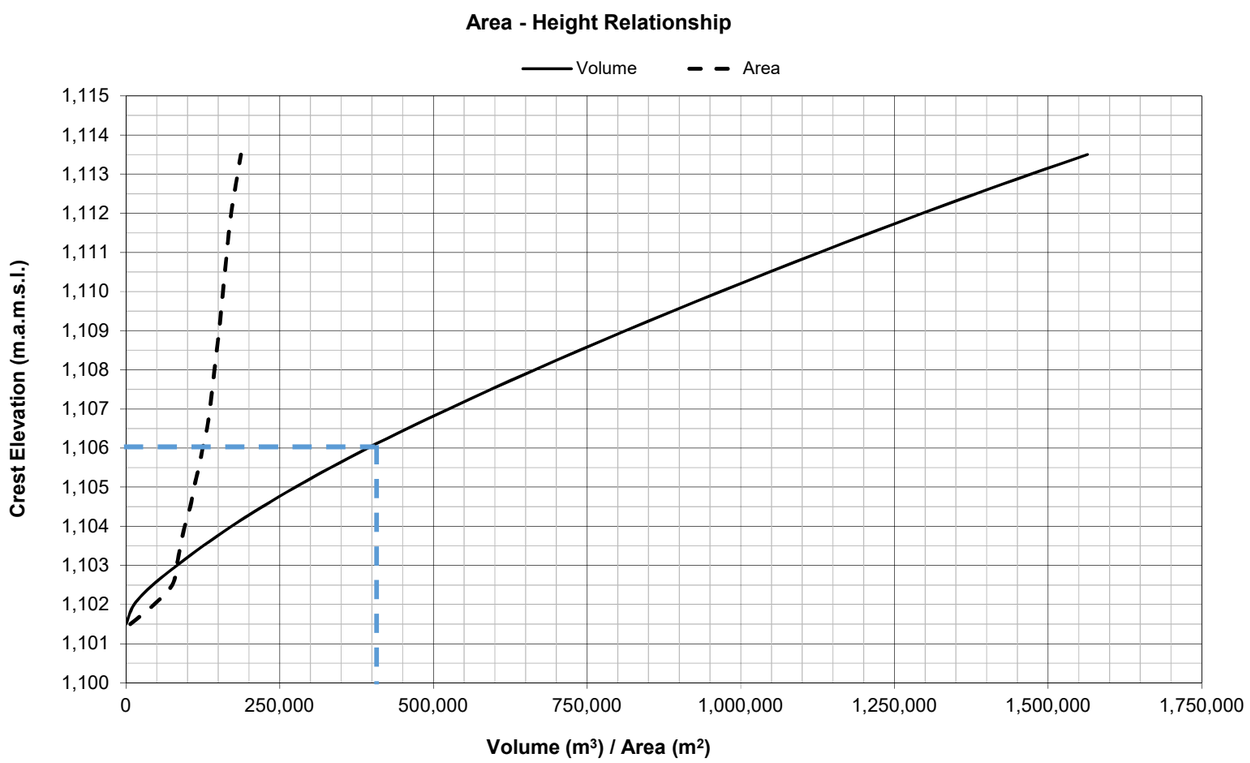
Tailings Deposition Scenarios		**1**	**2**	**3**	**4**	**5**
Percentage Deposition Split		**100%**	**6%**	**12%**	**18%**	**24%**
Tailings Production Rate	dry tons/mnth	**365,000**	**22,000**	**44,500**	**67,000**	**89,000**
	dry tons/yr	**4,380,000**	**264,000**	**534,000**	**804,000**	**1,068,000**
Duration of Deposition	Years	**2.6**	**12.3**	**12.3**	**12.6**	**10.4**
	Months	**31.1**	**148.0**	**148.0**	**151.2**	**124.7**
Total Tailings Production	tons	11,355,453	3,256,698	**6,587,413**	10,130,400	11,096,196
Storage Volume Required	m^3	6,907,210	1,980,960	**4,006,942**	6,162,044	6,749,511

Stage Capacity Calculations						
Tailings Elevation	m.a.m.s.l.	1,112.0	1,099.0	**1,105.0**	1,111.0	1,112.0
Crest Elevation of TSF	m.a.m.s.l.	1,112.5	1,099.5	**1,105.5**	1,111.5	1,112.5
Capacity of Paddock	tons	11,096,196	4,436,421	**7,369,251**	10,560,022	11,096,196
Capacity of Paddock	Years	2.6	12.3	**12.3**	12.6	10.4
Datum Level	m.a.m.s.l.	1,095	1,095	**1,095**	1,095	1,095
Crest Height Above Datum	m	17.5	4.5	**10.5**	16.5	17.5
Depositional Area	ha	32.50	27.41	**31.29**	32.73	32.50
Rate of Rise	m/yr	8.20	0.59	**1.04**	1.49	2.00



PILANESBERG PLATINUM TAILINGS STORAGE FACILITY
STAGE CAPACITY RELATIONSHIP FOR COMBINED EASTERN PADDOCK



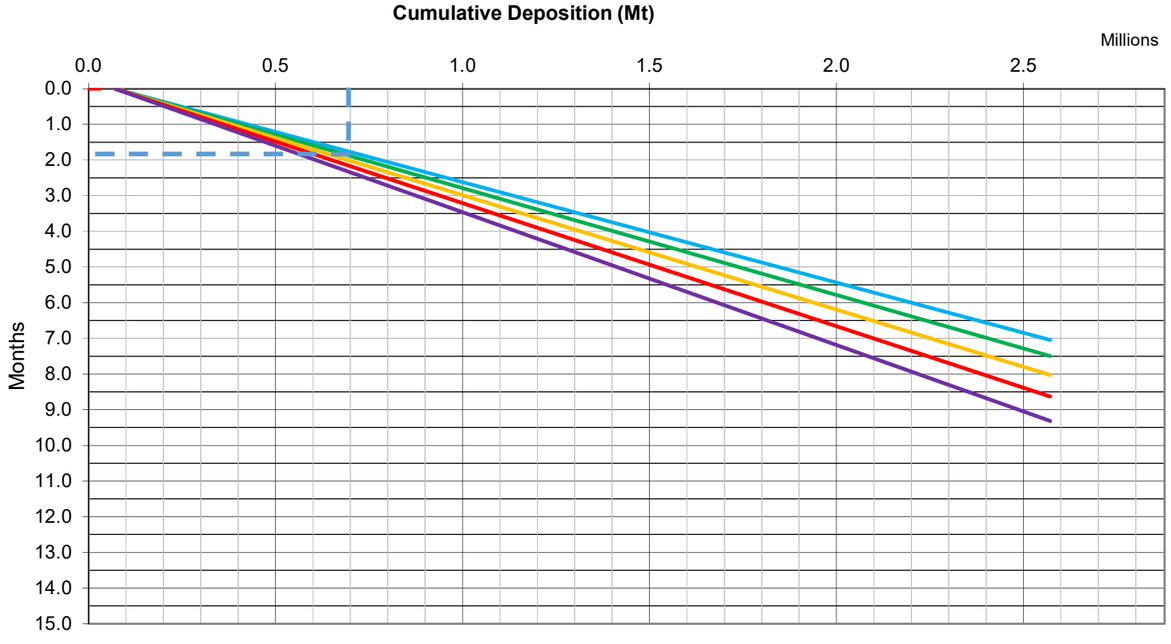


SUMMARY INFORMATION

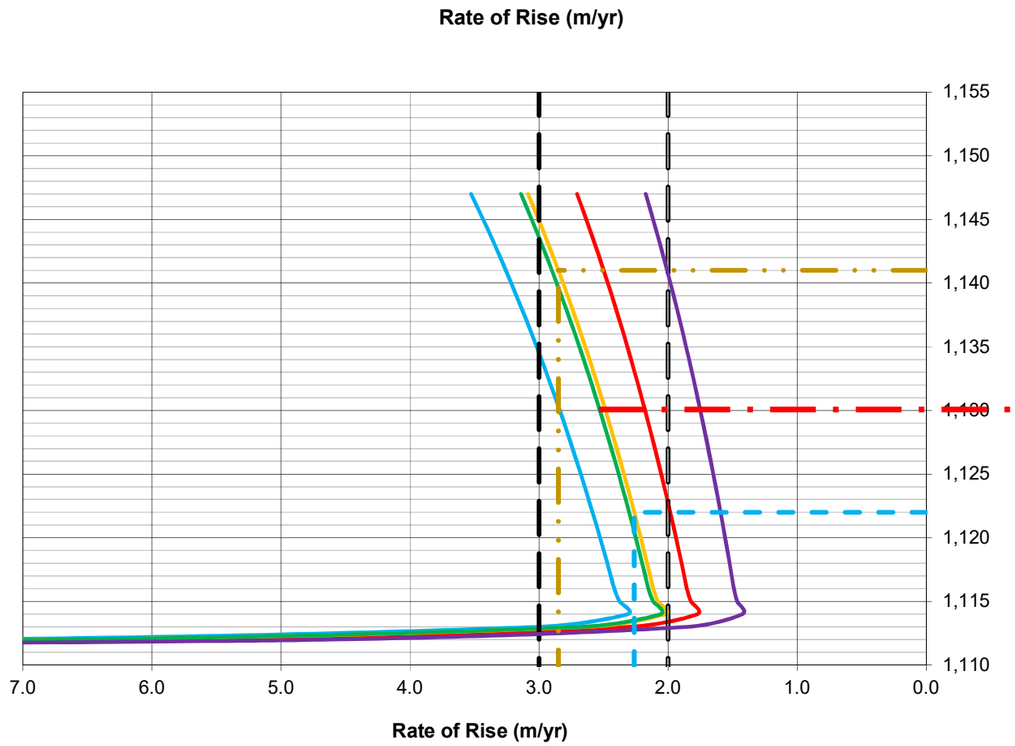
Ave In-Situ Dry Density	1.644	t/m³	Rate of Rise Limits	2	Upper
Crest elevation	1,113.50	m.a.m.s.l.		1	Lower
Storage Capacity	2,571,211	dry tons			

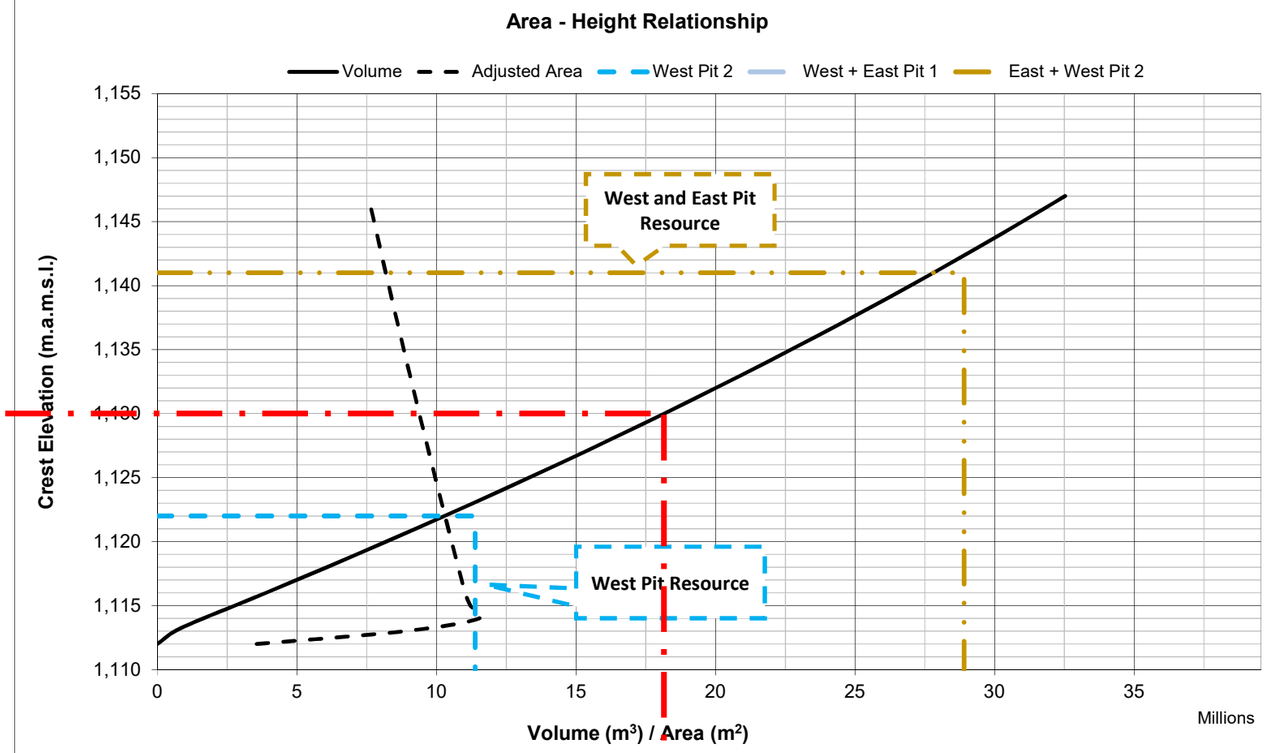
Tailings Deposition Scenarios		1	2	3	4	5
Percentage Deposition Split to Paddock		122%	114%	107%	99%	92%
Deposition Rate	dry tons/mnth	365,000	343,000	320,500	298,000	276,000
	dry tons/yr	4,380,000	4,116,000	3,846,000	3,576,000	3,312,000
Duration of Deposition	Years	0.59	0.62	0.67	0.72	0.78
	Months	7.04	7.50	8.02	8.63	9.32
Total Tailings Production	tons	2,571,211	2,571,211	2,571,211	2,571,211	2,571,211
Storage Volume Required	m³	1,563,997	1,563,997	1,563,997	1,563,997	1,563,997

Stage Capacity Calculations						
Tailings Elevation	m.a.m.s.l.	1,113.0	1,113.0	1,113.0	1,113.0	1,113.0
Crest Elevation of TSF	m.a.m.s.l.	1,113.5	1,113.5	1,113.5	1,113.5	1,113.5
Capacity of Paddock	tons	2,571,211	2,571,211	2,571,211	2,571,211	2,571,211
Capacity of Paddock	Years	0.6	0.6	0.7	0.7	0.8
Datum Level	m.a.m.s.l.	1,101	1,101	1,101	1,101	1,101
Crest Height Above Datum	m	12.5	12.5	12.5	12.5	12.5
Depositional Area	ha	18.69	18.69	18.69	18.69	18.69
Rate of Rise	m/yr	14.25	13.39	12.52	11.64	10.78



PILANESBERG PLATINUM TAILINGS STORAGE FACILITY
STAGE CAPACITY RELATIONSHIP FOR THE CONSOLIDATED CENTRAL COMPARTMENT AND EASTERN PADDOCK - MAIN TSF





SUMMARY INFORMATION

Ave In-Situ Dry Density	1.6	t/m^3	Rate of Rise Limits	3	Upper
Crest elevation	1,141.00	m.a.m.s.l.		2	Lower
Storage Capacity	47,520,997	dry tons			

Tailings Deposition Scenarios		1	2	3	4	5
Percentage Deposition Split		100%	89%	88%	77%	62%
Tailings Production Rate	dry tons/mnth	365,000	325,000	319,375	280,000	225,000
	dry tons/yr	4,380,000	3,900,000	3,832,500	3,360,000	2,700,000
Deposition Duration	Years	10.8	12.2	12.4	14.1	17.6
	Months	130.1	146.1	148.7	169.6	211.0
Total Tailings Production	tons	47,478,674	47,478,674	47,478,674	47,478,674	47,478,674
Storage Volume Required	m^3	28,879,972	28,879,972	28,879,972	28,879,972	28,879,972

Stage Capacity Calculations						
Tailings Elevation	m.a.m.s.l.	1,141	1,141	1,141	1,141	1,141
Crest Elevation of TSF	m.a.m.s.l.	1,143	1,143	1,143	1,143	1,143
Capacity of Paddock	tons	48,373,499	48,373,499	48,373,499	48,373,499	48,373,499
Capacity of Paddock	Years	10.8	12.2	12.4	14.1	17.6
Datum Level	m.a.m.s.l.	1,106	1,106	1,106	1,106	1,106
Crest Height Above Datum	m	37.0	37.0	37.0	37.0	37.0
Depositional Area	ha	79.68	79.68	79.68	79.68	79.68
Rate of Rise	m/yr	3.34	2.98	2.93	2.56	2.06