Fish Habitat Compensation Work
at The Jericho Diamond Mine, Nunavut Territory
Construction and Monitoring of Eight Rock Shoals in 2007

Submitted to:

Tahera Diamond Mine Corp.

Prepared by:

EBA Engineering Consultants Ltd.

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Tahera Diamond Corporation

FISH HABITAT COMPENSATION WORK
2007 ROCKFILL SHOAL CONSTRUCTION
JERICHO DIAMOND MINE, NUNAVUT

E12101016

July 2007

EBA Engineering Consultants Ltd.
p. 403.203.3355 • f. 403.203.3301
Riverbend Atrium One • 115, 200 Rivercrest Drive SE • Calgary, Alberta T2C 2X5 • CANADA

EXECUTIVE SUMMARY

This report documents the progress of construction of eight rockfill shoals in two lakes in the vicinity of the Tahera Diamond Corporation's (TDC's) Jericho Diamond Mine in Nunavut. EBA Engineering Consultants Ltd. (EBA) was retained during construction by TDC to complete the 2007 implementation of this work. Innovative techniques were used by EBA that increased the likelihood that the as-built rock structures will perform as expected and provided an estimated 4 to 6 fold increase in shoal rock placement rates.

The placement of the rockfill shoals form part of compensation measures put forward by the Department of Fisheries and Oceans Canada (DFO) for the loss of fish habitat due to the mine operations. The DFO required measures were performance based and therefore although the desired end result was well known, the method of construction was not been specified. Little public information was available to guide winter construction of rockfill shoals.

EBA looked at either placing shoal rock through openings in the ice or placing the shoal rock on the ice surface. It was agreed with TDC to use the ice cover as a working platform. The on-ice rock piles were constructed using sorted Run of Mine (shoal rock) and are expected to drop to the lakebed with the melting of the ice cover in the spring and form shoals.

The shoal rock was transported from the mine partly via an ice road and dumped on the ice by Caterpillar 730 articulated trucks.

Approximately 8,000 m^3 of rock material was placed on the ice with approximately 500 truck loads – each truck weighting about 60 tonnes. The maximum load of any single rockfill shoal was approximately 2,000 tonnes. Ice deflections at the shoals, ice temperatures and crack developments of the ice were monitored to maintain a safe work environment. Pictures were taken before, during and after shoal construction.

Maintaining safety of operators and equipment was paramount during the entire operation. In order to satisfy the production objectives and meet the safety objectives, on-site and off-site engineering review was provided by an EBA senior ice specialist. Site specific work practices were implemented to take full advantage of the ice structural capacity to place the maximum amount of rock in the limited time available.

Unlike many manufactured materials ice structural properties vary spatially and in time, hence, monitoring the behaviour of the ice constituted an essential component of the operation. No ice related incidents occurred during the entire 2007 shoal construction and key information was collected that will facilitate the safe and efficient construction of shoals in 2008. Details pertaining to planning, execution and monitoring of the on-ice operations can be found in the "Operational Report" submitted to Tahera, July 2007.

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1.0 INTRODUCTION

This report documents the 2007 construction of rockfill shoals in two lakes in the vicinity of the Jericho Diamond Mine. A total of twenty-two rockfill shoals have been proposed, located in six lakes north of the mine as shown on Figure 1 (taken from Ref. 1, Mainstream Aquatics Ltd. Memorandum, 23.11.2005, Appendix A). Eight of the twenty-two shoals were completed between March 2007 and April 2007.

The placement of the rockfill shoals form part of compensation measures put forward by the Department of Fisheries and Oceans Canada (DFO) for the loss of fish habitat due to the mine operations. The specific requirements can be found in Appendix "A" and have been summarized in Section 2.

This report summarizes the approaches recommended to Tahera Diamond Corporation (TDC) by EBA Engineering Consultants Ltd. (EBA) from design through construction and documents the as-built condition to May 28, 2007.

An as-built survey of the rockfill shoals will be executed and documented during the 2007 open water season.

2.0 REQUIREMENTS BY THE DEPARTMENT OF FISHERIES AND OCEANS CANADA (DFO)

The operator of the Jericho Diamond Mine is required to provide fish habitat compensation for the loss of fish habitat as a result of the mine operation. Part of the habitat compensation consists of rockfill shoals in several lakes near the mine.

DFO Canada issued with its letter of April 15, 2005 an Authorization, No. NU-00-0068, named "Authorization for Works or Undertakings affecting Fish Habitat". A copy of this document can be found in Appendix A. Details related to the location, shoal size, shoal rock, and respective habitat monitoring of the shoals are given in Ref. 1.

In an additional letter/email exchange between the DFO and TDC with input from Mainstream Aquatics Ltd. (Mainstream) in March 2006, a number of issues related to the construction and monitoring of the rockfill shoals were discussed and clarified.

Some of the more relevant requirements with regard to the construction of the shoals are summarized below:

- The 22 rockfill shoals will be constructed within 2 seasons.
- The size and location of the shoals are listed in Table 1 (from Ref. 1). The aerial extent of the shoals range from 500 m^2 to 1,125 m^2 with an average height of 1 m.
- The material used for the construction of the rockfill shoals consists of Run of Mine (ROM) rock, ranging from 0.1 m to 1.0 m in diameter. The occasional oversized rock could reach the 2.0 m diameter size.

3.0 PLANNING AND DESIGN OF ROCKFILL SHOALS

3.1 SELECTION OF CONSTRUCTION METHOD

EBA was retained to evaluate the ice conditions; review the available equipment and prescribe a safe work procedure that would allow Tahera's workforce to construct the maximum number of shoals practical for March 2007 and April 2007.

Ice conditions are described in Appendix C.

The type of equipment available for the construction of the shoals consisted of:

- Caterpillar Model 730 articulated trucks;
- Caterpillar Model 950 loader; and
- Caterpillar Model 14 grader.

Technical details of the equipment can be found in Appendix B.

Two options of rock placement were considered for this project:

- Option 1: placing the rock on the ice cover in the winter season and have it drop to the lake bottom when the ice melts in the spring; and
- Option 2: placing the rock through a cut hole in the ice cover.

Option 1: Placing Rock on the Ice

Option 1 was deemed to be the safest and most efficient approach. The challenge was to place the shoal rock in piles on the ice so that rock pile will drop at the predetermined location. A key element was to load the ice as close as safely possible to its structural limit. Through maximization of the load the intention was to achieve failure of the supporting ice cover after the time of placement and prior to the melting of the surrounding lake ice. Establishing a safe threshold required close monitoring which included documenting the initiation and development of cracks and deformations of the ice cover in the vicinity of the loaded area. This information was back analyzed to assess the assumed material properties.

Safety guidelines and recommendations for conventional on ice operations involving transport (roads and air strips), storage or stationary activities (drilling) can be found in various relevant references and government guidelines. Safety factors and maximum allowable stresses of the ice sheet design are generally safe for most on ice operations but prohibitively conservative for the special needs of the 2007 work and precluded shoal construction in the time frames required by DFO.

Through EBA's work the weight of rock placed exceeded that that would be prescribed by standard techniques by a multiplier of at least 4. A six-fold increase was achieved over trial placements at Jericho by others. EBA's analysis therefore significantly increased the likelihood that construction of most of the shoals will comply with the Mainstream/DFO guidelines and potentially in as little as one pass.

Option 2: Placing Rock through Openings in the Ice

For Option 2, a slot would need to be cut in the ice through which the rock will be dumped directly from the edge of the ice to the bottom of the lake. Cutting ice into manageable cubes and removing it away from the site would be required. Men and equipment would also be required to work close to open water which is a safety concern. In addition it was determined that thicker ice would be needed for safe operation due to the discontinuity of the ice cover.

3.2 DESIGN CRITERIA FOR OPERATING ON FLOATING ICE

Ice is a non-homogeneous material with a high compressive strength but considerable less flexural and shear strength. Its material properties are highly dependent on temperature changes. At the limits of loading time dependent deflection (creep) can reach a considerable magnitude.

Fundamentally, ice thickness, available free board (FB), flexural strength and deformation characteristics determine the operational on-ice capabilities. The first two parameters were measured on site. For preliminary design a literature derived flexural strength of 550 kPa was used for assessing vertically loading of the ice sheet. The flexural strength chosen was based on observed ice quality.

For known ice thickness and equipment details (including its allowable pay loads), stresses in the ice cover can be estimated by applying algorithms developed by Westergaard (Ref. 3). Refinements to the allowable loading were then coupled to the deformations by predicting then measuring deflection.

An ice cover deflects when loaded vertically. The amount of deflection depends on the magnitude and distribution of the applied load, the ice quality and the load duration. The largest deflection (and maximum stress) occurs at the centre of the load. In the case of shoals the maximum deflection and stresses occur at the shoal centres.

As the ice deflects, the available FB decreases with additional load applications until water flows onto the ice surface (negative FB). This condition provides an open connection between the water and ice surface and generally marks the onset of unsafe conditions and should be avoided.

3.3 SAFETY CONSIDERATIONS FOR ON-ICE OPERATIONS

All operators were instructed on the does and don’ts when working on the ice. Key elements specific to working on lake ice were:

- follow instructions by the on ice supervisor;
- wear the appropriate safety gear for offshore;
- place rockfill shoals only during daylight;
- stockpile rock material on shore fast ice and designated access roads during the night;

- place rockfill on the lake ice only under supervision;
- allow only one truck on the ice at a time;
- maintain radio contact between operator and supervisor;
- maintain radio contact between supervisor and camp;
- operate trucks only in designated areas; and
- discontinue on-ice operation whenever uncontrolled water is observed on the ice.

3.4 SEQUENCE OF ROCK PLACEMENT

EBA requested survey at each shoal. Following the survey of the shoals a survey stake was placed. A hole was drilled through the ice at each corner of the shoal footprint as needed. Ice thickness, FB and water depth were measured and recorded. The results of the survey are listed in Table 1. The corner numbering system corresponds that prescribed by Mainstream Aquatics (Ref 1).

After a shoal location was cleared of snow and measurements of the ice and water depth measurements were taken, the first step to shoal construction was the placement of 150 mm Maximum Size crush material (see Photo 1) on the ice within the shoal area. This protective layer was used to minimize damage of the ice and avoid brittle failure during placement of the ROM material with boulders of up to 2 m diameter.

In order to avoid ice failure due to high flexural stresses, the rock material placement commenced at the shoal ends and continued towards the shoal centre until excessive crack development and a decrease in FB (water on the ice) caused a stop to the operation.

The shoals are located on floating ice close to shore fast ice. Due to the uncertainty of the melting sequence of the lake ice and possible related movements of the ice cover during breakup, it was decided to weaken the ice surrounding the shoals. The intent was to initiate failure of the supporting ice that would cause subsequent drop of the rock to the lakebed prior to melting/breakup of the lake ice. This would reduce the possibility of the shoals from floating away from the designated areas.

Active weakening of the ice was done by cutting the ice at strategic places close to the loaded area. This work requires careful planning and safety procedures to mitigate the risks.

Passive weakening methods involve generally accelerated melting of the ice cover supporting the shoals.

4.0 MONITORING

Monitoring by EBA included visual evaluations of the quality and size distribution of the shoal rock, measurement of the ice properties, construction methods and the deformation behaviour of the ice. Techniques for monitoring both the shoal rock and ice are described in more detail in the Rockfill Shoal Operational Manual (pending). EBA's methods for monitoring ice evolved during this to capture key information using non-destructive methods where possible and adaptive to the specific logistics of construction. For example, monitoring methods used square shaped rockpiles were modified for long linear rock piles.

In the latter stages the monitoring routine consisted of:

- taking deflection readings at the shoal centre;
- monitoring number and location of truck load dumped;
- observing and marking crack development on the ice and snow; and
- continuously plotting load vs. deflection.

The strength of the ice cover is related to its temperature profile. Temperature profiles within the ice cover were collected to monitor the change in ice strength due to warming of ice cover. Ice cover temperature was monitored by mounting temperature calibrated thermistors on a 2x4 as shown in Photo 18, and freezing the assembly in a previously drilled hole into the ice. Cables and plugs for resistance measurements were mounted at the end of the post as can be seen in Photo 19. The location of the thermistors in relation to the ice thickness is shown on Figure 3. The corresponding temperature readings are plotted on Figure 4.

5.0 RESULTS

Table 3 summarizes the construction completion dates for the respective shoals, the number of 60 tonne truckloads placed at each shoal location and the criteria used to terminate shoal rock placement.

Initially, the six shoals on Carat Lake were built by dumping a protective layer of 150 mm Maximum Size crush material on shore fast ice (see Photo 2), picking it up with the loader and distributing it over the shoal area as shown in Photo 3. On Lake O1, trucks dumped the material directly on the floating ice and the grader distributed it over the shoal area.

The placement and distribution of the 150 mm Maximum Size crushed rock did not require monitoring of the ice because the loader inclusive payload and the grader were lighter than the loaded trucks and the material was well distributed over the shoal area.

Dumping the ROM material (see Photo 4), however, resulted in the application of heavy concentrated loads on the ice. These loads and the superposition effects of these loads were assessed. Due to safety considerations, a gap of ROM material at the centre of the Carat Lake shoals can be seen in Photo 5.

In order to avoid ice failure due to high stresses, the rock material placement commenced at the shoal ends and continued towards the shoal centre until excessive crack development and a decrease in FB (water on the ice) caused a stop to the operation. Due to safety considerations, a gap of ROM material at the centre of the Carat Lake shoals can be seen in Photo 5.

The point in time when the rock will fall through the ice cover depends on the state of deterioration of the ice which in turn is largely controlled by the change in ambient meteorological conditions (warmer air temperatures and increased solar radiation). An evaluation of the effectiveness of weakening of the ice cover to initiate early failure and breakthrough of the rockfill shoals is in progress. An as-built survey is to be executed and documented during open water season in the summer of 2007.

5.1 CONCLUSIONS

The shoal construction was basically controlled by two requirements:

- fulfilling the requirements as stipulated by the DFO, and
- safety.

The work was carried out in accordance with construction details such as shoal location, shoal dimensions and rock material to be used as specified in Ref. 1. To improve the likelihood that the rock material would break through the ice at the on-ice location to the specified rockfill shoal location, trial measures were taken to initiate failure of the ice supporting the shoals. The as-built location of the rock material will be surveyed once the ice is gone.

Placing such heavy loads on the ice and observing deflections that exceed the available FB by several hundred percents is unprecedented. However, monitoring the behaviour of the ice cover by qualified personnel mitigated the risks to an acceptable level. Such monitoring is essential for making it safe to work on the ice under these loading conditions.

The practices employed were entirely specific to conditions existing at the time of construction and therefore loading and safe work practices will change from winter month to winter month and from year to year.

5.2 RECOMMENDATIONS

The experience gained from the 2007 activities can be applied to the 2008 Rockfill Shoal construction program. Additional planning and preparations will be necessary to complete the construction of the remaining 14 rockfill shoals in 2008.

Four important operational planning components are:

- storage of construction material to minimize the on-ice hauling distance;
- construction of winter access roads to the lakes;
- construction of the ice pads; and
- site specific construction of the rockfill shoals.

It is recommended to start the construction of the access roads and ice pads as early as possible.

EBA should be advised by TDC of the results of the rock underwater survey by others. Advanced analytical methods and further refinements to the methods described herein may be possible.

Recommendations for the construction of the remaining 14 shoals can be found in the Jericho Rockfill Shoal Construction and Operations Manual (pending).

6.0 CLOSURE

We trust this information satisfies your current requirements. Should you have any questions, please contact the undersigned.

Respectfully submitted,
EBA Engineering Consultants Ltd.

REGISTERED PROFESSIONAL ENGINEER
S.A. PROSKIN
LICENSEE
19 July 2007
NWT/NU

Volker Neth, Ph.D.
Project Manager
Direct Line: 403.203.3305 x889
vneth@eba.ca

Samuel A. Proskin, Ph.D. P.Eng.
Senior Project Engineer
Direct Line: 780.451.2130 x282
sproskin@eba.ca

Mark D.Watson, M.Eng., P.Eng.
Project Director
Direct Line: 780.451.2130 x277
mwatson@eba.ca

/am/bvb

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2) Sodhi, D.S. 1995. Breakthrough loads of floating ice sheets. ASCE Journal of Cold Regions Engineering, 9(1): 4-22.

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TABLES

TABLE 1: SIZE AND LOCATION OF ROCK SHOALS

					Corner 1			Corner 2			Corner 3			Corner 4		
Site	Lenth (m)	Width (m)	Area (m^2)	Approx. Slope (%)	Easting	Northing	Depth (m)	Easting	Northing	Depth (m)	Easting	Northing	Depth (m)	Easting	Northing	Depth (m)
LO401	100	10	1,000	10	479691	7323844	2.0	479731	7323936	2.0	479700	7323840	3.0	479740	7323932	3.0
LO402	100	10	1,000	10	479773	7323739	2.0	479717	7323822	2.5	479782	7323744	4.0	479726	7323828	3.0
LO403	100	10	1,000	5	479919	7323671	2.0	479825	7323704	2.0	479923	7323681	2.5	479828	7323714	3.5
LO404	50	20	1,000	8	480005	7323684	2.0	479957	7323662	2.0	479996	7323702	3.5	479950	7323680	3.5
LO301	50	20	1,000	3	479678	7322499	2.0	479643	7322536	2.0	479692	7322513	2.5	479658	7322550	4.0
LO302	100	10	1,000	10	479834	7322556	2.0	479749	7322502	2.0	479829	7322564	3.0	479744	7322510	3.0
LO201	50	10	500	30	479198	7322720	2.0	479219	7322765	2.0	479189	7322724	5.0	479210	7322769	5.5
LO202	50	10	500	5	479344	7322739	2.0	479317	7322782	2.0	479336	7322734	2.5	479308	7322776	4.0
LO203	100	10	1,000	10	479292	7322628	2.0	479338	7322717	2.0	479283	7322633	3.0	479329	7322722	3.0
LO101	100	10	1,000	15	479036	7321707	2.0	479137	7321709	2.0	479036	7321717	3.5	479137	7321719	3.5
LO102	100	10	1,000	20	479150	7321738	3.0	479198	7321827	2.0	479141	7321743	5.0	479189	7321832	4.0
LIN01	100	10	1,000	15	478104	7321802	2.5	478200	7321774	3.0	478107	7321812	5.5	478203	7321784	4.0
LIN02	40	25	1,000	10	478228	7321761	2.0	478266	7321777	2.0	478218	7321784	4.5	478255	7321800	4.5
LIN03	50	20	1,000	10	478280	7321799	2.0	478302	7321844	2.5	478262	7321808	4.0	478284	7321853	4.5
LIN04	50	20	1,000	15	478312	7321850	2.0	478347	7321886	2.0	478298	7321865	5.0	478333	7321900	5.5
LIN05	50	20	1,000	20	478354	7321986	2.0	478305	7321996	2.0	478350	7321966	6.0	478301	7321977	6.5
LCA01	50	20	1,000	3	478462	7320908	5.0	478512	7320908	2.0	478462	7320928	5.5	478512	7320928	2.5
LCA02	45	25	1,125	14	478536	7320907	2.5	478575	7320919	2.5	478528	7320931	6.0	478567	7320944	5.5
LCA03	50	20	1,000	8	478614	7320921	2.0	478650	7320957	2.0	478600	7320936	3.5	478636	7320971	4.0
LCA04	45	25	1,125	14	478642	7321034	2.5	478638	7321074	2.0	478617	7321032	6.0	478613	7321071	5.5
LCA05	45	25	1,125	10	478637	7321094	2.0	478632	7321134	2.0	478612	7321092	4.5	478607	7321132	5.5
LCA06	50	20	1,000	18	478630	7321153	2.0	478629	7321204	2.0	478610	7321153	5.5	478610	7321203	4.5

Notes:

- Rock shoals built in 2007

TABLE 2: CARAT LAKE SHOAL SURVEY – MARCH 22, 2007												
Shoal	Corner 1			Corner 2			Corner 3			Corner 4		
	H	FB	WD	H	FB	WD	H	FB	WD	H	FB	WD
LCA 01	1.76	0.18	5.71	1.76	0.19	2.77	1.75	0.19	6.00	1.83	0.21	2.90
LCA 02	1.77	0.19	2.84	1.76	0.19	6.06	1.72	0.16	2.74	1.55	0.02	9.60
LCA 03	1.74	0.15	3.85	NOT ACCESSIBLE			1.71	0.17	8.60	FLOODED		4.10
LCA 04	1.63	0.16	2.56	1.77	0.17	2.40	1.72	015	6.75	1.74	0.15	3.88
LCA 05	1.75	0.18	2.40	1.76	0.19	2.20	1.80	0.18	3.20	1.68	0.15	5.20
LCA 06	1.74	0.19	2.15	1.74	0.18	1.74	1.74	0.15	5.30	1.75	0.17	3.26

Notes:

H – Ice thickness.

FB – Free board.

WD – Water depth.

TABLE 3: SHOAL CONSTRUCTION AT CARAT LAKE (CL) AND LAKE O1			
Shoal	2007 Completion Date	Truck Loads	Reason for Termination
CL-1	March 26	64	Deflection/Cracking
CL-2	April 12	63	Deflection/Cracking
CL-3	April 13	55	Deflection/Cracking
CL-4	March 25	59	Flooding
CL-5	March 24	49	Flooding
CL-6	March 23	63	Flooding
O1- 1	April 16	65	
O1-1	April 19	66	

FIGURES

Figure 1

Overview of rock shoal locations, 2005

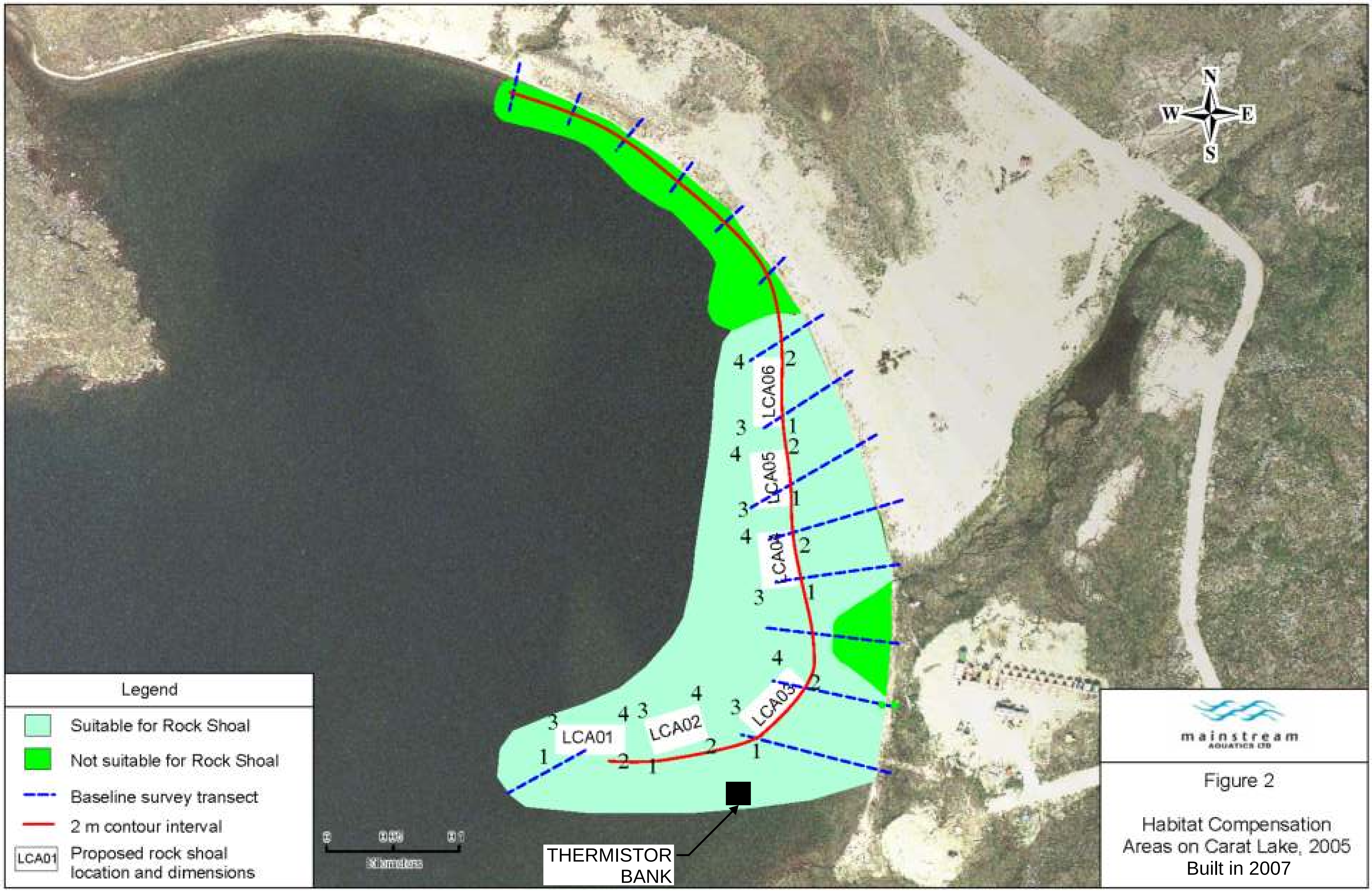
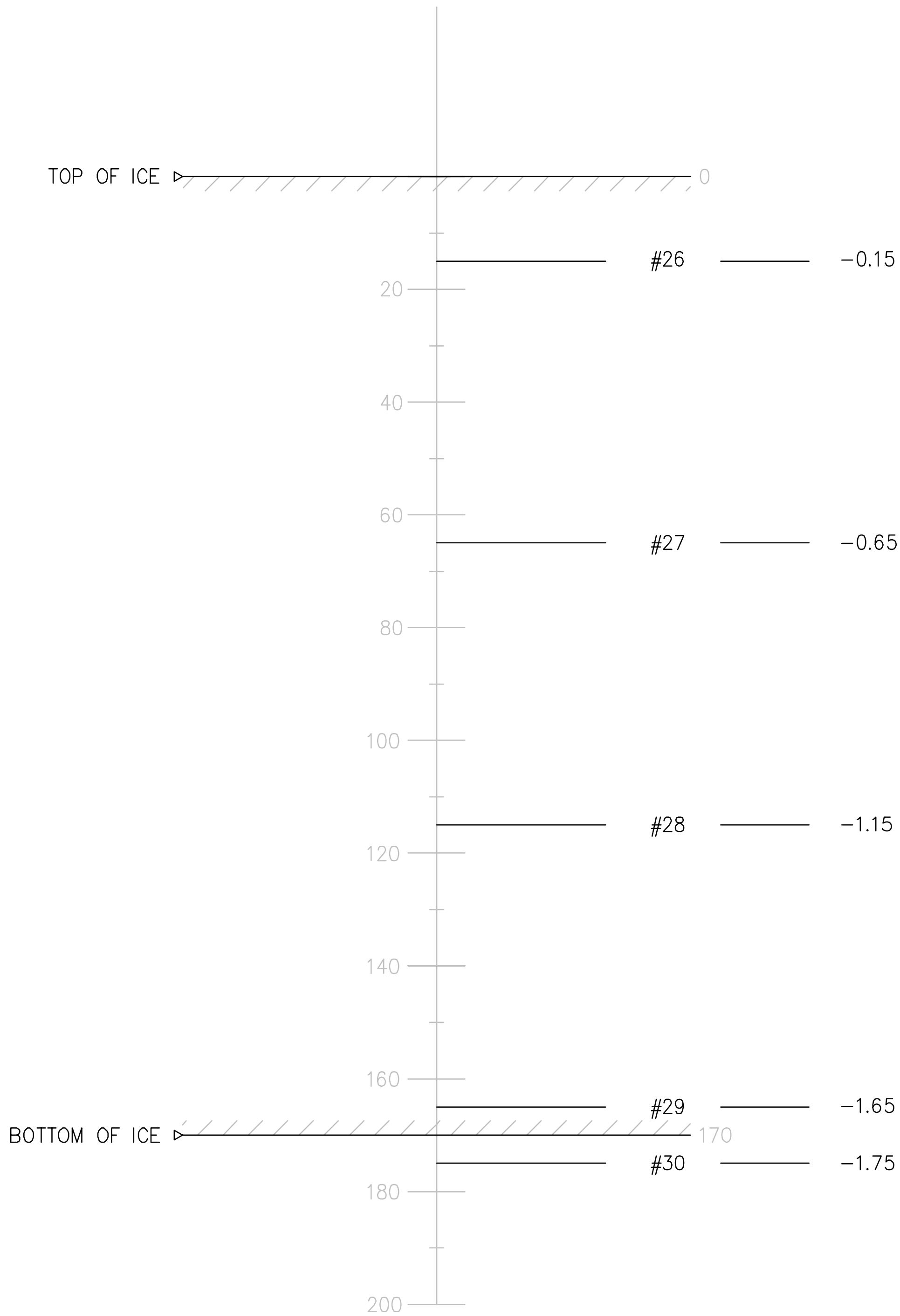


Figure 2

Habitat Compensation Areas on Carat Lake, 2005
Built in 2007

CROSS-SECTION OF ICE COVER



NOTES:
ICE THICKNESS H =1.70m
FREEBOARD, FB = 0.15m
WATER DEPTH W = 2.45m
INSTALLED: 25th of March, 2007 @ 10:15am

0 25 50
Scale: 1: 1250 (metres)

CLIENT
Tahera Diamond Mine Corp.

EBA Engineering Consultants Ltd.

JERICHO 2007 SHOAL CONSTRUCTION

ID NUMBER AND LOCATION OF THERMISTORS

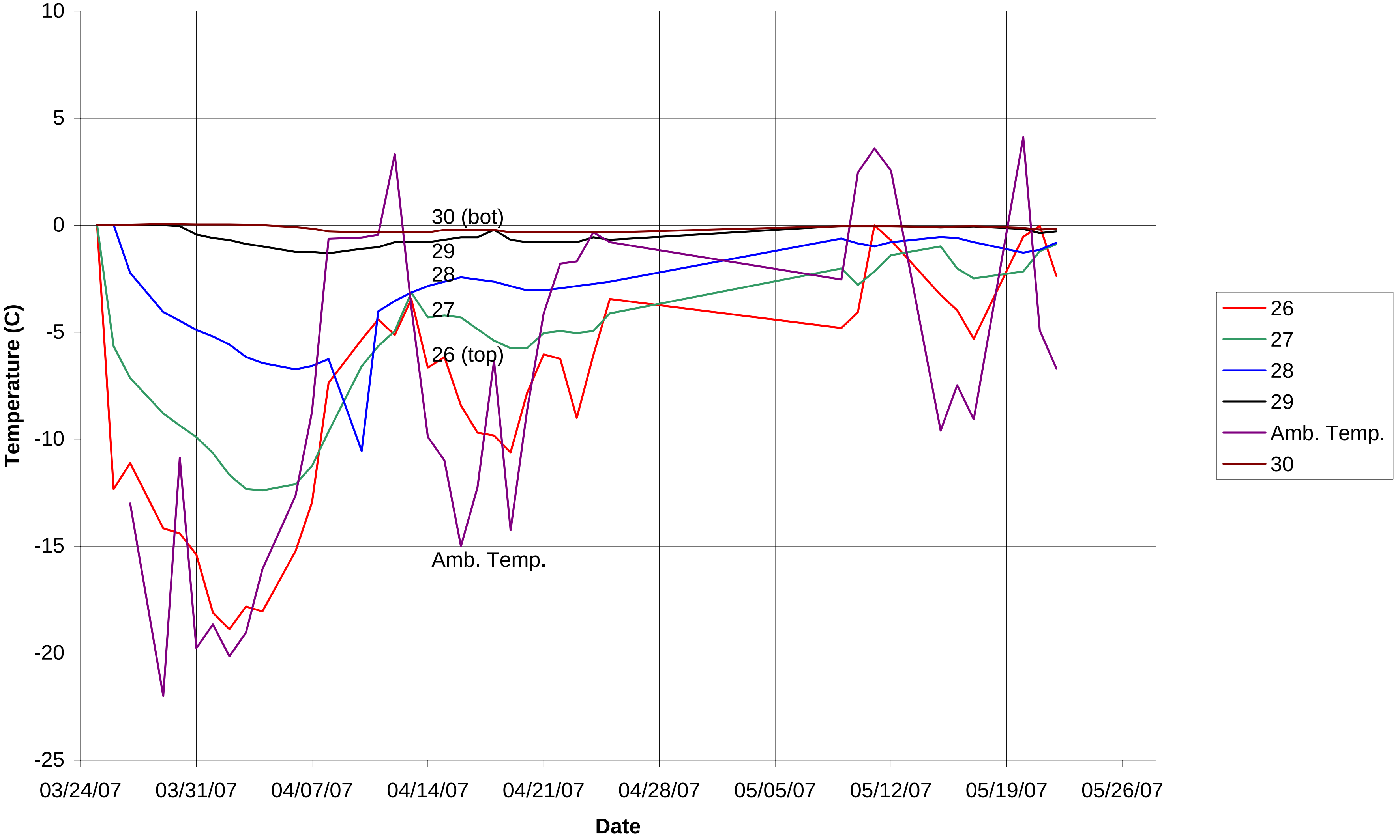
PROJECT NO.	DWN	CKD	REV
E12101016	CD	VN	0

OFFICE	DATE
EBA-RIV	June 01, 2007

Figure 3

G:\0101\1100060\dwg\1100060 FIG 3.dwg [8.5X11 P] June 14, 2007 - 1:20:11 pm (BY: KSENIJA AGATONOVIC)

Fig.4:Temperature Readings - Jericho 2007



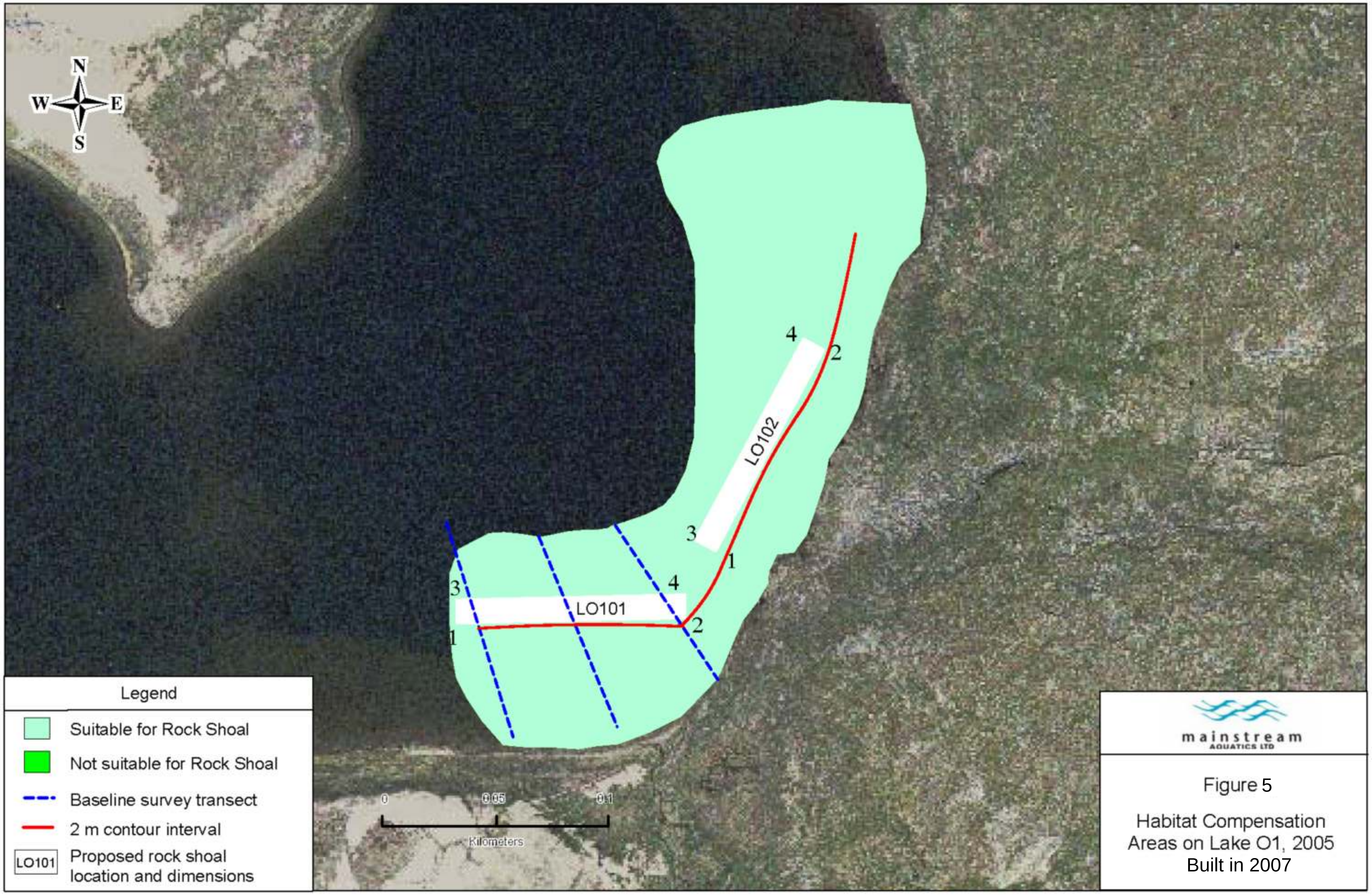


Figure 5

Habitat Compensation Areas on Lake O1, 2005
Built in 2007

PHOTOGRAPHS

Photo 1
Carat Lake – Dumping six inch crush material on shore fast ice.

Photo 2
Carat Lake – Typical six inch crush material.

Photo 3
Carat Lake – 950 loader distributes crush material.

Photo 4
Carat Lake – Dumping rock (ROM) on six inch crush material.

Photo 5
Carat Lake – Aerial photo of shoals showing gaps of ROM at shoal centres.

Photo 6
Carat Lake – Flooding of Shoal #3 with ROM dumped in February 2007, and grader clearing snow in background, March 22, 2007.

Photo 7
Carat Lake – Loader cleans snow north of Shoal #1 and Shoal #2, March 22, 2007.

Photo 8
Carat Lake – Loader and grader removing large amounts of snow around Shoal #3, March 22, 2007.

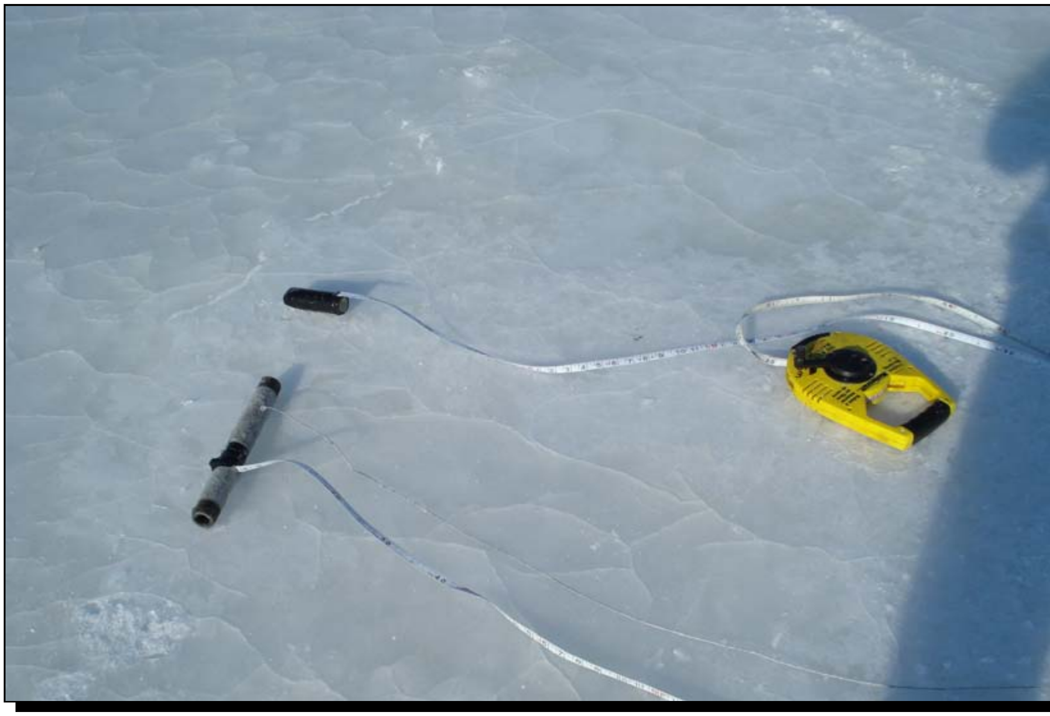


Photo 9
Carat Lake – Devices for measuring ice thickness and water depth.

Photo 10
Carat Lake – 730 truck dumps ROM.

Photo 11
Carat Lake – Flooding east of Shoal #5, March 25, 2007.

Photo 12
Carat Lake – Flooding of Shoal #6, March 25, 2007

Photo 13
Carat Lake – Rock pile at centre of Shoal #1, March 26, 2007.

Photo 14
Carat Lake – Rock placement on Shoal #1, March 26, 2007.

Photo 15
Carat Lake – Rock placement on Shoal #2, March 27, 2007.

Photo 16
Carat Lake – Crack in ice cover at the northeast corner of Shoal #6.

Photo 17
Carat Lake – Close ups of crack at the northeast corner of Shoal #6.

Photo 18
Carat Lake – Six thermistors and cables are attached to a 2 x 4 ready for installation.

Photo 19
Carat Lake – Thermistors installed south of Shoal #2, March 25, 2007.

Photo 20
Carat Lake – Cutting ice with chain saw to weaken ice cover, April 17, 2007.

Photo 21
Carat Lake – Partial cut of ice cover around Shoal #6, April 17, 2007.

Photo 22
Carat Lake – Aerial photo of Shoal #1 to Shoal #3 on April 18, 2007. Taken east of Shoal #3, April 18, 2007.

Photo 23
Carat Lake –Failure of Shoal #2 and Shoal #3, aerial photo taken east of Shoal #3, May 25, 2007.

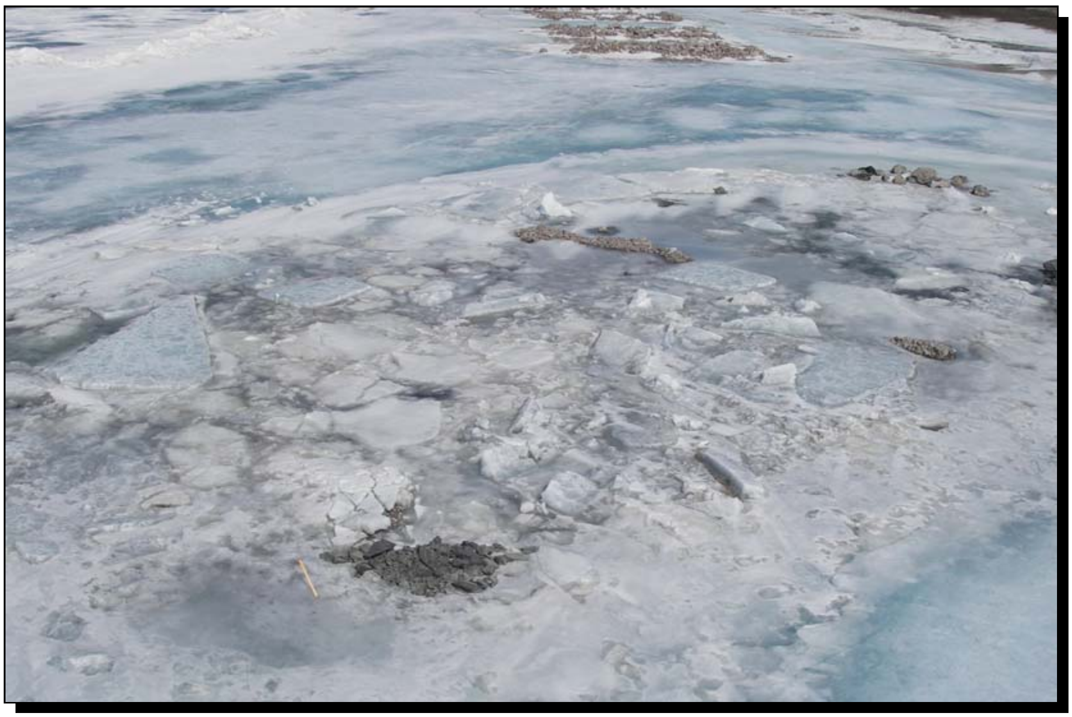


Photo 24
Carat Lake – Close up of Shoal #3, May 25, 2007.

Photo 25
Carat Lake – Ice blocks at Shoal #3, May 16, 2007.

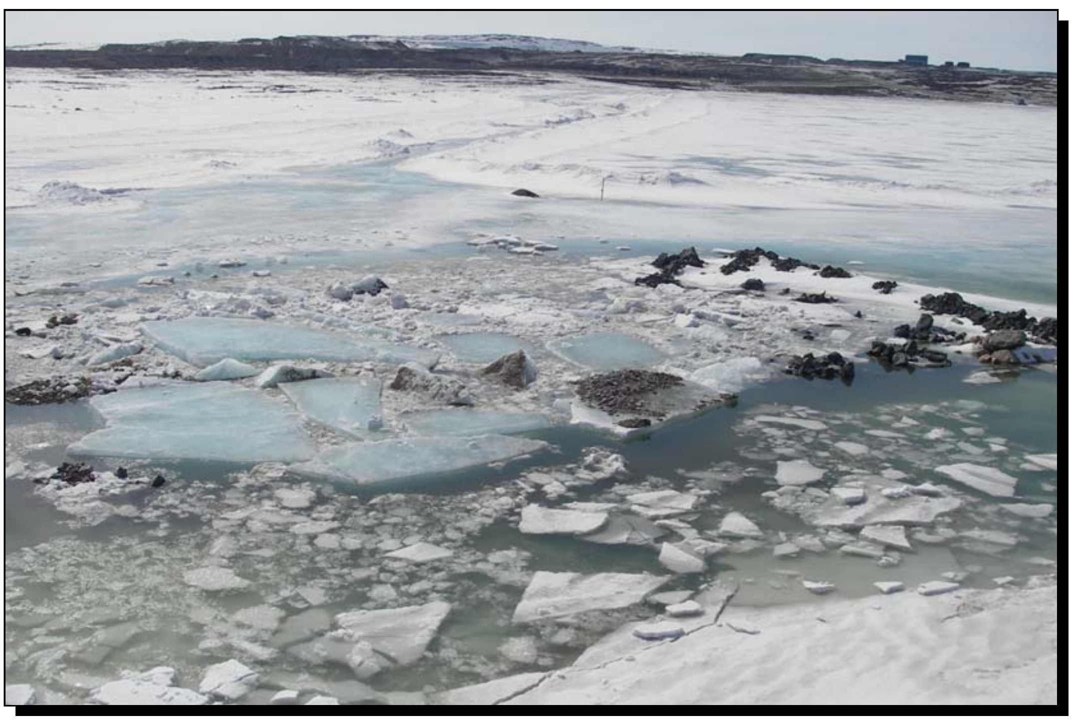


Photo 26
Carat Lake – Broken ice at Shoal #2, May 25, 2007.

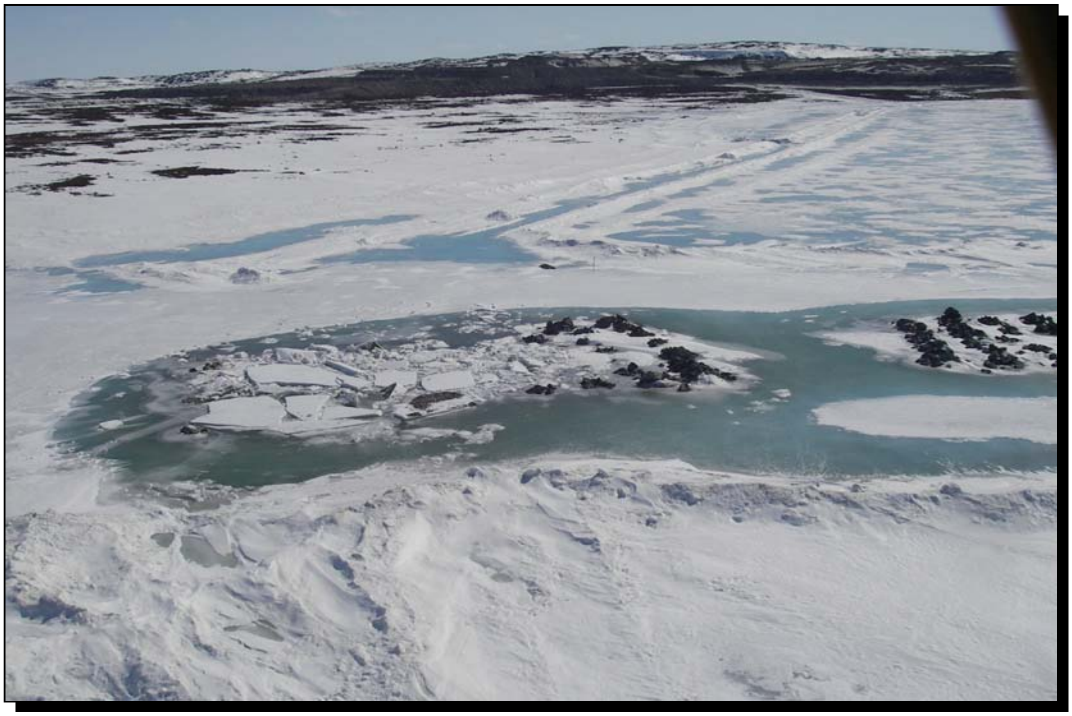


Photo 27
Carat Lake – Broken ice at Shoal #2 and flooded ice road, May 28, 2007.

Photo 28
Carat Lake – Shoal #1 to Shoal #6, May 25, 2007.

Photo 29
Lake O1 – Aerial view of completed Shoal #1 and Shoal #2 under construction, April 18, 2007.

Photo 30
Lake O1 – Loading Shoal #2 with ROM, circumferential cracks at the end of Shoal #1.

Photo 31
Lake O1 – Large cracks between Shoal #1 and shore fast ice.

Photo 32
Lake O1 – Development of circumferential cracks at the north end of Shoal #1.

Photo 33
Lake O1 – Flooding of Shoal #1, May 25, 2007.

APPENDIX

APPENDIX A DESCRIPTION OF WORK OR UNDERTAKINGS AS REQUIRED BY FISHERIES AND OCEANS CANADA (DFO) UNDER FILE NO. NU-00-0068

Fisheries and Oceans Canada
Eastern Arctic Area
P.O. Box 358
Iqaluit, NU
X0A 0H0

Pêches et Océans Canada
Secteur de l'Arctique de l'est
Boîte postale 358
Iqaluit, NU
X0A 0H0

Our file Notre référence
NU-00-0068

April 15, 2005

Greg Missal,
Vice-President – Nunavut Affairs
Benachee Resources Inc.,
803-121 Richmond Street West,
Toronto, Ontario M5H 2K1

Dear Mr. Missal:

<u>SUBJECT</u>: Authorization for the harmful alteration, disruption or destruction of fish habitat pursuant to subsection 35(2) of the *Fisheries Act*

The harmful alteration, disruption or destruction of fish habitat arising from the Jericho Diamond Project mine is hereby authorized pursuant to subsection 35(2) of the *Fisheries Act*. This Authorization shall be conditional upon implementation of mitigation and compensation measures specified on the attached document.

The environmental impacts of this undertaking have been reviewed by Fisheries and Oceans Canada in accordance with the *Canadian Environmental Assessment Act*. This review concluded that the project is not likely to cause significant adverse environmental effects if the mitigation and compensation measures specified are implemented.

Failure to comply with any of the conditions specified on the attached Authorization may result in a contravention of section 35 of the *Fisheries Act*.

<u>NOTE</u>: None of the foregoing should be taken to imply Authorization of this undertaking in accordance with any section of the *Fisheries Act* **<u>other</u>** than section 35. Also note that Authorization under the *Fisheries Act* does not release the proponent from the requirements of any other federal, provincial or municipal legislation.

Please contact Derrick Moggy at (867) 979-8011 should you have any questions or require additional information.

Sincerely,

Michelle Wheatley
Area Director
Fisheries and Oceans Canada – Eastern Arctic Area

Attachment(s): *Fisheries Act* Authorization

c.c.: Stephanie Briscoe – Nunavut Impact Review Board
Philippe Di Pizzo – Nunavut Water Board
Glen Stephens – Indian and Northern Affairs Canada
Rob Johnstone – Natural Resources Canada

Canadä

Fisheries and Oceans
Pêches et Océans

AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT
AUTORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON

NU-00-0068
Authorization No./N° de l'autorisation

Authorization issued to:	Autorisation délivrée à :
Greg Missal Vice-President, Nunavut Affairs	Greg Missal Vice-President, Nunavut Affairs
Benachee Resources Inc., a wholly owned subsidiary of Tahera Diamond Corporation (BRI) 803-121 Richmond Street West, Toronto, Ontario M5H 2K1	Benachee Resources Inc., a wholly-owned subsidiary of Tahera Diamond Corporation (BRI) 803-121 Richmond Street West, Toronto, Ontario M5H 2K1
(416) 777-1998	(416) 777-1998

Location of Project/Emplacement du projet

This Authorization is in relation to the harmful alteration, disruption or destruction (HADD) of fish habitat resulting from the works or undertakings at the Jericho Diamond Project, within the Carat Lake watershed in Nunavut near the northwest corner of Contwoyto Lake (65° 59' 50" Latitude, 111 ° 8' 30" Longitude), located 420 km northeast of Yellowknife, NT.

Valid Authorization Period / Période de validité

From / Du	To / Au
April 15, 2005	**December 31, 2007**

The valid Authorization periods for the other conditions of this Authorization are set out below.

Description of Works or Undertakings (Type of work, schedule, etc.)
Description des ouvrages ou entreprises (Genre de travail, calendrier, etc.)

Benachee Resources Inc. (BRI) proposes to conduct open pit and underground mining of kimberlite pipes at their Jericho Diamond Project mine site (Project). As a result of the project, a causeway will be constructed and operated from the shoreline of Carat Lake to support a water intake facility to provide process water for mine operations. The storage of fine fraction from the processing operation will occur in the Long Lake System (made up of Long Lake, an unnamed pond north of Long Lake and an unnamed pond west of Long Lake), which will be dammed and converted to a Processed Kimberlite Containment Area. As a result, flows from the Long Lake System to Lake C3 via Stream C3, will be disrupted during operation. To facilitate access to the open pit, a section of Stream C1 will be realigned away from the pit using a diversion channel. Furthermore, management of site water around and within the open pit, will result in the reduction of flows in Stream C1 during operation.

The following works or undertakings are subject to this Authorization:

1. The construction, operation, maintenance and abandonment of a 100 metre long causeway to support a water intake facility in Carat Lake, will affect 1800 m^2 of foraging, nursery/rearing and wintering habitat for Arctic char, Arctic grayling, Burbot, Lake Trout, Round whitefish, and all habitat types for Slimy sculpin.

2. The construction, operation and abandonment of a Processed Kimberlite Containment Area (PKCA) using the Long Lake system, including:

   - Long Lake, which will affect 100 300 m^2 of all habitat types for Burbot and Slimy sculpin;
   - An unnamed pond, north of Long Lake, which will affect 7 100 m^2 of all habitat types for Slimy sculpin;
   - An unnamed pond, west of Long Lake, which will affect 9 600 m^2 of all habitat types for Burbot and Slimy sculpin; and,
   - Stream C3, which will affect 839 m^2 of nursery/rearing and production habitat for Arctic char, Burbot, Lake trout, and Round whitefish, all habitat types for Slimy sculpin, and nursery/rearing, spawning and production habitat for Arctic grayling.

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3. The construction, operation, maintenance and abandonment of a diversion channel, adjacent to Stream C1, which will affect 2 153 m^2 of production habitat for Arctic char, Arctic Grayling, Burbot, Lake trout, Round whitefish, and Slimy sculpin.

4. The management of site water during mine operation within the Stream C1 watershed, adjacent to the open pit, which will affect 313 m^2 of production and nursery/rearing habitat for Arctic char, Burbot, Lake trout and Round whitefish, all habitat types for Slimy sculpin and nursery/rearing, spawning and production habitat for Arctic grayling.

Conditions of Authorization/Conditions de l'autorisation

Conditions that relate to the Proponent Plan ("Plan"):

1. The conditions of this Authorization notwithstanding, should the above works or undertaking, due to weather conditions, different soils or other natural conditions, or for any other reason, appear, in the opinion of the Department of Fisheries and Oceans ("DFO") likely to cause greater impacts than the parties previously contemplated, then DFO may direct the Proponent, and its agents, and contractors, to suspend or alter works and activities associated with the project, to avoid or mitigate adverse impacts to fisheries resources. DFO may also direct the Proponent and its agents, and contractors, to carry out at the Proponent's expense any works or activities deemed necessary by DFO to avoid or mitigate further adverse impacts to fisheries resources. In circumstances where DFO is of the view that greater impacts may occur than were contemplated by the parties, DFO may also modify or rescind this authorization. If the authorization is to be changed the Proponent will be given an opportunity to discuss any proposed modifications or rescission.

2. BRI confirms that all plans and specifications for all works and undertakings proposed relating to this Authorization have been duly prepared and reviewed by appropriate professionals working on behalf of BRI. BRI acknowledges that it is solely responsible for all design, safety and workmanship aspects of all works associated with this Authorization.

3. The construction must comply with those criteria as identified within this Authorization. Harmful alteration; disruption or destruction of fish habitat other than that specifically identified within this Authorization is not permitted. Only the HADD of fish habitat resulting from the following shall be authorized during the time period specified under the heading **"Valid authorization period"**, and as set out under the heading **Description of Works or Undertakings**, above:

   3.1. The construction of a 100 m long causeway resulting in the destruction of 1800 m^2 of fish habitat in Carat Lake.

   3.2. The construction and operation of the Processed Kimberlite Containment Area (PKCA) resulting in the destruction of 100 300 m^2 of fish habitat in Long Lake, 7 100 m^2 of fish habitat in an unnamed pond north of Long Lake, 9 600 m^2 of fish habitat in an unnamed pond west of Long Lake and the disruption of 839 m^2 of fish habitat in Stream C3.

   3.3. The construction, operation and abandonment of a 470 metre diversion channel resulting in the destruction of 2 153 m^2 metres of fish habitat in Stream C1.

   3.4. The management of site water around the open pit resulting in the harmful alteration of 313 m^2 metres of fish habitat in the lower section of Stream C1.

4. Works will be conducted following the practices outlined in the following reports:

   4.1. Application for Authorization for Works or Undertakings Affecting Fish Habitat, dated 17 November 2000.

   4.2. Jericho Diamond Project Final Environmental Impact Statement, dated January 2003, Tahera Corporation.

   4.3. Water Permit Submission for the Jericho Diamond Mine Nunavut, submitted to the Nunavut Water Board, by Tahera Diamond Corporation, dated August 2004.

   4.4. Addendum to the Submission to the Nunavut Water Board Jericho Diamond Project, dated October 8, 2004. Tahera Diamond Corporation.

   4.5. Mainstream Aquatics Ltd. 2004. Revised fish habitat no net loss plan for the Jericho Diamond Project. Prepared for Tahera Diamond Corporation. Report No. 04006BF: 62p. + Appendices.

4.6. Memorandum entitled "Response to DFO Concerns – Blasting Analysis", from Rick Pattenden (Mainstream Aquatics Ltd) to Derrick Moggy, Fisheries and Oceans Canada, dated November 22, 2004.

4.7. The above drawing(s) and/or document(s) are hereafter referred to as the **Plan**. Where contradictions exist, the most recent version shall apply.

Conditions that relate to the mitigation of potential harmful alteration, disruption or destruction of fish habitat:

5. BRI shall carry out the works or undertakings, set out under the heading **Description of Works or Undertakings** and described in the **Plan** above, and **Conditions of Authorization** with due diligence to avoid any HADD of fish habitat beyond that for which this Authorization has been issued, and in particular, but without restricting the generality of the foregoing:

5.1. A qualified biologist or environmental inspector shall be on site during all in-water construction and restoration works to ensure implementation of the designs as intended in the **Plan** and conditions of this Authorization.

5.2. No in-water work shall occur during critical spawning and rearing periods for any fish species in the affected waterbody. The timing of any works proposed for the open water season shall be determined by BRI and approved by DFO prior to the start of any in-water work.

5.3. All materials and equipment used for the purpose of site preparation and project completion shall be operated, maintained and stored in a manner that prevents any deleterious substance from entering the water.

5.3.1. Any stockpiled materials shall be stored such that they will not, under any conditions, erode into the watercourse.

5.3.2. Vehicle and equipment re-fuelling and/or maintenance shall be conducted away from the water.

5.3.3. Any part of a vehicle and/or equipment entering the water shall be free of fluid leaks and externally cleaned/degreased to prevent any deleterious substance from entering the water.

5.3.4. Only clean material free of fine particulate matter and any deleterious substance shall be placed in the water.

5.4. Sediment and erosion control measures shall be in place prior to commencement of the work and are left in place until such time that any previously exposed soils are stabilized and are no longer subject to erosion and will not result in the deposit of sediment into the water.

5.4.1. During construction, all sediment and erosion control measures shall be inspected daily to ensure that they are functioning properly and are maintained and/or upgraded as required to prevent entry of sediment into the water.

5.4.2. After construction, all sediment and erosion control measures shall be inspected weekly, or daily during any rainfall or thaw events, to ensure that they are functioning properly and are maintained and/or upgraded as required to prevent entry of sediment into the water.

5.4.3. Extra sediment and erosion control measures shall be immediately available on site for upgrades or repairs.

5.4.4. All disturbed areas of the work site shall be stabilized (to prevent any erosion) immediately and re-vegetated as soon as conditions allow.

5.4.5. Total suspended solids in surface runoff from the mine site shall be controlled so as to prevent impact to fish habitat.

5.5. The construction of the Stream C1 diversion channel shall be completed in the dry and allowed to stabilize for a minimum of one year prior to implementation.

5.5.1. Fish shall be removed from the existing channel prior to de-watering and released alive immediately downstream.

5.5.2. Silt or debris that has accumulated around the temporary cofferdams shall be removed prior to their withdrawal.

5.5.3. To prevent erosion and sediment release, flow dissipaters and/or filter bags (or equivalent) shall be placed at water discharge points, and located a minimum of 15 m from the watercourse, to allow sediment laden water to settle and/or filter before re-entering the watercourse downstream of the construction area.

5.6. BRI shall implement the **Fish Salvage Program,** during the de-watering of Long Lake, in the manner outlined in the DFO Fish-Out Protocol.

5.7. If the fish habitat mitigation measures are not functioning as intended, BRI shall design and implement a **Contingency Plan** that adequately addresses any limitations. This plan shall be submitted for review and approval by DFO prior to implementation.

Conditions that relate to the compensation for the loss of 122 000 m² of fish habitat:

6. The following areas of fish habitat shall be created as compensatory fish habitat:

6.1. 607 m² of fish habitat in Carat Lake shall be enhanced during the construction and operation of the causeway by incorporating larger-sized rock material (up to 0.5 metre diameter) into the margins.

6.1.1. The enhancement will benefit foraging, nursery/rearing and wintering habitat for Arctic char and Arctic grayling, and all habitat types for Burbot, Lake trout, Round whitefish and Slimy sculpin.

6.2. 1207 m² of fish habitat of Carat Lake shall be enhanced through the development of underwater rock shoal by excavating to at least 2 metre below normal summer water levels during abandonment of the causeway.

6.2.1. The enhancement shall benefit foraging, nursery/rearing and wintering habitat for Arctic char and Arctic grayling, and all habitat types for Burbot, Lake trout, Round whitefish and Slimy sculpin.

6.2.2. Final detailed design drawings for the reclamation of the causeway shall be submitted to DFO for review and approval prior to November 30th, 2005.

6.3. 940 m² of fish habitat in the 470 m long diversion channel shall be enhanced by incorporating natural channel features into design.

6.3.1. The enhancement shall benefit production habitat for Arctic char, Arctic grayling, Burbot, Lake trout, Round whitefish and Slimy sculpin.

6.3.2. Final detailed design drawings for the diversion channel shall be submitted to DFO for review and approval at least sixty (60) days prior to construction and shall incorporate the following features into the lower 150 metre portion of the channel:

6.3.2.1. A sinuous configuration, which includes at least 10 meanders with a 6 metre radius, shall be incorporated into the channel to mimic natural channel form and maximize channel length;

6.3.2.2. Ten riffles shall be incorporated into the channel design;

6.3.2.3. A low flow channel shall be incorporated into the design to maintain a wetted width of 0.5 m and water depths up to 0.5 m;

6.3.2.4. A channel gradient shall be designed to ensure fish passage;

6.3.2.5. Boulders shall be placed in the channel to provide physical in-stream cover; and

6.3.2.6. A long, narrow pool shall be incorporated into the design at the lowermost and uppermost portion of the channel.

6.4. 21 000 m² of fish habitat shall be enhanced through the construction of twenty-one (21) underwater rock shoals:

6.4.1. The enhancement shall result in the creation of foraging, nursery/rearing and wintering habitat for Arctic char and Arctic grayling, and all habitat types for Burbot, Lake trout, Round whitefish and Slimy sculpin;

6.4.2. Final design plans for the construction of the twenty-one (21) rock shoals shall be submitted to DFO for review and approval prior to November 30th, 2005 and shall incorporate the following features:

6.4.2.1. Each rock shoal shall be at least 10 metres wide by 100 metres long by 1 metre thick and placed in water with a depth of at least 2 metres below the normal summer water levels;

6.4.2.2. Each rock shoal shall be constructed with rock material demonstrated to have no potential to release deleterious contaminants to fish; and,

6.4.2.3. Distinct rock shoals shall be constructed in the quantity and location as follows: Six (6) rock shoals along the northeast shore of Carat Lake; Five (5) rock shoals along the southeast shore of Interbasin Lake; Two (2) rock shoals along the southeast shore of Lake O1; Two (2) rock shoals along the north/south east/west shore of Lake O2; Two (2) rock shoals along the northeast shore of Lake O3; and, Four (4) rock shoals along the south shore of Lake O4.

6.4.3. A final Detailed Compensation Monitoring Plan for construction of the twenty-one (21) rock shoals shall be submitted to DFO for review and approval prior to November 30th, 2005.

6.4.4. Implementation of the Approved drawings for the construction of the rock shoals shall be completed prior to November 30th, 2007.

6.5. 182 m^2 of fish habitat shall be enhanced in a connecting channel (Stream O21) to improve fish passage between Lake O2 and Lake O3.

6.5.1. The enhancement shall benefit foraging and nursery/rearing for Arctic char, Arctic grayling, Burbot, Lake trout, Round whitefish, and foraging, nursery/rearing and spawning habitat for Slimy sculpin; and,

6.5.2. Final detailed design drawings for Stream O21 shall be submitted to DFO for review and approval prior to November 30th, 2005 and shall incorporate the following features:

6.5.2.1. The connecting channel shall be constructed with rock material demonstrated to have no potential to release deleterious contaminants to fish.

6.5.3. A final Detailed Compensation Monitoring Plan for the connecting channel (Stream O21) shall be submitted to DFO for review and approval prior to November 30th, 2005.

6.5.4. Implementation of the Approved drawings for connecting channel (Stream O21) shall be completed prior to November 30th, 2007.

6.6. All fish habitat compensatory works shall be completed prior to November 30th, 2007.

6.7. If at any time the Proponent becomes aware that the compensatory habitat is not completed and/or functioning as described in the habitat compensation plan, the Proponent shall carry out any works which are necessary to ensure the compensatory habitat is completed and/or functioning as described in the habitat compensation plan.

6.8. The Proponent confirms that they shall leave the compensatory habitat undisturbed. After the compensatory habitat has been created the Proponent shall not carry on any work or undertaking that will adversely disturb or impact the compensatory habitat.

6.9. If the fish habitat compensation measures are not functioning as intended, BRI shall design and implement a **Contingency Plan** that adequately addresses any limitations. This plan shall be submitted for review and approval by DFO prior to implementation.

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NU-00-0068
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Conditions that relate to the monitoring of the Proponent Plan, the Mitigation and the Compensation ("Monitoring Program")

7. The proponent shall undertake a Mitigation Monitoring Program and will report to DFO, on or by November 30th of every year, whether works were conducted within the schedule of the proponent plan and whether the mitigation measures outlined in the proponent plan and this authorization were followed, by:

7.1. Providing a photographic record taken of the pre construction, during construction and post construction periods, showing all sediment control works and details of how they functioned to prevent sediment entry into the watercourse according to the approved Plan and conditions of the Authorization.

7.1.1. The photographic record shall include, but not be limited to, a record of existing conditions, the work phase including sediment and erosion control measures, and completed works including compensation measures, site stabilization and restoration.

7.1.2. The photographs for each pre construction, during construction and post construction time period shall be taken from the same vantage point(s), direction and angle of view for easy comparison.

7.1.3. All photographs shall be clearly labelled with the date, location and viewing direction. The photographic locations and viewing directions shall be indicated on a plan view drawing of the work site and clearly indexed to the photographs.

7.2. Providing details of the effectiveness of the mitigation measures in achieving their objectives, as outlined in the Fish Habitat No Net Loss Plan – Jericho Project (Mainstream, 2004).

7.3. Providing details of any contingency measures that were followed in the event that mitigation measures did not function as described in the proponent plans.

7.4. Preparing and submitting "As constructed" drawings, stipulating that structures and/or works were constructed according to the approved plans, to DFO on or before November 30th of the year following the completion of that structure and/or work.

7.5. Preparing a report on the **Fish Salvage Program** following the dewatering of Long Lake, in the manner outlined in the DFO Fish-Out Protocol before November 30th, 2006.

8. The proponent shall undertake a Compensation Monitoring Program and report on an annual basis by November 30th, whether the compensation works were conducted according to the habitat compensation plan by:

8.1. A photographic record shall be taken of the pre construction, during construction and post construction periods, showing all compensation works completed according to the approved Plan and conditions of the Authorization.

8.1.1. The photographic record shall include, but not be limited to, a record of existing conditions, the work phase including sediment and erosion control measures, and completed works including compensation measures, site stabilization and restoration.

8.1.2. The photographs for each pre construction, during construction and post construction time period shall be taken from the same vantage point(s), direction and angle of view for easy comparison.

8.1.3. All photographs shall be clearly labelled with the date, location and viewing direction. The photographic locations and viewing directions shall be indicated on a plan view drawing of the work site and clearly indexed to the photographs.

8.2. Providing details of the effectiveness of the compensation measures in achieving their objectives as fish habitat, as outlined in the Fish Habitat No Net Loss Plan – Jericho Project (Mainstream, 2004), and the Detailed Compensation Monitoring Plan for the rock shoals and the connecting channel (Stream O21). The report shall include but not be limited to, the stability of all habitat features contained therein, habitat characteristics, fish use, abundance, distribution and population characteristics:

8.2.1. Monitoring of the Causeway shall be reported at the end of Year 2, 3, 4, 6, 8 and one (1) years following causeway reclamation, and shall report on the sediment deposition adjacent to the structure.

8.2.2. Monitoring of the Stream C1 Diversion Channel shall be reported at the end of Year 3, 4, 6, 8, 10 and 12, and shall include stream discharge and temperature (correlated with ambient air temperature).

8.2.3. Monitoring of the rock shoals shall be reported at the end of Year 4, 5, 6, 8 and 10, as outlined in the Detailed Compensation Monitoring Plan for rock shoals.

8.2.4. Monitoring of the connecting channel (Stream O21) shall be reported at the end of Year 4, 5, 6, 8 and 10, as outlined in the Detailed Compensation Monitoring Plan for the connecting channel (Stream O21).

8.3. Preparing and submitting "As constructed" drawings to DFO by November 30th of the year following construction, stipulating that structures and/or works were constructed according to the approved plans.

8.4. Providing a description of the contingency measures that were followed if, during the Monitoring Program, it was determined that the compensatory habitat was not functioning as described in the proponent plans.

Financial Security:

9. To guarantee the performance of all of BRI's obligations under this Authorization, including the performance of any additional work determined by DFO to be necessary to achieve the objective of No Net Loss of Fish Habitat, BRI shall provide DFO with a security deposit in the form of an irrevocable letter of credit (Letter of Credit) on the following terms and conditions:

9.1. BRI shall deliver the Letter of Credit to DFO (Iqaluit, NU Office), payable to the Receiver General of Canada, within 30 days from the issuance of this authorization in the amount of Canadian **$280,000.00**; and valid until **December 31st, 2016** issued in a form and by an Issuer that is approved by Fisheries and Oceans Canada - Eastern Arctic Area.

9.2. The Letter of Credit will be for a one-year term and will be renewed by BRI on an annual basis until all of its obligations under this Authorization are completed to the satisfaction of DFO.

9.3. DFO may draw down on the Letter of Credit at any time upon written notice to the Issuer any amount that DFO deems to be necessary to satisfy any of BRI's obligations under this Authorization, including any work which may be required due to a failure of the compensation and mitigation measures to function as anticipated as determined by DFO.

9.4. BRI covenants and undertakes to and with DFO that, in the event that any drawings are made by DFO on the Letter of Credit, BRI will cause the Letter of Credit to be confirmed or re-issued (as the case may be). The Irrevocable Letter of Credit to be confirmed or re-issued (as the case may be) at the first of the next following calendar year.

9.5. At any time during the term of this Authorization, based upon review of the effectiveness of the compensation, mitigation and monitoring requirements set out in this Authorization, if DFO, in its absolute discretion considers those measures to be functioning as designed, DFO may authorize BRI to reduce the amount of the Letter of Credit, and shall provide to the Issuer the appropriate notice.

9.6. Once BRI has fulfilled all of its obligations and met all requirements and conditions set out in this Authorization to the satisfaction of DFO, DFO shall provide instructions to the Issuer to cancel the Letter of Credit and shall provide to BRI a statement of account detailing any withdrawals made by DFO pursuant to section 9.3 above.

10. Notification of the commencement of in-water works or undertaking shall be provided to DFO via fax (867-979-8039) within ten days prior to the initiation of the works or undertaking.

10.1. The notification shall be forwarded to the attention of Derrick Moggy, Habitat Management Biologist and include the Authorization number (NU-00-0068) and the date when in-water works or undertakings are scheduled to take place.

11. Any deviation from the approved plan, work schedule or compensation, mitigation and monitoring measures stated above, shall be discussed with and approved in writing by DFO, prior to implementation.

12. BRI shall carry out all works or undertakings related to the **Description of Works or Undertakings** at the Jericho Project and implement mitigation and compensation measures to the satisfaction of DFO.

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13. A copy of this Authorization shall be prominently posted at the work site during all work periods. BRI shall ensure that all work crews are made familiar with the conditions of this Authorization prior to implementation of the works or undertakings.

The holder of this authorization is hereby authorized under the authority of section 35(2) of the Fisheries Act, R.S.C., 1985, c.F. 14, to carry out the work or undertaking described herein.

This authorization is valid only with respect to fish habitat and for no other purposes. It does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

Failure to comply with any condition of this authorization may result in charges being laid under the Fisheries Act.

This authorization form should be held on site and work crews should be made familiar with the conditions attached.

Le détenteur de la présente est autorisé en vertu du paragraphe 35(2) de la Loi sur les pêches L.R.C. 1985, ch. F. 14, à exploiter les ouvrages ou entreprises décrits aux présentes.

L'autorisation n'est valide qu'en ce qui concerne l'habitat du poisson et pour aucune autre fin. Elle ne dispense pas le requérant de l'obligation d'obtenir la permission d'autres organismes réglementaires concernés ou de se conformer à leurs exigences.

En vertu de la Loi sur les pêches, des accusations pourront être portées contre ceux qui ne respectent pas les conditions prévues dans la présente autorisation.

Cette autorisation doit être conservée sur les lieux des travaux, et les équipes de travail devraient en connaître les conditions.

Date of Issuance: April 15, 2005

Approved by:

Title: John Cooley
A/Regional Director General
Central and Arctic Region
Fisheries and Oceans Canada

Date de délivrance : le 15 Avril 2005

Approuvé par :

Titre : John Cooley
A/ Directeur Général Régional
Région du Centre et de l'Arctique
Pêches et Océans Canada

APPENDIX

APPENDIX B EQUIPMENT SPECIFICATIONS

Machines

- » **Articulated Trucks**
- » Backhoe Loaders
- » Cold Planers
- » Compactors
- » Feller Bunchers
- » Forest Machines
- » Forwarders
- » Harvesters
- » Hydraulic Excavators
- » Knuckleboom Loaders
- » Material Handlers
- » Motor Graders
- » Multi Terrain Loaders
- » Off Highway Tractors
- » Off Highway Trucks
- » Paving Equipment
- » Pipelayers
- » Road Reclaimers
- » Scrapers
- » Skid Steer Loaders
- » Skidders
- » Soil Stabilizers
- » Telehandlers
- » Track Loaders
- » Track-Type Tractors
- » Underground Mining
- » Wheel Dozers
- » Wheel Excavators
- » Wheel Loaders

730 ARTICULATED TRUCKS

— Sel

Overview **Specifications** **Benefits & Features** **Standard/ Optional Equip.**

SPECIFICATIONS

Units: **US** | **Metric**

Engine	
Engine Model	Cat® C11 ACERT™
Gross Power - SAE J1995	325 hp
Net Power - SAE J1349	317 hp
Net Power - ISO 9249	321 hp
Net Power - EEC 80/1269	321 hp
Flywheel Power	317 hp
Bore	5.1 in
Stroke	5.5 in
Displacement	680 in3
Weights	
Rated Payload	31 tons
Body Capacities	
Heaped SAE 2:1	22.1 yd3
Struck	17.1 yd3
Heaped SAE 1:1	26.9 yd3
Transmission	
Forward 1	4.75 mph
Forward 2	8.97 mph
Forward 3	13.64 mph
Forward 4	20.9 mph
Forward 5	29.1 mph
Forward 6	34.37 mph
Reverse 1	5.27 mph
Operating Weights	
Front Axle - Empty	28969 lb
Center Axle - Empty	11023 lb
Rear Axle - Empty	10384 lb
Total - Empty	50376 lb
Front Axle - Rated Load	5997 lb
Center Axle - Rated Load	27999 lb
Rear Axle - Rated Load	27999 lb
Total - Rated Load	61994 lb
Front Axle - Loaded	34965 lb 31'\

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Center Axle - Loaded	39022 lb 35%
Rear Axle - Loaded	38382 lb 34%
Total - Loaded	112370 lb

Body Plate Thickness

Front	.31 in
Scow	.55 in
Side	.47 in
Base	.55 in

Service Refill Capacities

Fuel Tank	95 gal
Cooling System	22.7 gal
Hydraulic System	26.4 gal
Engine Crankcase	9.8 gal
Transmission	9.5 gal
Final Drives/Differential	34.9 gal
Output Transfer Gear Box	4.8 gal

Sound Levels

Interior Cab	76 dB(A)

Body Hoist

Raise time	12 Seconds
Lower time	8 Seconds

Standards

Brakes	SAE J/ISO 3450:1998
Cab/FOPS	SAE J231:JAN81 and ISO 3449:1992 Level II
Cab/ROPS	SAE J1040 May 1994 and ISO 3471:1994
Steering	ISO 5010 1992E

Specifications | **Wheel Loaders Integrated Toolcarriers**

   

MODEL	950G		950G Series II		962G/IT62G		962G Series II IT62G Series II	
Flywheel Power: Net	134 kW	180 hp	136 kW	183 hp	149 kW	200 hp	162 kW	204 hp
Max.	147 kW	197 hp	146 kW	196 hp	154 kW	207 hp	157 kW	210 hp
Engine Model	3126 DITA		3126B ATAAC		3126 DITA		3126B ATAAC	
Rated Engine RPM	2200		2200		2200		2200	
Bore	110 mm	4.3"	110 mm	4.3"	110 mm	4.3"	110 mm	4.3"
Stroke	127 mm	5"	127 mm	5"	127 mm	5"	127 mm	5"
No. Cylinders	6		6		6		6	
Displacement	7.2 L	439 in³	7.2 L	439 in³	7.2 L	439 in³	7.2 L	439 in³
Speeds Forward	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1st	6.9	4.3	6.9	4.3	6.9	4.3	6.9	4.3
2nd	12.7	7.9	12.7	7.9	12.7	7.9	12.7	7.9
3rd	22.3	13.9	22.3	13.9	22.3	13.9	22.3	13.9
4th	37.0	23.0	37.0	23.0	37.0	23.0	37.0	23.0
Speeds Reverse								
1st	7.6	4.7	7.6	4.7	7.6	4.7	7.6	4.7
2nd	13.9	8.7	13.9	8.6	13.9	8.7	13.9	8.7
3rd	24.6	15.3	24.6	15.2	24.5	15.3	24.5	15.2
4th	40.5	25.3	40.0	24.9	40.5	25.3	40.0	24.9
Hydraulic Cycle Time,					Seconds		Seconds	
Rated Load in Bucket:	Seconds		Seconds		962G	IT62G	962G II	IT62G II
Raise	6.3		6.5		6.3	6.1	6.3	6.1
Dump	2.2		1.8		2.2	2.1	2.1	2.1
Lower (Empty, Float Down)	2.2		2.7		2.2	2.8	3.0	2.8
Total	10.7		11.0		10.7	11.0	11.4	11.0
Tread Width	2.14 m	7'0"	2.14 m	7'0"	2.14 m	7'0"	2.14 m	7'0"
Width Over Tires	2.89 m	9'6"	2.89 m	9'6"	2.89 m	9'6"	2.89 m	9'6"
Ground Clearance	400 mm	16"	412 mm	16"	400 mm	16"	412 mm	16"
Fuel Tank Capacity	294 L	77.6 U.S. gal	294 L	77.6 U.S. gal	294 L	77.6 U.S. gal	294 L	77.6 U.S. gal
Hydraulic Tank Capacity	88 L	23.2 U.S. gal	88 L	23.2 U.S. gal	88 L	23.2 U.S. gal	88 L	23.2 U.S. gal
Hydraulic System Capacity (includes tank)	153 L	40.4 U.S. gal	153 L	40.4 U.S. gal	153 L	40.4 U.S. gal	153 L	40.4 U.S. gal

203-5301



MODEL	14H		16H		24H	
Net Flywheel Power	164 kW	220 hp	198 kW	265 hp	373 kW	500 hp
Variable Horsepower: Gears 4-8	179 kW	240 hp	213 kW	285 hp	—	
Operating Weight*	18 600 kg	41,010 lb	24 740 kg	54,350 lb	61 950 kg	136,610 lb
Engine Model	3176C		3196		3412E HEUI	
Rated Engine RPM	2000		2000		2000	
No. of Cylinders	6		6		12	
Displacement	10.3 L	628 in³	11.9 L	726 in³	27 L	1647 in³
Max. Torque Rise	50%		50%		30%	
No. of Speeds Forward/Reverse	8/8		8/8		6/3	
Top Speed: Forward	48.1 km/h	28.7 mph	48.1 km/h	29.9 mph	37.7 km/h	23.4 mph
Reverse	51.1 km/h	31.8 mph	43.2 km/h	26.9 mph	36.1 km/h	22.4 mph
Std. Tires — Front & Rear	16.00-24 (12 PR) (G-2)		18.00-25 (12 PR) (E-2)		29.5-29	
Front Axle/Steering:						
Oscillation Angle	32°		32°		32°	
Wheel Lean Angle	18°		18°		18°	
Steering Angle	50°		50°		50°	
Articulation Angle	20°		20°		25°	
Minimum Turning Radius**	8 m	26'3"	8.2 m	27'0"	12 m	39'11"
Front Frame Section Modulus:						
Min.	2649 cm³	162 in³	3746 cm³	228 in³	9655 cm³	589 in³
Max.	5091 cm³	310 in³	8057 cm³	491 in³	22 490 cm³	1372 in³
No. Circle Support Shoes	6		6		8	
Hydraulics: Pump Type	Axial Piston		Axial Piston		Axial Piston	
Max. Pump Flow	243 L/min	64.1 gpm	243 L/min	64.1 gpm	508 L/min	134 gpm
System Capacity	125 L	32.5 U.S. gal	130 L	33.8 U.S. gal	250 L	65 U.S. gal
Implement Pressure: Max.	24 150 kPa	3500 psi	24 150 kPa	3500 psi	24 150 kPa	3500 psi
Min.	3100 kPa	450 psi	3100 kPa	450 psi	3100 kPa	450 psi
Interior Sound Level/SAE J919	80 dBA		80 dBA		75 dBA	
Electrical:						
System Size	24V		24V		24V	
Std. Battery CCA @ 0° F	1100		1300		1300	
Std. Alternator	75 amp		75 amp		100 amp	
GENERAL DIMENSIONS:						
Height (to top of ROPS)	3.34 m	10'11"	3.52 m	11'7"	4.35 m	14'3"
Height (stripped top)***	2.85 m	9'4"	3.11 m	10'2"	—	
Overall Length	9.34 m	30'8"	9.99 m	32'9"	14.16 m	46'6"
With Ripper & Pushplate	10.77 m	35'4"	11.62 m	38'2"	15.80 m	51'10"
Wheelbase	6.55 m	21'6"	6.96 m	22'10"	10.23 m	33'7"
Blade Base	2.86 m	9'5"	3.07 m	10'1"	4.08 m	13'4"
Overall Width (at top of front tires)	2.82 m	9'3"	3.08 m	10'1"	4.23 m	13'8"▲
Standard Blade: Length	4.27 m	14'0"	4.88 m	16'0"	7.32 m	24'0"
Height	686 mm	2'3"	787 mm	2'7"	1067 mm	3'6"
Thickness	25 mm	1"	25 mm	1"	51 mm	2"
Lift Above Ground	419 mm	16.5"	419 mm	16.5"	634 mm	25"
Max. Shoulder Reach:◄						
Frame Straight	2.08 m	6'10"	2.31 m	7'7"	3.22 m	10'7"
Articulated Position	3.07 m	10'1"	3.37 m	11'1"	5.05 m	16'7"
Fuel Tank Capacity	416 L	110 U.S. gal	492 L	130 U.S. gal	1207 L	319 U.S. gal

*Operating Weight — based on standard machine configuration with full fuel tank, coolant, lubricants and operator. 24H includes ripper.
**Minimum Turning Radius — combining the use of articulated frame steering, front wheel steer and unlocked differential.
***Height (stripped top) — without ROPS, exhaust, seat back or other easily removed encumbrances.
◄Applicable for the standard blade with hydraulic sideshift and tip control. Maximum shoulder reach is obtainable to the right on 14H, both sides on 16H.
▲Overall width with optional rear fenders 4.22 m (13'10").

[illegible]VEL SPEEDS @ RATED RPM WITH STD. TIRES (ALL VERSIONS)

Gear		1		2		3		4		5	
		km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
[illegible]	Forward	3.6	2.3	5.0	3.1	7.2	4.5	9.9	6.2	15.7	9.[illegible]
	Reverse	2.9	1.8	6.4	3.3	7.8	4.9	12.3	7.7	23.1	14.[illegible]
[illegible]	Forward	3.6	2.3	4.9	3.1	7.2	4.5	9.9	6.2	15.4	9.[illegible]
	Reverse	2.9	1.8	5.4	3.3	7.8	4.9	12.1	7.5	23.0	14.[illegible]
[illegible]	Forward	3.8	2.3	5.1	3.2	7.4	4.6	10.3	6.4	16.2	10.[illegible]
	Reverse	3.0	1.8	5.8	3.5	8.1	5.0	12.8	7.9	23.8	14.[illegible]
[illegible]	Forward	3.8	2.3	5.1	3.2	7.4	4.6	10.3	6.4	16.2	10.[illegible]
	Reverse	3.0	1.8	5.6	3.5	8.1	5.0	12.8	7.9	23.9	14.[illegible]
[illegible]	Forward	3.8	2.3	5.1	3.2	7.4	4.6	10.3	6.4	16.2	10.[illegible]
	Reverse	3.0	1.8	5.6	3.5	8.1	5.0	12.8	7.9	23.9	14.[illegible]
[illegible]	Forward	3.8	2.4	5.1	3.2	7.5	4.7	10.3	6.4	16.0	9.[illegible]
	Reverse	3.0	1.9	5.6	3.5	8.1	5.1	12.6	7.9	23.7	14.[illegible]
[illegible]	Forward	3.8	2.4	5.1	3.2	7.5	4.7	10.3	6.4	16.0	9[illegible]
	Reverse	3.0	1.9	5.6	3.5	8.1	5.1	12.6	7.9	23.7	14[illegible]
[illegible]	Forward	4.0	2.5	5.7	3.5	7.7	4.8	11.1	6.9	16.8	10[illegible]
	Reverse	4.5	2.8	6.3	3.9	8.5	5.3	12.3	7.6	18.6	11[illegible]
[illegible]	Forward	4.2	2.6	5.9	3.7	8.0	5.0	11.6	7.2	17.5	10[illegible]
	Reverse	3.8	2.3	5.3	3.3	7.2	4.5	10.4	6.5	15.7	9[illegible]
[illegible]H Wide-[illegible]ed tires	Forward	3.2	2.0	4.9	3.1	8.5	5.3	13.1	8.1	24.3	15[illegible]
	Reverse	4.7	2.9	12.6	7.8	36.1	22.4	—	—	—	—

[illegible]H Standard Version travel speeds, multiply by 0.95.

[illegible]LL WHEEL DRIVE (AWD)

	143H	
[illegible]er with AWD engaged: VHP	149 kW	200 hp
VHP Plus	164 kW	220 hp
[illegible]rking Range:		
[illegible]orward Gears	1-7	
[illegible]everse Gears	1-5	
[illegible]mp Type	Axial Piston	
[illegible]em Capacity	175 L/min	46.2 gpm
[illegible]rating Pressure: Max.	35 000 kPa	5080 psi
Min.	5500 kPa	800 psi

[illegible]M10 — MOUNTED SCARIFIERS

	120H, 135H, 12H, 14[illegible]	
[illegible]ype	V	
[illegible]rking Width	1184 mm	46.6"
[illegible]th (Max.)	292 mm	11.5"
[illegible]mber of Shank Holders	11	
[illegible]pacing	116 mm	4.6"

[illegible]able on Global Versions only.

APPENDIX

APPENDIX C 2007 CONSTRUCTION RECORD

C.1 CARAT LAKE WORK

Initial preparation for construction of the shoals was carried out under the direction of Tahera. At Carat Lake an ice road, consisting of two lanes, was constructed in January 2007. Also, the six shoals (Figure 2) were surveyed and the ice around the shoals was cleared of snow at the same time.

In February, the first nine truck loads of Run of Mine (ROM) material were dumped directly onto the ice within the No. 3 shoal area. Holes drilled by TDC in the ice cover close the rock location indicated an ice thickness of 1.5 m. A negative free board (flooding of the ice) (see Photo 6) was observed and hence additional rock placement was halted until further investigations could be conducted. Flooding of the shoal areas initiated to increase ice thickness.

EBA Engineering Consultants Ltd. (EBA) was retained in mid March to provide ice engineering services.

On March 22, 2007, access to the shoals and the shoal areas were cleared of snow. The weight of the snow alone was observed by EBA to cause substantial depression of the ice at several shoals.

EBA guided snow clearing to reduce the influence of the snow loads on the works. Snow north of the Carat Lake Shoals 1 and 2 was pushed back towards the lake centre, away from the shoals by a 950 loader as shown in Photo 7. Large amounts of snow had accumulated east of Shoal 3 which was pushed towards the shore with a grader and a loader over a period of 3 hours (see Photo 8).

EBA requested survey at each of the Carat Lake shoals. Following the survey of the six shoals a survey stake was placed and a hole was drilled through the ice at each corner of the six shoals. Ice thickness, free board (FB) and water depth were measured and recorded. Devices for measuring ice thickness and water depth are shown in Photo 9. The results of the survey are listed in Table 2. The corner numbering system corresponds to the one given in Mainstream Table 1.

Summary of the observations:

- the average ice thickness was 1.75 m with a FB of 0.175 m;
- the FB at one corner of Shoal 2 and one corner of Shoal 3 (flooding) was greatly reduced due to previous loading of the ice sheet; and
- water depths varied between 1.75 m (grounding) and 9.60 m.

Both the ROM material and 150 mm maximum size crush were hauled from the mine to the shoals. Caterpillar 730 trucks were made available for material transport.

The 150 mm materials placed as a cushioning layer to protect the ice from ROM boulders.

ROM material was sorted before loading of the trucks to comply with the requirements of the DFO as outlined in Section 2. Loads with excess fines were rejected.

To accelerate work some hauling of materials occurred on night shift. During the night truck movements were restricted to shore fast ice and only involved the transport of 150 mm material.

Trucks started with the rock placement always at the deepest water and they approached the shoals always from shore fast ice.

A summary of the rock volumes and dates of completion is provided in Table 1 of the Tables section of the report.

The remaining three Carat Lake shoals were loaded differently. No FB monitoring holes were drilled in the shoal vicinity and hence no FB measurements were taken. Instead the centre deflection of the shoal was measured with the aid of a survey level and rod.

Active weakening of the ice can be done by cutting slots or drilling holes. Passive weakening can be accomplished by accelerated thawing of the ice cover. For instance, the ice can be covered with a material that absorbs considerably more solar radiation than the surrounding ice cover. At Carat Lake a combination of both methods was applied.

As shown in Photo 20, the ice was cut with a chainsaw, equipped with a 1 m long blade. Cuttings from the slot were removed and the slot was covered with gravel to prevent it from refreezing and from filling it with blowing snow.

Cutting the ice surrounding Shoal #6 commenced April 17 as can be seen in Photo 21. Cracks on the ice are marked with orange paint.

Around May 15, Shoal #3, the first shoal, broke through the ice. An aerial photo (Photo 22), was taken April 18 from East, shows the distribution of ROM material on the shoal. Another aerial photo (Photo 23) was taken on May 24 from approximately the same position. A close-up photo (Photo 24) shows some rock material above the water/ice surface which can be attributed to the shallower water depth. Of interest is the difference in texture of the broken ice pieces floating over the shoal area. Large ice blocks turned up in the middle of the shoal as shown on Photo 25 which was taken on May 16, shortly after the rock broke through the ice.

An aerial photo taken North of Shoal #2 on May 25 (Photo 26) shows also partial submergence of the rock at the east end of the shoal. As in the case of Shoal #3, most of the rock material submerged first at the deeper end of the shoal. Again, of interest are the different types of floating ice pieces. The thermistor bank can be seen in the background, south of the shoal.

Comparing Photo 26 with Photo 27 (taken May 28), shows that most of the smaller (and thinner) ice pieces have disappeared due to melting. Of interest is also the rapid melting of the ice road leading to the shoals in the background.

Shoal #1, Shoal #4, Shoal #5, and Shoal #6 were still intact on May 28 as shown on Photo 28.

C.2 LAKE O1 SHOALS

There are only two shoals, 100 m long and 10 m wide at Lake O1 as shown on Figure 5.

Prior to bringing any equipment on the ice, the ice thickness was checked in the afternoon of April 13 and found to be in excess of 1.70 m. The average snow cover amounted to about 0.20 m. The shoals were surveyed and a grader cleared the ice from snow off the shoal area on the same day as can be seen in Photo 29. A short access road was constructed from the airport road to the lake.

Based on the experience gained from the shoal construction at Carat Lake, no FB monitoring holes were drilled at the four shoal corners and hence no ice thickness, FB and water depth measurements were taken at Lake O1.

Six inch (150 mm Maximum Diameter) crush material was hauled from the crushing plant to a storage place close to the lake. From there the material was loaded onto the 730 trucks which transported and dumped it on the shoal areas. A type 14 grader was used to distribute the 150 mm Maximum Size crush over the shoals.

Between 12:00 pm and 9:40 pm, 36 truck loads of ROM material were placed on Shoal #1. The remaining 13 loads were placed the next day (April 16) between 7:50 am and 10:30 am.

Placing the ROM at Lake O1 was done differently compared to the method used at the Carat Lake due to the difference in shoal shape. Two long rows of material were placed side by side starting at one end of the shoal and working towards the other shoal end as shown in Photo 30 for Shoal #2.

Deflection measurements were taken with a survey level at the two ends and the centre of the shoal.

Substantial cracks of the ice cover developed between Shoal #1 and the shore fast ice (Photo 31) as well as some circumferential cracks at the ends of Shoal #1 as shown in Photo 30 and Photo 32.

Since the trucks were needed for dam construction, shoal construction was halted for two days. With several interruptions, placement of the ROM material commenced on April 17 and was completed at 9:30 pm, April 19. Blowing snow and high winds reduced the visibility to a few metres during the placement of the last ten truck loads.

Deflections were measured at the ends and the centre of both shoals and the crack development was monitored during and after the rock placement. It was found that the deflections at the Lake O1 shoals were considerably less than those measured at the Carat Lake. However, cracks at the Lake O1 ice cover were much more severe and more extensive. The crack between Shoal #1 and the shore fast ice opened up about 7 cm in width and about 0.90 m in depth.

It is believed that differences in load distribution are a major contributor to the difference in the performance of the ice covers.

Of interest is also that circumferential cracks developed well into the floating ice region.

No shoal failures were reported as of May 28 when some aerial photos were taken at Lake O1. Some flooding of Shoal #1 can be seen in Photo 33 which took place in the middle of the shoal between the shoal and the shore fast ice. There is no indication of flooding around Shoal #2.