MOUNT POLLEY MINE

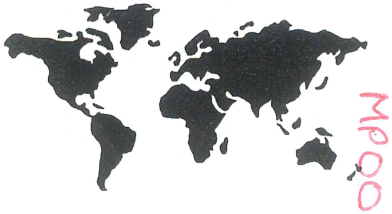
SITE MEETING

EVALUATION OF CYCLONED TAILINGS FOR EMBANKMENT CONSTRUCTION

NOVEMBER 4, 1998

MOUNT POLLEY MINE

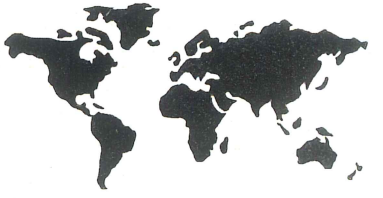
Knight Piésold



EVALUATION OF CYCLONED TAILINGS FOR EMBANKMENT CONSTRUCTION

Scope of Report

- Comments on the tailings characteristics and the potential for cycloning.
- Review of the existing embankment design
- Discussion on potential design changes.

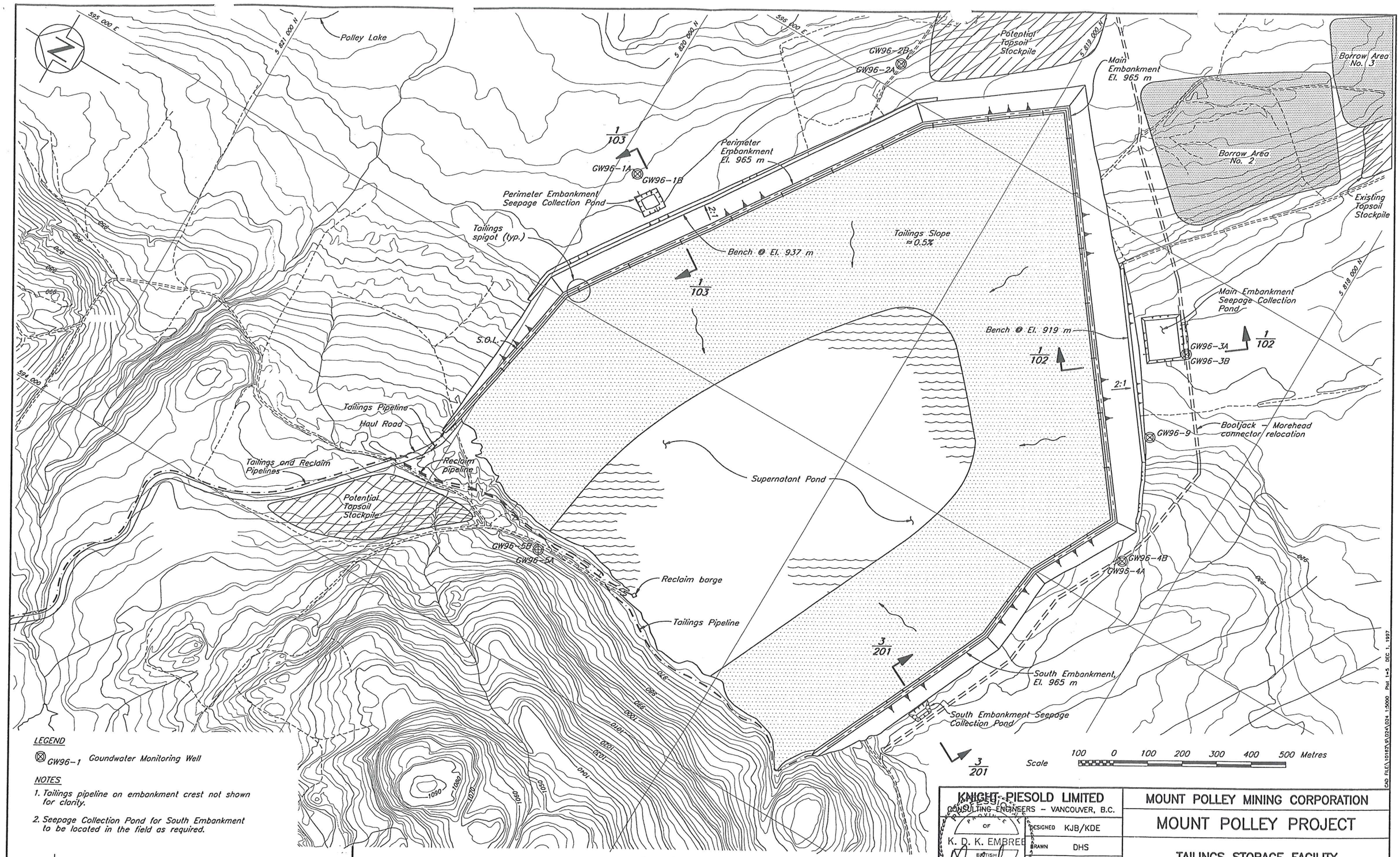


MOUNT POLLEY MINE

EVALUATION OF CYCLONED TAILINGS FOR EMBANKMENT CONSTRUCTION

The current embankment designs include:

- Low permeability, glacial till core zones.
- Downstream and upstream glacial till fill zones.
- Chimney drains with longitudinal (collector) drains and outlet (conveyance) drains in the downstream glacial till fill zones.
- Downstream shell zones constructed from mine waste rock.
- Upstream shell zones constructed from cyclone sand.
- Toe drains in the upstream shell zone.
- Seepage collection ponds located downstream of the ultimate embankment toes (for the current design).



LEGEND

⊗ GW96-1 Goundwater Monitoring Well

NOTES

1. Tailings pipeline on embankment crest not shown for clarity.
2. Seepage Collection Pond for South Embankment to be located in the field as required.

DRG. NO.	DESCRIPTION
201	TSF – FINAL TAILINGS EMBANKMENT – SECTIONS

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	APPROVED

REVISIONS

REV.	DATE	DESCRIPTION	APPROVED
0	DEC 1/97	ISSUED FOR DESIGN REPORT	

REVISIONS

KNIGHT PIESOLD LIMITED
CONSULTING ENGINEERS – VANCOUVER, B.C.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA K. D. K. EMBREE

MOUNT POLLEY MINING CORPORATION

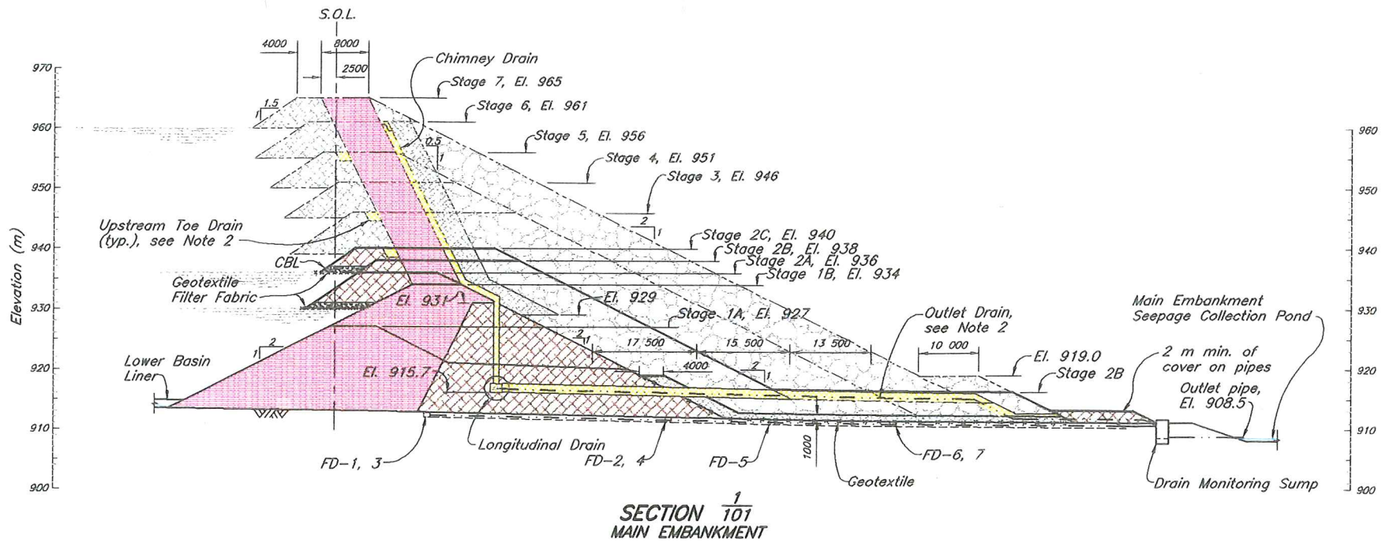
MOUNT POLLEY PROJECT

TAILINGS STORAGE FACILITY FINAL ARRANGEMENT

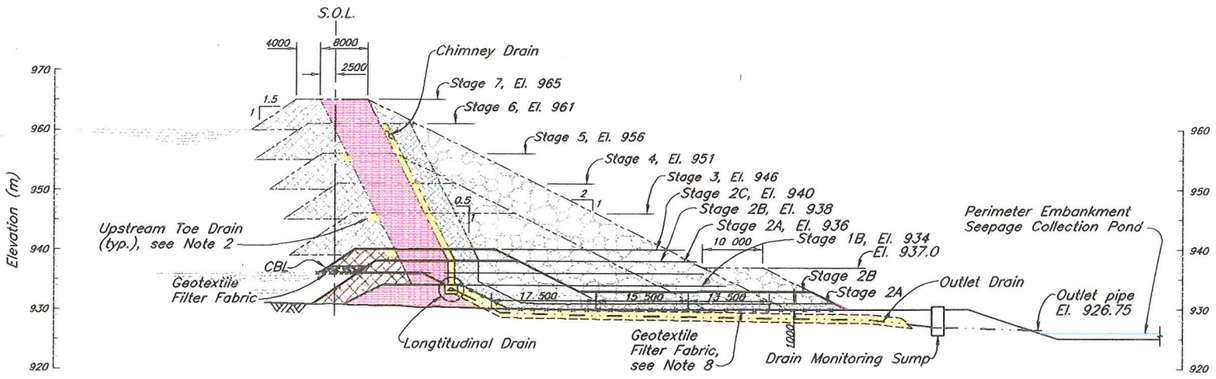
DESIGNED	KJB/KDE
DRAWN	DHS
CHECKED	ABW
APPROVED	

DATE DEC. 1, 1997 | SCALE AS SHOWN | DRG. NO. 10162-9-200 | REV. 0

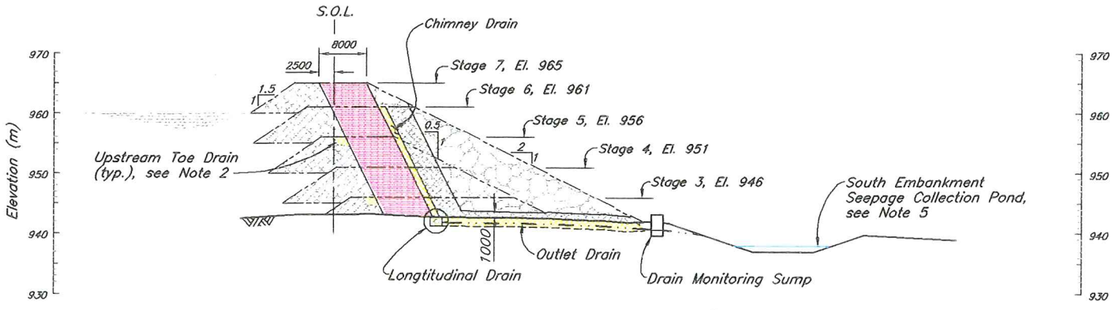
CAD FILE\10162\9\D24\D24 1:5000 Plot 1=5 DEC 1, 1997



SECTION 1/101
MAIN EMBANKMENT



SECTION 2/200
PERIMETER EMBANKMENT



SECTION 3/200
SOUTH EMBANKMENT

ZONE	LOCATION	MATERIAL TYPE	PLACEMENT AND COMPACTION REQUIREMENTS
S	Core Zone	Glacial till	Placed, moisture conditioned and spread in maximum 300 mm thick layers (after compaction). Vibratory compaction to 98% of Standard Proctor maximum dry density or as approved by the Engineer.
B	Fill Zone	Glacial till, glaciolacustrine or granular material	Placed, moisture conditioned and spread in maximum 1000 mm thick layers (after compaction). Vibratory compaction to 92% of Standard Proctor maximum dry density or as approved by the Engineer.
T	Transition Zone	Mine Rock	Placed and spread in maximum 600 mm thick layers. Compaction as directed by the Engineer.
C	Shell Zone	Mine Rock	Placed and spread in maximum 1000 mm thick lifts. Four passes with a specified vibratory roller.
F	Chimney Drain	Filter sand	Placed and spread in maximum 600 mm thick lifts. Compaction as directed by the Engineer.
F	Longitudinal/ Outlet Drain	Filter Sand	Placed and spread carefully around filter fabric/drain gravel. Compaction as directed by the Engineer.
G	Foundation/ Longitudinal/ Outlet Drain	Drain Gravel	Placed and spread carefully around seepage collection pipes. Compaction as directed by the Engineer.
–	Basin Liner	Glacial till, glaciolacustrine or granular material	Placed and spread in maximum 150 mm thick lifts. Compaction as directed by the Engineer.
CBL	Coarse Bearing Layer	Random Rockfill	End dumped and spread as required for trafficability and fill placement.
FDF	Upstream Shell Zone	Free draining Random Fill	Placement and compaction requirements to be determined.

NOTES

1. Pond elevations estimated from Filling Schedule and Staged Construction Curve and include provision for 2.5 million cubic metres of reclaim water.
2. Stage 2 Upstream Toe Drains to be designed and installed during Stage 3. Future Upstream Toe Drains to be added as required.
3. Dashed lines imply preliminary design. Ongoing design and crest elevations to be modified as required based on filling records and monitoring data.
4. Chimney Drain extension requirements to be reviewed for each raise. Chimney Drain to have a minimum continuous width of 1000 mm.
5. South Embankment Seepage Collection Pond and Drain Monitoring Sump to be constructed during Stage 3.
6. Coarse Bearing Layer required on tailings. To be added on ground as required to provide a firm bearing layer for fill placement.
7. All dimensions in millimetres with elevations in metres, unless noted otherwise.
8. Extent of Geotextile Filter Fabric on foundation to be determined in the field.

NOT FOR CONSTRUCTION

Scale 10 5 0 10 20 30 40 50 m

CAD FILE:\10162\9\D20\020 1:500 Plot 1=0.5 DEC 1, 1997

REFERENCE DRAWINGS			REVISIONS				REVISIONS			
DRG. NO.	DESCRIPTION		REV.	DATE	DESCRIPTION	APPROVED	REV.	DATE	DESCRIPTION	APPROVED
200	TSF – FINAL ARRANGEMENT						0	DEC 1/97	ISSUED FOR DESIGN REPORT	

KNIGHT PIESOLD LIMITED
CONSULTING ENGINEERS – VANCOUVER, B.C.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
K. D. K. EMBREE

DESIGNED	KJB/KDE
DRAWN	DHS
CHECKED	ADW
APPROVED	

MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY PROJECT

TAILINGS STORAGE FACILITY
FINAL TAILINGS EMBANKMENT
SECTIONS

DATE DEC. 1, 1997 | SCALE AS SHOWN | DRG. NO. 10162-9-201 | REV. 0

MOUNT POLLEY MINE

TAILINGS STORAGE FACILITY

STAGED EMBANKMENT FILL QUANTITIES AND CYCLONE SAND AVAILABILITY

F:\JOB\DATA\10162-11\misc\[CYCSAND.XLS]20% - 7mos

27-Oct-98

Stage and Crest (m) (El.)	Estimated Fill Volume (m^3)										Total Months Available	Months Available for Cyclone	Cycloned Sand Available (m^3)
	CBL	Zone B	FDF	Zone S	Filter Sand	Drain Gravel	Zone T	Zone C	Total	Year Constructed			
Stage 1b 934	-	220,000	-	352,000	24,500	2,000	-	-	598,500	1996/97	0	0.0	-
Stage 2A 936	9,000	84,000	-	21,000	800	400	52,000	-	167,200	1998	6	1.0	76,042
Stage 2B 938	-	29,400	-	45,500	22,900	1,800	137,500	506,600	743,700	1999	6	3.5	266,146
Stage 2C 940	15,500	66,500	-	46,900	5,900	-	23,500	29,300	187,600	1999	6	3.5	266,146
Stage 3 946	-	-	256,455	163,500	23,380	500	93,420	812,500	1,349,755	2000	12	7.0	532,292
Stage 4 951	-	-	221,375	162,500	21,250	200	80,600	130,800	616,725	2002	24	14.0	1,064,583
Stage 5 956	-	-	229,625	167,500	21,350	100	83,400	6,800	508,775	2004	24	14.0	1,064,583
Stage 6 961	-	-	235,510	172,500	21,775	50	85,700	1,368,900	1,884,435	2006	24	14.0	1,064,583
Stage 7 965	-	-	175,400	140,500	-	-	-	61,600	377,500	2008	24	14.0	1,064,583
TOTAL	24,500	399,900	1,118,365	1,271,900	141,855	5,050	556,120	2,916,500	6,434,190		126	71.0	5,398,958

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TAILINGS STORAGE FACILITY

SUMMARY OF PHYSICAL TESTWORK ON TAILINGS

27-Oct-98

Year and Sample	Tailings Composition (%)			Specific Gravity	PI[1]	Settled Density (tonne/m^3)		Average Void Ratio [2] e	Vertical Permeability (cm/sec)
						Undrained	Drained		
	Sand	Silt	Clay			Initial		(Settled)	
Preliminary Testwork (1989/90)	6	64	30	2.78	NP	0.90 - 1.10 (1.30 final)			1 to 2 x 10^{-5}
1996 Testwork - Slimes Tails (57%)		85 - 90	10 - 15						
1996 Testwork - Sand Tails (43%)	26 - 30	70 - 74							
1996 Testwork - Bulk Tails	13	77 - 82	5 - 10						
1997 Testwork - BK1 (Bulk Slurry)	21	68	11	2.74	NP	0.81	0.91	1.94	4.7 x 10^{-5}
1997 Testwork - BK2 (Bulk Composite)	31	61	8			1.10	1.10	1.39	2.2 x 10^{-5}
1997 Testwork - BH1 (Beach Tailings)	66	31	3			1.19	1.20	1.45	5.5 x 10^{-5}
1997 Testwork - SS1 (Fine Slurry)						0.49	0.57	3.75	5.4 x 10-6

NOTES:

1) PI = plasticity index

2) Average void ratio is after drained settling.

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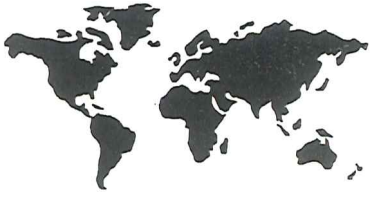
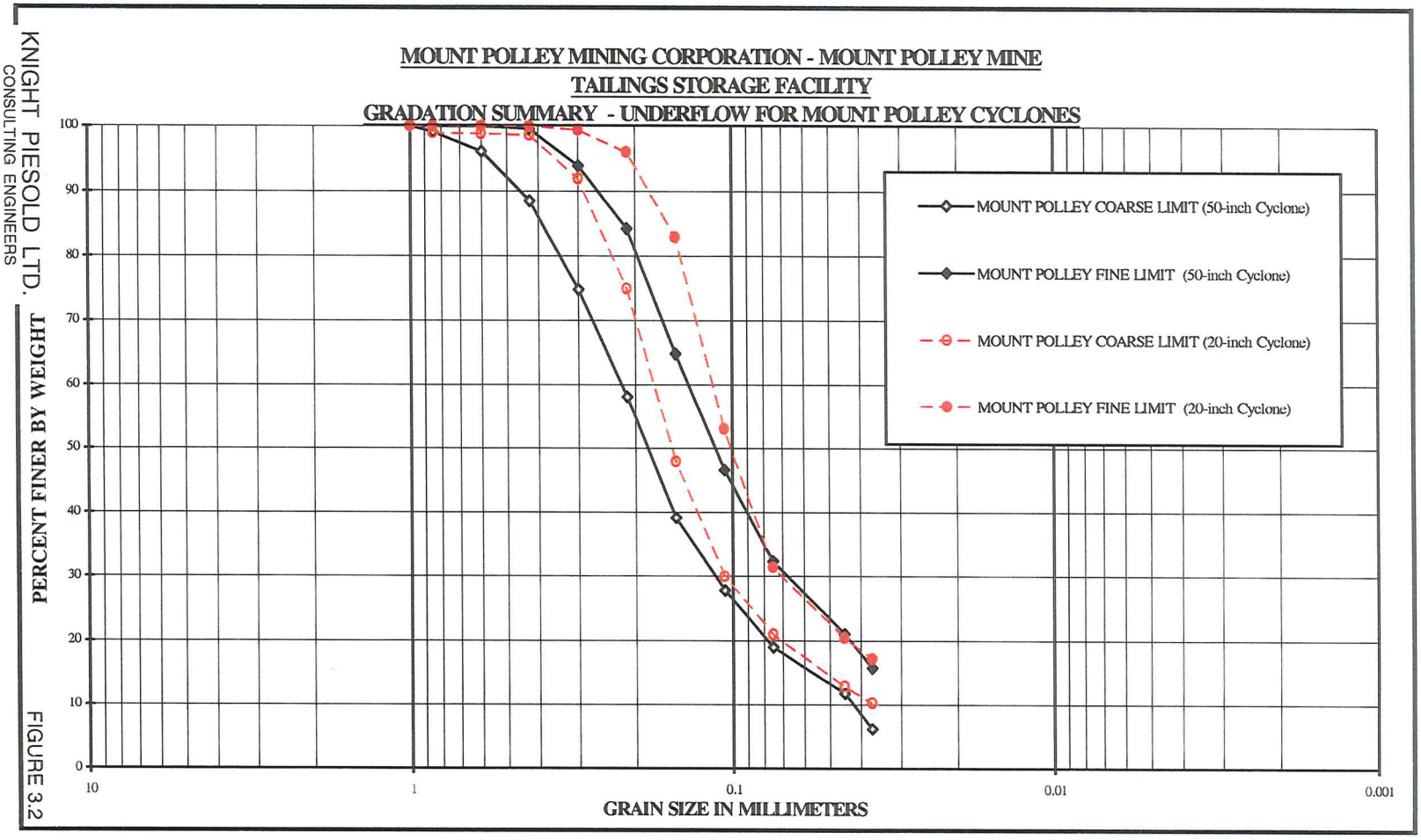


MOUNT POLLEY MINE



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8

MOUNT POLLEY MINE

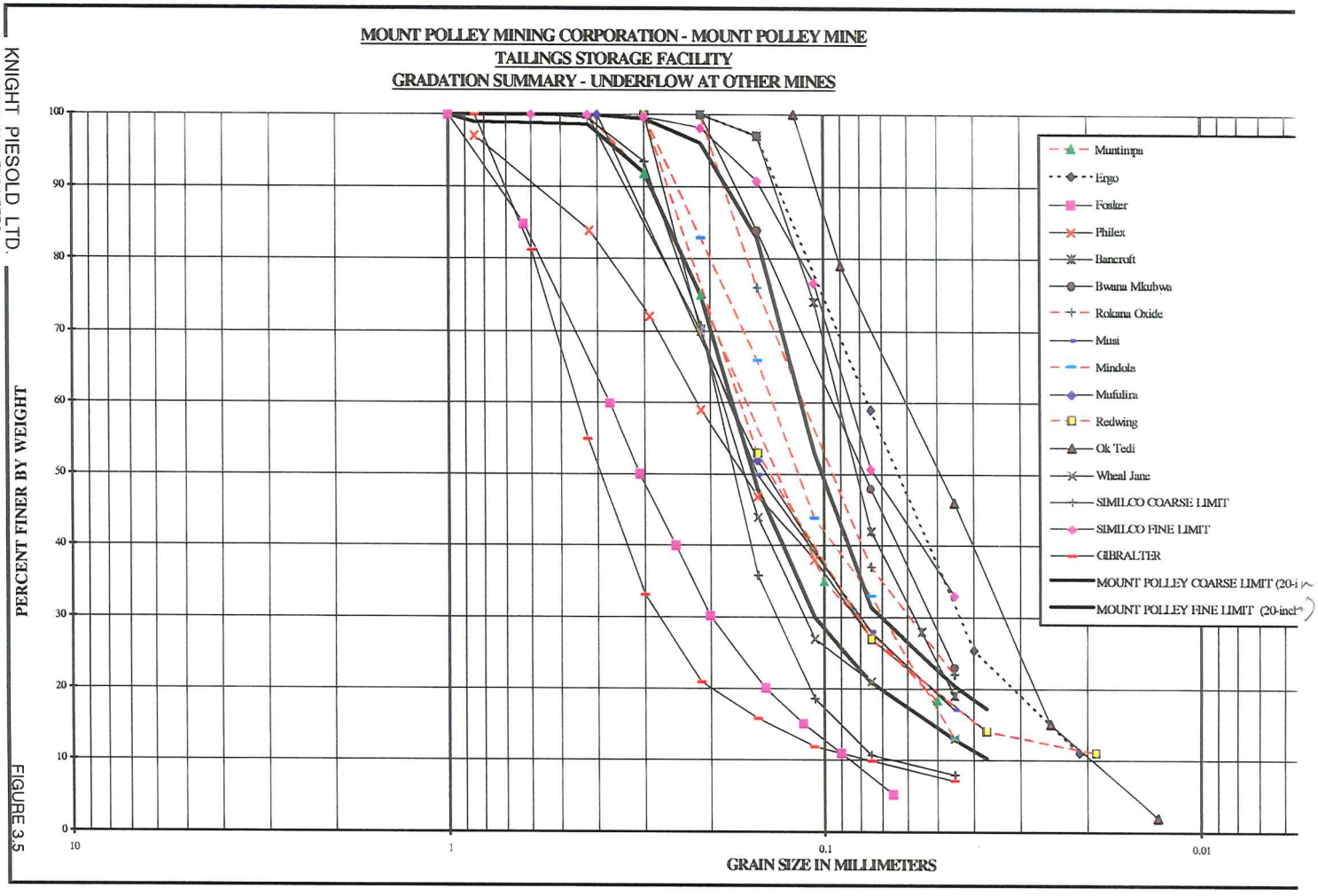

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FIGURE 3.5

(9)

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MOUNT POLLEY MINE

ESTIMATED PERMEABILITY OF UNDERFLOW

6-Oct-98

Description	Particle Size (mm)				Calculated Permeability (cm/s)		
					Hazen's Formula	Krumbein & Monk	Average
	D_{10}	D_{16}	D_{50}	D_{84}	$k = D_{10}^2$	$k = 0.734(D_{50}^2)(D_{16}/D_{84})^{0.945}$	
50" cyclone - coarse limit	0.042	0.06	0.18	0.38	1.76E-03	4.16E-03	2.96E-03
50" cyclone - fine limit	*0.01*	*0.018*	*0.09*	0.19	1.00E-04	6.41E-04	3.71E-04
20" cyclone - coarse limit	0.037	0.05	0.16	0.25	1.37E-03	4.11E-03	2.74E-03
20" cyclone - fine limit	*0.018*	0.035	0.10	0.15	3.24E-04	1.86E-03	1.09E-03

D_{10}, D_{16}, D_{50}, D_{84} are taken from underflow samples tested at site. Numbers in *italics* are extrapolated.

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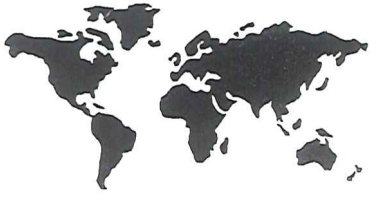

MOUNT POLLEY MINE

CYCLONE SAND AVAILABILITY

J:\JOB\DATA\10162-11\MISC\CYCSAND.XLS 27-Oct-98

Embankment Stage and Crest (m)	(El.)	Year of Construction	Total Months For Stage	Cyclone Sand Availability (m^3)			
				7 months/yr		9 months/yr	
				Underflow Split		Underflow Split	
				20%	25%	20%	25%
Stage 1b	934	1996/97	0				
Stage 2A	936	1998	6				
Stage 2B	938	1999	6				
Stage 2C	940	1999	6	525,000	656,250	675,000	843,750
Stage 3	946	2000	12	525,000	656,250	675,000	843,750
Stage 4	951	2002	24	1,050,000	1,312,500	1,350,000	1,687,500
Stage 5	956	2004	24	1,050,000	1,312,500	1,350,000	1,687,500
Stage 6	961	2006	24	1,050,000	1,312,500	1,350,000	1,687,500
Stage 7	965	2008	24	1,050,000	1,312,500	1,350,000	1,687,500
TOTAL			126	5,250,000	6,562,500	6,750,000	8,437,500
Average Annual Cyclone Production (m^3):				552,632	690,789	710,526	888,158

NOTES:

Estimate of cyclone material availability assumes:

a. Mill throughput (tpd) 20,000

b. Cycloned sand density (t/m^3) 1.60

c. Assumes 100 percent cyclone availability.

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MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY MINE

TAILINGS STORAGE FACILITY

SUMMARY OF PHYSICAL TESTWORK ON TAILINGS

27-Oct-98

Year and Sample	Tailings Composition (%)			Specific Gravity	PI[1]	Settled Density (tonne/m^3)		Average Void Ratio [2] e	Vertical Permeability (cm/sec)
						Undrained	Drained		
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NOTES:

1) PI = plasticity index

2) Average void ratio is after drained settling.

Knight Piésold

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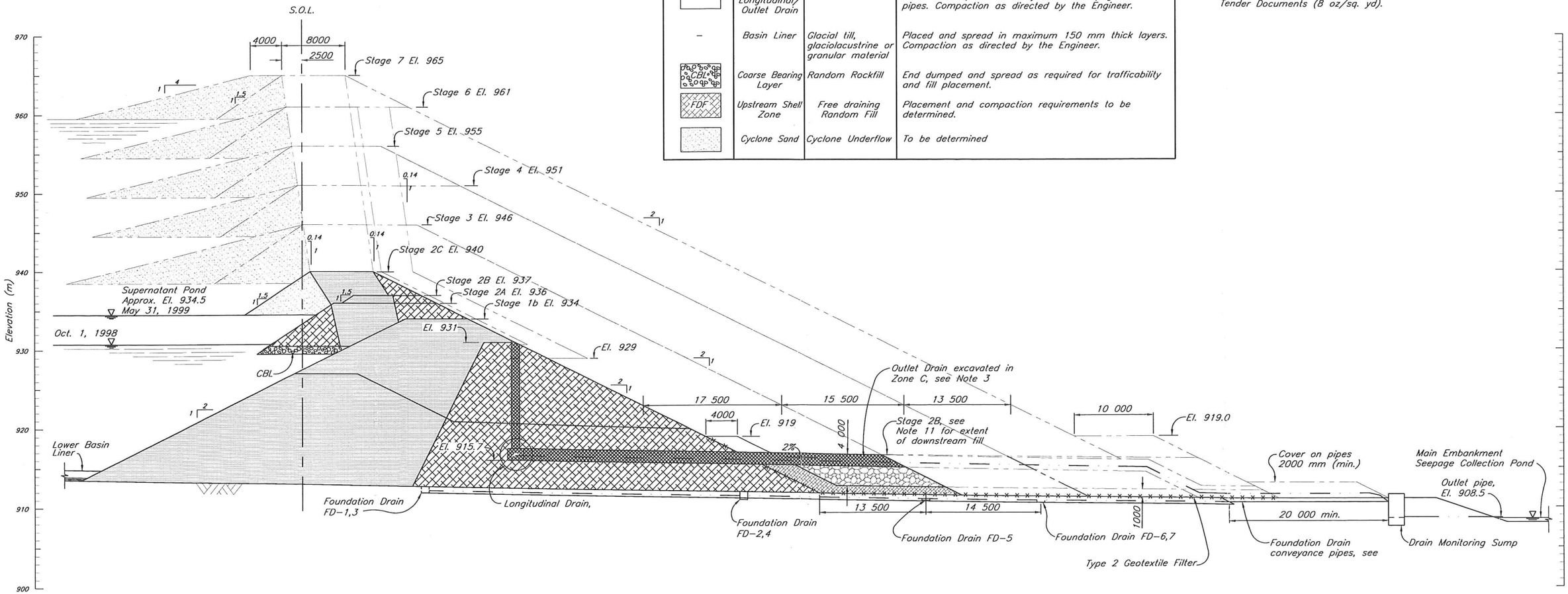
B	Fill Zone	Glacial till, glaciolacustrine or granular material	Placed, moisture conditioned and spread in maximum 1000 mm thick layers (after compaction). Compaction to 92% of Standard Proctor maximum dry density or as approved by the Engineer.
T	Transition Zone	Mine Rock	Placed and spread in maximum 600 mm thick layers. Compaction as directed by the Engineer.
C	Shell Zone	Mine Rock	Placed and spread in maximum 1000 mm thick layers. Four passes with a specified vibratory roller.
F	Chimney Drain	Filter sand	Placed and spread in maximum 600 mm thick layers. Compaction as directed by the Engineer.
F	Longitudinal/ Outlet Drain	Filter Sand	Placed and spread carefully around filter fabric/drain gravel. Compaction as directed by the Engineer.
G	Foundation/ Longitudinal/ Outlet Drain	Drain Gravel	Placed and spread carefully around seepage collection pipes. Compaction as directed by the Engineer.
–	Basin Liner	Glacial till, glaciolacustrine or granular material	Placed and spread in maximum 150 mm thick layers. Compaction as directed by the Engineer.
CBL	Coarse Bearing Layer	Random Rockfill	End dumped and spread as required for trafficability and fill placement.
FDF	Upstream Shell Zone	Free draining Random Fill	Placement and compaction requirements to be determined.
	Cyclone Sand	Cyclone Underflow	To be determined

NOTES

1. Supernatant pond elevations estimated from Filling Schedule and Staged Construction Curve.
2. Chimney Drain was constructed to El. 929 during Stage 1b. The Longitudinal Drain was constructed to invert El. 929 during Stage 1b.
3. Outlet Drains to be extended through downstream fill zones. Drains require min. 2% slope.
4. Upstream Toe Drains to be designed and installed as required.
5. Coarse Bearing Layer may be equired on tailings to provide a firm bearing layer for fill placement.
6. All dimensions in millimetres with elevations in metres, unless noted otherwise.
7. Type 1 Geotextile Filter Fabric to be placed on tailings as required to improve trafficability. Specification provided in Tender Documents (12 oz/sq. yd).
8. Type 2 Geotextile Filter Fabric required from the right abutment (approx. Ch. 15+75) to El. 920 on the left abutment (approx. Ch. 23+00). Specification provided in Tender Documents (8 oz/sq. yd).



NOT FOR CONSTRUCTION

November 2, 1998

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY MINE

TAILINGS STORAGE FACILITY

CYCLONE SAND UPSTREAM SHELL ZONE

FIGURE 4.1

XREF FILE :

CAD FILE: I:\PROJECT\10162\11\FIG\B5.dwg 1:500 PLOT 1=0.5 11/02/98 by: DSR

ZONE	LOCATION	MATERIAL TYPE	PLACEMENT AND COMPACTION REQUIREMENTS
S	Core Zone	Glacial till	Placed, moisture conditioned and spread in maximum 300 mm thick layers (after compaction). Compaction to 98% of Standard Proctor maximum dry density or as approved by the Engineer.
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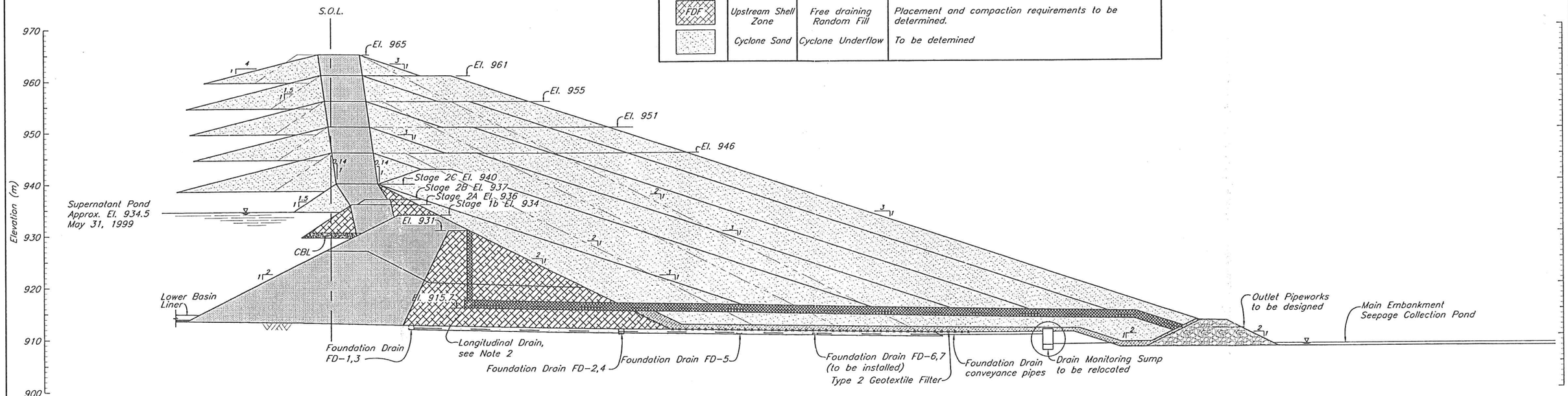
T	Transition Zone	Mine Rock	Placed and spread in maximum 600 mm thick layers. Compaction as directed by the Engineer.
C	Shell Zone	Mine Rock	Placed and spread in maximum 1000 mm thick layers. Four passes with a specified vibratory roller.
F	Chimney Drain	Filter sand	Placed and spread in maximum 600 mm thick layers. Compaction as directed by the Engineer.
F	Longitudinal/ Outlet Drain	Filter Sand	Placed and spread carefully around filter fabric/drain gravel. Compaction as directed by the Engineer.
G	Foundation/ Longitudinal/ Outlet Drain	Drain Gravel	Placed and spread carefully around seepage collection pipes. Compaction as directed by the Engineer.
–	Basin Liner	Glacial till, glaciolacustrine or granular material	Placed and spread in maximum 150 mm thick layers. Compaction as directed by the Engineer.
CBL	Coarse Bearing Layer	Random Rockfill	End dumped and spread as required for trafficability and fill placement.
FDF	Upstream Shell Zone	Free draining Random Fill	Placement and compaction requirements to be determined.
	Cyclone Sand	Cyclone Underflow	To be detemined

NOTES

1. Supernatant pond elevations estimated from Filling Schedule and Staged Construction Curve.
2. Chimney Drain was constructed to El. 929 during Stage 1b. The Longitudinal Drain was constructed to invert El. 929 during Stage 1b.
3. Outlet Drains to be extended through downstream fill zones. Drains require min. 2% slope.
4. Upstream Toe Drains to be designed and installed as required.
5. Coarse Bearing Layer may be equired on tailings to provide a firm bearing layer for fill placement.
6. All dimensions in millimetres with elevations in metres, unless noted otherwise.
7. Type 1 Geotextile Filter Fabric to be placed on tailings as required to improve trafficability. Specification provided in Tender Documents (12 oz/sq. yd).
8. Type 2 Geotextile Filter Fabric required from the right abutment (opprox. Ch. 15+75) to El. 920 on the left abutment (opprox. Ch. 23+00). Specification provided in Tender Documents (8 oz/sq. yd).



NOT FOR CONSTRUCTION

Scale 8 0 8 15 23 30 38 Metres

November 2, 1998

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY MINE

TAILINGS STORAGE FACILITY

CYCLONE SAND DOWNSTREAM SHELL ZONE WITH MODIFIED SEEPAGE COLLECTION POND

FIGURE 4.3

XREF FILE :

CAD FILE: K:\PROJECTS\0182\11\FIG\B4.dwg 1:500 PLOT 1=0.5 02/11/98 by: DSR

ZONE	LOCATION	MATERIAL TYPE	PLACEMENT AND COMPACTION REQUIREMENTS
S	Core Zone	Glacial till	Placed, moisture conditioned and spread in maximum 300 mm thick layers (after compaction). Compaction to 98% of Standard Proctor maximum dry density or as approved by the Engineer.
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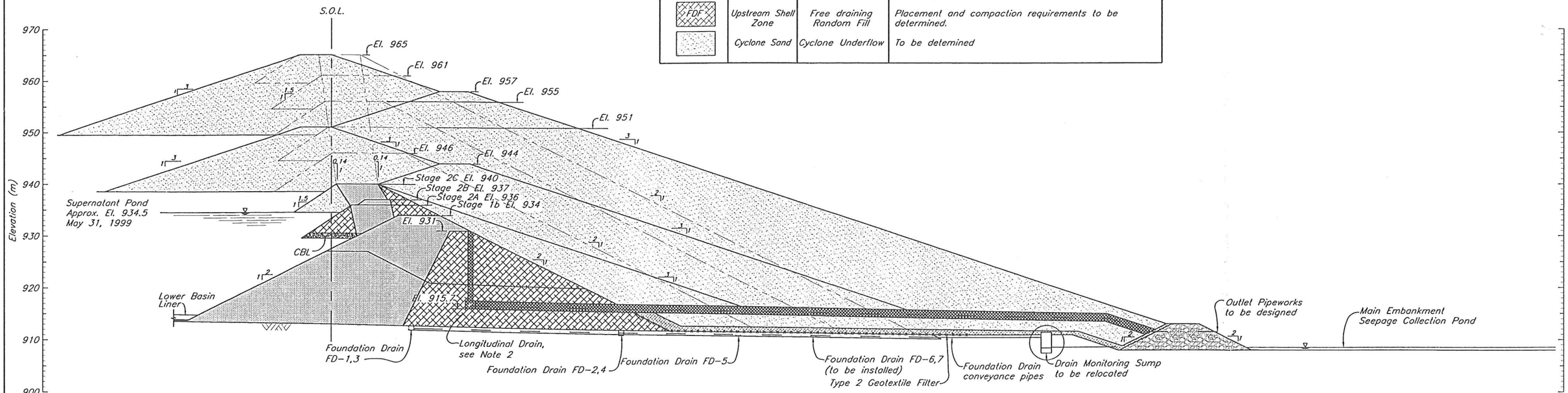
–	Basin Liner	Glacial till, glaciolacustrine or granular material	Placed and spread in maximum 150 mm thick layers. Compaction as directed by the Engineer.
CBL	Coarse Bearing Layer	Random Rockfill	End dumped and spread as required for trafficability and fill placement.
FDF	Upstream Shell Zone	Free draining Random Fill	Placement and compaction requirements to be determined.
	Cyclone Sand	Cyclone Underflow	To be determined

NOTES

1. Supernatant pond elevations estimated from Filling Schedule and Staged Construction Curve.
2. Chimney Drain was constructed to El. 929 during Stage 1b. The Longitudinal Drain was constructed to invert El. 929 during Stage 1b.
3. Outlet Drains to be extended through downstream fill zones. Drains require min. 2% slope.
4. Upstream Toe Drains to be designed and installed as required.
5. Coarse Bearing Layer may be equired on tailings to provide a firm bearing layer for fill placement.
6. All dimensions in millimetres with elevations in metres, unless noted otherwise.
7. Type 1 Geotextile Filter Fabric to be placed on tailings as required to improve trafficability. Specification provided in Tender Documents (12 oz/sq. yd).
8. Type 2 Geotextile Filter Fabric required from the right abutment (approx. Ch. 15+75) to El. 920 on the left abutment (approx. Ch. 23+00). Specification provided in Tender Documents (8 oz/sq. yd).



NOT FOR CONSTRUCTION

Scale 8 0 8 15 23 30 38 Metres

November 2, 1998

KNIGHT PIESOLD LTD.
CONSULTING ENGINEERS

MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY MINE

TAILINGS STORAGE FACILITY

FULL CYCLONE SAND EMBANKMENT WITH MODIFIED SEEPAGE COLLECTION POND

FIGURE 4.5