Developer Response to
Tuktoyaktuk-Inuvik Working Group

The Developer (Hamlet of Tuktoyaktuk, Town of Inuvik and GNWT Department of Transportation) is pleased to provide the following responses to the conformity review comments provided in the Tuktoyaktuk-Inuvik Working Group's letter dated June 27, 2011.

This document is provided in addition to the Addendum to the Environmental Impact Statement submitted to the Environmental Impact Review Board (EIRB) in response to the EIRB's letter dated July 15, 2011: *Conformity Statement and Board Direction Regarding the Draft Environmental Impact Statement for the Hamlet of Tuktoyaktuk, Town of Inuvik and GNWT – Construction of the Inuvik to Tuktoyaktuk Highway, Northwest Territories* [02/10-05].

1. TERMS OF REFERENCE - SECTION 7.2

Reviewer's Comments:

The developer did provide information on alternate route descriptions, criteria, rational and feasibility in section(s) 2.1 and 2.6 of the EIS, however, a reflection of the environmental assessment information requested for the alternate routes is lacking. This information should be provided at the earliest possible opportunity.

Developer's Response:

Section 2.2 of the EIS (Comparison of Alignment Options) described the evaluation process used to evaluate each highway alignment (route) option for environmental, economic, social and technical factors using a relatively simple multiple accounts process.

As indicated in the conclusion of this Section (2.2.7), the Developer's Project Team reviewed the previous Project studies, the 2009-2010 assessment, the current opportunities to fund and construct the Highway, the route evaluations, and the community views presented during the October 2009 and January 2010 consultation proceedings. After considering these factors, the Primary 2009 Route was reconfirmed as the preferred primary alignment.

In the vicinity of the Husky Lakes, the Project Team recognized that other minor realignments needed to be considered to fully respect the Husky Lakes setback. As a result, Alternative 1 (2009 Minor Realignment) was proposed and considered along with Alternative 2 (Upland Route). Subsequent to the initial evaluation, Alternative 3 (2010 Minor Realignment) was recommended by Inuvialuit interests in an effort to provide a more direct route through suitable terrain.

Based on the considerations identified in Section 2.1.2 (Alignments Considered in the Current Stage of Project Development) and Section 2.2 (Comparison of Alignment Options), Alternative 2 (Upland Route) is no longer considered by the Developer to be a viable route option due to the more rugged terrain encountered, increased volume of granular material quantities required, and substantially increased cost to construct and maintain.

The Project Team considers Alternative 3 to be a promising route realignment, but has not yet assessed the engineering considerations related to this option in the field. However, the Project Team feels that subject to Project approval, Alternative 3 would be further considered and likely adopted in the detailed design stage based on the additional field information that needs to be gathered.

As stated in the EIS, the Developer has committed to conducting further necessary field studies along the proposed Highway alignment and at proposed borrow sites. Details on field studies underway to gather information are provided in the Addendum to the EIS submitted to the EIRB in response to Category 3 Conformity Request #5.

2. TERMS OF REFERENCE - SECTION 10.1.4.

Reviewer's Comments:

Water Quality & Quantity was discussed in section 3.1.5 and 3.1.6 of the EIS and information was provided on the potential for changes to water quality due to in stream activities and the probable impacts at water crossings. Information on the potential impacts of the project on water quality and quantity with respect to the discharge or seepage of wastewater effluent, contaminants, chemical additives, etc., seemed to be absent. A lack of consideration of the potential effects of slope stability, increased turbidity, the formation of frost bulbs and related icings at watercourse crossings and possible changes to water quality due to thaw slumps was also identified through this review.

Developer's Response:

The assessment of potential effects of Highway construction on Water Quality and Quantity is discussed in Section 4.2.4 of the EIS. Discussion is provided on Highway Design, Clear-span Bridge Construction, Culvert installation and Maintenance, Use of Heavy Equipment, Water Extraction, Road Drainage, Dust Generation, Highway Maintenance (during the long-term operations phase) and Project Design and Mitigation Measures available to minimize possible effects on water quality and quantity as well as surface flow patterns.

Discussion on the management of wastes including wastewater (sewage), contaminants and chemical additives (fuels, waste oil, solvents, glycol, etc.) is provided in Section 4.4.3 (Waste Management) of the EIS. As discussed in this section, the Project will have waste management procedures in place that will ensure wastes are handled, stored, transported, and disposed of in a manner that will prevent the unauthorized discharge of contaminants, mitigate impacts to air, land, and water, and minimize risks of animal attraction, while maintaining health and safety of personnel and wildlife.

To effectively manage wastes generated by the highway construction project, the Developer will develop a Project-specific waste management plan for all wastes associated with pre-construction and construction activities. The waste management plan will apply to the Developer and all its Project contractors involved in the generation, treatment, transferring, receiving, and disposal of waste materials for the Project.

The existing terrain conditions along the Primary 2009 Route alignment are discussed in Section 2.3 of the EIS. Key Highway geotechnical issues, including information related to permafrost and permafrost-related features, sensitive terrain, thermokarst, thaw flow slides and pingos is presented in Section 2.4 of the EIS. Additional information on the terrain, geology, soils and permafrost of the general area, including the Primary 2009 Route and alternative alignments considered, is provided in Section 3.1.1.

In their comments regarding Section 10.1.4 of the EIRB Terms of Reference, the Tuktoyaktuk-Inuvik Working group identified a lack of consideration of the potential effects of slope stability, increased turbidity, the formation of frost bulbs and related icings at watercourse crossings and possible changes to water quality due to thaw slumps.

The assessment of possible effects of highway construction and operation on the terrain, geology, soils and permafrost of the Project area is provided in Section 4.2.1 of the EIS and Project design and mitigation measures are outlined in Section 4.2.1.3.

Possible effects of highway construction on water quality are discussed in Section 4.2.4. The potential effects of the environment on the Project, including the possible effects of climate change, and proposed mitigation measures to adapt to climate change are discussed in Section 4.5.1.

Specific discussion of icings is not addressed in the EIS because this natural phenomenon is not known or anticipated to occur in the generally low energy streams crossed by the proposed Highway Project. Such icings, or aufeis fields, have been known to occur in the considerably more active floodplains of the Malcolm, Firth and other rivers on the Yukon Coastal Plain (Dome et al. 1982).

Aufeis fields typically consist of ice developed on the ground surface, followed by the progressive build-up of ice upon itself. These icings are typically fed by a combination of sources, including stream water, subsurface flow and groundwater stored in deep aquifers and discharged from bedrock through faults and joints (Kotlyakov 1984). In areas of continuous permafrost, such as within the proposed Highway corridor, the relatively impermeable permafrost acts as a barrier to vertical groundwater flow (Kane and Yang 2004).

However, as reported by TAC (2010), poor drainage conditions along a road over permafrost terrain may cause surface water ponding, thermal erosion, thermokarst and/or the formation of icings. Drainage and erosion control structures should be inspected regularly and repaired when necessary. Culverts are susceptible to ice build-up, particularly if water flows are continuous but low during the late winter months. Ice build-up can occur as the low water flow is forced to the surface of the stream channel. As indicated, such conditions are not typically expected to occur along the Highway because none of the smaller streams will have flows in the winter months and the larger streams will be crossed with bridges.

TAC (2010) advises that an efficient technique to control ice build-up in culverts is to install secondary culverts, or staggered (multi-level) culverts placed above the invert level of the main culvert The staggered culverts, being higher and slightly offset from the main culvert, remain ice-free and can be used during the peak spring flows.

Many potential drainage problems associated with the Highway will be avoided or minimized by careful refinement of the Highway alignment, based on the LiDAR information obtained in September 2011, and further field reconnaissance that will be conducted as necessary to assist with the final design of the Highway.

As discussed in Section 4.2.4 of the EIS, it is recognized that potential alterations of surface drainage patterns due to stream constriction at stream crossing sites or through obstruction of overland drainage are of concern but will be mitigated through the design and use of appropriate stream crossing structures and the installation of appropriately-sized cross culverts to divert and manage highway and surface drainage flows.

The application of such mitigation measures will also serve to prevent or minimize the formation of ponds or other effects on soil moisture, which in turn could lead to localized thermal changes such as thaw subsidence, ground surface heave or the formation of frost bulbs.

<u>References</u>

Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc. (Dome et al). 1983. Hydrocarbon Development in the Beaufort Sea – Mackenzie Delta Region.

Kane, D.L. and Yang, D. 2004. Overview of Water Balance Determinations for High Latitude Watersheds, Northern Research Basins Water Balance, D.L. Kane and D.Yang (eds.), Proc. Workshop, Victoria, Canada, March, IAKS Pres, Wallington, UK, 2004.

Kotlyakov, V. M. (ed.). 1984. Glyatsiologicheskiy Slovar (Glossary of Glaciology). Leningrad, USSR: Gidrometeoizdat, 1984, 528 pp.

Transportation Association of Canada (TAC). 2010. Guidelines for the Development and Management of Transportation Infrastructure in Permafrost Regions.

3. TERMS OF REFERENCE - SECTION 10.1.6

Reviewer's Comments:

The developer did provide information on the proposed methods of watercourse crossings, the criteria used to select each method and the anticipated extent of physical disturbance resulting from each method, however, the information on the potential for the project to impact sensitive life stages of fish and fish habitat is deficient.

It was also felt that since the project is projected to provide increased access to Husky Lakes, an area of great social and cultural value to the Inuvialuit, more attention needs to be given to the possible impacts to fish resources of the area due to increased access and how this in turn could affect Inuvialuit Subsistence Harvesting activities.

Developer's Response:

Section 4.3.7 of the EIS does indeed identify that the Project would provide increased access to the Husky Lakes area and the Developer concurs that priority attention needs to be given to the possible effects that increased access could have on the fish resources of the area and Inuvialuit subsistence harvesting activities. This section also identifies proposed Project design and mitigation measures that should be employed and the important roles that the existing resource management agencies, such as the Fisheries Joint Management Committee, the Wildlife Management Advisory Council, the HTCs and GNWT ENR will need to fulfill to effectively manage the sustainable harvesting practices in the region after the Highway is constructed.

4. APPENDIX A: BASELINE INFORMATION REQUIREMENTS: WATER QUALITY AND QUANTITY

Reviewer's Comments:

Baseline information on water quality and quantity was incomplete as many requested information topics were not discussed in the EIS. Some of which include; identification of watercourses with year round flow, identification of seasonal or perennial springs located in or near the study area, identification and/or information on naturally occurring springs and an indication on the recharge ability of lakes to be used for winter road watering, etc.

Developer's Response:

All known and available baseline water quality information for the proposed Project area is presented in Section 3.1.5 (Water Quality and Quantity) of the EIS. Section 3.1.6 (Hydrology) of the EIS summarizes the available hydrological information for the Project area. As noted in the EIS, very few streams crossed by the proposed Highway have significant water flows during the entire seasonal ice-free period. Zed Creek, Hans Creek and Trail Valley Creek, which have relatively large catchments, are identified as having continuous flows throughout the ice-free period. The hydrograph for Trail Creek indicates that flows in this stream are typically recorded between the beginning of May and mid-October and no flows are reported for the period mid-November to the end of April.

5. APPENDIX A: BASELINE INFORMATION REQUIREMENTS: FISH AND FISH HABITAT

Reviewer's Comments:

Baseline information provided on fish and fish habitat was more complete, however, it is felt that attention should be given to all possible fish species in the area and not just to species of harvesting value as every species has a role to play in the ecosystem. Forage fish were not included in the list of fish species as was requested in the ToR and again information was lacking on sensitive habitat.

Developer's Response:

Forage fish species are recognized as being ecologically important within the streams and lakes of the Project area. While not utilized directly in recreational, commercial, or traditional fisheries, they represent an important food supply for valued fish species and essential links in the food web. The EIS does not specifically identify these species because it was determined that protection of anthropogenically-valued species and their habitat would automatically result in the protection of forage fish species. However, to supplement the information provided in the EIS, the following provides life history and habitat preference information for the forage species anticipated to be present within the Highway Project area.

The ninespine stickleback was the only forage species captured or observed during 2010 field studies. However, it is possible that some of the streams within the Highway corridor support slimy sculpin (*Cottus cognatus*) and/or lake chub (*Couesius plumbeus*). In a study carried out for the GNWT Department of Transportation related to a proposed Inuvik to Tuktoyaktuk road, Rescan (1999) identified ninespine stickleback in Zed (Parsons) Creek and slimy sculpin in Hans and Zed creeks.

No fish were sampled in Trail Valley Creek and lake chub were not found in any of the study streams. However, Scott and Crossman (1973) indicated that lake chub were widely distributed in the Northwest Territories, including the Project area, and are therefore included as a species that may possibly be encountered during Highway construction.

A brief synopsis of the life history and habitat requirements of these three species are provided below:

Ninespine Stickleback

The ninespine stickleback is ubiquitous in the Northwest Territories and is also found throughout rivers and lakes in north central Canada and in portions of the Arctic Islands (Richardson et al. 2001; Evans et al 2002). It is found in a variety of habitats and includes lacustrine, riverine, and anadromous life histories.

Spawning and Egg Development

Ninespine stickleback spawn in lakes or streams from May to mid-July in nests built by the males in shallow, weedy waters. Nests are built from vegetation and debris, which is glued together using kidney secretions. Nests can also be made in burrows in muddy substrates and between or under rocks along lake shores. Males guard the nests and tend fertilized eggs by fanning the nest entrance to create a current of oxygenated water.

Larvae and Juveniles

Eggs hatch in about one week, after which the male guards the fry a further two weeks in a nursery area constructed above the nest, until they are free swimming and disperse into shallow, vegetated waters (Richardson et al. 2001). The young move into deeper water to overwinter.

Adults

In streams, ninespine sticklebacks are usually found in shallow, slow flowing areas over sand or mud substrates (Evans et al. 2002). Their food consists of aquatic insects and crustaceans, and occasionally small fish fry and fish eggs (Scott and Crossman 1973). These sticklebacks generally mature within the first year of life (Scott and Crossman 1973; Richardson et al. 2001) and have a life span of about three years. These fish are common prey for other fish species.

Anthropogenic Factors Influencing Survival

The selection of shallow, weedy habitats in streams and at lake margins suggests that the habitat of the ninespine stickleback may be affected by either increasing or decreasing water levels. Increasing water velocities could result in displacement of juveniles and adults, which are adapted to slow flowing waters. In addition, excessive erosion and sedimentation due to construction activities have the potential to affect spawning success and prey availability.

Slimy Sculpin

The slimy sculpin is found in cold, well oxygenated waters throughout the Northwest Territories, in addition to its wide distribution elsewhere in northern North America. It is typically found in flowing waters, from rivers to small creeks, and also in lakes (Richardson et al. 2001; Evans et al. 2002; Birtwell et al. 2005).

Spawning and Egg Development

Spawning sites are selected by sculpin males in May, usually under a rock, ledge, or submerged woody debris; over sand, gravel, or rock substrates. Deposited eggs adhere to the ceiling of the nest and are subsequently guarded and tended by territorial males, sometimes up to the time that fry begin to feed (Scott and Crossman 1973). Egg incubation takes approximately one month, after which fry fall to the bottom of the nest and exist on absorbed yolk for 3-6 days (Evans et al. 2002).

Larvae and Juveniles

Free swimming sculpin fry remain in shallow water over sand or gravel substrates, and where velocities are generally less than 0.5 m/s. (Evans et al. 2002). As the fish grow, they may move into faster water over coarser substrates where they reside in contact with the stream bottom. In lakes, juveniles shift to deep water as they grow (Richardson et al. 2001; Birtwell et al. 2005).

Adults

Adult slimy sculpin in streams are found in moderate to fast areas of streams, in contact with gravel or cobble substrates, which they use as refugia, although they also select sand and silt bottoms (Evans et al. 2002). In lakes, adults occupy a wide range of depths, but tend to choose depths of less than 10 m in small northern lakes. They consume a variety of prey items, but particularly benthic invertebrates and crustaceans (Scott and Crossman 1973; Birtwell et al. 2005). Adults tend to be relatively immobile in streams, choosing spawning areas near feeding habitats. Maturity of sculpin in the north usually occurs at ages 3-4. Slimy sculpin are eaten by predaceous fish species.

Anthropogenic Factors Influencing Survival

The potential factors leading to adverse effects on slimy sculpin due to the Highway Project include significant changes in water flow and sedimentation of stream habitats.

Lake Chub

Lake chub, a member of the Cyprinidae family, occurs throughout Canada in small streams, rivers, and lakes. In the Northwest Territories, this species occurs throughout all the major watersheds (Scott and Crossman 1973). Despite its almost ubiquitous distribution, very little is known about its life history.

Spawning and Egg Development

Adults undergo spawning migrations from lakes to streams in the summer in the NWT, possibly as late as August. Although information on post-spawning survival is sparse, a study reported by Scott and Crossman (1973) suggested that post-spawning mortality does occur. Spawning occurs over rock or gravel; sinking eggs settle into crevices within these substrates. No nests or redds are constructed. The eggs hatch after incubating for about 10 days.

Larvae and Juveniles

Young lake chub feed mainly on zooplankton. Little else is known of their habitat selection.

Adults

Adult lake chub feed on terrestrial and aquatic insects, but may also feed on algae, zooplankton, and even small fishes, and have been known to scavenge on decaying fish. Fish mature in their third or fourth year, and rarely survive past age five (Scott and Crossman 1973). Adult lake chub are preyed upon by larger fish, including northern pike and burbot, but also by predaceous birds.

Anthropogenic Factors Influencing Survival

Direct and indirect effects on lake chub survival and productivity may result from activities resulting in sediment releases that reduce the availability and quality of spawning and juvenile rearing areas. Sedimentation of these habitats fills interstitial spaces into which eggs normally settle and affects benthic invertebrate productivity and species composition. In addition, zooplankton availability is reduced in turbid waters.

References:

Birtwell, I.K., S.C. Samis and N.Y. Khan 2005. Commentary on the management of fish habitat in northern Canada: Information requirements and policy considerations regarding diamond, oil sands and placer mining. Canadian Technical Report of Fisheries and Aquatic Sciences 2606.

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