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10 February 2003

Mackenzie Valley Environmental Impact Review Board (MVEIRB)
Box 938, 5102 – 50th Avenue
Yellowknife, NT X1A 2N7

Attention: Glenda Fratton, Environmental Assessment Coordinator

Dear: Glenda

**SUBJECT: Fish Habitat Information and Loss Accounting**

Please accept the attached technical memo titled "Fish Habitat Information and Loss Accounting for Waterbodies Situated on the Northwest Peninsula of Snap Lake" for submission to the Public Registry. This memo was compiled in response to issues raised by the Department of Fisheries and Oceans (DFO) during the MVEIRB Technical Sessions and a follow-up letter from DFO (15 January 2003, previously submitted to the Public Registry) providing clarification on the additional information required.

Should you have any questions, please feel free to contact the undersigned.

Sincerely,
**SNAP LAKE DIAMOND PROJECT**

for Robin Johnstone
Senior Environmental Manager

DE BEERS CANADA MINING INC.

#300 – 5102 50th AVENUE
YELLOWKNIFE NT X1A 3S8 CANADA
TEL (867) 766-7300 FAX (867) 766-7347

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**REPORT ON**

# FISH HABITAT INFORMATION AND LOSS ACCOUNTING FOR WATERBODIES SITUATED ON THE NORTHWEST PENINSULA OF SNAP LAKE

Submitted to:

Department of Fisheries and Oceans
Mackenzie Valley Environmental Review Board
as supplemental information to the Snap Lake
Diamond Project Environmental Assessment

DISTRIBUTION:

2 Copies - De Beers Canada Mining Inc., Yellowknife, Northwest Territories
2 Copies - Golder Associates Ltd., Saskatoon, Saskatchewan

February 2003
022-6659/5300

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## 1.0 INTRODUCTION

De Beers Canada Mining Inc. (De Beers) prepared the following supplemental information to the Snap Lake Diamond Project Environmental Assessment Report (EAR). This document was submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) and the Department of Fisheries and Oceans Canada (DFO) as follow-up to the commitment made on Day Four of the MVEIRB Technical Sessions conducted in November 2002. On that day, DFO noted that the EAR provided an accounting of the fish habitat in Snap Lake, but did not account for habitat lost or gained as a result of the project on lakes situated within the project footprint on the northwest peninsula. To that end, DFO (letter dated January 15, 2003) provided De Beers with clarification on the additional information that was required, whereas De Beers agreed to provide the required information in a document that would be placed on the public record. The present report provides the requested supplemental information on waterbodies located on the northwest peninsula of Snap Lake.

Specifically this report is intended to:

- provide rationale used to include or exclude a waterbody on the northwest peninsula in the fish habitat impact assessment (Section 2);
- detail the types of waterbodies on the northwest peninsula and available bio-physical information for each waterbody (Section 3 and Section 4);
- discuss the suitability of each affected waterbody as fish habitat or its capability to contribute to a fish community (Section 5);
- reiterate the assessment of the loss of fish habitat to the Snap Lake ecosystem (Section 6);
- account for the losses of fish habitat, if necessary, on the northwest peninsula (Section 7); and,
- summarize the losses of fish habitat on the northwest peninsula and the losses and gains of fish habitat in Snap Lake and the next steps to be taken in "No Net Loss" (NNL) accounting (*i.e.*, related to DFO's [1986] policy of NNL in fish habitat).

## 2.0 WATERBODY SELECTION AND SCREENING APPROACH

A screening process was undertaken to determine the suitability and use of these waterbodies as fish habitat, to evaluate their contribution to fish habitat in Snap Lake, and to select waterbodies to be included in the assessment of effects on fish habitat. For the purposes of the EAR and this document, fish habitat was defined according to the *Fisheries Act*: "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes". Screening criteria included:

- location of the waterbody in relation to the project;
- physical nature of the waterbody (*e.g.*, depth);
- hydrologic conditions of the drainage into and out of the waterbody;
- connections to any other waterbodies; and,
- presence of overwintering habitat.

The presence of overwintering habitat is a significant factor in determining the suitability of a waterbody to provide permanent fish habitat. Consequently, the overwintering capacity of waterbodies, as measured by depth, was taken into account. The screening process is outlined in Table 1 and each step in the screening process is described in the following sections. Results of the screening and baseline information collected on waterbodies within the northwest peninsula are provided in Sections 3, 4, and 5.

### 2.1 Step 1: Identifying Waterbodies within or near the Project

In 1999, waterbodies within or near the project area were identified based on input from Winspear Resources and De Beers Canada Mining Inc. that specified the location of proposed project elements. Waterbodies within or immediately adjacent to the proposed project area were located on a 1:50,000 National Topographic System, Natural Resources Canada (NTS) topographical map and an air photograph of the area. The area considered for the identification of waterbodies was larger than the final project footprint presented in the EAR.

### 2.2 Step 2: Identifying the Potential for Waterbodies to be affected by the Project

Once a final site layout was determined, the waterbodies with the potential to be affected by the proposed project were identified. This included waterbodies that will be directly affected by an element of the project but did not include waterbodies within the project footprint that were not affected by project elements due to changes and improvements at the project design phase (*e.g.*, the emulsion road was routed to avoid impact within the Stream 27 basin).

**Table 1**
**Steps used to determine if a Waterbody should be included in a Fish Habitat Impact Assessment**

| Step | Question | Answer | Outcome |
|---|---|---|---|
| Step 1 | Identify the waterbodies near or within a conceptual project area. | -- | include all |
| Step 2 | Will the waterbody actually be affected by the project? | Yes | include |
| | | No | exclude |
| Step 3 | Is the waterbody present, and does it have aquatic habitat as evaluated through field surveys and Ecological Land Classification from Land Sat imagery? | Yes | include |
| | | No | exclude |
| Step 4 | Does the waterbody have the potential to be fish habitat in a direct or indirect manner? | Yes | include: proceed with (1) environmental assessment of impacts of loss of fish habitat to watershed and (2) accounting of lost fish habitat due to the project for *no net loss* plan |
| | | No | exclude |

Waterbodies that would not be affected by the project were excluded from further consideration.

## 2.3 Step 3: Is the Waterbody Present as Denoted on a Topographical Map?

Waterbodies with the potential to be affected by the proposed project were surveyed by fisheries biologists in spring 1999 and 2001 and by a vegetation ecologist in July 1999. Fisheries biologists conducted aerial and ground surveys of the waterbodies. The vegetation ecologist reviewed 1994 Land Sat imagery of the project area and then conducted aerial and ground-truthing surveys to confirm the Ecological Land Classification (ELC) units defined by the Land Sat (see Section 10.3.1.4.1 of the EAR).

Information from the ELC and the field surveys was used to determine if a waterbody was present and had the physical characteristics denoted on the topographical map and air photograph. Waterbodies that were not present or were not aquatic habitat were excluded. Specifically, habitats that were not aquatic and were defined as terrestrial habitats (*e.g.*, heath boulder, closed spruce forest) through the ELC were excluded from the assessment. Waterbodies that were present and were lakes, streams, and wetlands moved to Step 4 of the assessment.

### 2.4 Step 4: Does the Waterbody Support or have the Potential to Support a Fish Community?

Waterbodies that did not contain fish were deemed to have no ability to support fish permanently because of the following characteristics: a) small size; b) shallow (greater than 90% of the lake <3 m deep); and, c) isolated from fish-bearing waterbodies (in accessible or undefined connections). Such waterbodies were determined to have no potential to support a fish community. This evaluation was done through a combination of aerial reconnaissance and field surveys. These waterbodies were excluded from the assessment.

Waterbodies that were determined to support or have the potential to support a fish community, because fish were present or a waterbody connected to another waterbody with fish (permanent or temporary contributions), were carried forward in the fish habitat impact assessment presented in the EAR. The environmental impact of the loss of the fish habitat to the Snap Lake watershed was then completed (EAR Section 9.5). The area of fish habitat lost was calculated for the development of a NNL Plan for the Snap Lake Diamond Project. Accounting for lost habitat in Snap Lake itself was presented in Appendix IX.12 of the EAR. Such accounting for waterbodies on the peninsula is new information that was not previously presented as there was no requirement to do so under the Terms of Reference for the EAR.

The remainder of this document will detail the results of the screening, summarize the EAR findings, and presents habitat loss accounting for the waterbodies on the northwest peninsula.

## 3.0 WATERBODIES ON THE NORTHWEST PENINSULA (STEP 1)

Waterbodies within or immediately adjacent to the proposed Snap Lake Diamond Project footprint were delineated from a 1:50,000 topographical map (75M/10) and an August 1998 air photograph of the project area. This delineation was done in spring 1999 when the proposed project footprint was still conceptual, and thus, waterbodies in an area larger than the final project footprint presented in the EAR were examined.

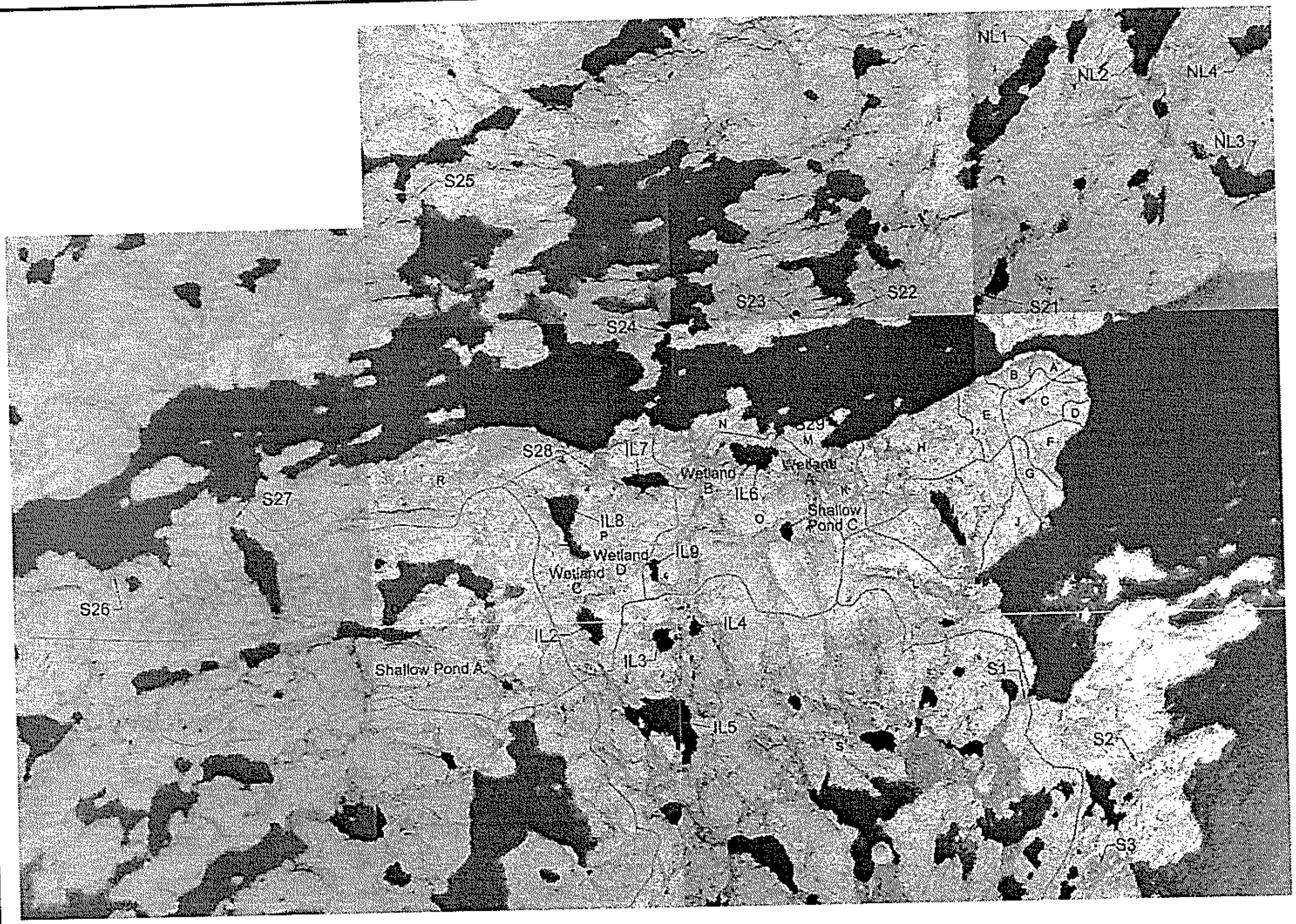
Four types of waterbodies were identified on the topographical map: lakes, shallow ponds, streams, and wetlands. Shallow ponds appear as very small lakes on the topographical map and were assessed by aerial reconnaissance and ground-truthing to confirm size, depth, and connections to other waterbodies. The shallow pond category was then applied to those waterbodies with a small surface area (<1 ha) and observed shallow depths. Field sampling sessions on the shallow ponds supported this categorization as distinct from the category of 'lake'.

Twenty waterbodies were determined to be within or immediately adjacent to the proposed project (Figures 1, 2, 3, 4, and 5). These waterbodies were given names based on the type of habitat and relevance to Snap Lake. For example, inland lakes were defined as all lakes on the northwest peninsula (*i.e.*, "inland" from Snap Lake) and were numbered from one to nine. Shallow ponds and wetlands were given alphabetic names. Inlet streams of Snap Lake were numbered clockwise around the lake in consecutive order starting at the original Snap Lake Exploration Camp (Snap-Ex) facilities (Figure 1.2-3 and Figure 9.5-3 of the EAR). The twenty waterbodies within or immediately adjacent to the proposed project are listed below:

- Inland Lake (IL) 2, 3, 4, 5, 6, 7, 8[1], and 9;
- shallow pond A, B, and C;
- stream (S) 1, S27, S28, S29, shallow pond B stream; and,
- wetland A, B, C, and D.

Physical and biological data for the above waterbodies are presented in Section 4 below.

[1] Please note that the Environmental Assessment contained an error in Table 9.5-15. Data attributed to IL8 (with the exception of lake area) were in fact the data results for IL9. Data attributed to IL9 (with the exception of lake area) were in fact the data results for shallow pond C.




**LEGEND**

| | |
|---|---|
| (D) | DRAINAGE BOUNDARIES |
| S# | STREAMS |
| IL# | INLAND LAKES |
| NL# | NORTHERN LAKES |

**NOTE**

DRAINAGE BOUNDARIES TAKEN FROM FIGURE 9.3-2 OF THE ENVIRONMENTAL ASSESSMENT REPORT.

**REFERENCE**

AIRPHOTOS FROM SEPTEMBER 1998.

500 0 500
SCALE METRES

N

PROJECT

DE BEERS

TITLE

**AERIAL PHOTOGRAPH OF THE SNAP LAKE NORTHWEST PENINSULA**

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
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| PROJECT | 022-6659.5300 | | FILE No. | |
| DESIGN | | | SCALE AS SHOWN | REV. 0 |
| CADD | SB | 05/02/03 | FIGURE: 1 | |
| CHECK | | | | |
| REVIEW | | | | |

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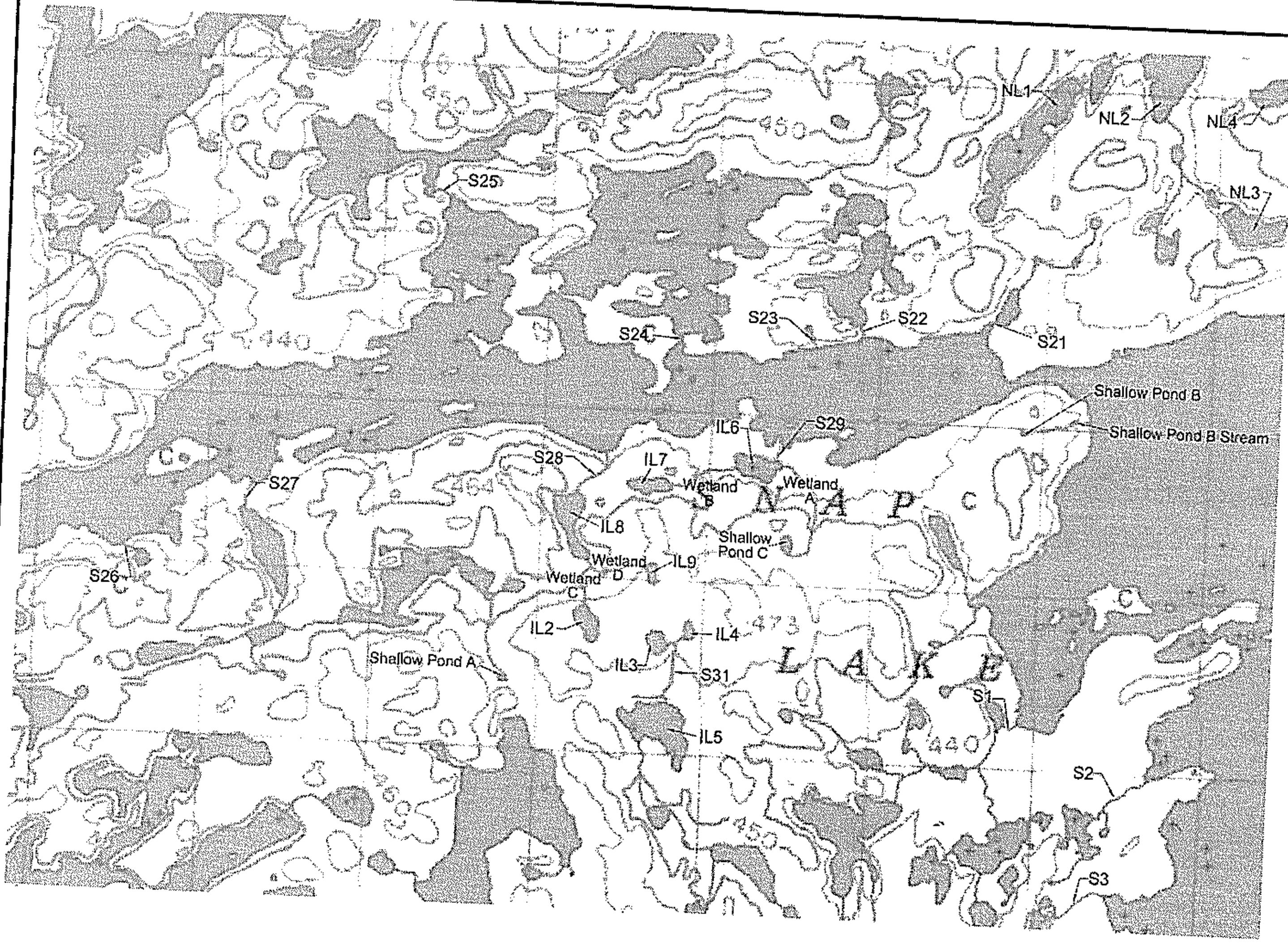


**LEGEND**

| | |
|---|---|
| S# | STREAMS |
| IL# | INLAND LAKES |
| NL# | NORTHERN LAKES |

**REFERENCE**

TOPOGRAPHIC MAP FROM SCAN OF NTS MAP 75M/11.

500 0 500
SCALE METRES

PROJECT

DE BEERS

TITLE

**TOPOGRAPHICAL MAP OF THE SNAP LAKE NORTHWEST PENINSULA**

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
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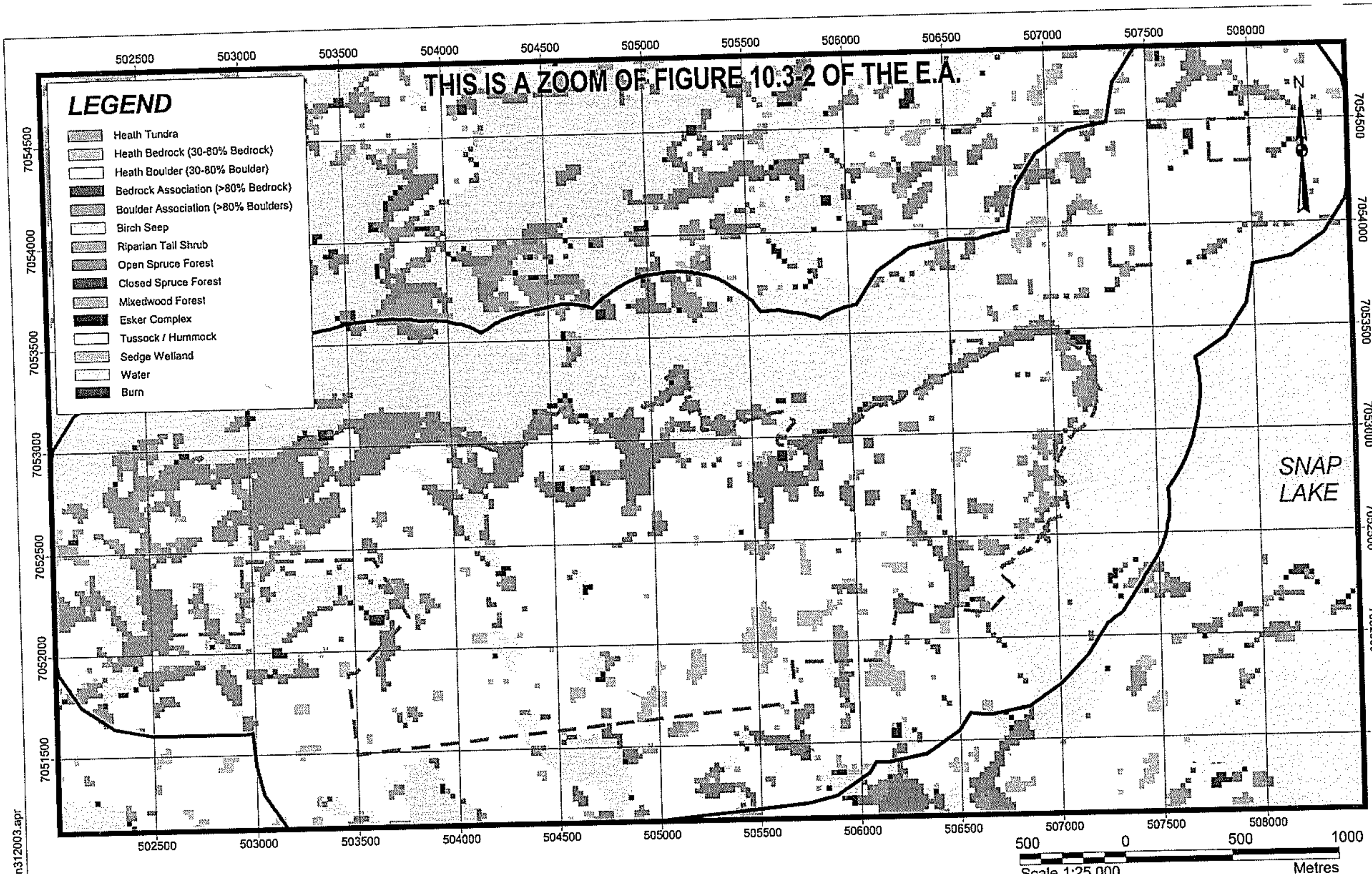
| REVIEW | | | | |

N:\Active\6600\022-6659 De Beers EA Support\cad\5300\ Drawing file: 6659-5300-HABITATMEMO-FIG2.dwg Feb 06, 2003 - 10:10am




## LEGEND

Vegetation Local Study Area

Project Footprint

## REFERENCE

Digital map data from National Topographic Data Base (NTDB 1:250,000 scale).
Datum: NAD 83 Projection: UTM Zone 12 Imagery and land cover information derived from Landsat TM (Bands 5,4,3) Image Date: Aug.2, 1994

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PROJECT

DE BEERS

TITLE

ECOLOGICAL LAND CLASSIFICATION OF THE SNAP LAKE NORTHWEST PENINSULA

Golder Associates
Calgary, Alberta

| PROJECT No. 022-6659.5300 | | | SCALE AS SHOWN | REV. 0 |
|---|---|---|---|---|
| DESIGN | HM | 30 Jan. 2003 | FIGURE 3 | |
| GIS | RD | 30 Jan. 2003 | | |
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| REVIEW | HM | 30 Jan. 2003 | | |

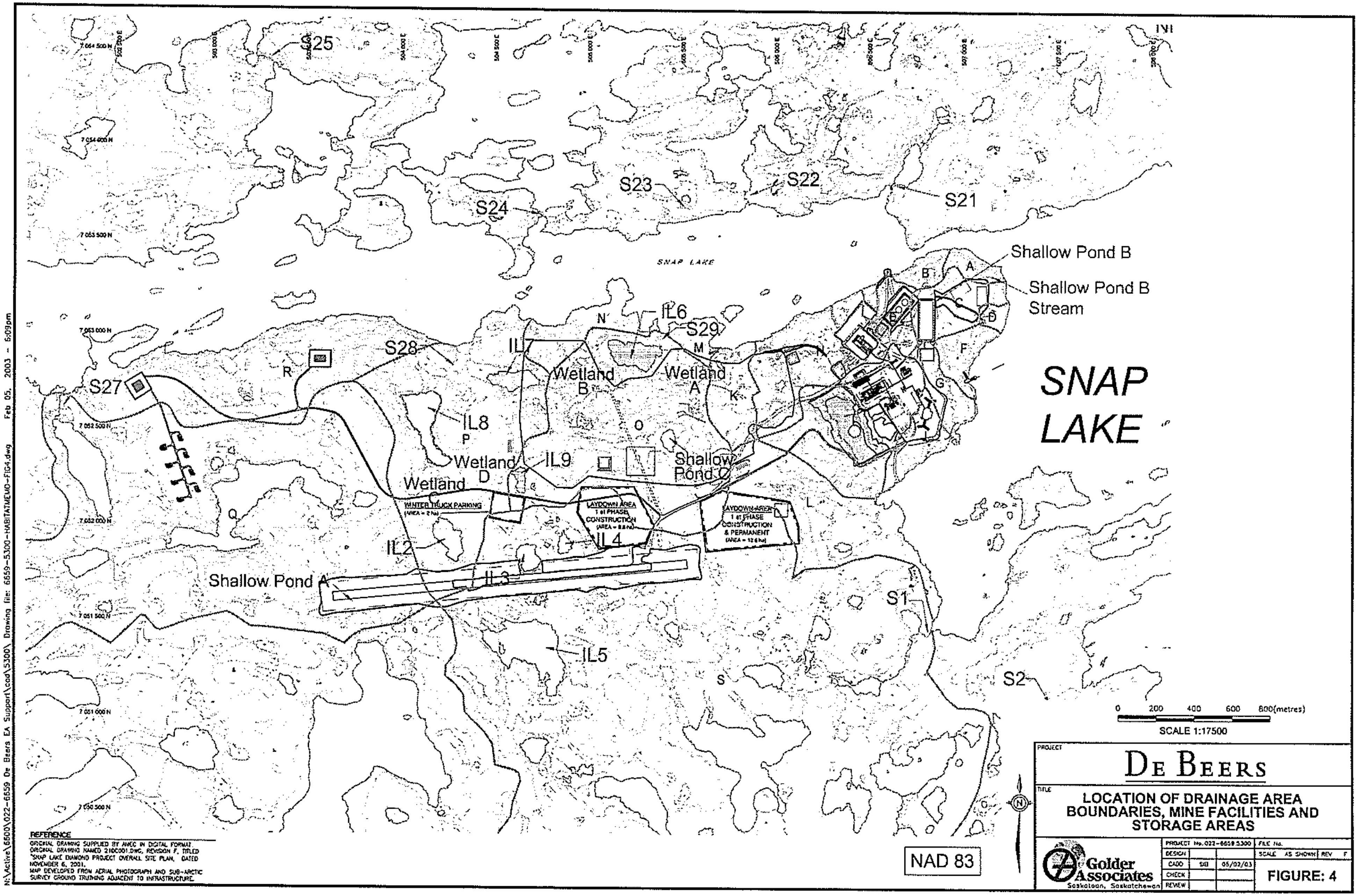
S25
S24
S23
S22
S21
SNAP LAKE
Shallow Pond B
Shallow Pond B
Stream
IL6
S29
IL7
S28
R
S27
Wetland
B
Wetland
A
IL8
P
O
Wetland
D
IL9
Shallow
Pond C
Wetland
C
WINTER TRUCK PARKING
LAYDOWN AREA
1 st PHASE
CONSTRUCTION
LAYDOWN AREA
1 st PHASE
CONSTRUCTION
& PERMANENT
Q
IL2
IL4
IL3
Shallow Pond A
L
S1
IL5
S
S2
SNAP
LAKE
0 200 400 600 800(metres)
SCALE 1:17500
REFERENCE
ORIGINAL DRAWING SUPPLIED BY AMEC IN DIGITAL FORMAT.
ORIGINAL DRAWING NAMED 210C001.DWG, REVISION F, TITLED
"SNAP LAKE DIAMOND PROJECT OVERALL SITE PLAN, DATED
NOVEMBER 6, 2001.
MAP DEVELOPED FROM AERIAL PHOTOGRAPH AND SUB-ARCTIC
SURVEY GROUND TRUTHING ADJACENT TO INFRASTRUCTURE.
NAD 83
PROJECT
DE BEERS
TITLE
LOCATION OF DRAINAGE AREA
BOUNDARIES, MINE FACILITIES AND
STORAGE AREAS
Golder Associates
Saskatoon, Saskatchewan
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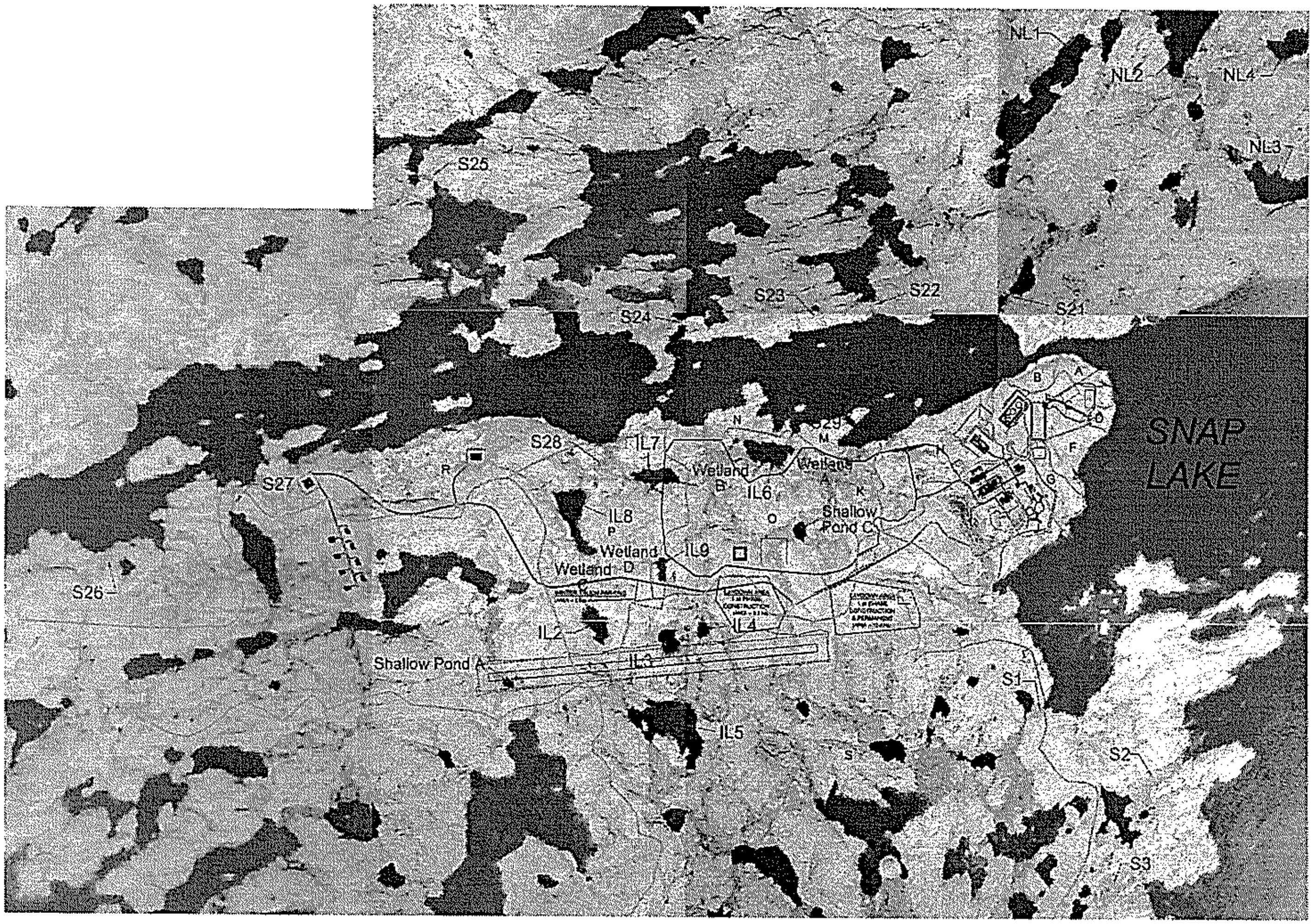
FIGURE: 4




**LEGEND**

| | |
|---|---|
| D | DRAINAGE BOUNDARIES |
| S# | STREAMS |
| IL# | INLAND LAKES |
| NL# | NORTHERN LAKES |

**NOTE**

DRAINAGE BOUNDARIES TAKEN FROM FIGURE 9.3-2 OF THE ENVIRONMENTAL ASSESSMENT REPORT.

**REFERENCE**

AIRPHOTOS FROM SEPTEMBER 1998.

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PROJECT

# DE BEERS

TITLE

## AERIAL VIEW OF THE PROPOSED SNAP LAKE DIAMOND PROJECT ON THE SNAP LAKE NORTHWEST PENINSULA

Golder Associates
Saskatoon, Saskatchewan

| | | | |
|---|---|---|---|
| PROJECT | 022-6659.5300 | FILE No. | |
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# 4.0 DATA FROM WATERBODIES ON THE NORTHWEST PENINSULA OF SNAP LAKE

Data collected during field surveys carried out in 1999, 2001, and 2002 on waterbodies of the northwest peninsula of Snap Lake are listed below. A summary of the dates and scope of work for each waterbody is presented in Table 2. Specific methodology for the field programs was presented in the EAR (Section 9.5 and Appendix IX.9). Surface areas were derived from NTS topographical maps that covered the project area (Figure 4).

## 4.1 Peninsula Hydrology Description

### 4.1.1 Drainage Rates and Flow Directions from Small Lake Basins

Expected flow rates, volumes, and likely drainage paths were estimated for a series of small inland lakes located in the vicinity of the Snap Lake mine footprint area. Runoff rates determined for these lakes are based on measured flow from the H4 watershed located immediately south of the "O" watershed. The H4 watershed is considered very similar to the IL watersheds in terms of numbers of lakes, muskegs areas, and surficial material and other physical characteristics that influence runoff.

Flow data collected during the spring runoff period (June 1 to June 30) of 1999 were used in the current assessment. However, subsequent analyses indicated that runoff levels in 1999 were high (*i.e.*, in the vicinity of the 1:10 year magnitude and frequency). Average flow conditions were determined by adjusting the 1999 values downward according to the ratio of 1999 flows to the mean value for June at the outlet of Snap Lake. June 1999 values were estimated at 1.7 times greater than the average outflow for that month. Thus, a coefficient of 0.58 was applied to the 1999 values to provide an estimate of mean spring (June) run off for all locations in the watersheds are provided in Table 2.

Broad drainage boundaries within the footprint area were obtained from Figure 9.3-16 from the Snap Lake EAR, while small sub-watersheds for the inland lakes were determined from topographic gradients, water and muskeg elevations, and photographic information.

Table 2 provides estimated outflow from lakes IL2, IL3, IL4, IL6, IL7, IL8, IL9, and from shallow ponds A and C. Both 1999 spring runoff values and the estimated mean spring run off values are provided.

**Table 2**
**Estimated Outflow from Selected Waterbodies Occurring on the Mine Footprint Area during the Spring Freshet (June 1 - June 30)**

| Waterbody | Lake Surface Area ($km^2$) | Contributing Drainage ($km^2$) | Unit Area Runoff ($m^3/s/km^2$) | Mean Outflow ($m^3/s$) | Total Volume ($dam^3$) |
|---|---|---|---|---|---|
| **Mean Spring Runoff** | | | | | |
| Shallow Pond C | 0.008 | 0.36 | 0.0238 | 0.009 | 22 |
| IL6 | 0.029 | 0.84 | 0.0238 | 0.020 | 52 |
| IL9 | 0.008 | 0.06 | 0.0238 | 0.002 | 4 |
| IL7 | 0.024 | 0.18 | 0.0238 | 0.004 | 11 |
| IL8 | 0.043 | 0.50 | 0.0238 | 0.012 | 31 |
| IL2 | 0.019 | 0.11 | 0.0238 | 0.003 | 7 |
| IL3 | 0.012 | 0.09 | 0.0238 | 0.002 | 6 |
| IL4 | 0.005 | 0.09 | 0.0238 | 0.002 | 6 |
| Shallow Pond A | 0.003 | 0.13 | 0.0238 | 0.003 | 8 |
| **1999 Spring Runoff** | | | | | |
| Shallow Pond C | 0.008 | 0.36 | 0.0407 | 0.015 | 38 |
| IL6 | 0.029 | 0.84 | 0.0407 | 0.034 | 89 |
| IL9 | 0.008 | 0.06 | 0.0407 | 0.003 | 7 |
| IL7 | 0.024 | 0.18 | 0.0407 | 0.007 | 19 |
| IL8 | 0.043 | 0.50 | 0.0407 | 0.020 | 53 |
| IL2 | 0.019 | 0.11 | 0.0407 | 0.004 | 12 |
| IL3 | 0.012 | 0.09 | 0.0407 | 0.004 | 10 |
| IL4 | 0.005 | 0.09 | 0.0407 | 0.004 | 9 |
| Shallow Pond A | 0.003 | 0.13 | 0.0407 | 0.005 | 14 |

Note: $km^2$ = square kilometres; $m^3/s/km^2$ = cubic metres per second per square kilometre; $m^3$ = cubic metres; $dam^3$ = cubic decametres.

In all cases, drainage development is poorly defined. Runoff tends to collect in low-lying areas or muskegs, which often encompass the small shallow lakes. In spring, inflow into these lakes and muskegs may be sufficient to allow surface drainage but these flows do not tend to form distinct channels. Rather, drainage passes through boulder areas and muskegs.

### 4.1.2 Shallow Pond A

Shallow Pond A has a surface area of 0.003 $km^2$ (0.3 ha) and a local drainage area of 0.13 $km^2$ (13 ha). Much of the pond is surrounded by muskeg and the likely drainage path is northward through a series of muskeg areas, eventually reporting to IL11. Mean spring outflow from the pond is estimated at 0.003 $m^3/s$ (3 L/s). Given the extensive muskeg surrounding the pond (approximately half the drainage area) it is likely that much of the spring runoff is attenuated in the muskeg and evaporated over the summer. While it is not known whether an actual surface channel exists at this location, it is likely that the flowpath would be dry or contain only seepage over most of the open water period.

### 4.1.3 Shallow Pond C

Shallow Pond C is 0.008 $km^2$ in size and receives inflow over an area of 0.36 $km^2$. Extensive muskeg encompasses Shallow Pond C, and drainage from the pond and muskeg appears to be northward, passing though a series of connected treed muskegs to a large muskeg located along the margin of Snap Lake, immediately east of IL6. From this location the flow is either toward IL6 or towards an indistinct outlet on the eastern edge of the muskeg.

Spring runoff flow from Shallow Pond C is estimated at 0.009 $m^3/s$ (9 L/s) during an average runoff year and 0.015 $m^3/s$ (15 L/s) during a high runoff year. Similar to Shallow Pond B, actual flows may be somewhat less due to attenuation by the surrounding muskeg and evaporation. No visible outflow channel is evident from aerial photograph though a linear series of black spruce and muskeg does define the flow path toward a large muskeg near Snap Lake.

### 4.1.4 IL6

At its outlet, IL6 drains an area of approximately 0.48 $km^2$ and may receive inflow from Shallow Pond C which reports to the muskeg east of IL6. This large muskeg extends some 380 m east of IL6 and has a second outlet directly to Snap Lake on its eastern margin. It is unclear whether flow from Shallow Pond C flows through IL6 prior to entering - Snap Lake or flows out the eastern muskeg outlet. For the purposes of this review it is assumed that, all flow from the Shallow Pond C drainage areas passes through IL6 thereby increasing the drainage area of IL 6 to 0.84 $km^2$.

The mean spring discharge rate from IL6 to Snap Lake is estimated as 0.02 $m^3/s$ (20 L/s). The discharge rate may reach 0.034 $m^3/s$ (34 L/s) during a high runoff year (Table 2). The outflow channel from IL6 to Snap Lake is poorly defined, passing through boulders, cobble, and riparian vegetation. Flows are dispersed over a relatively wide area with the wetted width estimated to be approximately 5 m.

Given a low flow velocity of 0.2 m/s (V) and a total discharge of 0.02 $m^3/s$ (Q), the cross sectional channel area (A) necessary to pass the flow is 0.1 $m^2$ (A=Q/V). With an estimate channel width of approximately 5 m, the depth required to achieve the cross-sectional area of 0.1 $m^2$ is 0.02 m or 2 cm. Even with half the channel blocked by boulder and vegetation the corresponding increase in depth is unlikely to exceed 5 cm. Subsurface flows will further reduce the channel depths. Based on these estimates it is unlikely that the existing channel will provide fish passage. For comparison, small forage fish were observed at streamflow monitoring station H4 in 1999 when June flow averaged 0.28 $m^3/s$ (280 L/s), about 10 times the estimated mean flow from IL6.

#### 4.1.5 IL7

IL7 has a local drainage area of 0.18 $km^2$. The lake surface is 0.024 $km^2$ and the estimated average spring outflow is 4 L/s. IL7 is connected to large muskeg areas on both the eastern and western ends of the lake. No open water outlet exists on either side. Based on the topography, drainage appears to flow west to S28 but no open water channel could be detected.

#### 4.1.6 IL8

IL8 covers 0.043 $km^2$ and receives drainage from an area of 0.61 $km^2$, including flow from IL2. Estimated flow from IL8 during June is 0.015 $m^3/s$ (15 L/s), including 0.003 $m^3/s$ (3 L/s) from IL2. Similar to other lakes, the outflow path is not well defined but appears to pass northward to Snap Lake through a series of treed muskeg areas. A large muskeg which receives flow from IL2 extends southward from the southern end of the IL8.

#### 4.1.7 IL2

IL2 covers an area of 0.019 $km^2$ and drains an area of 0.11 $km^2$. Estimated outflow from the lake is 0.003 $m^3/s$ (3L/s). Drainage from the lake appears to be northward to a muskeg area adjacent to IL8. The drainage path is considered ephemeral. No photos are available for this location.

#### 4.1.8 IL3 and IL4

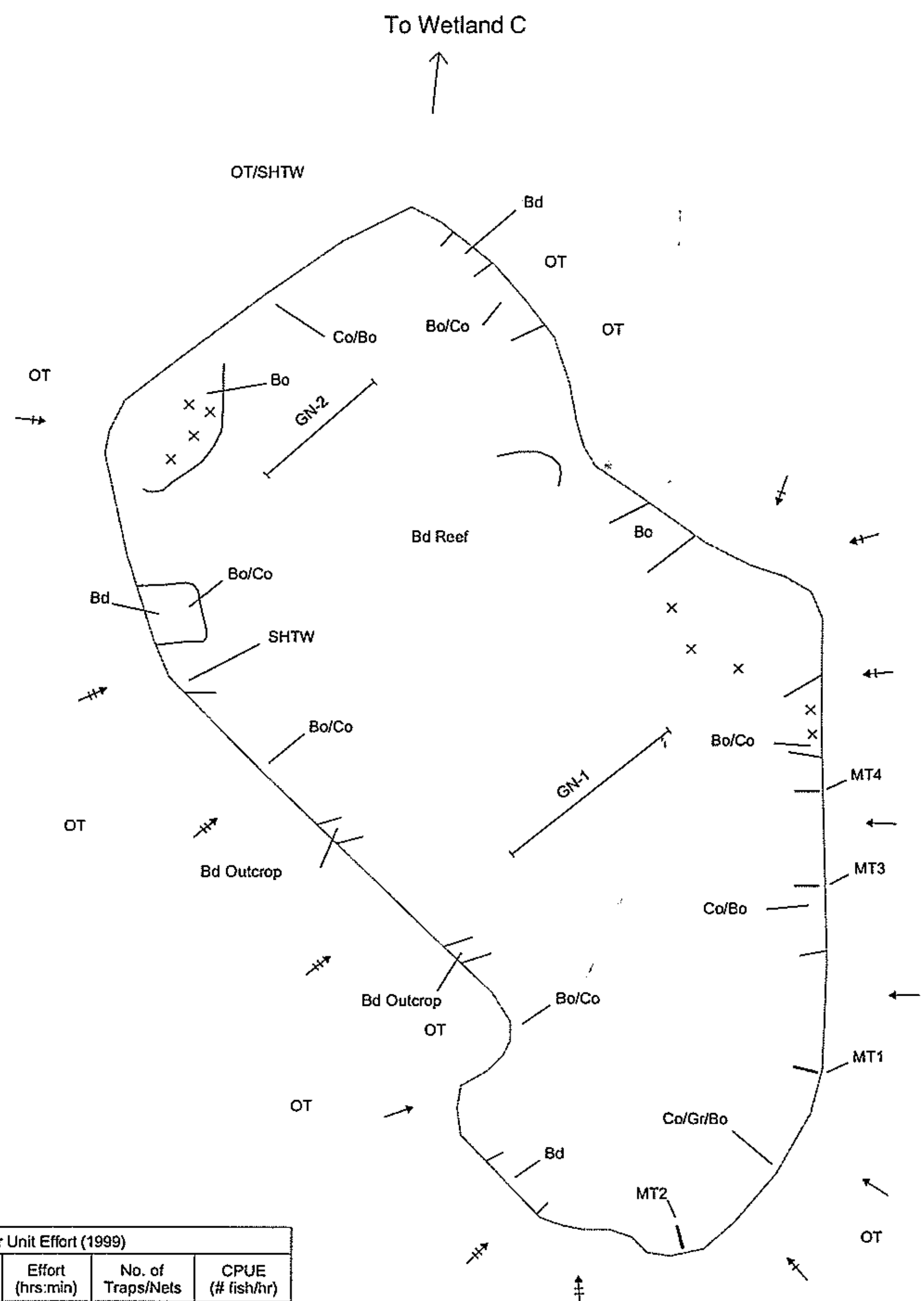
Lake IL3 is located immediately north of the airstrip and adjacent to IL4. The local drainage area is 0.09 $km^2$ and the lakes surface area is 0.012 $km^2$. Estimated spring outflow is 0.002 $m^3/s$ which appears to drain toward IL4. Muskeg surrounds the lake on the northern and eastern margins, extending to near IL4. IL4 drains an area of 0.09 $km^2$ and has a surface area of 0.005 $km^2$. As the lake is assumed to receive flow from IL3, the combined outflow is 0.004 $m^3/s$ (4L/s). From IL4, drainage appears to be eastward through a large muskeg which trends southward and is overlain by the airstrip. No apparent surface channels occur, though existing muskeg and boulder fields would permit subsurface drainage.

### 4.2 Inland Lakes Fish and Fish Habitat Community Investigations

Of the nine small lakes located near the proposed project, fish were captured in only one lake, IL5. Lake chub were the only species of fish captured in IL5. Fish were not captured or observed in any other of the inland lakes. Most of the lakes were too shallow to provide overwintering habitat (*i.e.*, lakes with depths less than 2 m are likely freeze to the bottom in winter) and/or they lacked connectivity to known fish-bearing waterbodies.

#### 4.2.1 IL2

IL2 is a small, isolated waterbody with no defined inlet or outlet streams (Photo 1, Figure 6). It has a wetted area of 1.98 hectares (ha) and a maximum depth of 2.1 m (Figure 7). The lake basin is dominated by shallow (<1 m deep) rocky shoals. IL2 was sampled in 1999 with nine minnow traps for a total of 91 hours (h) and 44 minutes (min) and with gillnets of a total length of 68.4 m for a total of 5 h 42 min (Tables 3 and 4). No fish were captured by either method. Water quality samples were not collected from IL2.




| Catch per Unit Effort (1999) | | | |
|---|---|---|---|
| Method | Effort (hrs:min) | No. of Traps/Nets | CPUE (# fish/hr) |
| MT | 91:44 | 9 | 0 |
| GN | 5:42 | 2 | 0 |

LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | MT | Minnow Trap |
| Bo | Boulder | GN | Gill Net |
| Co | Cobble | → | Shallow Slope |
| Gr | Gravel | →+ | Moderate Slope |
| OT | Open Tundra | →++ | Moderately Steep Slope |
| SHTW | Shrub, Tall Willow | | |
| x | Exposed Rock | | |

N

NOT TO SCALE

PROJECT

DE BEERS

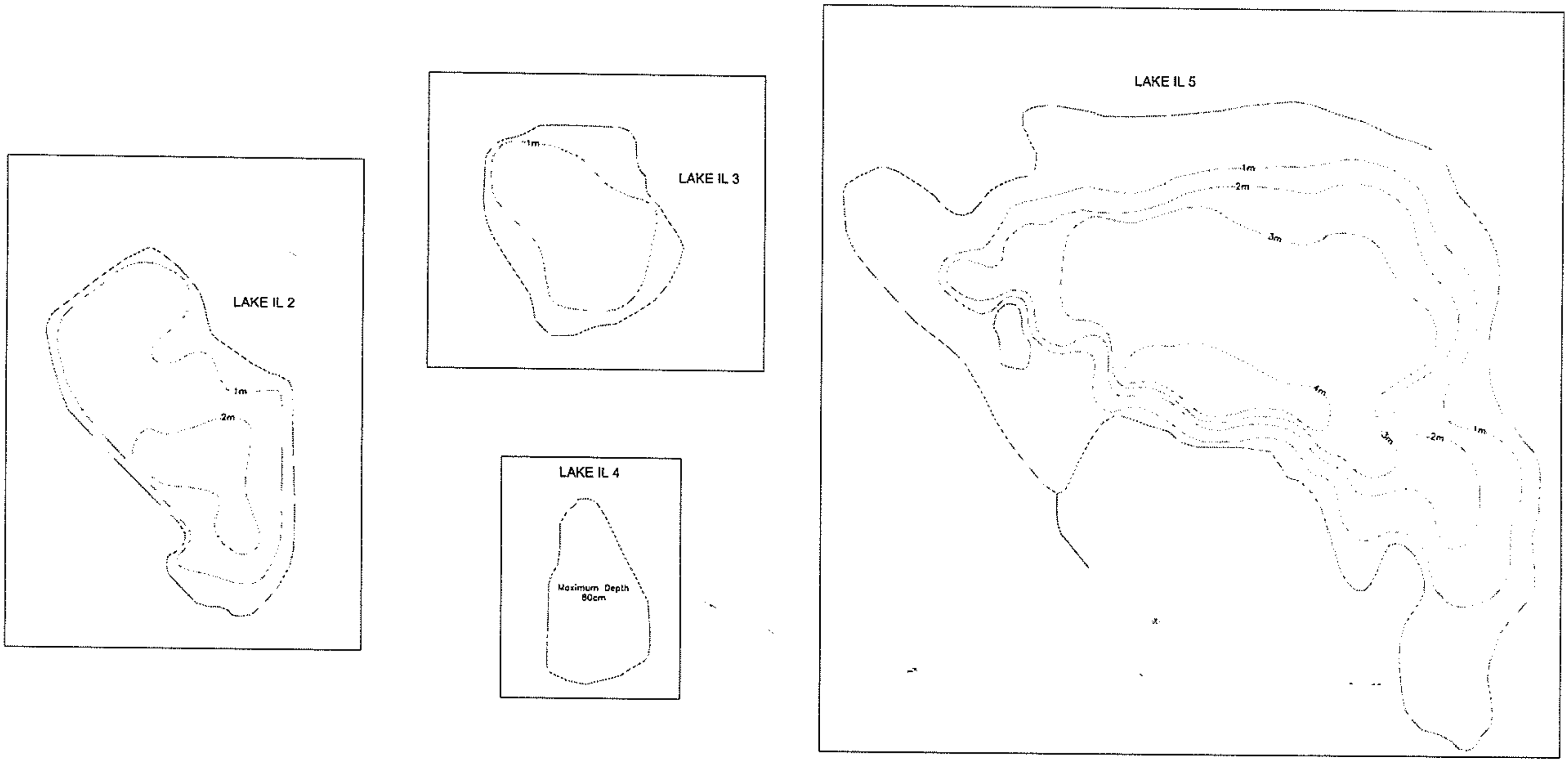
TITLE

**HABITAT MAP FOR IL2**

Golder Associates
Saskatoon, Saskatchewan

| | | | | | |
|---|---|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. | | |
| DESIGN | | | SCALE AS SHOWN | REV. | 0 |
| CADD | SIB | 05/02/03 | **FIGURE: 6** | | |
| CHECK | | | | | |
| REVIEW | | | | | |

N:\Active\6600\022-6659 De Beers EA Support\cad\5300\ Drawing file: 6659-5300-HABITATMEMO-FIG6.DWG Feb 05, 2003 - 7:14pm




NOT TO SCALE

PROJECT

DE BEERS

TITLE

**BATHYMETRY MAPS OF LAKES IL2, IL3, IL4 AND IL5**

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
|---|---|---|---|---|
| PROJECT No. 022-6659.5300 | | | FILE No. | |
| DESIGN | | | SCALE | REV 0 |
| CADD | SB | 05/02/03 | **FIGURE: 7** | |
| CHECK | | | | |
| REVIEW | | | | |

N:\Active\6600\022-6659 De Beers EA Support\cad\5300\ Drawing file: 6659-5300-HABITATMEMO-FIG7.dwg Feb 05, 2003 - 3:00pm

**Table 3**
**Summary of the Aquatics Surveys of Waterbodies on the Northwest Peninsula**

| Waterbody | GPS Location | Date Sampled | Sampling Summary | Process |
|---|---|---|---|---|
| **Inland Lakes** | | | | |
| IL2 | UTM 504241, 7051948 | June 26/99, July 18/99 | A general fish inventory was completed in 1999 | Fish sampling was conducted using gillnets and minnow traps |
| | | June 28/99 | Lake bathymetry was conducted in 1999 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |
| | | June 28/99 | Shoreline habitat mapping was conducted in 1999 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics |
| IL3 | UTM 504660, 7051846 | June 28/99 July 19/99 | A general fish inventory was completed in 1999 | Fish sampling was conducted using gillnets and minnow traps |
| | | June 28/99 | Lake bathymetry was conducted in 1999 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |
| | | June 28/99 | Shoreline habitat mapping was conducted in 1999 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics. |
| IL4 | UTM 504852, 7051924 | June 27/99 | Lake bathymetry was conducted in 1999 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |
| | | June 27/99 | Shoreline habitat mapping was conducted in 1999 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics. |
| IL5 | UTM 504684, 7051391 | June 27/99 | A general fish inventory was completed in 1999 | Fish sampling was conducted using gillnets and minnow traps and a number of parameters were recorded for each fish |
| | | June 27/99 | Lake bathymetry was conducted in 1999 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |
| | | June 27/99 | Shoreline habitat mapping was conducted in 1999 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics. |
| IL6 | UTM 505225, 7052920 | June 28/99 | A general inventory was completed in 1999 and re-sampled in 2001 | Fish sampling was conducted using gillnets and minnow traps |
| | | July 20,21/01 | A fish inventory was completed in 1999 and re-sampled in 2001 | Fish sampling was conducted using gillnets and minnow traps |
| | | June 28/99 | Lake bathymetry was conducted in 1999 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |

**Table 3**
**Summary of the Aquatics Surveys of Waterbodies on the Northwest Peninsula (continued)**

| Waterbody | GPS Location | Date Sampled | Sampling Summary | Process |
|---|---|---|---|---|
| | | June 28/99 | Shoreline habitat mapping was conducted in 1999 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics |
| IL7 | UTM 504546, 7052786 | July 19,20/01 | A general non-lethal fish inventory was completed in 2001 | Fish sampling was conducted using gillnets and minnow traps |
| | | July 19/01 | Lake bathymetry was conducted in 2001 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |
| | | July 19/01 | Shoreline habitat mapping was conducted in 2001 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics |
| IL8 | UTM 504097, 7052619 | -- | Lake area calculated | No field sampling conducted. |
| IL9 | UTM 504616, 7052265 | July 21/01 | A general non-lethal fish inventory was completed in 2001 | Fish sampling was conducted using gillnets and minnow traps |
| | | July 21/01 | Lake bathymetry was conducted in 2001 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |
| | | July 21/01 | Shoreline habitat mapping was conducted in 2001 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics |
| **Streams** | | | | |
| S1 | UTM 506866, 7051263 | June 3/99 | Aerial survey and ground-truthing was conducted | These surveys were conducted by aerial and direct observation of the stream to determine potential fish habitat, including fish presence |
| | | June 4/99 | Stream habitat mapping was conducted | Habitat mapping was conducted with information on habitat capability, accessibility, and fish presence and use of the streams |
| | | June 4/99 | Spring spawning potential was investigated | Visual surveys for spawning fish and eggs were conducted, as well as the identification of spawning habitat. This stream was also used as a hydrology and water quality sampling station. |
| S27 | UTM 502214, 7052550 | June 5/99, June 26/99 | Aerial survey and ground-truthing was conducted | These surveys were conducted by aerial and direct observation of the stream to determine potential fish habitat, including fish presence |

**Table 3**
**Summary of the Aquatics Surveys of Waterbodies on the Northwest Peninsula (continued)**

| Waterbody | GPS Location | Date Sampled | Sampling Summary | Process |
|---|---|---|---|---|
| | | June 5/99, June 26/99 | Spring spawning potential was investigated | Visual surveys for spawning fish and eggs were conducted as well as the identification of spawning habitat. |
| | | June 26/99 | Stream habitat mapping was conducted | Habitat mapping was conducted with information on habitat capability, accessibility, and fish presence and use of the streams. |
| S28 | UTM 504393, 7052710 | June 26/99 | Aerial survey and ground-truthing was conducted | These surveys were conducted by aerial and direct observation of the stream to determine potential fish habitat, including fish presence |
| | | June 2002 | Access to IL8 and spring spawning potential was investigated. | Site visit during freshet. |
| S29 | UTM 505419, 7052799 | June 5/99, June 26/99 | Aerial survey on June 6th and aerial and ground-truthing was conducted on the 26th. | These surveys were conducted by aerial and direct observation of the stream to determine potential fish habitat, including fish presence |
| | | June 26/99 | Stream habitat mapping was conducted | Habitat mapping was conducted with information on habitat capability, accessibility, and fish presence and use of the streams. |
| | | June 26/99 | Spring spawning potential was investigated | Visual surveys for spawning fish and eggs were conducted as well as the identification of spawning habitat potential. |
| | | August, 2001 | Summer survey of IL6 included investigation of outlet conditions. Two investigation by separate biologists | Visual survey along IL6 shoreline, no outflow detected.<br>Visual inspection of the S29 area from IL6 to Snap Lake.. |
| | | June 2002 | Access to IL6 and spring spawning potential was investigated.<br>Stream Habitat Mapping was conducted. | Site visit during freshet. Habitat mapping was conducted with information on habitat capability, accessibility, and fish presence and use of the streams. |
| **Wetland Areas** | | | | |
| Wetland A | UTM 505848, 7052730 | July 7/99 | Assessment of aquatic habitat potential | An assessment was completed based on water depth, substrate, aquatic and upland vegetation composition, and connectivity to other waterbodies. |
| Wetland B | UTM 504942, 7052781 | July 2002 | Water samples taken for analysis | Assessment of water quality related to wetlands that will be covered by processed kimberlite. |

**Table 3**
**Summary of the Aquatics Surveys of Waterbodies on the Northwest Peninsula (continued)**

| Waterbody | GPS Location | Date Sampled | Sampling Summary | Process |
|---|---|---|---|---|
| Shallow pond A | UTM 503734, 7051604 | 1999 | Assessment of aquatic habitat potential | Aerial reconnaissance of area. |
| Shallow pond B | UTM 506822, 7053203 | June 1999 | Aerial reconnaissance of area to determine presence/absence of pond and the stream draining pond to Snap Lake | Aerial reconnaissance of area. No further sampling pond within Advanced Exploration Program disturbance footprint. |
| Shallow pond C | UTM 505409, 7052478 | July 22/01 | A general fish inventory was completed in 2001 | Fish sampling was conducted using gillnets and minnow traps |
| | | | Lake bathymetry was conducted in 2001 | The bathymetry was recorded using a chart-recording echo-sounder and used to create a bathymetric map. |
| | | | Shoreline habitat mapping was conducted in 2001 | Habitat mapping was conducted by visually assessing and recording shoreline characteristics |

Note: GPS = global positioning systems; UTM = universal transverse mercator.

**Table 4**
**Minnow Trapping Effort and Catch Data for Inland Lakes**

| Year | Lake | Total Sampling Effort (hrs:min) | Number of Traps Set | # Fish Captured | Species | CPUE (# fish/hr) |
|---|---|---|---|---|---|---|
| 1999 | IL 2 | 91:44 | 9 | 0 | none | 0.00 |
| 1999 | IL 3 | 42:00 | 10 | 0 | none | 0.00 |
| 1999 | IL 4 | none - too shallow | | | | |
| 1999 | IL 5 | 12:30 | 5 | 18 | lake chub | 1.44 |
| 1999 | IL 6 | 16:00 | 4 | 0 | none | 0.00 |
| 2001 | IL 6 | 203:30 | 10 | 0 | none | 0.00 |
| 2001 | IL 7 | 76:03 | 10 | 0 | none | 0.00 |
| 2001 | IL 8 | 34:10 | 10 | 0 | none | 0.00 |
| 2001 | IL 9 | 29:10 | 10 | 0 | none | 0.00 |

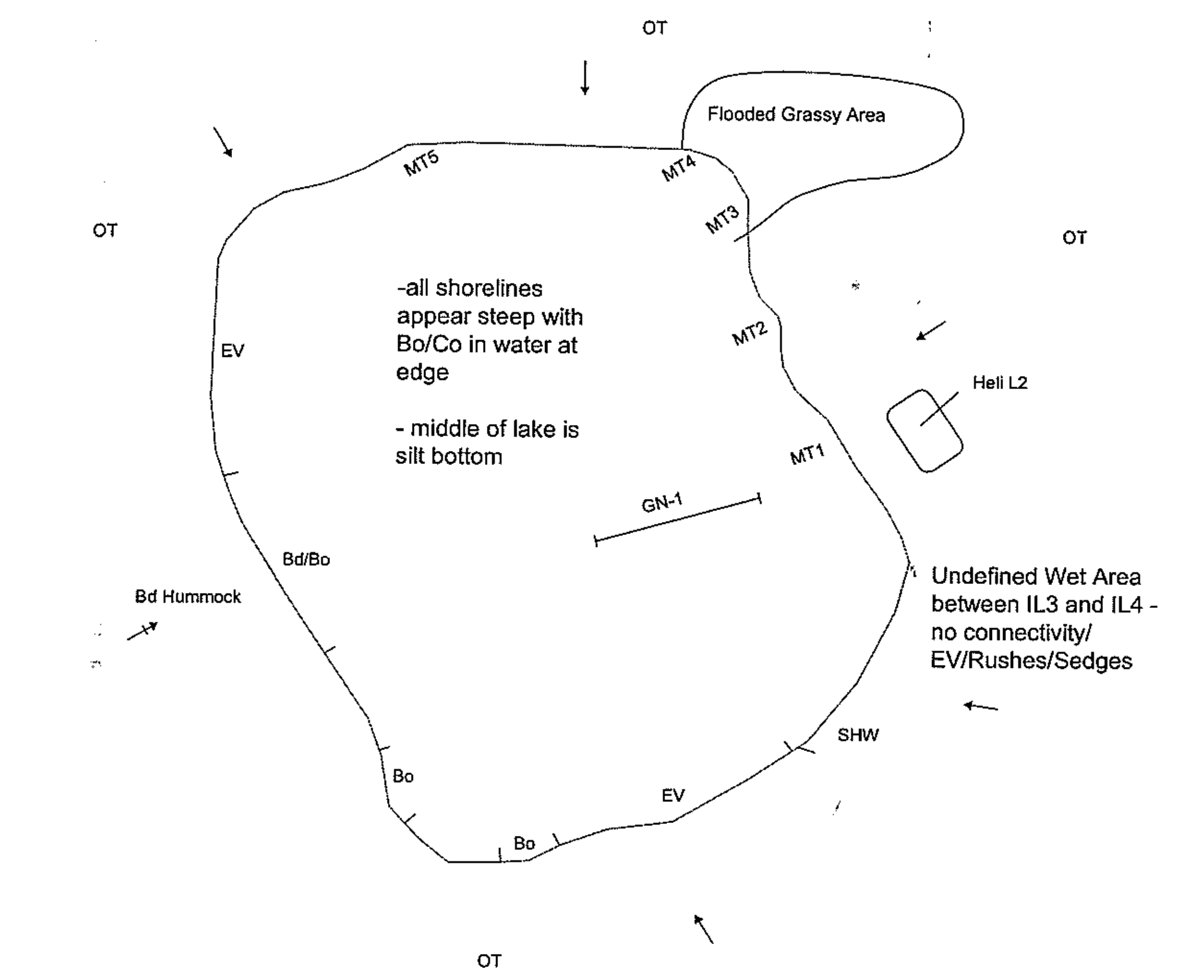
Note: hrs:min = hours and minutes; CPUE = catch-per-unit effort (listed as the number of fish captured per hour).

### 4.2.2 IL3

IL3 is a small (1.15 ha), isolated waterbody with a maximum depth of 1.9 m (Photos 2 and 3; Figures 7 and 8). No defined channels connect IL3 to another waterbody. The lake substrate is organic/detritus with boulder cobble along the shorelines. In 1999, ten minnow traps were set in IL3 for a total of 42 hours (Table 4). One gillnet that was 30.4 m long was set in the lake for 1 h 43 min (Table 5). No fish were captured or observed. A loon was observed on the lake but was not nesting nor observed feeding at this location. Results from water quality samples collected from IL3 are shown in Appendix I.

### 4.2.3 IL4

IL4 was the smallest (0.53 ha) lake in the proposed project area (Figure 9; Photos 2 and 4). The maximum depth of IL4 was 0.8 m and the average depth was approximately 0.6 m (Figure 7). No defined channels connected IL4 to any other waterbody. No sampling for fish occurred. No gill nets were set in the lake because the lake was too shallow to sample effectively (*i.e.*, the height of the gill net panels was greater than the depth of the lake). No minnow traps were set. The lake perimeter was surrounded by inundated vegetation and boulders areas. Results from water quality samples from IL4 are shown in Appendix I.




| Catch per Unit Effort (1999) | | | |
|---|---|---|---|
| Method | Effort (hrs:min) | No. of Traps/Nets | CPUE (# fish/hr) |
| MT | 42:00 | 10 | 0 |
| GN | 1:43 | 1 | 0 |

LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | MT | Minnow Trap |
| Bo | Boulder | GN | Gill Net |
| Co | Cobble | ——▸ | Shallow Slope |
| Gr | Gravel | —+▸ | Moderate Slope |
| OT | Open Tundra | —++▸ | Moderately Steep Slope |
| SHTW | Shrub, Tall Willow | | |
| x | Exposed Rock | | |
| EV | Emergent Vegetation | | |
| Heli L2 | Helicopter Landing Site | | |

N

NOT TO SCALE

PROJECT

DE BEERS

TITLE

HABITAT MAP FOR IL3

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
|---|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. | |
| DESIGN | | | SCALE AS SHOWN | REV. 0 |
| CADD | SIB | 05/02/03 | FIGURE: 8 | |
| CHECK | | | | |
| REVIEW | | | | |

N:\Active\6600\022-6659 De Beers EA Support\cad\5300\ Drawing file: 6659-5300-HABITATMEMO-FIG8.DWG Feb 05, 2003 ~ 7:15pm

**Table 5**
**Gill Nets Effort and Catch Data for Inland Lakes**

| Year | Lake | Total Sampling Effort (hrs:min) | Number of Nets Set | Total Net Length (metres) | # Fish Captured | Species | CPUE # fish /100m /hour |
|---|---|---|---|---|---|---|---|
| 1999 | IL 2 | 5:42 | 2 | 68.4 | 0 | none | 0.00 |
| 1999 | IL 3 | 1:43 | 1 | 30.4 | 0 | none | 0.00 |
| 1999 | IL 4 | none - too shallow | | | | | |
| 1999 | IL 5 | 5:40 | 2 | 68.4 | 0 | none | 0.00 |
| 1999 | IL 6 | 7:45 | 2 | 68.4 | 0 | none | 0.00 |
| 2001 | IL 6 | 5:10 | 2 | 100 | 0 | none | 0.00 |
| 2001 | IL 7 | 6:44 | 2 | 100 | 0 | none | 0.00 |
| 2001 | IL 8 | 7:00 | 2 | 100 | 0 | none | 0.00 |
| 2001 | IL 9 | 5:00 | 2 | 100 | 0 | none | 0.00 |

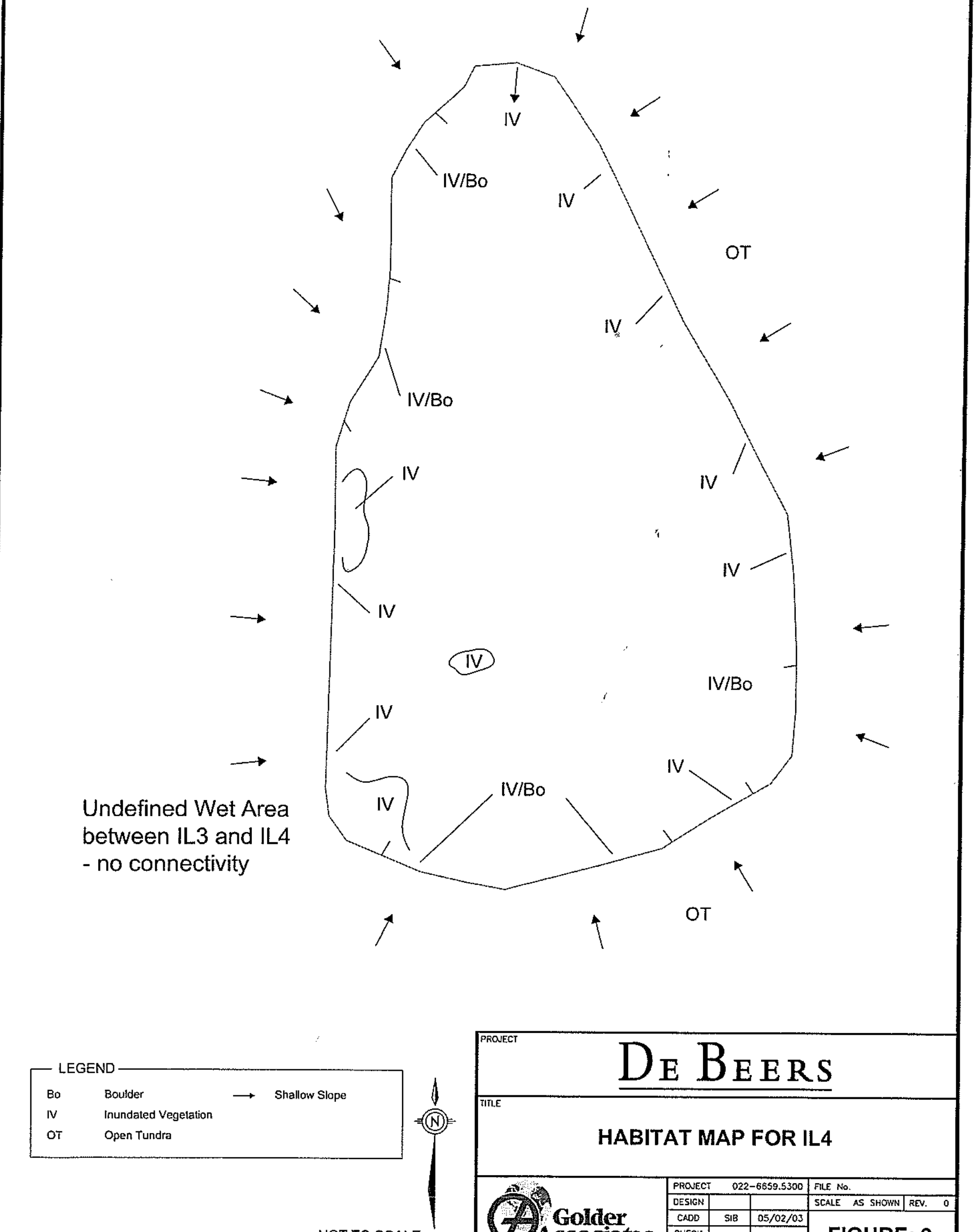
Note: hrs:min = hours and minutes; CPUE = catch-per-unit effort (listed as the number of fish captured per 100 m of net per hour).

### 4.2.4 IL5

IL5 was the largest (8.21 ha) and deepest (max depth 4.0 m) of the inland lakes sampled in the proposed project area (Figures 7 and 10; Photos 5, 6 and 7). IL5 is part of the largest sub-basin of Snap Lake, which has an area of 7.04 $km^2$ (Sub-basin S, Table 9.3-35 of the EAR). IL5 was the only inland lake in which fish were captured. Five minnow traps were set for a total of 12 h 30 min; 18 lake chub were captured (Table 4). The catch-per-unit-effort for the minnow traps was 1.4 fish per hour. Two gillnets (68.4 m total length) were set for a total of 5 h 40 min, but no fish were captured (Table 5). The shoreline and substrate of IL5 were dominated by large boulders with limited areas of fine organic sediment (Figure 10). Aquatic macrophytes were also present. Water quality parameters measured in IL5 are shown in Appendix 1.

### 4.2.5 IL6

IL6 is located approximately 70 m from Snap Lake and has an area of 2.88 ha (Figure 11; Photos 8 and 9). The maximum depth measured in the lake was 2.5 m (Figure 12). An ephemeral, sedge wetland area (wetland B) exists to the west of IL6 but no defined channel exists through the wetland. The topography information for the area also suggests there is no connection through this area to IL7. Wetland A connects with IL6 to the east. Although IL6 is only 130 m from Snap Lake, the area between the lakes is




| | | | | |
|---|---|---|---|---|
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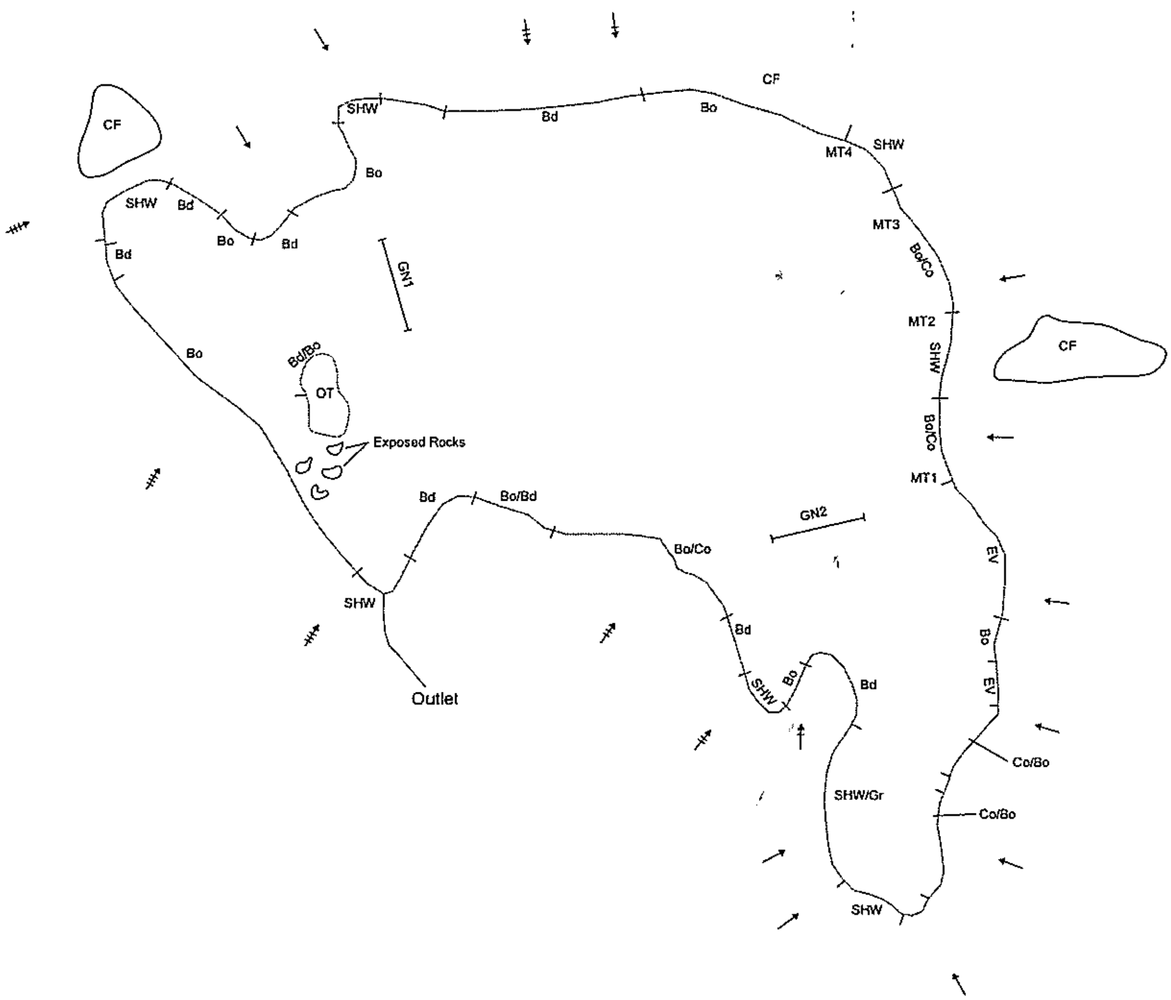
| TITLE: HABITAT MAP FOR IL4 | | | | |
| Golder Associates, Saskatoon, Saskatchewan | PROJECT | 022-6659.5300 | FILE No. | |
| | DESIGN | | SCALE AS SHOWN | REV. 0 |
| | CADD | SIB 05/02/03 | FIGURE: 9 | |
| | CHECK | | | |
| | REVIEW | | | |

Image:Wsplogo3.gif

N:\Active\6600\022-6659 De Beers EA Support\cad\5300\ Drawing file: 6659-5300-HABITATMEMO-FIG9.DWG Feb 05, 2003 - 7:12pm




| Catch per Unit Effort (1999) | | | | | |
|---|---|---|---|---|---|
| Method | Effort (hrs:min) | No. of Traps/Nets | Species | # Captured | CPUE (# fish/hr) |
| MT<br>GN | 12:30<br>5:40 | 5<br>2 | LKCH<br>- | 18<br>- | 1.44<br>0 |

LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | MT | Minnow Trap |
| Bo | Boulder | GN | Gill Net |
| Co | Cobble | → | Shallow Slope |
| Gr | Gravel | ─┼→ | Moderate Slope |
| CF | Coniferous Forest | ─┼┼→ | Moderately Steep Slope |
| OT | Open Tundra | ─┼┼┼→ | Steep Slope |
| EV | Emergent Vegetation | | |
| SHW | Shrub, Willow | | |

N

NOT TO SCALE

PROJECT

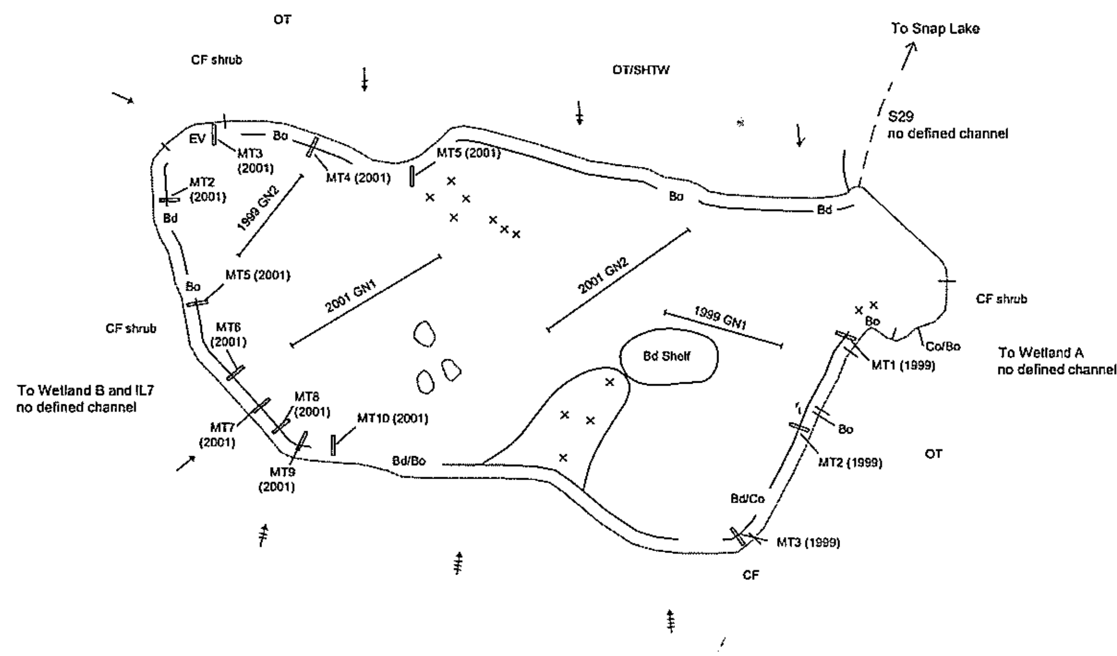
DE BEERS

TITLE

## HABITAT MAP FOR IL5

Golder Associates
Saskatoon, Saskatchewan

| | | |
|---|---|---|
| PROJECT | 022-6659.5300 | FILE No. |
| DESIGN | | SCALE AS SHOWN REV. 0 |
| CADD | SIB 05/02/03 | |
| CHECK | | FIGURE: 10 |
| REVIEW | | |




| Catch per Unit Effort | | | | |
|---|---|---|---|---|
| Year | Method | Effort (hrs:min) | No. of Traps/Nets | CPUE (# fish/hr) |
| 1999 | MT | 16:00 | 4 | 0 |
| 1999 | GN | 7:45 | 2 | 0 |
| 2001 | MT | 203:30 | 10 | 0 |
| 2001 | GN | 5:10 | 2 | 0 |

LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | MT | Minnow Trap |
| Bo | Boulder | GN | Gill Net |
| Co | Cobble | | Shallow Slope |
| CF | Coniferous Forest | | Moderate Slope |
| OT | Open Tundra | | Moderately Steep Slope |
| EV | Emergent Vegetation | | Steep Slope |
| SHTW | Shrub, Tall Willow | | |
| x | Exposed Rock | | |

NOT TO SCALE

PROJECT

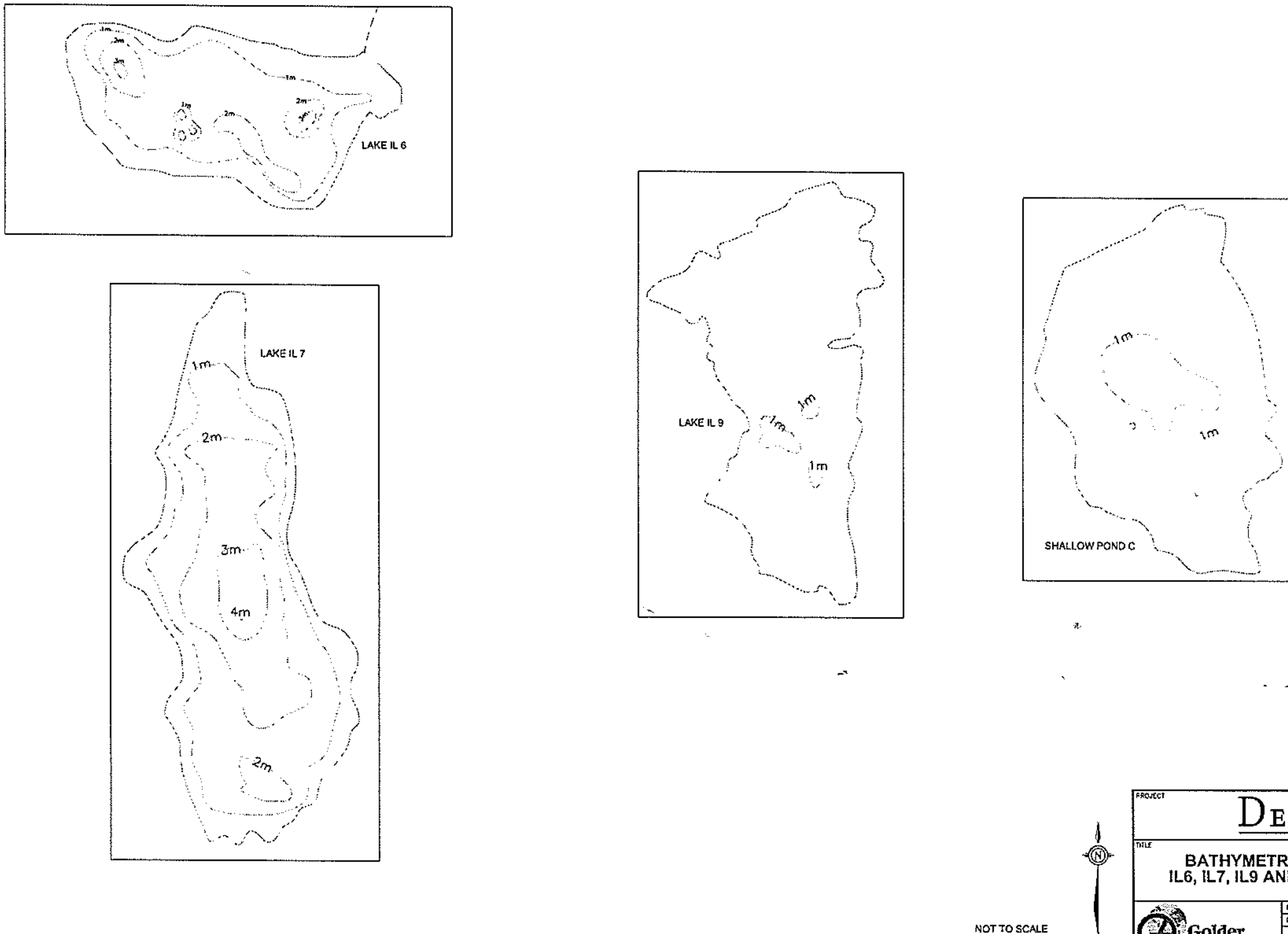
DE BEERS

TITLE

# HABITAT MAP FOR IL6

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
|---|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. | |
| DESIGN | | | SCALE AS SHOWN | REV. 0 |
| CADD | SIB | 06/02/03 | FIGURE: 11 | |
| CHECK | | | | |
| REVIEW | | | | |




PROJECT

DE BEERS

TITLE

**BATHYMETRY MAPS OF LAKES IL6, IL7, IL9 AND SHALLOW POND C**

Golder Associates
Saskatoon, Saskatchewan

| PROJECT No. 022-6659-5300 | | | FILE No. |
|---|---|---|---|
| DESIGN | | | SCALE / REV. |
| CADD | SIB | 06/02/03 | FIGURE: 12 |
| CHECK | | | |
| REVIEW | | | |

N:\Active\6600\022-6659 De Beers EA Support\cad\5300\ Drawing file: 6659-5300-HABITATMEMO-FIG12.dwg Feb 05, 2003 - 10:05am densely vegetated with no distinct channel connecting the two waterbodies. The elevation difference between IL6 and Snap Lake is 2.24 m. The shoreline of IL6 is dominated by vertical fractured bedrock, particularly on the north side of the lake. Lake substrate are dominated by boulder and cobble with small areas of fine organic material. IL6 was sampled for fish in 1999 using four minnow traps for a total of 16 hours (Table 4) and two gillnets (total length of 68.4 m) for a total of 7 h 45 min. No fish were captured (Table 5). Because of the potential for an impact to this waterbody from the north pile, and its close proximity to Snap Lake, IL6 was sampled more intensively again in 2001. Ten minnow traps were set overnight for a total time of 203 h 30 min and two gillnets totalling 100 m of net was fished for 5 h 10 min. Again, no fish were captured. Field water quality parameters measured in IL6 are shown in Appendix I.

#### 4.2.6 IL7

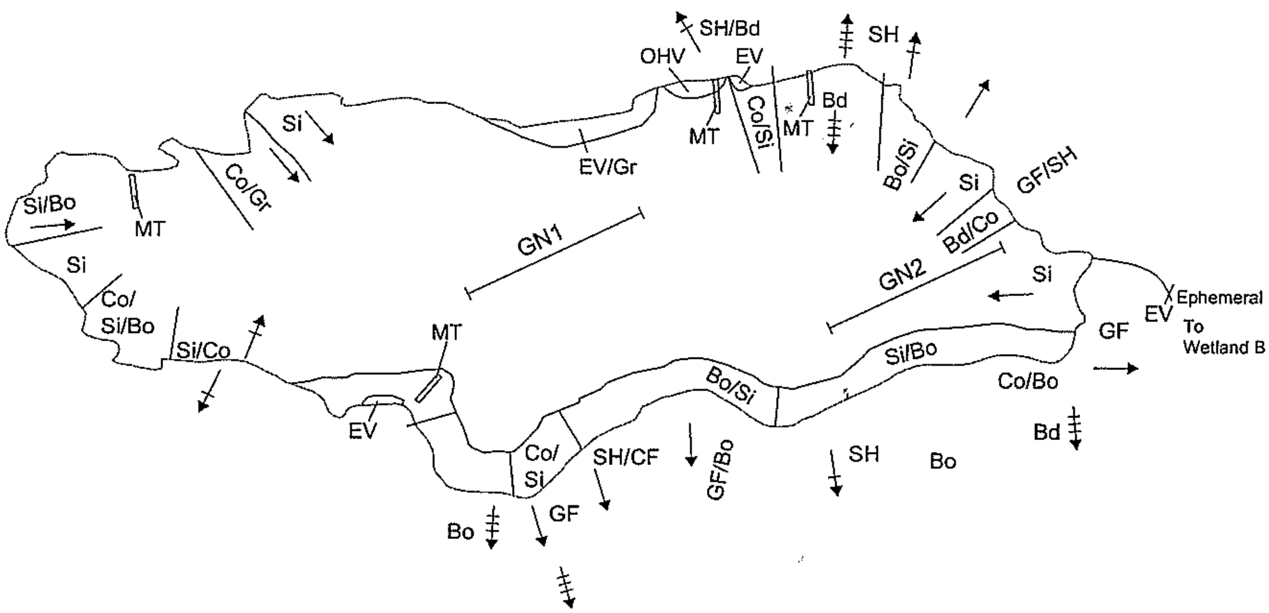
IL7 has a surface area of 2.4 ha and a maximum depth of approximately 4 m (Figures 12 and 13, Photo 10). A narrow, ephemeral drainage leads toward IL6 through the wetland B area but no flow could be detected in July of 2001. The shoreline of IL7 was dominated by shrubs and grasses interspersed with boulders and spruce trees (Photo 11). Steep terrain surrounds much of lake; however, wetlands are found on both the east (wetland B) and west ends of the lake. Based on the topography of the area, this lake drains to the west, toward the area designated as S28. The lake substrate is dominated by boulder, cobble, and silt.

IL7 was sampled for fish in 2001 using 10 minnow traps for a total of 76 h 3 min (Table 4) and two gillnets totalling 100 m in length for a total of 6 h 44 min (Table 5). No fish were caught using either method. Field water quality parameters measured at IL7 are shown in Appendix I.

#### 4.2.7 IL8

IL8 has a surface area of 4.3 ha and likely drains towards Snap Lake through the area designated as S28 (see below for the discussion of S28). In summer 1999, the north pile plan was refined which meant that the project footprint would not affect IL8. No field surveys of the lake were undertaken.

As mentioned previously in the in the footnote in Section 3, the EAR contained an error in Table 9.5-15. Data attributed to IL8 were in fact the data for IL9.




| Catch per Unit Effort | | | |
|---|---|---|---|
| Method | Effort (hrs:min) | No. of Traps/Nets | CPUE (# fish/hr) |
| MT | 76:03 | 10 | 0 |
| GN | 6:44 | 2 | 0 |

LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | MT | Minnow Trap |
| Bo | Boulder | GN | Gill Net |
| Co | Cobble | → | Shallow Slope |
| Gr | Gravel | →+ | Moderate Slope |
| Si | Silt | →++ | Moderately Steep Slope |
| OHV | Overhanging Vegetation | →+++ | Steep Slope |
| EV | Emerging Vegetation | | |
| CF | Coniferous Forest | | |
| SH | Shrub | | |
| GF | Grass, Forbs | | |

NOT TO SCALE

PROJECT

DE BEERS

TITLE

# HABITAT MAP FOR IL7

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
|---|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. | |
| DESIGN | | | SCALE AS SHOWN | REV. 0 |
| CADD | SIB | 05/02/03 | FIGURE: 13 | |
| CHECK | | | | |
| REVIEW | | | | |

### 4.2.8 IL9

IL9 is a small (0.8 ha) isolated lake with a maximum depth of 1.1 m (Figures 12 and 14, Photos 12 and 13). No inlet or outlet streams connect IL9 to any other waterbody. The lake's shoreline is dominated by shrubs interspersed with boulders and spruce trees. The summer 2001 survey identified a 0.5-m high bedrock ledge surrounding the entire lake. Substrate in IL9 is primarily boulder and cobble, interspersed with silt. Ten minnow traps were set in 2001 for a total time of 34 h 10 min (Table 4) and 100 m of gillnet were set for 7 hours (Table 5). No fish were captured. Field water quality parameters measured in IL9 are shown in Appendix I.

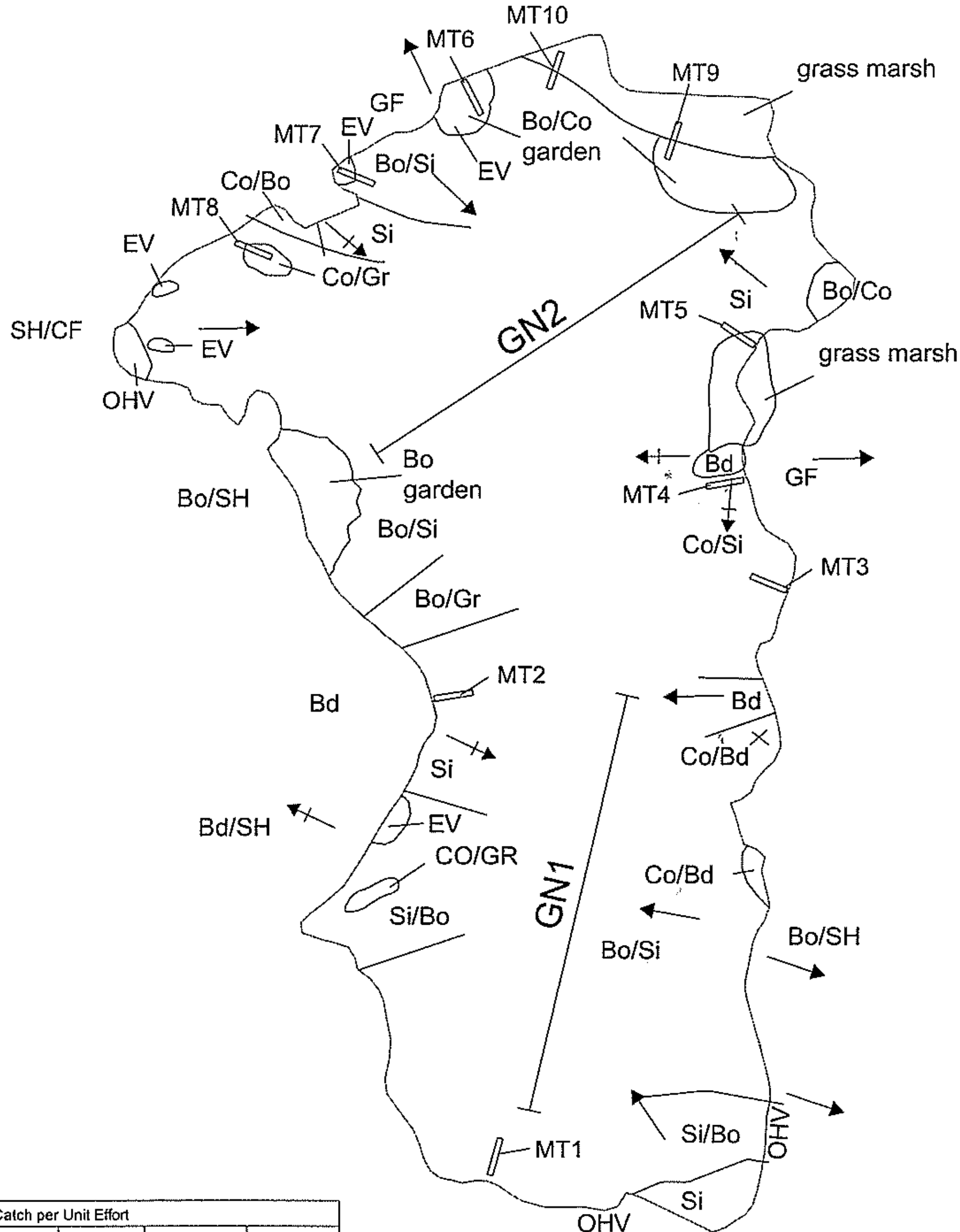
### 4.2.9 Shallow Pond A

Shallow pond A is a small approximately 0.3 ha isolated pond with internal drainage (Photo 14). No inlet or outlet streams connect the pond to any other waterbody. Aerial reconnaissance of the area in the summer of 1999 indicated that this pond was shallow and not connected to other waterbodies. The topography and hydrology of the surrounding area also indicated a lack of connections and the likelihood of this pond being less than 1 m in depth.

### 4.2.10 Shallow Pond B

Shallow Pond B covers approximately 0.1 ha and has a maximum depth of 0.4 m (Photos 15 and 16). The pond is not connected to Snap Lake contrary to what is denoted on the 1:50,000 NTS topographical map (Figure 2). The pond is surrounded by grasses and boulders. The helipad of the Advanced Exploration Program (AEP) abuts this pond and may cover a portion of the original margins. Runoff from the helipad to the pond is being monitored as part of the Acid Rock Drainage Program for the AEP.

The 1:50,000 NTS topographical map (Figure 2) illustrates a stream connecting shallow pond B to Snap Lake. No stream or channel was located during June 1999 aerial surveys (Photo 15). The more detailed topographical map (Figure 4) also confirms that no stream occurs in this area.




| Catch per Unit Effort | | | |
|---|---|---|---|
| Method | Effort (hrs:min) | No. of Traps/Nets | CPUE (# fish/hr) |
| MT<br>GN | 34:10<br>7:00 | 10<br>2 | 0<br>0 |

LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | MT | Minnow Trap |
| Bo | Boulder | GN | Gill Net |
| Co | Cobble | → | Shallow Slope |
| Gr | Gravel | →+→ | Moderate Slope |
| Si | Silt | →++→ | Moderately Steep Slope |
| OHV | Overhanging Vegetation | →+++→ | Steep Slope |
| EV | Emerging Vegetation | x | Exposed Rock |
| CF | Coniferous Forest | | |
| SH | Shrub | | |
| GF | Grass, Forbs | | |

NOT TO SCALE

PROJECT

DE BEERS

TITLE

## HABITAT MAP FOR IL9

Golder Associates
Saskatoon, Saskatchewan

| | | | |
|---|---|---|---|
| PROJECT | 022-6659.5300 | FILE No. | |
| DESIGN | | SCALE AS SHOWN | REV. 0 |
| CADD | SIB 05/02/03 | | |
| CHECK | | FIGURE: 14 | |
| REVIEW | | | |

#### 4.2.11 Shallow Pond C

Shallow Pond C has a surface area of 0.8 ha and has a maximum depth of 1.6 m (Figures 12 and 15; Photos 17 and 18). Ephemeral flow is present between this pond and a wetland to the east. No flow was detected in the channel in July 2001. The shoreline of the pond consists of muskeg and sedges. Some macrophytes were present along the shore and areas of fine organic sediments were noted. In July 2001, ten minnow traps were set for a total of 29 h 10 min and two gillnets totalling 100 m were set for five hours (Tables 4 and 5). No fish were captured. Field water quality parameters measured are shown in Appendix I.

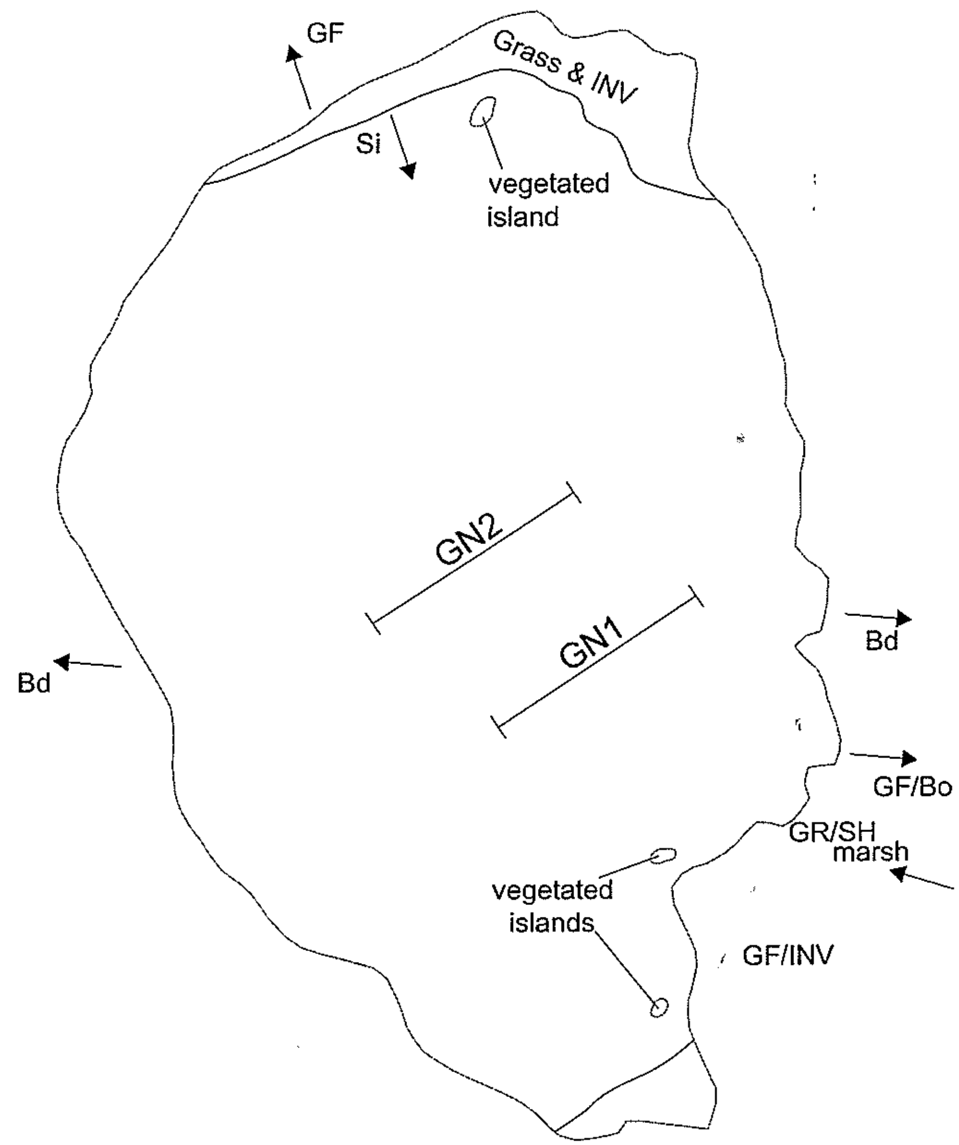
### 4.3 Streams

Four streams in the vicinity of the proposed project were assessed to determine their potential as fish habitat. In addition, notes are provided on the shallow pond B stream noted on the 1:50,000 NTS map (Figure 2).

#### 4.3.1 S1

S1 flows into Snap Lake from sub-basin S, south of the proposed mine site and was surveyed in June 1999 (Photo 19, Figure 16). This stream drains the IL5 sub-basin. This stream has been repeatedly monitored for water discharge as part of the hydrology monitoring program and it is the second largest sub-basin flowing to Snap Lake. S1 is approximately 100 m long with an average width of 1.9 m (full bank width) and an average depth of 0.4 m. The water stage was high at the time of the survey. Maximum pool depth was 1.0 m and maximum riffle depth was 0.4 m. The stream gradient was 2% for most of the length of the stream but was 10% near the creek mouth. The stream contained alternating pool, riffle, and run habitat (see Appendix IX.8 of the EAR for definitions). The substrate was primarily cobble-boulder with silt in some slower flowing areas. Velocity ranged from 0.0 to 0.24 metres per second (m/sec). Boulder and overhanging vegetation were the main type of cover. Results from water quality samples collected from S1 are shown in Appendix I.

Visual surveys were conducted for spawning fish, eggs, and habitat quality. Fish were observed near the mouth of the stream and in a grassy pool located 40- m upstream of Snap Lake. The direct connection to Snap Lake and the presence of fish and fish eggs in the stream indicate it provides fish habitat.




| Catch per Unit Effort | | | |
|---|---|---|---|
| Method | Effort (hrs:min) | No. of Traps/Nets | CPUE (# fish/hr) |
| MT | 29:10 | 10 | 0 |
| GN | 5:00 | 2 | 0 |

LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | MT | Minnow Trap |
| Bo | Boulder | GN | Gill Net |
| Gr | Gravel | → | Shallow Slope |
| Si | Silt | | |
| INV | Inundated Vegetation | | |
| SH | Shrub | | |
| GF | Grass, Forbs | | |

NOT TO SCALE

PROJECT

DE BEERS

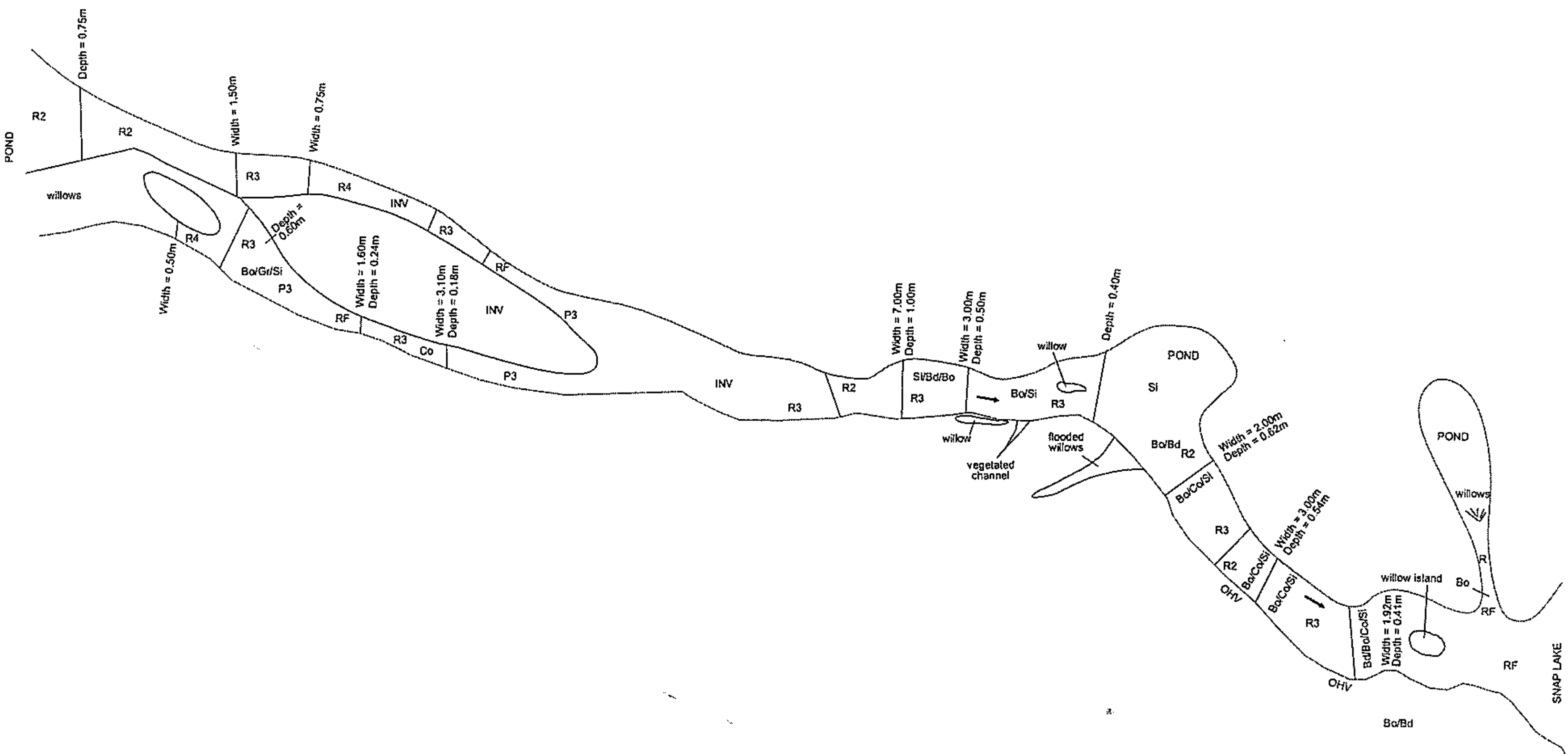
TITLE

**HABITAT MAP FOR SHALLOW POND C**

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
|---|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. | |
| DESIGN | | | SCALE AS SHOWN | REV. 0 |
| CADD | SIB | 05/02/03 | **FIGURE: 15** | |
| CHECK | | | | |
| REVIEW | | | | |

N:\Active\6600\022-6659 De Beers EA Support\cad\5300\ Drawing file: 6659-5300-HABITATMEMO-FIG16to18.DWG Feb 05, 2003 - 7:10pm




## LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | R | Run |
| Bo | Boulder | RF | Riffle |
| Co | Cobble | R2 | Class 2 Run - Moderate Quality Run |
| Gr | Gravel | R3 | Class 3 Run - Lowest Quality Run |
| Si | Silt | P3 | Class 3 Pool - Low Quality Pool Habitat |
| OHV | Overhanging Vegetation | | |
| INV | Inundated Vegetation | ⟶ | Flow Direction |

N

NOT TO SCALE

PROJECT

# DE BEERS

TITLE

## HABITAT MAP FOR S1

Golder Associates
Saskatoon, Saskatchewan

| | | | |
|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. |
| DESIGN | | | SCALE AS SHOWN REV. 0 |
| CADD | SIB | 05/02/03 | |
| CHECK | | | FIGURE: 16 |
| REVIEW | | | |

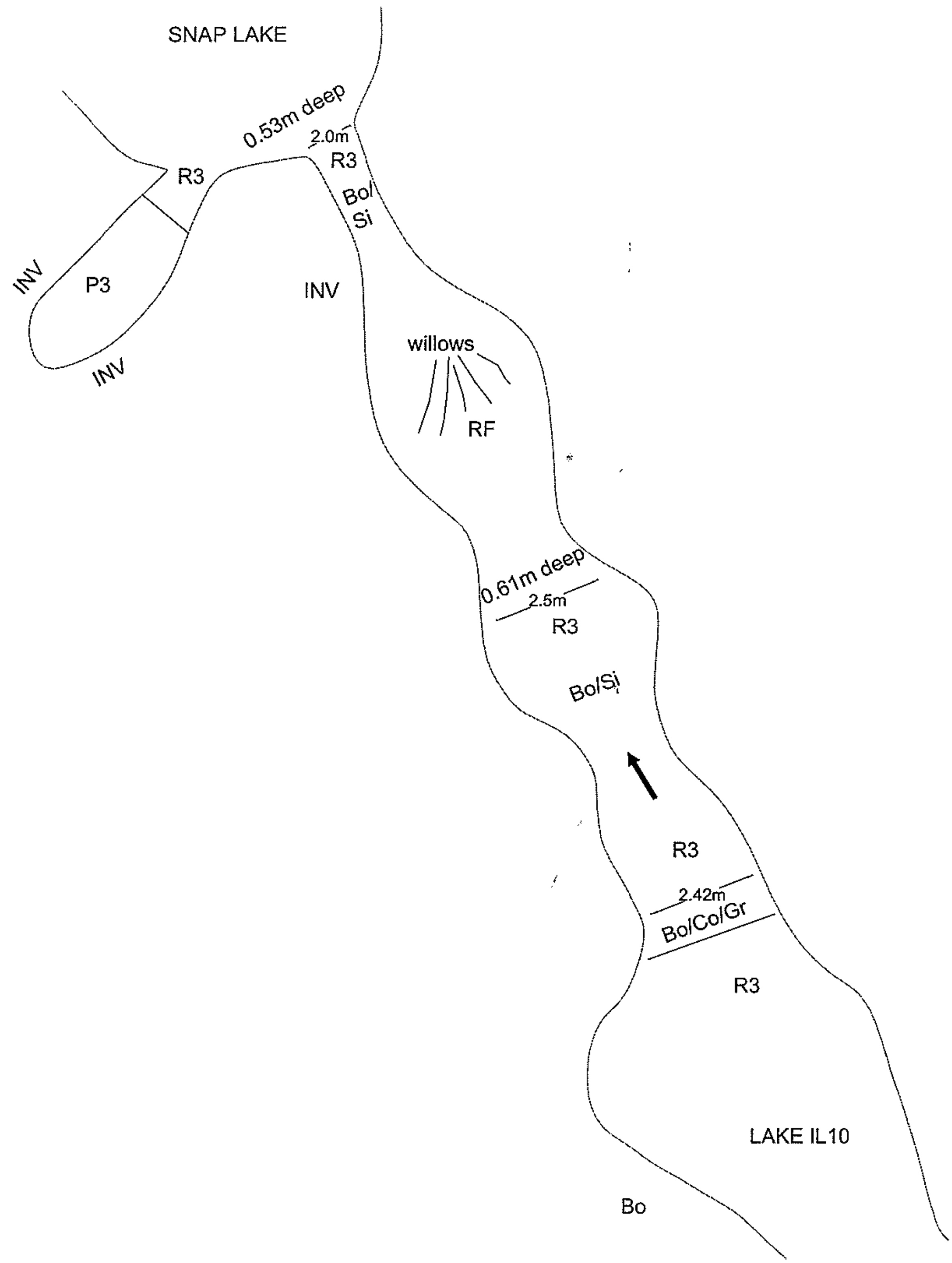
#### 4.3.2 S27

Stream S27 flows from sub-basin Q, one of the larger sub-basins in the Snap Lake watershed, in Snap Lake. This stream was surveyed on June 5 and 26, 1999. S27 is approximately 150 m long (Figure 17; Photos 20 and 21). The bank full width ranged from 2.0 to 2.5 m on June 5, 1999 but wetted width was approximately 1 m wide on June 26, 1999. The substrate consisted of organic debris and inundated vegetation in the mid-reach, but was cobble and boulder for the remaining areas. The stream channel was split and braided in one location where it entered a thicket, creating a possible vegetation and rock barrier to fish movement. The average depth was approximately 0.4 m and the velocity measured ranged from 0.25 m/sec to 0.53 m/sec.

On June 26, 1999, kick sampling for fish eggs was conducted immediately downstream of the first lake upstream of Snap Lake in the basin (named IL10 for map reference). Six small unidentified eggs were found. One small, unidentified fish was observed in the stream. In an August 2001 inspection of the dustfall station that is located north of IL10, small fish were observed in IL10. Results from a water sample collected in S27 are shown in Appendix I.

#### 4.3.3 S28

S28 is an area between Snap Lake and IL8 and IL7 over 300 m in distance to either lake (Figure 4). This low-lying area is shown as a stream connecting IL8 to Snap Lake on the 1:50,000 NTS topographical map (Figure 2). However most of the area is relatively flat except near Snap Lake where there is a steep slope. No distinct stream channels exist in the area and no flow was visible during the aerial surveys in early June, 1999 or during the field visit on June 26, 1999. The area was investigated again in June 2002. No flow or outlet could be found. The steep gradient of the area along the Snap Lake shore line was also noted during this survey. Although the spring of 1999 was a high run-off year based on regional hydrology data, no stream or significant amount of drainage was observed to occur in this area. Isolated, pools of ponded water were present on an organic and grassy substrate in the low lying areas. Because of the absence of a defined stream channel, no aquatic habitat maps were prepared and no additional surveys were conducted. On the ELC maps for the Snap Lake study area, this patch of terrain is designated as open spruce forest. It is likely that even the low-lying areas dry completely in the summer months.




**LEGEND**

| | | | |
|---|---|---|---|
| Bd | Bedrock | R | Run |
| Bo | Boulder | RF | Riffle |
| Co | Cobble | R2 | Class 2 Run - Moderate Quality Run |
| Gr | Gravel | R3 | Class 3 Run - Lowest Quality Run |
| Si | Silt | P3 | Class 3 Pool - Low Quality Pool Habitat |
| OHV | Overhanging Vegetation | | |
| INV | Inundated Vegetation | ⟶ | Flow Direction |

N

NOT TO SCALE

PROJECT

DE BEERS

TITLE

# HABITAT MAP FOR S27

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
|---|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. | |
| DESIGN | | | SCALE AS SHOWN | REV. 0 |
| CADD | SIB | 05/02/03 | **FIGURE: 17** | |
| CHECK | | | | |
| REVIEW | | | | |

#### 4.3.4 S29

S29 is approximately 130 m long and lies between IL6 and Snap Lake (Figure 18, Photos 22 and 23). The area is heavily vegetated with a gradient of 3 %. No defined channel was observed during an aerial survey on June 7, 1999 (freshet). During the field visit on June 26, 1999, much of the area was observed to be dry. Some small areas of ponded water were observed at the downstream end of the stream as well as areas of subsurface flow. No further sampling was conducted in 1999 due to a lack of water.

The ephemeral nature of this connection and the barriers to fish passage were confirmed during a site visit in the summer of 2001. No outflow from IL6 was observed in the 2001 investigation and barriers to fish migration (subsurface flow) were noted approximately 30 m upstream from Snap Lake. In June 2002, a second spring survey identified subsurface flow for the first 100 m of the area and no passable channel between IL6 and Snap Lake could be found. In the lower most 30 m of channel, a small flowing channel was observed. During the peak run-off, this was observed to be approximately 0.1 m in depth with an average channel width of 0.8 m. One adult (approximately 25 cm) Arctic grayling (*Thymallus arcticus*) was observed in this lower portion of the drainage in June 2002, approximately 25 m upstream from Snap Lake. The substrate in the region is primarily boulders and organic material.

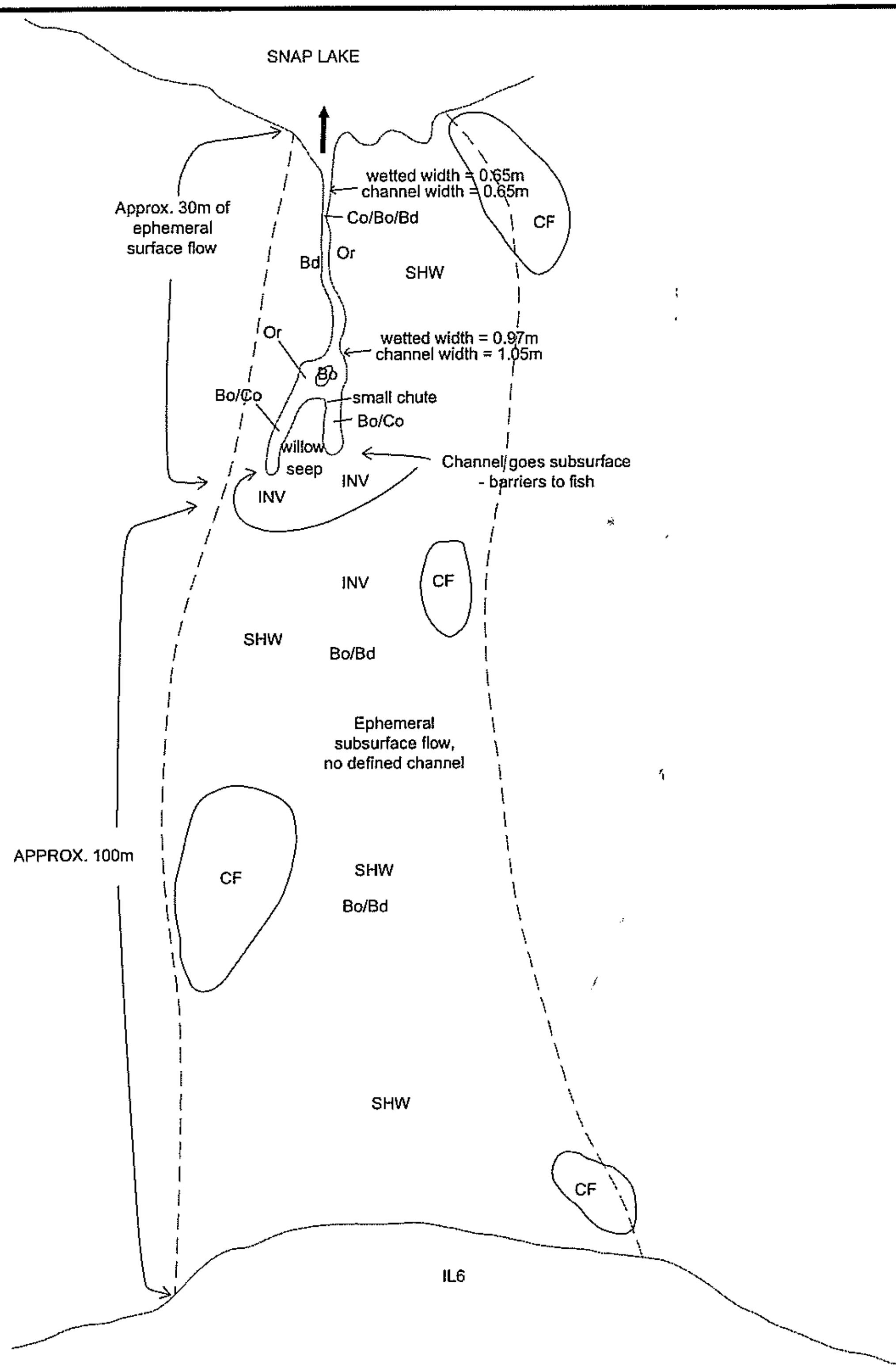
#### 4.3.5 Shallow Pond B Stream

The 1:50,000 NTS topographical map (Figure 2) illustrates a stream connecting Shallow Pond B to Snap Lake. No stream or channel was located, however, during June 1999 aerial surveys (Photo 15). The more detailed topographical map (Figure 4) also confirms that no stream occurs in this area.

### 4.4 Wetlands

#### 4.4.1 Wetland A

Wetland A is located east of IL6 (Figures 1, 2 and 4). Although the 1:50,000 NTS topographical map (Figure 2) denotes this as a stream connecting Shallow Pond C to IL6, no defined connection between the waterbodies was observed. When visited on July 7, 1999, most of the standing water area in the wetland consisted of shallow water (<5 cm deep). Water up to 25 cm deep was found in a diffuse drainage area approximately 10 m from a main area of standing water. The area was thus named a "wetland". The wetland area consisted primarily of sedges and marsh grasses and the substrate was comprised of




## LEGEND

| | | | |
|---|---|---|---|
| Bd | Bedrock | R | Run |
| Bo | Boulder | RF | Riffle |
| Co | Cobble | R2 | Class 2 Run - Moderate Quality Run |
| Gr | Gravel | R3 | Class 3 Run - Lowest Quality Run |
| Si | Silt | P3 | Class 3 Pool - Low Quality Pool Habitat |
| OHV | Overhanging Vegetation | | |
| INV | Inundated Vegetation | | |
| CF | Coniferous Forest | Or | Organics |
| SHW | Shrub, Willow | → | Flow Direction |

N

NOT TO SCALE

PROJECT

DE BEERS

TITLE

# HABITAT MAP FOR S29

Golder Associates
Saskatoon, Saskatchewan

| | | | | |
|---|---|---|---|---|
| PROJECT | 022-6659.5300 | | FILE No. | |
| DESIGN | | | SCALE AS SHOWN | REV. 0 |
| CADD | SIB | 06/02/03 | | |
| CHECK | | | FIGURE: 18 | |
| REVIEW | | | | |

approximately 50 cm of organic material over firm substrate material (Photo 24). Water samples were collected on in July 1999 and on July 12, 2002. Results from water quality sampling are shown in Appendix I. No fish sampling was conducted due to the lack of defined channels connecting the wetland to other waterbodies and due to the shallow depth and small surface area of standing water within the wetland.

### 4.4.2 Wetland B

Wetland B is located between IL6 and IL7 (Photos 10 and 11). While this appears as a stream-type connection between IL6 and IL7, no defined channel was observed in 1999 or 2001. The topographic information presented in Figure 4 also indicates that no connection exists between these lakes and that IL7 likely flows to the west. The area was dominated by spruce, sedges, and grasses. The ELC classification (Figure 3) notes this area as closed spruce forest and heath tundra. Because of the stream connection shown on the 1:50,000 NTS map (Figure 2) and some very small areas of standing water that might occur, this area was named a "wetland" for the purposes of the aquatic survey. When visited on July 12, 2002, water samples were collected (see Appendix 1 for results). No fish sampling was conducted due to the lack of defined channels connecting the wetland to other waterbodies and due to the shallow depth and small surface area of standing water within the wetland.

### 4.4.3 Wetland C

Wetland C is located between IL2 and IL8 (Figures 1, 2, and 4). The area was dominated by spruce and boulders. While this appears as a stream-type connection between IL2 and IL8 on the 1:50,000 NTS map (Figure 2), the ELC classification (Figure 3) denotes this area as heath boulder with patches of open spruce forest. Because of the NTS map designation and the possibility of water occurring, this area was named a "wetland" for the purposes of the aquatic survey. No fish sampling was conducted due to the lack of defined channels connecting the area to other waterbodies and due to the terrestrial nature and the lack of standing water within the wetland.

### 4.4.4 Wetland D

Wetland D is located between IL9 and IL8 (Figure 1, 2, and 4). The area was dominated by spruce and boulders. While this appears as a stream-type connection between IL9 and IL8 on the 1:50,000 NTS map (Figure 2), the ELC classification (Figure 3) denotes this area as heath boulder with patches of open and closed spruce forest. Because of the NTS map designation and the possibility of water occurring, this area was named a "wetland" for the purposes of the aquatic survey. No fish sampling was conducted due to the lack of defined channels connecting the area to other waterbodies and due to the terrestrial nature and the lack of standing water within the wetland.

# 5.0 SCREENING DECISIONS (STEP 2 TO 4)

After the 20 waterbodies in the proposed project area were identified and described (Sections 3 and 4), Steps 2 to 4 of the screening criteria were applied to determine if the waterbodies should be included or excluded from the fish habitat impact assessment and NNL accounting (Table 6).

Note that even if a waterbody was excluded from the fish habitat assessment (Section 9.5 of the EAR), the impact of the loss of the habitat to landscape diversity or to surface hydrology was assessed and presented in EAR Sections 10.3 and 9.3 respectively.

## 5.1 Step 2: Waterbodies Affected by the Project

Of the 20 waterbodies originally identified within or near the project area (Figures 1, 2, 3, and 4), eight will not be affected by the proposed project (*e.g.*, outside of the project footpring area). These include IL2, IL3, IL4, IL5, IL8, S1, S27 and S28. The remaining 12 waterbodies will likely be affected by the proposed project and were carried forward to Step 3 of the assessment (Table 6).

**Table 6**

**Screening of Waterbodies on the Northwest Peninsula within or near the Snap Lake Diamond Project Footprint**

| Waterbody | Will the Waterbody be Affected by Final Project Design? | Relation to Project |
|---|---|---|
| IL2 | no | Road to emulsion plant was routed north of lake. |
| IL3 | no | Airstrip routed around lake. |
| IL4 | no | Airstrip will not impact lake. |
| IL5 | no | Airstrip will not impact lake. |
| IL8 | no | Road to emulsion plant routed south and east of lake. |
| S1 | no | De Beers decided not to place waste rock pile on or near the Stream 1 drainage basin because of the extensive containment needed and because it is one of the largest basins in the Snap Lake watershed and it is fish-bearing (Figure 2.4-1 of the EAR). |
| S27 | no | Road to the explosive storage area routed to high ground and away from Stream 27 basin. |
| S28 | no | No project element near the stream. |
| IL6 | yes | Will be used as a sedimentation pond for the north pile. |
| IL7 | yes | Will be used as a sedimentation pond for the north pile. |
| IL9 | yes | Will be used as a sedimentation pond for the north pile, and will be partially covered. |
| shallow pond A | yes | Will be covered by the airstrip. |
| shallow pond B | yes | Will be covered by the site facilities. |
| shallow pond C | yes | Will be used as a sedimentation pond for the north pile and will be permanently covered by the north pile. |
| shallow pond B stream | yes | Upper portion of the drainage as denoted on the topographical map will be covered by site facilities. |
| S29 | yes | The connection from IL6 to S29 will be bermed. |
| wetland A | yes | Will be covered by the north pile. |
| wetland B | yes | Will be covered by the north pile. |
| wetland C | yes | Will be crossed by the road to the explosives storage area. |
| wetland D | yes | This area will not be directly disturbed. |

## 5.2 Step 3: Screening for Waterbodies that do not Exist Contrary to What was Denoted on the 1:50,000 National Topographic Systems Topographical Map

Three of the 12 waterbodies likely affected were either not located during the field survey or were not determined to be aquatic habitat. Wetland C and D were not present as true sedge wetlands or streams as denoted on the topographical map but were heath boulder associations with patches of open spruce forest and very little standing water (Figures 3 and 4). These areas did not have a direct connection to IL2, IL8, or shallow pond C contrary to what was denoted on the 1:50,000 NTS topographical map (Figure 2). Wetlands C and D were therefore excluded from further fish habitat impact assessment. Assessment of the impacts of the loss of portions of wetlands C and D to Snap Lake landscape diversity is found in Section 10.3 of the EAR. Discussion of the increase in surface flow expected to occur in sub-basin P in which wetlands C and D are found is in Section 9.3.2.2.3 of the EAR.

Although the topographical map illustrates a stream connecting shallow pond B to Snap Lake, a connection was not visible during the spring aerial survey in 1999 (Photos 15 and 16). No channel could be located. This location was excluded from further assessment. The impact of the alteration of surface runoff due to the project facilities in sub-basin A, in which the shallow pond B is located, was assessed as a negligible impact to Snap Lake and sub-basin A (Section 9.3 of the EAR).

Following the exclusion of three waterbodies in Step 3, nine waterbodies were carried forward to Step 4.

### 5.3 Step 4: Waterbodies that Cannot Support or have no Potential to Support a Fish Community

Five of the nine remaining waterbodies: IL7, IL9, shallow pond A, shallow pond B and shallow pond C were found to have no potential to support a fish community (Figure 1). A description of these waterbodies, including rationale for their classification, is outlined below.

IL7 is an isolated internal drainage waterbody. It does not have any discernible surface connections to IL6 (through wetland b) or S28. Consequently, it lacks any surface connections to any fish-bearing waterbodies. IL7 has a surface area of 2.4 ha and a maximum depth of 4 m. No fish were captured when this lake was surveyed. Based on data available, it was determined that the lake made no contribution, directly or indirectly to fish habitat. IL7 was therefore excluded from further fish habitat assessment. Assessment of the impact on the Snap Lake study area landscape diversity resulting from the loss of IL7 is provided in Section 10.3 of the EAR. Assessment of the expected impact on sub-basin P (where IL7 is located) resulting from the alteration of surface hydrology is provided in Section 9.3 of the EAR.

IL9 is an isolated, primarily internal drainage waterbody. It does not have surface connections to lakes in sub-basin O or sub-basin P. This pond is small (0.8 ha), is shallow enough to freeze to the bottom during winter (1.1 m maximum depth), and lacks surface connections to any fish-bearing waterbodies. In addition, no fish were captured when this pond was surveyed. Based on data available, it was determined that the pond made no contribution, directly or indirectly to fish habitat. IL9 was therefore excluded from further fish habitat assessment. Assessment of the impact on the Snap Lake study area landscape diversity resulting from the loss of IL9 is provided in Section 10.3 of the EAR. Assessment of the expected impact on sub-basin O (where IL 9 is located) resulting from the alteration of surface hydrology is provided in Section 9.3 of the EAR.

Shallow pond A is an isolated, internal drainage waterbody. It does not have the surface connections to lakes in the Stream 27 basin (sub-basin Q) denoted on the topographical map. Because of its small size (see Section 4 above), shallow depth, and lack of connection to a fish-bearing waterbody, it was determined that the pond made no contribution, directly or indirectly to fish habitat. Shallow pond A was therefore excluded from further fish habitat assessment. Assessment of the impact on the Snap Lake study area landscape diversity resulting from the loss of Shallow pond A is provided in Section 10.3 of the EAR. Assessment of the expected impact on sub-basin O (where IL 9 is located) resulting from the alteration of surface hydrology is provided in Section 9.3 of the EAR.

Shallow pond B is an isolated, shallow waterbody. It does not have the surface connection to Snap Lake denoted on the 1:50,000 NTS topographical map. Because of its small size, shallow depth (0.4 m), lack of overwintering habitat and lack of connection to a fish-bearing waterbody, it was determined that the pond made no contribution, directly or indirectly to fish habitat. Shallow pond B was therefore excluded from further fish habitat assessment. Assessment of the impact on the Snap Lake study area landscape diversity resulting from the loss of Shallow pond B is provided in Section 10.3 of the EAR. Assessment of the expected impact on sub-basin O (where IL 9 is located) resulting from the alteration of surface hydrology is provided in Section 9.3 of the EAR.

Shallow pond C is also a pond with isolated, primarily internal drainage. It has no surface connection to other waterbodies; though water from it likely drains over a dispersed area to wetland A or IL6 (see Section 4 above). This pond is small (0.8 ha), is shallow enough to freeze to the bottom during winter (1.6 m max depth), and lacks surface connections to any fish-bearing waterbodies. In addition, no fish were captured when this pond was surveyed. Based on all the data available, it was determined that the pond made no contribution, directly or indirectly to fish habitat. Shallow pond C was therefore excluded from further fish habitat assessment. Assessment of the impact on the

Snap Lake study area landscape diversity resulting from the loss of Shallow pond C is provided in Section 10.3 of the EAR.

Assessment of the expected impact on sub-basin O (where IL 9 is located) resulting from the alteration of surface hydrology is provided in Section 9.3 of the EAR. Following the elimination of IL9, Shallow Pond A, shallow pond B and shallow pond C, four waterbodies with the potential to provide direct fish habitat or indirect contributions to fish habitat remain in the present assessment. The remaining waterbodies are IL6, wetland A, wetland B, and S29. Separate from the impact assessment completed for fish habitat (EAR Section 9.5.2.3), loss accounting for all waterbodies that were determined to provide either direct or indirect fish habitat was requested by DFO. This accounting is provided in Section 7 of this document.

# 6.0 ACCOUNTING OF THE LOSS OF FISH HABITAT

## 6.1 Approach

The overall environmental consequence for fish habitat in the Snap Lake Basin was determined and the Fish Habitat Loss Accounting was completed for Snap Lake proper in the EAR (Section 9.5.2.3; Appendix IX.12). The present report, however, assess small waterbodies situated on the northwest peninsula of Snap Lake. These waterbodies need to consider the potential for both direct and indirect contributions as fish habitat. To complete this, the type and relative amount of contribution from the waterbodies on the northwest peninsula to the fisheries resources of the Snap Lake watershed were considered.

Waterbodies that provide fish habitat directly are considered to be those that fish can access or occupy waterbodies for one or all of their life stages, at least periodically. These types of areas include:

- fish bearing lakes (all accessible areas of the lake and lake margins), streams or rivers with permanent fish populations;
- seasonal streams or non-fish bearing lakes with periodic access for fish; and,
- streams providing seasonal migration corridors to other waterbodies that can support fish.

These areas can provide one, several, or all of the following life history requirements: spawning, nursery, rearing, foraging, overwintering, and refuge habitat. The contribution provided by these types of fish habitats can generally be quantified by calculating the quantity and quality of the various discrete areas of habitat provided, for all fish species potentially occupying or using the waterbody. This approach results in the calculation of habitat units (HUs) and relies on the ability to estimate the relative value of a specific habitat type for various fish species and life stages. This exercise was carried out for the changes to Snap Lake habitat that would result from the proposed water intake and outlet structures (EAR Appendix IX.12).

Indirect contributions to fish habitat comes from those areas with some connection to direct fish habitat, but because of physical barriers or other features, cannot be used directly by fish. These areas may provide a variety of other benefits to the fish in adjacent areas through water and nutrient delivery, and as sources of invertebrates (forage). However, because of the small amount of water or other benefits contributed by individual wetlands or small waterbodies, particularly from seasonal and short-term discharge, these indirect contributions cannot be quantified in relation to their contribution to the productive capacity of a downstream habitats. In other words, when small contributions are considered, the removal of the contribution/inputs would not result in a measurable change to the ability of downstream habitat to produce fish. However, if a large part of the indirect contributions from a watershed are removed, effects could eventually result in a decrease in productive capacity of downstream habitats.

### 6.2 Contributing Waterbodies

The waterbodies on the northwest peninsula considered to have potential for direct or indirect contributions to fish habitat include wetland A, S29, wetland B, and IL6 (Table 7). These waterbodies are interconnected and form a complex of open water, wetland, and treed depressions. The data available for these locations indicates their contributions are limited to indirect support to habitats in Snap Lake (Sections 4 and 5 of this document) with direct fish habitat occurring only in the lower 30 m of S29. One of the key components in the determination of the indirect nature of the contributions from IL6, and wetlands A and B is the inability for fish passage to occur through S29. A summary of the evidence used to screen out other waterbodies is provided in Table 8.

Through the field investigations, it was determined that the S29 channel is not passable by fish. This is supported by several lines of evidence. Firstly, the physical nature (*e.g.*, gradient, barriers, subsurface flow) of S29, IL6 and the sub-basin O in which they occur (*e.g.*, small size, and limited water run-off potential), limit the possibility of the channel being passable. Secondly, no fish where captured or observed in IL6, even with significant fishing effort supports the assertion that fish do not directly use S29 or IL6.

The key features of the physical nature of the stream and sub-basin include the limited size of the basin and the topography of the area. Some of the run-off in sub-basin O reaches IL6 as well as wetland A and wetland B, and exits IL6 through S29 as well as wetland A. This area represents approximately 0.84 $km^2$ of the run-off from sub-basin O. Basins with areas less than 1 $km^2$ have very limited run-off potential (generally lasting only a few days in spring). This was observed as part of the Diavik Diamond Project Environmental Impact Assessment (Diavik 1998a).

**Table 7**
**Summary of Northwest Peninsula Waterbodies with the Potential to Provide Direct or Indirect Fish Habitat**

| Lake | Size (ha) | Maximum Depth (m) | Contributing Drainage Area ($km^2$) | Connection to Fish Bearing Waters via Streams | Characteristics | Fishing Gear Used | Fish Caught or Observed | Potential Impact | Habitat Assessment |
|---|---|---|---|---|---|---|---|---|---|
| IL6 | 2.9 | 2.5 | 0.84 | no – ephemeral subsurface flow to Snap Lake through vegetated terrain via stream S29. | Shoreline dominated by vertical fractured bedrock, lake substrate dominated by boulder and cobble with small areas of fine organic substrates | Gill nets/ minnow traps | none | Borders north pile; will be used as sedimentation pond during operations | Not direct fish habitat. Undetectable indirect contribution to Snap Lake |
| S29 | 0.06 (5 m width X 130 m) | 0.1 | IL6 area of 0.84 | No - diffuse ephemeral flow from IL6 to Snap Lake through vegetated terrain | Heavy vegetation, boulder field, subsurface flow for most of the channel. Lower 30 m has an open channel with an average channel width of 0.8 m.<br>Sub-surface flow area approximately 5 m wide by 75 m long | None- due to lack of water in 1999 and summer 2001 | 1 adult Arctic grayling observed in lower 30 m section of channel in June 2001. | Bermed off at IL6 margin during operations, no flow through area until post closure | First 100 m downstream from IL6 not direct habitat due to lack of access, no defined channel, and sub-surface flow. Undetectable indirect contribution for this section.<br>Lower 30 m of open channel providing some direct habitat. |
| Wetland A | 0.04 | 0.25 | n/a | no – drainage passes through IL6 | Sedges and grasses over organics | n/a | n/a | Under north pile footprint | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |
| Wetland B | 0.02 | n/a | n/a | no – drains towards stream S28 | Open spruce forest and heath tundra | n/a | n/a | Under north pile footprint | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |

Note: ha = hectares; m = metres; $km^2$ = square kilometres; n/a = not available.

**Table 8**
**Summary of Northwest Peninsula Waterbodies Screened out of the Fish Habitat Analysis**

| Lake | Size (ha) | Maximum Depth (m) | Contributing Drainage Area ($km^2$) | Connection to Fish Bearing Waters via Streams | Basin Characteristics | Fishing Gear Used | Fish Catch | Potential Impact | Habitat Assessment |
|---|---|---|---|---|---|---|---|---|---|
| IL2 | 1.9 | 2.1 | 0.11 | no – drainage passes through wetlands c and d | Dominated by shallow <1 m shoals Small >1 m basin | Gill nets/ minnow traps | none | Near airstrip – No impact predicted | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |
| IL3 | 1.2 | 1.9 | 0.12 | no | Dominated by shallow <1 m areas, organic/detritus substrate small > 1 m basin | Gill nets/ minnow traps | none | Near airstrip – No impact predicted | Not direct fish habitat. Undetectable indirect contribution to IL5 through stream S31 |
| IL4 | 0.5 | 0.8 | 0.09 | no | All shallow water, mean depth 0.6 m | None used due to lack of depth | n/a | Near airstrip – No impact predicted | Not direct fish habitat. Undetectable indirect contribution to IL5 through stream S31 |
| IL5 | 8.21 | 4.0 | 0.8 | yes – defined channel with suitable habitat for cyprinids | Shoreline dominated by large boulders, some macrophytes present, some areas of fine organic sediments present | Gill nets/ minnow traps | 18 lake chub | Near airstrip – No impact predicted | Suitable small bodied fish habitat, overwintering available for these species |

**Table 8**
**Summary of Northwest Peninsula Waterbodies Screened out of the Fish Habitat Analysis (continued)**

| Lake | Size (ha) | Maximum Depth (m) | Contributing Drainage Area ($km^2$) | Connection to Fish Bearing Waters via Streams | Basin Characteristics | Fishing Gear Used | Fish Catch | Potential Impact | Habitat Assessment |
|---|---|---|---|---|---|---|---|---|---|
| IL7 | 2.4 | 4 | 0.18 | no – seepage towards S28 | Shoreline dominated by shrubs and grasses interspersed with boulders and spruce trees. Steep drop-off surrounds entire lake, substrate dominated by boulder cobble and silt. | Gill nets/ minnow traps | none | Borders north pile; will be used as sedimentation pond during operations and will be partially covered by north pile | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |
| IL8 | 4.3 | 1.1 | 0.50 | no – subsurface drainage to Snap Lake via stream S28 | Shoreline dominated by shrubs interspersed with boulders and spruce trees; 0.5 m bedrock drop-off surrounds entire lake, substrate dominated by boulder cobble interspersed with silt | Gill nets/ minnow traps | none | Near north pile footprint; no impact predicted | Not direct fish habitat. Undetectable indirect contribution to Snap Lake |
| IL9 | 0.8 | 1.6 | 0.06 | no – drainage passes through wetlands b to IL6 | Shoreline muskeg and grasses, some macrophytes present, some areas of fine organic sediments present | Gill nets/ minnow traps | none | Borders north pile; will be used as sedimentation pond during operations | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |

**Table 8**
**Summary of Northwest Peninsula Waterbodies Screened out of the Fish Habitat Analysis (continued)**

| Lake | Size (ha) | Maximum Depth (m) | Contributing Drainage Area ($km^2$) | Connection to Fish Bearing Waters via Streams | Basin Characteristics | Fishing Gear Used | Fish Catch | Potential Impact | Habitat Assessment |
|---|---|---|---|---|---|---|---|---|---|
| Shallow Pond A | 0.3 | < 1 | 0.13 | no – no discernible inlet or outlet | Shoreline dominated muskeg. Substrate dominated by fines and boulders | n/a | n/a | Under expanded airstrip footprint | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |
| Shallow Pond B | 0.1 | < 1 | 0.04 | no – no discernible inlet or outlet | Shoreline dominated by grass and boulders. Substrate dominated by fines and boulders | n/a | n/a | Under Advanced Exploration Project footprint | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |
| Shallow Pond C | 0.8 | 1.6 | 0.36 | no – drainage through wetland a | Shoreline dominated muskeg. Substrate dominated by fines and boulders | Gill nets/ minnow traps | none | Under north pile footprint | Not direct fish habitat. No potential to provide indirect benefit to fish bearing waters |
| S1 | 190 (Avg 1.9 m width X 100m) | 0.4 | 7.02 | yes – partially obstructed channel available for fish passage to upstream lake | Avg. width 1.9 m. Riffle run, pool habitat configuration along channel. Substrates boulder/cobble with inundated and overhanging vegetation | | small fish and eggs observed | None – outside project footprint | Direct fish habitat provided for fish. |

**Table 8**
**Summary of Northwest Peninsula Waterbodies Screened out of the Fish Habitat Analysis (continued)**

| Lake | Size (ha) | Maximum Depth (m) | Contributing Drainage Area ($km^2$) | Connection to Fish Bearing Waters via Streams | Basin Characteristics | Fishing Gear Used | Fish Catch | Potential Impact | Habitat Assessment |
|---|---|---|---|---|---|---|---|---|---|
| S27 | 0.03 (Avg 2.25 width X 150 m) | 0.4 | 2.64 | yes – partially obstructed channel available for fish passage to upstream lake | Avg. width 2.25 m. Run class 4 and 3 dominant. No pools. Substrates boulder with inundated vegetation | | Several small eggs collected and 1 small unidentified fish observed | None – outside project footprint | Direct fish habitat provided – Braided channel through boulder garden and willow thickets may act as barriers to fish |
| S28 | 0 (no drainage channel) | 0 | 0.87 | no – no observable channel or flow | Isolated ponded water surrounded by grasses | | none | None | No potential to provide migration corridor habitat or direct habitat. Undetectable indirect contribution to Snap Lake |
| Shallow Pond B Stream | 0 (no drainage channel) | 0 | 0.04 | no – no distinct channel or observable flow | Open spruce forest and heath tundra | | none | None | No potential to provide migration corridor habitat or direct habitat. Undetectable indirect contribution to Snap Lake |
| Wetland C | n/a | 0 | n/a | no observable connections | Heath boulder with patches of open spruce forest | n/a | n/a | n/a | No potential to provide direct or indirect fish habitat. |
| Wetland D | n/a | 0 | n/a | no observable connections | Heath boulder with patches of open and closed spruce forest | n/a | n/a | n/a | No potential to provide direct or indirect fish habitat. |

Note: ha = hectares; m = metres; $km^2$ = square kilometres; n/a = not available.

As indicated in the previous discussion of the hydrologic conditions in the sub-basins of the northwest peninsula, the connections among wetland A, IL6, and wetland B affect the potential for the connection to Snap Lake to allow fish passage at any time. The water level in IL6 is expected to vary only slightly between dry and wet years. Since these waterbodies, particularly IL6 and wetland A, are at the same elevation, increases in run-off during a high-flow spring spreads widely and simply extends into the adjacent wetlands. This limits the effect of any increased spring run-off on S29. Water is released across a broader, more diffuse area through wetland A as well as through S29. In summary, increased run-off is not expected to result in significant changes to the water flow though S29 and would not increase the accessibility of the drainage to fish.

Observations in S29 itself completed in the spring of 1999, which was a high water year, identified that the surface flow in S29 was ephemeral, had no defined channel, and flow was subsurface over much of the area between IL6 and Snap Lake. The elevation difference between IL6 and Snap Lake is 2.24 m. The natural water level fluctuation in Snap Lake is 0.55 m and would not be expected to overtop the connection to IL6. Based on the size of the drainage area reaching IL6 and the elevation of wetland A, the peak spring flow duration for the S29 drainage would be expected to be less than one week. During that time, the maximum peak flow predicted is 34 L/s in a high run-off year. Defined stream channels are not expected to form in watersheds of <1 $km^2$ as not enough physical energy is generated by flow to create distinct pathways. Rather diffuse flow around and among landscape features occurs in low lying depressions which can create wetted areas with unique vegetation features (in the Snap Lake region, thick willow or spruce stands may occur in these wetter areas). This was also observed in the baseline investigations for the Diavik Diamond Project (Diavik 1998a). These factors combined indicate: 1) that there is no channel for fish to access or use; and, 2) even under high flow conditions impassable barriers for fish occur at this location.

The fishing effort expended in IL6 also supports the assertion that fish cannot pass through S29 and that IL6 cannot support a fish community. In this instance, fish were not captured in IL6 after fishing during two separate years, with two separate crews of biologists, using both gillnetting and minnow trapping. Over 219 hours of minnow trapping throughout the lake (including overnight trapping effort) and approximately 13 hours of gillnetting in several locations were included in the sampling effort. In comparison, in IL5 the capture of 18 lake chub occurred with only 12 hours of minnow trapping effort. For the small lakes north of Snap Lake (NL1, NL2, NL3, NL4, and NL5) minnow trapping in each lake occurred with either four of five traps set for between two and three hours (totals of less than 12 hours for each lake) and small fish were captured in each lake. De Beers considers that the lack of any fish captured or observed in IL6, given the fishing effort expended, supports the evidence that there is no access to this lake through S29 and that no overwintering habitat exists to support a fish community.

As was observed for S29, there is also no fish access available into wetland A or wetland B from Snap Lake. Observations of this wetland also indicate it is not likely passable by fish and the topography indicates that no connection to IL7 through this wetland occurs. The lack of access through S29 also limits the possible contributions of wetland B, in relation to downstream fish habitat, as indirect.

Based on the above rationale the waterbodies on the northwest peninsula that will be affected by the proposed project were all found to make an indirect contribution to fish habitat.

### 6.3 Indirect Loss Accounting

The total surface area for wetland A and B, and IL6 combined equals 2.96 ha. The contribution from these areas to Snap Lake would be water delivery, nutrients in the runoff, and some amount of invertebrate food production that may reach Snap Lake. No fish were captured in these lakes and no access from any fish bearing waters is available to these lakes or wetlands. There is currently no feasible way to quantitatively account the indirect contributions from these lakes make to productive capacity of Snap Lake. It is incalculable in the sense that there is no way to calculate how such a small change from an indirect source may influence the productive capacity of a downstream habitat. However, it is reasonable to believe that change in productive capacity and the resulting effects on the aquatic community or fish population levels will be undetectable as these waterbodies on the northwest peninsula that are affected by the project represent 0.04% of the Snap Lake watershed. In addition, the waters diverted from wetland A and B, and IL6 by the placement of the north pile will still reach Snap Lake during operations. This water will be collected by the north pile drainage system and forwarded to the water treatment plant before release to Snap Lake. As such, there will be no loss of water to Snap Lake.

The total area associated with S29 is 0.06 ha assuming an area approximately 5 m wide with some level of influence from water (*i.e.*, accounting for the thick vegetation in the areas of subsurface flow). The indirect contribution of this stream would be from some amount of food production during the spring freshet when water is released from IL6 through this area. As indicated above, although there is no feasible way to account for these indirect contributions from the upper 100 m length of the stream it is reasonable to expect that these effects will be within the range of natural variability.

## 6.4 Direct Loss Accounting

### 6.4.1 Lakes and Wetlands

Based on the evaluation of lakes, wetlands and other waterbodies on the northwest peninsula, there is no direct loss of fish habitat on the northwest peninsula from wetland A, wetland B, or IL6 to be calculated.

### 6.4.2 Streams

Stream S29 was identified as providing direct fish habitat in the lower 30 m, at the outlet to Snap Lake. The total stream area associated with S29 is 0.06 ha. The lower 30 m, with an average channel width of approximately 0.8 m, accounts for 0.002 ha of stream habitat.

**Specific Habitat Provided**

A total of five separate surveys of S29 were conducted between 1999 and 2002. The only fish species observed to be using the lower portion of the stream was Arctic grayling. This observation was limited to one of the five surveys. Consequently the NNL calculations are limited to this species.

The lower 30-m area of S29 provides limited forage habitat during the spring freshet when water is released from IL6. Use of this stream by fish as a corridor connecting Snap Lake to IL6 is not possible as was indicated previously. The limited duration of spring flow though this channel (<1 week) would preclude the use of the stream as spawning or rearing habitat since adequate flow must available for three weeks to allow egg incubation and emergence of fry, as well as time to allow fry to access suitable rearing habitat before flows drop to levels where the fry can no longer navigate the stream (Diavik 1998b).

In the Diavik NNL Plan (Diavik 1998b), the duration of flows was selected as one of the most important variables for identifying potential spawning streams. Duration of flow was strongly related to basin size. Streams in the Lac de Gras study area were found to have three main types of flow conditions: (1) those flowing for very brief time periods during snowmelt run-off, some for only a few days (basins <1 $km^2$) and others less than three weeks (basins <2 $km^2$); (2) those flowing into the summer and lasting for one month and occasionally two months (basins between 3 and 8 $km^2$); and, (3) those flowing during the entire open-water season (basins >37 $km^2$).

One adult Arctic grayling was observed in S29 in June 2002, approximately 25 m upstream from Snap Lake. Based on the biology of Arctic grayling, successful spawning requires enough time to complete the spawning and incubation phases as well as a post-hatch, sub-gravel larval phase (Diavik 1997b). The literature cited in the Diavik NNL Plan indicated a range of 8 to 32 days for egg incubation depending on water temperature (averages of 15°C for eight days and 5°C for 32 day incubation period). Sixteen to 18 days for incubation were reported at water temperatures of 9°C. In addition to the time required for incubation, several days prior to spawning are often required for staging and an additional three to four days are required to complete the post-hatch, sub-gravel stage before the fry emerge. Air temperature observations in the Snap Lake area range between a low of 4.3°C and high of 13.9°C in June (Table 9.3-4 of the EAR). Water temperatures in shallow streams would closely match air temperature during spring run-off. At these temperatures, a minimum of three weeks was conservatively estimated as the requirement in most years for a combined spawning, incubation, and sub-gravel period for Arctic grayling.

Based on the above criteria S29 would not support spring spawning, rearing, or migration corridor habitat. The remaining use of this stream is as foraging habitat during the peak spring run-off period.

### Habitat Suitability and Habitat Unit Determination

Based on the physical habitat characteristics of the stream, the relative value of the area as foraging habitat for Arctic grayling was assessed as equal to 0.25 on a scale of 0 to 1 (as per the modified Habitat Evaluation Procedure presented in Appendix IX.12 and the Arctic grayling habitat suitability index Table IX.12-5c of the EAR). These characteristics included:

- primarily boulder/cobble substrate with some organic material;
- shallow depth;
- some overhead cover available;
- limited accessibility; and,
- limited flow volumes.

To account for the limited time period over which this habitat is available, a maximum wetted duration of two weeks out of 52 weeks per year was assumed.

The total HUs in S29 is calculated by combining the HSI value and the quantity of habitat available (Table 9). Based on this, 0.00002 HUs will be disrupted during construction and operation of the mine as a result of blocking flow out of IL6. To be consistent with the HU calculations presented in Appendix IX.12 of the EAR for Snap Lake, the HU value for S29 was calculated in hectares.

**Table 9**
**Habitat Unit Determination for S29**

| Stream ID | Stream Length (m) | Stream Area (ha) | % Coarse Substrate | % Fines Substrate | Average Velocity | Peak Flow Duration | % Pools | Other Relevant Data | Overall HSI Value | HUs (stream area X HSI Value) |
|---|---|---|---|---|---|---|---|---|---|---|
| S29 | 30 | 0.002 | 70 | 30 | 0.2 m/s | <1 week | 0 | Available 2 weeks annually | 0.01 | 0.00002 |

Note: ID = identification; m = metres; ha = hectares; % = percentage; HSI = habitat suitability index; HUs = habitat units.

## 7.0 ENVIRONMENTAL ASSESSMENT OF WATERBODIES ON THE NORTHWEST PENINSULA

Based on the screening carried out in the present report, four waterbodies to be affected by the proposed Snap Lake Diamond Project on the northwest peninsula were identified as having potential to provide direct or indirect fish habitat. These are wetland A, Stream 29, wetland B, and IL6.

In the EAR the potential environmental consequences of impacts to the fishery resources of the Snap Lake watershed were evaluated in several ways. These included direct effects to fish bearing waters, direct effects to stream habitats accessible to fish, hydrologic change in sub-basin drainage patterns and run-off conditions, and direct and indirect effects to food resources in Snap Lake (EAR Section 9.5.2). As indicated in the waterbody screening, the potential for changes in the landscape diversity, including the amount of wetland area, were assessed through the ELC system presented in Section 10.3.2.2 of the EAR.

The assessment of impacts on fish habitat provided by waterbodies on the northwest peninsula as listed in Section 9.5 of the EAR are summarized below:

- Stream directly used by fish will not be affected by from infrastructure development (*e.g.*, no stream crossings by roads and no streams under the mine footprint).
- Small fish-bearing lakes (*i.e.*, lakes that are suitable as direct fish habitat) will not be affected.
- The expected changes to surface hydrology on the peninsula due to infrastructure development and runoff containment would alter runoff to Snap Lake at an estimated 2.5% of the Snap Lake basin. However, the runoff that is intercepted and contained by the project still reports to Snap Lake through discharge from the water treatment system.
- Fish-bearing waterbodies on the peninsula will not be affected by changes to surface hydrology
- Overall, the environmental consequence in relation to the footprint on the northwest peninsula and effects to fish habitat were evaluated as negligible (negligible is defined in the EAR as an impact affecting <1% of available fish habitat).

The negligible impact on fish-bearing waterbodies on the northwest peninsula is attributed to a detailed consideration of project alternatives during the design phase of the project and the selection of those that minimized potential adverse effects on the aquatic environment. De Beers implemented numerous mitigation strategies throughout the planning of the project and will incorporate these into the construction, operations, and closure phases of the development. These included:

- The decision to develop the mine as an underground mine and not an open pit operation. The absence of open pits avoided significant surface disturbance to the Snap Lake watershed.

- Decision to reduce the footprint size of the north pile, to limit the number of waterbodies potentially covered or affected.

- The selection of the shape and size of the footprint. The shape was deliberately selected to avoid loss of small lake and stream areas, particularly for lakes with the potential to support fish populations (*e.g.*, the road to the explosive storage was routed to avoid stream crossings and lakes, as were other features of the footprint including the airstrip). The size of the footprint was minimized to the extent possible, particularly with the decision to develop an underground mine and crushing system.

- The avoidance of infrastructure within the large Snap Lake sub-basins (such as sub-basin Q and S), to the extent possible, as these basins were known to have fish-bearing waterbodies.

- The development of the seepage and run-off containment system to prevent direct site run-off to Snap Lake which could cause increased sediment yield and total suspended solids (TSS) in this waterbody.

For the purposes of the environmental impact assessment, De Beers is confident that, although the fish habitat information for each waterbody on the peninsula was not presented in as much detail as it has been provided in this document, the environmental consequences to fish habitat on the northwest peninsula were fully evaluated in the EAR. Based on that evaluation, and on the definitions of effect levels in the EAR, a negligible effect to fish habitat on the peninsula would result from the development of the Snap Lake Diamond Project.

## 8.0 NEXT STEPS FOR A *NO NET LOSS* PLAN

De Beers has met the requirements of the Terms of Reference for the Environmental Assessment of the Snap Lake Diamond Project in providing an overview on how NNL will be achieved. However, De Beers recognizes that DFO has an obligation to ensure "No Net Loss" of fish habitat based on the *Policy for the Management of Fish Habitat* (DFO 1986) and is committed to fully completing any regulatory requirements associated with the Snap Lake Diamond Project. Also, De Beers recognizes that community consultation will be required to describe and discuss the losses and gains of fish habitat related to the project. De Beers also notes the responsibility of DFO to consult in the course of implementing NNL. De Beers would like to work in concert with DFO to achieve appropriate community consultation and ensure the objectives of "No Net Loss" for this project are communicated.

Compensation plans for the small amount of habitat disrupted in S29 have not yet been fully considered. However, several options are available that De Beers considers will meet the intent of "No Net Loss". One possibility is excavating IL6, post closure, and creating sufficient depth to support overwintering of fish. A second option would be to create more accessible stream habitat in S29 post closure through improvement of the existing channel based on principles of natural channel design and fluvial geomorphology. Both of these options would avoid disturbance to any new waterbodies outside the current disturbance footprint.

Based on the small amount of fish habitat affected in S29 (0.00002 HUs or 0.2 $m^2$) and the availability of compensation options that can achieve "No Net Loss", De Beers is confident that a NNL plan can be drafted and will fulfil the objectives of all parties concerned. De Beers submits the information in this package to DFO to work towards that goal.

## 9.0 CONCLUSION

A total of 20 waterbodies on the northwest peninsula were screened to determine if they had the potential to provide fish habitat. The results of this screening process that four waterbodies on the northwest peninsula would be affected by the development of the north pile and these were assessed as indirectly contributing to fish habitat. These are wetland A, wetland B, S29, and IL6. Because the affected areas of these watersheds represent 0.04% of the Snap Lake watershed, loss of indirect support from portions of the sub-basins would result in an immeasurable change to the productive capacity of Snap Lake. Based on this, De Beers considers that the value of the indirect habitat that will be lost cannot be quantified. In addition, the water diverted from these watersheds will be returned to Snap Lake via the north pile drainage collection system and the water treatment plant. Consequently, there will be no change in the amount of water reaching Snap Lake from these watersheds.

In addition, a small area of stream S29 at the outflow to Snap Lake, was identified as providing some seasonal foraging habitat. The Habitat Unit value for this area was determined to be 0.00002 ha (0.2 $m^2$).

The Snap Lake Diamond Project differs substantially from other diamond projects in that only an extremely small amount of fisheries habitat will be affected. The scale of this habitat is several orders of magnitude smaller than the areas of habitat affected by the development of BHP and Diavik. Overall, the environmental consequence of this small indirect and direct fish habitat loss or disruption on the northwest peninsula due to the Snap Lake Diamond Project will be negligible. Furthermore, based on the small number of HUs available in relation to this habitat, it is felt that through some minor restoration and improvement activities related to post-closure work in IL6, the temporary disruption of this habitat can be fully compensated and "No Net Loss" of fish habitat can be achieved simply.

## 10.0 REFERENCES:

Department of Fisheries and Oceans. 1986. Policy for the Management of Fish Habitat. Fish Habitat Management Branch. DFO/3524. 28p.

Diavik (Diavik Diamond Mines Inc.). 1998a. Diavik Diamonds Project Environmental Effects Report, Fish and Water Volumes 1 and 2. Prepared by Golder Associates. September.

Diavik (Diavik Diamond Mines Inc.). 1998b. Diavik Diamonds Project, No Net Loss Plan. Prepared by Golder Associates. August.

# APPENDIX I

# WATER QUALITY DATA FOR NORTHWEST PENINSULA WATERBODIES

Table L1
Water Quality Data from Inland Lakes and Streams on the Northwest Peninsula of Snap Lake

| Parameter (Unit) | R3 | | | R4 | | R5 | | | R6 | R7 | R9 | Shallow Pond C | S01 | | | | | | S27 | | Wetland "A" | | Wetland "B" |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1999 | | 2002 | 1999 | 2002 | 1999 | | 2002 | 2001 | 2001 | 2001 | 2001 | 1999 | | | 2001 | | | 1999 | 2002 | 1999 | 2002 | 2002 |
| | Jun-26 | Aug-13 | Aug-27 | Jun-26 | Aug-27 | Jun-26 | Aug-12 | Aug-27 | Jul-21 | Jul-20 | Jul-20 | Jul-21 | May-26 | May-28 | Jun-07 | May-29 | Jul-11 | Oct-06 | May-25 | Aug-27 | Jul-02 | Jul-12 | Jul-12 |
| **Total Metals** | | | | | | | | | | | | | | | | | | | | | | | |
| Total Aluminium (ug/L) | 110.0 | 149 | 174 | 132.0 | 174 | 61.2 | 69 | 85.2 | | | | | <30 | 43 | 47.7 | 78.6 | 51.2 | 71.8 | 77 | 43.9 | 200 | 210 | 290 |
| Total Antimony (ug/L) | <0.5 | <0.5 | 0.11 | 0.5 | 0.11 | 0.5 | <0.5 | 0.11 | | | | | 0.6 | 1.3 | 6.6 | 0.05 | 0.03 | 0.11 | 0.6 | 0.11 | <0.3 | <5 | <5 |
| Total Arsenic (ug/L) | 0.6 | <0.2 | 0.17 | <0.2 | 0.19 | <0.2 | <0.2 | 0.11 | | | | | <0.2 | <0.2 | <0.2 | 0.09 | 0.10 | 0.11 | <0.2 | 0.11 | <0.2 | <1 | <1 |
| Total Barium (ug/L) | 2.9 | 3.0 | 4.00 | 3.3 | 4.32 | 2.2 | 2.0 | 2.57 | | | | | 2.2 | 3.0 | 2.2 | 2.45 | 3.27 | 4.27 | 3.5 | 3.16 | 3.0 | 4.3 | 4.8 |
| Total Beryllium (ug/L) | <2 | <2 | <0.2 | <2 | <0.2 | <2 | <2 | <0.2 | | | | | 0.3 | 0.9 | <0.1 | <0.2 | <0.2 | <0.2 | <0.1 | <0.2 | <2 | <1 | <1 |
| Total Bismuth (ug/L) | <0.4 | <0.4 | <0.03 | <0.4 | <0.03 | <0.4 | <0.4 | <0.03 | | | | | <0.1 | <0.1 | <0.1 | <0.03 | <0.03 | <0.03 | <0.1 | <0.03 | <0.4 | <0.1 | <0.1 |
| Total Boron (ug/L) | | | 2 | | 1 | | | 1 | | | | | | | | 2 | 2 | <1 | | 2 | | <20 | <20 |
| Total Cadmium (ug/L) | <0.3 | <0.3 | <0.05 | <0.3 | <0.05 | <0.3 | <0.3 | <0.05 | | | | | <0.1 | <0.1 | <0.1 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.3 | <0.2 | <0.2 |
| Total Cesium (ug/L) | <0.4 | <0.5 | <0.1 | <0.4 | <0.1 | <0.4 | <0.4 | <0.1 | | | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.4 | <50 | <50 |
| Total Chromium (ug/L) | <3 | <3 | 0.40 | <3 | 0.41 | <3 | <3 | 0.32 | | | | | <2 | <2 | <0.2 | 0.15 | 0.46 | 0.26 | <2 | 0.35 | <3 | <0.6 | <0.6 |
| Total Cobalt (ug/L) | <1 | <1 | 0.3 | <1 | 0.4 | <1 | <1 | 0.2 | | | | | 0.5 | 0.7 | 0.1 | 0.3 | 0.1 | 0.2 | 0.7 | 0.2 | <1 | 0.4 | 0.4 |
| Total Copper (ug/L) | <2 | <2 | 0.9 | <2 | 1.5 | <2 | <2 | 1.2 | | | | | 1.4 | 3.5 | 1.1 | 1.1 | 1.2 | 1.4 | 1.0 | 1.8 | <2 | 3 | 2 |
| Total Iron (ug/L) | 504 | 640 | 571 | 558 | 587 | 1060 | 400 | 260 | | | | | 340 | 322 | 230 | 356 | 220 | 421 | 266 | 177 | 580 | 620 | 339 |
| Total Lead (ug/L) | 1.0 | <1 | 0.07 | 1.1 | 0.06 | <1 | <1 | <0.05 | | | | | <2 | <2 | <0.2 | <0.05 | <0.05 | <0.05 | <0.2 | <0.05 | <1 | 0.4 | 0.2 |
| Total Lithium (ug/L) | <3 | <3 | 1.6 | <3 | 1.4 | <3 | <3 | 1.1 | | | | | 0.7 | 1.1 | 0.7 | 0.8 | 0.9 | <0.1 | 0.6 | 0.9 | <3 | <6 | <6 |
| Total Manganese (ug/L) | 5.5 | 6.0 | 8.8 | 5.9 | 7.6 | 5.2 | 3.0 | 3.3 | | | | | 17.9 | 17.5 | 16 | 10.3 | 3.6 | 8.1 | 54.7 | 11.5 | 5.0 | 7 | 8 |
| Total Mercury (ug/L) | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | | | | | <0.01 | <0.01 | <0.01 | <0.02 | <0.02 | <0.02 | <0.01 | <0.02 | <0.01 | | |
| Total Molybdenum (ug/L) | <1 | <1 | 0.21 | <1 | 0.43 | <1 | <1 | 0.19 | | | | | 0.1 | 0.2 | 0.1 | 0.11 | 0.15 | 0.20 | <0.1 | 0.10 | <1 | 0.3 | 4.1 |
| Total Nickel (ug/L) | <1 | <1 | 0.58 | <1 | 0.51 | <1 | <1 | 0.36 | | | | | 0.4 | 0.7 | 0.5 | 0.47 | 0.57 | 0.63 | 0.3 | 0.27 | <1 | 1.3 | 3.3 |
| Total Rubidium (ug/L) | | | 1 | | <1 | | | <1 | | | | | | | | 1 | <1 | <1 | | <1 | | <50 | <50 |
| Total Selenium (ug/L) | <10 | <10 | <0.4 | <10 | <0.4 | <10 | <10 | <0.4 | | | | | <10 | <10 | <10 | <0.1 | <0.1 | <0.4 | <10 | <0.4 | <10 | <0.4 | <0.4 |
| Total Silver (ug/L) | <0.3 | <0.3 | <0.1 | <0.3 | <0.1 | <0.3 | <0.3 | <0.1 | | | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.3 | <0.4 | <0.4 |
| Total Strontium (ug/L) | 5.8 | 5.0 | 7.8 | 6.7 | 9.1 | 5.3 | 4.0 | 8.5 | | | | | 5.0 | 5.0 | 4.0 | 5.5 | 7.7 | 9.9 | 6.4 | 7.9 | 6.0 | 8.7 | 30.8 |
| Total Thallium (ug/L) | 1.0 | <0.4 | <0.03 | 0.9 | <0.03 | <0.4 | <0.4 | <0.03 | | | | | <0.1 | <0.1 | <0.1 | <0.03 | <0.03 | <0.03 | <0.1 | <0.03 | <0.4 | <0.1 | <0.1 |
| Total Titanium (ug/L) | <3 | <3 | 2.3 | <3 | 17 | <3 | <3 | 0.8 | | | | | 0.7 | 1.1 | 0.5 | 15 | 0.1 | 0.7 | 1.0 | 0.6 | <3 | <5 | 5 |
| Total Uranium (ug/L) | <0.3 | <0.3 | 0.05 | <0.3 | <0.05 | <0.3 | <0.3 | 0.05 | | | | | <0.1 | <0.1 | <0.1 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.3 | <0.1 | 0.2 |
| Total Vanadium (ug/L) | <1 | <1 | 0.40 | <1 | 0.35 | <1 | <1 | 0.18 | | | | | <0.1 | <0.1 | 0.2 | 0.15 | 0.20 | 0.18 | 0.3 | 0.17 | <1 | 0.2 | 0.3 |
| Total Zinc (ug/L) | <10 | <10 | 2.9 | <10 | 3.2 | <10 | <10 | 2.3 | | | | | <10 | <10 | <10 | 1.2 | 0.8 | <0.8 | <10 | <0.6 | <10 | 4 | <4 |
| **Dissolved Metals** | | | | | | | | | | | | | | | | | | | | | | | |
| Dissolved Aluminium (ug/L) | | 130 | 148 | | 141 | | 46.0 | 70.5 | | | | | 58.0 | 57.0 | 54.7 | 55.6 | 39.1 | 51.4 | 73.0 | 29.2 | 400 | 190 | 230 |
| Dissolved Antimony (ug/L) | | 0.5 | 0.12 | | 0.17 | | 1.4 | 0.13 | | | | | 0.6 | 0.6 | 0.9 | 0.04 | 0.03 | 0.28 | 0.7 | 0.12 | 0.4 | <0.8 | <0.8 |
| Dissolved Arsenic (ug/L) | | <0.2 | 0.13 | | 0.17 | | <0.2 | 0.11 | | | | | <0.2 | <0.2 | <0.2 | 0.07 | 0.09 | 0.11 | <0.2 | 0.11 | <0.2 | 0.8 | 0.7 |
| Dissolved Barium (ug/L) | | 3.0 | 3.71 | | 4.05 | | 1.7 | 2.43 | | | | | 2.2 | 2.6 | 2.2 | 2.34 | 3.34 | 4.01 | 2.9 | 2.95 | 59.6 | 3.6 | 4.1 |
| Dissolved Beryllium (ug/L) | | <0.2 | <0.2 | | <0.2 | | <0.2 | <0.2 | | | | | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 | <0.2 | <0.1 | <0.2 | <0.2 | <0.5 | <0.5 |
| Dissolved Bismuth (ug/L) | | <0.1 | <0.03 | | <0.03 | | <0.1 | <0.03 | | | | | <0.1 | <0.1 | <0.1 | <0.03 | <0.03 | <0.03 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 |
| Dissolved Boron (ug/L) | | | 2 | | 1 | | | 1 | | | | | | | | 2 | 2 | <1 | | 2 | | 9 | 18 |
| Dissolved Cadmium (ug/L) | | <0.1 | <0.05 | | <0.05 | | <0.1 | <0.05 | | | | | <0.1 | <0.1 | <0.1 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.1 | <0.1 | <0.1 |
| Dissolved Cesium (ug/L) | | <0.1 | <0.1 | | <0.1 | | <0.1 | <0.1 | | | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Dissolved Chromium (ug/L) | | <0.3 | 0.38 | | 0.40 | | <0.3 | 0.35 | | | | | <2 | 0.2 | 0.4 | 0.15 | <0.05 | 0.37 | <2 | 0.37 | 0.7 | 5.8 | 7.1 |
| Dissolved Cobalt (ug/L) | | 0.2 | 0.3 | | 0.4 | | <0.1 | 0.2 | | | | | 0.4 | 0.4 | 0.2 | 0.2 | <0.1 | 0.2 | 0.6 | 0.1 | 0.4 | 0.4 | 0.4 |
| Dissolved Copper (ug/L) | | 1.0 | 0.9 | | 1.2 | | 1.1 | 1.2 | | | | | 1.8 | 1.3 | 1.2 | 1.1 | 3.1 | 1.4 | 1.1 | 0.9 | 1.5 | 1.4 | 1.7 |
| Dissolved Iron (ug/L) | | 462 | 233 | | 201 | | 235 | 115 | | | | | 257 | 263 | 194 | 261 | 82 | 126 | 176 | 54 | 266 | 411 | 319 |
| Dissolved Lead (ug/L) | | 0.2 | 0.19 | | 0.23 | | <0.1 | 0.05 | | | | | 0.3 | 0.3 | 4.4 | <0.05 | <0.05 | <0.05 | <0.2 | 0.07 | 0.5 | 0.2 | 0.5 |
| Dissolved Lithium (ug/L) | | 1.3 | 1.5 | | 1.4 | | 0.9 | 1.0 | | | | | 0.4 | 0.8 | 0.6 | 0.8 | 0.9 | <0.1 | 0.7 | 0.8 | 1.4 | 1.3 | 0.8 |
| Dissolved Manganese (ug/L) | | 4.8 | 5.6 | | 6.9 | | 1.9 | 2.0 | | | | | 18.1 | 15.7 | 1.5 | 9.4 | 2.8 | 3.2 | 48.1 | 7.4 | 4.0 | 6 | 6 |
| Dissolved Mercury (ug/L) | | <0.01 | <0.02 | | <0.02 | | <0.01 | <0.02 | | | | | <0.01 | <0.01 | <0.01 | <0.02 | <0.02 | <0.02 | <0.01 | <0.02 | <0.01 | | |
| Dissolved Molybdenum (ug/L) | | 0.2 | 0.19 | | 0.35 | | 0.2 | 0.17 | | | | | 0.1 | 0.1 | 0.2 | 0.10 | 0.14 | 0.19 | <0.1 | 0.10 | 0.2 | 0.2 | 0.8 |
| Dissolved Nickel (ug/L) | | 0.5 | 0.74 | | 0.59 | | 0.2 | 0.49 | | | | | 0.4 | 0.5 | 0.5 | 1.11 | 0.84 | 0.80 | 0.3 | 0.64 | 0.8 | 0.7 | 0.7 |
| Dissolved Rubidium (ug/L) | | | 1 | | <1 | | | <1 | | | | | | | | 1 | <1 | <1 | | <1 | | <50 | <50 |
| Dissolved Selenium (ug/L) | | <1 | <0.4 | | <0.4 | | <1 | <0.4 | | | | | <10 | <10 | <1 | <0.1 | <0.1 | <0.4 | <10 | <0.4 | <1 | <0.4 | <0.4 |
| Dissolved Silver (ug/L) | | <0.1 | <0.1 | | <0.1 | | <0.1 | <0.1 | | | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.2 | <0.2 |
| Dissolved Strontium (ug/L) | | 6.5 | 7.5 | | 8.8 | | 4.7 | 6.6 | | | | | 4.8 | 5.1 | 4.0 | 5.3 | 7.7 | 9.8 | 5.9 | 7.5 | 12.3 | 8.1 | 12.2 |
| Dissolved Thallium (ug/L) | | <0.1 | <0.03 | | <0.03 | | <0.1 | <0.03 | | | | | <0.1 | <0.1 | <0.1 | <0.03 | <0.03 | <0.03 | <0.1 | <0.03 | <0.1 | <0.05 | <0.05 |
| Dissolved Titanium (ug/L) | | 1.6 | 1.0 | | 0.9 | | 0.4 | 0.6 | | | | | 0.3 | 0.5 | 0.7 | 0.5 | <0.1 | 0.5 | 0.6 | 0.3 | 0.8 | 1.0 | 3.1 |
| Dissolved Uranium (ug/L) | | <0.1 | <0.05 | | <0.05 | | <0.1 | 0.05 | | | | | <0.1 | <0.1 | <0.1 | <0.05 | <0.05 | <0.05 | <0.1 | <0.05 | <0.1 | <0.1 | 0.1 |
| Dissolved Vanadium (ug/L) | | 0.3 | 0.19 | | 0.20 | | 0.1 | 0.14 | | | | | 0.1 | <0.1 | 0.2 | 0.10 | 0.10 | 0.11 | 0.1 | 0.14 | 0.3 | 2.4 | 2.8 |
| Dissolved Zinc (ug/L) | | <10 | 19.8 | | 43.4 | | <10 | 10.4 | | | | | <10 | <10 | <10 | 1.6 | 2.2 | <0.8 | <10 | 9.4 | 47.2 | <2 | <2 |
| **Major Ions** | | | | | | | | | | | | | | | | | | | | | | | |
| Alkalinity/Acidity as CaCO3 (mg/L) | 2.5 | 2.7 | 7 | 2.7 | 8 | 3.7 | 3.0 | 6 | | | | | 3.2 | 12.7 | 2.9 | 7 | 7 | 9 | 3.9 | 8 | 3.3 | 7 | 10 |
| Bicarbonate (mg/L) | | | 9 | | 10 | | | 10 | | | | | | | 29 | 8 | 9 | 11 | | 10 | | 9 | 12 |
| Calcium (mg/L) | 0.64 | 0.92 | 1.05 | 1.18 | 1.49 | 0.93 | 0.90 | 1.18 | | | | | 1.06 | 1.10 | 0.95 | 1.05 | 1.49 | 1.99 | 1.04 | 1.23 | 1.22 | 1.37 | 2.66 |
| Carbonate (mg/L) | | | <5 | | <5 | | | <5 | | | | | | | | <5 | <5 | <5 | | <5 | | <5 | <5 |
| Chloride (mg/L) | <0.2 | 0.5 | <1 | 11.7 | <1 | <0.2 | 0.2 | <1 | | | | | 0.2 | 0.2 | 0.7 | <1 | <1 | <1 | <0.2 | <1 | 0.7 | <1 | <1 |
| Fluoride (mg/L) | 0.06 | 0.05 | 0.05 | 0.05 | 0.06 | <0.05 | 0.04 | <0.05 | | | | | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | | <0.05 | 0.05 | 0.06 | 0.05 | 0.07 |
| Hardness (mg/L) | 4.40 | 4.81 | 6 | 4.84 | 6 | 4.34 | 4.39 | 6 | | | | | 4.56 | 4.72 | 3.98 | 5 | 6 | 8 | 4.94 | 6 | 5.85 | 7 | 13 |
| Hydroxide (mg/L) | | | <5 | | <5 | | | <5 | | | | | | | | <5 | <5 | <5 | | <5 | | <5 | <5 |
| Magnesium (mg/L) | 0.58 | 0.61 | 0.75 | 0.46 | 0.66 | 0.49 | 0.52 | 0.73 | | | | | 0.47 | 0.48 | 0.39 | 0.47 | 0.55 | 0.73 | 0.57 | 0.64 | 0.64 | 0.86 | 1.46 |
| Potassium (mg/L) | 0.26 | 0.23 | 0.30 | 0.26 | 0.26 | 0.23 | 0.16 | 0.28 | | | | | 0.46 | 0.46 | 0.28 | 0.45 | 0.27 | 0.31 | 0.40 | 0.33 | 0.06 | 0.53 | 0.27 |
| Reactive Silica as SiO2 (mg/L) | | | 1.5 | | 2.9 | | | 1.8 | | | | | | | | | | | | 1.0 | | 2.0 | 5.8 |
| Sodium (mg/L) | 0.45 | 0.45 | 0.7 | 0.48 | 0.7 | 0.46 | 0.46 | 0.8 | | | | | 0.45 | 0.46 | 0.44 | 0.6 | 0.7 | 0.7 | 0.47 | 0.7 | 0.78 | 1.5 | 1.3 |
| Sulphate (mg/L) | 6 | 6 | 3.11 | 8 | 2.93 | <3 | <3 | 3.68 | | | | | <3 | <3 | <3 | 0.83 | 0.70 | 1.00 | <3 | 3.25 | 5 | 0.62 | 1.76 |
| **Nutrients** | | | | | | | | | | | | | | | | | | | | | | | |
| Dissolved Organic Carbon (mg/L) | 12.0 | 13.8 | | 14.0 | | 9.7 | 7.0 | | | | | | 8.0 | 7.5 | 7.4 | | 5 | | 7.4 | | | 13 | 11 |
| Dissolved Phosphorous (mg/L) | | 0.021 | 0.010 | | 0.006 | | 0.013 | 0.003 | | | | | 0.007 | 0.007 | 0.009 | 0.008 | 0.005 | 0.010 | 0.007 | 0.005 | 0.004 | 0.001 | 0.004 |
| Nitrate as N (mg/L) | | | 0.018 | | 0.007 | | | <0.006 | | | | | | | | | | | | <0.006 | | <0.006 | 0.039 |
| Nitrate/Nitrite as N (mg/L) | <0.006 | <0.006 | 0.024 | <0.006 | 0.014 | <0.006 | <0.006 | <0.006 | | | | | 0.011 | 0.012 | 0.006 | 0.019 | 0.039 | 0.010 | 0.016 | <0.006 | 0.054 | <0.006 | 0.042 |
| Nitrite as N (mg/L) | | | 0.007 | | 0.008 | | | 0.002 | | | | | | | | | | | | <0.002 | | 0.002 | 0.003 |
| ortho-Phosphate as P (mg/L) | <0.002 | 0.002 | 0.005 | <0.002 | 0.005 | <0.002 | <0.002 | 0.003 | | | | | <0.002 | <0.002 | <0.002 | 0.002 | <0.001 | 0.003 | <0.002 | 0.002 | <0.002 | 0.001 | 0.002 |
| Total Ammonia as N (mg/L) | 0.013 | 0.053 | <0.05 | 0.016 | <0.05 | 0.006 | 0.072 | <0.05 | | | | | <0.005 | <0.005 | <0.005 | 0.050 | <0.005 | <0.005 | <0.005 | <0.05 | 0.023 | 0.015 | 0.037 |
| Total Kjeldahl Nitrogen (mg/L) | 0.43 | 0.50 | 0.93 | 0.61 | 0.96 | 0.26 | 0.35 | 0.42 | | | | | 0.24 | 0.56 | 0.29 | 0.51 | 0.15 | 0.18 | 0.35 | 0.28 | 1.29 | 0.73 | 0.49 |
| Total Organic Carbon (mg/L) | 12.0 | 13.0 | 14 | 14.0 | 13 | 9.2 | 7.0 | 6 | | | | | 8.2 | 8.5 | 7.4 | | 8 | 9 | 7.6 | 6 | | 16 | 13 |
| Total Phosphorous (mg/L) | 0.015 | 0.037 | 0.018 | 0.016 | 0.013 | 0.009 | 0.020 | 0.003 | | | | | 0.014 | 0.012 | 0.012 | 0.010 | 0.006 | 0.010 | 0.014 | 0.006 | 0.017 | 0.016 | 0.011 |
| **Physical** | | | | | | | | | | | | | | | | | | | | | | | |
| Colour (TCU) | | | 140 | | 140 | | | 30 | | | | | | | | 60 | 30 | 55 | | 30 | | 100 | 125 |
| pH (units) | 6.15 | 6.06 | 6.1 | 6.07 | 6.5 | 6.42 | 6.28 | 6.7 | | | | | 6.42 | 6.32 | 6.20 | 6.2 | 6.7 | 6.6 | 6.46 | 6.6 | 6.06 | 6.9 | 6.2 |
| Specific Conductivity (uS/cm) | 11.9 | 12.9 | 16.0 | 12.7 | 17.0 | 12.3 | 11.3 | 18.1 | | | | | 15.6 | 13.7 | 11.4 | 13.3 | 18.0 | 22.7 | 14.1 | 17.4 | 14.3 | 20.1 | 29.0 |
| Total Dissolved Solids (mg/L) | 41.0 | 45.0 | 30 | 47.0 | <10 | 33.0 | 19.0 | <10 | | | | | 30.0 | 31.6 | 27.0 | 50 | 40 | 40 | 40.0 | <10 | 49.0 | 40 | 30 |
| Total Suspended Solids (mg/L) | 3 | 5 | 5 | 4 | <3 | 4 | 9 | <3 | | | | | <3 | 4 | <3 | <3 | <3 | <3 | <3 | 4 | 10 | 8 | <3 |
| Turbidity-Unfiltered (NTU) | 1.7 | 3.5 | 0.80 | 2.1 | 0.63 | 1.2 | 1.3 | 0.58 | | | | | 1.2 | 0.8 | 1.7 | 0.40 | 0.40 | 0.70 | 1.0 | 0.34 | 1.9 | | |
| **Field Measurements** | | | | | | | | | | | | | | | | | | | | | | | |
| Dissolved Oxygen (mg/L) | | | | | | | | | 12.1 | 9.2 | 9.2 | 8.2 | | | | | | | | | | | |
| pH | | | | | | | | | 6.7 | 6.5 | 5.8 | 5.9 | | | | | | | | | | | |
| Specific Conductivity (uS/cm) | | | | | | | | | 14 | 13 | 11 | 19 | | | | | | | | | | | |
| Water Temperature (deg. C) | | | | | | | | | 15.5 | 16.2 | 17.8 | 16.4 | | | | | | | | | | | |

Note: < = less than detection limit (refer to glossary for definition)
Source: Environment Canada
mg/L = milligrams per litre; µS/cm = microsiemens per centimetre; TCU = total color units; NTU = nephelometric units; µg/L = micrograms per litre

# APPENDIX II

# PHOTOS

## PHOTOGRAPHS

**PLATE: 1**

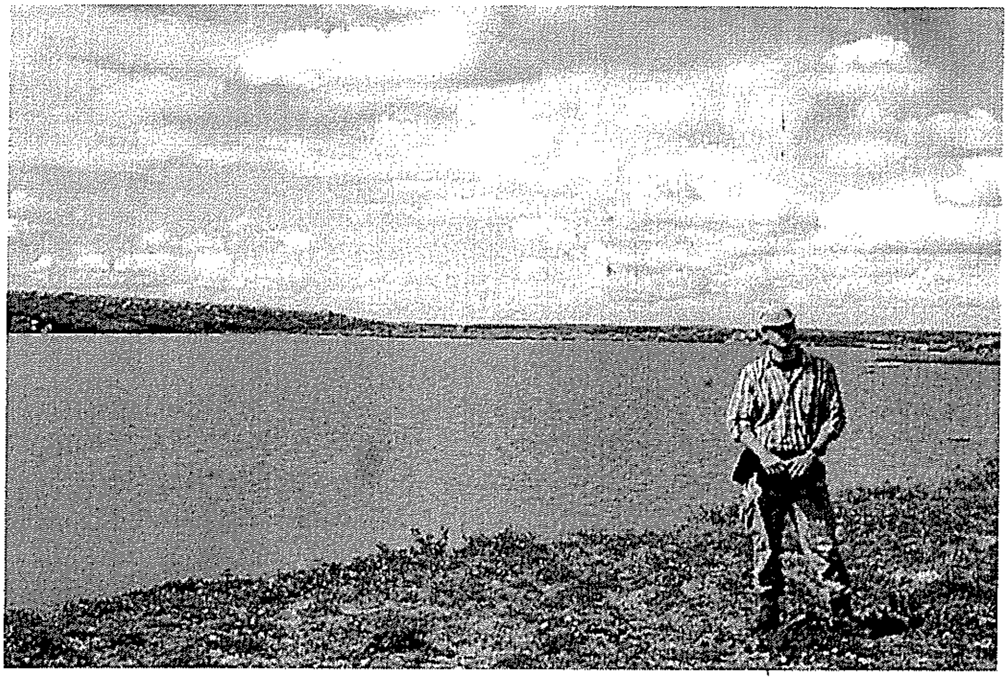


Photo 1: Lake IL2 facing northward looking down long axis of lake.

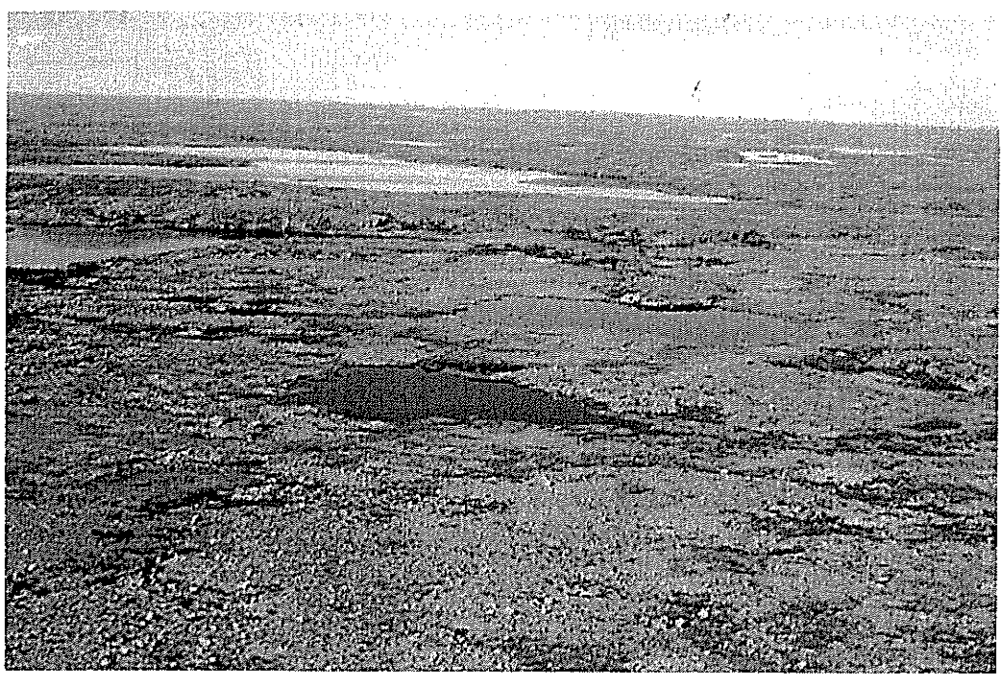


Photo 2: Aerial view of IL4 (in foreground) and IL3 (right behind IL4).

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PHOTOGRAPHS

PLATE: 2

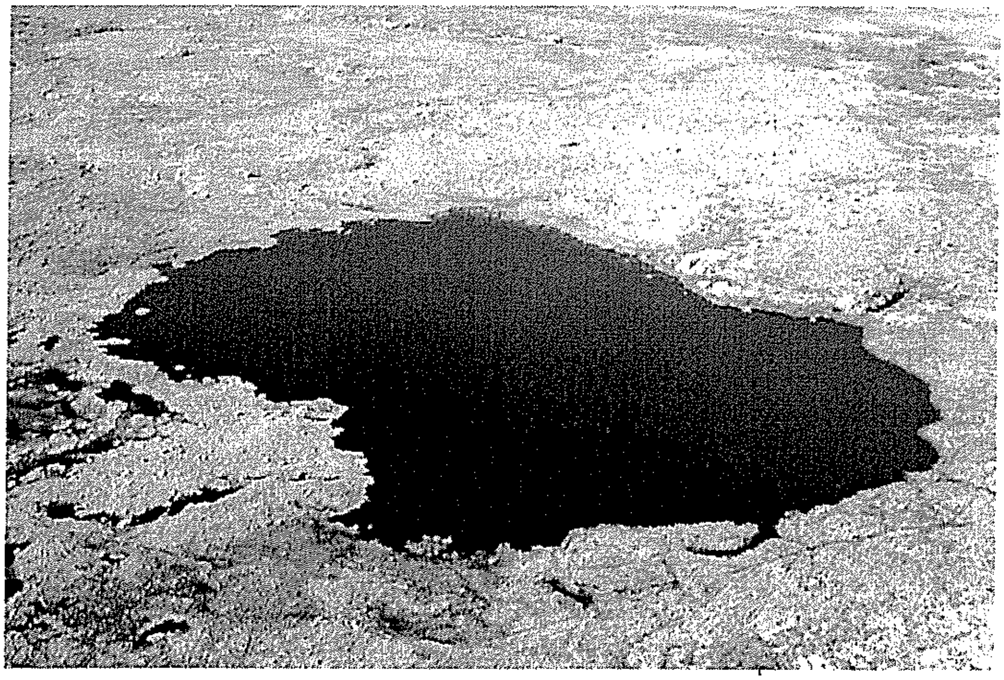

Photo 3: Aerial view of IL3, facing southwest.

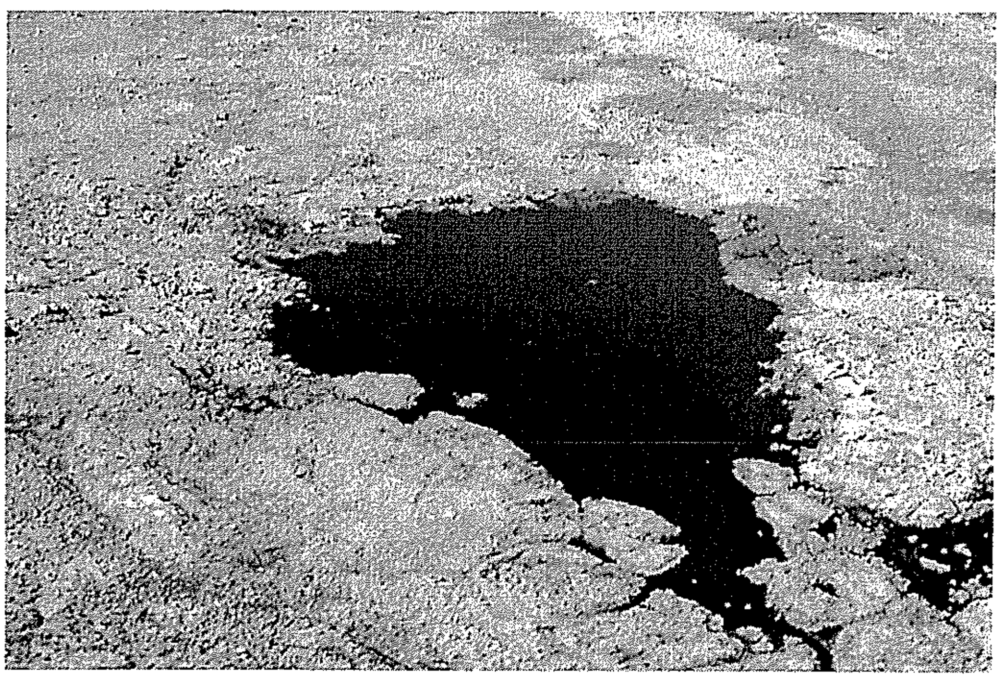

Photo 4: Aerial view of IL4 facing southwest.

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## PHOTOGRAPHS

**PLATE: 3**

Photo 5: Aerial view of IL5 facing due east.

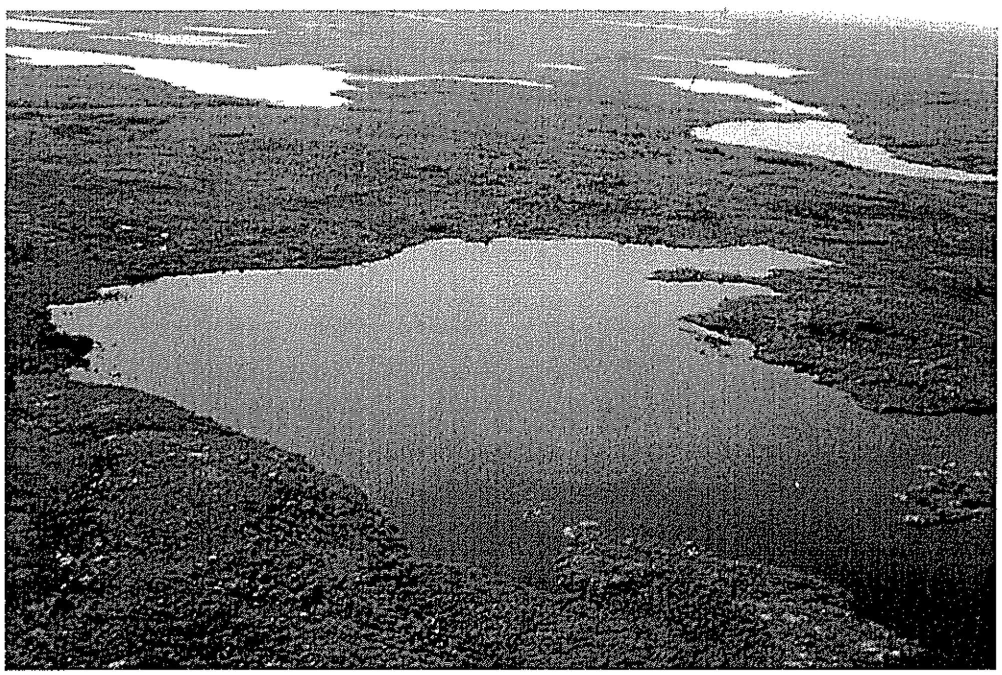

Photo 6: Lake IL5 facing southeast. Island in extreme right of frame is in the west margin of the lake.

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**PHOTOGRAPHS** | **PLATE: 4**

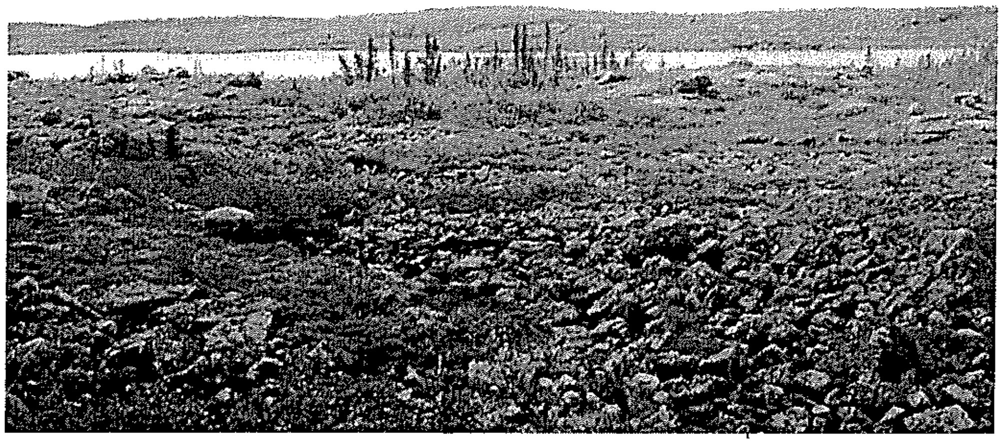

Photo 7: Rocky area between IL5, IL4, & IL3. Note lack of any distinct channels.

Photo 8: Aerial view of IL6 looking WNW with Snap Lake in background. Note steep cliff along south shore and (exposed) rocks in middle of lake.

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# PHOTOGRAPHS

PLATE: 5

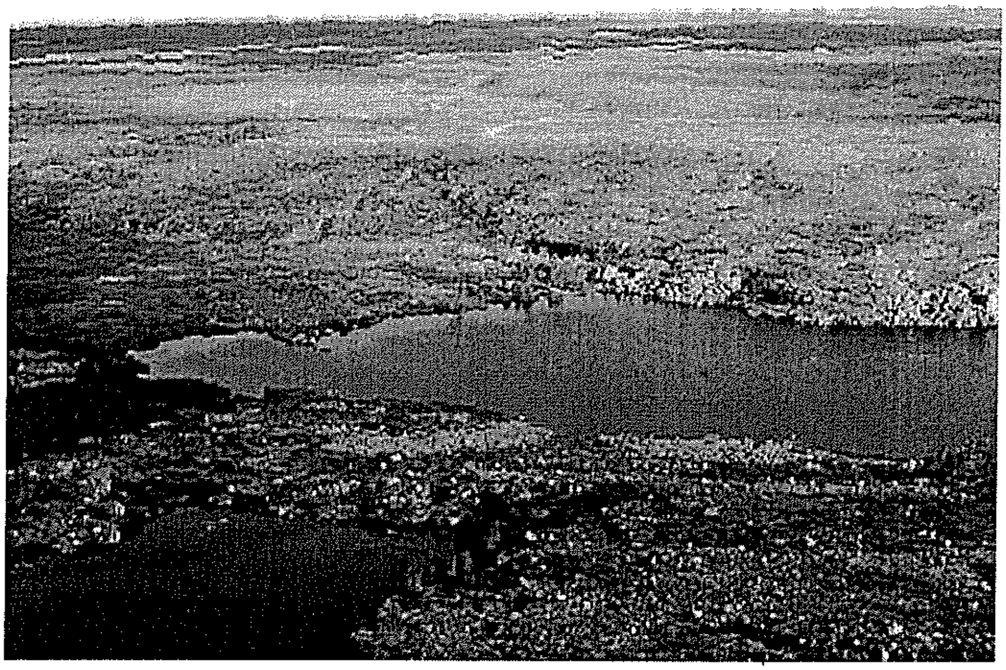

Photo 9: Aerial view of Eastern portion of IL6 facing roughly south.

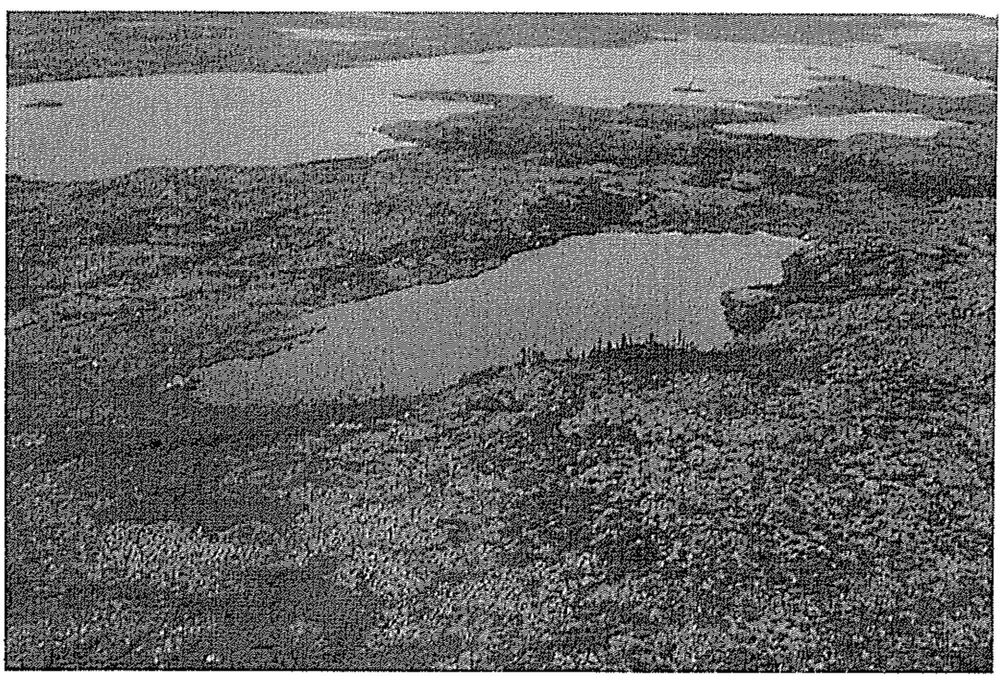

Photo 10: Aerial view of IL7 facing northeast.

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**PHOTOGRAPHS** | **PLATE: 6**

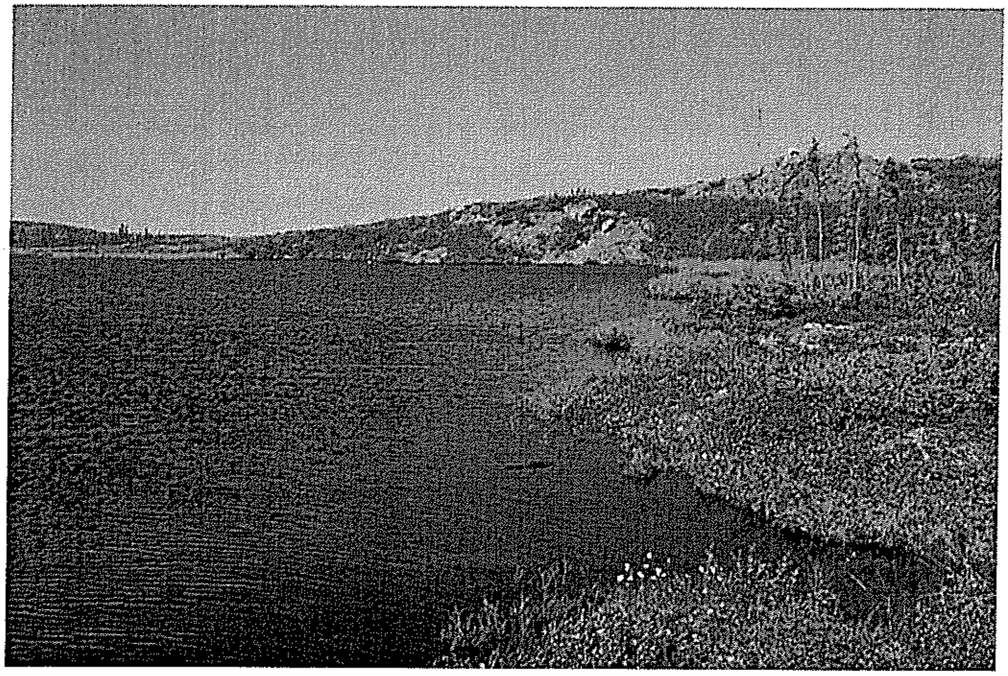

Photo 11: View IL7 from east end looking northwest.

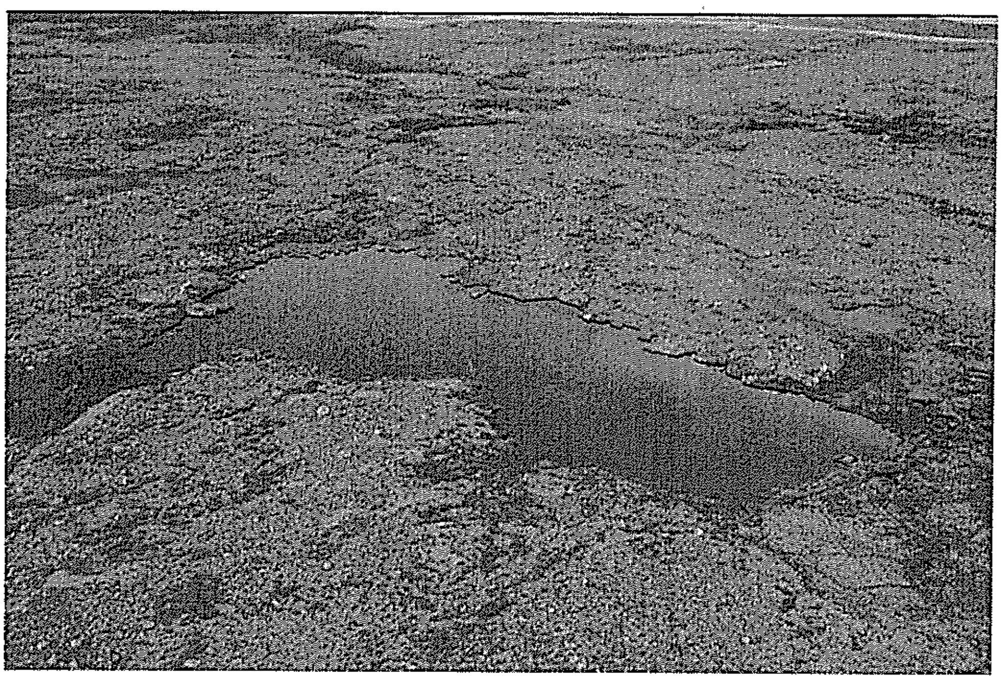

Photo 12: Aerial view of IL9 looking northeast.

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## PHOTOGRAPHS

**PLATE: 7**

Photo 13: Looking northwest from mid-way along the east shore at IL9.

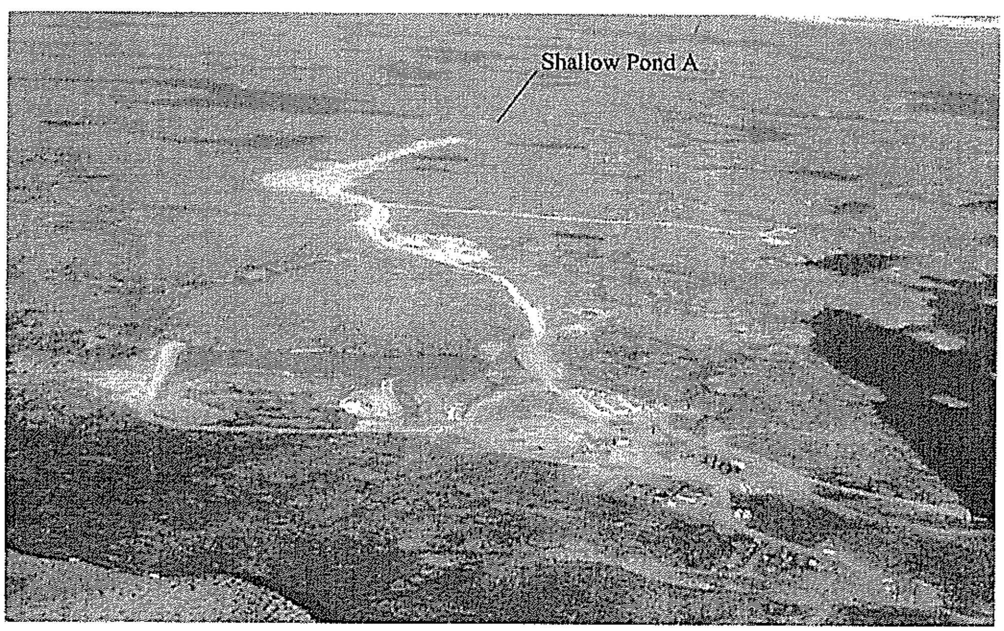


Photo 14: Aerial view showing location of Shallow Pond A.

# PHOTOGRAPHS

PLATE: 8

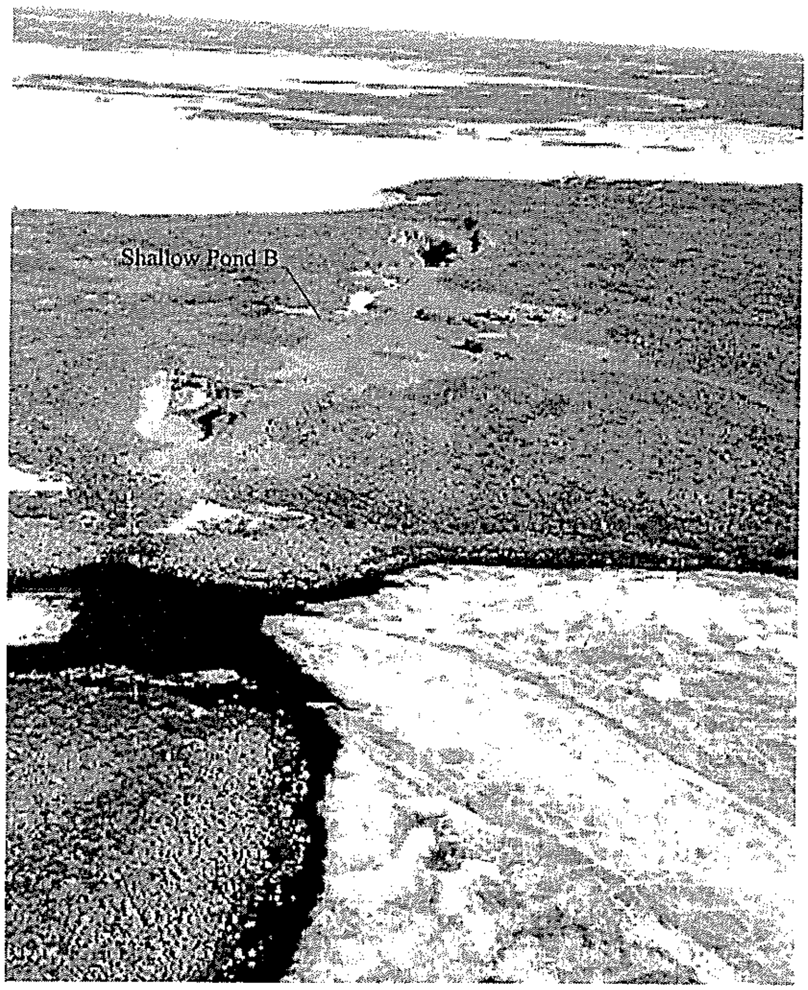


Photo 15: Aerial view of Shallow Pond "B"

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PHOTOGRAPHS

PLATE: 9

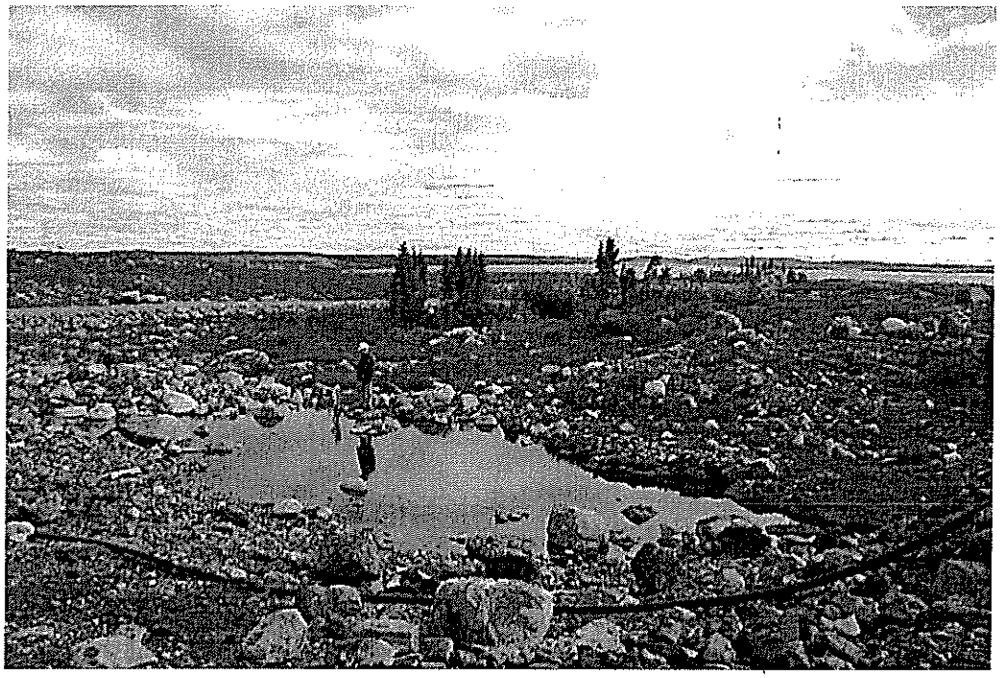

Photo 16: Shallow Pond "B"

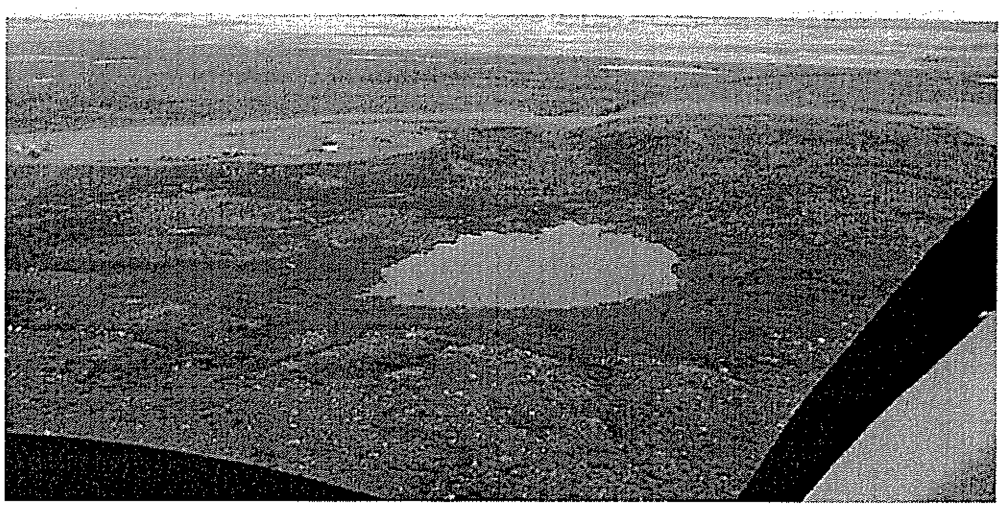

Photo 17: Aerial view of Shallow Pond "C" facing east southeast.

# PHOTOGRAPHS

**PLATE: 10**

Photo 18: Looking northwest across Shallow Pond "C" from east side of lake.

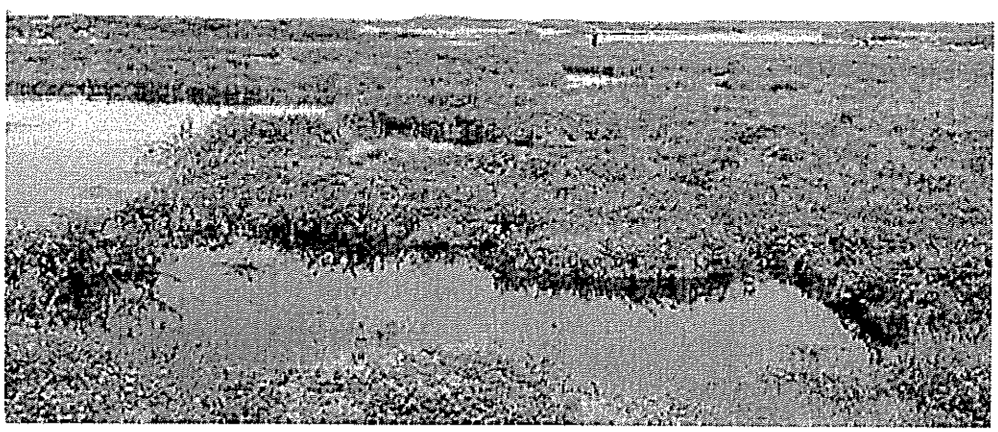

Photo 19: Looking at low gradient meander in stream S1 (H4)

PHOTOGRAPHS

PLATE: 11

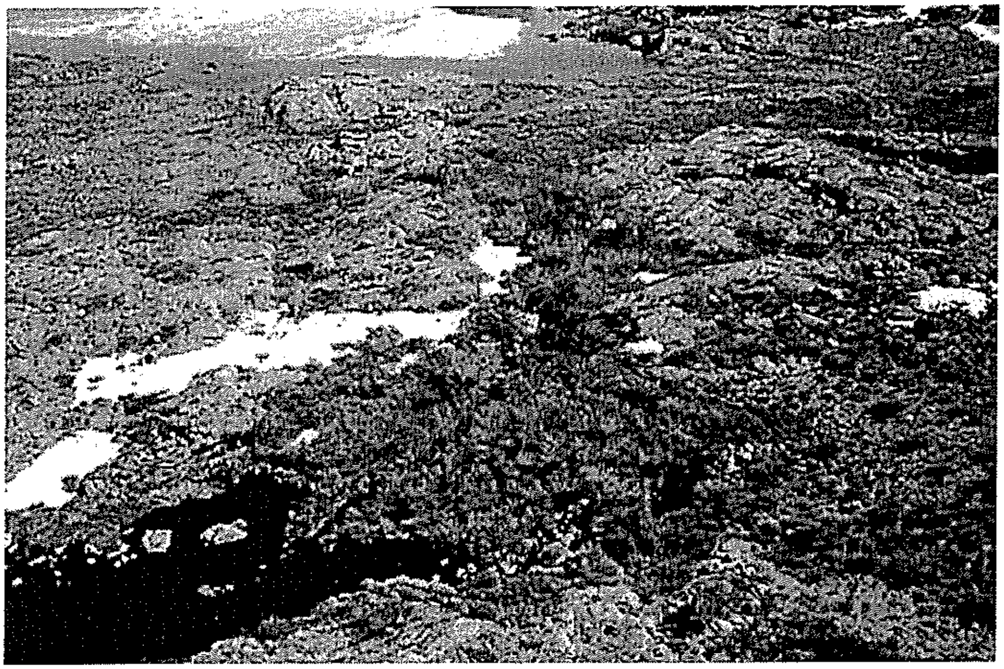

Photo 20: Aerial view looking upstream of stream S27

Photo 21: Looking at mid reach of stream S27 between Inland Lake and Snap Lake

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PHOTOGRAPHS

PLATE: 12

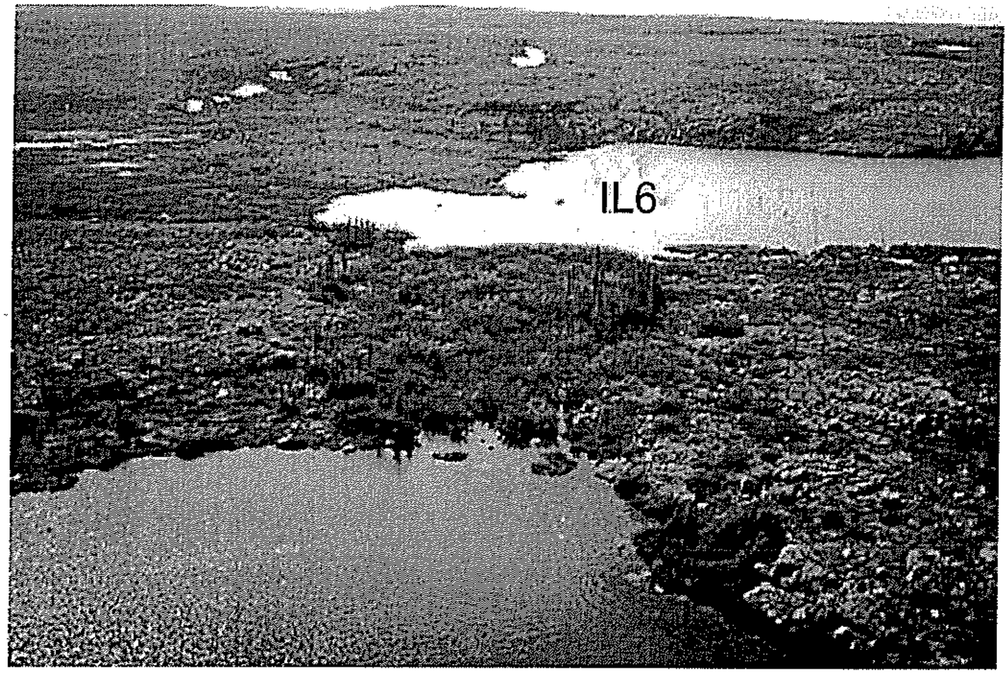


Photo 22: Aerial view of stream S29 between IL6 and Snap Lake

Photo 23: Looking at dense bush and trickle of water in ephemeral stream S29

## PHOTOGRAPHS

## PLATE: 13

Photo 24: Channel of S29 disappears subsurface approximately 30m upstream of Snap Lake.

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