WINDY LAKE EXPLORATION CAMP

GREY WATER FINAL SPILL REPORT # 05-198


RBC Windy Lake Overflow Tank, April 18 2005

MIRAMAR HOPE BAY LIMITED

IN COMPLIANCE WITH NWB LICENCE ## NWB2HOP0207

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SUMMARY

On the morning of Sunday April 17 2005, an employee of MHBL camp crew on his routine morning camp inspection noticed the "observed" media in between the RBC and Overflow tank and the top of the Overflow Tank. The frozen "observed" media can only been seen when snow covered is being blown away by wind, therefore did go unnoticed during past daily camp inspections routine. Further investigations indicate that the "observed" media was not coming from the RBC plant nor the Overflow Tank, but from other sources.

On April 18 2005, Senior MHBL personnel offsite were aware of the incident. Plans were underway to manage the issue. A NWT Spill Report Form was completed, faxed to NWT 24-hour Spill Report Line on April 25 2005 and allocated SPILL No. 05-198.

Specific Details of the Incident- Spill No. 05-198

Table 1 Specific details of Grey water Spill No. 05-198

Aspect/Action/Cause	Impact/Activity	Comments
• Root cause of incident	Maintenance on disposal system due to: • Frozen lines	Frozen lines due to: • Insufficient heating; and or • insufficient insulation cover
• Immediate Cause	Flushing of sewer line with freshwater let to drain	Flushed freshwater was not contained in a containment system for proper disposal.
• Impacted total surface Area	Estimated 10 m^2	Top of overflow tank and in-between the RBC unit and the overflow tank
• Faulty heat trace line	Insufficient heating along the particular section of the sewer line	That section of the heat trace line no longer provided sufficient heat
• Insulation cover material	Insufficient insulation for the sewer line	The insulation cover foam was thinning out therefore unable to contain the already limited heat generated by the heat trace line

Two sets of samples collected: one set from the sewer end-of-pipe release point and the other were clipped frozen sample from the "observed" what looked like frozen grey water media.

Taiga Environmental Laboratory carried out water quality analyses. Off particular interest was the level of faecal coliforms in each set of samples.

Microbiological analytical results shows what was "observed" to be grey water on top and bottom of Overflow tank and between the RBC and the Overflow tank was processed water. The processed water was likely to have originated from the flushing of the sewer lines after completion of the maintenance due to the frozen lines.

However, faecal coliforms counts for the "observed" media were within conditions (Part D – Conditions Applying to Sewage and Sludge Disposal) stipulated in Nunavut Water Board Licence No. NWB1BOS0106, Boston Camp. No such numerical standards stipulated in the conditions (Part E) for Hope Bay (Licence No. NWB2HOP0207).

Based on the results obtained and management strategies implemented, MHBL recommends that this Spill Report No. 05-198 issue be close.

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1 INTRODUCTION

1.1 General

In year 2000, MHBL constructed a Rotating Biological Contractor (RBC) sewerage treatment system at Windy Lake Camp and commissioned at the start of 2001 exploration field program. This replaced the previous latrine system. All grey water from the camp reports to this facility for treatment prior to release to an uphill area situated north of the camp. Licence # NWB2HOP0207 issued by the Nunavut Water Board covers this system of waste treatment and disposal.

1.2 RBC Grey Water Disposal System

The RBC plant is located between the kitchen and Windy Lake. The system consists of: (a) the RBC plant; (b) overflow tank with a pump; and (c) transfer pump box. Release of grey water is via a series of insulated and heat trace 2-inch line. Here are the specifications for the unit.

Type of Unit: An *S-40 ROTORDISK ™ Full Steel packaged sewage treatment plant with bio-supported media for 14,000 liters/day.*

ROTORDISK™ sewage treatment plant has three major steps in the purification process. In the primary settlement chamber, gross solids separate from the flow by either settling or flotation. In the rotorzone, dissolved contaminates are broken down to simple, non-contaminating compounds by the biological growth ("biomass") which grows on the rotating disks.

The final settlement chamber permits gravity separation of spent biological growth, which continually sloughs off the disks in the rotorzone preceding it. The effluent leaving the final clarifier should be relatively clear, colourless and free of suspended matter. Although the final effluent itself should be relatively clear, some floating matter may accumulate on the surface of the final clarifier. Any overflow is gravity feed into the overflow tank (2,000 L) installed adjacent to the RBC plant and pumped to the transfer pump box located at the foot (Figure 2) of the hill east of the camp. At the transfer pump box, final release takes place over the ridge onto the tundra via a (984ft) 300 m line. Figures 1 & 2 illustrate the layout of the grey water disposal system installed at Windy Lake.

Figure 1 Windy Lake Grey Water Disposal System

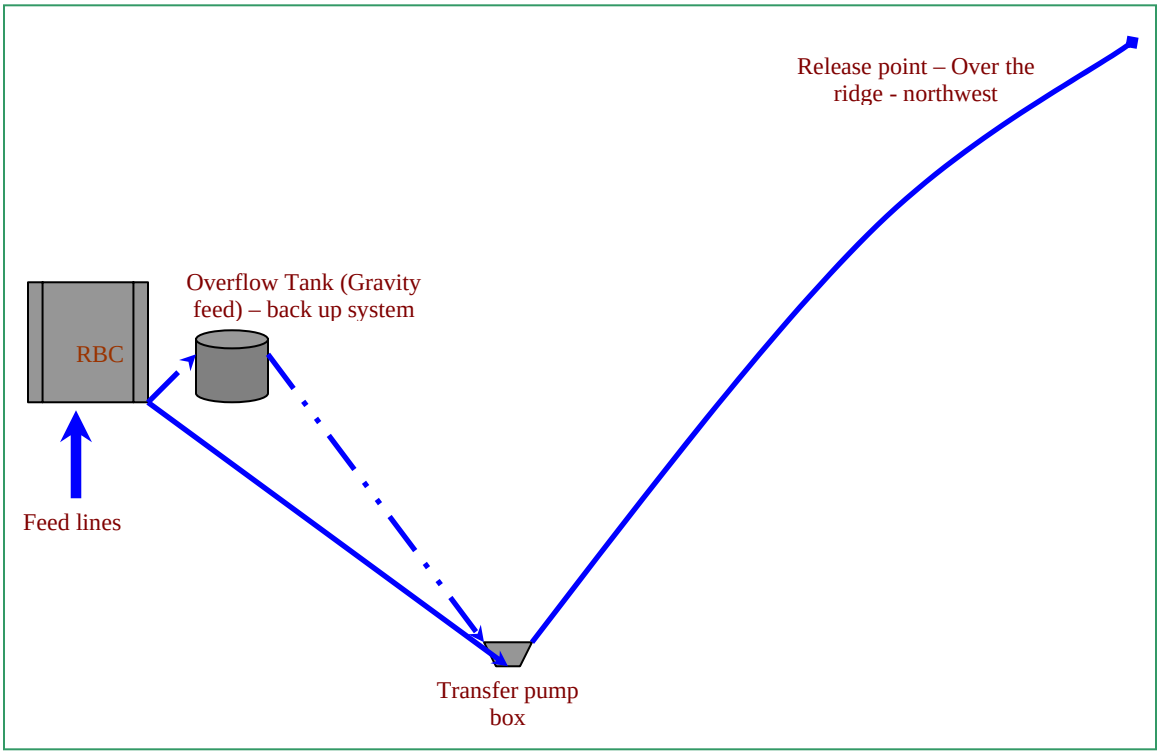


Figure 2 shows a photograph of Windy Lake with identified location of the disposal system.

1.3 Grey Water Diversion Incident Reporting

On the morning of Sunday April 17 2005, an employee of MHBL camp crew on his routine morning camp inspection noticed the "observed" media in between the RBC and Overflow tank and the top of the Overflow Tank. The frozen "observed" media can only been seen when snow covered is being blown away by wind, therefore did go unnoticed during past daily camp inspections routine.

Further investigations indicate that the "observed" media was not coming from the RBC plant nor the Overflow Tank, but from other sources.

Windy Lake Site Supervisor logbook indicates a series of maintenance activities carried out to the sewer during temporary camp closure in 2004 and opening of camp in 2005. Section 2 provides detailed accounts of the activities.

On April 18 2005, Senior MHBL personnel offsite were aware of the incident. Plans were underway to manage the issue. A NWT Spill Report Form was completed, faxed to NWT 24-hour Spill Report Line on April 25 2005 and allocated ***SPILL No. 05-198***.

1.4 Scope of Reporting

This brief report provides a summary account of what happened, work planned and completed; ongoing work and long-term management strategy on prevent such unforeseen incidence.

2 CHRONOLOGY OF EVENTS

Site Supervisor's logbook provided the following accounts on maintenance work done to the grey water disposal system. Members of the Maintenance crew provided valuable additional information when information obtained required verification.

2.1 December 12-13 2004

- As part of the MHBL Closure Plan Management strategy for short-term camp closure, maintenance personnel at Windy Lake activated the process involving the temporary closer of the RBC sewer disposal system.
- From December 12-13 2004, preparation for winterization of the system started.
- The disposal lines checked, cleaned and flushed system using camp freshwater in preparation for closure of operation.

2.2 December 14 2004

- Operation at Windy Lake Exploration Camp ceased.

2.3 February 26 2005

- Three (3) maintenance crews flew into Windy Lake.
- Preparations began to get the camp ready for exploration personnel. The work normally involves heating of camp, opening tents, checking stored petroleum

products, food supplies, checking portable water supply and RBC sewer systems, removal of snow and preparation for a landing strip on Windy Lake.

2.4 March 1 2005

- Daily inspection revealed sewer line for main camp frozen. This section of the lines was located between the Transfer Pump Box on the foot of the hill east of the camp and the end-of-pipe over the ridge east of the camp. Line replaced and tested.
- Grey water transferred into empty 45-gallon drums, and then transported to end-of-pipe discharge point for disposal.
- Further inspection revealed another section of the line approximately 5-6 meters from the RBC unit was frozen. Line thawed out and flushed with camp freshwater.

2.5 March 5 2005

- Sewer lines for kitchen and main dry frozen. Line thawed out and flushed with freshwater.

2.6 April 16 2005

- Environmental personnel arrived at Windy Lake.

2.7 April 17 2005

- Notified of what looked like grey water around the RBC and top of the overflow tank.
- On the same day, inspected the area with Site Supervisor and saw what seems to look like frozen grey water.
- The alarm system installed at the RBC is an automatic primary warning system, which goes off when the grey water in the Final Clarifier of has reached a certain level thus giving a high probability for an overflow situation to occur. The alarm was tested and found to be working as expected.

2.8 April 18 2005

- Plans were underway to determine what the source of this "observed" media was. The plan was simple, go through the site supervisor logbook to determine if any maintenance was carried out to the sewer disposal system either prior to 2004 temporary camp closure or before re-opening of the camp for winter exploration program.
- When it was safe to do so, collect samples to determine the nature of the "observed" by-product.
- Senior MHBL personnel made aware of the incident.

2.9 April 19 2005

- Survey of the impacted area completed. The impacted area was 10 m^2

2.10 April 25 2005

- Completed NWT Spill Report Form faxed to NWT 24-hour Spill Report Line. Returned fax showed - Incident allocated Spill No. 05-198.

2.11 April 30 2005

- The delay in getting the samples was due to lack of sterile sewer sample bottles. Taiga Environmental Laboratory supplied the required bottles and the bottles arrived at Windy Lake on April 30 2005.

2.12 May 3 2005

- A set of sewer samples collected from the sewer discharge system (end-of-pipe) and chipped frozen samples from "observed" media. The end-of-pipe sample gives an indication of the actual grey water quality, in particular faecal coliforms count.
- Samples sent on the same day to Taiga Environmental Laboratory, Yellowknife for microbiological determination.

2.13 May 26 2005

- Final analytical results received from Taiga Environmental Laboratory.

3 INCIDENT ANALYSES

3.1 Root cause of incident

It is apparent that the root cause of the incident was the maintenance work done on the disposal system due to:

- Sewer lines froze

The section of the sewer line froze due to the fact that: (i) insufficent heat and (ii) insufficent insulation foam cover.

During maintenance work to the forzen section of the line, it was discovered that the heat trace line for that particular section of the sewer line was not delivering the expected voltage along the line. The insulation foam cover over the same section of the line was observed to have thinned out.

3.2 Immediate Cause

- Letting flushed freshwater to drain

During flushing of the sewer lines, flushed freshwater was let to drain. Flushed water was seen between the Overflow tank and the RBC, and the back of the RBC plant. Frozen flushed water was also seen under the snow over the top of the overflow tanks and at the foot of the

tank. The impact of flushing could not really be determined as the whole area was covered with high snow banks. Evidence of the drianed water could be seen in photographs shown in Appendix 3 of this report.

4 GREY WATER IMPACT

4.1 Area of Impact

The visual impacted area measured approximately 10 m^2. As the high bank of snow covered the whole area around the RBC, it was quite impossible to determine the exact route of the flushed water thereby calculating the impacted area. Appendix 3 shows a series of photographs taken of the impacted area.

5 REMEDIATION

5.1 Objectives

Two objectives were identified for this challenge which are listed below:

(i) Protecting the health of the camp occupants; and

(ii) Complying with regulatory requirements as stated in Licence # NWB2HOP0207.

5.2 Work Plan

(i) To meet the above objectives, the first priority was to determine the faecal coliform content of the "observed" frozen media of concern; and

(ii) Remove the frozen "observed" media by chipping before spring runoffs. The chipped portions to be disposed off into the RBC Final Clarifier and released together with the final effluent.

6 WATER SAMPLE RESULTS

Grey water samples were taken from at the discharge pipe (End-of-Pipe) and frozen samples clipped from the top overflow tank. Due to the extremely cold weather at the time of sampling, limited forzen samples were collected and sent out to Taiga Environmental Laboratory, Yellowknife for mircobiological determinations.

The analytical results as shown in Table 2 for the chipped frozen sample taken from the top of the overflow tank is within the NWB standard - a requirement for Boston Camp discharge Licence No. NWB1BOS0106. No such standard is included in the Windy Lake Licence No. NWB2HOP0207.

The results also indicate that the "observed" media is processed water which mostly likely to have derived from the flushing of the sewer lines during the maintenance activities carried out on the lines. A copy of the laboratory analytical results is attached in Appendix 1.

Table 2 Microbiological determination of sewer samples (end-of-pipe) and "Observed" media (Top of Overflow Tank)

Environmental Parameters →	pH	TSS (mg/L)	Faecal Coliform	Total Coliform	Escherichia coli (E.coli)	BOD_5 mg/L	Oil & Grease
Standard	6.0-9.5	100	10,000	-	-	80	Non-vis
Windy Lake – RBC - end of pipe	7.55	178	420,000	24,200,000	816,000	202	-
Windy Lake – RBC – Overflow Tank	8.52	*	<100	<100	<100	*	-
*- indicate analyses were not done due to not enough sample for testing & * test not requested. Faecal Coliform is reported as CFU/100 ml*							

7 FOLLOW-UP & LONG-TERM STRATEGY

7.1 Ongoing Inspections

- Continue with daily inspection of the RBC plant; note and report any abnormal changes or situations.

7.2 Long-term Strategy

- Site Supervisors are encouraged to develop a plan maintenance procedure for dewatering of the lines during temporary camp shut down.
- Future maintenance on the disposal system should undergo risk assessment process before any changes taking place.
- Continue with daily inspection of the grey water disposal system.
- Carry out further water sampling (where runoff meets the lake) to verify compliance to water quality standards as stated in NWB2HOP0207 during open water sampling season.

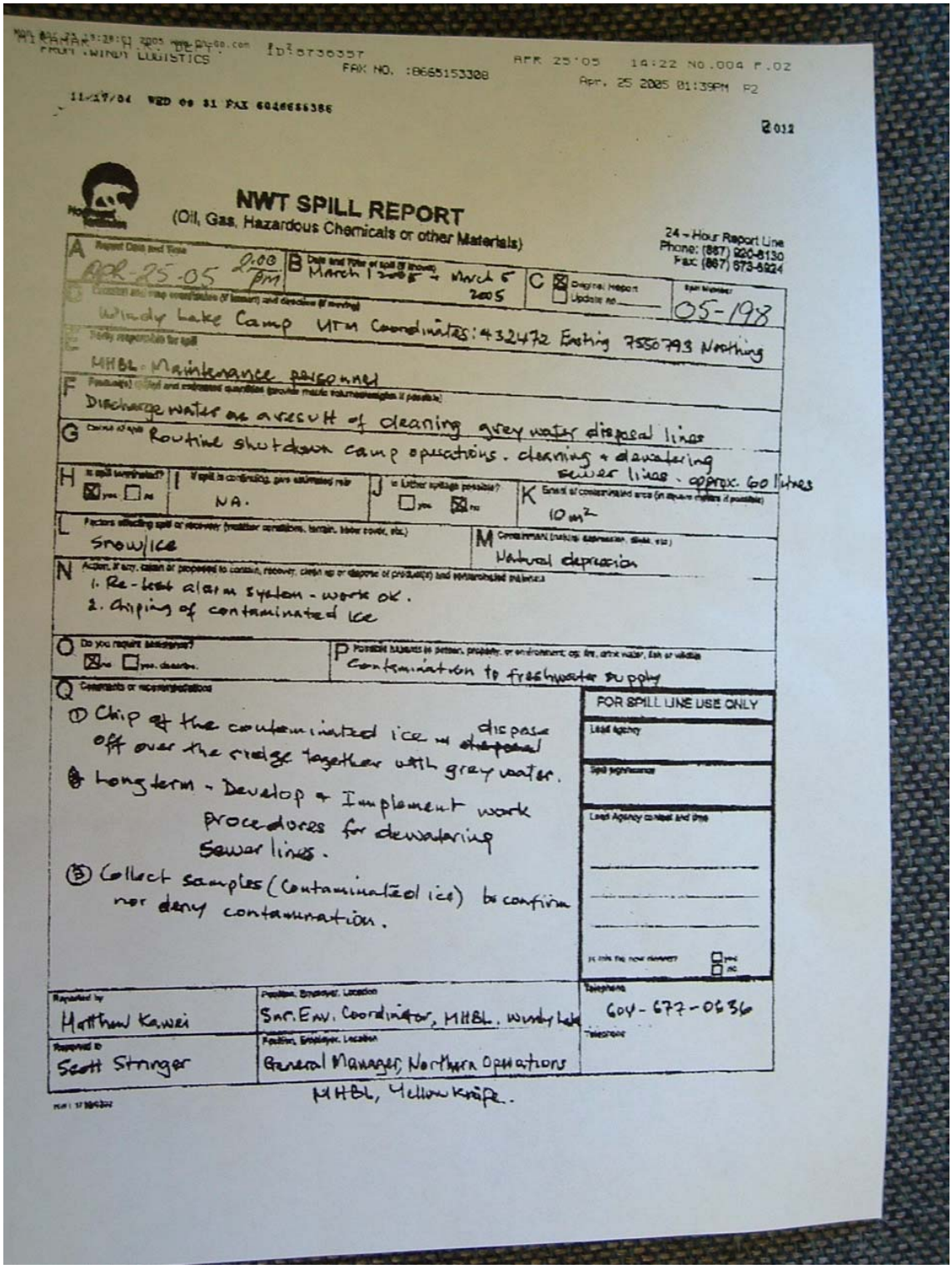
8 CLOSURE

The short and long-term strategies implemented and proposed will add benefit to the maintenance and management of the grey water disposal system at Windy Lake camp. MHBL recommends that this Spill Report No. 05-198 be close.

9 APPENDIX 1 – ANALYTICAL RESULTS

(see PDF files attached -)

10 APPENDIX 2 – NWT SPILL REPORT NO. 05-198



FROM :WINDY LOGISTICS FAX NO. :8665153308 APR. 25 2005 01:39PM P2

11/17/04 WED 09 31 FAX 6026656386 012

NWT SPILL REPORT
(Oil, Gas, Hazardous Chemicals or other Materials)

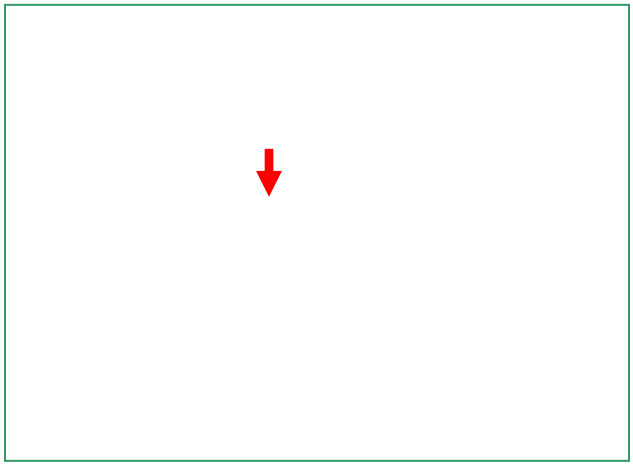
24 – Hour Report Line
Phone: (867) 920-8130
Fax: (867) 873-8924

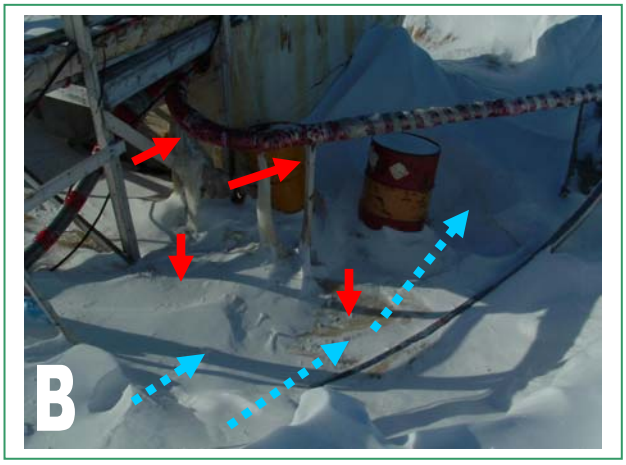
A Report Date and Time: APR-25-05 2:00 pm
B Date and Time of spill (if known): March 1 2005 – March 5 2005
C ☒ Original Report ☐ Update no. ____
Spill Number: 05-198
D Location and map coordinates (if known) and direction (if moving): Windy Lake Camp UTM Coordinates: 432472 Easting 7550793 Northing
E Party responsible for spill: MHBL - Maintenance personnel
F Product(s) spilled and estimated quantities (provide metric volume/weight if possible): Discharge water as a result of cleaning grey water disposal lines
G Cause of spill: Routine shutdown camp operations. cleaning + dewatering sewer lines. approx. 60 litres
H Is spill controlled? ☒ yes ☐ no
I If spill is continuing, give estimated rate: NA.
J Is further spillage possible? ☐ yes ☒ no
K Extent of contaminated area (in square meters if possible): 10 m²
L Factors affecting spill or recovery (weather conditions, terrain, water cover, etc.): Snow/ice
M Containment (natural depression, dikes, etc.): Natural depression
N Action, if any, taken or proposed to control, recover, clean up or dispose of product(s) and contaminated materials:
1. Re-heat alarm system - work ok.
2. Chiping of contaminated ice
O Do you require assistance? ☒ no ☐ yes, describe:
P Possible hazards to person, property, or environment, eg. fire, drink water, fish or wildlife: Contamination to freshwater supply
Q Comments or recommendations:
① Chip of the contaminated ice and dispose off over the ridge together with grey water.
② Long term - Develop + Implement work procedures for dewatering sewer lines.
③ Collect samples (Contaminated ice) to confirm nor deny contamination.

FOR SPILL LINE USE ONLY
Lead Agency:
Spill Maintenance:
Lead Agency contact and phone:
Is this the final report? ☐ yes ☐ no

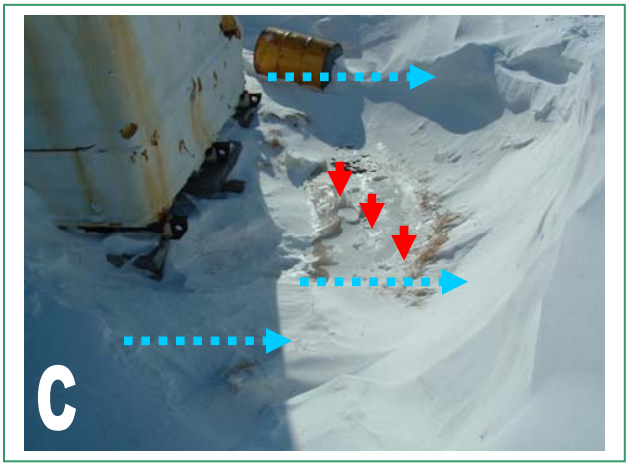
Reported by: Matthew Kawai
Position, Employer, Location: Snr. Env. Coordinator, MHBL. Windy Lake
Telephone: 604-677-0636
Reported to: Scott Stringer
Position, Employer, Location: General Manager, Northern Operations MHBL, Yellowknife.
Telephone:

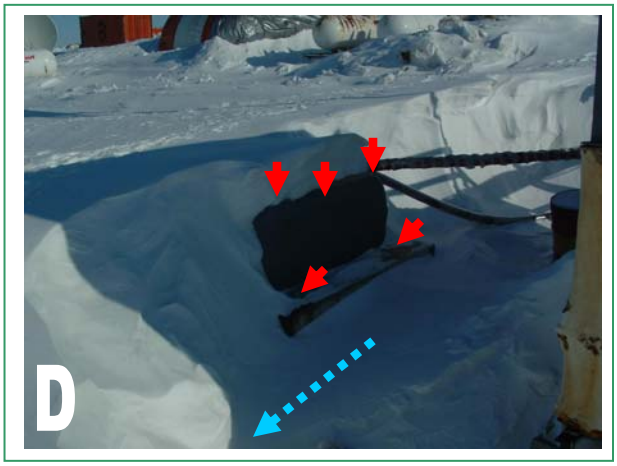
11 APPENDIX 3 - WINDY LAKE RBC PICTURES





A: Red arrow indicating location of Windy Lake RBC plant, B: Solid red arrows indicating observed frozen flushed freshwater after flushing of sewer lines. Dotted blue arrows indicate spring runoff direction – southward toward Windv Lake.





C: Solid red arrow indicating frozen flushed freshwater at the back of the RBC; D: Solid red arrows indicating, "Observed" media on top and bottom of the overflow tank. Dotted blue arrows indicate spring runoff direction – southward towards Windv Lake.