

APPENDIX B

PHOTO SUMMARIES

Appendix B1Test PitsAppendix B2Surface Sampling



APPENDIX B1

TEST PITS

(Pages B1-1 to B1-9)

NB11-00054 January 26, 2011



Photo 1 - TP-2010-01 looking north



Photo 2 - TP-2010-01 looking east



Photo 3 - TP-2010-01 looking south



Photo 4 - TP-2010-01 looking south



Photo 5 - TP-2010-01 profile (0.00 - 1.90 m)

0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

AVALON RARE METALS INC.

THOR LAKE PROJECT

GEOTECHNICAL FIELD PROGRAM SUMMARY TP-2010-01 PHOTO SUMMARY

Knight Piésold

P/A NO. NB101-390/2

REF. NO. NB11-00054

FIGURE B1-1



Photo 1 - TP-2010-02 looking north



Photo 4 - TP-2010-02 looking south



Photo 2 - TP-2010-02 looking east



Photo 5 - TP-2010-02 profile (0.00 - 2.12 m)





0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D





Photo 1 - TP-2010-03 looking north



Photo 4 - TP-2010-03 looking south



Photo 2 - TP-2010-03 looking east



Photo 5 - TP-2010-03 profile (0.00 - 2.10 m)





0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

AVALON RARE METALS INC. THOR LAKE PROJECT GEOTECHNICAL FIELD PROGRAM SUMMARY TP-2010-03 PHOTO SUMMARY P/A NO. NB101-390/2 REF. NO. NB11-00054 Knight Piésold FIGURE B1-3







Photo 4 - TP-2010-04 looking south



Photo 2 - TP-2010-04 looking east



Photo 5 - TP-2010-04 profile (0.00 - 2.10 m)





0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

AVALON RARE METALS INC. THOR LAKE PROJECT GEOTECHNICAL FIELD PROGRAM SUMMARY TP-2010-04 PHOTO SUMMARY P/A NO. NB101-390/2 REF. NO. NB11-00054 Knight Piésold FIGURE B1-4



Photo 1 - TP-2010-05 looking north



Photo 2 - TP-2010-05 looking east



Photo 3 - TP-2010-05 profile (0.00 - 2.05 m)

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Photo 4 - TP-2010-05 stockpile

AVALON RARE METALS INC.					
THOR LAKE PROJECT					
GEOTECHNICAL FIELD PROGRAM SUMMARY TP-2010-05 PHOTO SUMMARY					
Knight Piésold	P/A NO. NB101-390/2	REF. N NB11-00	0. 054		
CONSULTING	FIGURE B1	-5	REV 0		

0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



Photo 1 - TP-2010-06 looking north



Photo 4 - TP-2010-06 looking south



Photo 2 - TP-2010-06 looking east



Photo 5 - TP-2010-06 profile (0.00 - 1.61 m)





0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

AVALON RARE METALS INC. THOR LAKE PROJECT GEOTECHNICAL FIELD PROGRAM SUMMARY TP-2010-06 PHOTO SUMMARY P/A NO. NB101-390/2 REF. NO. NB11-00054 Knight Piésold FIGURE B1-6



Photo 1 - TP-2010-07 looking north



Photo 4 - TP-2010-07 looking west



Photo 2 - TP-2010-07 looking east



Photo 5 - TP-2010-07 profile (0.00 - 1.84 m)





0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D





Photo 1 - TP-2010-08 looking north



Photo 4 - TP-2010-08 looking west



Photo 2 - TP-2010-08 looking east



Photo 5 - TP-2010-08 profile (0.00 - 1.90 m)





0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

GEOTECHNICAL FIELD PROGRAM SUMMARY TP-2010-08 PHOTO SUMMARY

Knight Piésold

P/A NO. NB101-390/2

REF. NO. NB11-00054

FIGURE B1-8



Photo 1 - TP-2010-09 looking north



Photo 4 - TP-2010-09 looking west



Photo 2 - TP-2010-09 looking east



Photo 5 - TP-2010-09 profile (0.00 - 1.62 m)





0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

AVALON RARE METALS INC. THOR LAKE PROJECT GEOTECHNICAL FIELD PROGRAM SUMMARY TP-2010-09 PHOTO SUMMARY P/A NO. NB101-390/2

Knight Piésold

REF. NO. NB11-00054

FIGURE B1-9



APPENDIX B2

SURFACE SAMPLING

(Page B2-1)

NB11-00054 January 26, 2011



Photo 1 - GR-1 looking north



Photo 2 - Close-up of GR-1



Photo 3 - GR-2 looking north



Photo 5 - WR-2 looking north



Photo 6 - WR-3 looking southwest



Photo 7 - TI-1 looking west

0	26JAN'11	ISSUED WITH MEMO	RDW	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



Photo 4 - WR-1 looking west



Photo 8 - TI-3 looking southwest

AVALON RARE METALS INC. THOR LAKE PROJECT GEOTECHNICAL FIELD PROGRAM SUMMARY SURFACE SAMPLING PHOTO SUMMARY

Knight Piésold

P/A NO. NB101-390/2 REF. NO. FIGURE B2-1

NB11-00054



APPENDIX C

LABORATORY MATERIAL INDEX TESTING REPORTS

(Pages C-1 to C-18)

Water Content of Soil and Rock ASTM D2216-05

SOIL MOISTURE CONTENT AND SAMPLE INFORMATION SHEET

PROJECT NUMBER	10-024	PROJECT	Pine Point Site Investigation
DATE	2-Dec-2010	LOCATION	Pine Point, NT
CLIENT	Knight Pieshold Consulting	SAMPLED BY	Ryan Weir, EIT

MOISTURE CONTENT

BOREHOLE #	GT-2010-01-BU1	GT-2010-01-BU2	GR-1	GR-2	TI-1	TI-2
DEPTH (m)	0.61 to 1.22	0.76 to 1.37	.05 to .10	.05 to .10	0.05 to 0.15	0.05 to 0.15
SAMPLE #	BU1	BU2	GR-1	GR-2	TI-1	TI-2
B WT OF MOIST SAMPLE + PAN (g)	1148.5	1121.7	4996.7	11345.0	5551.8	6681.0
C WT OF DRY SAMPLE + PAN (g)	1107.3	1096.3	4747.5	10786.9	5003.4	5934.2
D WT OF WATER (g)	41.2	25.4	249.2	558.1	548.4	746.8
E WT OF PAN (g)	409.2	408.7	0.0	1163.5	0.0	407.0
F WT OF DRY SAMPLE (g)	698.1	687.6	4747.5	9623.4	5003.4	5527.2
G MOISTURE CONTENT (%)	5.9	3.7	5.2	5.8	11.0	13.5

MOISTURE CONTENT

BOREHOLE #	TI-3	TP-2010-01-BU1	TP-2010-02-BU1	TP-2010-03-BU1	TP-2010-04-BU1	TP-2010-05-BU1
DEPTH (m)	0.05 to 0.40	1.50 to 1.90	1.72 to 2.12	1.70 to 2.10	1.70 to 2.10	1.65 to 2.05
SAMPLE #	TI-3	1	2	3	4	5
B WT OF MOIST SAMPLE + PAN (g)	5531.7	1164.4	5509.7	1056.0	6960.9	1057.8
C WT OF DRY SAMPLE + PAN (g)	5103.3	1137.7	5064.7	1028.4	6512.8	968.5
D WT OF WATER (g)	428.4	26.7	445.0	27.6	448.1	89.3
E WT OF PAN (g)	408.9	410.1	408.7	408.4	1163.5	408.8
F WT OF DRY SAMPLE (g)	4694.4	727.6	4656.0	620.0	5349.3	559.7
G MOISTURE CONTENT (%)	9.1	3.7	9.6	4.5	8.4	16.0

MOISTURE CONTENT

BOREHOLE #	TP-2010-06-BU1	TP-2010-07-BU1	TP-2010-08-BU1	TP-2010-09-BU1
DEPTH (m)	1.21 to 1.61	1.44 to 1.84	1.50 to 1.90	1.22 to 1.62
SAMPLE #	6	7	8	9
B WT OF MOIST SAMPLE + PAN (g)	5320.5	1017.9	9475.4	991.7
C WT OF DRY SAMPLE + PAN (g)	4760.3	962.2	9192.0	945.6
D WT OF WATER (g)	560.2	55.7	283.4	46.1
E WT OF PAN (g)	408.1	408.3	1163.5	407.5
F WT OF DRY SAMPLE (g)	4352.2	553.9	8028.5	538.1
G MOISTURE CONTENT (%)	12.9	10.1	3.5	8.6

Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project # Title Client	:	10-02 Pine I Knigh	24 Point Site at Piesholo	Investigation Consulting	on g	S Q L	ource luantity (oad Cou	m3) nt	「est Pit n/a n/a	L	ot No. Sample.	TF	P-201	n/a 0-02-B	3U1
Sample L	ocatio	'n	Pine	Point, NT				Siev (r	ve Size nm)		Percent Passing		Spe	cificat	ion
Sample [Descrip	otion	Silt/C	Clay, some	sand, som	e gravel		```	,		0				
									50		100.0				
Fractured	d Face	%	n/a						25	_	94.6				
In situ Wa	ater Co	ontent	% 9.6 Doce	mbor 2 20	10				20 16	_	93.1				
Tested R	v			urque	10			1	25		90.7 88.9	_			
Testeu D	у		1. D	Juique					10	_	87.1	_			
Remarks									5		81.4				
Samp	le retri	ieved b	v the clier	nt.					2.5		75.5				
			,					1	.25		69.0				
								C).63		63.3				
								0	.315		57.8				
								0).16	_	50.4				
								0	0.08	_	42.1				
							_								
101 90 91 91 91 91 91 91 91 91 91 91 91 91 91	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0				10	Gra	1 ain Size (i	mm)	0.1		0.0	D1			0.001
	В	oulders	Cobbles	Gi	ravel		Ç	Sand		-	Silt			Cla	ay
				Coarse	Fine	Coarse	Medium		Fine						
	G	ravel %)	24.5	9	Sand %		33.5		Silt/C	lay %			42.1	
								Review	ed By:						
					VA	SKWA RNGI									

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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project #: Title Client	10 Pii Kr	-02 ne F night	4 Point Site t Pieshol	e Inv d Co	estigati onsultin	on Ig			Source Quantity (Load Cou	m3) int	Tes n n	st Pit n/a n/a		Lot N Sam	lo. ple.	TI	- -2(n/a 010-	a 04-BU1
Sample Loc	ation		Pine	• Poi	nt NT					S	ieve	Size	-	Perc	cent		Sr	recit	ication
			1 1110	, 1 01	,						(mn	n)		Pass	sing		10	Cu	stom
Sample Des	cription	I	San	d, so	ome silt	t/clay,	trac	e grave	I		`	/			- 5				
·	•			,				U			50)		10	0.0				
Fractured Fa	ace %		n/a								25	,		98	3.1				
In situ Wate	r Conte	nt %	6 8.4								20			97	'.5				
Date Tested	1		Dec	emb	er 3, 20	010					16	i		94	.7				
Tested By			Т. В	ourc	lne						12.	5		92	2.1				
											10			88	8.6				
Remarks:											5			75	5.5				
Sample	retrieve	d by	/ the clie	nt.							2.5) 	_	/0).9 \				
											1.2	ວ ວ	_	00	0.0 0.0				
											0.0	১ । চ	_						
											0.31	6		44	1.0				
											0.0	8		30) 4				
											0.0	•							
100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 0.0												*							
1	000		10	00		1	0		1			0.1			0.0	01			0.001
								G	rain Size (mm)			-						
	Devilde		Cabbles		G	iravel			:	Sand					0.14				Class
	Boulde	ers	Coddles		Coarse	Fi	ne	Coarse	Medium	n	Fin	е			Silt				Clay
	Grave	el %			29.1			Sand %	, D	4	0.4		Silt	/Clay	%			3	0.4
										Revi	iewed	l By:							
							M	≜SKW≜ RNO	INRERING LTD	L									

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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project #: Title Client	10-02 Pine F Knigh	4 Point Site I t Pieshold	nvestigatio Consulting	n J	S Q L	ource luantity (oad Cou	m3) nt	Test Pit n/a n/a	Lot N Sam	lo. ple.	TP-2	n/a 2010-0	6-BU1
Sample Locati	on	Pine F	Point. NT				Si	eve Size	Perc	ent	S	pecifi	cation
			,					(mm)	Pass	sing		Cust	tom
Sample Descri	iption	Sand,	some grav	vel, trace s	silt			、 /		0			
·			Ũ					50	100	0.0			
Fractured Face	e %	n/a						25	97	.8			
In situ Water C	Content %	% 12.9						20	93	.5			
Date Tested		Decer	nber 3, 20	10				16	90	.8			
Tested By		Τ. Βοι	urque					12.5	88	.1			
								10	83	.9			
Remarks:								5	74	.8			
Sample ret	rieved by	y the client	•					2.5	67	.0			
								1.25	60	.1	_		
								0.63	53	.0	_		
								0.315	38	.0	_		
								0.10	20	2	_		
								0.00	0.	3	_		
Liner Than 100.0 0.00 0.00 0.00 100 100 100	0 30ulders	Cobbles	Gra	10 Tine	Gra	1 ain Size (I	mm) Sand	0.1		0.01			0.001
(Gravel %	,	33.0	5	Sand %		60).6	Silt/Clay	%		6.	3
							Revie	ewed By:					

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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project #: Title Client	10-024 Pine Poiı Knight Pi	nt Site Inv ieshold C	vestigation Consulting		S Q Lo	ource uantity (i oad Coui	m3) nt	Test Pit n/a n/a	Lot No. Sample.	n/a TP-2010-0)8-BU1
Sample Location		Pine Po	oint, NT				Sie	eve Size	Percent	Specif	ication
·			,					(mm)	Passing	Cus	tom
Sample Descripti	on	Sand, s	ome grave	el, trace	silt/clay			<u> </u>			
								50	100.0		
Fractured Face %	6	n/a						25	92.4		
In situ Water Cor	ntent %	3.5						20	89.3		
Date Tested		Decem	ber 3, 2010	0				16	86.9		
lested By		I. Bour	que					12.5	83.9		
Demerika								10	80.7		
Remarks:	ماند بر الم مر	o oliont						5	69.3		
Sample retrie	ved by th	e client.						2.0	60.9		
								0.63	31.2		
								0.03	16.9		
								0.016	6.3		
								0.08	4.2		
								0.00			
Liner Than 0.00 0.08 0.08 0.07 0.00											
0.0		100		10		<u> </u> 1		0.1	0(<u> </u>	I 0_001
1000		100			Gra	ain Size (r	nm)	0.1	0.0	~ ·	0.001
			Grav	/el		S	Sand				
Bou	lders Co	bbles —	Coarse	Fine	Coarse	Medium		Fine	Silt		Clay
Gra	avel %		39.1		Sand %		56	.7	Silt/Clay %	4	.2
				МА	SKWA ENGLI	IKKRING LTD.	Revie	wed By:			

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The testing services reported herein have been performed in accordance with the indiced dated recognized standard, or in accordance with local industry practice. This report is for the sole use of the designated client. This report constitutes a testing service only and does not represent any results interpretation or opinion regarding specification compliance or material suitability. Engineering interpretation can be provided by Maskwa Engineering Ltd. upon request.

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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project #: Title Client	10-024 Pine F Knight	4 Point Site Iı t Pieshold	nvestigation Consulting	n	So Q Lo	ource uantity (r oad Cour	Surfao m3) nt	ce Samp n/a n/a	ole Lo [.] Sa	t No. Imple.	n/ GR	a -1
Sample Location	า	Pine F	Point NT			r	Sieve	Size	Pe	ercent	Spec	ification
	1	1 1110 1	Onit, NT				(m	m)	Pa	assina	C	ustom
Sample Descript	tion	Grave	L some sa	nd trace of	cobbles	ł	(,		looning		ustom
Campie Decempt		erare	i, como ca				5	50	1	100.0		
Fractured Face	%	n/a				ľ	2	25		94.1		
In situ Water Co	ntent %	6 5.2					2	20		90.0		
Date Tested		Decer	nber 6, 201	10		ľ	1	6		82.9		
Tested By		A. Her	on				12	2.5		77.9		
							1	0		72.9		
Remarks:							:	5		59.5		
Sample retrie	eved by	the client					2	.5		49.3		
							1.	25		39.6		
							0.	63	_	31.5		
							0.3	315		22.6		
							0.	16		16.1		
							0.	08	-	12.2		
						L						
Lecent Line 0.00 0.08 0.03 0.06 0.06 0.000 0.00 0.00 0.0000 0.00000 0.0000 0.00000 0.0000 0.00000 0.00000 0.00000 0.000000 0.00000000												
1000		100		10		1		0.1		0.01		0.001
Γ					Gra	in Size (r	nm)					
Bo	ulders	Cobbles	Gra	ivel		S	Sand			Silt		Clay
Во		000000	Coarse	Fine	Coarse	Medium	F	ïne		Siit		Ciay
Gr	avel %		50.7	5	Sand %		37.1		Silt/Cla	ay %	1	2.2
				U A (ZKWA PRATR	RRDING I TO	Reviewe	ed By:				

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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project #: Title Client	10-02 Pine F Knigh	4 Point Site I t Pieshold	nvestigatio Consulting	n J		Source Quantity Load Co	r (m bunt	Surface 3) r r	e Samp n/a n/a	ole L S	ot No. Sample.		n/a GR-2	2
Sample Locatio	n	Pine F	Point, NT				Γ	Sieve	Size	F	Percent	;	Specifi	cation
Sample Decorin	tion	Crove		nd trace	aabbl	20		(mr	n)	F	Passing		Cus	tom
Sample Descrip		Glave	i, some sa	nu, nace	CODDI	55		50)		100.0	+		
Fractured Face	%	n/a						25	5		85.2			
In situ Water Co	ontent %	6 5.8 Decer	mbor 6 20	10				20)		80.9			
Tested By		A Hei	ron	10				12	5		<u>73.8</u> 69.2	+		
l oolog by		71.110						1()		63.6			
Remarks:								5			51.1			
Sample retri	eved by	/ the client						2.	5		43.9			
								1.2	<u>25</u> 33		38.1	_		
								0.3	15		26.5			
								0.1	6		19.0			
								0.0)8		13.0			
Hercent Fine 100.0 90.0 0.0 0.0 1000 B G G	oulders	Cobbles	Gra Coarse 56.1	10 Fine	Coarse	1 Brain Size	e (mi Sa	m) nd 30.9	0.1	Silt/C	0.0*		13	0.001
			-				-				y			
							R	eviewed	d By:					

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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Sample Location Pine Point, NT Sample Description Sit/Clay, some gravel, some sand Fractured Face % n/a insitu Water Content % December 6, 2010 Tested By T.Bourque Remarks: Sample retrieved by the client. Menu Passing Content % December 6, 2010 Tested By T.Bourque Remarks: Sample retrieved by the client. Menu Passing Content % December 6, 2010 Tested By T.Bourque Remarks: Sample retrieved by the client.	Project #: Title Client	10-02 Pine I Knigh	24 Point Site It Pieshold	Investigatio d Consulting	on J	S Q L	ource Quantity (m oad Coun	Surface Sar n3) n/a t n/a	mple Lot No. Sample.	n/a TI-1		
Sample Description Silt/Clay, some gravel, some sand Fractured Face % n/a In situ Water Content % 11.0 Date Tested By T.Bourque Remarks: Sample retrieved by the client. 12.5 63.6 0.63 56.8 0.63 56.8 0.63 56.8 0.63 56.8 0.63 56.8 0.63 56.8 0.03 15 51.7 0.16 44.9 0.08 37.5 0.16 44.9 0.00 0.0 0.00 0.0 0.0	Sample Loca	ition	Pine	Point, NT			Г	Sieve Size	Percent	Specif	ication	
Sample Description Sitt/Clay, some gravel, some sand Fractured Face % n/a In situ Water Content % 11.0 Date Tested December 6, 2010 Tested By T.Bourgue Remarks: Sample retrieved by the client. Sample retrieved by the client. 10.778.1 0.16 44.9 0.16 44.9 0.16 44.9 0.16 44.9 0.16 44.9 0.08 37.5 0.08 37.5 0.09 0.00 0.00 10 1 0.1 0.01 0.0 0.00 10 1 0.1 0.01 0.0 0.00 10 1 0.1 0.01 0.0 0.00 10 1 0.1 0.01 0.0 0.00 100 10 1 0.1 0.01 0.0 0.00 100 10 1 0.1 0.01 0.0 0.00 100 10 1 0.1 0.01 0.0	·			,				(mm)	Passing	Cus	stom	
Fractured Face % n/a isitu Water Content % 11.0 Date Tested December 6, 2010 Tested By T.Bourque Remarks: Sample retrieved by the client. Sample retrieved by the client. 5 10.0 71.9 2.5 67.9 0.63 58.5 0.63 58.5 0.63 57.5 0.16 44.9 0.08 37.5 0.08 37.5 0.00 10 1 0.1 0.00 10 1 0.1 0.01 0.00 100 10 1 0.1 0.01 0.00 100 10 1 0.1 0.01 0.01 0.00 100 10 1 0.1 0.01 0.01 0.00 100 10 1 0.1 0.01 0.01 0.00 100 10 1 0.1 0.01 0.01 0.00 100 10 1 0.1 0.01 0.01	Sample Desc	cription	Silt/C	lav. some o	pravel, som	ne sand	-	/				
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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project Title Client	#:	10-02 Pine I Knigh	24 Point Site I It Pieshold	nvestigatio Consulting	n J	S Q Lo	ource uantity (oad Cou	Sur m3) nt	face Samı n/a n/a	ple Lot No Sample	Ə.	n/ Tl	a -2
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									(mm)	Passir	ng	С	ustom
Sample	Descr	ription	Silt/Cl	ay, some g	gravel, son	ne sand							
									50	100.0)		
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resteu	БУ		1.D0u	ique					12.0	77 5			
Remark	(S.								5	68.1			
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								Revie	wed By:				
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ENGINEERING LTD.

Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Project #: Title Client	10-02 Pine I Knigh	24 Point Site II It Pieshold	nvestigation Consulting	n	Sc Qi Lc	ource uantity (r oad Cour	Surfac m3) nt	e Samp n/a n/a	le Lot No Samp). e.	n/a TI-3	
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							(mi	m)	Passi	ng	Cust	.om
Sample Desci	ription	Silt/Cla	ay, some g	ravel, son	ne sand		5	0	100	0		
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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

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	Γ			Gra	vel		<u>,</u>	and					
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	(Gravel %)	95.8	S	Sand %		4.2		Silt/Clay	%	0.	
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					MAS	skwa engin	REALING LTD.						

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Project #: Title	10-0 Pine	24 Point Site I	nvestigatior	า	S Q	ource uantity (r	Surface S n3) n/a	Sampl a	le Lot No Samp). le.	n/a WR-2	2
Client	Knig	ht Pieshold	Consulting		Lo	oad Cour	nt n/a	а				
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Sample De	scription	Cobbl	es and Bou	Iders			()				Gua	
Fractured Face %		n/a %										
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Remarks:						ŀ	<u>75</u> 50		95. 14.	1 8		
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100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0				10	Gra	1 1 1 1 1	nm)	0.1		0.01		0.001
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	Gravel 9	%	96.6	S	Sand %	weaturn	3.2		Silt/Clay %	6	0.	1
						F	Reviewed I	By:				
				MAS	SKWA ENGIN	ÆKRING LTD.						

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Sieve Analysis of Fine and Course Aggregates ASTM C136 / CSA A23.2-2a

Projec Title Client	t #:	10-02 Pine F Knigh	4 Point Site I t Pieshold	nvestigatio Consulting	n	S C L	ource Quantity (oad Cou	Surfao m3) nt	ce Samp n/a n/a	ole Lot Sa	t No. mple.	n/a WR-:	3
Sampl	e Locatio	on	Pine F	Point, NT				Sieve	e Size	Pe	ercent	Specifi	cation
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	Ģ	Gravel %		97.9	S	Sand %		1.9		Silt/Cla	ay %	0.	1
								Reviewe	ed By:				
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Job No.

10-204

Test Peformed By

Troy Bourque

Date of Test

6-Dec-10

MOISTURE DENSITY RELATIONSHIP

Trial No.	1	2	3	4	5
Mold No.	Split Ring	Split Ring	Split Ring		
Wt of sample wet + mold (g)	11166.5	12038.7	11926.9		
Wt. Of mold (g)	6977.1	6977.1	6977.1		
Wt. Of sample wet (g)	4189.4	5061.6	4949.8		
Volume of Mold (cm ³)	2124.0	2124.0	2124.0		
Wet Density (kg/m ³)	1972.4	2383.1	2330.4		
Dry Density (kg/m ³)	1965.8	2243.6	2097.4		
MOISTURE CONTENT					
Tare No.	T1	T2	T3		
Wt of sample wet + tare (g)	2130.7	2388.6	2838.8		
Wt of sample dry + tare (g)	2124.9	2272.7	2596.0		
Wt. Water	5.8	115.9	242.8		
Tare mass (g)	406.6	408.5	410.3		
Wt. Dry soil (g)	1718.3	1864.2	2185.7		
Moisture content (%)	0.3	6.2	11.1		



kg/m³ **6.5** % **ASTM D698** С Rock Correction (if required) % **2266** kg/m³ @ 6.1% Description: Combonation of samples TI-1

	ombonation of samples frint,							
TI-2, and TI-3.	Samples consisted of mostly							
silt and clay with some gravel and sand present								

REMARKS:

Proctor conducted on a mix of three separate samples, oversize content calculated by taking the average of the three samples oversize percentage.



Job No.

10-204

Test Peformed By

Troy Bourque

Date of Test

6-Dec-10

MOISTURE DENSITY RELATIONSHIP

Trial No.	1	2	3	4	5
Mold No.	Split Ring	Split Ring	Split Ring		
Wt of sample wet + mold (g)	11804.1	12060.4	12008.0		
Wt. Of mold (g)	6977.1	6977.1	6977.1		
Wt. Of sample wet (g)	4827.0	5083.3	5030.9		
Volume of Mold (cm ³)	2124.0	2124.0	2124.0		
Wet Density (kg/m ³)	2272.6	2393.3	2368.6		
Dry Density (kg/m ³)	2258.2	2253.9	2164.1		
MOISTURE CONTENT					
Tare No.	T1	T2	Т3		
Wt of sample wet + tare (g)	864.0	745.8	2734.6		
Wt of sample dry + tare (g)	861.1	726.0	2533.5		
Wt. Water	2.9	19.8	201.1		
Tare mass (g)	405.7	405.7	405.7		
Wt. Dry soil (g)	455.4	320.3	2127.8		
Moisture content (%)	0.6	6.2	9.5		

2300 **Maximum Dry Density** Max. Dry 2290 Density kg/m³ 2280 2280 Optimum 2270 Moisture 3.4 % 2260 2250 Standard **ASTM D1557** Dry Density (kg/m³) Method С 2240 2230 Rock Correction (if required) 2220 % Oversize 14.6 % 2210 Max. Dry 2200 **2322** kg/m³ @ Density 3.0% 2190 2180 2170 Sample 2160 Description: Combonation of samples GR-1 2150 and GR-2. Samples consisted of mostly gravel 0 2 4 10 6 8 and sand with some silt/clay present. Moisture (%) ٠ Dry Density Zero Air Voids Poly. (Poly Edit)



Proctor conducted on a mix of two separate samples, oversize content calculated by taking the average of the two samples oversize percentage.



May 2011

Appendix C.17

Thor Lake Project - Estimate of Groundwater Inflows to Underground Mine. Report NB11-00076



MEMORANDUM

To:	Mr. David Swisher	Date:	February 22, 2011
Сору То:	Bill Mercer, Cara Stapley, Kevin Hawton, Matt Parfitt	File No.:	NB101-390/2-A.01
From:	Jordin Barclay	Cont. No.:	NB11-00076
Re:	Thor Lake Project - Estimate of Groundwater Inflows	s to Undergro	und Mine

1.0 Introduction

Knight Piésold Ltd. (KPL) conducted a hydrogeological site investigation program at Avalon's Thor Lake Project site as part of the geomechanical site investigations to determine hydraulic characteristics of the Nechalacho Deposit rock mass. The results of the hydrogeological program were used to estimate groundwater inflows associated with the proposed underground mine. This memo presents the results of the modelling completed to estimate the mine water inflow into the proposed underground mine.

2.0 Conceptual Model

For the purpose of estimating groundwater inflows to the proposed underground mine, a simple conceptual model was developed. The boundaries of the model were primarily based on the estimated Project site watershed areas, as presented in KPL Memorandum "Feasibility Study Water/Solids Balance Analysis Results", issued on January 6, 2011 (Cont. No. NB10-00596, Rev 0). There are several lakes within the watershed area of the deposit, and the lakes in the immediate vicinity of the Nechalacho Deposit are expected to represent the primary groundwater flow boundaries.

Hydraulic conductivity values estimated from the 2010 packer testing results are relatively low. The hydraulic conductivity ranges from approximately $3x10^{-9}$ m/s to $2x10^{-7}$ m/s, which is consistent with expected values for intrusive and metamorphic crystalline rock (Freeze and Cherry, 1979). Results of the geomechanical program (as presented in KPL Memorandum Cont. No. NB10-00570) suggested that the Rock Mass Rating in the area of the deposit indicates GOOD to VERY GOOD rock with the design values typically being in the upper end of the GOOD range. Based on the data from the 2010 geomechanical investigations, flat-lying (horizontal) joints form the dominant joint set. Vertical to sub-vertical joint sets are also present although not as prominent.

The Deposit area is surrounded by a Sodalite Cumulate zone, a cap rock of the Nechalacho mineralized intrusion that was subsequently eroded away. The sodalite cumulate material is described as hydrothermally altered and is a mixture of illitic clays and sericite. There are no persistent records of drill fluid loss within this zone and it is expected to have very low hydraulic conductivity.

Temperature data has been collected from thermistors installed by Stantec (for their Environmental Baseline Report, dated December 23, 2009), and by KPL during winter 2010 to assess the presence of permafrost. Temperature data suggests that permafrost is discontinuous in the area and absent beneath the lakes and in some areas close to the lakes. No permafrost was encountered in the KPL drillholes equipped with thermistors.

Knight Piésold

3.0 Groundwater Inflow Model

Groundwater inflow was modelled using Visual MODFLOW software. The model was run in steady state and boundary conditions included: constant head cells for nearby lakes, recharge boundaries for precipitation at surface and drain cells for the proposed underground workings.

One hydrogeologic unit was used to simulate bedrock in the area of the deposit. It was assumed that the sodalite cumulate zone has similar hydraulic conductivity as the un-altered bedrock. The horizontal hydraulic conductivity is likely greater than the vertical hydraulic conductivity due to the orientation of the dominant joint sets. It was assumed that the horizontal hydraulic conductivity is two times higher than the vertical hydraulic conductivity is two times higher than the vertical hydraulic conductivity.

A range of hydraulic conductivity values were used to account for low and high hydraulic conductivities for bedrock. The estimated hydraulic conductivities assigned for the sensitivity analysis are included in Table 1. The range of selected hydraulic conductivity values is within a more narrow range than the results of packer testing. The highest hydraulic conductivity recorded $(2x10^{-7} \text{ m/s})$ was tested along a relatively shallow interval and is not representative of the bedrock at the depth of the deposit. The range of values selected for the sensitivity analysis provides a relatively conservative range of possible hydraulic conductivity values is.

A simplified version of the Pre-Feasibility Study mine layout was entered into the model as drain cells representing the ramp and the base of the deposit area. Arbitrarily high hydraulic conductivity was assigned to cells in the area of the deposit to represent the mine workings. Groundwater inflows were estimated at steady state conditions prior to initiation of paste backfilling. It was assumed that the open area of the mine was greatest just prior to the start of paste backfilling (at the end of Year 4).

4.0 Estimated Groundwater Inflow

The estimated range of groundwater inflows is between 3 L/s and 10 L/s. It is estimated that approximately 60% of the groundwater will inflow along the ramp and approximately 40% will inflow into the underground workings through the surrounding rock.

The predicted groundwater drawdown in bedrock at ground surface for the 10 L/s case is illustrated on Figure 1.

During mine development, groundwater inflows may be higher than the range that has been estimated herein. Higher inflows may occur if mine development intersects any relatively high permeability features. It is expected that high inflows would decrease quickly as the groundwater stored in high permeability features was drained. There is also a possibility that a high permeability feature may provide a conduit for groundwater flow from a surface water body to the mine, resulting in persistent higher than predicted groundwater inflows. To date, there have been no geologic units or structures that have been intersected during site investigations that are interpreted to potentially produce relatively high long term inflows. KPL understands that Avalon intends to drill additional drillholes along the alignment of the proposed ramp. KPL recommends that the results of additional drilling be evaluated to update the hydrogeological characterization.

The chance of relatively high long term groundwater inflows can be reduced during advancement of the ramp. Investigation is recommended in advance of the face during ramp development to avoid potentially high groundwater inflows. If high inflows are observed during investigation, the area can be grouted prior to advancing the ramp.



5.0 Estimated Underground Flooding

During post-closure the underground workings will be allowed to flood. It was estimated that 95% of the void space of the underground mine will be filled with paste backfill. The remaining void space will be flooded with groundwater. The MODFLOW simulation of the groundwater inflows was also used to model underground mine flooding by modifying the elevation of the drain boundaries. Results suggest that the inflow rate does not change significantly during underground mine flooding.

The volume of the void space including the ramp and non-backfilled stopes for the end of mine was estimated to be 500,000 m³. Based on the estimated void volume and the simulated mine inflows, the underground mine will be flooded 5.3 years to 1.6 years after mine closure. It was anticipated that for each scenario it will take an additional 0.5 years to re-establish water levels to pre-mine conditions.

Jordin Barclay, P.Geo Project Hydrogeologist Approved:

Matthew Parfitt, P.Eng. Specialist Engineer/Project Manager

References

Signed:

Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ.

Attachments:

 Table 1 Rev 0
 Model Parameters and Sensitivity Analysis

 Figure 1 Rev 0
 Predicted Groundwater Drawdown Due to Mine Dewatering

/jab



TABLE 1

AVALON RARE METALS INC. THOR LAKE PROJECT

ESTIMATE OF GROUNDWATER INFLOWS TO UNDERGROUND MINE MODEL PARAMETERS AND SENSITIVITY ANALYSIS

Print Feb/22/11 10:55:06

Geologic Unit	Low Hydraulic Conductivity	High Hydraulic Conductivity		
	(m/s)	(m/s)		
Bedrock (Horizontal)	8.E-09	2.E-08		
Bedrock (Vertical)	4.E-09	1.E-08		

I:\1\01\00390\02\A\Correspondence\NB11-00076 - Mine Inflow Modelling Summary\[Table 1.xlsx]Table 1 - PARAMETERS

NOTES:

1. HYDRAULIC CONDUCTIVITY ESTIMATES BASED ON THE RANGE OF PACKER TEST RESULTS AND TYPICAL RANGES FOR GEOLOGIC UNITS (FREEZE AND CHERRY, 1979).

0	22FEB11	ISSUED WITH MEMO NB11-00076	JAB	CLS	MRP
REV	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D



