DE BEERS
CANADA
SNAP LAKE MINE

December 20, 2012 File:MV2011L2-0004

Mr. Dave White
Snap Lake Environmental Monitoring Agency
Main Floor, Lahm Ridge Tower
P.O. Box 95
Yellowknife, NT.
X1A 2L1

Dear Mr. White,

Re: De Beers – Snap Lake Mine
2011 Environmental Assessment Annual Report

The 2010 Environmental Assessment report is forthcoming; however, please see the subject report for your review and records.

Should you have any questions, comments or require further clarification, please do not hesitate to contact me at 767-8646 or email me at the following address: Alexandra.Hood@debeerscanada.com

Sincerely,

A. Hood

Alexandra Hood
Permitting and Environmental Superintendent

Cc:

Michele Culhane	AANDC
Lionel Marcinkoski	AANDC
Patrick Clancy	GNWT
Zhong Liu	SLEMA

Plain Language Summary

The Snap Lake Mine (Mine) is a diamond mine owned and operated by De Beers Canada Inc. (De Beers), and is located about 220 kilometres northeast of Yellowknife, Northwest Territories. De Beers received regulatory approval for the Mine in 2004, which included an Environmental Agreement. Mining began in 2007 and is expected to 2030. We have completed seven years of environmental monitoring since construction started for the Mine. This annual report for the Mine's Environmental Agreement summarizes the monitoring activities and results from 2011.

Since we received regulatory approval for the Mine in 2004, we have written 32 monitoring and management plans for the Mine. In 2011, we submitted eleven annual reports, three management plans and three reports under the fisheries authorization. A summary of each of these reports is provided in this Annual Report.

Information is collected from various parts of the environment because what happens to one area (for example, air) can affect what happens to another (for example, water). Here is a summary of what we found in our environmental monitoring studies in 2011.

Air quality: When any fuels are burned, greenhouse gases and other compounds are produced. We calculate the amount of greenhouse gases produced by the Mine because they can add to global warming. We measure the amount of other air quality compounds produced by the mine because they can lead to changes in air quality near the mine. Emission rates were a little higher in 2011 from 2010 estimates primarily due to more power generation and fleet use at the facility.

Aquatics (fish and fish habitat): We found increases, relative to baseline levels, in dissolved salts, nutrients, and a few metals in the water in Snap Lake in 2011. The increases in dissolved salts were greater than expected, and resulted from more loading of dissolved salts from the Mine dewatering process in the underground mine than originally planned. These changes are not harmful to fish or other life in Snap Lake. We checked the amount and types of algae, and bugs that live in the water and on the bottom of Snap Lake, to see if there were any changes in food for fish compared to previous years. The amount and types of algae and bugs in the water of Snap Lake have changed from year to year, but this may not be related to the Mine alone, because similar changes also occur in all lakes. The number of different types of bugs on the bottom of Snap Lake in 2011 was similar to those in previous years, and the Mine only had a small effect on them. We also checked the mud that the bugs live in at the bottom of the lake and found that two nutrients and a few metals were higher.

Archaeology: None of the historical sites discovered near the winter road and Mine were disturbed in 2011.

Hydrology (surface water quantity and quality): Water surface elevation changes in Snap Lake appear to be influenced more by climatic conditions than by mine effects. In the Environmental Assessment Report a water surface elevation of 3.3 to 5.5 centimetres was predicted, while fluctuations due to evaporation, precipitation and flow are as high as 15 centimetres.

Hydrogeology and Geochemistry (groundwater quantity and quality): The rock types and classification at the Mine have not changed from our original predications. We have discovered that up to 2008, more water was seeping into the underground mine than was predicted in the 2002 EAR, resulting in higher concentrations of salts and dissolved solids in the water, however, the flows and loadings generally decreased to below predictions after 2008 and into 2011.

Vegetation: Satellite pictures were taken of the Mine to determine the total size of area affected by the Mine in 2008. We found that the disturbance area of each vegetation type was less than was predicted. Only 0.5 hectares of the esker, where gravel is quarried for project development, was expected to be disturbed, but 1.6 hectares of the esker was disturbed in the winter of 2001. No further disturbance on the esker is expected to happen. Dustfall exceeded the Alberta Ambient Air Quality Objective for commercial and industrial properties on one month at one sampling location. Overall, evidence of dustfall effects on the mine site have not been observed.

Wildlife: In 2011, monitoring indicators for caribou, grizzly bear and wolverine all indicated low levels of activity, but this result is likely related to the recent declines in the Bathurst caribou herd. Incidents in 2011 were mostly related to fox and wolverine at site, and some isolated incidents included caribou and songbirds. Wildlife mortalities have been rare at Snap Lake, but in 2011, two songbirds, a ptarmigan, a raven, fox and wolverine were all found dead within the Mine boundaries. Wolf den and raptor nest surveys are no longer WEMP components as agreed at monitoring workshops with regulators and communities in 2010 and 2011 but are monitored as an in-kind contribution to the Government Northwest Territories, Department of Environment and Natural Resources regional databases.

Compliance: Seven inspections were conducted by Aboriginal Affairs and Northern Development Canada in 2011. All issues brought up by the Inspector were addressed or are being addressed.

Mitigative Measures: The Aquatic Effects Monitoring Program annual report demonstrates that the Snap Lake Mine's impact is similar to what was predicted in the Environmental Assessment. This demonstrates that the mitigative measures being used by De Beers are working effectively. Currently, the main area of investigation for new mitigative measures is in the area of total dissolved solids lake concentrations. This work is ongoing.

Adaptive Measures: Adaptive measures adopted in 2011 included the construction of the Main Settling Sump underground in the mine, new cleaning methods for the water treatment plant filters, the start of the five-year review of the Aquatic Effects Monitoring Program, and the grizzly bear hair snagging program.

TRANSLATIONS

YATI BENEREDÍ XA ʔEREHTŁ'ÍS XÁLĮ

ʔeyı Snap Lake Tsąmba K'é (Tsąmba K'é) sí De Beers Canada Inc bets'ı dıamond xa tsąmba k'é hálʔą-u yeghádálana ʔat'e, ʔeyı t'ók'e ʔeʔą sí Beghúldesche, Northwest Terrıtorıes ts'ı (220) nǫ́nonąts'ę́n nǫ́nądechën ʔanıłtha, yudás tth'ı́s ts'ę́n xaʔa ʔeyër t'á xáʔą ʔat'e. Yuní 2004 kú t'a yatı thela gháré ʔeghálahena xa ʔę́ héts'edı, ʔeyı xél Ní ʔesáne ch'a Badı xa ʔerehtł'ís k'e yatı nílya gháré tth'ı xél nų́hų́t'ą. ʔeyı Tsąmba k'é ʔeghálada sí 2007 kú búnı́dhër, ʔeyı sí 2030 ghayé ts'ę́n xa núhų́t'ą ʔat'e. ʔeyı tsąmba k'é nų́hų́t'á xa húnı́dhër ts'ı ɔıłą́ı́sdı nélt'e ní ʔesáne ch'á badí xa net'ı́ ʔat'e. ʔedërı xaye tąlt'u Ní ʔesáne ch'á badı xa ʔerehtł'ís hehełtsı sí ʔeyı 2011 ts'ı t'at'ú ní badı k'é xáʔą sí ghą t'e.

Yuní 2004 kú begháré ʔeghálada xa yatı gháré tsąmba k'é húnídhër, ʔeyı kú ts'ı harelyų t'á (32) tǫ́nąts'ę́n náke ʔerehtł'ís hıghą ʔat'e ʔeyı sí t'at'ú ʔesǫ́hóne ch'a xa hadí sí gha-ú tth'ı t'at'ú ts'ąmba k'é beghálada xa seʔų́t'e sí ghą tth'ı. 2011 kú, xaye tanélt'ú ʔerehtł'ís xałe nı ts'ı ɔıłaghеʔadhel ʔerehtł'ís nílya, taghe sí t'at'ú beghálada xa sehų́t'e sí ghą-ú, tth'ı taghe ʔerehtł'ís t'ą łue ghą k'aldé gháré tth'ı beba. ʔeyı ts'ı ʔerehtł'ís hegą sí ʔedırı xaye tąnełt'ú ʔerehtł'ís xałe sí xél thela xat'e.

Harelyų́ ʔełk'éch'a nı ghą hanı ʔełá nıłye, t'a t'á sí ʔaxą-ú ɔıłás ts'ę́n ʔesáʔų́t'e dé (ʔeyı ʔaxą-ú, nıłts'ı ts'ejí lát'ı) ʔeyı bet'á ʔeyıle ts'ę́n nídhır xat'e (ʔaxą-ú t'u lát'ı ts'ę́n). ʔedırı ʔereht'ís sí yuní 2011 kú ní badı ghą bek'onełtą gháré t'a hų́łʔą sí ghą ʔat'e.

Nıłts'ı ts'ejí t'at'e: T'o lasí tłës dek'ę́n dé bets'ı ʔę́né ní nídhıl xél tth'ı ʔeyıle ʔasíe beta hų́lı́ ʔát'ı ʔat'e. Tsąmba k'é tłës leré hełtsı t'á ní nı́dhıle sí t'anílt'e sí xa húltá ʔat'e bet'á harelyų́ nę́né ts'ę́n hunídhıl xáʔą xél ʔat'e t'á. Tsąmbe k'é t'a nıłts'ı ts'ejí beta ʔasíe ʔų́lı ʔat'ı́ sí xa búldzáy ʔat'e, ʔaxą-ú tsąmbe k'é náré nıłtsı ts'ejí ʔedų́ ʔáne dé xa. Tłës leré sí 2011 ghayé xa dé yudághe ts'ę́n ʔajá 2010 ghayé chu xa dé, t'a t'át'e hunıdhën sí deʔánı́łt'e power dek'ę́n t'á ʔasíe hetł'él chu tth'ı ʔasíe łą tłës t'á hetł'ę́l bet'á xat'ı ʔeyër xáʔą sí.

Tehyághe ʔasíe dána (łue chu tok'e náday chu): Yuní 2011 ghayé ʔeyër Snap Lake ts'í tu yé dedhay-u, ʔasíe yeldél xa tehnı-u tth'ı náye beta satsán lat'ı dǫ́lı sí yudághe ʔajá k'e. ʔeyı dedhay tu yé nalghı sí deʔánı́łt'e sí t'at'u xa hunıdhën nı sí ʔą́s ts'ę́n ʔajá k'e, ʔeyı t'a ts'ı ʔę́né ʔajá sí ʔeyı tsamba k'é dedhay tu yé nalghı níeyághe ts'ı tu hadzíl sí t'anílt'e hílchú xa nı sí ʔeyı ʔází hílchu ʔat'e. ʔeyër Snap Lake tu ʔedų ʔája sí bet'a lue-ú tó ʔasíe dáną sí beba ʔesát'e xat'e ʔíle. ʔeyı t'anílt'e-u tth'ı t'at'ı tehdláre ʔų́lı sí xa net'ı́ ʔat'e, tth'ı ʔeyër Snap Lake tehtł'ághe t'at'ı tehguʔáze ʔų́lı sí tth'ı net'ı́, t'a xalʔı sí lue xa tehnı ʔų́lı sí ʔak'enıgháyé ts'ı ʔedų́ ʔájá dé xa. ʔeyër Snap Lake tu yé t'anílt'e-ú tth'ı t'at'ı tehdláré chu tehguʔaze ʔų́lı sí xaye tanélt'u ʔedų́ nát'ı́ ʔat'e, kú xát'e húlí tsąmba ké xáʔáı́ t'át'e ʔíle, ʔeyı k'ízı́ ʔeyíle tu dáthela sí xát'ı ʔat'e. Yuní 2011 kú ʔeyër Snap Lake tehtł'ághe t'anílt'e ʔełk'éch'a tehguʔaze ʔų́lı sí yuní ghayé dohdhër sí chu ʔełelt'éé, tsąmba k'é xáʔą sí bet'á hútł'ëth ʔedų́ ʔájaíle. ʔeyër tehtł'ághe hatł'ës beyé guʔaze náde sí tth'ı nílʔı gháré nake tehnı chu satsáne lat'ı hų́lı sí yudághe ʔája k'e.

Tthaydëne Bezázé k'é bek'óneta: Yuní 2011 kú ʔeyër xay tı̨lu chu tsąmba k'é xáʔą gá tthaydëne bezázé k'é húlʔą sí hat'ı́ ʔíle.

Tu Bek'óneta (tu daghe t'aníłt'e chu t'at'e chu): ʔeyër Snap Lake tu t'a tanłtha yudághe chu yuyághe chu nat'ǫ́ sí ʔeyı harelyǫ nǫ́né ʔedǫ́ nǫ́ʔǫ́dhır sí ts'í ǫ́né ʔat'e, ʔeyër tsąmba k'é xáʔáy t'á ʔat'e ʔíle. ʔeyı Envıronmental Assessment Report yé xa dé tu yudághe/yuyághe nat'ı sí 3.3 ts'ı 5.5 dënechéth ʔalnłtha xa hunıdhën nı sí hájáíle tu hegën chu tu nátł'ır chu ts'ı ʔǫ́né harelyǫ t'a 15 dënechéth tanłtha yudághe ʔájá k'é.

Tu T'anótł'ır chu Ní t'ohóʔa sí (Ní túé t'aníłt'e chu t'at'e chu): ʔeyër tsąmba k'é gá tthe t'at'e chu tth'ı t'at'ı sí ʔeyı t'at'e xa hunıdën nı sí xat'ée. T'a húlʔą sí yunı 2008 ts'ǫ́n níeyághe tsąmba k'é beghálada ts'ı tu deʔánłt'e háǫ́lı ʔájá k'é, ʔeyı 2002 EAR ʔerehtł'ís ghárę xáne xa hunıdhën nı sí hájáíle, ʔeyı ts'ıǫ́né tu yé dedhay chú ʔeyıle beta ʔasíe dólı sí deʔánłt'e ʔájá, xat'e húlí, t'oke dzérelbën-u tth'ı t'aníłt'e nıtł'ır sí ʔedek'aʔu ʔájá ʔunı 2008 ts'ı 2011 ts'ǫ́n.

Ní hádáúneshe: ʔeyër tsąmba k'e xáʔą sí yunı 2008 ts'ı Satellıte t'á nírehtł'ís náltsı ʔeyı ghárę ʔeyër ní t'áǫ́łyą bek'e hat'ı sí xa. T'a húlʔą sí t'ok'e harelyǫ setthı ní hadáúneshe bek'e hat'ǫ́ sí dek'aʔu ʔąłyą, t'aʔorłyą xa hunıdën nı k'áʔaǫ ʔat'e. ʔeyı thaıtéth xa dé 0.5 dechën ʔąǫ́łyą ʔeyı ní beghálada xa hadzáí t'á, ku t'a ʔąǫ́łyą xa hunıdhën nı húlí, ʔeyı thaıtéth 1.6 dechën ʔąǫ́łyą bek'e hat'ǫ́ k'e yunı 2001 ku ʔałǫ́ xay-u. Kú t'a ʔeyı thaıtéth bek'e hat'ı xat'eíle. ʔeyı Alberta Ambıent Aır Qualıty Objectıve ʔerehtł'ís ghárę xa dé thay ts'érétth'ay nátł'ır sí deʔánłt'e ʔája ʔeyı harelyǫ́ ts'ǫ́n xáʔą ʔeghádálada sí, ʔeyër tok'e net'ǫ́ sí, ʔłła za t'a ʔłá hóreʔą k'eyaghe net'ǫ́ ghárę. Harelyǫ́ setth'ı xa dé ʔeyër tsąmbe k'é xáʔą gá thay ts'érétth'ay ʔútł'ëthé bek'óríjaíle cho ʔíle.

Tech'adıé: 2011 kú tech'adıé badı ghárę ʔetthën-u, dłeze-u tth'ı nunyé hanúníle, ʔeyı sí ʔetthën dek'aʔǫ ʔája tth'ı ts'ıǫ́né ʔat'e bunıłdhën. 2011 kú tsąmba k'é ga ʔesáʔǫ́t'e dé ʔeyı nagıthe chu nághaı chu t'á t'e, tth'ı beghą thën ʔetthën chu ʔıyësaze chu tth'ı. ʔeyër tsąmbe k'é xáʔą gą tech'adıé bexél ʔesaja xa hanúníle, hát'e húlí yunı 2011 kú, náke ʔıyësaze-u, k'asba-u, datsą-u, nágıth-u, tth'ı naghaı dhıh dáılya ʔeyër tsąmba k'e xáʔą ʔanáré. WEMP ghárę nunıye beʔą́ghe chu tth'ı det'ancho lat'ı bet'oghe sí bek'óneta nı sí beghádáíle, ʔeyı t'a ghárę ʔalyá sí t'ą k'alde begháre ʔeghádálada chu Háyurıla dáhala begháre ʔalya, kú hat'e húlí ʔałǫ Government of the Northwest Terrıtorıes chu Department of Envıronmental and Natural Resources hanı ʔegháǫ́rele t'a ʔedenı beba ʔałǫ́ hálʔǫ.

ʔak'áʔǫ́t'e: 2011 kú ǫłaísdǫ ʔasíe kónehtá ʔeyı sí Aborıgınal Affaırs and Northern Development Canada yelʔǫ. ʔeyı t'ą ʔasíe kaneta dëne (Inspector) t'a ghą náyaltı sí ʔałdëne selya-u to dǫ selye xa beghálada ʔat'e.

ʔasíe tsę́dhı ch'á dek'áʔǫ ʔalʔǫ: ʔeyı Aquatıce Effects Monıtorıng Program xaye talt'u ʔerehtł'ıs hełsı sí ghárę xa dé ʔeyër Snap Lake tsąmba k'e xáʔą ʔeyı t'o Envıronmental Assessment yé t'ane xa hunıdhën nǫ sí xat'e. ʔedërı ghárę ʔasíe tsę́dhı ch'á dek'áʔǫ ʔałʔǫ sí De Beers hat'u t'a beba ʔusǫ́ ʔeghálaną. Dǫ́, ʔate t'a net'ǫ sí ʔeyı ʔasíe tsę́dhı ch'á dek'áʔǫ ʔałʔǫ xa beghálada xa sí ʔeyı tu hehʔą beyé ʔasíe ʔǫhı ʔat'ǫ́ sı ʔat'e. ʔedërı t'at'u beghálada xa sí xat'éé xa.

T'at'u sugha xa sehúlye: Yunı 2011 kú t'at'u sughá xa sehúlye húnıdhër sí ghárę ʔeyër níeyaghe tsąmba k'e ʔeghálada tu ʔełtł'ír Maın Settłıng Sump húlye beghálada xa, tu sureldhën kǫ́ę́ xa tth'ı tu benuzé tł'ır bet'á tu delk'al xa tth'ı hunıdhır xat'e, ʔeyı ʔerehtł'ís Aquatıc Effects Monıtorıng Program (tu/łu badı) hulye sí tth'ı nanet'ǫ xat'e, xél tth'ı ʔeyı dleze beghá net'ı xa hílchu nı tth'ı xa.

YATI DEZHÌLEA K'È ATI'È

The Snap Lake Mıne sǫǫ̀mbak'è goʔǫ sıı De Beers Canada Inc. gıts'ǫ hǫt'e, eyıts'ǫ danı̨hts'ı k'ambatsǫ̀ ts'ǫk'e Sǫǫ̀mbak'è gots'ǫ 220 gochı̨ goʔǫ̀. 2004 ekò De Beers sǫǫ̀mbak'è k'e eghàlagìde gha hę̀ʔę̀ gogedı t'à la wexè hogı̨hdè eyıxè ndè esaowodech'à gha nàowo gehtsı̨. 2007 dıı la wexè hoı̨wo xè 2030 gots'ǫ gık'e eghàlagìde ha. Łǫhdı̨ xo gots'ǫ̀ ndè esawòdech'à wexòets'ıhdì. Dıı nı̨htł'è ts'ehtsı̨ sıı 2011 edànanì la wek'e eghàlaı̨ts'ı̨da weghǫ nı̨htł'è hǫt'e.

2004 gots'ǫ dıı la ts'ǫ̀ hę̀ʔę̀ gots'edı ts'ǫ 32 edànì dıı la wexòedı ha eyıts'ǫ edànì wek'e eghàlats'ìde ha weghǫ nı̨htł'è ts'ehtsı̨ t'à wexòets'ıhdı ha. 2011 hò, honǫdaòts'ǫ̀ ıłè xo tą̨t'e nı̨htł'è ts'ehtsı̨ weghǫ gondı nı̨htł'è ts'ehtsı̨, k'àodee nı̨htł'è taı gehtsı̨ eyıts'ǫ łıwe gha k'àodee nı̨htł'è taı sìı gehtsı̨. Eyìı nı̨htł'è nek'ǫ̀ą̨ t'à atł'è sìı dıı nı̨htł'è weyìì whehchì.

Ndè wegondı nàts'ehtsı̨ nı̨dè, asìı hazhǫ ładı̨ xìdı hǫt'e, akıhò nı̨hts'ı sìı xìdı eyıxè achı̨ ahsı̨̀ ndè wegondı nàts'ehtsı̨ nı̨dè tı sìı wexìdı ha dìle. 2011 ndè wegondı nàts'ehtsı̨ hò, dìı hanı wegondı wegòts'ı̨ʔǫ

Nı̨hts'ı Edànahtso: Tłeh t'ala sìı wek'èk'ǫ̀ nı̨dè, wet'à tłehlo eyıts'ǫ tłeh wet'à ndè whekǫ̀ ayı̨̀hwhǫ hǫt'e. Sǫǫ̀mbak'è edàtłǫ tłehlo yehtsı̨ sìı eyìı tłeh wet'à dıı ndè whekǫ̀ ayı̨whǫ sìı wexèts'ıhdzà. Eyıts'ǫ dıı sǫǫ̀mbak'è wemǫ tłehlo edàtłǫ yehtsı̨ sìı wexèts'ıhdzà, tłehlo edànì wek'ewehts'ı sǫǫ̀mbak'è wemǫ nı̨hts'ı sıı ładı̨ ade ha. 2010 ts'ǫ 2011 ts'ǫ̀ tłehlo edàtłǫ wexìdzà sìı yazèa ı̨doo ajà, satsǫ̀ etłe eyıts'ǫ satsǫ̀behchı̨̀ edàtłǫ k'edè wets'ı̨ʔǫ netłǫ ajà.

Tıch'aàdìı Teè Nàdè: Yazèa ı̨doo ajà, akwełǫ̀ dìı wegondı nàts'ehtsı̨ hò ayìı wegòts'ı̨ʔǫ ghà ats'edı, dewa yìì gohłı̨ sìı, sìì netłǫ wendì, eyıts'ǫ 2011 Snap Lake teè yìì satsǫ̀ yazèa wegǫ̀t'ǫ. Dewa sìı yazèa wegohłı̨, edàtłǫ gohłı̨ ha ı̨łè sìı, yazèa netłǫ gǫ̀ǫ̀ wegǫt'ǫ, eyıts'ǫ sǫǫ̀mbak'è ndè gotł'a ts'ǫ̀ tı wek'enàetse kǫ̀ gots'ǫ tı weta dewa gohłı̨ nàgıhtale. Dìı hanì ładı̨ ade nehò łıwe gha esą̨nı̨le eyıts'ǫ Snap Lake tì asìı wek'e nàde sìı gıgha esą̨nı̨le. Eyıts'ǫ łıwe wendì ładı̨ hazhǫ wek'ats'ehtǫ, eyıts'ǫ tehtsàtsòa teè gotł'a ts'ǫ̀ nàdè sìı wek'ahòetǫ, ahsı̨̀ ı̨dı edlatłǫ xo gots'ǫ gındì ładı̨ ajà nìì gha wek'ahòetǫ, hanìkò sǫǫ̀mbak'è zǫ wet'à ts'edı ha dìì, tıa hazhǫ hanì lanì hazhǫ ełexèht'e. 2011 Snap Lake wetł'a ts'ǫ̀ tehtsà edàtłǫ ładı̨ nàdè sìı ek'èdaexo ts'ǫ ładı̨ ajà, eyıts'ǫ dìı sǫǫ̀mbak'è yazèa zǫ wet'à ładı̨ ajà. Eyıts'ǫ tehtsà hazhǫ ładı̨ teè gotł'a ts'ǫ̀ ehtł'è yìì nàdè sìı wek'ats'ehtǫ eyıts'ǫ wendì nàke eyıts'ǫ satsǫ̀ mǫhdaà yazèa nàtso wegogı̨hʔǫ.

Whàedǫ Goht'ǫ Whela K'è: 2011 sǫǫ̀mbak'è gà eyıts'ǫ xo tı̨lı̨ gà whàedǫ gokǫ̀k'è gohłı̨ wegogıhʔǫ sìı wexèlagıhdıle.

Tı K'etł'o (ndè goka tı edàtłǫ gohłį eyıts'ǫ edànahtso: Snap Lake edànì tı k'etł'o ładį at'į sìı, sǫǫ̀mbak'è edànì la k'e eghàlagìde ts'į̀ǫ̀ hǫt'e nį̀le, mǫht'aà edàgǫht'e wets'į̀ǫ̀ agǫ̀ht'e. Ndè esawòdech'à gha weghǫ nį̀htł'è hòlį hò, tı 3.3 5.5 ts'ǫ̀ ade ha hǫt'e gedı į̀lè, hanìkò tı nį̀hts'ı ts'ǫ̀ at'į sıı nàgıhtà t'à, 15 ts'ǫ̀ netłǫ ade ha hǫnı gedı į̀lè.

Tı eyıts'ǫ edànì ndè wegohłį (ndè gotì edàtłǫ eyıts'ǫ edànahtso): Kwe edàwhìt'į eyıts'ǫ akwełǫ̀ kwe edàtłǫ gohłį ts'edı į̀lè sìı eyìı gondı ładį ajàle. 2008 gots'ǫ tı netłǫgǫǫ̀ ndè gotł'a ts'ǫ̀ k'etł'o wegots'į̀hǫ̀ǫ 2002 edàtłǫ ts'edı į̀lè sìı weè?ǫ̀ gots'ǫ̀, wet'à dewa netłǫgǫǫ̀ gohłį eyıt'sǫ asìı sıı teè ts'òełè, hanìkò, edànì tı k'etł'o sìı 2008 edàts'edı į̀lè sìı yazèa ładį ajà, 2011 edàts'edı į̀lè sıı we?ǫ̀ ts'ǫ̀.

Asìı Yàeshe: 2008 hò sǫǫ̀mbak'è edaı̨cho ne ndè edaı̨cho wek'e eghàlagìde wek'egezhǫ gha wenı̨hchì gıhchì į̀lè. Ndè edaı̨cho wek'e eghàlats'ìdè yazèa nechalèagǫǫ̀ hǫt'e nǫ wek'ehòts'ıhzhà. Whatè k'e ewa gohłį sìı 0.5 zǫ dıı la gha ewa wet'àts'et'į, hanìkò, 1.6 h 2001 t'a ewa hatłǫ wet'àts'ı̨t'į. Achį akǫ ts'ǫ whatè ewas gohłį sìı wet'àts'et'į hale. Nı̨hts'ı wek'ewehts'ı wexèts'ıhdzà hò Alberta nı̨hts'ı edàtłǫ nàeta ha gedı sìı dìı hanı la gha eyıts'ǫ dìı hanı la k'e eghàlats'ìde nı̨dè, į̀łè sa ndè į̀łè ts'ǫ̀ wegondì nàgehtsı̨. Hazhǫ t'à, ewa wek'ewehts'į ndè į̀łè zǫ k'e gohłı̨le.

Tıch'aàdìı: 2011 k'e, ekwǫ̀, sahcho eyıts'ǫ nǫ̀gha netłǫ wek'ehòewhole wegògı̨?ǫ, hanìkò Bathhurst ekwǫ̀ netłǫle ajà gedı wets'į̀ǫ̀ hǫt'e tahkò. 2011 k'e nǫgeè eyıts'ǫ nǫ̀gha zǫ wegaht'į eyıts'ǫ ekwǫ̀ mǫhdaà eyıts'ǫ chı̨ą mǫhdaà sıı gìaı̨. Snap Lake tıch'aàdìı łǫ ładele, hanìkò 2011 k'e chı̨ą nàke, k'àmba į̀łè, tatsǫ̀, nǫgeè eyıts'ǫ nǫ̀gha hazhǫ sǫǫ̀mbak'è gà ełaı̨dè wegogı̨hǫ. Nǫdı eyıts'ǫ det'ǫchotsòa wegondı gıhchıle ajà, 2010 eyıts'ǫ 2011 kǫ̀ta done xè łets'àdı hò wedę̀ hò gedı t'à wedę ats'ı̨là, hanìkò Government of Northwest Terrıtorıes gha dìı wegondı nàts'ehtsı̨, wet'à asach'aǫdǫ wegondı wet'àget'į gha nàts'ehtsı̨.

Wek'èts'ı̨t'e Ha: Sǫǫ̀mba Nàledǫ Canada 2011 k'e nàowo łǫhdı̨ ghà asìı wek'agehtǫ į̀lè. Asìı hazhǫ weghǫ haı̨tı sìı wek'e hayagı̨htı hanìle dè wek'e eghàlagı̨da.

Edànì Senàgele Ha: Tıch'aàdìı teè nàde wexòedı gha ndè esawòdech'à la weghǫ xo tą̀t'e weghǫ nı̨htł'è gehtsı̨ sìı asìı hazhǫ hagode ha gedı į̀łè sìı hagojà. Eyıt'à edànì De Beers ndè senàgele ha gedı į̀lè sìı nezı̨ wek'è eghàlahoda xè, dìı gha edànì tı tah asìı weta àt'į sìı t'a wedànàhota. Dìı la ats'ǫ wek'e eghàlahòda.

Edànì Asìı Ładı̨ Aǫ̀ı̨: 2011 k'e edànì asìı ładı̨ adle ha nàowo holı̨ hò, adı̨ tı k'etł'o ha ndè gotł'a ts'ǫ̀ nı̨ı̨t'ıì gha gedı t'à hòlı̨, edànì tı wenìı whehchì xè tı k'etł'o gha senàdle ha, sı̨lai xo ts'ǫ̀ edànì wexòedı xè tıch'aàdìı teè nàde sìı edànì wegondı nàtsı̨ ha eyıts'ǫ sahcho weghà nàtsı̨ ha sìı į̀ła wek'e eghàlagìde ha.

TABLE OF CONTENTS

SECTION **PAGE**

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AAAQO	Alberta Ambient Air Quality Objectives
A/ARD	acid/alkaline rock drainage
AEMP	Aquatic Effects Monitoring Program
AMP	Adaptive Management Plan
ANFO	ammonium nitrate and fuel oil
AQEMMP	Air Quality and Emissions Monitoring and Management Plan
AQMP	Air Quality Monitoring Program
ARD	acid rock drainage
BCMOE	British Columbia Ministry of the Environment
BSMRP	bulk sample mine rock pad
C&R	Closure and Reclamation
CCME	Canadian Council of Ministers of the Environment
De Beers	De Beers Canada Inc.
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
e.g.	for example
EAR	Environmental Assessment Report
ELC	ecological land classification
EMP	Emissions Management Plan
EMS	Environmental Management System
ENR	Department of Environment and Natural Resources
ERP	Emergency Response Plan
ERT	Emergency Response Team
FAR	Fresh Air Raise
GHG	greenhouse gas
GNWT	Government of the Northwest Territories
Golder	Golder Associates Ltd.
i.e.	that is
INAC	Indian and Northern Affairs Canada
LSA	local study area
Mine	Snap Lake Mine
MSDS	Material Safety Data Sheets
MVEIRB	Mackenzie Valley Environmental Impact Review Board

MSS	main setting sump
MVLWB	Mackenzie Valley Land and Water Board
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
NWT	Northwest Territories
OSWRPKMP	Ore Storage, Waste Rock, and Processed Kimberlite Management Plan
PAG	potentially acid generating
pers. comm.	personal communication
PK	processed kimberlite
PM	particulate matter
PM_{10}	particulate matter nominally less than or equal to 10 micrometres (µm) aerodynamic diameter
$PM_{2.5}$	particulate matter nominally less than or equal to 2.5 µm aerodynamic diameter
PSP	permanent sample plot
QA/QC	quality assurance/quality control
RSA	regional study area
S27	Stream 27
S29	Stream 29
SHE OPs	Safety, Health, and Environment Operational Procedures
SLEMA	Snap Lake Environmental Monitoring Agency
SNP	Surveillance Network Program
SO_2	sulphur dioxide
TDG	transportation of dangerous goods
TDS	total dissolved solids
the Mine	Snap Lake Mine
TOC	total organic carbon
TSP	total suspended particulate
TSS	total suspended solids
VEC	valued ecosystem component
VMP	Vegetation Monitoring Program
WEMP	Wildlife Effects Monitoring Program
WMP	water management pond

UNITS OF MEASURE

%	percent
µg/L	micrograms per litre
$\mu g/m^3$	micrograms per cubic metre
µm	micrometres
cm	centimetre
ha	hectares
kg	kilograms
km	kilometres
km^2	square kilometres
kt/yr	kilotonnes per year
L	litres
L/s	litres per second
m	metres
$mg/dm^2/30d$	milligrams per square decimetre per 30 days
mg/L	milligrams per litre
mm	millimetre
ppmw	parts per million by weight

1 INTRODUCTION

De Beers Canada Inc. (De Beers) owns and operates the Snap Lake Mine (Mine). The Mine is located in the Northwest Territories (NWT) approximately 220 kilometres (km) northeast of Yellowknife and 30 km south of MacKay Lake (Figure 1-1).

An Environmental Assessment Report (EAR) for the proposed mine (De Beers 2002a) was completed and submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) in February 2002. The MVEIRB in turn completed a review, and recommended that the Mine proceed subject to the implementation of measures to mitigate environmental impacts (MVEIRB 2003). The MVEIRB's report and recommendation was submitted to the Minister of Indian and Northern Affairs (INAC) in July 2003 and received ministerial approval in October 2003. De Beers received the necessary Water License, Land Use Permit, Land Leases, and Environmental Agreement in May 2004 to begin construction and operation of the Mine. Operation of the Mine began in 2008 and is expected to continue until 2030.

1.1 ANNUAL REPORT REQUIREMENTS

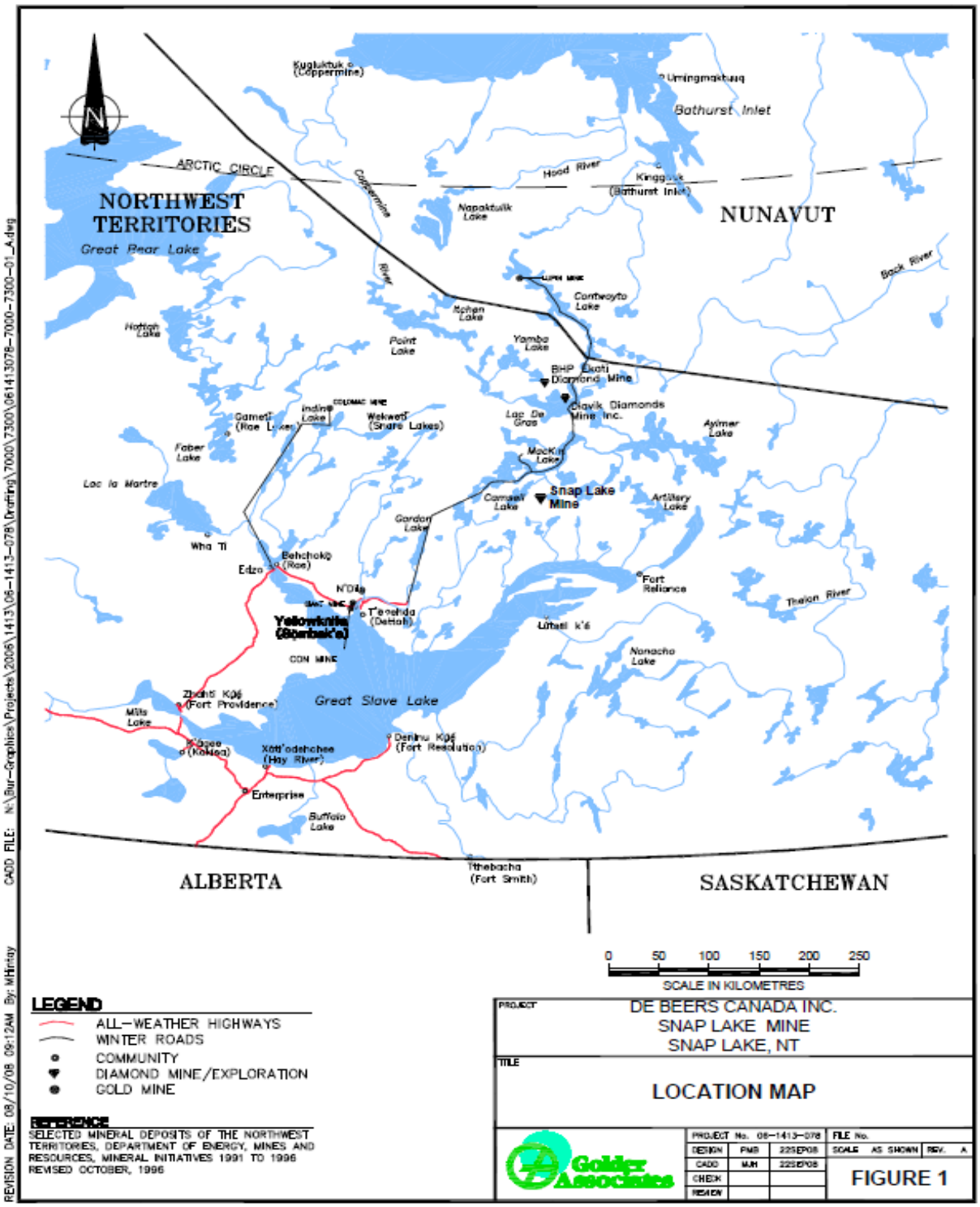
As part of its environmental agreement commitments, De Beers must prepare and submit an annual report outlining the results of the previous year's environmental monitoring programs. This report presents a summary of the results of the 2011 Snap Lake Environmental Monitoring Programs.

Article X, Section 10.1 of the Environment Agreement outlines the requirements for the Annual Report submission as follows:

10.1 Annual Report

a. *De Beers shall prepare and submit an annual report (the "Annual Report") to the Parties and the Monitoring Agency for each calendar year during the term of this Agreement.*

Figure 1-1 Location of Snap Lake Mine, Northwest Territories



Each Annual Report shall include the results of Environmental Monitoring Programs, and a rolling summary and analysis of environmental effects data over the life of the Project to illustrate any trends. The actual performance of the Project shall be compared to the results predicted in the environmental assessment and the MVEIRB Report and an evaluation provided as to how De Beers' Adaptive Management has performed to the date of each Annual Report.

b. Each Annual Report shall include, but not be limited to, the following:

i. a comprehensive summary of all supporting information, data and results from the Environmental Monitoring Programs and all studies and research;

ii. a comprehensive summary of all compliance reports required by the Regulatory Instruments;

iii. a comprehensive summary of operational activities during the preceding year;

iv. actions taken or planned to address effects or compliance problems which are set out in the Annual Report;

v. a comprehensive summary of operational activities for the next year;

vi. lists and abstracts of all Environmental Plans and Programs;

vii. verification of accuracy of environmental assessments;

viii. determination of effectiveness of mitigative measures;

ix. a comprehensive summary of all Adaptive Management measures taken;

x. a comprehensive summary of public concerns and responses to public concerns;

xi. a comprehensive summary of the new technologies investigated;

xii. the Minister's comments, including any Minister's Report, on the previous Annual Report;

xiii. a plain English executive summary and translations into Dogrib and Chipewyan using appropriate media.

c. In order to prepare each Annual Report and with a view to both ensuring that an opportunity is provided for early disclosure and discussion of problems and that each Annual Report meets with the requirements of this Agreement, De Beers shall Consult with the Minister, the Monitoring Agency, and the GNWT as De Beers compiles the information and data to be included in such Annual Report.

A summary of where the requirements of the Environmental Agreement are addressed in the 2011 Environmental Agreement Annual Report is provided in Table 1-1.

Table 1-1 Summary of the Environmental Agreement Annual Report Requirements and Sections Addressing Those Requirements in the 2011 Annual Report

Environmental Agreement Section	Requirement in the Environmental Agreement	Section in the 2011 Annual Report
Article X, 10.1, b	Each Annual Report shall include: • the results of Environmental Monitoring Programs • a rolling summary and analysis of environmental effects data over the life of the Mine • the performance of the Mine shall be compared to the results predicted in the environmental assessment and the MVEIRB Report	Section 2 – 2011 Environmental Monitoring Program Summary
Article X, 10.1, b	Each Annual Report shall include: • an evaluation provided as to how De Beers' Adaptive Management has performed to the date of each Annual Report	Section 8 - Summary of Adaptive Measures
Article X, 10.1,c,i	Comprehensive summary of all supporting information, data and results from the Environmental Monitoring Programs and all studies and research	Section 2 - 2011 Environmental Monitoring Program Summary Section 4 - 2011 Report Submissions
Article X, 10.1,c,ii	Comprehensive summary of all compliance reports required by the Regulatory Instruments	Section 5 - Summary of Compliance
Article X, 10.1,c,iii and v	Comprehensive summary of operational activities during the preceding year and next year	Section 6 - Summary of Activities at Snap Lake
Article X, 10.1,c,iv	Actions taken or planned to address effects or compliance problems which are set out in the Annual Report	Section 5 - Summary of Compliance
Article X, 10.1,c,vi	Lists and abstracts of all Environmental Plans and Programs	Section 3 - Summary of Snap Lake Monitoring and Management Plans
Article X, 10.1,c,vii	Verification of accuracy of environmental assessments	Section 2 - 2011 Environmental Monitoring Program Summary
Article X, 10.1,c,viii	Determination of effectiveness of mitigative measures	Section 7 - Summary of Mitigation Measures
Article X, 10.1,c,ix	Comprehensive summary of all Adaptive Management measures taken	Section 8 - Summary of Adaptive Measures
Article X, 10.1,c,x	Comprehensive summary of public concerns and responses to public concerns	Section 9 - Summary of Public Concerns
Article X, 10.1,c,xi	Comprehensive summary of the new technologies investigated	Section 10 - Summary of New Technologies Investigated
Article X, 101.1,c,xii	Minister's Report on the previous Annual Report	Section 1 - Introduction
Article X, 101.1,c,xiii	Plain English executive summary and translations into Dogrib and Chipewyan using appropriate media	Plain Language Summary
Article X, 101.1,d	De Beers shall Consult with the Minister, the Monitoring Agency, and the GNWT as De Beers compiles the information and data to be included in such Annual Report	Section 1.2 - Introduction

MVEIRB= Mackenzie Valley Environmental Impact Review Board; GNWT= Government of the Northwest Territories.

1.2 2010 ANNUAL REPORT

De Beers submitted the 2010 Annual Report to the Minister on March 31, 2011, and distributed it to all Parties and the Snap Lake Environmental Monitoring Agency (SLEMA). Concerns were raised by SLEMA, the Inspector, and AANDC concerning the water constituent in processed kimberlite slurry being pumped to the North Pile. De Beers Canada Inc. has responded to the concerns raised.

2 2011 ENVIRONMENTAL MONITORING PROGRAM SUMMARY

As required under Article X Section 10.1c (vii) of the Environmental Agreement, this section of the report provides a summary of the 2011 monitoring activities, observations, and comparisons of results with EAR predictions (Table 2-1).

Table 2-1 Summary of 2011 Snap Lake Mine Environmental Monitoring Programs

Program	Purpose of the Monitoring Program	Key Activities	Environmental Assessment Report Predictions	Key Results
Air Quality and Emissions Monitoring	Verify the accuracy of impact predictions made in the EAR and meet regulatory requirements and corporate commitments.	Meteorological and hydro-meteorological monitoring Ambient monitoring of TSP, PM10, and PM2.5 concentrations Ambient monitoring of dustfall GHG emissions calculations	The maximum predicted SO_2 and NO_X concentrations were predicted to be below both the applicable NWT air quality standards and the federal objectives. Since the bulk of mining will occur below ground in a wet environment, the particulate emissions are anticipated to be low relative to open-pit mining operations. The maximum 24-hour TSP, $PM_{10,}$ and $PM_{2.5}$ were predicted to be above applicable criteria within and near the active mine area; however, the annual concentrations of these compounds were predicted to be below the respective criteria. Activities and operations at the Mine will result in the emission of carbon dioxide and other GHGs. The overall GHG emissions (expressed as equivalent CO_2) from the Mine were projected to be 102 kt/yr.	Meteorological monitoring – Wind speed and wind direction were within the long-term averages for the area. Rainfall at Snap Lake was higher than the 30 year Yellowknife climate normals (1971 to 2000) through August, September and October, but was lower than Yellowknife normals throughout the rest of the year (Environment Canada 2012). The annual average temperature at Snap Lake in 2011 was -7.4°C, which was the coldest recorded annual average at the station. The temperature was 3.4°C colder than the long term average recorded at Yellowknife. The relative humidity followed the same pattern as the previous five years. Particulate monitoring – Consolidation of the 2011 particulate monitoring data indicate substantial challenges with the particulate monitoring program in 2011. Effort is currently under way to improve the success of the particulate monitoring program. Passive Monitoring – The highest monthly NO2 concentration was 16.2 µg/m3 observed May 17 to June 15 period at the Tank passive monitoring site located just west of the tank farm. This peak concentration falls well below the maximum desirable annual level of 60 µg/m3 set forth in the National Air Quality Objectives (Environment Canada 1981). The highest SO2 concentration monitored during 2011 was 1.9 µg/m3 and was observed twice. The two occurrences were observed during the February 15 to March 15 period and during the October 15th to November 15th period at the Tank passive monitoring site located west of the tank farm. This peak concentration falls well below the maximum annual average objective of 30 µg/m3 regulated by the GNWT (GNWT 2011). The peak concentration also falls below the maximum monthly average objective of 30 µg/m3 regulated by the Government of Alberta (Government of Alberta 2012). The comparison of monthly values to annual criteria for the GNWT is conservative as monthly criteria would be expected to be higher. Snap Lake Mine emissions – Fuel consumption was 30,760,346 litres of diesel with a sulphur content of 15 parts per million by weight. Waste oil consumption was 311,780 litres with an assumed sulphur content of 20,000 ppm by weight. Emission rates were generally higher in 2011 from 2010 estimates primarily due to more power generation and higher fleet use at the facility. All emissions remained well below the 2007 Air Modelling Update and all applicable criteria.
Aquatic Effects Monitoring	Verify the accuracy of impact predictions made in the EAR and meet regulatory requirements and corporate commitments.	Water and sediment quality monitoring Zooplankton and phytoplankton monitoring Benthic invertebrate monitoring Fish health special study Fish tasting Plume characterization special study	The maximum whole lake average concentrations in Snap Lake of all assessed water quality parameters will remain below water quality guidelines or EAR benchmarks. The maximum total area or volume that could be affected by seepage and runoff would be less than 0.5% of Snap Lake area or volume. The effect on sediment quality is expected to be negligible. Concentrations are expected to stay near baseline levels.	**Water Quality** In 2011 water quality measurements for individual parameters in Snap Lake were generally below water quality guidelines, EAR benchmarks, and Water License limits, with the exception of fluoride, which was routinely above the guideline for the protection of aquatic life (CCME 1999 with updates to 2012). Whole-lake average and maximum concentration of total dissolved solids (TDS) in Snap Lake was below the License limit of 350 milligrams per litre (mg/L) in 2011. The 2011 total phosphorus loading to Snap Lake from the sewage treatment system and water treatment plants was also below the Water License limit of 256 kilograms (kg). The 2011 Snap Lake results for TDS, major ions, nutrients and metals indicate that water quality was within maximum whole-lake average EAR predictions, with some exceptions. Whole-lake average concentration and cumulative loads of TDS from 2006 to 2011 were higher than predicted in the EAR. Occasional instances of copper and manganese concentrations from Snap Lake were above EAR predictions; however, whole-lake average concentrations were below EAR predictions. Based on the spatial pattern of treated effluent exposure, the source of the elevated manganese concentrations measured in the northwest are in 2011 was not likely the treated effluent from the water treatment plant. Elevated manganese concentrations in the northwest arm were more likely related to lower dissolved oxygen (DO) concentrations at this location, and the reduction of manganese to the more soluble form under such conditions. Manganese concentrations are not increasing over time and were not correlated with conductivity, but will continue to be monitored and reviewed. Similar to manganese, there were no spatial trends in copper concentrations to indicate that the source was treated effluent from the water treatment plant. Copper concentrations are not increasing over time, but will also continue to be monitored and reviewed. Concentrations and levels of water quality parameters in treated effluent discharges to Snap Lake in 2011 were below EAR predictions, with the exception of f low-weighted average concentrations of sulphate and beryllium. Detection limits for beryllium were greater than the maximum EAR predicted average, so the comparison should be interpreted with this limitation in mind. Sulphate concentrations have increased in Snap Lake; however, 2011 values were below the recommended drinking water guideline. The CCME does not recommend aquatic life criteria for sulphate. Because sulphate is a component of TDS (i.e., approximately 9%), it will be implicitly considered as a part of the ongoing aquatic toxicity testing being conducted to develop an appropriate site-specific, effects-based TDS water quality benchmark. Runoff volumes from all the surface monitoring locations were small compared to the volume of Snap Lake; therefore, changes in water quality in Snap Lake from runoff inflows are expected to be localized, temporary, and negligible relative to the changes from the treated effluent plume. At most stations, runoff samples were collected from small, isolated catchments with no observable flow and limited connectivity to Snap Lake or the inland lakes at the time of collection. The EAR predicted increases in concentrations of major ions, nutrients, and metals over time in Snap Lake due to discharge of treated effluent (De Beers 2002). In 2011, the parameters that appeared to be increasing in at least one area of Snap Lake were TDS, total alkalinity, total hardness,, bicarbonate, calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate, all monitored nitrogen parameters, barium, boron, lithium, molybdenum, nickel, rubidium, strontium, titanium, and uranium. Concentrations of the these parameters have not and are not expected to increase above water quality guidelines, EAR benchmarks, or EAR predictions in the near future, with the exception of fluoride. Future increases in fluoride are not likely to be a concern in Snap Lake as these increases will be accompanied by increases in calcium and hardness, which are expected to reduce the potential for toxic effects from fluoride. In addition, the British Columbia Ministry of the Environment (BCMOE) recently published new guidance on calculating aquatic life criteria for fluoride using hardness (BCMOE 2011). Using the formula provided, and a hardness of 120 mg/L, the BCMOE recommended aquatic life guideline is 1.4 mg/L. In comparison, the maximum fluoride concentration measured in 2011 was 0.17 mg/L and the Canadian Council of Ministers of the Environment (CCME) guideline for protection of aquatic life is 0.12 mg/L (CCME 1999 with updates to 2012). During 2011 and over the past several years, vertical patterns in field conductivity indicate that the effluent plume may no longer be sinking to the bottom of Snap Lake due to a lower density difference between the plume and lake water. Open-water profiles of conductivity indicate that the plume continues to be more evenly mixed throughout the water column during open-water conditions. In the EAR, parameter concentrations associated with the treated effluent discharge were conservatively predicted to reach background concentrations within 44 km of Snap Lake, assuming maximum concentrations during operations. In 2011, evidence of the treated effluent was measured throughout Lakes 1 and 2, and near the inlet of Lac Capot Blanc (Lake 3), which are immediately downstream, of Snap Lake. Concentrations of Mine-related constituents reached background concentrations approximately 6 km downstream of Snap Lake.
Aquatic Effects Monitoring (continued)			The effect of toxicity from changes in sediment and water quality on benthic invertebrates, phytoplankton, and zooplankton were predicted to range from	**Sediment Quality** Evaluation of spatial and temporal trends in sediment quality did not provide clear evidence of an effect on Snap Lake sediments in areas exposed to treated effluent. Concentrations of available phosphate continued to be elevated in the diffuser area following the large increase that occurred in 2008; concentrations decreased with increasing distance from the diffuser but were still higher than in 2007. Available phosphate concentrations should continue to be monitored for further spatial and temporal

Table 2-1 Summary of 2011 Snap Lake Mine Environmental Monitoring Programs (continued)

Program	Purpose of the Monitoring Program	Key Activities	Environmental Assessment Report Predictions	Key Results
			negligible to moderate. Snap Lake was predicted to remain mesotrophic (i.e., moderately productive). The effect of changes to Snap Lake and inland lakes and streams was predicted to be negligible for fish abundance and fish health. The permanent diffuser was expected to result in dilution factors that ranged from 34 to 200 across the range of effluent discharges expected over the life of the Mine.	changes. Overall, evaluation of spatial and temporal patterns in sediment quality did not provide clear evidence of an effect on Snap Lake sediments in areas exposed to treated effluent from the Mine. Ongoing sediment quality monitoring under the AEMP is expected to provide a more reliable indication of any potential effects on sediment quality in Snap Lake as the number of years of available data increases. If potential effects to sediment quality have occurred to date, they have been subtle and not clearly different than natural variability. Inclusion of Northeast Lake as a reference lake should still allow future comparisons of temporal trends between the two lakes, thereby controlling for long-term regional trends. **Phytoplankton/Zooplankton** Significant spatial and temporal variation in total phytoplankton biomass and community composition occur naturally in lakes, and have been observed in Snap Lake between 2004 and 2011. Trend analyses and multivariate analyses indicated that there has been a shift in plankton community composition, since 2004. Chlorophyll a results to date suggest that the trophic status of Snap Lake has not changed; however, this variable may not be an accurate surrogate of the Snap Lake phytoplankton community. At this time, continued monitoring of chlorophyll a concentrations is required by the Water License MV2001L2 0002 (Water License) Part G, Condition 2d. Currently, chlorophyll a is not recommended as a surrogate measure of the Snap Lake phytoplankton community, due to the poor correlation between chlorophyll a and total phytoplankton biomass. Calanoid copepods remain the dominant zooplankton group within Snap Lake, with seasonal changes occurring in the biomass of the cyclopoid copepods and rotifers. Cladocerans, commonly referred to as water fleas, continue to account for a relatively small proportion of the zooplankton community. A shift in biomass-based community composition has been documented in Snap Lake between 2004 and 2011. Although chlorophyll a and total phosphorus concentrations suggest that Snap Lake remains within the range of oligotrophic lakes, concentrations of total nitrogen were within the range of eutrophic lakes. Although the lake remains severely phosphorus limited, results suggest that the lake is becoming nitrogen enriched with continued discharges of treated effluent. Multivariate analysis and evaluation of trends suggest that the plankton community is experiencing mine-related effects consistent with nutrient enrichment and consistent with the EAR predictions. **Benthic Invertebrates** The benthic community of Snap Lake in fall 2011 was characterized by variable but low total density, low to moderate richness, and dominance by Chironomidae and Pisidiidae. This type of community is expected in the sub-Arctic region where Northeast Lake and Snap Lake are located (Beaty et al. 2006; Northington et al. 2010). Richness, diversity and evenness varied moderately, and density variables were highly variable. Biomass was typically low and highly variable among stations, and was positively correlated with total density. Station NEL01 in Northeast Lake and SNAP05 in the near-field area of Snap Lake had considerably higher total invertebrate density and biomass than all other stations sampled in 2011.Differences between Northeast Lake, and the near-field and far-field exposure areas in Snap Lake during fall 2011 in terms of taxa present were minor and not indicative of an adverse effect on the benthic community. Statistical tests comparing benthic community variables among sampling areas detected a significant difference only in Tanytarsus density. Despite large differences between the Northeast Lake and the two exposure areas in Snap Lake in mean total density and mean densities of individual taxa, statistical analyses detected only one significant difference, suggesting the sensitivity of statistical tests was low for density variables. The lower than expected sensitivity of statistical tests likely resulted from the highly variable data for density variables. Although statistical comparisons between Northeast Lake and exposure areas in Snap Lake provided limited evidence of effects on the benthic community of Snap Lake, visual evaluation of the differences in abundances of dominant taxa suggests a Mine-related enrichment effect. Higher total density and densities of the dominant taxa (Pisidiidae, Microtendipes, Valvata, and Procladius), in the near-field area in previous years (De Beers 2011) suggest that nutrient enrichment is occurring in this area. Higher total density and densities of dominant taxa were not as prevalent in the near-field area compared to Northeast Lake in 2011 due to unusually high densities at NEL01 in Northeast Lake, with only Pisidiidae density, Tanytarsus density, and Valvata density being higher in the near-field area. The higher densities at NEL01 are unusual for 2011 and it remains to be seen if this will continue in the future. In addition to the fall results, trends of increasing density and richness, and decreasing evenness in the near-field area over time based on late winter data (De Beers 2010) also indicate that the benthic community is changing over time in a direction consistent with nutrient enrichment. Multivariate analysis did not provide clear evidence of a mine-related effect on the benthic community of Snap Lake. The analysis identified some stations with unique communities, but it did not identify clusters of stations with similar communities at similar levels of exposure to the treated effluent. Reference stations and stations with varying levels of exposure to the treated Mine effluent were intermixed on the ordination plot. Results of multivariate analysis suggest that at this time, a factor other than the Mine discharge exerts a stronger influence on the benthic community structure, or the high variability in the data masks the effect of the Mine discharge. The overall magnitude of the effect on the benthic invertebrate community can be classified as low because no statistically significant differences were detected in total invertebrate density and richness in the 2011 data, and taxonomic composition of the community has not changed appreciably compared to baseline conditions. The observed low magnitude is consistent with EAR predictions of a negligible to low effect on the benthic invertebrate community in Snap Lake. **Fish Tasting** Fish tasting was conducted on September 7-8, 2011, by Elders Eddie Camille and Noel Drybones of the Lutsel K'e Dene First Nations, Ed Jones and Wayne Lagdenhan, North Slave Métis Alliance, Alfred Baillargeon and Mike Francis from Yellowknife Dene First Nations with SLEMA and De Beers and interpreters. Fish were caught using rod and tackle or nets. All participants reported that the fish tasted good and that the fish were very healthy, "Above Average" (very good) to "Average" (good).
Archaeology Monitoring	Verify the accuracy of impact predictions made in the EAR and meet regulatory requirements and corporate commitments.	Aerial archaeological survey	The probability that direct and indirect effects would occur to archaeology sites was rated as negligible.	There were no effects to the archaeology sites in the vicinity of the Mine and winter access road.

Table 2-1 Summary of 2011 Snap Lake Mine Environmental Monitoring Programs (continued)

Program	Purpose of the Monitoring Program	Key Activities	Environmental Assessment Report Predictions	Key Results
Hydrology Monitoring	Verify the accuracy of impact predictions made in the EAR and meet regulatory requirements and corporate commitments.	Lake water and inflow and outflow monitoring, collection of atmospheric data	The EAR predicted small increases in the mean water elevation of Snap Lake as a result of mining operations. Predicted increases above baseline conditions ranged from 3.3 to 5.5 cm over the period of operations. Increases in peak flow due to mine construction, during the spring runoff are predicted to be negligible, with no effect on channel morphology.	The results indicate that 2010 had low water levels and streamflows compared to previous years. This trend was also observed at nearby Water Survey of Canada hydrometric stations and was indicative of a regional trend. Snap Lake water levels continue to exhibit similar increases and decreases as other monitored lakes. The Environmental Assessment Report (EAR) predicted small increases in the mean water levels of Snap Lake as a result of the mining operations (De Beers 2002). Predicted increases above baseline conditions ranged from 0.033 metres (m) to 0.053 m over the period of operations. Annual changes in Snap Lake water levels remain similar to three other monitored lakes in the region. Changes in lake water levels from 2007 to 2009 were within a range of previously measured changes, and appear to be less than predicted in the EAR for the construction period and early years of operation. During 2010, the lake levels dropped to its lowest level since 2004 due to very low precipitation and high evaporation. The impact of mine activities on lake elevation remains small.
Hydrogeology and Geochemistry Monitoring	Verify the accuracy of impact predictions made in the EAR and meet regulatory requirements and corporate commitments.	Site-runoff monitoring, seepage and visual inspection of the site Supplemental sampling and geochemical analysis of mine rock	Geochemical characterization completed during the EAR demonstrates that the kimberlite unit at Snap Lake can be classified as non-PAG. During construction and operations, groundwater inflows to the underground mine workings are predicted to result in a minor decrease (up to 5%) in deep groundwater levels; however there will be little or no change in the overall quantity of deep groundwater is predicted. Groundwater levels are predicted to decrease progressively during Project construction and operations, but reverse within one month of mine closure. The residual changes in deep groundwater quality due to the underground mine are limited to a small portion (less than 5%) of the LSA during post-closure. No change was predicted to deep groundwater quality during construction and operations. Mine-affected groundwater was predicted to have a pH of 11.9 and elevated concentrations of aluminum (468 µg/L), chromium (313 µg/L), and molybdenum (81□ µg/L) relative to baseline groundwater quality. The high pH and elevated metal concentrations are expected to decline in the long-term; however, the duration is uncertain and could be much greater than 100 years. Changes in shallow groundwater quality are predicted to result from a small volume of seepage from the North Pile and the water management pond, resulting in localized effects, originating on the northwest peninsula and seeping into Snap Lake which are predicted to be greatest during operations, and decreasing after decommissioning as reclamation proceeds.	Minewater inflow rates were lower than predicted in the EAR during the 2011 monitoring period except for a brief period between November 14 and 26, 2011. Cumulative TDS loading trends from the mine were less than the EAR predicted values throughout the 2011 monitoring period. The geochemical assessment of granite, and kimberlite, has not changed as a result of the visual surveys or geochemical analysis of mine rock and confirmation geochemistry samples conducted in 2011 Granitic rock samples collected annually from areas of new construction contained less than 0.17% sulphide sulphur and with the exception of some rock observed at the FAR, no visible signs of sulphide oxidation or incipient ARD were observed in rock exposed in rock pads, roads, building foundations, and laydowns during the September 2011 site inspection. The understanding of the geochemical behaviour of metavolcanic rock has been substantially improved and enhanced through the supplemental testing completed on the remaining materials at the BSMRP in 2011. Based on the 2011 testing of metavolcanic rock, and the ongoing water quality monitored at the BSMRP it is considered unlikely that the remaining metavolcanic materials at the BSMRP will become acidic over the long term. The results of water quality analysis at most SNP monitoring stations, bogs, and seepage monitoring stations at the Mine were similar to those reported in previous monitoring seasons. Seepage from the North Pile could be resulting in elevated concentrations of nitrate, nitrite, and ammonia measured in downstream bogs, however overall discharge concentrations from treatment remain within discharge limits. Elevated concentrations of nitrate and ammonia were observed in the new monitoring locations in the bogs in the vicinity of the explosives storage facility.

Table 2-1 Summary of 2011 Snap Lake Mine Environmental Monitoring Programs (continued)

Program	Purpose of the Monitoring Program	Key Activities	Environmental Assessment Report Predictions	Key Results
Vegetation Monitoring	Verify the accuracy of impact predictions made in the EAR and meet regulatory requirements and corporate commitments.	Calculation of direct impacts to total area and ELC area Satellite data interpretation Reclamation Monitoring and Soil sampling Dust fall deposition monitoring	At full development, the EAR predicted a total disturbance of 218.8 ha in the LSA and 83.7 ha in the RSA (excluding the LSA). 39% of ELC units were predicted to be lost or altered in the LSA. Effects from habitat loss or alteration to rare plant potential were considered to be moderate, and effects on traditional plant potential were considered to be low. The effect of air emissions, including dust, on vegetation health were predicted to be low for the ELC components assessed and for rare and traditional plant health. The effect of the Mine on vegetation biodiversity was predicted to be low for all vegetation communities assessed.	A QuickBird satellite image was used to compare the total disturbance area in 2008 with predictions made in the EAR. Disturbance of the LSA and esker complex, as of July 2008, was 155.4 ha (11% of the LSA), which, to date, is below the predicted disturbance area, and therefore the Detailed ELC Monitoring Program is not triggered and modifications to the monitoring program are not needed at this time. Estimates of the disturbance to ELC units were calculated by using both Landsat Thematic Mapper in 2002 and QuickBird satellite imagery in 2008 to compare the Mine footprint with the vegetation types known to be present before start-up construction of the Mine. At full development, there is a predicted total disturbance of 218.8 ha in the LSA and 83.7 ha in the RSA, excluding the LSA. The RSA disturbance consists of the impact to the esker borrow site and associated winter esker access road, and the 35 km winter access Snap Lake Spur Road to the Tibbitt-to-Contwoyto winter road. The total area occupied or impacted by the LSA on July 2008 was 155.4 ha, which represents 71% of the maximum predicted extent of the Mine. For the RSA, construction activities have impacted 2.5 ha or 3% of the expected disturbed area. None of the ELC units have received a greater proportionate disturbance than predicted in the EAR as of July 2008, with the exception of the esker complex. As reported in previous VMPs, the area of disturbance to the esker was expected to be 0.5 ha; however, the actual disturbance was 1.6 ha. Granular material was removed from this esker in the winter of 2000-2001. No further disturbance to this esker is anticipated and none was recorded as occurring up to 2008. Overall, the disturbance covers 11% of the LSA which is below the predicted 15%. The Detailed ELC Monitoring Program is not triggered and modifications to the monitoring program are not needed at this time. During the 2004 and 2005 field surveys, 11 PSPs were established at existing disturbed sites to determine the rate and effectiveness of natural recovery as a revegetation method (i.e., natural revegetation relying on invasion or colonization by local species). Disturbed sites included the quarry at the esker, the air strip, and the old base camp. The established PSPs were assessed in 2008 and a total of 59 plant species naturally colonized the reclamation PSPs; an increase of five additional species from 2006. These plant species were similar to the plant species observed in the control and treatment PSPs for the Triggered Monitoring Programs. Due to the slow growth rates and colonization of vegetation in the arctic, reclamation surveys are not required annually. Reclamation PSPs were surveyed in 2008 and will be surveyed every five years thereafter. They will be assessed for changes in vegetation community composition and changes in soil properties or chemistry over time. Monthly dustfall samples were collected in the months of January to December, excluding May. The maximum deposition rate of 165 milligrams per square decimetre per 30 days (mg/dm²/30d) was recorded at DF008 in June/July 2011. The rest of the dustfall deposition rates were low in January and were within the Alberta Ambient Air Quality Objective (AAAQO) (AENV 2005). Only one sample exceeded the 158 mg/dm²/30d guideline for commercial and industrial properties. These results cannot be used solely to ascertain whether dustfall is affecting vegetation communities. The Alberta dustfall criteria were developed in 1975 to address aesthetic concerns associated with elevated dustfall levels (Fu 2006, pers. comm.). However, there are no scientifically defensible relationships between these dustfall criteria and discernible effects on vegetation communities. Vegetation is inspected visually to assess impacts of dustfall on vegetation. However, a structured and focused visual inspection of dustfall on vegetation was not conducted in 2010. A comprehensive study will be conducted again in 2013 or earlier if De Beers observes substantial dust accumulation and/or stressed vegetation in the interim.
Wildlife Effects Monitoring	Verify the accuracy of impact predictions made in the EAR and meet regulatory requirements and corporate commitments.	A comprehensive analysis conducted on data conducted to date (2004 to 2007) Surveys specific to each of the VEC species to assess changes to abundance and distribution On-site monitoring and wildlife management to avoid and document wildlife injuries and mortalities	Based on estimates of home range size and the area of the Mine lease in which wildlife habitat will be disturbed, the effect of direct habitat loss was predicted to be low for each of the current VEC species (i.e., <1% for caribou, grizzly bears, and wolves; <5% for waterfowl; <10% for wolverines; and 22% for falcons). The effect of indirect habitat loss on VEC species from dust was predicted to be low. The effects of blasting, human, vehicle and aircraft traffic, habitat fragmentation, and increased access on wildlife movement and behaviour was expected to be negligible to low for all VEC species. The effects of wildlife attraction, wildlife-human interactions, vehicle collisions, toxic spills, and increased access for hunting and trapping on wildlife abundance were predicted to range from negligible to moderate for VEC species. Moderate effects were predicted for raptors, wolverines, and barren ground grizzly bears.	So far, the effects of the Snap Lake Mine to wildlife have been within the range predicted in the Environmental Assessment Report (De Beers 2002). In 2011, the measures for caribou and bears indicated low levels of activity by these species. Further data collection and more comprehensive data analyses in the next comprehensive report will help to determine if these changes are related to the Mine, or natural factors. It is likely that some of these changes are influenced by the decline in the Bathurst caribou herd, and the bears, wolverine, and wolves that depend on caribou. Wildlife habitat loss due to the expanding Mine footprint mine has occurred as expected, and the Mine is currently about 71 percent (%) of its total predicted size. Further habitat loss will occur as the waste rock storage at the North Pile expands but this expansion is not expected to increase the size of the footprint. Incidents are any wildlife interaction that requires a response by Mine personnel, and may range from simple deterrent actions to the injury or death of an animal. De Beers environmental staff report all wildlife incidents, and follow written procedures. In 2011, there were eight wildlife incidents at the Mine, seven mortalities and one deterrence. These incidents involved a red fox, three songbirds, one ptarmigan, one raven, one male caribou and a wolverine. In 2011, a red fox, a ptarmigan, and two songbirds, and raven were all found dead within the Mine footprint. Worker education and good waste management are considered essential in limiting wildlife incidents

A/ARD = acid/alkaline rock drainage; AN = Ammonium Nitrate; AEMP = Aquatic Effects Monitoring Program; ANFO = ammonium nitrate and fuel oil; CCME = Canadian Council of Ministers of the Environment; CO_2 = carbon dioxide; DO= dissolved oxygen; EAR = Environmental Assessment Report; ELC = ecological land classification; FAR = fresh air raise; GHG = greenhouse gas; ha = hectares; ISQG = Interim Sediment Quality Guidelines; kg = kilograms; kt/yr = kilotonnes per year; L = litre; LSA = local study area; m = metre; mg/dm²/30d = milligrams per square decimetre per 30 days; mg/L = milligrams per litre; PM_{10} = particulate matter with particle diameter nominally smaller than 10 micrometres (µm); $PM_{2.5}$ = particulate matter with particle diameter nominally smaller than 2.5 µm; ppmw = parts per million by weight; NO_2 = nitrogen dioxide; PAG = potentially acid generating; PK= processed kimberlite; PSPs = permanent sample plots; RSA = regional study area; SO_2 = sulphur dioxide; TDS = total dissolved solids; TKN = Total Kjeldahl Nitrogen; TOC= total organic carbon; TSP = total suspended particulate; VEC = Valued Ecosystem Component; VMP = Vegetation Monitoring Program; WMP = Water Management Pond; WTP = Water Treatment Plant; < = less then; % = percent; µg/L = micrograms per litre; µg/m³ = micrograms per cubic metre.

3 SUMMARY OF SNAP LAKE MONITORING AND MANAGEMENT PLANS

De Beers has developed a total of 25 compliance reports (11 Monitoring Programs [Section 3.1] and 14 Management Plans [Section 3.2]) for the Mine to meet the requirements under its regulatory approvals and corporate commitments. The monitoring programs were developed to verify the impact predictions made in the Mine's EAR (De Beers 2002a) for the construction, operation, and closure phases of the Mine. The management plans were developed to outline operational practices and procedures for mitigating impacts associated with the Mine.

This section contains a brief summary of each of the monitoring and management plans that De Beers has produced as part of their regulatory and corporate commitments. The monitoring and management requirements, submission dates, approvals, and status are listed in Table 3-1.

Table 3-1 Summary of Compliance Reports Required Under the Snap Lake Mine's Regulatory Approvals

Compliance Reports	Source of Requirement	Current Submission Date	Approval Date	Status	Annual Report Section
Adaptive Management Plan (AMP)	Water License Part B, Item 5u, Item 12, and Item 13	May 2011	N/A	In compliance. Updates to the AMP are to be provided in the Water License Annual Report. To date, updates have not been necessary.	Section 3.2.1
Air Quality Monitoring Program (AQMP) and Emissions Management Plan (EMP)	Environmental Agreement, Article VI, Section 6.3d and e and Article VII, Section 7.2a Water License, Surveillance Network Program (SNP), Section D, Item 1, 2 and 3	November 2, 2009	August 25, 2008	In compliance. This document was submitted to the GNWT (ENR), AANDC, SLEMA and Environment Canada as one Plan known as the Air Quality and Emissions Monitoring and Management Plan (AQEMMP). Comment was received in February 2007. A meeting between Golder, De Beers and ENR occurred on March 6, 2007. Final revisions are being completed.	Section 3.1.1 and Section 3.2.2
Aquatic Effects Monitoring Program (AEMP)	Water License, Part B, Item 5t, and Part G Environmental Agreement, Article VII, Section 7.2h	March 31 Annually	No response	In compliance. Under the Water License, the AEMP will be reviewed every five years.	Section 3.1.2
Best Management Practices Plan for Ammonia Source Control	Water License, Part F, Item 23	November 29, 2004	N/A	In compliance. De Beers submitted a letter to the MVLWB outlining the Best Management Practices for Ammonia Source Control. This plan is currently under review by De Beers Canada.	Section 3.2.3
Interim Closure and Reclamation (C&R) Plan "Revision A"	Water License, Part I, Item 1 and 2 Land Use Permit, Part C, Item 74	January 28, 2006	May 31, 2006	In compliance. The C&R Plan will continue to be updated and refined as the Mine approaches final closure in approximately 2030.	Section 3.2.4
Compensation Design Plan and Construction TSS Monitoring Program for the Water Intake and Minewater Outlet	Fisheries Authorization 4.3	June 7, 2005	July 23, 2005	In compliance. No update or changes required at this time.	Section 3.1.3
Construction and Monitoring Program for S27	Fisheries Authorization 4.3	March 2, 2006	April 15, 2006	In compliance. No update or changes required at this time.	Section 3.1.4
Domestic Waste and Sewage Management Plan	Water License, Part E, Item 10 Environmental Agreement, Article VI, Section 6.3a(v)	February 5, 2010	March 29, 2010	In compliance. Plan was submitted in January and reviewer comments will be incorporated into the document as required.	Section 3.2.5

Table 3-1 Summary of Compliance Reports Required Under the Snap Lake Mine's Regulatory Approvals (continued)

Compliance Reports	Source of Requirement	Current Submission Date	Approval Date	Status	Annual Report Section
Emergency Response Plan (ERP)	Water License, Part H, Item 1 Land Use Permit, Part C, Item 77 Environmental Agreement, Article VI, Section 6.3a(iii)	June 12, 2009	No response	In compliance. The ERP is reviewed annually. Modified ERPs will be submitted as necessary to reflect new developments and comments from reviewers. This plan is currently under review by De Beers Canada.	Section 3.2.6
Environmental Health Monitoring Program	Environmental Agreement, Article VII, Section 7.2d	September 30, 2003	N/A	This Plan currently does not require approval. It is a trigger program that will not be activated unless dustfall amounts monitored through the AQEMMP are greater than EAR predictions for three consecutive months.	Section 3.1.5
Fish Health Monitoring Plan	Fisheries Authorization 5.8	June 2009	June 2009	The Fish Health Monitoring Plan was incorporated into the AEMP. Discussions regarding the path forward with fish health are in progress with DFO. Interim approval only.	Section 3.1.2
Groundwater Quantity and Quality Monitoring Program	Water License, Part F, Item 5 and 6	September 15, 2005	October 24, 2005	In compliance. Updates to Groundwater Quantity and Quality Monitoring Program are to be provided in the Water License Annual Report. To date, no updates have been necessary.	Section 3.1.6
Hazardous Materials Management Plan	Water License, Part E, Item 14	June 9, 2010	June 9, 2010	Plan was submitted in November and reviewer comments will be incorporated into the document as required.	Section 3.2.7
High TDS Response Plan	Fisheries Authorization 5.6.5	N/A	N/A	Not required unless TDS exceeds 350 mg/L in Snap Lake at any depth during three consecutive sampling events.	N/A
Hydrology Monitoring Program	Environmental Agreement, Article VII, Section 7.2g	July 2009	N/A	This Plan is currently under De Beers review to reflect the hydro-meteorological program.	Section 3.1.7
North Pile Monitoring Program	Environmental Agreement, Article VII, Section 7.2e	N/A	N/A	This Plan is included as part of the North Pile Management Plan. Currently being updated by De Beers.	Section 3.2.8
North Pile Management Plan	Water License, Part E, Items 3-8 Environmental Agreement, Article VI, 6.3a (vii)	July 2012	N/A	This Plan is currently being reviewed by De Beers. Updated by De Beers in July 2012.	Section 3.2.8

Table 3-1 Summary of Compliance Reports Required Under the Snap Lake Mine's Regulatory Approvals (continued)

Compliance Reports	Source of Requirement	Current Submission Date	Approval Date	Status	Annual Report Section
Quality Assurance/Quality Control Management Plan	Water License- SNP- Part B- Items 23 to 25	March 22, 2006	April 30, 2006	In compliance. This Plan is reviewed annually and modified as necessary under the Surveillance Network Program.	Section 3.2.9
Quarry Management Plan	Environmental Agreement, Article VI, Section 6.3a (vi) Land Use Permit Part C Item 6	N/A	N/A	The Quarry Management Plan was submitted as part of the EAR (Appendix III.5). To date the Quarry Management Plan has not been updated because De Beers does not intend to quarry the esker. A Quarry Management Plan will be designed before the esker is excavated.	Section 3.2.10
Reclamation Research Plan	Water License - part I, Item 6	January 28, 2006	May 31, 2006	In compliance. Submitted as part of the C&R Plan.	Section 3.2.4
Restoration Plan	Land Lease Item 15	January 28, 2006	May 31, 2006	In compliance. Submitted as part of the C&R Plan.	Section 3.2.4
Sampling Plan for TDS, Calcium, and Chloride	Fisheries Authorization 5.6 Water License, Part F, Item 12	March 17, 2005	February 21, 2006	In compliance.	Section 3.2.11
Spill Contingency Plan	Water License, Part H- Item 1 Land Lease, Item 45 Land Use Permit, Part C, Item 77 Environmental Agreement, Article VI, Section 6.3a (ii)	February 2012	No formal response	In compliance. The Spill Contingency Plan is reviewed annually. Modified Spill Contingency Plans will be submitted as necessary.	Section 3.2.12
Vegetation Monitoring Program	Environmental Agreement, Article VII, Section 7.2b	April 1, 2005	November 2009	The VMP has never been approved. De Beers is in the process of updating the document to incorporate changes suggested by the GNWT and Environment Canada for the AQEMMP that directly link to the VMP.	Section 3.1.9
Water Intake Monitoring Program	Fisheries Authorization 5.0	May 31, 2005	July 22, 2005	In compliance. This Plan was approved by DFO.	Section 3.1.10
Water Management Plan	Water License- Part F, Item 4 Environmental Agreement, Article VI, Section 6.3a(iv)	June 3, 2010	July 23, 2010	In compliance. This Plan was approved July 2010.	Section 3.2.13

Table 3-1 Summary of Compliance Reports Required Under the Snap Lake Mine's Regulatory Approvals (continued)

Compliance Reports	Source of Requirement	Current Submission Date	Approval Date	Status	Annual Report Section
Wildlife Management Plan	Environmental Agreement, Article VI, Section 6.3a(ix), f, and g	November 30, 2007	Under De Beers review	De Beers re-submitted in November 2007 after responding to comments received in February 2007. Additional comments were received in February 2007. These are currently under De Beers review.	Section 3.2.14
Wildlife Effects Monitoring Program	Land Use Permit, Part C, Item 36 Environmental Agreement, Article VII, Section 7.2c	November 2009	N/A	The Plan has not received comment from the GNWT. A WEMP update is being prepared for submission in 2013.	Section 3.1.11

(a) Regulatory Requirements are as follows: Mackenzie Valley Land and Water Board Class A Water License MV20001L2-0002 (issued April 2004); Environmental Agreement (issued May 2004); Type "A" Land Use Permit (issued June 2004); Northwest Territories Land Lease #75m/10-1-2, #75m/10-2-2; 75 m/10-3-2; #75m/10-4-2 (issued June 2004); DFO Fisheries Authorization SC00196 (updated August 2006); DFO Approval of Fish Screen for the Temporary Water Intake SC99123-A2 (issued September 2004); DFO Approval for Permanent Water Intake SC00196-7.1 (issued August 2004).

GNWT = Government of the Northwest Territories; INAC= Indian and Northern Affairs Canada; SLEMA= Snap Lake Environmental Monitoring Agency; MVLWB = Mackenzie Valley Land and Water Board; S27 = Stream 27; TSS = total suspended solids; EAR = Environmental Assessment Report; DFO = Fisheries and Oceans Canada; TDS = total dissolved solids; mg/L = milligrams per litre; N/A = Not Applicable.

3.1 MONITORING PROGRAMS

3.1.1 Air Quality Monitoring Program

The Air Quality Monitoring Program (AQMP) is a requirement of Article VI, Section 7.2 a) of the Environmental Agreement and Section D (Surveillance Network Program [SNP]), of the Mine's Water License.

The initial draft of the AQMP was prepared in September 2003 and updated in September 2005 based on feedback from the GNWT and Environment Canada. A draft of an Emissions Management Plan (EMP) was submitted to the GNWT ENR and Environment Canada in February 2006, and based on feedback received in April and August 2006, these two documents were harmonized into one document, the Air Quality and Emissions Monitoring and Management Plan (AQEMMP) to demonstrate the linkages between the two programs. The data from the two programs will be presented together each year in the annual report.

3.1.2 Aquatic Effects Monitoring Program

The AEMP is a requirement of the Water License and Environmental Agreement. A draft AEMP was submitted to the MVLWB in July 2004 and an updated AEMP was submitted in June 2005. This Plan was approved in July 2005.

The purpose of the AEMP is to meet requirements in Part G of the Water License, Section 7.2h) of the Environmental Agreement, related corporate commitments, and to compare Mine-related effects with EAR predictions. Mine monitoring will measure future changes in water and sediment quality, including dissolved oxygen concentrations within Snap Lake, and effects to the following biological receptors:

- fish health;
- fish taste;
- benthic invertebrate community;
- phytoplankton and zooplankton communities; and
- fish habitat.

The primary study area is Snap Lake, which receives treated effluent from the combined water treatment plant and domestic waste water treatment plant discharges. A reference lake (Northeast Lake) was selected in November 2005 and

was approved by the MVLWB in May 2006. It is sampled as part of the annual AEMP field program.

De Beers submits an Annual Report for the AEMP as part of the Water License Annual Report to the MVLWB and Fisheries and Oceans Canada (DFO) by March 31 of each year. This Annual Report describes the AEMP activities that took place in the previous year, including monitoring results for all components listed above and any special studies as required.

3.1.2.1 Water and Sediment Quality

The principal objective of the water and sediment quality component of the AEMP is to provide information that will allow De Beers to evaluate changes in water and sediment quality of Snap Lake resulting from the construction, operation, and closure of the Mine. This component of the AEMP focuses on monitoring and analysis of changes in concentrations of specific parameters in the water column (water quality) and lake bottom sediments (sediment quality).

The focus of the water quality program is changes in the following four parameter types:

- nutrients;
- dissolved oxygen (DO);
- total dissolved solids (TDS) and major ions; and,
- metals, ammonia, nitrate, and other contaminants.

The sediment quality program monitors for changes in the following parameters in lake bottom sediments:

- nutrients;
- total metals; and,
- particle size and total organic carbon (TOC).

3.1.2.2 Fish Health

The principal objective of the fish health component of the AEMP for the Mine is to answer the study question: “Will fish health be affected by the changes in water quality in Snap Lake and will any change be greater than that stated in the EAR?” This question is related to the following direct effects:

- lake-wide increases in TDS;
- slight increases in the concentration of hexavalent chromium in the mixing zone and, potentially, in sediments; and,
- reduced DO concentrations during winter in deeper areas of Snap Lake.

3.1.2.3 Benthic Invertebrates

The principal objective of the benthic invertebrate community component of the Mine AEMP is to answer the following questions:

- Was the benthic invertebrate community affected by the changes in water and sediment quality in Snap Lake?
- If the benthic invertebrate community was affected, was the change greater than that stated in the EAR?

Effects monitoring for benthic invertebrates includes:

- statistical comparisons of benthic invertebrate summary variables between near-field and mid-field exposure areas of Snap Lake, and Northeast Lake (reference lake);
- statistical evaluation of differences among years for benthic invertebrate summary variable;
- multi-variate statistical evaluation of potential differences in community structure between Snap Lake and Northeast Lake; and,
- qualitative evaluation of temporal trends in Snap Lake to evaluate whether observed trends in the benthic invertebrate community are consistent with Mine discharge-related effects.

3.1.2.4 Phytoplankton and Zooplankton

Both phytoplankton and zooplankton (plankton) communities can be useful indicators of environmental stress because of their rapid turnover times. However, the inherent variability within the plankton community poses a challenge and a limitation to its usefulness as a monitoring tool. The existing dynamics of the Snap Lake plankton communities, like all Arctic lakes, are not well understood. Therefore, the purpose of the plankton component of the AEMP is to collect data annually, with particular emphasis on assessing the following variables within Snap Lake during the open-water season:

- Phytoplankton and Zooplankton community composition, abundance, and biomass;
- Picoplankton (Small phytoplankton) and flagellated phytoplankton abundance; and,
- Concentrations of microcystin, which is a cyanotoxin.

3.1.2.5 Fish Tasting

Fish tasting is an informal annual gathering of members of Aboriginal organizations and De Beers' staff at the Mine site to taste fish from Snap Lake. The principal objective of the fish tasting is to determine if the flavour and texture of the fish in the lake is acceptable to community members.

3.1.3 Compensation Design Plan and Construction Total Suspended Solids Monitoring Plan for the Water Intake and Mine Water Outlet at Snap Lake

As part of the Mine, De Beers constructed two structures in Snap Lake on the northwest peninsula:

- a water intake to draw freshwater from Snap Lake for camp use; and,
- a mine water outlet to discharge treated effluent from the water treatment plant and the domestic waste water treatment plant into Snap Lake.

Fisheries and Oceans Canada (DFO) issued an Authorization for Works or Undertakings Affecting Fish Habitat (SC00196) for the Mine in 2004, which was subsequently updated in 2006. This Fisheries Authorization (SC00196) contains requirements for addressing the fish habitat losses and gains during the Mine's construction. Section 4.3 of the Fisheries Authorization requires that De Beers submit a Compensation Design Plan for each of the fish compensation works for the Mine. The Compensation Design Plan is to contain the following elements:

- a description of activities for the construction of the water intake and mine water outlet in relation to fish habitat compensation works;
- detailed engineering designs;
- general schematics of final designs;
- construction schedule;
- contingencies for construction activities; and,

- a summary of how De Beers has incorporated comments from Aboriginal groups into the Plan.

Section 3.0 of the Fisheries Authorization requires that De Beers mitigate against the harmful alteration, disruption or destruction of fish habitat beyond that which is named in the Fisheries Authorization. Construction activities that take place in and near water may have the potential to increase TSS, which may affect fish habitat as silt is deposited on the lake bottom (a process referred to as sedimentation). Sections 18 and 19 of the SNP of the Water License requires that TSS and turbidity be monitored during construction of the water intake and mine water outlet in the vicinity of SNP Station 02-22 (mine water outlet) and SNP Station 02-23 (water intake). These sections of the Water License also specify that the manner and frequency of sampling be established by DFO.

These monitoring requirements are addressed in the Construction TSS Monitoring Plan, which is part of the Compensation Design Plan for the water intake and mine water outlet. This plan outlines the approach to measure and monitor the level of suspended sediments in Snap Lake near the water intake and mine water outlet during construction, including monitoring the effectiveness of TSS control measures (silt curtains). It also identifies conditions under which additional mitigations are required. This consolidated plan was submitted to DFO in June 2005 and was subsequently approved in July 2005.

Data sheets and photographs obtained to document functioning of the silt curtains will be retained on-site. Water quality data collected at these SNP stations will be reported to the MVLWB in the De Beers monthly SNP report.

3.1.4 Construction and Monitoring Plan for Stream 27

As discussed in Section 3.1.3, compensation for habitat losses is required under Section 4.3 of the Fisheries Authorization (SC00196) for the Mine. The construction of a sedimentation pond berm for the North Pile will eliminate the flow from Inland Lake 6 to Stream 29 (S29) for the life of the Mine; with flow being restored at Mine closure.

To compensate for the temporary loss of habitat in S29, De Beers has proposed undertaking habitat compensation activities in Stream 27 (S27). Activities proposed in S27 (i.e., removal of fish migration barrier), would result in the creation of access to new stream habitat to fish from Snap Lake, and would minimize the disturbance to existing fish habitat. An increase in foraging, spawning, rearing, and nursery habitat for Arctic Grayling is expected with the removal of the blockage, for a total increase of 225 habitat units. The proposed habitat compensation at S27 was the option

preferred by Aboriginal groups that visited the site in July 2004 and was also acceptable to DFO during a site visit in August 2005.

The Construction and Monitoring Plan for S27 was submitted March 2006 to DFO and approved in April 2006. This plan contains a description of the pre-construction monitoring of S27, construction activities in the stream, and post-construction monitoring to achieve the physical and ecological criteria for the habitat compensation program success (as outlined in Appendix I of Construction and Monitoring Plan for S27). The physical habitat alteration will be deemed successful if:

- the blockage is manually removed such that there is surface water sufficient for fish passage along the area of the blockage of S27 from IL10 to Snap Lake for a period greater than 5 days during freshet; and,
- the channel size in the area of the blockage is approximately 0.25 metres (m) wide (wide enough for an adult fish to pass).

The removal of the blockage in S27 will be considered to be successful in creating fish habitat from an ecological perspective if:

- Arctic Grayling, identified by life stage if possible, are found above the former area of the barrier after the initial 5 days of freshet or other life stages of fish are identified during other periods; and,
- no adult Arctic Grayling are observed stranded above the blockage during the late June survey.

The blockage in S27 was removed manually in September 2006, and plant material and rocks were removed from the stream bed and/or relocated within the stretch of the stream to construct a channel that is approximately 0.25 m wide to allow adult fish passage. Section 4.6 of the Mine's Fisheries Authorization, requires that an as-built report be submitted within six months of the completion of the construction works in the stream. The as-built report for S27 was submitted in July 2007.

The blockage to S27 was successfully removed in September 2006. At the same time, channel modifications were made above the blockage and a rock weir at the outlet of IL10 was constructed. This weir will serve to prolong the period of freshet and ensure adequate flows during Grayling spawning, incubation and early life stages. Post-construction monitoring occurred during the spring of 2007. Results of pre- and post-construction monitoring were reported to DFO in October 2007. In 2008, De Beers monitored Stream 27 to ensure there were no obstructions.

3.1.5 Environmental Health Monitoring Program

The draft Environmental Health Monitoring Program was submitted to the GNWT and Environment Canada in September 2003. The objective of the Environmental Health Monitoring Program is to respond to triggers initiated from the air quality component. If dustfall monitoring conducted as part of the AQMP (i.e., the updated AQEMMP) shows dust amounts greater than predicted in the EAR (De Beers 2002a) and the Alberta guideline (AENV 2011; since there is no NWT standard for dustfall) for more than three consecutive months, the Environmental Health Monitoring Program would be activated. If triggered, the Program is also designed to evaluate the potential uptake of chemicals from dust into plants and snow, and subsequent ingestion by wildlife (the chemical analysis is collected as part of the Vegetation Monitoring Program [VMP]).

The following components are included in the Environmental Health Monitoring Program:

- uptake of metals and polycyclic aromatic hydrocarbons in vascular plants and deposition to lichens;
- deposition of dust on snow; and,
- a wildlife health risk assessment.

At this time the Environmental Health Monitoring Program has not been triggered and therefore, the Plan has not been updated. The results of the Environmental Health Monitoring Program will be part of the annual environmental monitoring report for the Environmental Agreement for the year in which monitoring activities are conducted.

3.1.6 Groundwater Quantity and Quality Monitoring Program

As required by the Water License, the Groundwater Quantity and Quality Monitoring Program was submitted to the MVLWB in August 2004, and subsequently updated from regulatory feedback in September 2005. It was approved in October 2005.

This monitoring plan has three primary objectives:

- to provide information that will allow De Beers to assess the Mine water and seepage water quality for comparison against predictions made in the EAR;

- to comply with groundwater-related requirements in Part F, Section 5 and Part E, Section 9 of the Water License; and,
- to meet corporate commitments and the terms of the Environmental Agreement related to groundwater monitoring.

The monitoring program monitors groundwater from three sources:

- mine water;
- seepage from the water management pond; and,
- seepage from the North Pile.

This plan also includes a seepage survey, which is a semi annual survey of seepage from storage areas and the water management pond.

Consistent with the other environmental monitoring requirements under the Water License, the annual groundwater requirements as part of the Water License Annual Report will be submitted by March 31 of each calendar year.

3.1.7 Hydrology Monitoring Program

Section 7.2 (g) of the Environmental Agreement for the Mine includes a requirement for a Hydrology Monitoring Program. Hydrology-related requirements of the Mine's Water License are as follows:

- provide data for components of the overall Mine water balance, specifically, estimates and measurements of precipitation and runoff;
- monitor water elevations in Snap Lake during the open-water season;
- provide flow or water level data for selected locations under Parts A, B, and C of the SNP;
- provide quality assurance/quality control (QA/QC) for selected equipment used for flow or water level measurements;
- evaluate Mine impacts to Snap Lake by monitoring outflow from Snap Lake; and,
- collect meteorological data (precipitation and evaporation).

A draft Hydrology Monitoring Program document was prepared in December 2004. This document is in the process of being updated to reflect the hydro-meteorological monitoring program component that was added in the spring of 2005.

Water elevation and streamflow are monitored near the Mine to meet three principal objectives as follows:

- confirm EAR predictions related to changes in lake water levels and streamflows;
- provide flow and water level information for fish habitat compensation monitoring and to provide an annual water balance and lake level data for water quality monitoring; and
- fulfill requirements of the Mine's Water License and the Environmental Agreement.

Consistent with the other environmental monitoring requirements under the Water License, the annual hydrology requirements as part of the Water License Annual Report will be submitted by March 31 of each calendar year.

3.1.8 North Pile Monitoring Program

The North Pile Monitoring Program (geotechnical stability and deformation, and temperature monitoring) was incorporated into the North Pile Management Plan as outlined in Section 3.2.8 of this report.

3.1.9 Vegetation Monitoring Program

This VMP is a requirement of the Mine's Environmental Agreement (Article VII, 7.2b), and provides support for the Closure and Reclamation (C&R) research and monitoring requirements outlined in Part I of the Mine's Water License. A draft VMP was prepared for the Mine in April 2005 and submitted with the 2005 Environmental Agreement Annual Report Supplement in May 2007.

To comply with regulatory requirements, De Beers has designed the VMP to address the following objectives:

- verify the accuracy of impact predictions made in the EAR;
- implement, through the Environmental Management System (EMS), operational practices that mitigate disturbance to native vegetation;
- determine the effectiveness of mitigation measures implemented through the EMS;
- consider and incorporate where possible, traditional knowledge;

- establish action levels or triggers for early warning signs to implement adaptive management and mitigation measures where appropriate;
- provide opportunities for the involvement and active participation of Aboriginal parties in the implementation of the VMP; and,
- design studies and data collection techniques that are consistent with, and will contribute to, understanding and managing vegetation effects and ensuring effective reclamation.

To meet these objectives, three vegetation monitoring studies will be conducted as follows:

1) Area of Impact Monitoring Program (monitoring the total area of direct impact due to the Mine);
2) Ecological Land Classification (ELC) Area Monitoring Program (monitoring the change in the ELC area due to the Mine); and,
3) Reclamation Monitoring Program (monitoring the success of revegetation and reclamation activities).

Two additional triggered monitoring programs may be implemented, when necessary, if specific action levels set out in the VMP are exceeded:

1) Detailed ELC Monitoring Program; and,
2) Effects of Dustfall on vegetation.

3.1.10 Water Intake Monitoring Program

The water intake screen was authorized by DFO on August 27, 2004 pursuant to the Mine's Fisheries Authorization (SC00196). Several conditions were listed in the approval, including the development of a fish screen monitoring program and reporting schedule, which is subject to DFO approval prior to implementation, and is required within three months of the issuance of the approval. The Water Intake Monitoring Program was submitted in May 2005 and approved by DFO on July 22, 2005.

The fish screen monitoring program is comprised of two components: a physical component and a biological component.

The physical monitoring of the intake screen includes two steps:

- construction/post-construction monitoring, which includes documenting the fabrication details for the screen, and ensuring there are no gaps greater than 2.5 millimetres (mm) between the screen and the intake pipe; and,
- operational monitoring, which includes monitoring approach velocity and to determining if any fouling of the screen is occurring.

The biological monitoring component is species and life-stage dependent. The objective of the biological monitoring program is to demonstrate that 25 mm Burbot (the target species and life stage for this monitoring program) are not being impinged or entrained by the screen during its operation. The biological monitoring component involves two steps:

- monitoring for the presence of larval Burbot in Snap Lake in the area of the screen; and,
- monitoring behind the screen to determine if fish are being entrained.

The proposed duration of the monitoring program is two years, with the objective that all of the necessary physical and biological measurements would be carried out in the first year. The first year of monitoring occurred in 2007.

3.1.11 Wildlife Effects Monitoring Program

The principal purpose of the Wildlife Effects Monitoring Program (WEMP) is to meet Condition 42 of the Land Use Permit and to comply with relevant Articles in the Environmental Agreement (e.g., Articles VII and VIII) and related corporate commitments (Appendix A). The intent of this document is to establish the guidelines and scope of the WEMP including monitoring components, objectives, methods, frequency, analyses, and reporting. To comply with the relevant terms and conditions stated in the Land Use Permit and Environmental Agreement, De Beers has designed the WEMP to include the following objectives:

- test impact predictions made in the EAR;
- implement, through the Environmental Management System (EMS) (De Beers 2002b), operational practices that mitigate disturbance to wildlife and wildlife habitat, including migratory birds and their nesting areas, species at risk, and caribou;
- determine the effectiveness of mitigation measures implemented through the EMS;
- consider and incorporate where possible, traditional knowledge;

- establish action levels or triggers for early warning signs to implement adaptive management and mitigation measures where appropriate;
- provide opportunities for the involvement and active participation of the public in the implementation of the WEMP;
- design studies and data collection techniques that are consistent with, and will contribute to, understanding and managing regional cumulative effects; and,
- develop and review the WEMP in collaboration with the Government of the Northwest Territories Department of Environment and Natural Resources and SLEMA.

To achieve the principal purpose of the WEMP, monitoring of Mine-related effects will include measuring the following environmental components grouped under three main headings:

- Wildlife Habitat:
  - direct change of habitat types associated with the Mine footprint; and,
  - indirect change of habitat value for caribou and grizzly bears within the zone of influence of the Mine.
- Disturbance to Wildlife:
  - caribou number, movement, distribution, behaviour, and group composition during the northern and post-calving migrations;
  - presence and distribution of grizzly bear (and black bear) within the study are;
  - relative activity of wolverines in the study area;
- Wildlife Incidents:
  - number of Mine-related incidents with wildlife.

During the WEMP, De Beers will record all incidental observations of rare or new species (i.e., species that have expanded their range to include the study area). De Beers will provide an annual monitoring report that summarizes the data collected under the WEMP during each year. As experience has shown that significant patterns associated with effects from mining operations and natural factors are typically not apparent with data collected during one- to two-year periods, the annual monitoring report will be expanded every three years to include a discussion of the cumulative results for each component of the monitoring program.

3.2 MANAGEMENT PLANS

3.2.1 Air Quality and Emissions Monitoring and Management Plan

As outlined in Section 3.1.1 (Air Quality Monitoring Program), a draft of an EMP was submitted to the GNWT and Environment Canada in February 2006. Upon receipt of feedback on this draft document from GNWT and Environment Canada in April and August 2006, this document was harmonized with the AQMP into one document, the AQEMMP, to demonstrate the linkages between the two programs. The data from the two programs will be presented together each year in the annual report. The original EMP portion of the AQEMMP meets the requirements as outlined in Article VI, Section 6.3 items d) and e) and Article VII, Section 7.2a(i) of the Environment Agreement. The AQEMMP was submitted to the GNWT and Environment Canada in November 2007. De Beers received comment in February 2007. A meeting occurred between GNWT (ENR), De Beers and Golder Associates Ltd. (Golder) on March 6, 2007 to improve and agree to a final AQEMMP. The AQEMMP was submitted August 25, 2007.

The AQMP concentrates on the following five main components:

1. on-site meteorological monitoring, which consists of hourly measurements of wind speed, wind direction, solar radiation, temperature, relative humidity, and rainfall;
2. on-site hydro-meteorological monitoring, which calculates and records lake evaporation rates to calculate the Snap Lake water balance;
3. ambient monitoring of total suspended particulate (TSP) and fine particulate matter (PM_{10} and $PM_{2.5}$) that consists of 24-hour average values;
4. ambient monitoring of dustfall; and,
5. passive monitoring of sulphur dioxide (SO_2) and nitrogen dioxide (NO_2).

The EMP focuses on the following three main components:

1. emissions estimates of oxides of nitrogen (NO_X), SO_2, particulate matter (PM), and greenhouse gases (GHGs) were calculated based on annual fuel consumption;
2. annual fuel use summary; and,
3. emissions mitigation strategies, which includes the fugitive dust abatement program.

De Beers will provide an annual report that summarizes the air quality monitoring and air emissions data collected during each year. To ensure that the AQEMMP is effective, it will be reviewed every 5 years in co-operation with the signatories to the Environmental Agreement.

3.2.2 Best Management Practices Plan for Ammonia Source Control

As per the requirement of the Water License under Part F, Item 23 for a plan to control the source of ammonia in effluent discharge, Safety, Health and Environment Operational Procedures (SHE OPs) and action plans have been designed by De Beers to control and monitor ammonia discharge in current mine water effluent from the Snap Lake underground mine.

The Explosive Conservation Procedure highlights the general nature of the overall operational monitoring controls in place within the EMS, while the Environmental Monitoring Program highlights the adaptive management protocol within the EMS to both monitor and respond to fluctuating ammonia levels in mine water discharge samples. Both programs were scheduled for expansion in 2005, in conjunction with the North Pile construction and development activities, to include routine monitoring of sump collection water and diversion to the water management pond and finally the water treatment plant.

3.2.3 Interim Mine and Closure and Reclamation Plan

Mining is considered to be a temporary use of the land. At closure, the Mine site and the land affected by the mining operations are to be reclaimed to achieve the following objectives, in order of priority:

- protect public health and safety;
- prevent or mitigate environmental degradation caused by mining-related activities at the Mine; and,
- ensure that upon the end of mining and processing activities, the Mine site is returned to site's original use or an acceptable alternative that considers community input and values and can be used by future generations.

A Preliminary Mine C&R Plan was submitted to the MVLWB in February 2003. This Plan was updated with the Interim Mine C&R Plan to meet the specific requirements contained in Part I, Item 1 of the Water License. This C&R Plan was submitted in

February 2005 and following regulators' comments was re-submitted in January 2006 and approved in May 2006. This plan was updated in 2010.

Reclamation cannot totally remove the entire disturbance caused by development and operation of the Mine, but it prevents degradation of the surrounding water, air, and land after mine closure. The targeted post-closure land use for the Mine is wildlife habitat. This end land use is a reflection of the current use of the tundra area surrounding the Mine site by wildlife (both resident and migratory), and traditional activities of the local communities and First Nations.

As such, the C&R Plan is considered to be a "living" document. It is anticipated that the plan will undergo several further major revisions over the next 18 years. While meeting Water License requirements, it will continue to be updated and refined as the Mine moves through construction, commissioning, into operation and approaches final closure in 2030. The level of detail of C&R planning contained within the Plan will continue to increase with each revision. Those revisions will incorporate the lessons learned from the planned reclamation research and from progressive reclamation of the North Pile as the initial cells are completed. In addition, the revisions will also reflect the input from local communities, First Nations, and other stakeholders who have an interest in how the Mine is ultimately reclaimed.

3.2.4 Domestic Waste and Sewage Management Plan

A Domestic Waste and Sewage Management Plan for the Mine was submitted to the MVLWB in June 2004 as a requirement of the Water License (Part E, Section 10) and the Environmental Agreement (Article VI, Section 6.3a[v]). A subsequent update of the Plan was submitted in December 2006 and was approved in February 2007. In line with the De Beers EMS and the AMP, this Plan is iterative in nature and is subject to revision due to operational changes and or continual improvement(s). This plan was updated and resubmitted in October 2012 and will continue to be updated when changes occur.

The overall goal of this Plan is to create a framework for the proper handling and disposal of wastes, the minimization of potentially adverse effects on the environment, and compliance with the Mine's Water License and other regulatory guidelines for waste management. To meet this overall goal, the Plan has been developed to address the following three specific objectives:

- to describe domestic wastes generated at the Mine;

- to outline practices and procedures for the collection, storage, transport, and disposal of those wastes; and,
- to present monitoring and mitigation procedures for domestic wastes.

Because the Mine is located in a remote site, considerable volumes of materials are transported and stored on-site to ensure availability of supplies during the periods when winter road access is not available. To address this volume of waste, the waste management strategy for construction and operations will continue to focus on the following:

- Reduction of the amount of material consumed wherever possible. These measures include the following:
  - use of bulk containers for items used in large quantities (i.e., lube oil, cooking oil, beverages);
  - tire recycling (where opportunities exist);
  - use of waste oil for heat generation; and,
  - appropriate separation of waste for on-site and off-site disposal;
- Replacing hazardous solvents with less hazardous soy-based solvents that reduce occupational exposure to solvent vapour (i.e., using refillable pump bottles instead of aerosol cans and using rechargeable batteries).
- Effective and efficient disposal of waste on-site.
- Appropriate storage of waste awaiting removal from site.
- Transportation of waste to an appropriate off-site facility for reuse, recycling, or disposal.

As part of the overall continuous improvement process for the Mine site, De Beers has SHE OPs integrated within the Mine Environmental Management System (EMS) system. These operational procedures are reviewed every 1 to 2 years and updates are completed as required. The Plan will be incorporated into the EMS, and as such, is being subject to periodic review within the adaptive framework of the EMS.

3.2.5 Emergency Response Plan

As per Part H, Item 1 of the Water License and Article VI, Section 6.3a [iii], the Emergency Response Plan (ERP) was submitted to the MVLWB in September 2005, and approved in October 2005. It was updated and re-submitted in June 2007, and approved in August 2007. It will be reviewed and updated in 2013. The ERP contains specific procedures for potential emergency situations at the

Mine. The procedures in the ERP are stand-alone documents, and include the following:

- Announcing Emergencies by Radio: Radio Procedure for Announcing Emergencies.
- Alarms: Alarms at the Mine.
- Medical: Medevac Procedure.
- Emergency Communications Protocol for Site: Procedure for Information Technology (IT) personnel.
- Medical Emergencies on Site – Surface and Underground: *Trained Emergency Response Team (ERT) List*.
- Trained First Aid Personnel List: *Underground Emergencies*: Emergency Preparedness and Response Plan for Underground.
- Water Treatment Plant Emergencies: Water Treatment Plant Emergencies – Medical, Fire or Spill.
- Fire: Fire Evacuation Procedures for the Snap Lake Main Camp Complex; Fire in the Main Camp Complex - Management & ERT Duties; Fires On-Site (not including the Main Camp or Skid Camp Complex) – Management and ERT Duties; Fires Off-Site – Management Duties.
- Aircraft – Helicopter Crash at Site: Aircraft or Helicopter Crash at Site – Management and ERT Duties.
- Spill Response: Short Form – Spill Response Procedure (for posting).
- Wildlife: Wildlife Encounters; Caribou on Roads or Runway; Dealing with Bear Sightings, Encounters or a Bear in Camp – ERT; Encountering Wildlife Carcasses.
- Ice Road Emergencies: Emergency Response Procedures for Medical, Fire, and Spill Response; Emergencies on the Mine Spur Ice Road; Vehicle Through the Ice.
- Weather Procedures: Cold Weather Safety; Ice/Winter Road, Reduced Visibility and White-Outs.

3.2.6 Hazardous Materials Management Plan

Waste management is an important component of the De Beers' EMS and Environmental Policy. As per Part E, Item 14 of the Water License, the Hazardous Materials Management Plan was submitted to the MVLWB in June 2004. It was revised and then re-submitted in January 2005. The plan was approved in February 2005. The document was reviewed by De Beers, and was resubmitted to the

MVLWB in November 2009. The newest version of the plan was submitted to the board in June 2010.

De Beers' overall waste management policy is based on the following principles:

- health and safety of all site employees and visitors is paramount;
- reduction, reuse, and recycling of waste materials;
- adherence to applicable regulations and waste handling guidelines required under the *Environmental Protection Act* (GNWT Department of Resources, Wildlife, and Economic Development) is mandatory;
- treatment, disposal, and management of waste will be performed on-site to the maximum practical and economic extent in order to minimize the volume of waste shipped off-site;
- proactive management of wastes that may attract wildlife and to minimize the interaction between humans and wildlife;
- a materials procurement policy that stipulates which types of materials are prohibited on site, due to known unacceptable waste products, and will require that products with minimal waste generation be given priority over alternatives where economic and practical; and,
- waste management principles and procedures will form a fundamental component of personnel site orientation and education; environmental awareness training and waste management training will form part of the EMS.

Procedures outlined in this program are enforced by site management personnel, through regular site inspections and auditing. Construction and services contracts also include contractual requirements to comply with site waste management procedures.

The majority of hazardous materials that will be used during the construction phases of the Mine can be grouped into the following three site categories:

- petroleum, oils, and lubricants;
- explosives; and,
- other hazardous chemicals.

An inventory control of all hazardous materials is conducted on-site by Materials Management. Logistics is responsible for insuring that Transportation of Dangerous Goods (TDG) paperwork is completed as required by TDG legislation. This includes shipments of hazardous materials received at the Mine, as well as hazardous waste

materials that are shipped off-site for disposal. Contractors are required to submit copies of Material Safety Data Sheets (MSDS) to Materials Management for all hazardous materials prior to, or accompanying all shipments to the Mine. Material Safety Data Sheets are submitted to a service provider who uploads the MSDS to a customized on-line collection which can be easily accessed by contractors and employees. Contractors are also required to maintain copies of MSDS applicable to their contracts and ensure copies are available to their crews.

Compliance with all environmental laws, regulations, guidelines, and best management practices as well as the Mine EMS, will be monitored using the following mechanisms:

- environmental inspections;
- environmental audits (internal and external);
- communication with regulatory authorities (federal, provincial, regional, and municipal); and,
- communication with De Beers' Corporate Legal Department and other De Beers' facilities.

3.2.7 North Pile Management Plan

The North Pile Management Plan, formerly known as Ore Storage, Waste Rock, and Processed Kimberlite Management Plan (OSWRPKMP), is a requirement of the Mine's Water License (Part E items 3 to 8). The NP was initially submitted in December 2004 and was updated with the planning and development of three phases of the Mine's North Pile Waste Rock and Processed Kimberlite Storage Facility, which includes the schedule, location, and quantities of stockpiles, operational procedures for the pile development, waste management (hydrocarbon contaminated soils and solid waste management), and monitoring programs in October 2005. It was also approved in October 2005. The NP was revised by De Beers in 2009, and was resubmitted to the MVLWB in November 2009. It was revised again in January 2010 and approved in February 2010. The latest submission occurred in July 2012 and is currently being revised upon recommendations from the Mackenzie Valley Land and Water Board.

The NP consists of the following monitoring programs related to the North Pile:

- geotechnical stability and deformation;
- temperature monitoring (thermal conditions of the waste rock pile using thermistors);

- hydrology (measuring surface runoff); and,
- hydrogeology and geochemistry (evaluation of flow and geochemistry of seepage from the North Pile Starter Cell).

The Acid Rock Drainage and the Geochemical Characterization Plan, which discusses the assessment of potentially acid generating (PAG) rock and the monitoring and managing of this rock was formerly an appendix of the North Pile Management Plan. This Plan is reviewed annually and was submitted.

3.2.8 Quality Assurance/Quality Control Management Plan

This QA/QC Plan is a requirement of the Water License SNP Section (Part B, Items 23 to 25). The Plan addresses the analysis of blanks, and certified reference material and replicate sampling to assess accuracy, precision, and field contamination during environmental effects monitoring. The Plan was submitted in July 2004, revised and re-submitted in March 2006, and approved in April 2006. The plan was updated in October 2008.

The QA/QC Plan discusses field sampling procedures including sample site locations and designations, sampling equipment and methods, and sample handling procedures including preservation, sample identification, and shipping protocols. Water sampling frequency, monitoring requirements, laboratory requirements (including laboratory accreditation, detection limits, methodology and reporting procedures), and SNP reporting requirements are also described.

The AEMP and the Monitoring Plan for TDS, calcium, and chloride include all SNP Stations located within Snap Lake, specifically SNP Stations 02-18, 02-20, and 02-21. Because sampling, including QA/QC is described in detail in these and other plans, details related to SNP Stations 02-18, 02-20, and 02-21 are not included in the QA/QC Plan.

The QA/QC Plan is reviewed annually and modified as necessary, as per Part B, Item 24 of the Water License SNP.

3.2.9 Quarry Management Plan

The Quarry Management Plan is a required under the Environmental Agreement (Article VI, Section 6.3a, [vi]) and under the Land Use Permit (Part C, Item 6). A Quarry Management Plan was submitted as part of the EAR (Appendix III.5). As there are no plans to quarry the esker, this plan has not been updated. A Quarry Management Plan will be designed before the esker is excavated.

3.2.10 Sampling Plan for Total Dissolved Solids, Calcium, and Chloride

The Sampling Plan for Total Dissolved Solids, Calcium, and Chloride is a requirement of the Water License (Part F, Item 12) and the Fisheries Authorization (Section 5.6). This plan was submitted to the MVLWB and DFO in August 2004. It was revised in March 2005 and it received approval in May 2005. This plan is currently under review by De Beers.

The primary objective of this document is to outline a sampling plan that will allow De Beers to monitor for compliance with the whole-lake average TDS limit (350 milligrams per litre [mg/L]) and include a framework for forecasting TDS, calcium, and chloride concentrations in Snap Lake that will allow De Beers to anticipate future concentrations in Snap Lake, and implement mitigation measures as early as possible, should they be required. The Plan also includes sampling electrical conductivity since it is strongly correlated with TDS, calcium, and chloride.

A mass balance model will also be used to forecast the maximum whole-lake average TDS concentrations in Snap Lake that could occur over the life of operations. The mass balance model forecasts will be updated annually. The maximum forecast TDS concentrations will provide an early warning indicator for the management of TDS levels as part of the AMP and the Mine's EMS.

Results of the TDS, Calcium, and Chloride Sampling Plan will be reported annually to the MVLWB as part of the AEMP Annual Report on March 31, and to DFO in the Annual TDS Monitoring Report which is submitted on July 31.

3.2.11 Spill Contingency Plan

The Spill Contingency Plan is a requirement of the Mine's Environmental Agreement (Article VI, Section 6.3a [ii]), Water License (Part H Item 1), and Land Leases. This Plan was initially submitted in 2004 and was approved in July 2005. It has been reviewed and updated annually, and was revised and resubmitted to the MVLWB in 2009. This year's submission was March 31, 2012.

The purpose of this Spill Contingency Plan is to:

- facilitate the prompt, efficient, and safe clean-up of materials used during the construction and operation of the Mine;
- identify the team members, responsibilities, and reporting procedures of the Snap Lake ERT in the event of an emergency or spill; and,

- provide support and information on available resources, facilities, and trained personnel if a spill or an emergency occurs.

This plan deals with the following types of materials that are handled on the Mine site:

- fuels, oils, lubricants, and other petroleum products;
- compressed gases;
- explosives;
- process and water treatment chemicals; and,
- effluents and slurries.

The Spill Contingency Plan outlines contact information, response organization, training courses taken by spill response teams, and reporting responsibilities. An overview of spill response exercises for the response team is also included. It provides a brief description of the major facilities found at the site that have the greatest potential to have a large or environmentally significant spill and preventative measures to avoid environmental incidents, including clean-up strategies. Basic emergency response actions and procedures and basic spill response theory and actions are also outlined in the Spill Contingency Plan. The Spill Contingency Plan provides a list of all spill response equipment and a list of support documents used in preparation of this plan.

Of all the facilities at the site, those having the greatest potential for spills include the following:

- fuel storage and transfer systems;
- chemical and explosives storage and transfer systems;
- hazardous materials handling and storage facility;
- water treatment and management systems;
- sewage treatment system; and
- auxiliary systems (pipelines).

Basic procedures and decontamination steps during any spill response have been established, and Action Plans and SHE OPs have been developed for liquid and fuel spills on land, water, snow, and ice. General spill response equipment, including small and large kits are available on-site to assist in spill response. The Spill Contingency Plan is reviewed annually and updated as needed.

3.2.12 Water Management Plan

The Water Management Plan is a requirement of the Mine's Water License and Environmental Agreement. A Plan was submitted initially in August 2004 and was updated in March 2005 for the Phase 1 Pre-production Program, commencing in 2004, through construction in 2006 and up to, but not including commissioning of the permanent water treatment plant. The Plan was revised and resubmitted to the MVLWB in November 2009. The Water Management plan will be revised and resubmitted in June 2010.

The Water Management Plan has two principal objectives:

- to minimize the impacts of the Mine on the quantity of surface water; and,
- to minimize the impacts of the Mine on the quality of surface and groundwater.

The Water Management Plan contains three sections:

- a listing of water management objectives, strategies to implement objectives, and minimum water management standards;
- a tabulated estimate of the water balance (gains and losses of water on-site), and a brief description of each component of the water balance; and,
- an outline of the water management system.

As water management planning requires a multidisciplinary understanding of water-related issues (e.g., water quality, water quantity, contingency planning, and environmental monitoring), aspects of its management are found in other monitoring plans including the OSWRPKMP; the Sampling Plan for Total Dissolved Solids, Calcium, and Chloride; the Groundwater Quantity and Quality Monitoring Program; the Hydrology Monitoring Program; and the AEMP. This Plan was updated with the water balance information for operations.

3.2.13 Wildlife Management Plan

The Environmental Agreement (Article VI, Section 6.3f) requires that a Wildlife Management Plan be developed for the Mine. The draft Wildlife Management Plan was submitted in December 2006. Responses from regulators and other parties were received in February 2007. Responses were incorporated into the Plan and re-submitted November 8, 2007. A final version was submitted in April, 2008. The

intent of the plan is to highlight mitigation measures used by De Beers to limit potential impacts on wildlife, and promote and facilitate wildlife safety. Mitigation measures associated with the various stages of the Mine are emphasized to illustrate the connection between Mine activities, potential effects on wildlife, and the various adaptive management and mitigation measures. To meet the requirements of the Environmental Agreement, on-site wildlife management, waste and odour management, and caribou protection are addressed in this document.

The plan has been developed in consultation with the GNWT and SLEMA as per the Environmental Agreement specifications. The Agreement also states there should be an environmental monitoring program to support the process of adaptive management. The WEMP (Section 3.1.11) was submitted to the GNWT in July 2004, and has been ongoing since March 2001.

De Beers is committed to maintaining wildlife safety on the Mine site and will continuously evaluate and update mitigation strategies as necessary.

4 2011 REPORT SUBMISSIONS

De Beers submitted 17 reports and technical memorandums in 2011 as required under their Water License, Land Use Permit, Environmental Agreement, Fisheries Authorization and Land Lease. The Reports and Plans that were submitted in 2011 are listed in Table 4-1. This section provides abstracts of the Annual Reports and Non-Annual Reports (i.e., As-Built and Detailed Design Reports, and monitoring reports under the Fisheries Authorization related to habitat compensation). Abstracts have not been included for the updates to the monitoring and management plans as these monitoring programs are outlined in Section 3.

Table 4-1 Summary of 2011 Report Submissions for the Snap Lake Mine

Submission Title	Date of Submission	Report Section
2011 Air Quality-Meteorological and Emissions Report	April 2012	4.1.2
2011 Hydrology Monitoring Program Annual Report	June 2012	4.1.3
2011 Vegetation Monitoring Program Annual Report	June 2012	4.1.4
2011 Wildlife Effects Monitoring Program Annual Report	March 2012	4.1.5
2011 Type A Water License Water License Annual Report	March 2012	4.1.6
2011 Acid Rock Drainage and Geochemistry Annual Monitoring Report	March 2012	4.1.7
2011 Dam Inspection Report	December 2011	4.1.8
2011 Aquatic Effects Monitoring Program Annual Report	May 2012	4.1.9
2011 Dissolved Oxygen Annual Monitoring Report	August 2010	4.1.10
2011 Total Dissolved Solids Monitoring Near Fish Habitat Compensation Areas in Snap Lake	May 2012	4.1.11

4.1 ANNUAL SUBMISSIONS

4.1.1 2011 Environmental Agreement Annual Report

The Mine is a diamond mine owned and operated by De Beers, and is located about 220 km northeast of Yellowknife, Northwest Territories (NWT). De Beers received regulatory approval for the Mine in 2004, which included an Environmental Agreement. Mining began in 2007 and is expected to continue until 2030. We have completed nine years of environmental monitoring since construction started for the Mine. This annual report for the Mine's Environmental Agreement summarizes the monitoring activities and results from 2011.

Since we received regulatory approval for the Mine in 2004, we have written 32 monitoring and management plans for the Mine. In 2011, we submitted eleven annual reports, three management plans, and three reports under the fisheries authorization. A summary of each of these documents can be found in this Annual Report.

Here is a summary of what we found in our environmental monitoring studies in 2011.

Air quality: When any fuels are burned, greenhouse gases and other compounds are produced. We calculate the amount of greenhouse gases produced by the Mine because they can add to global warming. We measure the amount of other air quality compounds produced by the mine because they can lead to changes in air quality near the mine. Emission rates were a little higher in 2011 from 2010 estimates primarily due to more power generation and fleet use at the facility.

Aquatics: We found increases, relative to baseline levels, in dissolved salts, nutrients and a few metals in the water in Snap Lake in 2011. The increases in dissolved salts were greater than expected, and resulted from more loading of dissolved salts from the Mine dewatering process in the underground mine than originally planned. These changes are not harmful to fish or other life in Snap Lake. We checked the amount and types of algae, and bugs that live in the water and on the bottom of Snap Lake, to see if there were any changes in food for fish compared to previous years. The amount and types of algae and bugs in the water of Snap Lake have changed from year to year, but this may not be related to the Mine alone, because similar changes also occur in all lakes. The number of different types of bugs on the bottom of Snap Lake in 2011 was similar to those in previous years, and the Mine only had a small effect on them. We also checked the mud that the bugs live in at the bottom of the lake and found that two nutrients and a few metals were higher.

Archaeology: None of the historical sites discovered near the winter road and Mine were disturbed in 2011.

Hydrology: The results indicate that 2011 had low water levels and streamflows compared to previous years. Snap Lake water levels continue to exhibit similar increases and decreases as other monitored lakes in the surrounding area. Water level increases are less than predicted in the EAR and appear more related to climatic conditions than mining influences.

Hydrogeology and Geochemistry: The rock types and classification at the Mine have not changed from our original predictions. We have discovered that up to 2008, more water was seeping into the underground mine than was predicted in the 2002 EAR, resulting in higher concentrations of salts and dissolved solids in the water, however, the flows and loadings generally decreased to below predictions after 2008 and into 2011.

Vegetation: Satellite pictures were taken of the Mine to determine the total size of area affected by the Mine in 2008. We found that the disturbance area of each vegetation type was less than was predicted. Only 0.5 ha of the esker, where gravel is quarried for project development, was expected to be disturbed, but 1.6 hectares of the esker was disturbed in the winter of 2001. No further disturbance on the esker is expected to happen. Dustfall exceeded the Alberta Ambient Air Quality Objective for commercial and industrial properties in one month at one sampling location. Overall, evidence of dustfall effects on the mine site have not been observed.

Wildlife: In 2011, monitoring indicators for caribou, grizzly bear, and wolverine all indicated low levels of activity, but this result is likely related to the recent declines in the Bathurst caribou herd. Incidents in 2011 were mostly related to fox and wolverine at site, and some isolated incidents included caribou and songbirds. Wildlife mortalities have been very rare at Snap Lake, but in 2011, two songbirds, a ptarmigan, a raven, fox and wolverine were all found dead within the Mine boundaries. Wolf den and raptor nest surveys are no longer WEMP components as agreed at monitoring workshops with regulators and communities in 2010 and 2011 but are monitored as an in-kind contribution to the Government Northwest Territories, Department of Environment and Natural Resources regional databases.

Compliance: Seven inspections were conducted by Aboriginal Affairs and Northern Development in 2011. All issues brought up by the Inspector were addressed or are being addressed.

Mitigative Measures: The AEMP annual report demonstrates that the Mine's impact is similar to what was predicted in the Environmental Assessment. This demonstrates that the mitigative measures being used by De Beers are working effectively. Currently, the main area of investigation for new mitigative measures is in the area of TDS lake concentrations. This work is ongoing.

Adaptive Measures: Adaptive measures adopted in 2011 included the construction of the Main Settling Sump in the underground, new cleaning methods for the water treatment plant filters, the start of the five-year review of the AEMP, and the grizzly bear hair snagging program.

4.1.2 Air Quality, Meteorological Monitoring and Emissions Reporting 2011 Annual Summary

Why do we conduct air quality and meteorological monitoring at Snap Lake?

The principal objective of the Air Quality, Meteorological Monitoring and Emissions Reporting Annual Summary is to comply with the SNP described in Section D of the SNP, Appendix to Water License MV2001L2-0004, Article VI Section 6.3 items d and e and Article VI Section 7.2 part a) of the Environmental Agreement, and related corporate commitments including the Snap Lake Environmental Management System.

This report provides the results of the air quality and meteorological monitoring programs that were active at Snap Lake during 2011. This document fulfills the annual reporting requirements outlined in the Air Quality and Emissions Management and Monitoring Plan (De Beers 2008a). Changes to the original Plan (De Beers 2005) were made in 2007 and 2008 to align with design recommendations from the GNWT Ministry of Environment and Natural Resources and Environment Canada (GNWT and Environment Canada 2006).

What was monitored in 2011?

In 2011, the air quality and meteorological monitoring program included the following components:

- Meteorological monitoring – Hourly measurements of wind speed, wind direction, solar radiation, temperature, relative humidity, and rainfall were collected from instruments mounted on a 10 m tower and a 3 m tripod;
- Particulate monitoring – 24-hour average values of total suspended particulate (TSP), particulate matter nominally less than or equal to 2.5 micrometres (µm) aerodynamic diameter ($PM_{2.5}$), and particulate matter nominally less than or equal to 10 µm aerodynamic diameter (PM_{10}) sampled once every six days between January and December; and,
- Passive gas monitoring – Passive gas sampling began in January and continued through December; monthly samples were collected for nitrogen dioxide (NO_2) and sulphur dioxide (SO_2).

What were the results of the 2011 air quality and meteorological monitoring program?

The results of the 2011 monitoring program included:

- Meteorological monitoring – Wind speed and wind direction were within the long-term averages for the area. Rainfall at Snap Lake was higher than the 30 year Yellowknife climate normals (1971 to 2000) through August, September and October, but was lower than Yellowknife normals throughout the rest of the year (Environment Canada 2012). The annual average temperature at Snap Lake in 2011 was -7.4°C, which was the coldest recorded annual average at the station. The temperature was 3.4°C colder than the long term average recorded at Yellowknife. The relative humidity followed the same pattern as the previous five years.,.
- Particulate monitoring – Consolidation of the 2011 particulate monitoring data indicate substantial challenges with the particulate monitoring program in 2011. Effort is currently under way to improve the success of the particulate monitoring program.
- Passive Monitoring – The highest monthly NO_2 concentration was 16.2 µg/m^3 observed May 17 to June 15 period at the Tank passive monitoring site located just west of the tank farm. This peak concentration falls well below the maximum desirable annual level of 60 µg/m^3 set forth in the National Air Quality Objectives (Environment Canada 1981). The highest SO_2 concentration monitored during 2011 was 1.9 µg/m^3 and was observed twice. The two occurrences were observed during the February 15 to March 15 period and during the October 15th to November 15th period at the Tank passive monitoring site located west of the tank farm. This peak concentration falls well below the maximum annual average objective of 30 µg/m^3 regulated by the GNWT (GNWT 2011). The peak concentration also falls below the maximum monthly average objective of 30 µg/m^3 regulated by the Government of Alberta (Government of Alberta 2012). The comparison of monthly values to annual criteria for the GNWT is conservative as monthly criteria would be expected to be higher.
- Snap Lake Mine emissions – Fuel consumption was approximately 31,000 cubic metres of diesel with a sulphur content of 15 parts per million by weight. Waste oil consumption was 311,780 litres with an assumed sulphur content of 20,000 ppm by weight. Emission rates were higher in 2011 than 2010 primarily due to an overall increase in fuel consumption. SO_2 emissions increased primary due to the increased level of combustion of waste oil and associated higher sulphur content. Emissions remained below the 2007 Air Modelling Update.

4.1.3 Hydrology Monitoring 2011 Annual Report

Why do we monitor water elevation and streamflow at Snap Lake?

Water elevation and streamflow are monitored near the Mine to meet three principal objectives:

- evaluate EAR predictions (De Beers 2002) related to changes in lake water levels and streamflows;
- provide flow and water elevation information for fish habitat compensation monitoring, and annual water balance and lake elevation data for water quality monitoring; and,
- fulfill requirements of the Water License MV2001L2-0004 (MVLWB 2012) and the Environmental Agreement (De Beers 2004).

What did we monitor in 2011 at Snap Lake?

In 2011, water level data were collected at four stations in the Snap Lake drainage area and at one station at each of the following lakes; the 1999 Reference Lake, North Lake, and Northeast Lake. Additional flow data was collected from their outflow channels and on smaller streams that flow into Snap Lake.

What are the results of the 2011 Streamflow and Lake Elevation Monitoring Program?

Lake water levels and outflows from Snap Lake, and discharge monitoring of one representative inflow tributary were monitored during the spring, summer, and fall of 2011. These monitoring data were collected to assess EAR predictions that Mine operations would have a negligible effect on water elevations and outflow (De Beers 2002).

The annual change in the Snap Lake water surface elevation, measured September 2010 to September 2011, was different than the other monitored lakes in the region: Snap Lake decreased 103 mm; North Lake showed no change; and, Northeast Lake and Reference Lake showed an increase in water surface elevations of 160 mm and 232 mm respectively. It is not clear why Snap Lake did not follow the regional trends in 2011. The water balance calculations indicated that a decrease of 118 mm would be observed in Snap Lake; the actual measured decrease was 103 mm. These values are considered reasonably consistent with each other given the uncertainty associated with the Snap Lake inflow and outflow data.

4.1.4 Vegetation Monitoring Program 2011 Annual Report

Why is vegetation monitored at Snap Lake?

A VMP is a requirement of the Mine's Environmental Agreement (De Beers 2004) and provides support for the closure and reclamation monitoring requirements as outlined in Part I of the Mine's Water License (MV2001L2-0004; MVLWB 2012). A VMP was prepared for the Mine in 2005 (De Beers 2005).

What was monitored at Snap Lake in 2011?

De Beers has implemented and maintains a VMP for the Mine, which includes annual/interval monitoring including Area of Impact, ELC area, and reclamation monitoring programs. The VMP also includes triggered vegetation monitoring of detailed ELC and effects of dustfall on vegetation. In addition to complying with the requirements of the Environmental Agreement and the Water License, the VMP has been designed to verify the accuracy of the impact predictions made in the EAR (De Beers 2002a). It also provides information to the Snap Lake Environmental Management System (EMS) (De Beers 2002b), and supports De Beers commitment to mitigate impacts during Mine planning and operation (De Beers 2005).

Triggered programs are additional field programs that are initiated if established action levels are exceeded. Adaptive management and mitigation measures are implemented, where appropriate, only when the defined trigger is surpassed.

What were the results of the Monitoring Programs?

Area of Impact and ELC Monitoring were not required as part of the VMP in 2011 as there was minimal additional surface disturbance. QuickBird satellite images are scheduled to be captured every five years until closure. The next QuickBird image and associated assessment will be completed in 2013. Reclamation monitoring was not required in 2011 and will be continued in 2013.

Area of Impact

The disturbance of the local study area (LSA) and esker complex, as of July 2008, is 155.4 hectares (ha), or 11 percent (%) of the LSA. This is below the predicted disturbance area; therefore, the Detailed ELC Monitoring Program is not triggered and modifications to the monitoring program are not needed at this time.

Ecological Land Classification Area Monitoring

None of the ELC units have received a greater proportionate disturbance than predicted in the EAR (De Beers 2002a) as of July 2008, with the exception of the esker complex. As reported in previous VMPs, the area of disturbance to the esker

was expected to be 0.5 ha; however, the actual disturbance was 1.6 ha. Granular material was removed from this esker in the winter of 2000/2001. No further disturbance to this esker is anticipated and none was recorded. Overall, the disturbance covers 11% of the LSA, which is below the predicted 15%. The Detailed ELC Monitoring Program is not triggered and modifications to the monitoring program are not needed at this time.

Reclamation Monitoring

During the 2004 and 2005 field surveys, 11 permanent sample plots (PSPs) were established at existing disturbed sites to determine the rate and effectiveness of natural recovery as a revegetation method (i.e., natural revegetation relying on invasion or colonization by local species). Disturbed sites included the quarry at the esker, the air strip, and the old base camp.

Because of slow growth rates and colonization of vegetation in the Arctic, reclamation surveys are not required annually. Reclamation PSPs were last surveyed in 2008 and will be monitored every five years thereafter. The next survey will take place in 2013. Reclamation PSPs will be assessed for changes in vegetation community composition and changes in physical and chemical properties of soil over time.

What were the results of the Triggered Monitoring Programs?

Detailed Ecological Land Classification Monitoring Program

Treatment and reference PSPs were surveyed from 2004 to 2006 to collect baseline data. Reference plots are undisturbed and outside the zone of influence of the mine, while treatment plots are undisturbed and within the zone of influence of the mine. These data will be compared to data collected during future annual/interval monitoring programs and, if required, Triggered Monitoring Programs. Surveys were conducted in 2008 and will be conducted every five years thereafter. The next survey will take place in 2013. No Triggered Monitoring Programs have been initiated thus far.

Dustfall Monitoring Data

Monthly dustfall samples were collected in the months of January to December, excluding the September/October period when access was restricted due to ice conditions. The maximum deposition rate of 165 milligrams per square decimetre per 30 days (mg/dm^2/30d) was recorded at DF008 in June/July 2011. The remainder of the dustfall deposition rates were moderate to low in June/July and were within the Alberta Ambient Air Quality Objective (AAAQO) (AENV 2005). Only

one sample exceeded the 158 mg/dm²/30d guideline for commercial and industrial properties.

These results cannot be used solely to ascertain whether dustfall is affecting vegetation communities. The Alberta dustfall criteria were developed in 1975 to address aesthetic concerns associated with elevated dustfall levels (Fu 2006, pers. comm.). However, there are no scientifically defensible relationships between these dustfall criteria and discernible effects on vegetation communities. Vegetation is inspected visually to assess impacts of dustfall on vegetation. Structured and focused visual inspections of dustfall on vegetation are conducted every five years (next in 2013), unless De Beers observes substantial dust accumulation and/or stressed vegetation in the interim.

4.1.5 Wildlife Effects Monitoring Program 2011 Annual Report

Why do we monitor wildlife at Snap Lake?

In accordance with the Mine's WEMP (De Beers 2004a), commitments made in the EAR (De Beers 2002), and the Mine's Environmental Agreement (De Beers 2004b), a WEMP report is to be completed each year. Because of the large degree of natural variation inherent in ecosystems, it is often difficult to detect indirect effects with only one or two years of data. Therefore, a more comprehensive analysis and discussion of all data from the WEMP will be completed every five years; the next comprehensive report will include all data collected from 1999 to December 2012. For the intermediate years, the annual reports will present findings from that year, and summarize cumulative data collected up to that year. If critical issues become apparent in the shorter term, then a discussion of these issues will be presented in annual reports.

What did we monitor at Snap Lake in 2011?

Consistent with other mining developments in the Northwest Territories, wildlife studies in 2011 were focused on Valued Ecosystem Components (VECs). Criteria for choosing VECs were based on the ecological, social, cultural, and economic aspects of the ecosystem. The VECs used in the WEMP are:

- wildlife habitat;
- barren-ground caribou;
- grizzly bear and black bear; and
- wolverine.

Wildlife studies were completed in the regional study area (RSA), defined by a circle with a radius of 31 km, centred on the Mine site, and equivalent to 3,019 square kilometres (km^2). Data collected from 1999 to 2004, were used to provide estimates of the range of baseline values (variation) in species presence, abundance, distribution, and habitat use in the RSA. Effects monitoring began in 2005 when construction started.

What have been the effects of the Snap Lake Mine?

So far, the effects of the Snap Lake Mine to wildlife have been within the range predicted in the EAR (De Beers 2002). In 2011, the measures for caribou and bears indicated low levels of activity by these species. Further data collection and more comprehensive data analyses in the next comprehensive report will help to determine if these changes are related to the Mine, or natural factors. It is likely that some of these changes are influenced by the decline in the Bathurst caribou herd, and the bears, wolverine, and wolves that depend on caribou.

Wildlife habitat loss due to the expanding Mine footprint mine has occurred as expected, and the Mine is currently about 71 % of its total predicted size. Further habitat loss will occur as the waste rock storage at the North Pile expands but this expansion is not expected to increase the size of the footprint.

Incidents are any wildlife interaction that requires a response by Mine personnel, and may range from simple deterrent actions to the injury or death of an animal. De Beers environmental staff record and report all wildlife incidences. Eight wildlife incidents, seven of them mortalities, were recorded at the Mine in 2011. These incidents included responding to a male caribou near the Emulsion Plant. Wildlife mortalities have been very rare at the Mine. In 2011, wildlife mortalities recorded at the Mine were: three songbirds; a fox; a ptarmigan; a raven; and, a wolverine. Worker education and good waste management are considered essential in limiting wildlife incidents.

Caribou pass through the RSA, particularly during their spring and fall migrations. They are monitored through the movements of satellite-collared caribou, observations by employees at the Mine, and with aerial surveys by helicopter. The number of caribou observed has been very different from year to year since monitoring began in 1999. Aerial surveys during the northern migration are no longer required, because they were deemed ineffective by wildlife managers and monitoring agencies, and as such, were discontinued in 2010. In 2011, 12 caribou were observed during the post-calving migration aerial surveys.

The second year of a pilot hair snagging study design to monitor bears occurred in 2011. Hair snagging results indicated that grizzly bears continue to be present in the RSA, although at low levels.

Wolverine are monitored by recording observations of tracks in the snow along the same 50 transects each year. Each transect is 4 km long and checked by two observers on two snowmobiles. In 2011, surveys for wolverine snow-tracks were completed in March and again in April. The snow-track results indicated that the wolverine continue to be present in the RSA. The percent of transects with snow-tracks in 2011 was the highest level of wolverine activity since 2006,

Although no longer required as a WEMP component, wolf den and raptor nest surveys were completed as an in-kind contribution to the Department of Environment and Natural Resources in 2011 (Marshall 2009, Handley 2010). Both raptor nests and wolf dens were monitored for use and productivity as part of the WEMP between 1999 and 2009. Previous monitoring results from these two programs are available in annual WEMP reports during this period.

What are the results collected during baseline and construction (1999 to 2007) at Snap Lake?

Vegetation Loss

Based on the July 2008 satellite image and the June 2007 esker quarry survey, the estimated area directly impacted by Mine in the LSA or core Mine site is 155.4 ha, or approximately 71% of the expected disturbed area. A further 60.9 ha of disturbance is expected before the Mine footprint reaches maximum extent, much of which will be associated with the development of the North Pile waste rock storage area. With the exception of esker habitat, Mine-related disturbance to vegetation types is below the predicted maximum. Currently, the largest amount of disturbance, by area, has been to heath tundra/boulder, which is the dominant land cover type in the LSA. Esker habitat has been disturbed by 1.1 ha more than anticipated. The disturbance was associated with the granular material borrow site at the esker south of the Mine, where a total of 2.5 ha were disturbed (boulder, heath tundra/boulder and water were also disturbed at this site). Granular material was removed from this esker along the esker access road during the winter of 2000. No further disturbance to this esker is anticipated.

Caribou

The Mine is located within the migratory range of the Bathurst and Ahiak caribou herds. The Bathurst herd's calving grounds are near Bathurst Inlet, Nunavut, and the Ahiak calve further east near the Queen Maud Gulf. Each forms a discrete herd during calving and rut, but may overlap during the migratory and winter periods.

Caribou are of great cultural and economic importance to Aboriginal groups in the area, and are an important source of food for residents of Nunavut and the NWT. Caribou are also an important prey species for other wildlife such as bears, wolverine, and wolves. The Bathurst and Ahiak herds may be exposed to mining activities at Snap Lake during their northern migration to the calving grounds, and during the subsequent post-calving migration and rut. Because Snap Lake is near the treeline, caribou may also be present in the study area during the winter.

Caribou monitoring at Snap Lake consists of aerial surveys conducted during the northern migration, and post-calving migration. Surveys are flown along seven transect lines, spaced 8 km apart, running in a north-south direction. Usually, 2 to 6 surveys are completed during each migration period, until the caribou leave the study area. During these surveys, wildlife biologists and community members record information on the number, location, behaviour, group composition (males, females, and calves), and habitat type of caribou. Caribou tracks and trails in the snow are also documented.

During the northern migration, observed caribou numbers ranged from 1 to over 3,800 during baseline (1999 to 2004), between 40 and approximately 300 during construction (2005 to 2007), and 76 during operation (2008 to 2009). Discussion among BHP Billiton Inc., Diavik Diamond Mines Inc., De Beers, ENR, the mine monitoring agencies, and other interested parties at the Diamond Mine Wildlife Monitoring Workshop held in June 2009 (Marshall 2009) and again in June 2010 (Handley 2010) concluded that results from aerial surveys of caribou during the northern migration are ineffective for monitoring mine-related effects and are no longer required (Marshall 2009; Hanley 2010). Therefore, aerial surveys of caribou during the northern migration were not completed in 2010 and are no longer a component of the WEMP.

During the post-calving period, estimated caribou numbers ranged between approximately 300 and 6,900 during baseline, between 1 and approximately 6,500 during construction, and none in the first year of operation in 2008. This indicates a relatively high level of variation in caribou numbers across years, with no consistent trends over time.

Bears

Both grizzly bears and black bears can occur within the study area. Bear signs are monitored to determine if the Mine influences the activity and distribution of bears in the study area. Occurrences of bear signs, which include tracks, scat, digs, beds, hair, dens, and prey remains, are recorded by observers in plots placed throughout the study area.

From 2001 to 2008, a total of 432 plot surveys for bear sign were conducted, including 229 sedge wetland plots, and 203 riparian plots. A total of 116 fresh bear signs were detected in 66 of the 229 sedge wetland plots, and 113 fresh signs were detected in 68 of 203 riparian plots. In both habitats, the number of sign per plot was highest in 2001, mostly due to the high number of tracks detected. Scats and digs were the next most frequently observed sign type. The number of signs per plot varied annually between habitat types ranging from 0.2 to 2.0.

In 2010, monitoring of bears changed to hair snagging techniques due to the inadequacy of past programs to evaluate EAR predictions (Marshall 2009, Handley 2010). In 2010 and 2011, 40 hair snagging stations were deployed with the study area and inspected for the presence of bear hair. Results of these programs indicated that the presence of bears in the study area has been low.

Wolverine

Snow-track surveys were used to study the presence and relative activity of wolverine in the study area from 1999 to 2008. A new snow-track method using multiple 4 km transects in habitats preferred by wolverine was implemented in 2003. This method was adopted to resolve some of the limitations of the previous method, and to determine if wolverine are attracted to or avoid the Mine. In 2010, a second round of surveys was added to the program as an improvement. This report presents data gathered from 2003 to 2011.

From 2003 to 2011, the number of transects surveyed per year ranged from 12 to 50, accounting for between 48 and 364 km of survey distance. Overall, the results indicate a fairly even distribution of tracks throughout the RSA from 2003 to 2011, although transects closer to the south and east of the Mine appear to have a higher frequency of detections.

Mean track densities ranged from 0.1 in 2008 to 0.21 in 2003 and 2004. Generally, the mean tolerable daily intake (TDI) has decreased over time, although the associated variances indicate that the track densities may not statistically differ among most years. However, mean TDI during 2008 to 2011 has been lower than during 2003 to 2006.

In 2011, the mean probability estimate (±1 standard error) of wolverine presence in the RSA after accounting for detection of snow tracks was 0.96 (0.27). Detection probability of snow tracks was 0.37 (0.12), after controlling for effect of weather. This detection rate suggests that failure to observe tracks in previous years, where a single survey was completed, likely underestimated wolverine activity and distribution.

Raptors

Fifteen raptor nest sites have been identified within the study area between 1999 to 2010, although not all of these sites have been occupied every year. From 1999 to 2010, occupancy at raptor nest sites (not including raven, eagle, and kestrel) varied from 27% in 2009 to 92% in 2005. Nest success ranged from 14% in 2010 and 2005, to 83% in 2000 and 2003. Chicks have been produced in every year and productivity has ranged from 0.25 to 2.80 chicks per occupied site.

Raptor nest surveys are no longer a WEMP component as agreed at monitoring workshops with regulators and communities in 2010 and 2011 but are monitored as an in-kind contribution to the Government Northwest Territories, Department of Environment and Natural Resources regional database (Marshall 2009, Handley 2010).

Wildlife Incidents

Incidents are defined as any wildlife interaction that requires a response by Mine personnel, and may include simple deterrent actions, or the injury or death of an animal. De Beers environmental staff report all wildlife incidents, and follow the procedures outlined in the Snap Lake Wildlife Management Plan (De Beers 2008b).

In 2011, there were eight wildlife incidents at the Mine, seven mortalities and one deterrent action. These incidents involved a red fox, three songbirds, one ptarmigan, one raven, one male caribou and a wolverine. Mortalities included in these incidents were a red fox, two songbirds, one ptarmigan and a wolverine.

On January 1, 2011, a dead raven was discovered outside the entrance to the auxiliary generators. There was no obvious sign of cause of death. On June 8, 2011, a robin was found dead in the corridor between the Mechanical Shop and Utility Building. The cause of death is unknown. On August 29, 2011, two dead songbirds were discovered inside the mechanical shop. It is suspected that these birds flushed into a pillar in response to the presence of workers. On November 11, 2011, a dead ptarmigan was discovered outside the east entrance to the Services Building and was suspected to have flown into the building. These mortalities were reported to ENR and Snap Lake Environment staff were instructed to dispose of the birds at the Mine.

On November 13, 2011, the remains of a small animal, believed to be a red fox, were discovered in the accommodations sewage lift station. It was assumed that the animal gained access to the lift station through an open door. The maintenance procedure at the station was revised to indicate that all lids and doors need to be well secured at the conclusion of work.

Staff found a dead wolverine in a sea can on September 1, 2011. The carcass was well decomposed and the cause of death was unclear. It was assumed the wolverine gained access and became trapped when the door was closed. Environment staff collected the carcass and forwarded it to ENR for necropsy. Results of the necropsy have not been provided by ENR. Corrective action following this incident included reviewing with staff that all doorways must be secured to prevent access by wildlife.

4.1.6 2011 Type A Water License Annual Report

The 2011 Water License Annual Report addresses the annual reporting requirements under Water License MV2001L2-002 issued by the MVLWB in May 2004. The 2011 Water License Annual Report was submitted on March 31, 2012.

The 2011 Water License Annual Report consists of a main document addressing the following:

- monthly and annual quantities of freshwater removed from Snap Lake;
- monthly and annual quantities of discharge from the Water Treatment Plant;
- monthly and annual quantities of treated sewage effluent discharged from the sewage treatment plant;
- monthly and annual quantities of water pumped to the North Pile;
- monthly and annual quantities of mine water pumped from the Mine to the Water Treatment Plant;
- monthly and annual quantities of water pumped into and out of the Water Management Pond;
- monthly and annual estimates of seepage and evaporation losses from the water control and collection system;
- monthly and annual estimates and measurements of precipitation and runoff;
- monthly elevations of water in Snap Lake during ice-free conditions;
- monthly elevations of water in the Water Management Pond;
- annual quantities of processed kimberlite (PK);
- annual quantities of PK placed as underground backfill;
- annual quantities and locations of Mine rock placed in the North Pile;
- summary of construction activities;

- an updated mine plan showing all underground excavation and backfilling locations;
- summary of all work carried out under the OSWRPKMP;
- summary of modifications or maintenance work on water control and collection system;
- summary and explanation of changes to Water and Sewage Treatment Plants;
- summary of the SNP and a summary of activities at each station;
- report on studies requested by the MVLWB;
- approved revisions to Spill Contingency Plan;
- spills and unauthorized discharges;
- spill training and communications exercises;
- annual hydrogeological modelling; and,
- changes or updates to the AMP.

The appendices of the 2011 Water License Annual Report are as follows:

- 2011 Dam Inspection Report (Section 4.1.8);
- Detailed Tabular Summaries of the 2011 Water Quality Data for the SNP Stations;
- 2011 Fish Tasting Event Summary; and,
- 2011 Annual Report for the AEMP (Section 4.1.9).

4.1.7 2011 Acid Rock Drainage and Geochemistry Monitoring Report

The Mine is owned and operated by De Beers. Monitoring of acid/alkaline rock drainage (A/ARD) at the Mine is required in support of Type A Water License, MV2001L2-0004 (MVLWB 2012). Ongoing aspects of ARD monitoring program include: monitoring of site runoff/seepage; conducting an annual site inspection by a qualified hydrogeochemist to review material placement and identify signs of incipient acid generation (if any); and preparing an annual report describing the environmental conditions on site with emphasis on the presence of acid/alkaline drainage. This report summarizes the results of ARD and geochemical monitoring conducted during 2011, comprising the sixth year of reporting.

This report fulfills the annual reporting requirement as required under the Type A Water License Part B, Section 5k):

> *"The Licensee shall file an Annual Report with the Board no later than March 31 of the year following the calendar year reported which shall contain the following information … 5k) updated results of ARD and related geochemical test work."*

This report also fulfills the reporting requirement under the Type A Water License Part B, Condition 5j) pertaining to the reporting for seepage surveys:

> *"…j) summary of all work carried out under the Ore Storage, Waste Rock and Processed Kimberlite Management Plan including the results of seepage surveys of the kimberlite ore storage stockpiles, North Pile, and Water Management Pond."*

Under the Type A Water License, an ARD and Geochemical Characterization Plan for the Mine was submitted to the MVLWB as part of the Ore Storage, Waste Rock, Processed Kimberlite herein referred to as the North Pile Management Plan. Data in this report have been presented and reported in accordance with the 2005 ARD Plan (De Beers 2006).

Primary study areas for the 2011 ARD and Geochemistry Monitoring Report are as follows:

- the underground mine and surface facilities, including the North Pile; the Plant Site; the Water Management Pond (WMP), and associated areas;
- the explosive storage facility;
- the kimberlite ore stockpile; and,
- site infrastructure (i.e., roads, rock pads, and any areas where rock has been disturbed or deposited).

Conclusions of the 2011 ARD and Geochemistry Monitoring Program include the following:

Conclusions

Overall minewater inflow rates were lower than predicted in the EAR during the 2011 monitoring period (Figure 5-2) except for a brief period between November 14 and 26, 2011. Cumulative TDS loading trends from the Mine were less than the EAR predicted values throughout the 2011 monitoring period.

The results of the water quality analysis at most SNP monitoring stations, bogs, and seepage monitoring stations at the Mine were similar to previous data and trends as described in the 2010 annual report (De Beers 2011).

Seepage from the North Pile could be resulting in elevated concentrations of nitrate, nitrite, and ammonia measured in bogs downstream of the North Pile (Bog TS2 Northeast) and North Pile piezometer SP 06-05, however overall discharge concentrations from the treatment remain within discharge limits.

Elevated concentrations of nitrate and ammonia were observed in the new monitoring locations in the bogs in the vicinity of the explosives storage facility. These locations were added in 2011 to monitor the locations near the new explosives facility and long-term trends are not evident at this point,

New construction, such as rock placement, that took place during the 2011 monitoring period included: construction of portions of the East Cell perimeter embankment and containment structures; construction of finger roads within the East Cell; and, relocation of the kimberlite stockpile at the camp area. Metavolcanic rock was also relocated from the bulk sample mine rock pad (BSMRP) area to the North Pile.

Granite rock collected from areas of new construction and existing site infrastructure contained less than 0.17% sulphide sulphur.

With the exception of some rock observed at the FAR, no visible signs of sulphide oxidation or incipient ARD were observed in rock exposed in rock pads, roads, building foundations, and laydowns during the September 2011 site inspection.

The results of geochemical characterization of granite and kimberlite mine rock samples collected by De Beers and samples collected from site infrastructure during the September 2011 site visit were consistent with the observed ARD results and trends in mine rock/construction rock geochemistry in the EAR and previous annual reporting periods. The geochemical assessment of granite, and kimberlite, has not changed as a result of the visual surveys or geochemical analysis of mine rock and confirmation geochemistry samples conducted in 2011.

The understanding of the geochemical behaviour of metavolcanic rock has been substantially improved and enhanced through the supplemental testing completed on the remaining materials at the BSMRP in 2011. The weathering of these materials over the past 12 years constitutes a long term, in-situ kinetic test of these

materials that provides better data than is possible to obtain through standard laboratory kinetic test programs.

Based on the 2011 testing of metavolcanic rock, and the ongoing water quality monitored at the BSMRP it is considered unlikely that the remaining metavolcanic materials at the BSMRP will become acidic over the long term.

Recommendations

Recommendations for ongoing adaptive management at the Mine have been developed based on the results of ongoing ARD monitoring as of December 2011, and water quality/mass loading trends, include:

- The clean granite stockpiles located near the Apron Quarry should continue to be available as a source of non-acid generating (non-AG) construction material for operators and mine managers.
- Localized zones of metavolcanic rock have been identified near the BSMRP during site inspections conducted in 2011 and in other locations in previous monitoring years. Further testing of some of the in-situ materials in 2011 has shown that this rock remains neutral and continues to have alkaline paste pH values, even after 12 years of weathering. It is considered unlikely that the remaining metavolcanic materials at the BSMRP will become acidic over the long term, however continued water quality monitoring at SNP 02-05 is recommended.
- An ongoing record of visible signs of sulphide oxidation and/or incipient acid generation should be kept. If the results of downstream water quality monitoring from downstream locations show an influence attributable to acid generation, remedial measures would need to be investigated.

The following recommendations are related to ongoing water quality monitoring at the Mine:

- Water quality samples should continue to be collected from select SNP monitoring stations and bogs downstream of site infrastructure to evaluate changes in water quality over time resulting from runoff and/or seepage from key site facilities.
- Runoff from non-point source discharges that do not report to the WMP should continue to be monitored. If runoff located downstream of these locations reports elevated concentrations of acidity or dissolved metals, then remedial measures may be required.
- Ongoing monitoring of bogs downstream of the former ammonia nitrate storage pad, currently referred to as SNP 02-09, is recommended

confirm concentrations of these parameters relative to those observed before this facility was relocated.

- Ongoing monitoring of the piezometers in the north perimeter embankment of the East Cell is recommended to verify the performance of the North Pile, and to evaluate the composition of potential seepage from the North Pile.
- Piezometers at WMP Dam 1 and WMP Dam 2 should be routinely checked, and sampled, if possible, to assist in evaluation of seepage from the WMP.

The following recommendations relate to the ongoing geochemical characterization program at the Mine, including site water quality predictions:

- It is considered that the overall geochemical evaluation program as completed is reasonable and appropriate for the site. The scope of the geochemical evaluation program should continue to be evaluated as mine activities progress.
- Site water trends should continue to be monitored and loading rates should be evaluated routinely as additional operational monitoring information is updated.
- The North Pile water management collection system sumps near Snap Lake should be maintained at elevations lower than Snap Lake to ensure drainage is directed to the sumps and collection ditches.

4.1.8 2011 Dam Inspection Report

The geotechnical dam inspection and preparation of this summary report are required in partial satisfaction of De Beers' Water License obligations. The Summary of 2011 Geotechnical Site Inspection report, comprising the inspection of the North Pile and WMP dams, was submitted separate from the Water License Annual Report. The purpose of the inspection is to assess the performance of the structures from a geotechnical and hydrotechnical perspective and to bring deficiencies and points of concern to the attention of De Beers.

Mr. Paul M. Bedell, M.E.Sc., P.Eng., of Golder conducted the inspection of the WMP dams on September 12 and 13, 2011. None of the monitoring information was provided prior to or during the inspection as De Beers has not interpreted and summarized the data in a timely or proactive manner. This is a deficiency in the operation of the WMP dams. As a result, Golder was not able to perform an audit of the monitoring program. De Beers provided Golder with the monitoring data subsequent to the inspection; a report summarizing the analyses of the monitoring

data was issued under separate cover. The water level in the WMP at the time of the inspection resulted in the direct impoundment of water against the upstream face of Dam 1 and against the fill materials upstream of Dam 2. It was recommended that the water level decreased as soon as practicable to reduce the likelihood of seepage from the WMP. No significant changes from the 2010 inspection, by Golder, were noted. The dams appear to be in satisfactory condition. Reference to the reporting prepared by Golder should be made for additional details and information.

4.1.9 Aquatic Effects Monitoring Program 2011 Annual Report

The AEMP is designed to monitor Snap Lake for mine-related effects, to verify and update the EAR predictions (De Beers 2002), and to support and inform management decisions made by the Mine. The AEMP fulfills requirements of Part G of Water License MV2001L2-0004 (Water License; MVLWB 2012) for the Mine. Components of the AEMP must also comply with Part F of the Water License and Section 5 of the Fisheries Authorization for the Mine. The MVLWB approved the AEMP in July 2005. This document represents the eighth annual AEMP report for the Mine and presents the results of the 2011 program.

The core of the AEMP is monitoring of water quality, plankton, sediment quality, benthic invertebrate community, fish tasting, and fish health. All monitoring components, with the exception of fish health, are undertaken annually. Fish health monitoring occurs on a five-year cycle. It began in 2004 and is not included as a component of the 2011 AEMP. The fish tasting program was conducted by De Beers in 2011, and is reported in Appendix E of the AEMP.

The primary study area for monitoring in 2011 was Snap Lake. The MVLWB approved Northeast Lake as the reference lake for the AEMP in April 2006; accordingly, monitoring in Northeast Lake has been integrated into the Snap Lake AEMP. Water quality monitoring in Northeast Lake began in 2006 and results are presented in Section 2 of this report. Sediment quality and benthic invertebrate community monitoring were also conducted Northeast Lake in 2011.

Water Quality

The 2011 water quality results were compared to regulatory guidelines, EAR benchmarks, and Water License limits to assess whether there was a potential for effects to aquatic life in Snap Lake in 2011. Based on the laboratory results from Snap Lake in 2011, there does not appear to be potential for aquatic or human health effects from water quality in Snap Lake. Concentrations for most parameters

were below aquatic life and drinking water guidelines, and acute toxicity was not observed in samples collected in 2011.

In 2011 water quality measurements for individual parameters in Snap Lake were generally below water quality guidelines and EAR benchmarks, with the exception of fluoride, which was routinely above the guideline for the protection of aquatic life (CCME 1999 with updates to 2012). Whole-lake average and maximum concentration of TDS in Snap Lake was below the License limit of 350 mg/L in 2011. The 2011 total phosphorus loading to Snap Lake from the sewage treatment system and water treatment plants was also below the Water License limit of 256 kilograms (kg).

The 2011 Snap Lake results for TDS, major ions, nutrients and metals indicate that water quality was within maximum whole-lake average EAR predictions, with some exceptions. Whole-lake average concentration and cumulative loads of TDS from 2006 to 2011 were higher than predicted in the EAR. Occasional instances of copper and manganese concentrations from Snap Lake were above EAR predictions; however, whole-lake average concentrations were below EAR predictions.

Based on the spatial pattern of treated effluent exposure, the source of the elevated manganese concentrations measured in the northwest arm in 2011 was not likely the treated effluent from the water treatment plant. Elevated manganese concentrations in the northwest arm were more likely related to lower dissolved oxygen (DO) concentrations at this location, and the reduction of manganese to the more soluble form under such conditions. Manganese concentrations are not increasing over time and were not correlated with conductivity, but will continue to be monitored and reviewed. Similar to manganese, there were no spatial trends in copper concentrations to indicate that the source was treated effluent from the water treatment plant. Copper concentrations are not increasing over time, but will also continue to be monitored and reviewed.

Concentrations and levels of water quality parameters in treated effluent discharges to Snap Lake in 2011 were below EAR predictions, with the exception of flow-weighted average concentrations of sulphate and beryllium. Detection limits for beryllium were greater than the maximum EAR prediction average, so the comparison should be interpreted with this limitation in mind. Sulphate concentrations have increased in Snap Lake; however, 2011 values were below the recommended drinking water guideline. The CCME does not recommend aquatic life criteria for sulphate. Because sulphate is a component of TDS (i.e., approximately 9%), it will be implicitly considered as part of the ongoing aquatic toxicity testing

being conducted to develop an appropriate site-specific, effects-based TDS water quality benchmark.

Runoff volumes from all the surface monitoring locations were small compared to the volume of Snap Lake; therefore, changes in water quality in Snap Lake from runoff inflows are expected to be localized, temporary, and negligible relative to the changes from the treated effluent plume. At most stations, runoff samples were collected from small, isolated catchments with no observable flow and limited connectivity to Snap Lake or the inland lakes at the time of collection.

The EAR predicted increases in concentrations of major ions, nutrients, and metals over time in Snap Lake due the discharge of treated effluent (De Beers 2002). In 2011, the parameters that appeared to be increasing in at least one area of Snap Lake were TDS, total alkalinity, total hardness, bicarbonate, calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate, all monitored nitrogen parameters, barium, boron, lithium, molybdenum, nickel, rubidium, strontium, titanium, and uranium. Concentrations of the these parameters have not and are not expected to increase above water quality guidelines, EAR benchmarks, or EAR predictions in the near future, with the exception of fluoride.

Future increases in fluoride are not likely to be a concern in Snap Lake as these increases will be accompanied by increases in calcium and hardness, which are expected to reduce the potential for toxic effects from fluoride. In addition, the British Columbia Ministry of the Environment (BCMOE) recently published new guidance on calculating aquatic life criteria for fluoride using hardness (BCMOE 2011). Using the formula provided, and a hardness of 120 mg/L, the BCMOE recommended aquatic life guideline is 1.4 mg/L. In comparison, the maximum fluoride concentration measured in 2011 was 0.17 mg/L and the Canadian Council of Ministers of the Environment (CCME) guideline for protection of aquatic life is 0.12 mg/L (CCME 1999 with updates to 2012).

During 2011 and over the past several years, vertical patterns in field conductivity have indicated that the effluent plume may no longer be sinking to the bottom of Snap Lake due to a lower density difference between the plume and lake water. Open-water profiles of conductivity indicated that the plume continues to be more evenly mixed throughout the water column during open-water conditions.

In the EAR, parameter concentrations associated with the treated effluent discharge were conservatively predicted to reach background concentrations within 44 km of Snap Lake, assuming maximum concentrations during operations. In 2011, evidence of the treated effluent was measured throughout Lakes 1 and 2, and near the inlet of Lac Capot Blanc (Lake 3), which are immediately downstream of Snap

Lake. Concentrations of Mine-related constituents reached background concentrations approximately 6 km downstream of Snap Lake.

Recommendations for the water quality component of the 2012 AEMP are:

- Continue to investigate the accuracy and precision of analyzing individual components total phosphorus (TP) by the analytical laboratories currently used in the AEMP program. Between 2009 and 2011, water samples were collected during the phytoplankton and water quality programs of the AEMP, and then sent to two different laboratories for analysis. A review of the data from the two simultaneous studies indicates that the results from the two laboratories were typically different. A nutrient study was conducted in spring of 2011 to attempt to resolve these issues; however, inconclusive results from that study require that nutrient analysis continue to be elevated.
- Blind, commercial samples should be submitted to several laboratories for analysis in 2012. Additional split samples from both the water quality and plankton programs should be submitted to the various laboratories for analysis of the various phosphorus fractions. The results would be compared, and recommendations would be made regarding laboratory choice for future AEMP programs.
- Review the application of the fluoride, chloride and nitrate guidelines because there are known ameliorating factors that would likely apply in Snap Lake. A review of the application of the CCME guidelines for Snap Lake and consideration of new benchmarks would be consistent with the EAR benchmark developed for copper, cadmium, and hexavalent chromium.
- Continue to make necessary adjustments to loadings and predictions for TDS and other treated effluent-related parameters. The whole-lake average concentrations of TDS are above the predicted values in the EAR at this stage in the operation of the Mine. The re-evaluation of the predicted loadings and consequences to the water quality in Snap Lake are being conducted because the concentrations of TDS and other treated effluent-related parameters are directly related to loadings.

Recommendations for the five-year AEMP update are to:

- Shift the focus from spatial and seasonal trends in Snap Lake to temporal changes in Snap Lake and changes downstream of Snap Lake. As the overall water quality begins to change in Snap Lake, the seasonal and spatial differences in water quality in the lake become less relevant and the temporal changes in Snap Lake and changes downstream of Snap Lake become more relevant. Information gathered

from the 2011 Downstream Sampling Program could be used to establish new downstream stations that would be in addition to the current KING01 station.

- In 2012, it is suggested that station K30 in Northeast Lake be named NEL06 and it be profiled on the same schedule as other stations in the Northeast Lake. Dissolved oxygen concentrations from deeper stations in Snap Lake could then be compared to DO concentrations at similar depths in Northeast Lake.
- These changes would likely mean a lower monitoring effort in Snap Lake, and greater effort downstream of Snap Lake and in the reference lake, Northeast Lake, compared to the current AEMP. These recommendations will be refined through the process of updating the AEMP.

Phytoplankton and Zooplankton

Significant spatial and temporal variation in total phytoplankton biomass and community composition occur naturally in lakes, and have been observed in Snap Lake between 2004 and 2011. Trend analyses and multivariate analyses indicated that there has been a shift in plankton community composition, since 2004.

Chlorophyll *a* results to date suggest that the trophic status of Snap Lake has not changed; however, this variable may not be an accurate surrogate of the Snap Lake phytoplankton community. At this time, continued monitoring of chlorophyll *a* concentrations is required by the Water License MV2001L2-0004 (Water License) Part G, Condition 2d. Currently, chlorophyll *a* is not recommended as a surrogate measure of the Snap Lake phytoplankton community, due to the poor correlation between chlorophyll *a* and total phytoplankton biomass. Calanoid copepods remain the dominant zooplankton group within Snap Lake, with seasonal changes occurring in the biomass of the cyclopoid copepods and rotifers. Cladocerans, commonly referred to as water fleas, continue to account for a relatively small proportion of the zooplankton community. A shift in biomass-based community composition has been documented in Snap Lake between 2004 and 2011.

Although chlorophyll *a* and total phosphorus concentrations suggest that Snap Lake remains within the range of oligotrophic lakes, concentrations of total nitrogen were within the range of eutrophic lakes. Although the lake remains severely phosphours-limited, results suggest that the lake is becoming nitrogen enriched with continued discharges of treated effluent. Multivariate analysis and evaluation of trends suggest that the plankton community is experiencing mine-related effects consistent with nutrient enrichment and consistent with the EAR predictions.

Based on the results to date, continuation of the monitoring program is recommended, with adjustments to enhance consistency among AEMP components.

Specific recommendations for the plankton component of the 2012 AEMP are to:

- evaluate the reasons for discrepancies observed between total phosphorous results obtained from the University of Alberta (plankton program) and ALS Laboratories (water quality program);
- continue picoplankton monitoring in Snap Lake and the Northeast reference lake to accumulate more data to allow a detailed evaluation of the usefulness of this component; and,
- re-evaluate of the usefulness of microcystin sampling.

Sediment Quality

Sediment quality monitoring in Snap Lake from 2004 to 2011 documented variability in concentrations of most parameters, among stations and years, although the 2011 concentration ranges were within a factor of five for most parameters. Elevated concentrations of several parameters at the west end of the northwest arm appeared to be unrelated to Mine activities. Snap Lake sediments were generally characterized as fine-grained material with elevated TOC concentrations. Northeast Lake sediments exhibited similar characteristics to Snap Lake sediments. Mean concentrations of approximately half the target parameters analysed in 2011 were higher in Northeast Lake sediments than in Snap Lake sediments.

Concentrations of cadmium, chromium, copper, and zinc were above ISQGs at one or more Snap Lake stations in 2011, and at all five stations in Northeast Lake. Similar observations were noted in Snap Lake in previous AEMP years and in 2004 under baseline conditions, which indicate that concentrations of these metals are naturally elevated in both lakes.

The most notable concentration gradients among Snap Lake sampling areas in 2011 were for available phosphate and available ammonium. Since 2008, available phosphate has been highest at the diffuser station and decreased markedly in other Snap Lake sampling areas and in Northeast Lake. Mean concentrations of available ammonium were generally similar among sampling areas from 2008 to 2010, but in 2011 they increased by almost five times at the diffuser station and to a lesser extent in other sampling areas. Concentrations of bismuth, calcium, phosphorus, silver, and sodium varied significantly with bottom conductivity, an indicator of effluent exposure, but only silver concentrations varied in a manner consistent with a potential Mine-related effect. Clear temporal trends in concentrations of most

sediment quality parameters were not observed in the near-field and mid-field areas between 2004 and 2011. Increasing trends in concentrations of certain parameters were balanced by decreasing concentrations of others, whereas most parameters exhibited no clear trends. Of the parameters with significant positive trends at the diffuser area, only available potassium and strontium also had significant positive trends in other Snap Lake sampling areas.

Overall, evaluation of spatial and temporal patterns in sediment quality did not provide clear evidence of an effect on Snap Lake sediments in areas exposed to treated effluent from the Mine. Ongoing sediment quality monitoring under the AEMP is expected to provide a more reliable indication of any potential effects on sediment quality in Snap Lake as the number of years of available data increases. If potential effects to sediment quality have occurred to date, they have been subtle and not clearly different than natural variability.

Recommendations for the sediment component of the 2012 AEMP are:

- In 2012, repeat the comparison of sampling the top 5 centimetres (cm) and top 2 cm of sediment at a minimum of three stations, using a sediment coring device instead of the Ekman grab to determine whether sampling equipment affects the results obtained for these two different depth horizons.
- In the AEMP Design Update, expand monitoring of sediment quality to add at least one station downstream of Snap Lake, and add a second reference lake in addition to Northeast Lake.

Benthic Invertebrate Community

Differences between Northeast Lake, and the near-field and far-field exposure areas in Snap Lake during fall 2011 in terms of taxa present were minor and not indicative of an adverse effect on the benthic community. Statistical tests comparing benthic community variables among sampling areas detected a significant difference only in *Tanytarsus* density. Despite large differences between the Northeast Lake and the two exposure areas in Snap Lake in mean total density and mean densities of individual taxa, statistical analyses detected only one significant difference, suggesting the sensitivity of statistical tests was low for density variables. The lower than expected sensitivity of statistical tests likely resulted from the highly variable data for density variables.

Although statistical comparisons between Northeast Lake and exposure areas in Snap Lake provided limited evidence of effects on the benthic community of Snap Lake, visual evaluation of the differences in abundances of dominant taxa suggests

a Mine-related enrichment effect. Higher total density and densities of the dominant taxa (Pisidiidae, *Microtendipes*, *Valvata*, and *Procladius*), in the near-field area in previous years (De Beers 2011) suggest that nutrient enrichment is occurring in this area. Higher total density and densities of dominant taxa were not as prevalent in the near-field area compared to Northeast Lake in 2011 due to unusually high densities at NEL01 in Northeast Lake, with only Pisidiidae density, Tanytarusus density, and Valvata density being higher in the near-field area. The higher densities at NEL01 are unusual for 2011 and it remains to be seen if this will continue in the future. In addition to the fall results, trends of increasing density and richness, and decreasing evenness in the near-field area over time based on late winter data (De Beers 2010) also indicate that the benthic community is changing over time in a direction consistent with nutrient enrichment.

The overall magnitude of the effect on the benthic invertebrate community can be classified as low, because no statistically significant differences were detected in total invertebrate density and richness in the 2011 data, and taxonomic composition of the community has not changed appreciably compared to baseline conditions. The observed low magnitude is consistent with EAR predictions of a negligible to low effect on the benthic invertebrate community in Snap Lake.

Results of the fall 2011 benthic survey and conductivity data collected in Snap Lake in late winter and fall 2011 were examined to recommend adjustments to the study design for future monitoring under the AEMP. The following recommendation is made for the AEMP benthic invertebrate program:

AEMP Update Recommendation:

- The near-field and mid-field areas can be combined for future analysis of effects, because these areas are similarly exposed to treated mine effluent, as indicated by similar conductivity profiles in these areas, both under-ice and during the open-water season.

4.1.10 Dissolved Oxygen 2011 Annual Monitoring Report

Why do we monitor dissolved oxygen in Snap Lake?

Dissolved oxygen (DO) concentrations in water are often used as one indicator of the overall health of the aquatic environment. The concentration of DO is the amount (mass) of oxygen that is present in a given quantity of water. Fish and other aquatic animals and plant life living in Snap Lake use the oxygen that is dissolved in the water, much like people use the oxygen in the air they breathe. As part of the environmental assessment, De Beers predicted that the discharge of treated effluent

to Snap Lake could result in a small decrease in the amount of DO in lake water, but that concentrations would remain at a level that is healthy for aquatic life in Snap Lake.

The dissolved oxygen in Snap Lake is monitored to check that concentrations remain at a level that is healthy for aquatic organisms. The DO is measured most often during the ice-covered period because concentrations in lakes tend to be lower under ice-covered conditions than during the open-water season. In open-water conditions, the water surface is directly exposed to air and wind which actively adds oxygen to the water. Potential effects from the discharge of treated effluent at the Mine may be more easily observed during ice-covered conditions, when wind-driven influences are absent.

Monitoring of DO is required under the authority of the Water License, Environmental Agreement, Fisheries Authorization, and Environmental Agreement.

What did we do in 2010 to 2011?

Between July 2010 and May 2011, DO was measured at various depths throughout the water column at monitoring stations in Snap Lake and Northeast Lake. The stations included several relatively deep locations in Snap Lake because DO concentrations tend to be lower in deeper waters.

Concentrations of DO were measured in July, August, and September during the open-water period, and in February, March, April, and May during ice-covered conditions. Concentrations of DO were compared with the minimum concentration required for fish and aquatic animals and plant life to remain healthy. Also, the changes in DO concentration during the period of ice-cover in 2011 were compared with changes observed in previous years, and with predictions in the EAR for the Mine.

What did we learn?

The DO during the open-water season of 2010 and the ice-covered period of 2011 was monitored and then the results were compared to data from previous DO reports (De Beers 2009, 2010a). The monitoring confirmed that the concentrations of DO in Snap Lake were at levels considered healthy for fish and other aquatic organisms, with the exception of two locations within the northwest arm. Since monitoring began in 2007 at these two locations, low DO concentrations near the bottom of the lake have been observed during ice-covered conditions. Overall, DO concentrations in Snap Lake do not appear to have decreased as a result of Mine water discharge. In 2011, increases rather than reductions in bottom DO concentrations were observed around the diffuser relative to Northeast Lake.

We will continue to monitor DO while the Mine is operating to confirm that levels in Snap Lake remain within a healthy range for fish and other aquatic organisms.

4.1.11 Total Dissolved Solids Monitoring Near Fish Habitat Compensation Areas in Snap Lake

Why do we monitor total dissolved solids?

Total dissolved solids are defined as the measure of the total amount of dissolved matter in water, such as calcium, magnesium, carbonates, bicarbonates, and metallic compounds. The amount of solids dissolved in natural water varies with water type. The salt water in oceans, for instance, has a much higher concentration of TDS than freshwater in Arctic lakes, such as Snap Lake. High concentrations of TDS can be harmful to fish and other aquatic organisms if they are not adapted to these levels.

An increase in the concentration of TDS in Snap Lake water was predicted in the Mine environmental assessment (De Beers 2002) and, as expected, the concentration of TDS has increased in Snap Lake in recent years (De Beers 2011). Most of the water discharged from the Water Treatment Plant into Snap Lake is sourced from groundwater, which has higher concentrations of TDS than the water in the lake. The environmental assessment predicted that, over the life of the Mine, the average concentration of TDS in Snap Lake would remain below 350 mg/L. As a condition of the Water License for the Mine, TDS concentrations are specified to remain below 350 mg/L in Snap Lake (Mackenzie Valley Land and Water Board (MVLWB) 2004). The concentration of TDS in Snap Lake is monitored on an ongoing basis to confirm that it remains below the predicted maximum of 350 mg/L.

What did we do in 2010 and 2011?

Water samples and field water quality profile measurements were collected during open-water and ice-covered conditions from July 2010 to May 2011 near the artificial reef, fresh water intake embankment, and minewater outlet embankment. These are compensation structures established by the Mine to provide fish habitat compensation. Four sampling stations are used to measure TDS around the fish habitat compensation structures; these four stations are also part of the Snap Lake AEMP.

To evaluate the maximum TDS concentrations throughout Snap Lake, measurements of TDS from all stations in Snap Lake were also included in this assessment, including all other AEMP stations and three Surveillance Network Program (SNP) stations located closest to the treated minewater discharge location.

Water samples and field water quality profile measurements were collected from July 2010 to May 2011 from the AEMP and SNP stations. Monthly water samples and field water quality profile measurements were collected at the SNP stations when field conditions, such as ice thickness, were safe. Quarterly water samples, including samples in July and September 2010, and February and April 2011, were collected at the AEMP stations. Quarterly field water quality profile measurements during the 2010 open-water period and monthly field water quality profile measurement during the 2011 ice-covered period were collected at the AEMP stations.

What did we learn?

Monitoring during the 2010 open-water period and the 2011 ice-covered period confirmed that the concentrations of TDS near the fish habitat compensation structures, and throughout Snap Lake, were below 350 mg/L. The maximum TDS concentrations measured near the fish habitat compensation structures and throughout Snap Lake were 213 mg/L and 246 mg/L, respectively. To confirm that the concentration remains below the predicted maximum and within a healthy range for aquatic life in Snap Lake, monitoring of TDS in Snap Lake will continue over the life of the Mine.

4.1.12 Benthic Invertebrate Community

The objectives of the 2011 Snap Lake benthic invertebrate program were to determine if the benthic invertebrate community was affected by changes in water and sediment quality in Snap Lake, and to compare observed changes to EAR predictions.

Benthic invertebrate samples were collected at 13 stations in Snap Lake and 5 stations in Northeast Lake during the fall open-water season in 2011. Samples were analyzed for taxonomic composition and biomass.

The benthic community of Snap Lake in fall 2011 was characterized by variable but low total density, low to moderate richness, and dominance by Chironomidae and Pisidiidae. This type of community is expected in the sub-Arctic region where Northeast Lake and Snap Lake are located (Beaty et al. 2006; Northington et al. 2010). Richness, diversity, and evenness varied moderately, and density variables were highly variable. Biomass was typically low and highly variable among stations, and was positively correlated with total density. Station NEL01 in Northeast Lake and SNAP05 in the near-field area of Snap Lake had considerably higher total invertebrate density and biomass than all other stations sampled in 2011.

Differences between Northeast Lake, and the near-field and far-field exposure areas in Snap Lake during fall 2011 in terms of taxa present were minor and not indicative of an adverse effect on the benthic community. Statistical tests comparing benthic community variables among sampling areas detected a significant difference only in *Tanytarsus* density. Despite large differences between the Northeast Lake and the two exposure areas in Snap Lake in mean total density and mean densities of individual taxa, statistical analyses detected only one significant difference, suggesting the sensitivity of statistical tests was low for density variables. The lower than expected sensitivity of statistical tests likely resulted from the highly variable data for density variables.

Although statistical comparisons between Northeast Lake and exposure areas in Snap Lake provided limited evidence of effects on the benthic community of Snap Lake, visual evaluation of the differences in abundances of dominant taxa suggests a Mine-related enrichment effect. Higher total density and densities of the dominant taxa (Pisidiidae, *Microtendipes*, *Valvata*, and *Procladius*), in the near-field area in previous years (De Beers 2011) suggest that nutrient enrichment is occurring in this area. Higher total density and densities of dominant taxa were not as prevalent in the near-field area compared to Northeast Lake in 2011 due to unusually high densities at NEL01 in Northeast Lake, with only Pisidiidae density, Tanytarsus density, and Valvata density being higher in the near-field area. The higher densities at NEL01 are unusual for 2011 and it remains to be seen if this will continue in the future. In addition to the fall results, trends of increasing density and richness, and decreasing evenness in the near-field area over time based on late winter data (De Beers 2010) also indicate that the benthic community is changing over time in a direction consistent with nutrient enrichment.

Repeated measures of ANOVAs on the 2009 to 2011 data detected no significant year by area interactions for any of the benthic invertebrate summary variables. These results indicate that changes in the benthic invertebrate community of Snap Lake from 2009 to 2011 were similar to natural year-to-year variation observed in Northeast Lake.

Multivariate analysis did not provide clear evidence of a mine-related effect on the benthic invertebrate community of Snap Lake. The analysis identified some stations with unique communities, but it did not identify clusters of stations with similar communities at similar levels of exposure to the treated effluent. Reference stations and stations with varying levels of exposure to the treated Mine effluent were intermixed on the ordination plot. Results of multivariate analysis suggest that at this time, a factor other than the Mine discharge exerts a stronger influence on benthic community structure, or the high variability in the data masks the effect of the Mine discharge.

The mesh size special study suggested that the 500 µm mesh data were slightly less sensitive than the 250 µm data in detecting differences in diversity between Northeast Lake and near-field area of Snap Lake. Conclusions regarding the potential effects of treated effluent on the benthic invertebrate community in Snap Lake are similar regardless of the mesh size used. Continued use of the 500 µm mesh is recommended to continue accumulating a consistent long-term AEMP data set.

The overall magnitude of the effect on the benthic invertebrate community can be classified as low because no statistically significant differences were detected in total invertebrate density and richness in the 2011 data, and taxonomic composition of the community has not changed appreciably compared to baseline conditions. The observed low magnitude is consistent with EAR predictions of a negligible to low effect on the benthic invertebrate community in Snap Lake.

Results of the fall 2011 benthic survey and conductivity data collected in Snap Lake in late winter and fall 2011 were examined to recommend adjustments to the study design for future monitoring under the AEMP. The following recommendation is made for the AEMP benthic invertebrate program:

AEMP Update Recommendation:

- The near-field and mid-field areas can be combined for future analysis of effects, because these areas are similarly exposed to treated mine effluent, as indicated by similar conductivity profiles in these areas, both under-ice and during the open-water season.

4.2 NON-ANNUAL REGULATORY REPORTING REQUIREMENTS

4.2.1 Water Intake and Minewater Outlet Embankments Post Construction Habitat Compensation Monitoring Report

In 2005, De Beers began construction of the water intake and minewater outlet at the Mine. Although these structures were designed to minimize the change or loss of existing fish habitat, some fish habitat along the shore of Snap Lake was lost during installation of the pipes for the water intake and mine water outlet. To make up for the loss, new fish habitat was constructed by placing clean, large rocks (cobble and boulders) on top of the water intake and minewater outlet pipes. The large rocks placed on the water intake and minewater outlet pipes increased the amount of shoreline area available for fish at two locations in the lake.

De Beers conducted pre-construction (2005) and post-construction (2007 and 2008) fish and fish habitat monitoring at the intake and outlet locations. A variety of fish species were observed using the new habitat after construction was complete. More fish were seen after construction of the new shoreline habitat than before construction began. Monitoring of the new habitat will continue for one more year (2009) to ensure fish keep using these new areas.

4.2.2 Stream 27 Habitat Compensation Monitoring Report

One small stream (Stream 29) near Snap Lake will lose feeding habitat for Arctic Grayling due to the construction of a rock berm as part of the De Beers Mine. To make up for the loss of this habitat, habitat improvements were designed and implemented on another nearby stream, (Stream 27). The use of habitat in S27 by fish was limited by stream flow, low water levels in early summer, and the presence of natural barriers to fish passage. Habitat improvements to increase the potential of the stream to provide spawning and rearing habitat for fish species from Snap Lake were installed on S27 in fall 2007. A natural barrier (alder rootwad) was removed to increase stream flows and fish passage, and a rock weir was constructed at the head of the stream to moderate water levels during the spring freshet.

Use of the stream by fish was monitored before and after removal of the rootwad barrier. After the blockage was removed and the weir constructed, Arctic Grayling were observed spawning in S27 in both 2007 and 2008. Arctic Grayling eggs hatched in the stream, and juvenile fish were observed throughout the stream in spring and summer. The compensation work conducted at S27 is considered to be successful, as fish are not trapped in stream at low flows, and are able to spawn and rear in areas upstream from the old barrier. De Beers will continue to monitor the habitat in the stream and to stabilize the rock weir and rock wall as required. As of 2010, the stream 27 compensation is closed.

5 SUMMARY OF COMPLIANCE

In addition to the submissions discussed in previous sections, the INAC site inspections in 2011 are summarized in Table 5-1. The areas of the Mine that were inspected during each inspection are listed, followed by recommendations, comments and requests made by the Inspector. Observations by the Inspector concerning items that were recommendations or required action on previous inspection reports are also included. A summary of the De Beers response to the Inspector requests is also provided (Table 5-1). The complete INAC Inspection reports can be found on the MVLWB public registry.

Table 5-1 Summary of Compliance, 2011

Inspection Date	Inspection Report
February 10, 2011	The following areas were inspected: Scope: Develop the North Pile & Deposit PK [iv]. *[PK deposition into Starter Cell]* Part B: General Conditions [8]. Operate & maintain meters. *[Ammonia, pH, Conductivity]*. Part E: Waste Management [2]: Maintain waste containment structures so as to prevent the escape of wastes *[Diffuser; Dam 1; Bulk Nitrate Storage; Historic AN Pad].* Part I:Closure & Reclamation [10]: Report on reclamation action committed to in the Interim Mine Closure & Reclamation Plan.
February 10, 2011	The following areas were inspected: Part A, Scope of Permit 1 (a) (vii). Maintain a winter road. *[Construction of the winter road].* Part C, 26(1) (i), Clause 50. Dispose of all domestic waste as outlined in the Domestic Waste & Sewage Mgt. Plan. *[Burn Pit]* Part C, 26(1) (i), Clause 51. Dispose of hazardous waste as outlined in the Hazardous Waste Management Plan. *[WMA]* Part C, 26(1) (i), Clause 52. Remove non-combustible garbage & debris to a disposal site. *[WMA; Recycling; Landfill].* Part C, 26(1) (m), Clause 64. Don't allow petroleum products to spread to surrounding lands or into water bodies. *[Secondary containment for vehicles maintaining the Winter Road].*
April 6, 2011	The following areas were inspected: Part A, Scope of Permit 1 (a) (vii). Maintain a winter road. *[Improvement work on the winter road].* Part C, 26(1) (g), Clause 38. When drilling on ice, use a closed-circuit drilling system. *[drilling activity for dyke delineation project]* Part C, 26(1) (i), Clause 50. Dispose of all domestic waste as outlined in the Domestic Waste & Sewage Mgt. Plan. *[Burn Pit*] Part C, 26(1) (i), Clause 52. Remove all non-combustible garbage & debris…to an approved disposal site. *[Land fill]* Part C, 26(1) (m), Clause 74. Don't allow petroleum products to spread to surrounding lands or into water bodies.
May 25/June 8, 2011	The following areas were inspected:

Table 5-1 Summary of Compliance, 2011 (continued)

Inspection Date	Inspection Report
	Part A, Scope of Permit 1 (a) (iv). Develop the North Pile. *[Construction of East Cell ribs and divider berms].* Part C, 26(1) (a), Clause 5. Use a closed circuit drilling system & ensure cuttings don't enter any waterbody when drilling within 100m of ordinary high water mark. *[drilling activity for dyke delineation project]* Part C, 26(1) (g), Clause 35. Deposit all non-toxic drill waste into a sump. *[drilling activity for dyke delineation project].* Part C, 26(1) (i), Clause 50. Dispose of all domestic waste as outlined in the Domestic Waste & Sewage Mgt. Plan. *[Burn Pit]* Part C, 26(1) (i), Clause 52. Remove all non-combustible garbage & debris…to an approved disposal site. *[Land fill].* Part C, 26(1) (m), Clause 74. Don't allow petroleum products to spread to surrounding lands or into water bodies.
June 8, 2011	The following areas were inspected: Scope: Develop the North Pile [iv]. [Deposit PK; Starter Cell] Part B; Maintain meters [8]: *[Turbidity, Ammonia, pH meters*] Part E: Waste Management [2]: Maintain waste containment structures so as to prevent the escape of wastes *[Dam 1; Bulk Nitrate Storage; Historic AN Pad; Relocation of AN saturated material to the Starter Cell]* Part F: Water Management [21]: Ensure effluent discharged is not acutely toxic to aquatic life. *[Diffuser]* Part I: Closure & Reclamation [8 & 10]: Provide for approval a MineReclamation Status Report; Report on reclamation action committed to in the Interim Mine Closure & Reclamation Plan.
July 6, 2011	The following areas were inspected: Scope: (a) (Extract ore) [i]. *Drilling program (kimberlite delineation project)*. Part B: General Conditions [6]. Comply with SNP. (Copper exceedance; high nitrate in WMP) Part E: Waste Management [2]: Maintain waste containment & r/o control structures + ensure they're operated so that they prevent the escape of wastes to the surface & ground water systems. [*Dam 1*; *Bulk Nitrate Storage*; *Historic AN Pad*; *Sumps*] Part F (Water Management) [21]. Ensure effluent discharged is not acutely toxic to aquatic life. *[Diffuser]* Part I: Closure & Reclamation [8 & 10]: Provide for approval a MineReclamation Status Report; Report on reclamation action committed to in the Interim Mine Closure & Reclamation Plan.
August 3 and 4, 2011	The following areas were inspected: Scope: (a) (Extract ore) [i]. *Drilling program (kimberlite delineation project)*. Part B: General Conditions [4]. Operate in accordance with the last approved Plan (Water Management Plan). *[Dust suppression, dust from airstrip]* Part E: Waste Management [2]: Maintain waste containment & r/o control structures + ensure they're operated so that they prevent the escape of wastes to the surface & ground water systems. [*Dam 1*; *Bulk Nitrate Storage*; *Historic AN Pad*; *Sumps*] Part F (Water Management) [21]. Ensure effluent discharged is not acutely toxic to aquatic life. *[Diffuser]* Part G: AEMP [5]. Implement the AEMP. [Flume study] Part I: Closure & Reclamation [8 & 10]: Provide for approval a MineReclamation Status Report; Report on reclamation action committed to in the Interim Mine Closure & Reclamation Plan.

6 SUMMARY OF ACTIVITIES AT SNAP LAKE

6.1 2011 CONSTRUCTION ACTIVITIES

Construction milestones achieved during 2011 included:

- Placement of new diffuser
- Relocation of meta-volcanic rock by South Pit to the North Pile
- Construction of East Cell embankments and ribs
- De-commission temporary camp for shipment on the winter road
- Installed pipe bench for paste line

6.2 2012 CONSTRUCTION AND OPERATIONAL ACTIVITIES

Operation activities planned for 2012 include:

- East Cell development (North Pile).
- Dredging on the WMP
- Pipe infrastructure upgrade
- Landfill relocation
- Improved water management
- IL6 Ditch

7 SUMMARY OF MITIGATIVE MEASURES

The AEMP annual report demonstrates that the Mine's impact is similar to what was predicted in the Environmental Assessment. This demonstrates that the mitigative measures being used by De Beers are working effectively. Currently, the main area of investigation for new mitigative measures is in the area of TDS lake concentrations. This work is ongoing.

8 SUMMARY OF ADAPTIVE MEASURES

A summary of adaptive measures undertaken in 2011 are:

- **Control PED installation**
  - Wireless fan control for underground
  - Eliminate 770hp
  - 800,000L annual fuel savings
- **Decommissioned construction camp and moved into new accommodations**
  - More efficient building
  - Heated via generator heat recovery
  - Emission reductions are still being measured

9 SUMMARY OF PUBLIC CONCERNS

De Beers hosted a number of Aboriginal Communities to site visits at the Mine in 2011. The main concern was water management:

- Manage water as per design of the water control structures.
- Manage spills effectively and reduce the number of spill occurrences.
- Water treatment. Water coming into the site versus water being treated and discharged.

10 SUMMARY OF NEW TECHNOLOGIES INVESTIGATED

New technologies being researched:

- **Low temperature heat recovery for FAR pre-heat**
  - Recover waste heat from generators
  - Pre-heat air going underground prior to diesel burners
- **Optimal Generator Configuration**
  - Balance power and heat recovery efficiency
- **LED Lighting**
  - replace conventional lights as required
  - lower power consumption

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