Hope Bay Mining Limited

DORIS NORTH PROJECT
Mine Infrastructure Changes - Supporting Memo

NEWMONT™
NORTH AMERICA

Rescan™ Environmental Services Ltd.
Rescan Building, Sixth Floor - 1111 West Hastings Street
Vancouver, BC Canada V6E 2J3
Tel: (604) 689-9460 Fax: (604) 687-4277

November 2011

DORIS NORTH PROJECT

MINE INFRASTRUCTURE CHANGES - SUPPORTING MEMO

November 2011
Project #1009-007-02

Citation:

Rescan. 2011. *Doris North Project: Mine Infrastructure Changes – Supporting Memo*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd.

Prepared for:

NEWMONT™
NORTH AMERICA

Hope Bay Mining Limited

Prepared by:

Rescan™
Engineers and Scientists

Rescan™ Environmental Services Ltd.
Vancouver, British Columbia

Table of Contents

Rescan™
Engineers and Scientists

DORIS NORTH PROJECT
MINE INFRASTRUCTURE CHANGES - SUPPORTING MEMO

Table of Contents

List of Figures

FIGURE **PAGE**

List of Tables

TABLE **PAGE**

List of Plates

List of Appendices

1. Introduction

(English)

1. ᖁᑲᓂᖅ ᐱᖃᓕᑕᐅᔪᑦ ᒪᓂᐊ

(Inuktitut)

1. Unniqtuta

(Inuinnaqtun)

Rescan™
Engineers and Scientists

1. Introduction

This memo is intended to provide information requirements to support the requested Doris North infrastructure changes.

The activities/infrastructure addressed in this memo are as follows:

- Expansion of sewage treatment plant at Doris Camp (from 180 to 360 person capacity);
- Maintain the option of tundra sewage outfall diffusion as a backup after primary discharge moves to Tail Lake tailings facility;
- Move potable water use from Doris Lake to Windy Lake due to Doris Lake blue-green algae levels;
- Install water Intake from Roberts Bay for fire suppression system;
- Expansion of waste rock and ore storage pad at the Doris Mine site;
- Expansion of laydown area at Roberts Bay;
- Permanent use of accommodation barges frozen into Roberts Bay;
- Preserve ability to freeze in fuel tankers in Roberts Bay that meet Transport Canada regulations;
- Change mining rate from 720 tons/day to 1,000 tons/day and Milling Rate from 800 tons/day to a yearly average of 800 tons/day, with potential to take mining rate to 2,000 tons/day and mill to 1,600 tons/day;
- Accessing all Doris subdeposit resources via the Doris North Portal, resulting in a 2-4 year extension of mine life; and
- Sending saline groundwater and talik water encountered as part of accessing additional resources via the Doris North Portal to the Tailings Impoundment Area (TIA), and send excess TIA water to Roberts Bay via a subsea pipeline and diffuser rather than the currently-permitted discharge to Doris Creek, which flows to Roberts Bay.

The memo provides information on all of the proposed activities listed above. However, a more detailed report on the proposed subsea pipeline system and the proposed discharge of treated TIA water to Roberts Bay has been prepared for submission with the amendment package (Rescan 2011). Please refer to the Roberts Bay Report for details on the proposed subsea pipeline and diffuser system, potential environmental effects, mitigation measures, and proposed monitoring programs.

The following sections present information that was identified in the Supplementary Information Guidelines prepared by the Nunavut Water Board (NWB) as being applicable to this amendment application, and as identified in the Concordance Table enclosed with this amendment application.

1. ᖃᓄᖅ ᐱᔾᔪᑕᐅᔪᑦ ᒪᑯᐊ

ᐅᑯᐊ ᑎᑎᖃᑦ ᐊᑐᐃᓐᓇᐅᑎᔾᔨᒍᑕᐅᒻᒪᑕ ᑐᓴᒐᒃᓴᓂᒃ ᐊᑑᑎᓂᖃᓐᓂᐊᖅᑐᓂᒃ ᐋᕿᒋᐊᕈᑎᒃᓴᓂᒃ ᐅᑯᓄᙵᙵᔪᓂᒃ ᓈᓴᐅᑖ No. 04 ᑐᖄᑦᑐᓂᒃ ᐅᑯᓄᙵ Doris North−ᒧᑦ ᐃᒪᐃᑦᑐᒥᒃ A−ᒥᒃ ᐃᒥᓕᕆᔾᔪᑎᒃᓴᒥᒃ ᓚᐃᓴᒥᒃ ᓈᓴᐅᑖ 2AM-DOH0713.

ᐊᐅᓚᔾᔨᒍᑕᐅᓛᖅᑐᑦ ᓴᓇᔪᖃᓕᖅᐸᑦ ᐱᔾᔪᑎᓖᑦ ᑎᑎᖃᑦ ᐅᑯᓇᓃᑦᑐᑦ ᐊᑖᓂ:

- ᐊᖏᓪᓕᒋᐊᖅᑕᐅᓗᓂ ᖁᒃᑕᑯᓂᒃ ᓴᓗᒪᑎᔾᔨᒍᑦ ᐃᑲᓂ Doris ᐊᓯᓂ ᓄᓇᓕᒋᔭᒦᑦᑐᒥ (ᐃᒪᐃᓪᓗᐊᖅᑐᑦ 180 ᐃᓚᒋᐊᓛᖅᑐᑦ 360−ᓂᒃ ᐃᓄᖃᕈᓐᓇᓕᕐᓗᓂ);
- ᐋᕿᓯᐊᖅᓯᒪᓂᐊᓕᖅᑐᑦ ᓇᓪᓕᐊᒃᑯᑐᐃᓐᓇᖅ ᓄᓇᑐᐃᓐᓇᕐᒥ ᖁᖅᕕᒃᑕᓖᑦ ᓴᓗᒪᖅᓴᐃᒍᑎᓕᖕᓂᒃ ᐊᑐᐃᓐᓇᕆᔭᐅᓗᑎᒃ ᑕᒪᒃᑯᐊᓕ ᓯᕗᓪᓕᕐᒥ ᐅᕗᙶᖃᑦᑕᔪᒻᒪᑕ ᐊᒃᑕᑯᖃᐅᑦ ᓅᑕᐅᔪᒻᒪᑦ ᑕᓯᕐᒧᑦ ᐊᒃᑕᑯᖃᐅᒧᑦ ᐅᕗᙵ Tail Lake−ᒧᑦ ᐅᔭᖃᒃᓴᓕᕆᔾᔪᑎᒥᓂᖅᑕᓕᖕᒧᑦ;
- ᓅᑕᐅᓗᑎᒃ ᖁᖅᕖᑦ ᐊᑐᓲᑦ ᐃᒥᕐᒥᒃ Doris Lake−ᒥᒃ ᐅᕗᙵ Windy Lake−ᒧᑦ ᓅᑕᐅᔪᒻᒪᑕ ᐆᒪ Doris Lake ᑕᓯᙵ ᑐᖖᒍᔪᖅᓯᔪᒻᒪᑦ ᐆᔭᐅᔭᐅᓕᖅᓱᓂ ᐊᖃᔭᕈᒻᒪᑦ;
- ᓴᓇᔭᐅᓗᓂ ᐃᒥᐅᑉ ᐊᖅᑯᑖ ᐅᕙᙶᙵᔪᖅ ᑲᕕᓯᓕᒃᑑᒥᒃ ᐃᑭᑦᑐᖃᓐᓂᖅᐸᑦ ᖃᑦᑎᓇᒍᑎᒃᓴᒥᒃ;
- ᐊᖏᓪᓕᒋᐊᖅᑕᐅᓗᑎᒃ ᐅᔭᖃᓂᒃ ᐲᔭᖅᑕᐅᓂᑯᓂᒃ ᐊᒻᒪᓗ ᐅᔭᖃᓐᓂᐊᖅᑕᐅᓂᑯᑦ ᐅᔭᖃᑦ ᐃᓂᓕᐅᖅᑕᐅᓗᑎᒃ ᓄᓇᒥ ᒪᓂᖃᓴᖅᓯᒪᔪᒥ;
- ᐊᖏᓪᓕᒋᐊᖅᑕᐅᓗᓂ ᓄᓇᒧᑦ ᐃᓕᐅᖃᐅᕕᐅᓲᖅ ᑲᕕᓯᓕᒃᑑᒥ;
- ᑕᐃᒪᙵᓕᒫᖅ ᐊᑐᖅᑕᐅᖃᑦᑕᕐᓗᓂ ᓯᓂᕕᐅᕙᒃᑐᖅ ᐅᒥᐊᑦ ᓯᑲᐅᑦ ᖁᐊᑮᑎᓯᒪᔪᑦ ᑲᕕᓯᓕᒃᑑᒥ;
- ᓲᕐᕋᓂᐊᖏᒻᒪᑕ ᖁᐊᕋᓗᐊᕈᑎᒃ ᐅᖅᓯᐊᓗᖃᐅᑏᑦ ᑲᕕᓯᓕᒃᑑᒥ ᑕᒪᒃᑯᐊ ᒪᓕᒃᑐᑦ ᑲᓇᑕᒥ ᐃᖏᕐᕋᔪᓕᕆᔾᔪᑕᐅᑉ ᐱᖁᔭᖏᓐᓂᒃ ᒪᓕᒐᖅᑎᒎᑦ;
- ᐊᓯᕈᖅᑐᑦ ᐅᔭᖃᒃᓴᖅᓯᐅᖅᕕᖕᒥ ᐱᕙᓪᓕᐊᔭᑦ ᐱᕙᓪᓕᐊᓂᖏᑦ ᐅᕙᒻᒪᑦ 720 ᑖᓐᓯ ᐅᑉᓗᖅ ᐊᑕᐅᓯᖅ ᐅᕗᙵᙶᖅ 1,000 ᑖᓐᓯ ᐅᑉᓗᖅ ᐊᑕᐅᓯᖅ ᐊᒻᒪᓗ ᐅᔭᖃᒃᓴᓕᕆᕕᖕᒥ ᐱᕙᓪᓕᐊᓂᖏᑦ ᐅᕙᒻᒪᑦ 800 ᑖᓐᓯ ᐅᑉᓗ ᐊᑕᐅᓯᖅ ᑎᑭᐅᑎᓯᒪᔪᓂᒃ ᐊᕐᕌᒍᑕᒫᑦ ᒥᒃᓴᐅᓴᖕᓂᖏᑦ ᐃᒫᒃ 800 ᑖᓐᓯ ᐅᑉᓗᖅ ᐊᑕᐅᓯᖅ;
- ᐅᑯᓄᙵᙵᙵᔪᑦ Doris Central ᕿᑎᙵᓄᑦ, ᐊᒃᑐᐊᓂᙵᓄᑦ Connector−ᑯᑦ ᐱᑕᓖᑦ ᐅᕗᙵᙵᓗᑎᒃ Doris North ᑲᑕᙵᓄᑦ ᐃᓗᒻᒧᑦ ᐃᑎᖅᕕᐅᓲᖅ, ᑖᒃᑯᐊ ᐅᐃᒍᔭᐅᒐᔭᕐᒪᑕ ᐊᑑᑎᓂᖏᑦ ᐃᒫᑎᒋ 2-4 ᐊᕐᕌᒍᐃᑦ ᑕᐃᒪᓐᓇ ᐃᓚᒋᐊᕐᓗᑎᒃ ᐅᔭᖃᓐᓂᐊᖅᕕᐅᒍᓐᓇᕐᓂᙵᑕ ᐊᑑᑕᐅᓂᐊᕐᓂᙵᓄᑦ;
- ᐱᑕᑦᓯᖃᔭᖅᑐᖅ ᐃᒥᕐᒥᒃ ᑕᓇᐅᙵᓗᒥᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓃᑦᑐᖅ ᐃᒥᖅᑕᓕᒃ ᐊᒻᒪᓗ ᖁᐊᕈᓐᓇᖏᑦᑐᒥᒃ ᑕᓯᖅᑕᓕᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᖃᐅᔨᔭᐅᔪᖅ ᑕᒪᒃᑯᓄᙵᙵᔪᓄᑦ ᐃᓚᒋᔭᒻᒪᑦ ᐊᑑᑕᐅᓂᐊᖅᑐᓄᑦ ᐅᕗᙵᙵᔪᑦ Doris North ᑲᑕᙵᒍᑦ ᐃᓗᒻᒧᑦ ᑎᑭᐅᑎᓯᒪᔪᑦ ᐊᒃᑕᑯᖃᐅᒻᒧᑦ ᐅᔭᖃᒃᓴᓕᕆᔾᔪᑎᒥᓂᒃᑯᕕᖕᐅᑉ ᐃᓂᙵᓄᑦ ᐊᒻᒪᓗ ᑕᑕᓕᖃᐃᐸᐸᑦ ᐊᒃᑕᑯᖃᐅᑦ ᐃᒪᙵ ᐅᕗᙶᖃᑦᑕᓴᖅᑐᑦ ᑲᕕᓯᓕᒃᑐᕐᒧᑦ ᐃᒪᕐᒎᙵᔪᒧᑦ ᓱᓪᓗᓕᒃᑯᑦ ᐊᒻᒪᓗ ᓴᓗᒪᖅᓴᐅᑎᓕᒃᑯᑦ ᑎᖕᒥᑳᖅᑐᒥᒃ ᐊᑑᑎᙵᖏᓪᓗᑎᒃ ᒫᓐᓇ ᐱᔪᓐᓇᕈᑕᐅᕙᒃᑐᓂᒃ ᐆᒪ Doris Creek ᑰᙵᓅᙵᔪᓂᒃ.

ᐅᑯᐊ ᑎᑎᖃᑦ ᐱᑕᓖᑦ ᑐᓴᒐᒃᓴᓂᒃ ᐱᔾᔪᑎᓕᒫᓂᒃ ᑐᒃᓯᕌᓂᒃ ᐊᐅᓚᑕᐅᒐᔭᖅᑐᓂᒃ ᐅᖃᐅᓯᐅᕋᑖᖅᑐᑦ ᐅᑯᐊ ᖁᓚᓃᑦᑐᑎᒍᑦ. ᐱᑕᖃᒃᑲᓂᖅᑑᓚᓗᐊᖅ ᐅᑯᐊ ᐊᓯᖏᓐᓃᑦᑐᓂᒃ ᑐᓴᒐᒃᓴᓂᒃ ᐊᑑᑕᐅᒍᒪᒐᔭᖅᑐᓂᒃ ᐃᒪᐅᑉ ᐃᓗᐊᒍᑦ ᓱᓪᓗᓕᒃᑯᑦ ᐊᖁᑎᓕᖕᓂᒃ ᐊᒻᒪᓗ ᑐᒃᓯᕌᖑᒻᒪᑦ ᓴᓗᒪᖅᓴᐃᒍᑎᖃᖅᑐᖅ ᐊᒃᑕᑯᖃᐅᑦ ᐅᔭᖃᒃᓴᓕᕆᔾᔪᑎᒥᓂᒃᑯᕕᒃᑕᓕᐅᑉ ᐃᓂᒃᓴᖓ ᐃᒥᖅ ᑐᕌᒃᑕᖅᓯᒪᓪᓗᓂ ᑲᕕᓯᓕᒃᑑᒧᑦ ᑕᒪᒃᑯᐊ ᐋᑭᕐᓱᖅᑕᑦ ᑐᓂᐅᓯᖓᑦ ᐅᑯᑎᒎᓇ No. 04 ᐊᓪᓚᒃᓯᒪᔪᑦ ᐃᓗᐃᒃᑲᐅᑎᓪᓗᖏᑦ (Rescan 2011−ᒥ). ᐅᖃᓕᒫᕐᓗᒋᑦ ᑲᕕᓯᓕᕐᑐᒨᖓᔪᑦ ᑐᓴᒃᓴᑦ

ᐱᑕᖃᒻᒪᑕ ᐊᑕᖏᖅᑐᓂᒃ ᑐᓴᒐᒃᓴᓂᒃ ᑐᒃᓯᕌᓂ ᐃᒪᕐᒨᖓᔪᖅ ᐊᕐᑯᑕᐅᖃᑦᑕᕋᔭᕐᒪᑦ ᓱᓪᓗᓕᒃ ᐊᒻᒪᓗ ᓴᓇᔭᐅᓯᒪᔪᖅ ᓴᓗᒻᒪᖅᓴᐃᒍᑎᓕᒃ ᐊᑐᖅᑕᐅᖃᑦᑕᕐᓗᓂ, ᑕᒪᒃᑯᐊ ᓱᕐᕋᐃᑐᐃᓐᓇᕆᐊᓖᑦ ᐊᕙᑕᓃᑦᑐᓂᒃ, ᐸᓚᖅᑎᑦᓯᒍᑎᒃᓴᑦ ᐊᑑᑕᐅᒐᔭᕐᒪᑕ, ᑐᒃᓯᕌᖑᒻᒪᑕᑦᑕᐅᖅ ᖃᐅᔨᓴᖃᑦᑕᕈᑎᒃᓴᑦ ᖃᓄᖅ ᓱᕐᕌᔪᖃᒻᒪᖔᖅ ᐱᓕᕆᔾᔪᑎᒃᓴᑦ.

ᐅᑯᓇᓃᑦᑐᑦ ᐱᑕᓖᑦ ᑐᓴᒐᒃᓴᓂᒃ ᓇᓗᓇᐃᔭᑦᓯᐊᖅᓯᒪᔭᓂᒃ ᐅᓂᒃᑳᖅᑕᓖᑦ ᐃᓚᒋᓕᐅᑎᓯᒪᔪᓂᒃ ᑐᓴᒐᒃᓴᓃᑦᑐᑦ ᖃᓄᖅ ᐊᑑᑕᐅᒋᐊᓖᑦ ᒪᓕᒃᑕᐅᕐᑯᔭᖏᑦ ᐋᕿᒃᓯᒪᓪᓗᓂᒋᑦ ᓄᓇᕗᑦᒥ ᐃᒪᓕᕆᔩᑦ ᑲᑎᔨᖏᑦᑕ ᑖᒃᑯᐊ ᐊᑑᑕᐅᔪᓐᓇᖅᑐᑦ ᐅᑯᓄᖓᖓᔪᓄᑦ ᐋᕿᒋᐊᖅᑕᐅᒐᔭᖅᑐᓂᒃ ᑐᒃᓯᖅᑑᑎᑦ ᑕᑕᑎᒐᖅᑎᒍᑦ, ᐊᒻᒪᓗ ᓇᓗᓇᐃᔭᖅᓯᒪᔭᐅᒻᒪᑕ ᒪᓕᒃᑕᐅᒋᐊᓖᑦ ᑐᑭᓕᐅᖅᓯᒪᔭᐅᔭᕇᖅᑐᑦ ᐅᑯᐊ ᐃᓗᐊᓃᒻᒥᔪᑦ ᐋᕿᒋᐊᕈᑎᒃᓴᓅᖓᔪᑦ ᑐᒃᓯᖅᑑᑎᑎᒍᑦ.

1. Unniqtuta

Una tuihaqhit piniqhimayuq piqaq titninut tuhagakhat piyalgit ikayuqhiqninut tapkuat Ihuaqhigiagutit Katihimayut Nappaa 04 taphumunga Doris North Qanugitunia A Imaqmut Laisa 2AM-DOH0713.

Tapkuat huliniit/havagutit pinahuaqtai ukuat tuhaqhit tahapkuanguyut:

- Ilagiaqnia anaqnut halumaqhaivik talvani Doris Hiniktaqvik (talvanga 180 talvunga 360 inuqalaqtunut);
- Ihuaqhihimani pilaqnit natiqnami halumaqhainiq anaqnik kuvigaqvia halumaqtigutaunia atugiaqaqniqat kinguagut atuqqaqtitlugu kuvigainiq talvunga Tail Tahiq uyagaktaqnikunik havakvik;
- Nutnia imigaulaq imaq talvanga Doris Tahiq talvunga Windy Tahiq piplugu Doris Tahiq tungaqnia nauhimanit imaqmi amigailiqni;
- Iliuqaqni imiqtaqvik talvanga Roberts Bay-mi iqittuqhiutinut havagutit;
- Ilavaliqni iqakut uyaqat havikhatlu tutqumavi tungavit;
- Ilavaliqni iliuqaivik talvani Roberts Bay-mi;
- Atuinaqtukhaq hiniktaumavik umiaqpaup kaluta hikkutihimania talvunga Roberts Bay-mun;
- Huniqtailinia hikkutyauhimani uqhukhalgiagutit umiaqpait talvani Roberts Bay-mi naamaknitigut Aulatyutiligiyit Kanatami maligait;
- Ahianguqnia uyagaktaqni aktilangi talvanga 720 tons/upluq talvunga 1,000 tons/upluq tamnalu havikhaliuguhi Aktilanga talvanga 800 tons/upluq talvunga ukiumut mikhauttaqni 800 tons/upluq;
- naunaiyaqnia Doris Qitqani tamnalu Atatyuta piqaqnit atuqhugu tamna Doris North Nunamuktaqvia, naunaigutauyuq taphuminga 2-4 ukiunut uigunia uyagakhiuqvik atuqnikha; tamnalu
- Nuktiqni tagiunginaq maniqap imaqta nunap iluanilu imaq apquhaqtauyuq ilagiplugu naunaiyaqni ilagiaqnit piqaqni atuqhugu tamna Doris North Nunamuktaqvia talvunga Uyagaktaqnikut Hiamaktailivia (TIA-nga), nuktiqnilu amiakut TIA-nga imaqta talvunga Roberts Bay atuqhugu tagiup iluagut huplu akutyutauvikhaq atungitpaluqlugu tatya-piyungnaqtitauhimayuq inigiya tamna Doris Kuugauyaq.

Tamna tuhaqhit piqaqtita tuhagakhat tamaitnut uuktugutauyut huliniit titigaqhimayut qulaani. Kihimik, unniqtuttiaqhimayut tuhagakhaliat tapkununga uuktugutauyut tagiup iluanut huplu havagut tamnalu uuktugutauyuq kuvigaqnikha halumaqtiqhimayuq TIA-nga imaq talvunga Roberts Bay-mut hanaiyaqhimayuq taphumunga tuniyakhaq Nappaa 04 katihimayut (Rescan 2011). Takulugu tamna Roberts Bay Tuhagakhaliaq unniqtutiaqninut tapkuat uuktugutauyuq tagiup iluanut huplu akutyutaunikhalu havagutit, atulaqnitlu avatiliginiqmut aktuanit, ihuaqhigiagutikhat, uuktugutauyutlu munagiyauni havagutit.

Tahapkuat ilagiyai hatqigutai tuhagakhat naunaiqtauyut tapkunani Ilagiagutit Tuhagakhat Naunaipkutit hannaiyaqtai tapkuat Nunavut Imaligiyit Katimayit (NWB-kut) atulaqnikhai ukununga ihuaqhigiagutinut tukhigaut, tapkuatlu naunaiqtauni tapkunani Malikhaqnit Titiqat ilaliutihimayut uumunga ihuaqhigiagutmut tukhigaut.

2. Environmental Setting and Baseline

Rescan™
Engineers and Scientists

2. Environmental Setting and Baseline

NWB Information Request: Provide a brief overview of the environmental setting in the area where the proposed infrastructure/activities will occur.

A description of the environmental setting for the area was included in the Doris North Final EIS (Miramar 2005). The areas included in this amendment were covered in the Doris North Final EIS or the existing Type B Water Licence for water withdrawal from Windy Lake (2BE-HOP0712).

Chapter 4 of the Doris North EIS includes a description of the environmental setting for topography, geologic conditions, hydrologic characteristics, climate conditions, seismicity, and permafrost conditions. A description of the regional and local surface water regime and drainage areas relevant to this amendment were also included in the Miramar Doris North EIS.

The following sections provide requested information outlined in the NWB's Supplemental Information Guidelines. Information presented is either from the Doris North EIS or more recent information gathered as part of on-going compliance and/or baseline monitoring programs for the Doris North Project.

2.1 DESCRIPTION OF REGIONAL SETTING

NWB Information Request: Provide a description of the regional setting using maps and/or aerial photos with scales that allow the determination of distances between the objects depicted.

The Doris North Property is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the south shore of Melville Sound (Figure 2.1-1). The nearest communities are Omingmaktok (~75 km to the southwest of the property), Cambridge Bay, and Bathurst Inlet (~160 km to the southwest of the property).

The property consists of a greenstone belt running in a north/south direction, approximately 80 km long, with three main deposit areas. The Doris North deposit is located in the northern portion of the belt.

The northern portion of the belt (where the Doris North deposit is) consists of several watershed systems that drain into Roberts Bay, and a large river (Koignuk River) that drains into Hope Bay. Watersheds in the southern portion of the belt ultimately drain into the upper Koignuk, which drains into Hope Bay. The entire area lies within the Bathurst Inlet-Burnside Watershed.

Climate in the region can be described as a sub-Arctic desert with limited rainfall. Prevailing winds are from the northwest. Most precipitation falls as rain during the summer, and an average of 10 cm of snow per month falls during the winter (WKRLUP, 2005).

The property is located within the Queen Maud Gulf Lowlands, which covers the east central portion of the West Kitikmeot region. This area is made up of undulating plains near the coast, to massive Archean rocks rising to 300 metres above sea level in the south (WKRLUP, 2005). The coastal areas are mantled by postglacial silts and clays, and exposed bedrock, Cryosol soils, and marine deposits are common. Permafrost is continuous and deep with low ice content (WKRLUP, 2005).

The area lies within the Slave Geological Province, which is underlain by granite and related gneisses, as well as by sedimentary and volcanic rocks (more than 2.5 billion years old) (WKRLUP, 2005).

PROJECT # 1009-002-54 GIS # HB-01-026 September 7 2010

Figure 2.1-1

NEWMONT NORTH AMERICA

Doris North Project Location Map

Figure 2.1-1

Rescan™ Engineers & Scientists

The nearest Environment Canada climate station with a 30 year climate normal is Kugluktuk. The mean annual temperature is approximately -10.6˚C with a summer mean of 6.9˚C (June to September) and a winter mean of -19.4˚C (October to May). The mean annual precipitation range is 200–300 mm (Environment Canada website).

The region is characterized by long dark winters and short summers. The ground is covered in snow from October to June most years. Lakes are ice-covered from approximately October to June most years, with ice thickness reaching depths of 2.0 metres.

2.2 DESCRIPTION OF LOCAL SETTING

NWB Information Request: Provide a description of the local setting using maps and/or aerial photos with scales that allow the determination of distances between the objects depicted.

Chapter 4 of the Doris North Final EIS includes a description of the local setting of the areas relevant to this amendment. Further specific details are provided below.

Figure 2.2-1 shows the watershed boundaries in the Doris North Project area. All proposed activities in the amendment package are contained within the northern tip of the Doris Watershed, the area on land just north of the Doris Watershed and Roberts Bay, or the Windy Watershed. The Doris Watershed drains northward into Little Roberts Lake, which drains into Roberts Bay. The Windy Watershed drains northward through Glenn Outflow and into Roberts Bay. The land between these two watersheds where the existing road and Roberts Bay laydown area is has no defined streams but would ultimately drain into Roberts Bay.

Following are descriptions of the areas where the proposed amendment activities would occur.

2.2.1 Expansion of Sewage Treatment Plant and Backup Treated Effluent Discharge Area

The expansion of the Sewage Treatment Plant (STP) will involve increasing flow through the two existing 180 person capacity plants operating at Doris to reach a 360 person capacity. The arrangement to install the second STP as a backup was authorized by the NWB in 2010. Additional backup STP capacity may be added to allow the main systems to come down for maintenance.

The temporary discharge location for the expanded sewage treatment plant that will now become the emergency discharge will remain the same as the current location. By separate notification the diffusers on this line will be upgraded in 2011 to better disperse effluent. Treated sewage effluent is currently discharged on to the tundra, approximately 1.4 km away from Doris Lake, and approximately 1.5 km away from Glenn Lake. The discharge is located within the Windy Watershed, on high dry ground. Treated sewage effluent will continue to be discharged in this area, but may be discharged in to the tailings impoundment once that facility is constructed. HBML is requesting that they maintain the option of tundra discharge. Plate 2.2-1 shows the general area ~1.5 km upstream of Glenn Lake where the discharge pipe is located. The discharge pipe is moved periodically to avoid significant ponding that could damage the permafrost. As per Part G of the Type A Water Licence, the primary discharge will move as soon as the tailing discharge lines are run to the TIA. A decision on when to install the mill has not yet been made by Newmont.

There are no fish-bearing streams or suitable fish habitat in the current and proposed backup discharge area.

Plate 2.2-1. Area ~1.5 km upstream of Glenn Lake where treated sewage effluent is currently discharged, and is proposed to remain as the backup discharge location.

2.2.2 Moving Potable Water Use from Doris Lake to Windy Lake

Windy Lake is a large lake located ~4 km south southeast of Doris Camp. The lake has a surface area of 528.8 ha, has a total volume of 59,137,485 m^3, and has a maximum depth of 22 m (Figure 2.2-2). Figure 2.2-2 provides a map of Windy Lake, along with its bathymetric contours.

Windy Lake is part of the Windy Watershed, which consists of 2 main lakes; Windy Lake and Glenn Lake. Windy Lake drains northward into Glenn Lake, which drains northward into Roberts Bay (Figure 2.2-1). The watershed has a surface area of 48 km^2.

Windy Lake is ultraoligotrophic to oligotrophic, with clear waters, high dissolved oxygen concentrations, low nutrient and low metal concentrations. Concentrations of water quality parameters in Windy Lake are below the Health Canada Guidelines for Canadian Drinking Water (May 2008).

The fish community of Windy Lake consists of lake trout, lake whitefish, cisco, and ninespine stickleback. The littoral habitat of the lake consists of bedrock substrate along the western shoreline, and gravel/cobble substrates mixed with boulders and fine sediments along the eastern shoreline.

The location of the drinking water intake (which is not currently in use) can be seen in Plate 2.2-2. Windy Camp is currently in the process of being moved to the east of the historical camp location.

2.2.3 Expansion of Waste Rock and Ore Storage Pad

The proposed waste rock storage pad expansion lies directly east of Doris Camp, near the shore of Doris Lake. There is no surface water and no potential fish habitat in this area. The proposed pad has been designed with a 30 m setback from Doris Lake to avoid disturbance of fish habitat.

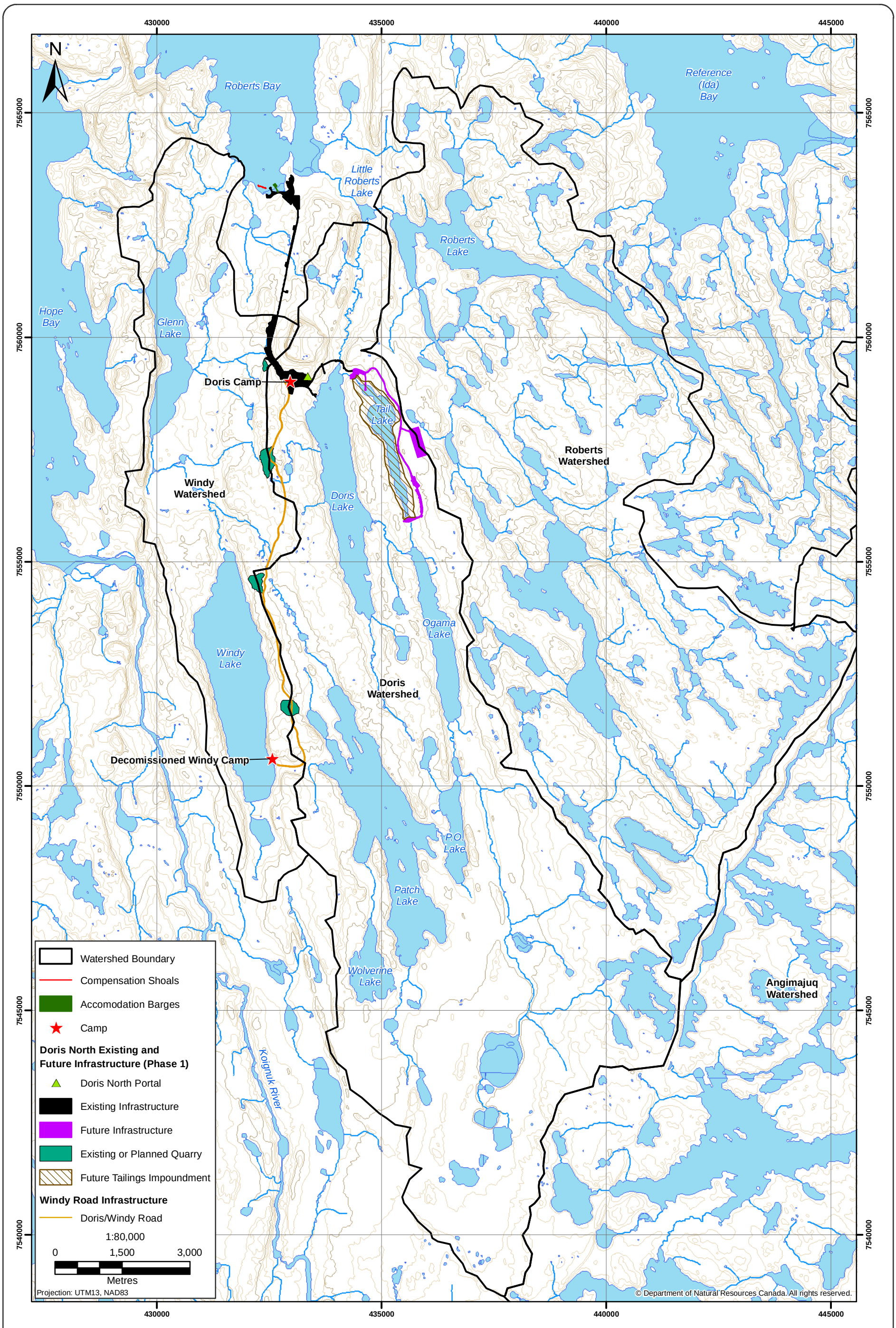

Figure 2.2-1

NEWMONT NORTH AMERICA

Doris North Project Drainage Basins

Figure 2.2-1

Rescan™ Engineers & Scientists

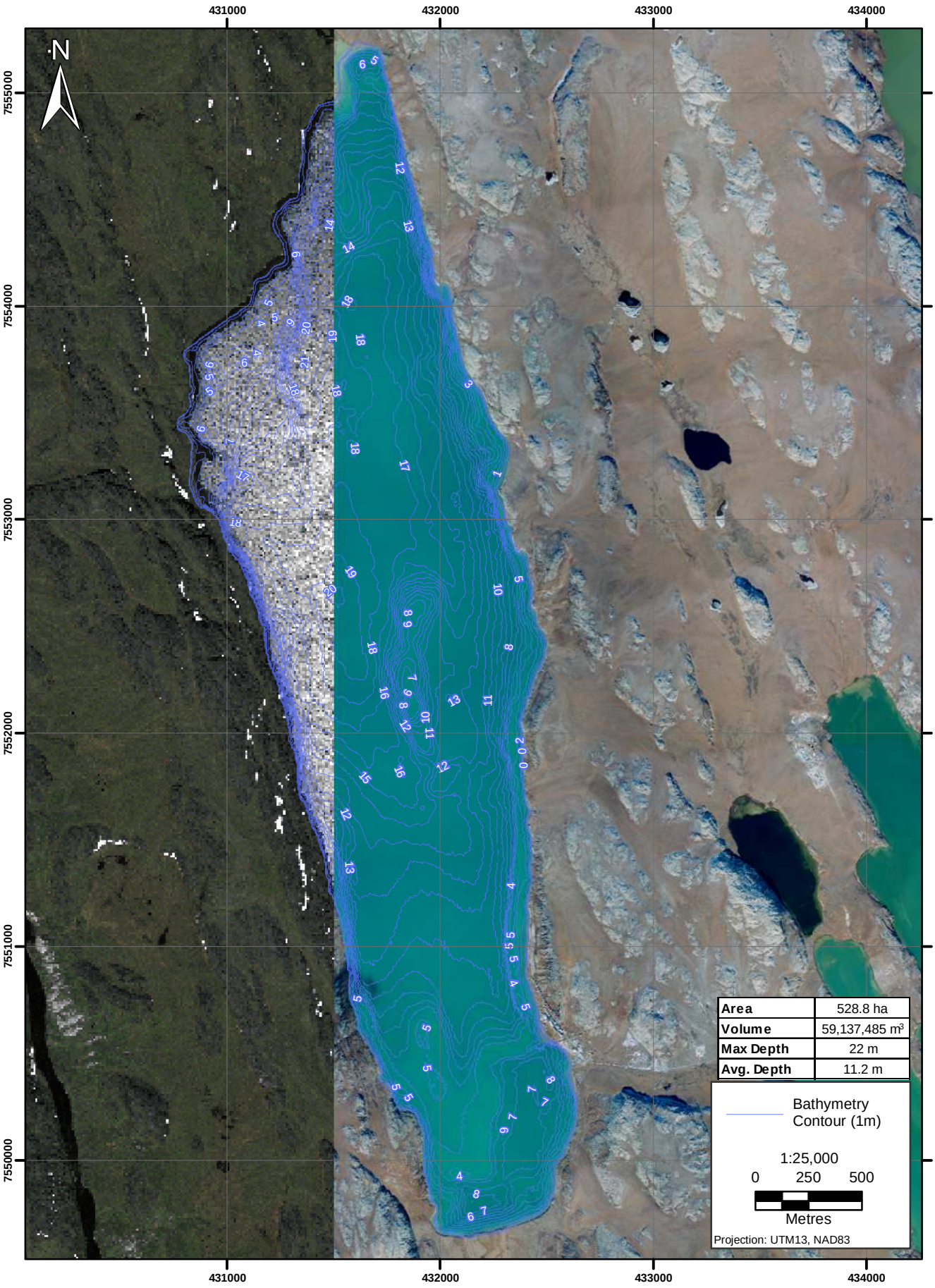

Figure 2.2-2

Windy Lake Bathymetry

NEWMONT NORTH AMERICA

Rescan™ Engineers & Scientists

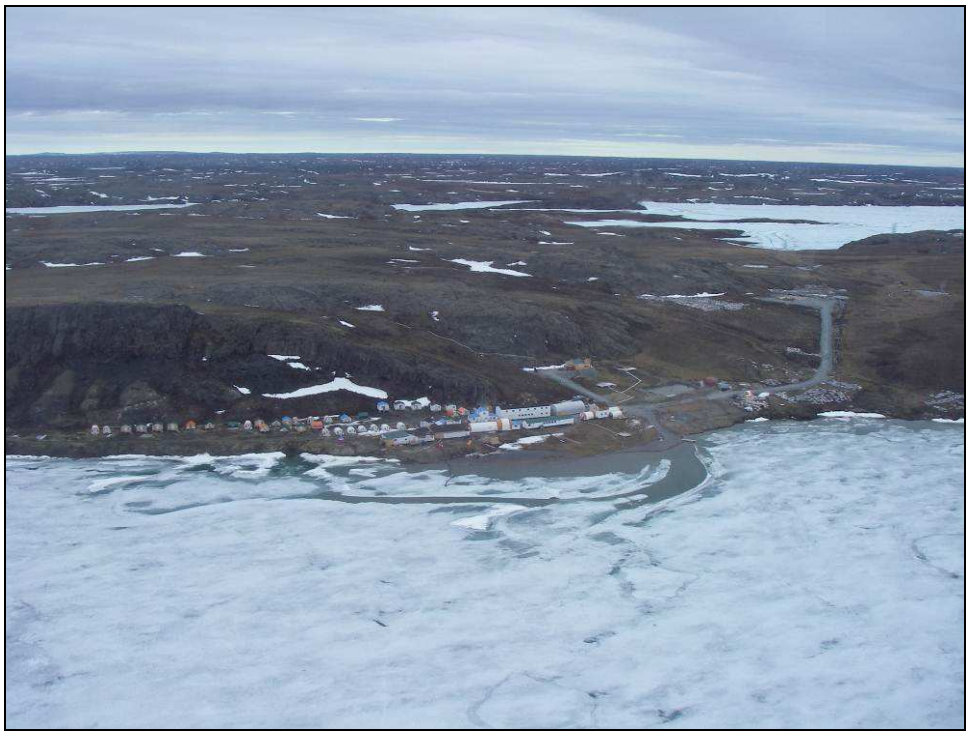

Plate 2.2-2. The location of the Windy Lake drinking water intake can be seen in front of the dark-roofed buildings in the centre of old Windy Camp (photo taken in June 2009).

The proposed ore storage pad lies directly north of Doris Camp. There was no surface water in this area and therefore no fish or fish habitat present.

The proposed waste rock and ore storage pad extensions will be placed in an area of *Eriophorum* Tussock Meadow. The *Eriophorum* Tussock Meadow ecosystem is the most common ecosystem in the study area, and is not preferentially used by wildlife because the sedges offer poor nutrition compared to other vegetation types.

2.2.4 Expansion of Roberts Bay Laydown Area

The general area is characterized by shallow valleys or pans interspersed with low hills, linear rocky outcrops (dykes) and mesas. The existing infrastructure and proposed expansion area for Roberts Bay are all contained within a shallow depression, bounded by Roberts Bay to the north and rocky outcrops to the south and east. Vegetation mapping in the area has been conducted in 1998 and 2010. Results indicate that the Roberts Bay area is characterized as predominantly Dryas Herb Mat on upland areas, Wet Meadow in lowlands, rock outcrops and beach landcover types. These landcover types are the most common coastal ecosystem types in the Local Study area.

Field studies were conducted between 1998 and 2010 to examine raptor populations. The closest raptor nests are in a cluster of three nests approximately 2 km to the east of Roberts Bay, with another group of nests approximately 3.5 km to the east of the bay. Grizzly bears are known to use the shoreline for travel along the coast and have been sighted at Roberts Bay regularly. DNA studies on grizzly bears were conducted in 2010 and are ongoing to examine the movement patterns of these bears.

The proposed expansion to the Roberts Bay laydown area involves two sections, one to the east, near the airstrip and another, smaller area to the west near the jetty. There are no water bodies or fish habitat in the western section. There is a single stream in the eastern Roberts Bay laydown area, flowing from the high ground near the airstrip north into Roberts Bay. Fish were found in the lower reaches of this stream, about 700 m from the proposed expansion area. However, the stream flows subsurface to the north of the laydown expansion area (Plate 2.2-3) and fish do not appear to access the upper reaches near the proposed expansion area.

Plate 2.2-3. View of the stream running north from the proposed laydown expansion area to Roberts Bay. At this point, about 250 m north of the proposed laydown area, the stream begins subsurface flow. No fish were found in this section of the stream.

2.2.5 Roberts Bay: Water Intake, Accommodation Barges and Winter Fuel Vessels

It is proposed to install a water intake at the jetty in order to provide seawater for fire suppression purposes in case of fire at the Doris North Project. Water would only be required when there is a fire or for regular maintenance flushing of the intake and fire water supply system.

HBML wishes to maintain the option to continue to use the accommodation barges that are currently on site in Roberts Bay. These barges have been critical for housing personnel, and HBML would like to maintain the option of keeping them on site for the duration of the Doris North Project.

This past winter, HBML brought fuel to site, but it had to remain in an Arctic class double-hulled fuel vessel frozen into the ice in Roberts Bay, as there was not available fuel storage on site. HBML would like to maintain the option of bringing in additional fuel in this manner in the future to allow flexibility while additional on-land fuel storage is being constructed.

Roberts Bay is located along the southern shore of Melville sound, positioned between Hope Bay, to the west, and Ida Bay (Reference Bay), to the east (Figure 2.2-3). The mouth of Roberts Bay faces north, with a width of approximately 1.8 km and the bay extending 6 km southward. Two main freshwater inputs enter Roberts Bay; Little Roberts Outflow, which enters from the southeast and drains the Doris and Roberts watersheds, and Glenn Outflow, which enters from the southwest and drains the smaller Windy Watershed.

Roberts Bay is frozen for most of the year, with melt typically beginning in June, continuing into July, and re-freezing beginning in late October. In both summer and winter a pycnocline separates the lower salinity water at the surface (20–26 ppt) from the higher salinity water at depth (27 ppt). Water temperatures range from as low as -1.4°C during winter to >10°C at the surface in the summer. Roberts Bay water in is generally well oxygenated, remaining above the marine CCME guideline of 8 mg/L (Rescan 2011).

Roberts Bay is inhabited by at least 18 species of fish, including 15 marine species, two anadromous species (Arctic char (*Salvelinus alpinus*) and lake trout (*Salvelinus namaycush*)), and the amphidromous ninespine stickleback (*Pungitius pungitius*) (Rescan 2011). None of the 18 species are currently endangered or threatened (COSEWIC 2010).

The accommodations barges are located directly east of the Jetty, approximately 70 m offshore, moored in 2 to 5 m of water. The accommodations barges are accessed by a floating walkway which connects them to the Roberts Bay laydown area.

The fuel vessel anchorage is currently at approximately 30 m of water, 2.3 km north of the Roberts Bay Jetty and approximately 500 m offshore. This anchorage would be moved in order to accommodate the proposed subsea pipeline and diffuser system in the bay (see Rescan 2011).

2.3 BASELINE INFORMATION

NWB Information Request: Indicate whether any baseline information has or will be collected as part of this amendment.

Numerous baseline studies have been conducted in the area of the Doris North Project since the mid 1990s. Many studies were conducted before the preparation and submission of the Doris North EIS. The Final Doris North EIS included numerous baseline reports (as supporting documents).

Additional baseline studies have been conducted since the Doris North Final EIS was submitted. The following baseline reports and compliance reports include the Doris North Project area including the geographical area of the proposed amendment activities:

- Air Quality Compliance Report for Section 4 Item 30 of the Project Certificate, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2009.
- Air Quality Compliance Report Q1 and Q2, 2010, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2010.
- Air Quality Compliance Report Q3 and Q4, 2010, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.
- 2010 Noise Compliance Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2011.

PROJECT #1009-002-09 GIS # HB-15-044 March 07 2011

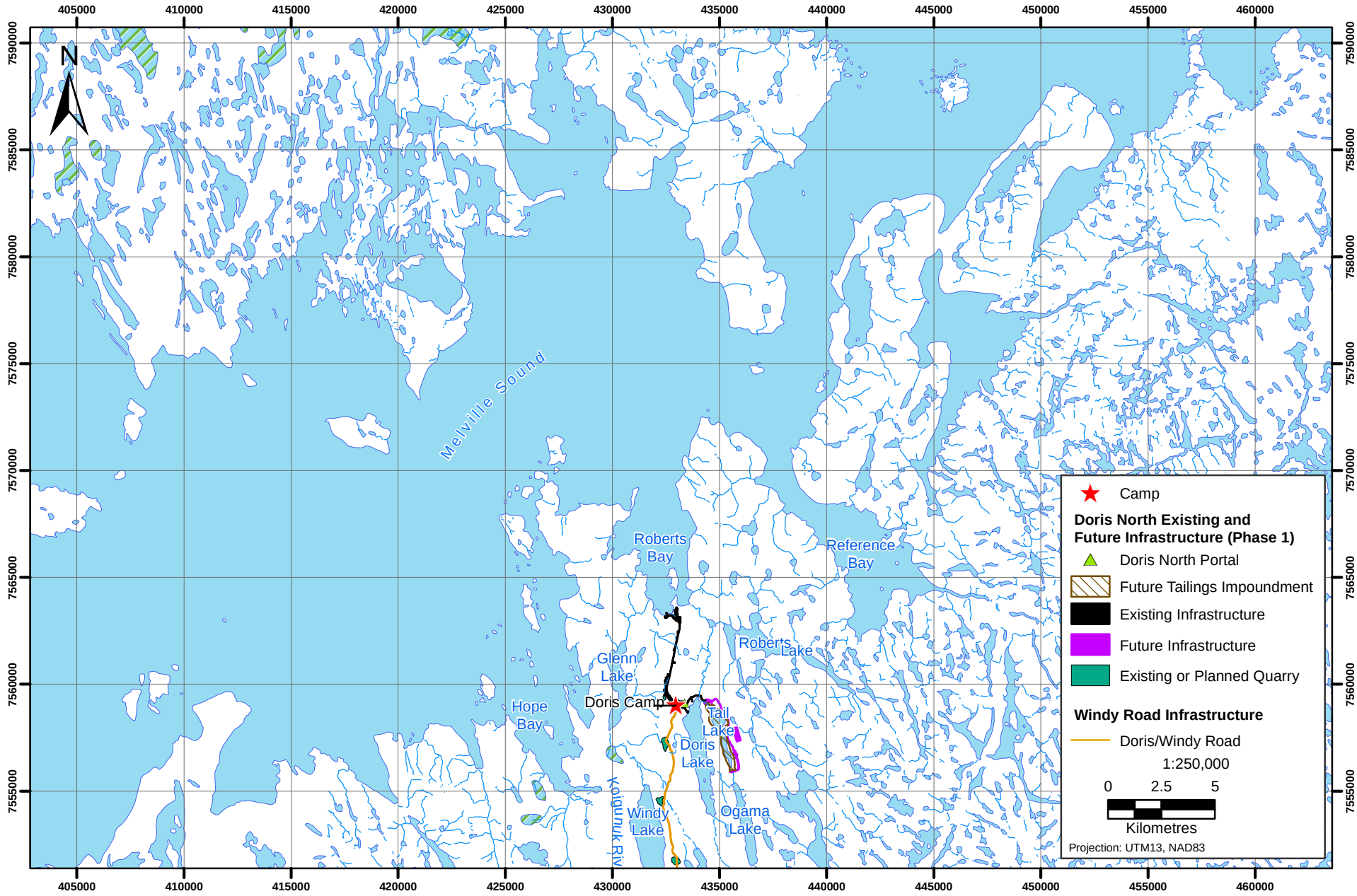

Figure 2.2-3

NEWMONT The Gold Company

General Location of Roberts Bay

Figure 2.2-3

Rescan Engineers & Scientists

- 2009 Meteorology Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2009.
- 2010 Meteorology Compliance Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2010.
- 2009 Hydrology Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2009.
- 2010 Hydrology Compliance Report, Doris North Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2010.
- 2010 Hydrology Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. February 2011.
- 2009 Freshwater Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. February 2010.
- Aquatic Effects Monitoring Plan, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. February 2010.
- 2010 Aquatic Effects Monitoring Program Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. June 2011.
- 2009 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. May 2010.
- Doris Mine Site Fisheries Authorization Monitoring Report 2010, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. January 2011.
- 2009 Marine Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2010.
- 2010 Marine Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. May 2011.
- 2009 Marine Fish and Fish Habitat Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2010.
- 2010 Marine Fish and Fish Habitat Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.
- 2009 Roberts Bay Jetty Fisheries Authorization Monitoring Report. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2009.
- 2010 Roberts Bay Jetty Fisheries Authorization Monitoring Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2010.
- Wildlife Mitigation and Monitoring Program, Doris North Gold Mine Project 2009. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. January 2010.
- Wildlife Mitigation and Monitoring Program, Doris North Gold Mine Project 2010. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. January 2011.
- Wildlife Mitigation and Monitoring Plan, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.
- 2010 Ecosystems and Vegetation Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.

- 2010 Terrain and Soils Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2011.
- 2007 Noise Measurement Report, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. October 2008.
- 2008 Noise Measurement Report, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. July 2009.
- Wildlife Mitigation and Monitoring Program - 2007, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. August 2008.
- Wildlife Mitigation and Monitoring Program - 2008, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. March 2009.
- 2006-2007 Aquatic Studies, Boston and Madrid Project Areas. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. December 2008.
- Aquatic Studies 2007, Doris North Project. Prepared for Miramar Hope Bay Limited by Golder Associates Ltd. April 2008.
- Aquatic Studies 2008, Hope Bay Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. March 2009.
- Preliminary Regional Ecological Land Classification, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. January 2009.
- 2008 Hydrology Baseline Update, Doris Project Area. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. March 2009.
- 2008 Roberts Bay Fisheries Authorization Monitoring Report, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. December 2008.

In order to ensure that no fish habitat was affected by the proposed amendments, site visits were made to all proposed amendment activity areas. Information from these site visits is included in this report in the fish habitat section.

2.4 CONSULTATION AND BASELINE

Public consultation was conducted as part of the Doris North EIS regulatory process. A summary of the consultation conducted as part of the Doris North Project can be found in Chapter 1, Section 1.6 of the Doris North Final EIS (Miramar 2005). Results of consultation were used throughout the environmental assessment and regulatory phase of the Doris North Project. Hope Bay Mining Limited (HBML) has been conducting on-going consultation activities since acquiring the leases for the Doris North Project. These activities have been summarized in the Annual Reports to the Nunavut Impact Review Board.

HBML has undertaken a range of consultation and communication activities with local communities, regulators and resource managers between 2008 and 2011 as part of the Doris North Project, including the potential amendments to the Type A Water Licence.

In order to specifically address the proposed No. 04 Type A Water Licence amendment activities, a round of community meetings were held in June 2011. The results of the June 2011 consultation are summarized below.

HBML visited five communities in early June 2011: Cambridge Bay, Gjoa Haven, Kugaaruk, Kugluktuk, and Taloyoak. Information pertaining to the No. 04 Type A Water Licence amendment application was presented. Table 2.4-1 summarizes the communities that were visited and the estimated number of attendees.

Table 2.4-1. Public Meeting Dates and Attendance, June 2011

Date	Community	Attendance*
Monday, June 6, 2011	Kugluktuk	5
Tuesday, June 7, 2011	Cambridge Bay	13
Wednesday, June 8, 2011	Kugaaruk	15
Thursday, June 9, 2011	Taloyoak	19
Friday, June 10, 2011	Gjoa Haven	Postponed due to weather

**Attendance numbers estimated from draw prize entries and visual observations.*

Comments and feedback pertaining to the information presented were documented and where practicable responses were provided by HBML staff that were in attendance. The overall attendance totalled 52 individuals, with the largest attendance being in Taloyoak. Meeting attendance was lower than anticipated in Kuglukuk as many residents were away fishing. Elders were present at the meetings in Kugaaruk and Taloyoak. HBML staff were unable to present information to the Gjoa Haven community as originally planned due to poor weather conditions. It is anticipated that the Gjoa Haven meeting will be rescheduled and information presented to residents for their feedback at a time convenient to the community.

Comments, questions, and responses pertaining specifically to the proposed No. 04 Type A Water License amendment activities were discussed in Cambridge Bay, Kugaaruk, and Taloyoak and have been summarized here.

- Cambridge Bay:
  - A question was asked regarding the limited bed capacity at camp, being approximately 180 beds plus those on the floating barge, and if camp expansion was tied to the No. 4 Type A Water license amendment. This was confirmed by HBML staff. Over 300 beds will be needed to proceed with on-going construction and environmental studies in the coming year or two, and moving forward with the camp expansion will help to ease capacity issues.
- Kugaaruk:
  - Concerns were raised by an Elder about the salt and water being diverted from Tail Lake into Roberts Bay and whether the water would impact fish or fish habitat. An explanation was given that water would pass through a treatment/filtration system which would remove particulates (such as zinc and copper) from the water before being diffused into the ocean of Roberts Bay.
- Taloyoak:
  - A meeting attendee wanted to know if the tailings and water in Tail Lake were dangerous. An explanation was made by HBML staff explaining that tailings are not dangerous but that they do contain metals and sediment. It is also likely that the water will have some salt content which is expected to be close to that of sea water.
  - A meeting attendee wanted to know if a fence would be erected around Tail Lake to keep wildlife out. No fence is currently planned; however, the lake will be ringed by a road so the pond can be patrolled.
  - An Elder wanted to know if the Water Board did routine inspections. It was explained that the Water Board does not have inspectors but inspections are conducted by Aboriginal Affairs and Northern Development Canada (previously INAC), Environment Canada, DFO and the KIA. However, the Water Board presents all inspection results in their annual reports

and all water monitoring and testing records are filed with NIRB and are available through their website or at their regional offices.

- An Elder asked if fish in the area were regularly inspected and tested. Fisheries work is conducted each year as well as sampling and testing of small aquatic organisms.

Other general comments and questions discussed at the meetings pertained to employment opportunities, training, mine production timelines, Inuit benefits, environmental testing, and potential effects on human health and social issues. This feedback will be incorporated into future discussions and considered during on-going project planning.

Previous consultation efforts were carried out in August 2010 when HBML conducted a community tour, in which the proposed amendments included in the Type A Water License Amendment Package No. 2 were presented and discussed with meeting attendees. Environmental baseline studies conducted in the Doris North area were also presented and discussed. Communities visited during the August 2010 meetings included Cambridge Bay, Gjoa Haven, Kugaaruk, Kugluktuk, and Taloyoak, with the overall attendance totalling approximately 121 attendees and the largest attendance being in Gjoa Haven. Community Elders were in attendance at Gjoa Haven, Taloyaok, and Kugaaruk. A detailed summary of the topics discussed during the 2010 meetings can be found in the Amendment Package No. 2 application.

In addition to community tours, a community newsletter, the *Hope Bay Belt Quarterly Newsletter,* was published and distributed in October 2010. The newsletter presented information pertaining to the 2010 sealift, summer field work, and employment information. It is hoped that this quarterly publication will reach a larger audience, including those who may not be able to attend the community meetings or site visits.

2.5 HISTORICAL USES OF WATER

NWB Information Request: Provide a description of the historical uses of the waters affected by the amendment.

Historical uses of water in the Doris North area were addressed in the Doris North EIS (Doris North EIS Supporting Documents, Section E1). All of the waters potentially influenced by the proposed amendments were included in the Doris North Project Final EIS.

The following text is a summary of what information was included in the Doris North Final EIS.

The *Inuit Qaujimajatuqangit* (Inuit Traditional Knowledge) workshop held in September 2003 revealed that the Hope Bay Belt area has historically been a popular fishing area. Inuit Elders and other knowledge holders from the communities of Cambridge Bay, Kugluktuk, Gjoa Haven, and Taloyoak commented that Doris Lake and surrounding lakes were commonly fished for Arctic char, lake trout, and lake whitefish.

Lakes in the Project area were historically used as a source of drinking water. Participants in the *Inuit Qaujimajatuqangit* workshop explained that drinking water sources were typically selected based on indicators such as water clarity, depth, substrate type, and taste and smell.

Archaeological studies of the Project area also found evidence of stone circles, hunting blinds, caches, and other structures throughout the Hope Bay Belt, including near the shores of Doris and Windy lakes (Doris North EIS Supporting Documents, Sections E4 and E5). These findings support the results of the *Inuit Qaujimajatuqangit* workshop and highlight the historical importance of the Project area.

3. Potential Environmental Effects and Cumulative Effects

Rescan™
Engineers and Scientists

3. Potential Environmental Effects and Cumulative Effects

3.1 PREDICTED ENVIRONMENTAL IMPACTS

NWB Information Request: Does the proposed amendment change the predicted environmental impacts of the undertaking and the proposed mitigation measures?

The proposed amendment activities that result in expanded footprint areas do not change the predicted environmental impacts as originally assessed in the Doris North Project Final EIS (Miramar 2005). The Doris North Project has numerous required mitigation measures in place in the form of management plans and monitoring programs. The existing Doris North management and monitoring programs include the geographical area and activities associated with the proposed amendments in this package.

The three activities that require additional information are water withdrawal from Windy Lake, water withdrawal from Roberts Bay, and the extension of mine life. These activities are addressed further below.

3.1.1 Moving Potable Water Use From Doris Lake to Windy Lake

The request to move the potable water use from Doris Lake to Windy Lake, which will include the water required for the total number of people in camp (increase from 180 to 360 person capacity) will act cumulatively with an existing Type B Water Licence (2BE-HOP0712) that allows water to be withdrawn from Windy Lake for the Windy Camp and regional exploration.

The current Doris North Type B Water Licence 2BE-HOP0712 allows for the withdrawal of a maximum of 76,595 m^3/year (average of 210 m^3/day) from Windy Lake (this includes the volume included in a recent amendment request for that licence to include water for dust suppression).

The request to move the existing potable water use from Doris Lake to Windy Lake for the current 180 person camp would result in additional water use of 35 m^3/day or 12,775 m^3/year.

The doubling of Doris Camp capacity from 180 to 360 people, will result in an additional water use of 35 m^3/day or 12,775 m^3/year.

Table 3.1-1 presents the total maximum volume that is requested to be withdrawn from Windy Lake including the No. 04 Type A Water Licence amendment and the Type B Water Licence amendment. The total potential maximum water withdrawal including this amendment request would be 102,145 m^3/year.

Table 3.1-2 presents the estimated changes in lake water level, lake volume, and lake surface area for Windy Lake that would result from the proposed water withdrawal volumes.

Cumulatively, the proposed withdrawal of an additional 70 m^3/day from Windy Lake would result in an overall potential 0.17% decrease in total lake volume (Type B and Type A maximum water volumes combined). This represents an estimated decline in the mean annual water level of 1.9 cm, and a 0.028% decrease in lake surface area (Table 3.1-2).

Table 3.1-1. Water Withdrawal Volumes for Windy Lake

Licence and Use	Daily Water Volume	Total Water Volume
Type B Water Licence 2BE-HOP0712		
• Domestic Use:	63 m^3/day x 365 days	22,995 m^3/year
• Drilling Use:	80 m^3/day x 365 days	29,200 m^3/year
• Dust Suppression Use:	200 m^3/day x 122 days	24,400 m^3/year
Total Type B:		**76,595 m^3/year**
Type A Water Licence 2AM-DOH0713		
Amendment Request No. 04		
• Domestic Use-Move current use from Doris to Windy Lake (current camp capacity of 180 people):	35 m^3/day x 365 days	12,775 m^3/year
• Domestic Use-Double the domestic use from Windy to accommodate doubling of Doris Camp (doubling in camp size; use for another 180 people):	35 m^3/day x 365 days	12,775 m^3/year
Total Withdrawal from Windy Lake:		**102,145 m^3/year**

Table 3.1-2. Estimated Changes to Windy Lake Water Level, Volume, and Surface Area

	Total Water Use (m^3/year)	Change in Windy Lake Water Level* (cm)	Change in Windy Lake Volume* (%)	Change in Windy Lake Surface Area* (%)
Type B Licence Maximum Water Withdrawal:	76,595	1.4	0.13	0.021
Proposed Type A Licence Amendment No. 04 Moving Current Potable Water Use to Windy Lake (for 180 person camp) Maximum Water Withdrawal:	12,775	0.24	0.022	0.0035
Proposed Type A Licence Amendment No. 04 Doubling Doris Camp Potable Water Use (for an additional 180 people at Doris Camp) Maximum Water Withdrawal:	12,775	0.24	0.022	0.0035
Total Water Withdrawal from Windy Lake:	102,145	1.9	0.17	0.028

** Estimates of changes in water level, lake volume, and lake surface area are based on data derived from the bathymetric profile of Windy Lake (see Appendix A).*

Historical data available for 2006, 2007, and 2009 indicate that the water level in Windy Lake fluctuates by approximately 20 to 30 cm during the ice-free season. In comparison, the estimated 1.9 cm decline in water level is expected to have no significant impact on lake water levels and hence fish habitat because it lies within the normal range of seasonal water level variation in Windy Lake. Lake water levels vary naturally on an hourly, daily, seasonal, and annual basis as a result of variation in precipitation, snowmelt runoff, evaporation, as well as ice formation and break-up. Moreover, normal wind-induced wave action can cause local variation in the height of the wetted shoreline that exceeds 2 cm. Fish within Windy Lake have adapted to variation in water elevations of this magnitude.

The most important fish habitat within Windy Lake consists of round cobble/boulder substrates in the littoral zone along the eastern shore, and cobble/boulder shoals in deeper parts of the lake. These areas provide suitable spawning habitat for all life stages of lake trout, and may also be suitable spawning and nursery habitat for cisco. The upper surfaces of these shoals are typically at 2 m depth, so a 1.9 cm drawdown in lake water level is unlikely to affect these habitats.

The lake's live-water storage volume is also an important parameter to consider. Live-water storage is defined as the upper layer of a waterbody that is located above the invert elevation of the lake's outlet. On a seasonal basis, the lake's live storage volume is affected by hydrologic input and output processes (i.e., snowmelt runoff, rainfall, rain-on-snow, evapotranspiration). With respect to hydrologically wet and dry water years, the amount of live storage available will change in response to associated fluctuations in the hydrologic processes within the lake's drainage catchment area. If the live-storage volume is not substantially affected, then downstream flow discharges along the outlet channel will likely not be affected as well. However during a more severe hydrologically dry water year, it is expected that the water withdrawal rates would begin to encroach upon the volume of water that would be available for downstream flow discharges. Ongoing monitoring of the lake's water outflow would detect if such conditions were present so that mitigative measures could be undertaken, if necessary.

The outflow stream of Windy Lake is approximately 35 cm deep at the outlet, hence a reduction in live water volume during hydrologically dry years could potentially reduce the flow in this stream. The fish habitat in Windy Outflow is of marginal quality. The substrate is predominantly organic fine sediments. Juvenile lake trout have been captured in the stream, indicating that it may be used to some extent as lake trout rearing habitat. Nine-spine sticklebacks could potentially inhabit the stream, although a 2009 fish survey did not capture sticklebacks. The stream eventually flows into Glenn Lake, but does not appear to provide a migration corridor between Glenn and Windy Lakes. For example, Arctic char, which are found in Glenn Lake and Glenn Outflow, are not present in Windy Lake or Windy Outflow.

Based on the available Windy Lake outflow monitoring information from 2008 and 2009, the lake's live-storage zone includes the estimated upper 0.3 m to 0.4 m of water depth across the lake surface. This is equivalent to a volumetric capacity of approximately 1,600,000 m^3 to 2,100,000 m^3. The mean annual discharge through the open-water period for the same years was 17,600 to 18,100 m^3/day. Given the proposed water use along with all other water usage in Windy Lake (maximum of 102,145 m^3/year), the estimated reduction in water volume ranges from 4.9% to 6.4% of the annual live-storage that is available from Windy Lake. This is considered to be within the normal variation of Windy Lake's live storage capacity and is expected not to cause any significant downstream effects.

Based on the information available, the additional water withdrawal of 70 m^3/day (12,775 m^3/year for the current Doris Camp potable water (180 people), plus 12,775 m^3/year for the doubling of the camp size to 360 people) from Windy Lake will continue to meet Fisheries and Oceans Canada's Nunavut Operations Statement for Mineral Exploration Activities; Water Withdrawal, section 11.2: "Ensure water withdrawal volumes do not impact fish or fish habitat. Withdrawals from fish-bearing waters should not result in any noticeable change in water level or downstream flows, particularly during sensitive life stages (e.g., by dewatering spawning or egg incubation areas)".

3.1.2 Water Intake from Roberts Bay for Fire Suppression System

It is proposed to install a water intake at the jetty in Roberts Bay to provide seawater for fire suppression purposes in case of a fire at the Doris North Project. Water would only be required when there is a fire or for regular maintenance flushing of the intake and fire water supply system. During a fire, the system will be able to provide up to 1,500 gal/min (340 m^3/hr) for a maximum duration of 24 hours. Thus, over a 24 hour period up to 8,160 m^3 of seawater may need to be withdrawn from

Roberts Bay for a single fire. The expected occurrence interval of a fire that would require the use of this system is expected to be less than once per year.

During extended periods of non-use, the system will require regular flushing so that the intake and supply pipes remain in good condition and function as intended when required. Maintenance flushing would likely be done once per month with the system working at full capacity for approximately 6 hours. Thus, each maintenance event would draw approximately 2,040 m^3 of seawater from Roberts Bay.

Roberts Bay is connected to the Arctic Ocean and Melville Sound to the north and has an approximate volume of 500,000,000 m^3. Extraction for fire suppression or fire suppression system maintenance purposes would represent a negligible withdrawal of water from Roberts Bay. There would be no associated impacts to water level or general circulation within Roberts Bay. Consequently, there are expected to be no biological impacts to the marine communities within Roberts Bay.

3.1.3 Extension of Mine Life

HBML plans to access the Doris Lower, Doris Central and Connector subdeposits via the Doris North Portal. This would result in a 2 to 4 year extension of the Doris North Project mine life.

Extension of the mine life and increase in the mining rate will result in a change on employment and the economy due to additional economic production, value-added (Gross Domestic Product, or GDP) employment, personal income, and government revenue. The additional on-site employment is also reflected in the increase of the Doris Camp accommodation capacity from 180 to 360 persons. The economic benefits of a mine life extension are predicted to occur across Canada, Nunavut and, more specifically, within the Kitikmeot Region. The effects of the additional business activity, employment, and income on communities are expected to change from that assessed in the 2005 EIS. Specifically, there is expected to be an increase in the total economic benefits of the Project to Nunavut with the increase in the mining rate and mine life, and the increase in the number of workers on-site.

For 2010, total HBML employment for the preparation and construction of the Doris North Project averaged approximately 82 persons, of which approximately 23% were Inuit; the number of Inuit employees in 2010 increased during the summer months to a high of approximately 32% in July. With respect to contractors in 2010, an average of approximately 330 workers spent at least one day on-site in any given month, with an estimated 13% of contractor workers being Inuit.

During operation, Doris North employment opportunities are predicted to be longer-term, with an increasing Inuit share. Based on the previous mine design, employment was estimated to average approximately 165 persons and total about 370 person-years during the 27 months of operation. It was also estimated approximately 155 person-years of this would consist of Nunavummiut, representing about 42% of the total mine workforce. With accessing the Doris Lower, Doris Central and Connector subdeposits via the Doris North Portal, total employment is predicted to increase to an average of approximately 230 persons over seven years, or approximately 1,610 person-years. The increase in the size of the workforce and the extension of the mine life will increase the employment benefits to Kitikmeot residents. With achievement of existing objectives, Inuit employment is expected to increase to an average of approximately 95 persons or 675 person-years. HBML will continue to work with stakeholders and suppliers from the communities to facilitate the direct and indirect hiring of Nunavummiut throughout operation. The HBML employment strategy includes entry-level employment skills training, employee development, and an employee retention strategy.

Education and training initiatives in the Kitikmeot Region will be continued so that a greater proportion of Nunavummiut meet the requirements for employment with the Project. Current initiatives around

the partnerships for training, such as with the Nunavut Arctic College and the Kitikmeot Economic Development Commission, will continue to be pursued and developed. It is predicted that with the longer duration of mine operation a greater number of Inuit will be able to take advantage of education and training opportunities. This will result in an increase in the human capital available within Kitikmeot communities, thus supporting continued economic development across the region.

Similarly, contract and business opportunities will be prolonged with the extension of mine life and are expected to increase in magnitude with an increase in the mining rate. The share of contracts to the Kitikmeot Corporation and affiliated businesses has increased from approximately 27% of annual Canadian spending on Doris North in 2008 to approximately 51% in 2010; from 2008 to 2010, this spending totaled approximately $150 million. The project's use of Kitikmeot Corporation and affiliated businesses, as well as other Kitikmeot-based businesses, will continue in line with the existing IIBA. This includes business opportunities for the provision of air transportation, logistical services, camp supplies, medical and safety supplies, and catering, as well as other goods and services.

For employment and economy, the proposed amendment to extend the mine life does change the predicted environmental impacts of the undertaking in that the total benefits are predicted to increase. There does remain the potential for there to be an adverse effect on other community employers, such as local government, if the labour demands of the Project result in a shortage of skilled workers resulting in an inability to fill certain positions; however, the effect is predicted to remain minor and be increasingly alleviated over the longer term. The mitigation measures in place for the Doris North Project remain appropriate to address adverse effects and enhance the positive effects on employment and income, education and training, and business opportunities. The residual effects assessment conclusions remain valid.

With respect to community services and infrastructure, minimal adverse effects are predicted on health care services, community well-being and delivery of social services, and public safety and protection services. As reported in the 2005 EIS, the Project is predicted to have a negligible effect on in-migration. This is primarily because of the adoption of a fly-in/fly-out arrangement with well-equipped camp facilities, as well as the high unemployment rates within Kitikmeot communities, that will discourage people from moving to the Kitikmeot Region for mine-related employment. In-migration that does occur will be primarily associated with indirect and induced business growth, mainly in Cambridge Bay, when qualified local workers are not available. This will minimize any additional demand on community services and infrastructure because of an increase in the local population due to the Project.

The expected increase in personal incomes, business incomes, and government revenues that are realized over the extended life of the mine is predicted to result in an increase in the benefits to community services and infrastructure. This is because of the overall positive effects of increases in employment and income on human health and well-being. There may be some increases in socially-damaging behaviour (e.g., gambling, substance abuse), as well as family stress and dysfunction, associated with increases in disposable incomes within communities. Levels of participation in traditional land-based activities may also decline in some communities with mine-related employment. However, positive effects on personal financial resources will increase the options available for individuals and increase government revenues to allow for an enhancement of supporting public infrastructure and services.

For community services and infrastructure, the proposed amendment to extend the mine life does not change the predicted environmental impacts of the undertaking. The mitigation measures in place for the Doris North Project are appropriate to address the predicted adverse effects on health services, social services, and safety and protection services. The residual effects assessment conclusions remain valid.

3.2 TRADITIONAL WATER AND LAND USE

NWB Information Request: Confirmation that no new traditional water use and land use areas may be impacted by the changes to the project.

The proposed amendment activities do not include any new geographical areas that were not included in the Doris North Project final EIS.

3.3 FISH HABITAT

NWB Information Request: With respect to fisheries, confirm whether changes have any impact or potential impact on fisheries. If applicable, provide baseline data and an evaluation of baseline data describing fish and fish habitat in the project area. The applicant is advised to consult with DFO regarding fish and fish habitat related issues and to visit DFO's website at http://www.dfo-mpo.gc.ca/habitat/habitat-eng.htm. Indicate whether the applicant has consulted with DFO and provide the results of any consultation.

The Doris North area supports populations of Arctic char and lake trout, both of which are important in Inuit subsistence fisheries. There is also a limited commercial fishery for Arctic char in the region. However, there will be no effect on fisheries as a result of this amendment. None of the waterbodies proximal to the expanded footprint contain char or lake trout habitat; nor do they support lake trout or char populations. The only species found in the area of the expansion is nine-spine stickleback, and even stickleback habitat has been avoided by at least 30 m for the proposed amendment activities. The outflow of Windy Lake may be used as rearing habitat for juvenile lake trout and as spawning, nursery and rearing habitat for nine-spine stickleback. However, the level of water drawdown will not be sufficient to impact fish habitat.

3.3.1 Expansion of Sewage Treatment Plant and Moving Potable Water Use from Doris Lake to Windy Lake

The expansion of the Doris Camp sewage treatment plant (STP) will occur on the existing pad at Doris Camp, and will therefore not impact fish and fish habitat.

Moving the potable water source from Doris Lake to Windy Lake, which will include the current water use based on 180 people, plus the water use for an additional 180 people, will result in an increase in water usage from Windy Lake. The drawing of water from Windy Lake will slightly reduce the water level in the lake. Windy Lake is fed by a small pond/wetland system; there are no large, permanent streams entering the lake. Windy Lake contains abundant cobble/boulder shoals but the basin substrate is dominated by fine clay. The outflow is a small stream consisting of riffles, glides and pools. This stream flows south and joins another tributary of Glenn Lake.

The withdrawal of water from Windy Lake for Doris Camp potable water is not anticipated to affect fish habitat, as described above in Section 3.1 of this report. The amount of volume proposed to be withdrawn from Windy Lake will still result in compliance with Fisheries and Oceans Canada's Nunavut Operations Statement for Mineral Exploration Activities; Water Withdrawal, section 11.2:11.

3.3.2 Expansion of Waste Rock and Ore Storage Areas, and Roberts Bay Laydown Area

Site-specific fish and fish habitat information was collected in the areas of the proposed waste rock storage area and ore storage area, and the proposed Roberts Bay laydown expansion area. This information was shared with engineers to allow adaptive planning, such that any potential habitat alteration, disruption, or destruction (HADD) could be avoided. The waste rock storage pad area and the ore storage pad area contained no surface water and no fish or potential fish habitat.

There is a single stream in the eastern section of the Roberts Bay laydown area, flowing from the high ground near the airstrip north into Roberts Bay. The stream is a grassy channel that provides good cover for spawning and rearing stickleback in its lower reaches. Ninespine stickleback were found in the lower reaches of this stream, about 700 m from the proposed expansion area. The stream connects Roberts Bay to a small wetland about 500 downstream of the proposed laydown expansion area. Upstream (south) of this wetland, however, the stream submerges and flows underground about 250 m north of the laydown expansion area. This appears to act as a barrier to fish passage as the upper reaches of the stream are not fish-bearing.

Based on the environmental data gathered, the infrastructure plans for this Project Certificate/Type A amendment have been engineered to avoid impacts on the aquatic environment.

Because the expanded infrastructure footprint was developed adaptively, through the use of environmental data collected in concert with engineering planning, the amendment will have a negligible impact on fish habitat. There are no structures being placed within or across water bodies, and a minimum 30 m setback is maintained from all waterbodies. This includes waters in which no fish were found, but which could be temporary fish habitat during spring high water levels.

3.3.3 Use of Roberts Bay for Water Intake, Accommodation Barges and Fuel

The nearshore areas of Roberts Bay provide habitat for at least 18 species of marine fish (Rescan 2011). These fishes utilize a variety of habitat types. Flatfishes inhabit sandy bottoms. Sculpins, gunnels and cods inhabit areas of hard substrate with vertical relief for shelter. Arctic char and lake trout inhabit the mid-water column. Of these, flatfishes and other species inhabiting soft bottoms have the highest potential to be affected by the barges, which are moored over soft bottom. The accommodations barges are located directly east of the jetty, approximately 70 m off shore, moored in 2 to 5 m of water. However, the accommodation barges are moored to four land-based mooring points in addition to permanent moorings in Roberts Bay. As such, there is little danger of anchor drag or of the barge grounding on the seafloor. The fuel vessel anchorage is currently located in approximately 30 m of water, 2.3 km north of the Roberts Bay Jetty and approximately 500 m offshore. However, this anchorage will be re-located to provide more distance between it and the proposed subsea pipeline and diffuser. The potential for physical damage to fish habitat as a result of keeping the barges and fuel vessel in Roberts Bay are minimal, and are generally limited to the potential for fuel spillage into fish-bearing waters. The withdrawal of water from Roberts Bay for fire suppression is not anticipated to affect fish habitat, as described above in Section 3.1 of this report. The volume proposed to be withdrawn from Roberts Bay would not result in a measurable drawdown of water from the bay.

3.4 WATER SOURCE

NWB Information Request: Provide a description of the effects of changes to water usage on the source from which water will be drawn, including the potential for drawdown, if any.

A description of the total maximum potential water usage for Windy Lake, along with predicted effects, is included in Section 3.1 above.

Cumulatively, the proposed withdrawal of an additional 70 m^3/day from Windy Lake would result in an overall potential 0.17% decrease in total lake volume (Type B and Type A maximum water volumes combined). This represents an estimated decline in the mean annual water level of 1.9 cm, and a 0.028% decrease in lake surface area (Table 3.1-2).

The flow within Windy Outflow relies on the discharge of water from Windy Lake. A large reduction in discharge during a hydrologically dry year could potentially disconnect fish habitats in Windy Outflow

from those in Windy Lake. Since Windy Outflow is not sufficiently deep to provide overwintering habitat for fish, any fish trapped within stream pools in a dry year would perish. However, the maximum cumulative effect of the proposed withdrawal would potentially reduce the Mean Annual Discharge of Windy Outflow by 4.9% to 6.4%. This level of drawdown is within the range of natural variability, and no adverse effects on fish habitat or aquatic life are anticipated.

A description of the water withdrawal from Roberts Bay for fire suppression purposes, along with predicted effects, is included in Section 3.1 above. Water would only be required when there is a fire or for regular maintenance flushing of the intake and fire water supply system. During a fire, the system will be able to provide up to 1,500 gal/min (340 m^3/hr) for a maximum duration of 24 hours. Each maintenance event would draw approximately 2,040 m^3 of seawater from Roberts Bay. Since the volume of Roberts Bay is approximately 500,000,000 m^3, the water intake is considered to be negligible and will have no effect on fish habitat or aquatic life.

3.5 POTENTIAL EFFECTS OF WATER USE AND WASTE DISPOSAL

NWB Information Request: Identify the potential effect of water use and waste disposal relating to the amendments, on the following components: Vegetation, Aquatic Ecosystems, Wildlife.

3.5.1 Vegetation

NWB Information Request: Identify the potential effect of water use and waste disposal relating to the amendments, on the following components: Vegetation including: species composition and abundance, non-native species introduction, accumulation of toxins and heavy metals (in relation to remediation objectives for closure).

The proposed water withdrawal from Windy Lake is not expected to result in any adverse effects to vegetation, given that the maximum potential drawdown (which includes the existing Type B water use and the proposed Type A use) is estimated at 1.9 cm, which is well within the range of natural variability.

The proposed expansion of the Doris Camp sewage treatment plant (STP) will not impact vegetation, as the STP has been placed on the existing Doris camp pad (existing STP processing rates to be increased).

The doubling of the STP will result in a doubling of the volume of treated sewage discharge. Please see the section below on Aquatic Ecosystems for a description of the discharge location and activities. The proposed backup discharge location will be the same as the current location, so there are no additional anticipated effects on vegetation. Ultimate diversion of the treated sewage discharge to the TIA will have no effect on vegetation.

The construction of the additional waste rock and ore storage areas will have a minimal impact on vegetation. The areas where these materials will be stored is dominated by *Eriophorum*-tussock tundra, which is the most common plant association in the area, and to a lesser extent by wet meadow, which is also one of the most common vegetation types. Hence, the additional construction does not remove any areas of important or sensitive plant communities. The development may increase local plant diversity by providing well-drained areas on the edges of the development area where grass communities can establish. Plant communities dominated by grasses are uncommon in the area. Baseline vegetation studies in 1998 and 2003, and ecosystem mapping in 2010, did not locate any rare or listed plant species in the area. These areas are within the area assessed in the 2005 Final Doris North Environmental Impact Statement and adjacent to existing infrastructure, and therefore any additional impacts associated with these expansions are not anticipated.

The expansion of the Roberts Bay laydown area would cover an additional 3.9 ha. This area is composed primarily of lowland vegetation types (68%) and upland vegetation (31%) with a small component of marine and beach communities (1%) (Table 3.5-1). Each of these communities is relatively common within the local and regional study areas. These areas were mapped using Terrestrial Ecosystem Mapping from aerial photos and field studies during 1998 and 2010. The majority of the footprint expansion is composed of Wet Meadow (56%) and Dryas Herb Mat (29%). These two ecosystem types are the most common types in the coastal area near Roberts Bay. Wet Meadow is also the third most common vegetation type in the Local Study Area, while Dryas Herb Mat is the fourth most common. None of the landforms represent rare ecosystems, and no rare plants were observed during field studies to support vegetation mapping. Given the small area of relatively common ecosystem affected, no additional impacts associated with these expansions are anticipated.

Table 3.5-1. Landcover Types within the Footprint Expansion of the Roberts Bay Laydown Area

Landcover Type	Code	Area (ha)
Marine		
Marine Backshore	MB	0.021
Marine Intertidal	MI	0.009
Beach	BE	0.013
Total		**0.043**
Lowland		
Betula-Moss	BM	0.308
Eriophorum Tussock Meadow	TM	0.148
Wet Meadow	WM	2.220
Total		**2.676**
Upland		
Dryas Herb Mat	DH	1.142
Rock	RO	0.063
Total		**1.205**
Grand Total		***3.923***

3.5.2 Aquatic Ecosystems

NWB Information Request: Identify the potential effect of water use and waste disposal relating to the amendments, on the following components: Aquatic Ecosystems including: Fish, benthic invertebrates, plankton.

The proposed water withdrawal from Windy Lake is not expected to result in any adverse effects to aquatic ecosystems, given that the maximum potential drawdown is estimated at 1.9 cm, which is well within the range of natural variability. Similarly, the withdrawal of water from Roberts Bay represents a miniscule fraction of the volume of Roberts Bay, and no impacts on fish habitat or aquatic life are expected.

The proposed expansion of the Doris Camp sewage treatment plant (STP) will not impact aquatic ecosystems, as the STP has been placed on the existing Doris camp pad.

The doubling of the STP will result in a doubling of the volume of treated sewage discharge. Discharging the treated sewage effluent to the TIA will not affect aquatic ecosystems as the TIA is an approved tailings pond and is not considered aquatic habitat.

The proposed backup discharge location will be the same as the current location, so there are no additional anticipated effects on aquatic ecosystems. Treated sewage effluent is being discharged at monitoring station ST-8, and is being monitored as outlined in the Doris North Type A Water Licence. The discharge location is located approximately 1.4 km away from Doris Lake, and drains away from the lake. The discharge location is approximately 1.5 km away from Glenn Lake, and a monitoring station has been established along the nearest shoreline of Glenn Lake (monitoring station ST-9). These locations have been included in the annual AANDC inspections.

The construction of the additional waste rock and ore storage areas and the expansion of the Roberts Bay laydown area are not expected to affect aquatic ecosystems. The additional waste rock and ore storage areas and the Roberts Bay laydown expansion area have been designed to avoid fish habitat and hence aquatic ecosystems. Any runoff from these areas will be managed as outlined in the Doris North Type A Water Licence.

3.5.3 Wildlife

NWB Information Request: Identify the potential effect of water use and waste disposal relating to the amendments, on the following components: Wildlife.

The proposed water withdrawal from Windy Lake is not expected to result in any adverse effects to wildlife, given that the maximum potential drawdown is estimated at 1.9 cm, which is well within the range of natural variability.

The proposed expansion of the Doris Camp sewage treatment plant (STP) will not impact vegetation, as the STP will be placed on the existing Doris camp pad.

The doubling of the STP will result in a doubling of the volume of treated sewage discharge. The discharge of treated sewage effluent to the TIA will not affect wildlife. The backup discharge location is the same as the current location, and is therefore not expected to result in any additional potential effects on wildlife.

The construction of the additional waste rock and ore storage area is not expected to affect wildlife. The *Eriophorum*-tussock association is the most common plant community in the area of the proposed expansions. In general, the habitat value of cottongrass and sedge associations (*Eriophorum*-Tussock Meadows and Wetlands) is as a source of early summer forage for caribou and grizzly bears when the emerging leaves of the sedges are high in nutrients needed by lactating animals. Grizzly bear use of the area is unlikely, since the primary effect of developments on bears is through visual and auditory disturbances. Since these disturbances are unchanged at the Project site, no new effects are predicted for grizzly bears. *Eriophorum*-tussock habitats in the Project area were likely used by caribou when the Bathurst herd calved on the eastern side of Bathurst Inlet. However, now that the calving ground is located southwest of the Inlet, there is negligible use of these areas by Bathurst caribou during the early summer. Likewise, Dolphin-Union caribou do not use these areas in summer, because they spend the summer on Victoria Island. Similarly, this habitat is not used by Ahiak caribou because they now calve to the east in the Queen Maude Gulf Sanctuary. There is suitable raptor nesting habitat on the south face of the mesa. Construction of these storage areas, however, is not anticipated to affect these sites. The storage areas are within the extents assessed in the 2005 Final Doris North

Environmental Impact Statement and adjacent to existing infrastructure, and therefore no additional impacts associated with these extensions are anticipated.

The Roberts Bay Laydown Area is located in a shallow pan bounded by Roberts Bay to the north and by rocky outcrops to the south and east. The expansion of the Laydown Area is planned to be contiguous with existing infrastructure and will not extend outside of the already-affected shallow pan where it is located. While the footprint of the Laydown Area will increase, the activities that will be carried out are not planned to change. Hence, the same level of disturbance from lights, noise and human presence and movement is expected. The primary effects of the Project on wildlife are expected to stem from disturbance. Since the level of disturbance is expected to remain constant, despite the footprint expansion, and this disturbance will be constrained to the same Laydown Area and shallow pan in which it is located, no additional effects on wildlife are anticipated.

Grizzly bears are known to travel along the coast and have been observed relatively often at the Roberts Bay site. Management plans for wastes (including garbage), fuels, and spills will minimize any attractive scents for grizzly bears and wolverine and ensure that bears do not receive any food rewards for investigating the Project site. No additional effects are anticipated for grizzly bears or wolverine due to the Roberts Bay Laydown expansion. Grizzly bears and wolverine are also the subject of ongoing DNA-based monitoring programs aimed at quantifying the number, habitat use, and effects on these species.

Upland breeding birds use the habitat types identified in the footprint area. Clearing of the expansion area will be conducted outside of the breeding bird season to minimize disturbance to adults and nests. Shorebirds and seabirds are not common in the Roberts Bay expansion area, but are instead observed nesting on the islands in Roberts Bay, where more exposed, rocky habitat is available and nest predators such as arctic foxes are less common. The nearest raptor nests are located approximately 2 km to the east and 3.5 km to the west of the Laydown Area. This distance is considered too great to cause any disturbance to raptors. Moreover, no new activities are planned at the site beyond those already conducted. Hence, no additional effects are expected for upland breeding birds, shorebirds or raptors due to the Laydown footprint expansion.

Caribou do occur in the Local Study Area, primarily Dolphin and Union caribou, as they pass through from their wintering grounds to the south to Victoria Island for the summer. When migrating and crossing sea ice, caribou are known to preferentially travel along capes, isthmus, and points such that their exposure on the ice is minimized. Aerial surveys in 2010 of caribou trails on the sea ice in Melville Sound corroborated this trend. Caribou are not expected to preferentially use the Roberts Bay site as a migration corridor. Aerial surveys for caribou between 1998 and 2010 during the northern (spring) migration support this assumption, with few caribou observed in the Roberts Bay area. No additional effect is expected for caribou due to the footprint expansion at the Roberts Bay Laydown Area.

3.6 POTENTIAL EFFECTS BY PROJECT PHASE

NWB Information Request: Identify effects separately for each project phase.

The Doris North Project final EIS provided an assessment based on each project phase. The proposed amendments are not anticipated to result in any new effects, so no further details are provided.

3.7 METHODS OF EFFECTS PREDICTION

NWB Information Request: Provide a description of the methods used to predict effects.

The Doris North Project Final EIS outlined the methods used to predict effects of the Doris North Project (Chapter 5 of the Final EIS). The proposed amendments have geographical areas that lie within the geographical area included in the Doris North Project Final EIS.

The following text is copied from Section 5 of the Doris North Final EIS.

Valued Environmental Components (VECs) were selected based on both western scientific data and *Inuit Qaujimajatuqangit*.

The detailed analysis of potential adverse environmental effects resulting from the Project is focused on VECs, determined by the Project team after full consideration of potential Project-environment interactions and a good understanding of the nature of the Project and the local area.

For each VEC, the environmental assessment methodology included the following steps:

- description of the existing environment;
- description of environmental assessment boundaries (administrative, spatial and temporal);
- a consideration of *Inuit Qaujimajatuqangit*;
- an assessment of likely future conditions without the Project;
- an environmental effects assessment;
- a consideration of cumulative environmental effects; and
- a summary of environmental design, mitigation and monitoring measures.

The environmental effects analysis included the identification of criteria against which to assess the significance of environmental effects. The analysis included a review of the pathways of potential environmental effects, a consideration of the project activities which may contribute to those pathways, and a consideration of potential effects in each phase of the Project including construction, operations, closure, postclosure, and accidental events. In each VEC chapter, the potential adverse environmental effects of the Project are described, as appropriate, using the following factors: magnitude; geographic extent; timing/duration and/or frequency; reversibility; ecological and socio/cultural context.

For the amendments proposed in this package, the activities and geographical areas were assessed in the Doris North Final EIS. No significant effects are expected as a result of the proposed amendment activities/infrastructure.

In order to confirm that none of the proposed amendments would adversely affect fish habitat, proposed footprint areas were surveyed in the field in August of 2010. If any habitat was found that could be fish-bearing, the field information was used to re-design the proposed infrastructure. The final proposed infrastructure amendments provided in this package avoid all fish habitat, and maintain a minimum 30 m setback from all fish habitat. These were the methods used to avoid effects (rather than predict effects), but by avoiding effects the need to rely on predictions is eliminated.

For the proposed water usage from Windy Lake, the methods and calculations used to predict effects are described in Section 3.1 of this report. To be conservative, maximum water withdrawal volumes were used, along with the detailed bathymetry of Windy Lake, to calculate maximum potential water

level decrease, lake volume decrease, and lake area decrease. Based on the available information, the maximum potential water level decrease lies well within the range of natural variability, and no adverse effects are anticipated.

3.8 CUMULATIVE EFFECTS

NWB Information Request: Provide a cumulative effects assessment of the changes to the project's water use and waste disposal activities in relation to other activities in the same drainage basin.

The cumulative effects assessment conducted in the Doris North Project Final EIS (Miramar 2005) included the proposed footprint amendment activities that involve waste disposal. Please see Chapter 5 of the Doris North Project Final EIS and supporting document D6 for details of the cumulative effects assessment that was conducted.

For the proposed water usage from Windy Lake, the request to move the potable water source from Doris Lake to Windy Lake and to double the camp capacity will act cumulatively with an existing Type B Water Licence (2BE-HOP0712) that allows water to be withdrawn from Windy Lake. Section 3.1 of this report provides details of the calculations used to estimate the maximum and cumulative potential effects of the requested water usage from Windy Lake.

Based on the calculations from Section 3.1 of this report, the maximum cumulative potential water level decrease lies well within the range of natural variability, and no adverse effects are anticipated.

3.9 TRADITIONAL KNOWLEDGE

NWB Information Request: Provide details as to how traditional knowledge was considered and incorporated in environmental analysis.

Traditional knowledge, or Inuit Qaujimajatuqangit, was considered and incorporated in the Doris North Project Final EIS (Miramar 2005). Please refer to Supporting Document, Section E1 for a report on the traditional knowledge that was available and used for the environmental analysis. The Doris North Project Final EIS covered the activities associated with the proposed amendments.

The following text provides a brief description of how traditional knowledge was considered and incorporated in the Doris North Project environmental analysis.

In May 2003, Miramar Hope Bay Ltd. (MBHL) conducted a review of Inuit Qaujimajatuqangit (Inuit traditional knowledge) available for the Kitikmeot Region. To supplement this information, an Inuit Qaujimajatuqangit workshop was held in September 2003 with Inuit Elders and other knowledge holders from the communities of Cambridge Bay, Kugluktuk, Gjoa Haven, and Taloyoak. The purpose of the workshop was to gather information about current and historical land and resource use, and to identify any key sensitive areas or periods of the year (e.g., caribou migration periods).

Results of the workshop and the review of Inuit Qaujimajatuqangit were considered and incorporated into the selection of Valued Environmental Components (VECs), which formed the basis of the environmental assessment process (see Section 3.7). Inuit Qaujimajatuqangit was incorporated in to every section of the VECs and VSECs of the Doris North Project Final EIS.

HBML has been working with the KIA since 2008 to reach an agreement for the use of the NTKP and TKN studies which were specifically designed to examine development in the Hope Bay region. This information will be incorporated in future submissions.

4. Mitigation, Management, and Monitoring

Rescan™
Engineers and Scientists

4. Mitigation, Management, and Monitoring

4.1 MONITORING SITES

NWB Information Request: Describe proposed additional locations of environmental monitoring sites resulting from changes.

The expansion of the sewage treatment plant (STP) will not result in additional monitoring sites. Monitoring sites are already in place for the area where treated sewage effluent is currently being discharged (which will be the backup location), as well as a downstream site near Glenn Lake. The site-specific monitoring location may chance if the discharge method is changed to better disburse the effluent (to avoid ponding). These site-specific decisions can be made with the help of the AANDC site inspector if and when the discharge method is changed.

For the proposed change in potable water source from Doris Lake to Windy Lake, the existing water intake site that has been used for Windy Camp will be used for the Doris Camp water intake. It is proposed that any monitoring requirements for camp potable water be applied to the Windy intake location.

The construction of the waste rock storage, ore storage, and Roberts Bay laydown areas may result in additional monitoring locations. Any new monitoring locations would be part of the site seepage/runoff monitoring program, which will be updated.

4.2 MITIGATION, MANAGEMENT, AND MONITORING PROGRAMS

NWB Information Request: Provide a description of any proposed mitigation, management and monitoring programs to mitigate adverse impacts.

Mitigation, management and monitoring programs associated with the construction of the waste rock storage area, the ore storage area, and the Roberts Bay laydown area are discussed in a separate memo.

For the remaining proposed activities, the Doris North Project has existing management and monitoring plans that will encompass the proposed amendment activities. The following monitoring plans already include the geographical areas and proposed activities associated with the amendments in this package:

- The Aquatic Effects Monitoring Program;
- The Hydrology Monitoring Program;
- The Wildlife Mitigation and Monitoring Program;
- The Noise Abatement Plan; and
- The Socio-Economic Monitoring Program.

The Aquatic Effects Monitoring Program (AEMP) was initiated in 2010. This program includes monitoring locations in both freshwater and marine environments around the Doris North Project area (as well as reference areas well away from the Project area), and includes locations in the Doris Watershed, Little Roberts Lake and Outflow, Roberts Bay, 2 freshwater reference areas, and 1 marine reference area. The freshwater monitoring sites will cover the activities taking place within the Doris Watershed and the area to the north, and the marine monitoring sites will cover the activities near and in Roberts Bay. The AEMP includes the monitoring of water quality, sediment quality, phytoplankton, periphyton,

benthic invertebrates, and fish, and is conducted on a yearly basis. Multiple samples per year are collected for water quality.

The Hydrology Monitoring Program in the area includes locations within the Doris Watershed, Windy Watershed, Roberts Watershed, and reference watersheds. Hydrometric monitoring has included two locations within the Windy Watershed; one station at the outlet of Windy Lake, and one station at the outlet of Glenn Lake. The continued monitoring of Windy Outflow can be used to ensure that there are no significant water level decreases in Windy Outflow during dry years that could affect fish habitat.

The Wildlife Mitigation and Monitoring Program (WMMP) has been ongoing for a number of years. This program has undergone refinements based on discussions between HBML, NIRB, CWS, and the Government of Nunavut, Department of Environment. The geographical areas associated with the proposed amendments are included in the monitoring area covered in the WMMP. The WMMP includes the monitoring of caribou, muskox, breeding birds, raptors, waterfowl, seabirds, grizzly bears, and wolverine. Monitoring evaluates the population and breeding success of wildlife populations adjacent to the mine site and at a greater distance (control areas).

Mitigation for wildlife would include scheduling construction activities during the least risk work timing windows. Wildlife monitoring activities will occur during construction activities that have the potential to cause negative impacts on wildlife or their habitat and will be conducted by qualified environmental monitors. Pre-construction surveys would also be required to ensure that no incidental wildlife or nests were present.

The Noise Abatement Plan is closely associated with the WMMP, as it includes the noise abatement mitigation measures to reduce or eliminate the potential effects of noise on wildlife. Again, this plan encompasses all of the current Doris North Project activities, and the activities associated with the proposed amendments will be covered in the existing Noise Abatement Plan.

The Socio-Economic Monitoring Program for Doris North defines a number of indicators that have been selected based on the impact predictions and mitigation measures in the FEIS. For each social and economic indicator, specific measures, data requirements, and data sources have been identified, and data collection and reporting is on-going. The Socio-Economic Monitoring Program allows for both early detection of adverse effects on valued socio-economic components (VSECs) and reporting of impact and benefit objectives for the Project. Extension of the Doris North mine life is not expected to result in the need to change the monitoring program given that there are no material differences in the nature of the predicted residual effects. The Socio-Economic Monitoring Committee (SEMC), which includes members from key government and stakeholder agencies, provides additional oversight to help ensure that on an on-going basis the monitoring program meets its objectives.

In addition to the above programs/plans, the following plans are also in place for the Doris North Project:

- Oil Pollution Prevention Plan/Oil Pollution Emergency Plan;
- Emergency Response Plan;
- Hazardous Waste Management Plan;
- Incinerator Management Plan;
- Doris North Landfarm Management and Monitoring Plan;
- Spill Contingency Plan;

- Quality Assurance and Quality Control Plan;
- Hope Bay Quarry Monitoring; and
- Doris North Infrastructure Project Management Plan.

5. List of Reports and Plans

5. List of Reports and Plans

NWB Information Request: Provide a list of studies, reports and plans relevant to the application that have been undertaken to date.

Numerous baseline studies have been conducted in the area of the Doris North Project since the mid 1990s. Many studies were conducted before the preparation and submission of the Doris North EIS. The Final Doris North EIS included numerous baseline reports (as supporting documents).

Additional baseline studies have been conducted since the Doris North Final EIS was submitted. The following baseline reports and compliance reports include the Doris North Project area including the geographical area of the proposed amendment activities:

- Monitoring and Follow-Up Plan, Doris North Gold Mine Project. Hope Bay Mining Limited. May 2011.
- Air Quality Management Plan, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2011.
- Air Quality Compliance Report for Section 4 Item 30 of the Project Certificate, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2009.
- Air Quality Compliance Report Q1 and Q2, 2010, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2010.
- Air Quality Compliance Report Q3 and Q4, 2010, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.
- Doris North Gold Mine Project: Incinerator Stack Testing Compliance Report for Section 4 Item 30 of the Project Certificate. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. February, 2010.
- 2010 Noise Compliance Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2011.
- 2009 Meteorology Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2009.
- 2010 Meteorology Compliance Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2010.
- 2009 Hydrology Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2009.
- 2010 Hydrology Compliance Report, Doris North Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. November 2010.
- 2010 Hydrology Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. February 2011.
- 2009 Freshwater Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. February 2010.
- Aquatic Effects Monitoring Plan, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. February 2010.

- 2010 Aquatic Effects Monitoring Program Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. June 2011.
- 2009 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. May 2010.
- Doris Mine Site Fisheries Authorization Monitoring Report 2010, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. January 2011.
- 2009 Marine Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2010.
- 2010 Marine Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. May 2011.
- 2009 Marine Fish and Fish Habitat Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2010.
- 2010 Marine Fish and Fish Habitat Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.
- 2009 Roberts Bay Jetty Fisheries Authorization Monitoring Report. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2009.
- 2010 Roberts Bay Jetty Fisheries Authorization Monitoring Report, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. December 2010.
- Wildlife Mitigation and Monitoring Program, Doris North Gold Mine Project 2009. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. January 2010.
- Wildlife Mitigation and Monitoring Program, Doris North Gold Mine Project 2010. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. January 2011.
- Wildlife Mitigation and Monitoring Plan, Doris North Gold Mine Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.
- 2010 Ecosystems and Vegetation Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. April 2011.
- 2010 Terrain and Soils Baseline Report, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Rescan Environmental Services. March 2011.
- 2007 Noise Measurement Report, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. October 2008.
- 2008 Noise Measurement Report, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. July 2009.
- Wildlife Mitigation and Monitoring Program - 2007, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. August 2008.
- Wildlife Mitigation and Monitoring Program - 2008, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. March 2009.
- 2006-2007 Aquatic Studies, Boston and Madrid Project Areas. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. December 2008.
- Aquatic Studies 2007, Doris North Project. Prepared for Miramar Hope Bay Limited by Golder Associates Ltd. April 2008.

- Aquatic Studies 2008, Hope Bay Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. March 2009.
- Preliminary Regional Ecological Land Classification, Hope Bay Belt Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. January 2009.
- 2008 Hydrology Baseline Update, Doris Project Area. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. March 2009.
- 2008 Roberts Bay Fisheries Authorization Monitoring Report, Doris North Project. Prepared for Hope Bay Mining Limited by Golder Associates Ltd. December 2008.

References

Rescan™
Engineers and Scientists

References

COSEWIC. 2010. *Committee on the Status of Endangered Wildlife in Canada*. http://www.cosewic.gc.ca/eng/sct0/rpt/rpt_csar_e.cfm (accessed April 2011).

Golder Associates Ltd. 2006. *Report on Bathymetric Surveys, Hope Bay Project, Hope Bay, Nunavut*. Prepared by Golder Associates Ltd. for SRK Consulting Canada Inc. October, 2006.

Health Canada 2008. *Guidelines for Canadian Drinking Water Quality Summary Table*. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. May 2008.

Miramar 2005. *Final Environmental Impact Statement*. Doris North Project, Nunavut, Canada. Miramar Hope Bay Ltd. October 28, 2005.

Rescan 2011. *Roberts Bay Report, Doris North Gold Mine Project. A Supporting Document for the Type A Water Licence Amendment Package No. 04*. Prepared for Hope Bay Mining Limited by Rescan Environmental Services Ltd. June 2011.

WKRLUP. 2005. *West Kitikmeot Regional Land Use Plan*. Draft. Public Hearing, Cambridge Bay, January 18-19, 2005.

Appendix A

The Relationship between Water Level, Volume, and Surface Area for Windy Lake

Rescan™
Engineers and Scientists

Appendix A. The Relationship between Water Level, Volume, and Surface Area for Windy Lake

Data Source: Windy Lake bathymetry data collected by Golder Associates Ltd. (2006) was processed using the Area and Volume Statistics tool from the 3D Analyst extension in ArcGIS 9.3.1 at 0.1 m intervals for the first metre and 1 m intervals for the remaining water levels (Table A-1). Surface area (Figure A-1) and water level (Figure A-2) changes corresponding to predicted decreases in lake volume were estimated by linear interpolation between the 0 and -0.1 m intervals.

Table A-1. Windy Lake Water Level, Area, and Volume

Water Level (m)	Surface Area (m^2)	Volume (m^3)
0	5,287,672	59,137,486
-0.1	5,279,934	58,609,105
-0.2	5,272,198	58,081,499
-0.3	5,264,094	57,554,678
-0.4	5,255,787	57,028,683
-0.5	5,247,462	56,503,521
-0.6	5,239,120	55,979,192
-0.7	5,230,759	55,455,698
-0.8	5,222,380	54,933,040
-0.9	5,213,984	54,411,222
-1	5,205,570	53,890,244
-2	5,085,888	48,741,847
-3	4,923,163	43,735,224
-4	4,738,661	38,905,519
-5	4,526,240	34,276,754
-6	4,095,189	30,019,017
-7	3,868,563	26,044,291
-8	3,601,926	22,331,743
-9	3,397,506	18,835,580
-10	3,148,113	15,564,996
-11	2,841,994	12,580,036
-12	2,541,346	9,902,886
-13	2,216,096	7,525,558
-14	1,826,438	5,542,939
-15	1,576,351	3,848,436
-16	1,312,131	2,407,662
-17	1,000,777	1,263,619
-18	586,400	464,308
-19	195,696	133,983
-20	51,288	29,731
-21	12,346	2,184
Max Depth = -21.235		

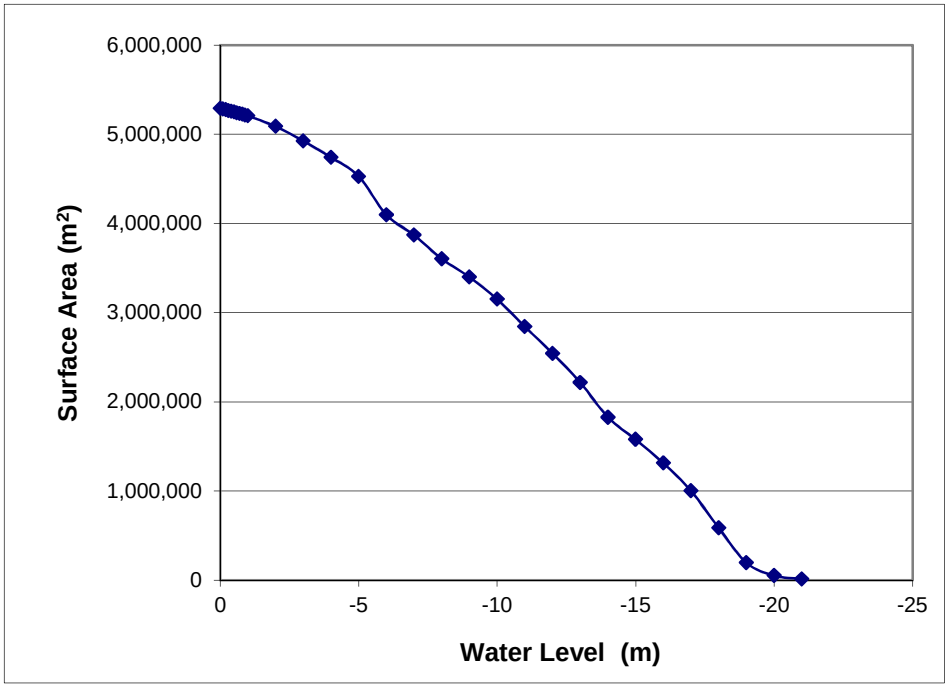

Figure A-1. Surface Area to Water Level for Windy Lake

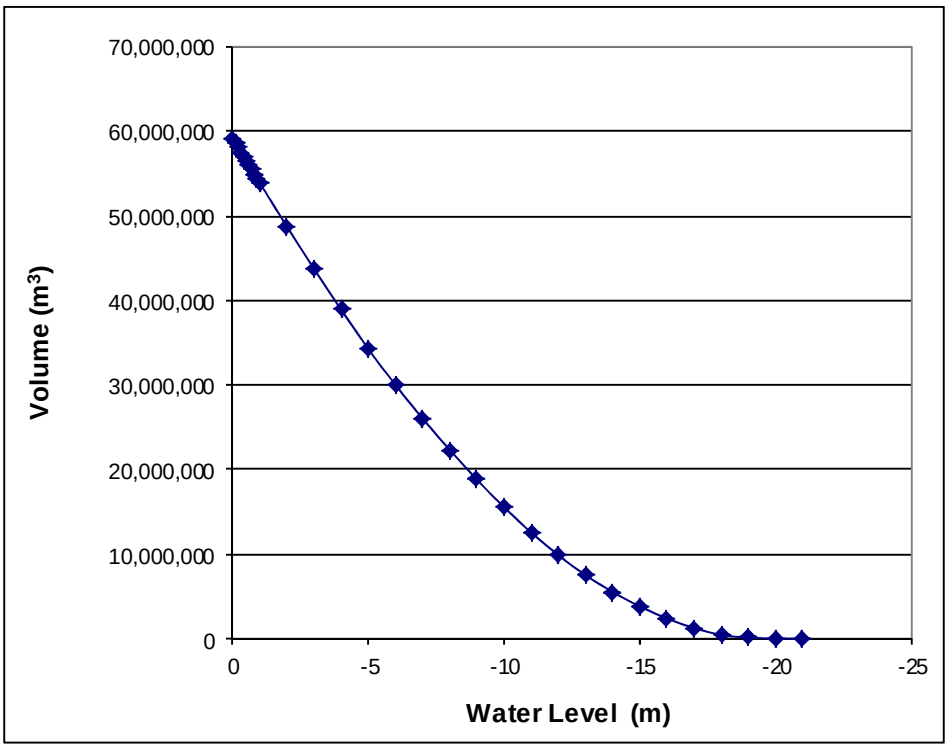

Figure A-2. Volume to Water Level for Windy Lake