Fisheries and Oceans | Pêches et Océans

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agft Rec'd via e-mail Fe 5/14/03

Your file *Votre référence*

Our file *Notre référence*
SC00196

February 14, 2003

Mackenzie Valley Environmental Impact Review Board
Box 938, 5102-50th Avenue
Yellowknife, NT
X1A 2N7

Attention: Glenda Fratton, Environmental Assessment Coordinator

Dear Ms. Fratton:

Please accept the attached technical report for submission to the Public Registry. This report identifies outstanding concerns identified by the Department of Fisheries and Oceans (DFO) subsequent to the public technical sessions.

A large number of Technical Memorandums have been received this week in response to requests raised during the technical sessions. DFO has not had adequate time to review this large body of new information. As a result, our review of these documents may alleviate or identify additional concerns with the Snap Lake Diamond Project.

We trust that this submission meets the Review Board's requirements. Should you have any questions please call me at (867) 669-4911.

Yours truly,

Julie Dahl
Area Chief
Fish Habitat Management
Department of Fisheries and Oceans- Western Arctic Area

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Copy Robin Johnstone – De Beers

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Summary

The technical report submitted by the Department of Fisheries and Oceans on February 14, 2003, identifies outstanding issues and concerns with the Snap Lake Diamond Project. The report describes outstanding issues subsequent to the technical sessions, but does not reflect a review of new information that has been received in the week prior to submission. The outstanding issues and recommendations identified in the report are summarized below and are subject to change.

FISH HABITAT ASSESSMENT AND DFO'S NO NET LOSS PRINCIPLE

A Technical Memorandum entitled *Fish Habitat of Inland Lakes* was submitted February 11, 2003, but it was not possible to conduct a thorough review. Additional information may be required to complete the No Net Loss accounting to ensure no net loss of fish habitat.

ADEQUACY OF BASELINE AQUATIC DATA

Benthic invertebrate communities in Snap Lake were not sampled in the deep waters of Snap Lake therefore predictions of impacts to the whole aquatic community are deficient.

IDENTIFICATION OF CRITICAL HABITAT AREAS

Potential fish spawning and rearing areas close to the mine near seepage and effluent sources have not been assessed for each fish species, therefore habitat suitability values for NNL accounting should be revised.

EFFECTS OF MINE EFFLUENT DISCHARGE

The mine effluent will impact the aquatic community in Snap Lake by direct and indirect means. There are concerns with the whole effluent toxicity, chronic toxicity of increased metal concentrations, plume delineation and the percentages of the lake that will be affected. There may be greater impacts than predicted on fish and aquatic organisms due to the bioaccumulation of metals and due to the density and total dissolved solids in the effluent plume. The nutrients in the mine effluent may cause a trophic status change of Snap Lake. The nutrient addition could also result in the loss of aquatic habitat and/or the loss of aquatic species.

METALS FROM NON-POINT SOURCES: EFFECTS ON FISH HABITAT

There are potential impacts on near-shore fish habitat from sediment runoff and from metals that can be mobilized from potential acid generating rock that will be contained in waste rock storages. Some of the water is predicted to leak from the storage and potentially runoff or seep into Snap Lake. The deposit of these materials is not acceptable.

FISH AND FISH HABITAT ISSUES AND THE SNAP LAKE DIAMOND PROJECT

1.0 INTRODUCTION

On February 2, 2001, De Beers Canada Mining Inc. (De Beers) submitted an application for a Class "A" Land Use Permit and a Class "A" Water Licence for the proposed Snap Lake Diamond Project. The application was to the Mackenzie Valley Land and Water Board (MVLWB) for the development of a 3000 tonnes per day underground diamond mine with an operating life of 22 years.

On May 23, 2001 the MVLWB referred the development application to the Mackenzie Valley Environmental Impact Review Board (Review Board) for an Environmental Assessment (EA). The Review Board is required by Section126 of the Mackenzie Valley Resource Management Act (MVRMA) to conduct an EA of the development in accordance with Part 5 of the MVRMA.

On February 26, 2002 De Beers submitted its Environmental Assessment Report (EAR).

The Department of Fisheries and Oceans (DFO) is participating in this review of the De Beers Snap Lake Diamond Project as an expert government reviewer as identified in the Environmental Assessment Terms of Reference (ToR). DFO's review has also considered fish and fish habitat issues as a Responsible Minister under its mandate established by the *Fisheries Act*. DFO is also required to consider issuing a ss.35(2) Fisheries Act Authorization for the harmful alteration, disruption or destruction of fish habitat. As such, DFO will be a regulatory authority for this development as defined in the MVRMA.

The Department of Fisheries and Oceans has conducted a technical review of the general subjects as described in the Terms of Reference. The review has considered the description of the existing environment in relation to aquatic organisms and habitat (ToR 2.5.2) and the Environmental Impacts of the project in relation to water quality and quantity (ToR 2.6.4) and aquatic habitat (ToR 2.6.5). Specific aspects of these areas were reviewed in the Snap Lake EAR, related Information Requests and Public Technical Sessions.

The following subject areas were not considered an issue or have been resolved:

- Hydrologic Impacts on Snap Lake and Area Streams
- Impacts of underground blasting on fish and fish habitat
- Rare or sensitive fish species and habitat
- Mortality (includes fishing)

However, there are a number of issues that are unresolved. These are listed below:

- DESCRIPTION OF EXISTING FISH HABITAT ANDAQUATIC ORGANISMS
    - Fish Habitat Assessment and DFO's No Net Loss Principle
- ADEQUACY OF BASELINE AQUATIC DATA
    - Identification of Invertebrates at Depth
- IDENTIFICATION OF CRITICAL HABITAT AREAS
    - Spawning Habitat
- EFFECTS OF CONSTITUENTS IN EFFLUENT DISCHARGE
    - Metals in Discharge
- PLUME DELINEATION AND % OF LAKE AFFECTED
    - Elevated TDS in deep water zones
- EFFECTS OF TDS ON LAKE TROUT AND OTHER ORGANISMS
- BIOACCUMULATION OF METALS
- NUTRIENTS AND EFFECTS ON FISH HABITAT
- METALS FROM NON-POINT SOURCES: EFFECTS ON FISH HABITAT
    - Leaching of metals from Potential Acid Generating Rock

2.0 TECHNICAL COMMENTS

DFO offers the following technical comments on unresolved issues pertaining to the EAR of the proposed Snap Lake Diamond Project.

2.1 DESCRIPTION OF EXISTING FISH HABITAT AND AQUATIC ORGANISMS

Reference: ToR line # 222, 402, 410-412 EA Report Section 9.5, 9.5.1.2.6 Fish Habitat Mapping and 9.5.1.2.7 Stream Surveys Appendix IX.12

2.1.1 Fish Habitat Assessment and DFO's No Net Loss Principle

In order to adequately assess project-related impacts to aquatic systems, specifically fish and fish habitat, DFO must be assured that an adequate determination of the presence or absence of fish habitat has been undertaken. This determination is also necessary to assess if any aspect of the project is likely to cause a harmful alteration, disruption, or destruction (HADD) of the identified fish habitat, specific to DFO's requirements under the Fisheries Act. There appears to be a lack of adequate assessment or at least a lack of demonstration to DFO that an adequate and defensible assessment of the impacted waterbodies has been undertaken.

Fish habitat assessments, the calculation of habitat units and related indices for No Net Loss (NNL) Accounting for Snap Lake are provided in Appendix IX.12 of the EAR. Although DFO's Habitat Management Policy guiding principle of NNL is mentioned in the EAR an overview of how this will be achieved during construction, operation, care and maintenance and closure stages of mine development is not provided.

DeBeers' Conclusion

Waterbodies that did not contain fish, were small or shallow (greater than 90% of the lake was < 3m deep) or had undefined connections were not determined by DeBeers to have the potential to support a fish community. These waterbodies were excluded from the assessment undertaken by DeBeers. In response to requests made by DFO to DeBeers (January 15, 2003 letter and Jan. 29, 2003 meeting) that further data be presented to support the determination of these waterbodies as not being fish habitat, the proponent provided the additional information on February 11, 2003. However, they stated that the requirement for information for waterbodies on the peninsula was not required under the Terms of Reference for EAR.

DFO's Position and Rationale

The Department of Fisheries and Oceans maintains that all waterbodies likely to be impacted by any aspect of the project, were to be assessed in the EAR. This requirement was identified in the Terms of References in lines 400-401, 402, and 410-412. The latter citation specifically addresses the requirement to provide an overview of how the DFO, 1986 principle of No Net Loss will be achieved. Some of the lakes and streams within the project footprint have not been assessed and/or documentation has not been provided.

Fish habitat is defined in the Fisheries Act, and reiterated in the Review Board's Term of Reference and Work Plan as "*Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes*". The presence or absence of fish aid in confirming the presence of fish habitat however, the lack of "defined streams" does not necessarily exclude the presence of fish habitat. Many undefined streams and channels support fish habitat for periods of the year. Small water bodies and even undefined streams can provide nutrient and/or food supply to adjacent or downstream habitat or contribute to water quality for fish.

The determination of presence or absence of fish habitat appears to have been based solely on water depth. Water bodies less than two meters deep were not evaluated, while deeper water bodies were assessed. Many of the inland lakes and streams identified within or next to the mine footprint were not classified as fish habitat since it was determined by De Beers' consultant (Golder) that the lakes were too shallow to overwinter fish.

The assessment may not have determined seasonal or transient use of various inland lake and stream habitats. For example, Lake IL5 has a resident fish population and lies at the top of a chain of inland lakes, therefore the intermediary lakes may be necessary migration routes to the lake from Snap Lake and should therefore be accounted for as fish habitat. Lake IL7 and its intermediaries to Snap Lake would likely also contain fish. Also, stream S27 and the headwater lake supplying this stream appeared to be under the mine footprint, but impacts were not assessed.

The EAR provided no data to substantiate that a thorough assessment of those water bodies to be impacted by the project, was undertaken.

DFO identified these deficiencies within the EAR and requested that De Beers submit this data by Information Request (IR) 2.1.1 and Information Request 4.1. IR 4.1 was submitted by DFO to the Review Board but was edited by the Review Board so that the information request was not forwarded to De Beers.

DFO determined that further assessment using criteria other than depth should be presented to demonstrate that water bodies or drainages under the direct footprint of the development are not fish habitat. DFO presented its concerns and requirements for fish habitat assessment for all aquatic habitat under the mine footprint at the Public Technical Sessions. A letter dated January 15, 2003, as mentioned above, that detailed specific requirements was also sent to the proponent.

During a meeting January 28, 2003, De Beers provided rationale as to why stream S27 would not be impacted and therefore an assessment was not completed. This rationale was accepted by DFO.

A Technical Memorandum entitled Fish Habitat of Inland Lakes was received by DFO on February 11, 2003.

DFO's Conclusion and Recommendation

It appears that the requested information has now been provided, however a thorough review of the document is not possible prior to submission of this Technical Report. An addendum to the DFO report will be submitted later. There also appears to be additional information required to complete the NNL accounting. The NNL accounting by definition must include losses and gains to result in no net loss of fish habitat. Thus far, only losses are identified.

2.2 ADEQUACY OF BASELINE AQUATIC DATA

Reference: ToR line # 222 EA Report Section 9.5.1.2.3, pg. 9-261

2.2.1 Identification of Invertebrates at Depth

The adequacy of the benthic invertebrate sampling program was identified as being questionable based on Responses by DeBeers to many information requests and information presented at the public technical sessions.

DeBeers' Conclusion

De Beers has maintained that they have undertaken a thorough baseline benthos sampling program.

DFO's Position and Rationale

DeBeers' baseline sampling program did not sample the benthic community in areas of Snap Lake deeper than 8 metres. The lack of these data compromises the assurance that an adequate baseline study has been undertaken and that prediction of impacts to the whole aquatic community are valid.

The concern with the lack of information is more pronounced due to possible effects on the aquatic community in the deep or profundal zones of the Snap Lake. Dissolved oxygen levels are predicted to decrease at depth and total dissolved solids (TDS) are predicted to increase at depth: both being project-related effects which could negatively impact the benthic invertebrate community.

DFO's Conclusion and Recommendation

A reduction of the benthic community could impact fish populations and disrupt the ecological balance within Snap Lake. Impact predictions should be undertaken to assess the potential for and magnitude of impacts to benthic invertebrates in deep areas of Snap Lake: such predictions may, however, be inadequate without baseline benthic invertebrate data from these deep areas.

2.3 IDENTIFICATION OF HABITAT AREAS

Reference: ToR line # 403 EA Report Section 9.5.2.3 pg. 9-338.

2.3.1 Spawning Habitat

Baseline studies had suggested that spawning habitat for lake trout was limited within Snap Lake. The preferred lake trout spawning habitat in Snap Lake was determined to be boulder-bedrock shoals near deep water. The most active spawning ground was located near the centre of Snap Lake. Although the deepest water is found at the extreme west end of the North Arm or Channel of Snap Lake no spawning areas for lake trout were identified in the North Arm. There are potential spawning areas located on shoals within the area of influence of the mine effluent, hence spawning fish, their eggs and fry could be negatively effected by discharges to Snap Lake.

DeBeers' Conclusion

De Beers has identified all spawning habitat areas for lake trout within Snap Lake and concluded that none will be impacted by the mine.

DFO's Position and Rationale

The areas of Snap Lake in the vicinity of the minewater discharge and wasterock pile seepage have not been adequately surveyed for their potential to support spawning of lake trout or other fish species. The EAR states that spawning areas are outside of any areas impacted by effluent discharges, but the only spawning areas identified in the report were

located in the main area of Snap Lake to the Southeast of the proposed mine. There are potential spawning areas located on shoals much closer to the mine within the area of influence of the mine effluent, hence eggs and larval fish in these area may experience acute and chronic toxicity resulting from project-related water quality changes.

Spawning surveys were only undertaken to document lake trout spawning sites. Potential effects to spawning areas of other fish in Snap Lake, such as round whitefish and burbot are also possible and were not assessed. Other habitat types i.e. rearing or feeding areas, etc. were also not identified or assessed for any fish species.

DFO's Conclusion and Recommendation

The presence and use of spawning, rearing and feeding habitats by all fish species within the vicinity of the proposed diffuser be determined and rationale/analysis provided to support the conclusions that there are no potential for impacts to any life stage of fish, or their habitat in the vicinity of the mine effluent.

2.4 EFFECTS OF CONSTITUENTS OF EFFLUENT DISCHARGE

Reference: ToR line # 336-368, 395-397, 406-408 EA Report Section 9.4, 9.5

2.4.1 Metals in discharge

The effluent from the water treatment plant will have effects on the aquatic community of Snap Lake. Effects will occur as a result of chronic toxicity in an area extending 230 m from the discharge location. Effects are also likely to occur over a larger area due to increased total dissolved solids (TDS) and impacts are likely to extend to the whole lake as a result of nutrient addition.

DeBeers' Conclusion

The impacts of the effluent are mitigated by the use of a multi-port diffuser, lake mixing and other limnological processes such as stratification. The EAR uses a zone of dilution and site specific benchmarks to rate the impact magnitude as negligible for environmental assessment purposes.

DFO's Position and Rationale

Ammonia, chloride, cadmium, copper, mercury, molybdenum, nickel, lead, and selenium and whole effluent chronic toxicity are cited in the EA as the parameters that will exceed water quality guidelines at end of pipe (p9-222,223, Table 9.4-18). A diffuser is proposed at the water outlet to aid in dispersion and to provide initial mixing of the effluent with water from Snap Lake. The intent of the diffuser is to reduce the toxicity of the mine effluent beyond end-of-pipe via dilution.

This effluent is diluted within an initial mixing zone in Snap Lake but concentrations of hexavalent chromium, cadmium, copper and ammonia in an area equivalent to 1% of Snap

Lake surrounding the discharge will exceed water quality guidelines. Chromium was not cited in the Table 9.4-18 as described above, but was carried forward as hexavalent chromium.

DFO has participated in three water quality sessions that Golder Associates have presented on behalf of DeBeers since the Technical Support Document and/or the EAR was issued. DFO has consistently expressed concern that the water treatment plant will discharge effluent that will exceed water quality guidelines at the point of discharge into Snap Lake.

Although several parameters are anticipated to exceed water quality guidelines at the point of discharge, only hexavalent chromium and total dissolved solids were carried forward for an impact assessment in the EAR. (pg. 9-300).

Chromium concentrations are of concern, since they are one of the 14 most noxious heavy metals. The biological effects of chromium depend on chemical form, solubility and valence. All forms of chromium compounds should be regarded as toxic, although the most toxic and carcinogenic chromium compounds tend to be the strong oxidizing agents. Hexavalent chromium is more toxic than the trivalent form because its oxidizing potential is high and it easily penetrates biological membranes.

Although there has been discussion that chromium will quickly convert to the less toxic form in Snap Lake, chromium could accumulate in the sediments and affect an area outside the zone of dilution.

Many of the impact predictions of toxicity presented by DeBeers are toxicological studies that were based on mine effluent or mine water obtained during the Advanced Exploration Stage. The effluent may not account for or test different formulations as predicted to occur with the paste backfill. In addition, many of the interpretations and toxicological tests have been undertaken on an individual parameter basis. The many different contaminants could affect toxicity interpretations due to synergistic effects.

Although the EAR uses a zone of dilution and site specific benchmarks to rate the impact magnitude as negligible for environmental assessment purposes there are regulatory requirements under the Fisheries Act that would negate the use of a zone of dilution.

DFO's Conclusion and Recommendation

The incorporation of a 230m mixing zone for mine effluent treatment is unacceptable as is the conclusion that the environmental effects are negligible based on negligible effects to Snap Lake on a whole lake basis (neglecting the 1-10% of the lake where the effects are <u>not</u> negligible). Treatment options should be considered to remove the need for a mixing zone beyond the immediate diffuser discharge to achieve effluent that is non chronically toxic for all constituents.

2.5 PLUME DELINEATION AND % OF LAKE AFFECTED.

Reference: ToR line # 358-362, 406-408 EA Report Section 9.4.2.2.3

2.5.1 Elevated TDS in deep water zones

DFO is concerned with the potential for increased impacts to fish habitat and aquatic organisms especially during the winter under ice. After initial mixing as it leaves the diffuser, the effluent is expected to settle in the deeper water of Snap Lake due to its density (greater than the lake water due to high TDS concentrations) and lack of lake currents in the winter. Temperature differences could also result in a concentrated stratified layer of effluent in the water column.

DeBeers' Conclusion

The impacts of the mine effluent on fish habitat and aquatic organisms in Snap Lake are projected to be mitigated by rapid mixing of the effluent in the water column facilitated by a multi-port diffuser and by natural lake mixing processes as well as other limnological processes such as stratification. The effluent will settle in the deep areas of the lake where it will have little impact on fish habitat or aquatic organisms.

DFO's Position and Rationale

The effectiveness of the multi-port diffuser, mixing and limnological processes were questioned and discussed in IR 2.1.6, 2.1.8 and during the public technical sessions.

Modeling predictions are based on a whole lake basis to incorporate mixing within the entire lake. However, the effluent plume will not interact or mix with waters within the North Arm of Snap Lake or small bays in the periphery during the winter, as it will settle at depth once it leave the diffuser, thereby reducing the water volume available for mixing and affecting the calculation of effluent concentration in Snap Lake. Concentrations of TDS and other parameters of concern may, therefore, be greater than predicted since the model incorporates the entire lake. These conditions will likely persist for the duration of the ice covered period (approximately 8 months of the year).

The denser effluent that settles in the deep areas of the lake will likely have negative effects on the aquatic community. Lake trout and other bottom dwelling fish may suffer greater impacts than predicted since higher concentrations may occur than presented in the EAR.

DFO's Conclusion and Recommendation

Modeling of the density plume should be revised to account for a reduced lake volume for mixing under ice conditions.

2.6 EFFECTS OF TDS ON LAKE TROUT, OTHER FISH SPECIES AND AQUATIC INVERTEBRATES

Reference: ToR line # 395-397, 406-408 EA Report Section 9.5.2.4

TDS concentrations are predicted to be considerably higher than the baseline concentrations in Snap Lake: the primary toxicological concern of TDS being an increase in osmotic stress on aquatic biota.

DeBeers' Conclusion

The EAR predicted that concentrations of TDS that would occur in Snap Lake were below harmful effect levels for fish. There are no TDS water quality criteria, but the EAR cites concentrations of 3000 mg/l TDS as a threshold level before freshwater biota begin to disappear.

DFO's Position and Rationale

The EAR made comparisons to coolwater fishes such as sticklebacks and members of the Percidae and Catostomidae families and reported that members of the Salmonidae are able to withstand high levels of salinity or TDS. Comparisons and projections of the effects of TDS on biota were also based on data obtained from saline lakes.

The comparisons made may not be valid. Snap Lake is much different from the referenced lakes in that it is an oligotrophic lake having an average TDS level of only 15 mg/L. The aquatic biota and especially lake trout that occur in this headwater lake have adapted to these low salinity conditions for many thousands of years. A large proportion of this local population or stock of fish could suffer increased mortality since it is adapted to low salinity conditions.

Of all the salmonids, lake trout exhibit the most sensitivity to ion concentrations in the water. The preferred requirement of < 50 mg/l TDS (Kerr and Lasenby, 2001) will be greatly exceeded causing stress and increasing the likelihood of mortality. Within Snap Lake, effluent discharge is predicted to result in increases in TDS levels from the average baseline of 15mg/l to 330 mg/l in 10 to 20% of the lake and 444 mg/l in 1 % of Snap Lake (p 9-306, 9-357).

Since the effluent will have an elevated concentration of TDS and will therefore, be more dense than the lake water, it will settle into deeper areas, potentially impacting lake trout eleutroembryos and young of the year. These young fish seek deeper water and remain close to the substrate. Since mixing of the lake will not occur instantaneously at "ice out" especially at the depths where TDS will be increased, the preferred fish habitat of lake trout, and other benthic dwelling fish such as whitefish and burbot will suffer greater impacts than predicted in the EAR. Benthic invertebrates will also be particularly susceptible since they complete their life cycle requirements in the substrate during this time. They will not be able to avoid or seek other habitat but will suffer mortality.

DFO's Conclusion and recommendation

Potential impacts of TDS on fish and benthic invertebrates need to be reassessed on more conservative values. If needed De Beers should propose ways to reduce TDS in the discharge water.

2.7 BIOACCUMULATION OF METALS

Reference: ToR line # 406-408 EA Report Section 9.5.2.3
Selenium and cadmium are metals that have the potential to bioaccumulate in biological tissues.

De Beers' Conclusion

No metals will bioaccumulate in biota

DFO's Position and Rationale

Selenium levels predicted in the mine water discharge were reported to be in excess of water quality guidelines (Table 9.4-18), but the results were dismissed due to analytical interference. Follow-up analysis resulted in selenium values below the detection limit and selenium was, therefore, not carried forward for assessment. Cadmium was however predicted to be discharged at levels above water quality guidelines.

Cadmium was identified as a metal that will be discharged in the effluent at levels that will cause chronic effects to the aquatic community in a portion of the water in Snap Lake. Cadmium has an affinity for particulate matter and readily settles and hence will accumulate in the sediments potentially affecting the benthic organisms living in that environment. Cadmium may accumulate in these organisms and then increase in higher trophic levels, such as fish, as the benthos is consumed, thereby having food chain effects. Increasing cadmium levels in fish may have implications to human health if the fish are consumed.

The concern that human health could be compromised was addressed in IR 4. As a result of information requests and information presented at technical sessions the concern that cadmium would bioaccumulate and cause human health effects is alleviated.

DFO, through IR 2.1.2 asked for more detailed information on the trophic feeding relationships of aquatic organisms in reference to a biomagnification or bioaccumulation perspective. De Beers response indicated that these relationships were noted in section 9.5.2.4.3 of the EAR. However, feeding relationships are not presented in this section of the report. The biomagnification issue is partially addressed in this section by the measurement and use of bioconcentration factors (BCFs) which represent the concentration of the substance in the tissue (ug/kg) relative to the concentration of the substance in water (ug/l).

A response to IR 3.8.8 was also reviewed and the response stated: "overall, the impact prediction is low as reliable data linking fish tissue to exposure concentrations is scarce."

Since the confidence is low, there is a need for further work to clarify the understanding of this topic. This concern was presented and was discussed at the public technical sessions.

A number of IR Responses (2.4.16, 3.4.12, 3.9.5) also indicated that additional testing and work has been undertaken to better define the chemistry of the paste backfill. Concern had been expressed that selenium, cadmium and metals of concern could become mobilized due high pH and interactions of groundwater in the paste backfill.

Since the proposed water treatment plant is not designed to treat metals, mobilization of metals as mine development progresses could result in increased concentrations should EA predictions not hold.

DFO's Conclusion and Recommendation

Potential impacts of metal bioaccumulation on fish and benthic invertebrates need to be reassessed on more conservative values. De Beers should propose ways to reduce metals in the discharge water.

2.8 NUTRIENTS AND EFFECTS ON FISH HABITAT

Reference: ToR line # 370-371, 406-408 EA Report Section 9.4.2.2.4

The supply of both phosphorus and nitrogen to Snap Lake, will increase as a result of mining activities. Phosphorus will originate from groundwater pumped from underground, mine workings and from treated sewage effluent. Nitrogen will increase primarily as ammonia which is a result of blasting residue. The increase in nutrients will increase the productivity of lower trophic levels in Snap Lake, and cause changes in biomass and species diversity in the aquatic community.

DeBeers' Conclusion

Snap Lake is an oligo-mesotrophic lake. Elevated phosphorus or nutrient levels in Snap Lake during mine construction and operations are expected to have a low or negligible impact on resident aquatic communities. A major shift in community structure is unlikely to occur. An increase in the deposition of organic matter may reduce winter DO in a small portion of available fish and benthic invertebrate habitat (less that 10 % of surface area).

DFO's Position and Rationale

The mine effluent will have greater amounts of bioavailable phosphorus (IR 4.1.8) than current natural inputs into Snap Lake. Linkages and interactions among trophic levels in response to nutrients have been poorly defined in the EAR, however the aquatic community in Snap Lake will likely change in response to increased levels of bioavailable phosphorus.

These concerns were presented by Information Request and were discussed during the technical sessions. The response to IR 4.1.8 indicated that phytoplankton biomass would increase in the water column and therefore that phosphorus levels would also increase in the sediments as phytoplankton die-off and settle to the lake sediments.

There could also be effects to zooplankton communities. Biomass of zooplankton could also change in response to changes in the phytoplankton community. However, the trophic level response of the zooplankton was not discussed, nor was possible effects to the invertebrate or fish community included in the EAR.

Increases in phytoplankton biomass reporting to the sediments due to die-off and settling, and the decomposition of these organisms can create a biological oxygen demand and cause decreases in dissolved oxygen levels at depth. Projections in the EAR have indicated that certain areas of Snap Lake will be inhabitable to fish due to low oxygen. The addition of more nutrients will result in greater areas inhabitable to fish which could have greater impacts than predicted.

DFO'S Conclusion and Recommendation

The addition of nutrients will likely affect fish and aquatic organisms at depth by decreasing dissolved oxygen. This will alter fish habitat. De Beers should propose methods to reduce nutrient input in effluent.

2.9 METALS FROM NON-POINT SOURCES: EFFECTS ON FISH HABITAT

Reference: ToR line # 319-320,337-341,391,392, 543-545 EA Report Section 3.5.1

2.9.1 Leaching of metals from potential acid generating rock (PAG)

Metals can leach from acid generating rock in waste rock storages and runoff or seep into groundwater or surface water systems. Section 3.5.1 of the EAR states that PAG rock will be mined during the pre-development stage and is to be stockpiled. Concern was expressed that this rock had the potential to cause increased mobilization of metals that would runoff and contaminate the surrounding aquatic ecosystem.

DeBeers' Conclusion

De Beers proposes to use a collection ditch and pond system to intercept approximately 90% of the seepage and runoff.

DFO's Position and Rationale

Discussions presented during the technical sessions indicated that some water will leak from the rock pile. Although 90% will be captured by diversion ditches, some of the water is

predicted to flow to Snap Lake. There are potential impacts on near-shore fish habitat which have not been assessed or quantified by DeBeers.

DFO's Conclusion and Recommendations

De Beers should quantify the fish habitat that will be potentially affected and propose mitigative measures to eliminate seepage concerns