Sinanni inc.

Montréal, 28 April 2003

Philippe di Pizzo
Executive Director
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RE: NWB Permit No. NWB5RES9803 - Annual Report, Supporting Document

Mr di Pizzo:

Please find enclosed a copy of *Scientific Investigations - Resolution Island 2002* prepared by Queen's University ASU, supporting the annual report that was submitted February 21, 2003.

Should you have any questions regarding the submitted document, please contact us.

Sincerely,

Karl Côté
Manager

cc Harry Flaherty, Qikiqtaaluk Corporation
Natalie Plato, INAC, Iqaluit

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Resolution Island 2002
Scientific Investigations

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Analytical Services Unit
Queen's University
Kingston, Ontario

Canada

Indian and Northern Affairs Canada

Affaires indiennes et du Nord Canada

Analytical Services Unit
March 2003

ACKNOWLEDGMENTS

The project was supported by Indian and Northern Affairs Canada through its office in Iqaluit, Nunavut. This is a special year since it was the first that was managed from Iqaluit. We would especially like to thank Natalie Plato, Glen Stephens and Stephen Traynor for their support and encouragement

The work was conducted in conjunction with the Qikiqtaaluk Corporation. Thanks are due to the many QC personnel who helped us with our work.

John Poland, Allison Rutter, and Graham Cairns, Queen's University directed the project. They were ably assisted by Indra Kalinovich, Catherine Montgomery, Michele Pacey, Krysta Paudyn, and Shakeel Virk of the ASU. This report was written by John Poland and edited by Allison Rutter. The maps were drawn by Graham Cairns.

Some laboratory analyses were conducted by Queen's University Analytical Services Unit, Kingston, Ontario. Thanks are due to Mary Andrews, Jody Bonsall, Jessica Montague, Sarah Wells and Paula Whitley who provided their usual high professional standards.

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ᐅᓇ ᐅᓂᒃᑳᓕᐊᕗᑦ ᖁᓕᐊᓐᖏᑦᑐᖅ ᓴᓇᔭᐅᒪᔪᖅ ᐊᕐᕌᒍᒧᑦ ᐅᓂᒃᑳᓕᐊᓂᒃ ᑖᒃᑯᓄᖓ ᕿᒥᕐᕈᐃᔨᑦ ᐱᔨᑦᑎᖅᑎᑦ ᐊᒡᒍᖅᓯᒪᔪᑦ (ᐊᓯᔪ) ᐱᓕᕆᓂᖏᑕ ᐊᕙᑎᐅᑉ ᕿᒥᕐᕈᔭᐅᓂᖓᓄᑦ ᐊᒻᒪᓗ ᐋᖅᑭᒃᑕᐅᓇᓱᐊᕐᓂᖓᓄᑦ ᑖᔅᓯᒪ ᐅᓇᓕᒃᓴᔭᒃᑯᑦ ᓄᓇᕕᓂᖓᑦ ᑐᔾᔭᓂᑦ. ᑖᒃᑯᐊ ᓯᕗᓪᓖᑦ ᐱᖓᓱᑦ ᐅᓂᒃᑳᓕᐊᖑᔪᑦ, ᐅᖃᐅᓯᖃᓚᐅᖅᑐᑦ ᐱᓕᕆᓂᕐᓂᑦ 1994-ᒥᑦ 1996-ᒧᑦ, ᐃᓚᖃᖅᑐᑎᒃ ᐃᓂᕕᓃᑦ ᖃᐅᔨᓴᖅᑕᐅᓂᖏᓐᓂᒃ, ᐋᖅᑭᒃᑕᐅᓇᓱᐊᕐᓂᖏᓐᓄᑦ ᐊᑐᖅᑕᐅᓗᐊᖅᑐᑦ ᓄᓇᐃᑦ ᐊᒻᒪᓗ ᓴᓇᔭᐅᓂᖏᓐᓄᑦ ᓴᓗᒻᒪᖅᓴᐃᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᓂᒃ ᐊᒻᒪᓗ ᑐᑭᒧᐊᒍᑎᒃᓴᓂᒃ. ᑕᒪᒃᑯᐊ ᐱᓕᕆᐊᖑᔪᑦ ᐊᕐᕌᒍᓂᑦ ᑲᒪᒋᔭᐅᓚᐅᖅᑐᑦ ᑖᒃᑯᓄᖓ ᐊᓯᔪᒃᑯᓐᓄᑦ. 1997-ᒥᑦ ᐊᒻᒪᓗ 1998-ᒥᑦ ᑕᒪᓐᓇ ᓵᓐᖓᔭᐅᓂᖅᓴᐅᓚᐅᖅᑐᖅ ᓴᓇᔪᓕᕆᓂᕐᒧᑦ ᐋᖅᑭᒃᓯᐃᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓂᒃ ᐊᒻᒪᓗ ᓂᐅᕕᕐᕋᓂᖅ ᑲᑎᖅᓱᐃᓂᕐᓗ ᓴᓇᔪᓐᓇᐅᑎᒃᓴᐅᔪᓐᓂᒃ ᓴᓗᒻᒪᖅᓴᐃᑎᓪᓗᒋᑦ ᓄᓇᐅᔪᒥᒃ. ᑕᐃᒪᓐᖓᓂᑦ 1997-ᒥᑦ ᐅᓪᓗᒥᒧᑦ, ᑕᒪᒃᑯᐊ ᑲᒪᒋᔭᐅᓂᖓ ᐱᓯᒪᔭᐅᒻᒪᑦ ᕿᑭᖅᑖᓗᒃ ᑯᐊᐳᓈᓴᒧᑦ ᓴᓗᒻᒪᖅᓴᖅᑕᐅᓂᖓᓄᑦ. ᐋᖅᑭᒃᑕᐅᓇᓱᐊᕐᓂᖓ ᓄᓇᐅᑉ ᐱᓕᕆᐊᖏᓪᓗ ᐱᒋᐊᖅᑕᐅᓚᐅᖅᑐᑦ 1998-ᒥᑦ ᑲᔪᓰᓐᓇᖅᓗᑎᒡᓗ ᐊᕐᕌᒍᑕᒫᖅ. ᑖᒃᑯᐊ ᐊᓯᔪᒃᑯᑦ ᐃᓚᐅᖏᓐᓇᖅᑐᑦ ᕿᒥᕐᕈᐃᔨᐅᓪᓗᑎᒃ ᖃᐅᔨᒪᔭᑕᕆᓪᓗᑎᒍᓪᓗ ᐱᓕᕆᑎᓪᓗᑕ ᐊᒻᒪᓗ ᓘᒃᑖᖅ ᔫᓐ ᐳᓚᓐᑦ ᐊᒻᒪᓗ ᓘᒃᑖᖅ ᐋᓕᓴᓐ ᕈᑦᑐ ᖃᐅᔨᒪᔭᑕᕆᔭᐅᓯᒪᕗᑦ ᐅᖃᐅᔾᔨᒋᐊᖅᑎᐅᓪᓗᑎᒃ ᐃᓄᓕᕆᔨᑐᖃᒃᑯᑦ ᐱᓕᕆᔨᖏᓐᓄᑦ ᑲᓇᑕᒥᑦ (ᐊᐃᓇᒃ) ᐱᓕᕆᓂᐅᔪᒧᑦ. ᑖᓐᓇ ᐅᓂᒃᑳᓕᐊᕗᑦ ᐅᖃᐅᓯᖃᖅᑐᖅ ᐱᓕᕆᐊᓂᒃ ᐊᓯᔪᒃᑯᓐᓄᑦ, ᑯᐃᓐ ᓯᓚᑦᑐᖅᓴᕐᕕᒡᔪᐊᖑᓄᑦ 2002-ᒥᑦ.

ᑕᒪᑐᒪᓂ ᐊᕐᕌᒍᒥᑦ ᑕᒪᓐᓇ ᐱᓕᕆᓂᕗᑦ ᓇᐃᑦᑐᒻᒪᕆᐅᓚᐅᕐᒪᑦ ᓴᓗᒻᒪᖅᓴᐃᓪᓗᑕ ᐱᖓᒨᔪᖅᑐᓄᑦ ᐱᓇᓱᐊᕈᓯᓄᑦ. ᑕᐃᒪᓕ ᐃᒻᒪᖃ 1000 ᒦᑕᑦ ᐅᖓᒻᒧᑦ, ᓴᓂᒧᑦ ᐊᒻᒪᓗ ᐊᒻᒧᑦ ᓄᓇᖓᑦ ᓘᑎᖅᑕᐅᓚᐅᖅᑐᑦ, ᐱᔭᐅᓪᓗᑎᒃ ᑕᑉᐸᖓᑦ S1/S4 ᐃᓂᖏᓐᓂᑦ ᐊᒻᒪᓗ ᓇᖅᓴᐅᑉ ᐃᓚᖓᓐᓂᑦ. ᑕᒪᓐᓇ ᓘᑎᕆᓂᖅ ᓄᓇᕕᓂᒥᑦ ᐊᑐᖅᑕᐅᓚᐅᖅᑐᖅ ᑭᐸᕇᒃᑎᑕᐅᔪᓄᑦ ᐊᒡᒍᖅᓯᒪᔪᓄᑦ ᐊᑐᐊᖅᓗᑎᒃ 2001-ᒥᑦ ᓴᖅᑭᑕᐅᓚᐅᖅᑐᒧᑦ ᐊᒻᒪᓗ ᑕᒪᑐᒪᓂ ᐊᕐᕌᒍᒥᑦ, ᐃᒻᒪᖃ 15 ᑭᐸᕇᒃᑐᑦ ᐱᔭᕇᖅᑕᐅᓚᐅᖅᑐᑦ ᑲᑎᓪᓗᒋᑦ ᐅᓄᕐᓂᖏᑦ ᓇᐃᓴᐅᑎᑎᒍᑦ ᐱᔭᕇᖅᓯᒪᔪᑦ ᑭᐸᕇᒃᑐᑦ 36-ᓄᑦ. ᑕᐃᒪ 14-ᖑᔪᑦ ᓄᓇᐃᑦ ᓯᓚ ᑕᑉᐸᓂ ᓄᓇᐅᔪᒥᑦ ᐱᓕᕆᔭᕆᐊᓕᕗᑦ ᓄᓇᖏᑦ ᓱᕈᔪᖃᕐᓂᖏᓐᓄᑦ ᓘᑎᑦᑕᐅᔭᕆᐊᖃᖅᑐᓂᒃ. ᑕᒪᒃᑯᐊ ᓄᓇᐃᑦ ᐃᖃᖅᑐᑦ ᐱᓯᐲᓂᒃ ᐊᖏᓂᖅᓴᐃᔪᓂᒃ 2000 ᐃᓚᖃᕐᓂᑦ 1,000,000 ᐊᒡᒍᖅᓯᒪᔪᓄᑦ ᐲᖅᑕᐅᔭᕆᐊᓕᑦ ᑐᖅᑯᖅᓯᒪᓗᑎᒃ. ᑕᒪᒃᑯᐊ ᑕᒪᐃᓐᓂᒃ ᓇᓗᓇᐃᖅᓯᒪᔪᑦ ᓄᓇᕕᓃᑦ ᐲᖅᑕᐅᓚᐅᖅᑐᑦ ᐱᓯᐃᓪ ᐊᒃᑐᑯᒃᑯᕕᖓᓐᓂᑦ. ᑕᒪᒃᑯᐊ ᓯᕗᓕᖅᓯᐅᑎᑦ ᐊᒃᓗᓈᖅᑕᐅᓂᑦ ᐊᒻᒪᓗ ᐊᒡᒍᖅᑐᖅᑕᐅᓂᖏᑦ ᐱᒋᐊᖅᑕᐅᓚᐅᖅᑐᑦ ᐃᓚᖓᓂᑦ ᓯᒡᔭᖓᑕ ᐸᕐᓇᒃᑕᐅᓇᓱᐊᖅᓗᓂ ᓯᕗᓕᖅᓯᐅᑎᒧᑦ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᐃᓗᑦᑐᐃᓂᕐᒥᑦ ᖃᓗᑦᑎᓯᒧᑦ ᐊᕐᕌᒎᓕᖅᑐᒧᑦ.

ᑐᖅᑯᖅᑕᐅᓂᖏᑦ ᓱᕈᐃᑦ ᓄᓇᐃᑦ ᓴᕕᕋᔭᓄᑦ 3.1 ᒦᑕᓂᒃ ᐅᖓᒻᒧᑦ, ᓴᓂᒧᑦ ᐊᒻᒧᓪᓗ ᐃᓂᓕᓐᓂᑦ ᐱᓕᕆᐊᖑᓚᐅᖅᓯᒪᔪᖅ ᐊᕐᕌᒎᔪᒥᑦ ᐸᕐᓇᒃᑕᐅᓪᓗᑎᒃ ᐅᒥᐊᕐᔪᐊᑎᒍᑦ ᐅᓯᑲᖅᑕᖅᑕᐅᓂᒃᓴᒧᑦ. ᑖᓐᓇ ᓴᓇᔭᐅᔪᖅ ᐅᒥᐊᕐᔪᐊᓄᑦ ᐅᓯᓕᖅᓯᕐᕕᒃ ᐱᓯᐲᓄᑦ ᑐᖅᑯᖅᓯᒪᕐᕕᐅᔪᖅ ᐃᓗᓕᖃᓕᖅᑐᖅ 234-ᓂᑦ ᐃᓗᓕᖅᓯᒪᔪᓂᒃ ᓴᕕᕋᔭᓂᒃ ᐅᓯᔭᐅᑐᐃᓐᓇᕆᓕᓐᓂᑦ ᖃᓪᓗᓈᑦ ᓄᓇᖓᓐᓄᑦ. ᑕᒪᒃᑯᐊ ᐱᔭᐅᓚᐅᖏᓐᓂᖏᓐᓂᑦ ᐴᖅᑐᖅᑕᐅᓯᒪᔪᑦ ᑖᒃᑯᓄᖓ ᐸᓇᑦ ᐊᕙᑎᓕᕆᔨᖏᓐᓄᑦ ᐊᔾᔨᒌᖏᑦᑐᑦ ᖃᐅᔨᓴᐃᓃᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᓕᑦ. ᑕᐃᒪᓕ ᑲᑎᓪᓗᒋᑦ 14-ᖑᔪᑦ ᖃᐅᔨᓴᐃᓃᑦ ᑲᒪᒋᔭᐅᓚᐅᖅᑐᑦ ᓱᕈᖅᑎᖅᓰᓂᑦ ᐊᒃᑎᒥᓂᖏᓐᓄᑦ, ᒪᓴᖃᕐᓂᖏᓐᓄᑦ, ᓱᕋᐃᔭᓐᓂᖓᓄᑦ, ᐱᓯᐲᓄᑦ, ᐅᖅᓱᐊᓗᕋᔭᓂᑦ ᐃᓚᖃᖅᓂᖓᓄᑦ, ᑯᓗᐊᕈᐸᓐᔭᐃᓐᓄᑦ, ᑕᐃᐋᒃᓯᓐᓄᑦ, ᕕᐅᕌᓐᓄᑦ ᐊᒻᒪᓗ ᓴᕕᕋᔭᒃᓴᕐᓄᑦ.

2001-ᒥᑦ, ᒥᑦᑕᕐᕕᐅᑉ ᐊᒃᑕᑯᒃᑯᕕᖓᑦ ᑭᓪᓕᓕᐅᕆᔭᐅᓚᐅᖅᑐᖅ ᐊᒻᒪᓗ ᑕᒪᒃᑯᐊ ᐊᒃᑎᒥᓂᖏᑦ ᓱᕈᖅᑎᖅᓯᒪᔪᑦ ᓄᓇᐃᑦ ᓇᓗᓇᐃᖅᑕᐅᓪᓗᑎᒃ. ᑕᒪᑐᒪᓂ ᐊᕐᕌᒍᒥᑦ ᑖᓐᓇ ᐊᒃᑐᑯᒃᑯᕕᒃ ᕿᒥᕐᕈᔭᐅᓚᐅᖅᑐᖅ ᐊᑐᖅᓯᓪᓗᑎᒃ ᐊᒻᒧᓪᓗᐊᖅ ᖃᐅᔨᓴᐃᓂᕐᒥᑦ ᐊᒻᒪᓗ ᖄᐸᖓᓂᑦ ᓄᓇᐅᑉ ᐃᓂᓕᐊᕆᔭᐅᓯᒪᔪᑦ ᐊᑐᖅᑕᐅᓪᓗᑎᒃ ᐊᖅᐸᓯᓈᖑᔪᒥᑦ ᐃᓚᖓᓐᓂᑦ ᐱᒋᐊᖅᓯᒪᓪᓗᑎᒃ. ᑕᐃᒪᓕ ᐱᓯᐲᓂᒃ ᐱᑕᖃᓚᐅᖏᑦᑐᖅ (<3.0 PPB) ᖄᖏᖅᑕᐅᓪᓂ 30 ᒦᑕᐃᑦ ᐅᖓᑖᓄᑦ ᐊᒃᑐᑯᖃᕐᕕᐅᑉ. ᑕᒪᒃᑯᐊ ᐊᒃᑎᒥᓂᕆᔭᖏᑦ ᐱᓯᐲᑦ ᓄᓇᐅᔪᒥᑦ ᐅᖓᓯᒃᓯᐸᓪᓕᐊᓪᓗᒍ ᒥᑭᓪᓕᐸᓪᓕᐊᓚᐅᖅᑐᑦ ᑕᒪᑐᒪᓐᖓᑦ < 3 PPB - 68 PPB ᑕᒪᓐᓇ ᓇᓗᓇᐃᖅᓯᓪᓗᓂ ᐃᓯᐊᕿᔪᖃᓗᐊᖏᓐᓂᖓᓐᓂᑦ ᑕᑉᐸᖓᑦ ᐊᒃᑕᑯᖃᕐᕕᐅᔪᒥᑦ.

ᖃᐅᔨᓴᖅᑕᐅᓂᖓ ᐊᒻᒪᓗ ᐃᑭᑕᐅᓂᖏᑦ ᖃᑦᑕᐅᔭᕕᓃᑦ ᑲᔪᓯᓚᐅᖅᑐᑦ ᐊᕐᕌᒍᒥᑦ. 67-ᖑᔪᑦ ᖃᑦᑕᐅᔭᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᐱᒋᔭᑦ ᐅᓇᓕᒃᓴᔭᒃᑯᓐᓄᑦ ᑲᓇᑕᒥᑦ. ᑕᒪᓐᓇ ᓄᓇᖓᑦ ᖃᐅᔨᓴᖅᑕᓚᖅᑐᖅ ᓱᕈᐃᔭᑦᑐᓂᒃ ᐆᒪᔪᕕᓂᕐᓂᑦ ᐅᖅᓱᐊᓗᕐᔭᒃᑕᖃᕐᒪᖔᑦ ᐃᓂᕕᓂᖏᓐᓂᑦ ᖃᑦᑕᐅᔭᐃᑦ. ᑕᒪᒃᑯᐊ ᑎᐱᖃᓪᓚᕆᒃᑐᑦ ᐅᖅᓱᐊᓗᕐᔭᐃᑦ ᖃᐅᔨᔭᐅᓚᐅᖅᑐᑦ ᐃᓚᖓᓐᓂᑦ ᐊᕝᕗᖅᑕᐅᔪᒧᑦ ᖃᑦᑕᐅᔭᖃᕐᕕᕕᓂᕐᓂᑦ ᓇᕐᓴᐅᔪᒥᑦ ᑭᓯᐊᓂ ᐅᖅᓱᐊᓗᕐᔭᒻᒥᑦ ᓇᓂᓯᔪᖃᓚᐅᖏᑦᑐᖅ ᓇᓪᓕᐊᑐᐃᓐᓇᕐᓂᑦ ᓄᓇᕐᔭᓐᓂᑦ ᖃᐅᔨᓴᖅᑕᐅᔪᓂᒃ. ᐃᓚᖏᑦ ᓱᕈᓗᐊᖑᔪᑦ ᐲᖅᑕᐅᓚᐅᖅᑐᑦ ᑕᒪᐃᓐᓂᒃ ᓯᒡᔭᒥᑦ ᐊᒃᑕᑯᖃᕐᕕᕕᓂᕐᓂᒃ ᑭᓯᐊᓂᓕ ᖃᐅᔨᓴᐃᓂᕐᒥᑦ ᐅᕝᕙᓘᓐᓃᑦ ᕿᒥᕐᕈᐃᓂᕐᒥᑦ ᐱᑕᖃᕆᐊᖃᓗᐊᖏᒻᒪᑦ ᑕᐅᕙᓂ. ᐊᓯᖕᒥᑎᑐᑦ ᐊᕐᕌᒍᑎᑐᑦ ᑕᒪᒃᑯᐊ ᑕᖕᒫᕐᕕᐅᑉ ᐃᒪᖃᐅᑎᖏᑦ ᐊᒻᒪᓗ ᑕᓯᐅᑉ ᐃᒪᖓᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ ᐅᓗᕆᐊᓇᕈᑎᓄᑦ. ᑕᒪᒃᑯᐊ ᖃᐅᔨᓴᖅᑕᐅᖏᓐᓇᕐᓂᖏᑦ ᐃᒪᖃᖅᑐᑦ ᓯᒡᔭᐅᑉ ᐊᒃᑕᑯᒃᑯᕕᖓᑕ ᑰᕋᓛᖓᓂᑦ, ᖄᖅᑐᕕᓂᐅᑉ ᐃᒪᖃᐅᑎᐅᑉ ᐊᑖᓂᑦ, ᐊᖓᔪᖅᑲᐅᑎᑦ ᐃᓂᖃᕐᕕᕕᓂᖏᑦ ᐊᒻᒪᓗ ᑲᒪᒋᔭᐅᔪᓄᑦ ᐊᐅᓚᐅᑎᓄᑦ ᐊᒃᑕᑯᒃᑯᕕᕕᓂᖓᑕ ᓴᕕᕋᔭᓄᑦ ᐊᒻᒪᓗ ᓱᕈᕐᓇᐅᑎᔪᓄᑦ ᖃᐅᔨᓴᖅᑕᐅᖏᓐᓇᖅᓗᓂ. ᑕᒪᒃᑯᐊ ᕿᒥᕐᕈᐃᖏᓐᓇᕐᓂᐅᔪᑦ ᐱᕈᖅᑐᕕᓂᕐᓂᑦ ᓄᓇᐅᑉ ᐃᓚᖓᓐᓂᑦ ᑲᔪᓯᑎᑕᐅᓚᐅᖅᑐᖅ ᑕᒪᑐᒪᓂ ᐊᕐᕌᒍᒥᑦ. ᑕᒪᒃᑯᐊ ᓇᓗᓇᐃᖅᓯᓚᖓᔪᑦ ᓇᓪᓕᐊᓐᓄᑦ ᓅᑉᐸᓪᓕᐊᒻᒪᖔᑦ ᓄᓇᖓᑦ ᐱᕈᖅᑐᖏᓪᓗ ᐊᑐᓪᓚᕆᒃᑲᔭᖅᓗᓂ ᓴᓇᔭᐅᒪᓕᖅᑎᓪᓗᒍ ᓄᓇᖓᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓴᖅᑕᐅᑐᐃᓐᓇᓕᖅᑎᓪᓗᒍ.

ᑕᒪᒃᑯᐊ ᐅᓪᓗᒥᐅᔪᖅ ᑐᓗᕈᑕᐅᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᓚᐅᖅᑐᑦ. ᖄᒃᑲᓐᓂᐊᒍᑦ, ᕿᒥᕐᕈᐃᓂᕐᒥᑦ ᐱᒋᐊᖅᑎᑦᑎᓚᐅᖅᑐᒍᑦ ᑕᑯᓇᒃᑕᐅᓪᓗᓂ ᐊᑕᐃᓐᓇᕐᓂᐊᖅᑐᓂᒃ ᐃᓯᐊᕿᔾᔭᐃᒃᑯᑎᓂᒃ ᓴᓇᓂᐅᔪᒧᑦ. ᑕᒪᒃᑯᐊ ᖃᐅᔨᓴᕈᑕᐅᔪᑦ ᐆᒃᑐᖅᑕᐅᔪᑦ ᐃᓯᐊᕿᔾᔭᐃᒃᑯᑎᑦ ᓴᓇᔭᐅᔪᑦ ᐊᒻᒪᓗ ᐊᑐᖅᑕᐅᓂᐊᖅᓗᑎᒃ 2003-ᒥᑦ. ᑕᒪᑐᒪᓂ ᓄᑖᒥᒃ ᓴᓇᔭᐅᒪᓂᖓᓄᑦ ᐸᕐᓇᐃᓂᕐᒥᒃ ᓴᖅᑭᑎᑦᑎᓚᐅᖅᑐᒍᑦ ᒪᓕᒃᓗᑎᒃ ᓄᑖᓂᒃ ᒪᓕᒋᐊᓕᓐᓂᑦ ᓴᖅᑭᑕᐅᔪᓂᒃ ᓴᓗᒪᓂᕐᒧᑦ ᓄᓇᓄᑦ ᐃᓄᓕᕆᔨᑐᖃᒃᑯᓐᓄᑦ 2002-ᒥᑦ.

EXECUTIVE SUMMARY

This report is the ninth annual report produced by the Analytical Services Unit (ASU) relating to the environmental assessment and remediation of the former military base at Resolution Island. The first three reports, pertaining to visits from 1994 to 1996, involved site assessment, remediation of critical areas and the development of cleanup plans and strategies. The work in these three years was managed by the ASU. In 1997 and 1998 the project focussed on infrastructure improvements and the purchasing and assembly of the equipment necessary for the cleanup of the site. From 1997 onwards, the management of the work has been conducted by the Qikiqtaaluk Corporation. Remediation activities started in 1998 and have continued each year. The ASU has provided analytical services and expertise to support this work and Dr. John Poland and Dr. Allison Rutter have acted as Scientific Advisors to Indian and Northern Affairs Canada (INAC) for the project. This report details the work undertaken by the ASU, Queen's University in 2002.

This year the field season was unusually short lasting only about six weeks. Approximately 1000 m^3 of CEPA soil was excavated, predominantly from the S1/S4 buildings and valley area. The excavation was carried out using the grid system set up in 2001 and this year 15 quadrants were completed bringing the total number of completed quandrants to 36. Fourteen quandrants in the S1/S4 valley area still contain CEPA soils which require excavation. All soil with a PCB concentration greater than 2000 ppm has been containerized. All CEPA soil was removed from the PCL dump. Initial roping and grid setup was started at the S1/S4 beach area in preparation for an initial test excavation planned for next season.

Containerization of the soil into 3.1 m^3 conical steel containers was commenced this year in preparation for shipment. The newly created transshipment PCB storage facility contains 234 filled containers which are ready to be shipped south. Before the containers can be received by Bennett Environmental a suite of analysis is required. A total of 14 samples were analyzed for particle size distribution, moisture content, pH, PCBs, total petroleum hydrocarbon, chlorobenzenes, dioxins and furans and metals.

In 2001, the airstrip dump was delineated and the volume of PCB contaminated soil determined. This year the dump was further assessed by taking depth and surface samples in drainage pathways leading away from the toe of the dump. No PCBs (<3.0 ppb) were detected further than 30 m from the dump. The concentration of PCBs in soil

beyond the dump ranged from < 3 ppb to 68 ppb indicating that there is minimal leaching of PCBs from the dump.

Testing and incineration of barrels continued this year. Sixty-seven barrels were tested most of which belonged to DND. Soil was tested for volatile organic hydrocarbons in areas in which barrels were previously stockpiled. Aromatic hydrocarbons were detected in a sample from the barrel cache valley but no chlorinated compounds were detected in any of the samples. A small amount of debris was removed from the two beach dumps but no sampling or analysis was required in that area. As in other years the camp drinking water and the lake water was tested. Background monitoring of water at the beach dump stream, imploded tank, officers mess and maintenance dump for metals and PCBs was continued. Monitoring of background plant samples was initiated this year. This data will create useful trend data which will be particularly valuable once the remediation of the site is complete and the monitoring stage has begun.

Existing barriers were monitored again this year. In addition, a research program into the design of permanent barriers was initiated. Trial barriers are being constructed and will be deployed in 2003. A new remediation plan was completed this year to comply with new guidelines produced by INAC in 2002.

I. OVERVIEW

A. General

This is the ninth year that the Analytical Services Unit (ASU) has conducted work at Resolution Island for Indian and Northern Affairs Canada (INAC). Over the period 1993-1996, environmental work at the site was detailed in a set of reports entitled "Environmental Study of a Military Installation at Resolution Island, BAF-5". These reports[1] fully described items such as site characteristics, history, and previous investigations. Scientific investigations have continued and have been reported annually[2]. From 1997 onwards, work at the site has been managed by the Qikiqtaaluk Corporation (QC) through a contribution agreement with INAC. This work started in 1997 with infrastructure improvements and expanded from 1998 onwards to include remediation activities and training. Map I-1 shows the location and general layout of the site at Resolution Island.

The work described in this report was conducted through a Contribution Agreement between Queen's University and INAC. This year the Resolution Island project was managed by the Nunavut Office. This report details the tasks carried out by the ASU in 2002 and outlines the progress made in the Resolution Island remediation project. The report includes a chapter detailing research has been conducted to support the design and construction of permanent barriers across the S1/S4 drainage pathway. A new remediation plan that includes excavation of Tier II and Tier I soils, the construction of a Tier II landfill, permanent containment barriers and a long term monitoring plan was prepared by the ASU and submitted to INAC as a separate report along with cost

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[1] Environmental Sciences Group (1994). Volume One, Analytical Services Unit (1995) Volume Two, Analytical Services Unit and Environmental Sciences Group (1996) Volume Three, and Analytical Services Unit (1997) Volume Four: Environmental Study of a Military Installation at Resolution Island. BAF-5. Prepared for Indian and Northern Affairs Canada.

[2] Analytical Services Unit (1998), (1999), (2000), (2001) and (2002). Resolution Island 1997: Scientific Investigations, Resolution Island 1998: Scientific Investigations: Resolution Island 1999: Scientific Investigation:s, Resolution Island 2000: Scientific Investigations and Scientific Investigations and Resolution Island 2001: Scientific Investigations. Prepared for Indian and Northern Affairs Canada.

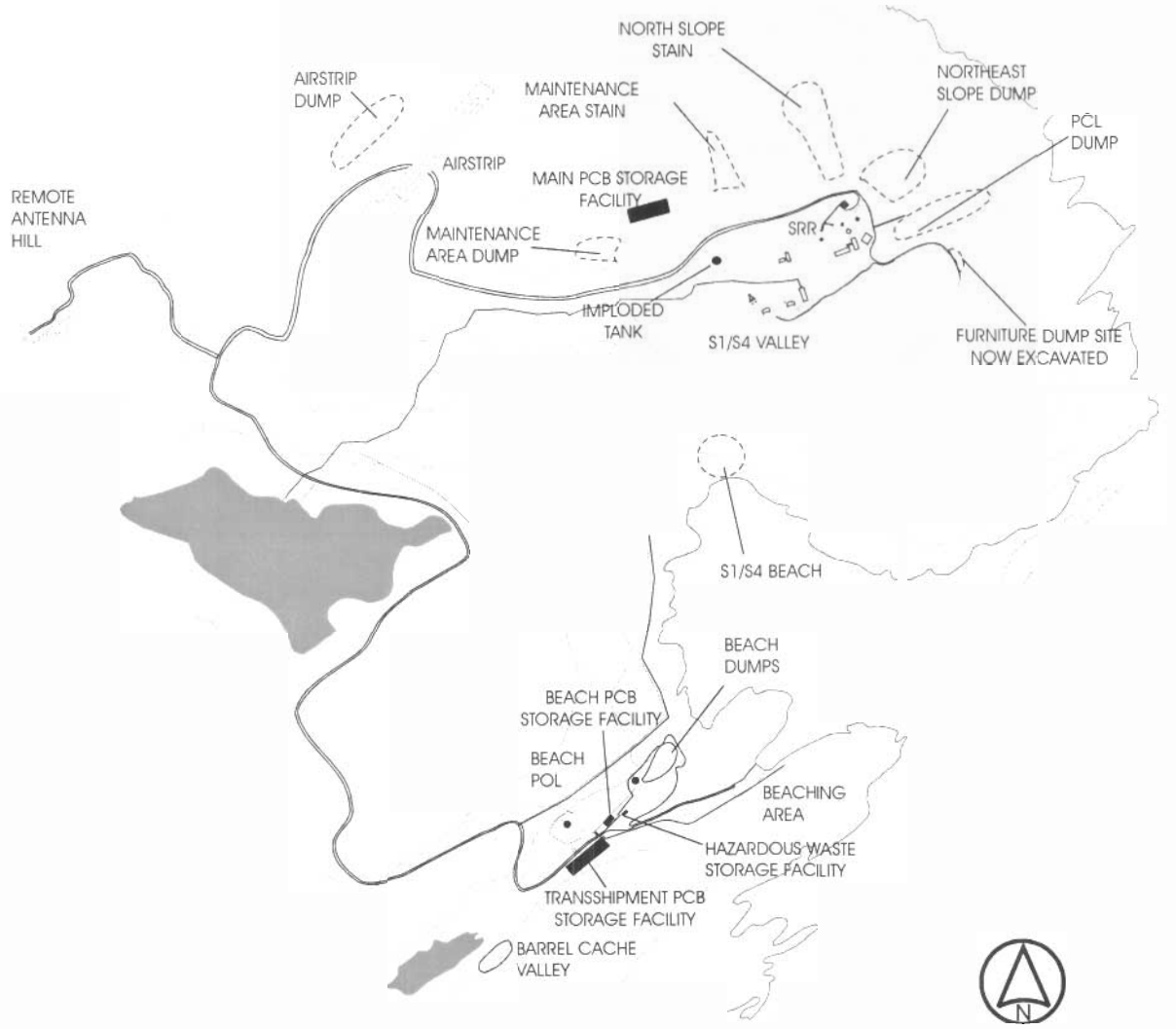
estimates. New INAC guidelines and new INAC management necessitated the formulation of an overall plan to bring the Resolution Island site to closure.

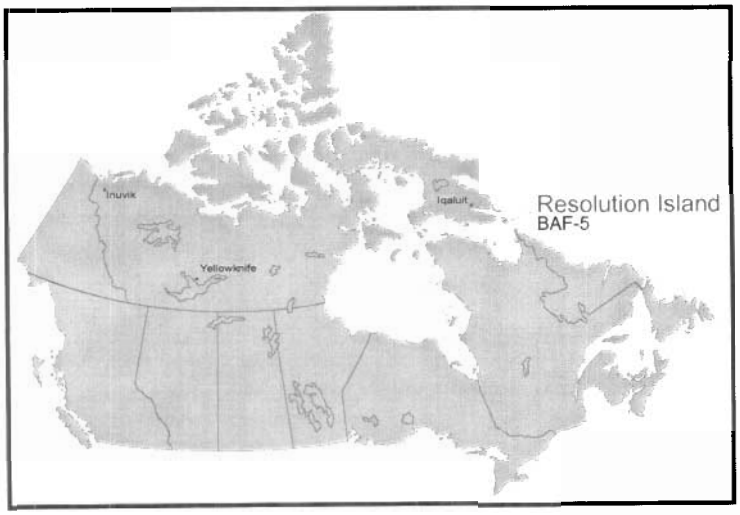
B. Site Activities

Most of the work conducted at Resolution Island this year was again managed by the Qikiqtaaluk Corporation (QC). QC managed the transportation to and from Iqaluit, provided meals and accommodation at the core camp and provided personnel and equipment to assist with our work.

The main accomplishments at the site for the year were the excavation of CEPA soil from the S1/S4 buildings and valley area (Photograph I-1) and the containerization of some CEPA soils (Photograph I-2). Excavation was not completed at the S1/S4 buildings and valley area and approximately 400 m^3 of PCB contaminated soil remains. On site activities started late again this year and the season also closed early. A contract to send the filled steel containers to Bennett Environmental was not awarded due to contractual difficulties. This together with the decision by QC to close the site early enabled funds to be available for, amongst other things, the design, construction specifications, drawings and cost estimates for a Tier II landfill, the development of a new plan for the complete site remediation and research to support the design of permanent barriers at the site.

Map I-1: Location and General Layout of the Site at Resolution Island





Photograph I-1: Excavating and Vacuuming PCB Contaminated Soils at the S1/S4 Valley Area

Photograph I-2: Filling the Conical Steel Containers with PCB Contaminated Soils from the Main PCB Storage Facility

C. On Site Scientific Investigations

The Queen's University team was on site from 17 July to 26 August 2002, an unusually short season.

The activities conducted at the site this year by the ASU and described in Chapters II-V of this report are listed below. There were four ASU personnel on site for most of the time this summer. Two people were generally required full time to operate the laboratory. The successful operation of the laboratory (Photograph I-3) ensured the ability to analyze PCBs and other parameters on site; this greatly facilitated the excavation and other activities on site. Equipment and supplies used by the ASU were flown to Iqaluit and transported into the site by helicopter or Twin Otter aircraft. The gas chromatograph was taken back to Kingston at the end of this year's field season for repairs and maintenance.

The ASU has also assisted in the design work related to the proposed Tier II landfill. Personnel from EBA Engineering and UMA Engineering visited the site in August in order to ascertain the best location for the landfill and to look at the potential borrow source sites from fill material, gravel and sand. ASU personnel assisted in mapping various areas with GPS and with discussions with EBA and UMA personnel concerning various aspects of their work.

Resolution Island meetings were attended in Iqaluit, Ottawa, and Kingston this year.

1. On Site Activities

The main tasks completed by the ASU this year are listed below:

- Provide scientific and engineering support at the site.
- Conduct analyses at the mobile laboratory. The analyses were mainly for PCB by the GC/ECD method in soil, water, and other matrices. The GC/ECD equipment and associated equipment for PCB analysis is complex and back up in case of equipment breakdown was provided by the provision of test kits (on-site) and GC/ECD at Queen's (off-site); split samples were regularly sent back to Queen's but fortunately not required. Test miscellaneous materials such as metals and used decontamination supplies for PCBs, water, daily pH testing of drinking water, and identity of unknown materials.

- Confirmation testing, mapping and roping at the S1/S4 Valley area. As remediation of this area was the main task at the Island this year, Queen's assigned a person to overseeing the operation. Conduct GPS work as required (Photograph I-4).
- Prepare S1/S4 Beach Area for 2003 excavation – roping (2002) and setting up a grid on maps that will be available for on-site marking in 2003. Additional confirmatory samples were necessary and samples also taken to ascertain whether test kits could be used as back up.
- Barrels – testing, sorting and labelling as required.
- PCB Storage facilities – adding materials to, and keeping an inventory of, the Beach facility as required – reporting records of the contents of both the Beach and Main PCB storage facilities and off site disposal to INAC at the end of the field season - and keeping INAC informed of any additional CEPA violations so that they can be reported promptly to Environment Canada. Oversee reorganisation of the Beach facility so as to separate CEPA materials from DND red steel boxes.
- Conduct further work on the environmental assessment of the airstrip dump by taking more samples at distances from 20-200 m from the toe of the dump and at depth.
- Drinking water and lake water. Test pH daily, and potability of drinking water during the summer and lake water and new landfill leachate (if present).
- Monitor, inspect and repair barriers.
- Collect and analyse air samples for PCBs, chlorinated hydrocarbons and volatile hydrocarbons as required.
- Act as scientific resource to INAC and attend meetings as required..
- Sample three areas (barrel cache valley, cotton grass and imploded tank) for degreasers in oily soil.
- Collect sixteen representative soil samples from CEPA materials to be shipped off site and analyse for the parameters required by Bennett Environmental Inc. Report the results to Bennett so that they can obtain a permit to receive the soil.

- Collect and analyse background water samples.
- Collect and analyse background plant samples.
- Prepare a poster displaying the activities of the 2002 field season.

D. Other Activities

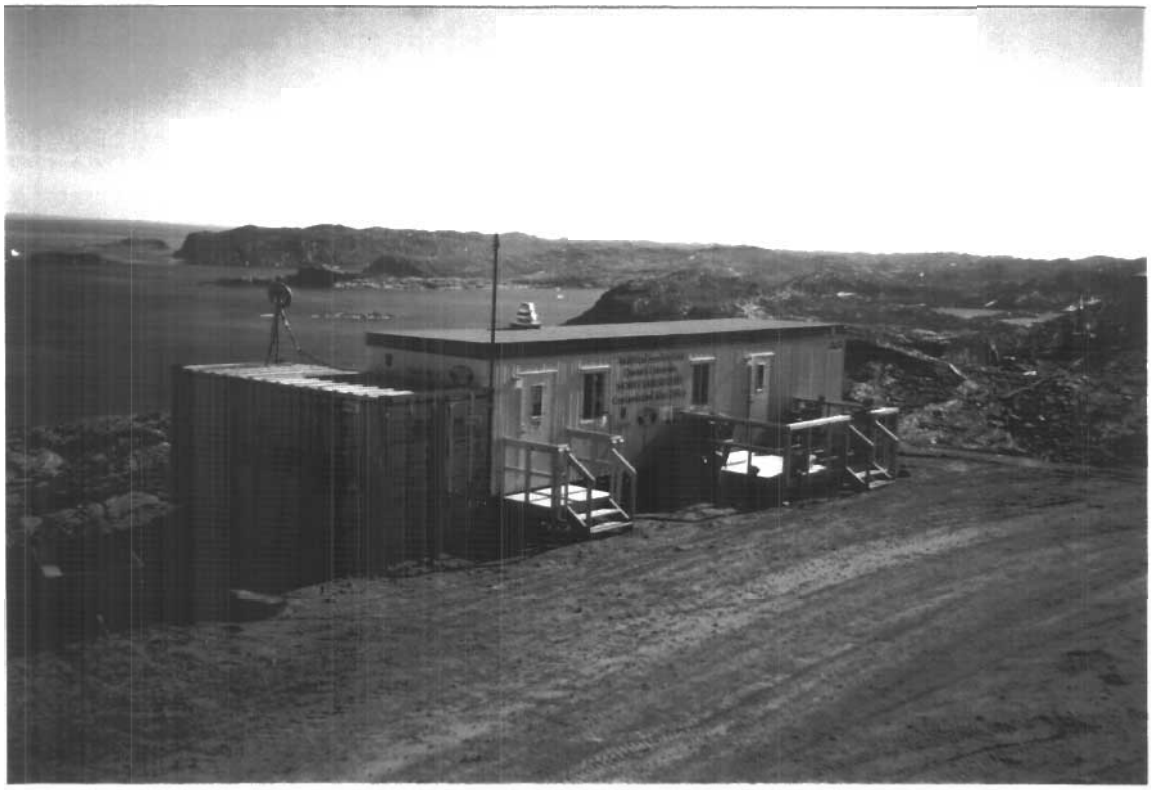
The two other major activities were conducted this year were the development of a new remediation plan and research to support the design of permanent interceptor barriers.

The Resolution Island remediation project, that is currently funded, is designed to bring the site into legal compliance. Even when all materials contaminated with PCBs above the 50 ppm level have been removed, this site will still be INAC's most contaminated site in Nunavut. At a meeting in Iqaluit on 3-4 October 2002, it was decided to develop a new remediation plan in line with recently approved INAC policies, to include cleanup of contaminated soils to lower criteria and to add additional items such as a new lined landfill, containment barriers and a long term monitoring program. The ASU has produced a detailed plan and a strategy to conduct this work which has been presented to INAC as a separate document. The plan has been devised such that the remediation work can be carried out within three years. Rough order of magnitude costs have been submitted to INAC separately.

It will not be possible to excavate all the PCB contaminated soil from the S1/S4 building, valley and beach areas. Some contaminated soils will remain in cracks and crevasses and the soil at the immediate base of the cliff is too dangerous to remove. In 1994, the ASU designed and constructed temporary barriers across the drainage pathway in order to prevent migration of PCBs to the ocean. While these were successful, they are now seven years old and becoming clogged with fine particulate matter. During excavation much loose material will be mobilized and this will increase the amount of silty material carried down the migration pathway; currently the surface is matted together with moss, and lichen. It is therefore proposed to design and construct permanent barriers across the S1/S4 drainage pathway at the top of the cliff and immediately before the ocean. It is worth noting that the situation in the S1/S4 drainage

pathway is unique, not only because of its location in the Arctic but also because the PCB contamination is located in such an inaccessible rugged terrain which includes a 300 m cliff. The work is described in Chapter VI has involved the development of the concept of a barrier system, the design and construction of a prototype barrier, and the testing of potential component materials under various conditions.

Dr Poland attended the third international conference on "Contaminants in Freezing Ground" in April as part of a cooperation with the Australian Antarctic Division (AAD), Environment Australia. A poster entitled "Conducting Environmental Analyses at Remote Sites in Cold Climates" by John Poland, Allison Rutter, Graham Cairns and Natalie Plato was presented and useful discussions took place.



Photograph I-3: The Mobile Analytical Laboratory at the Site

Photograph I-4: Mapping for the NEW Tier II Landfill Using the Ashtech Reliance Decimeter GPS System.