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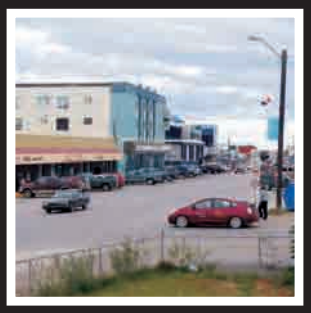

Hamlet of Tuktoyaktuk, Town of Inuvik and the Government of the Northwest Territories

PROJECT DESCRIPTION REPORT FOR CONSTRUCTION OF THE INUVIK TO TUKTOYAKTUK HIGHWAY, NORTHWEST TERRITORIES

ISSUED FOR USE
February 2010

File: V23201098

Northwest Territories

Town of Inuvik

KIGGIAK - EBA

Hamlet of Tuktoyaktuk, Town of Inuvik and
Government of Northwest Territories

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PROJECT DESCRIPTION REPORT FOR CONSTRUCTION OF THE INUVIK TO TUKTOYAKTUK HIGHWAY, NORTHWEST TERRITORIES

V23201098

February 2010

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EXECUTIVE SUMMARY

INTRODUCTION

Since the 1960s, the completion of the Inuvik to Tuktoyaktuk Highway (the Highway) has been a high priority goal of the Town of Inuvik, the Hamlet of Tuktoyaktuk and the residents of the Inuvialuit Settlement Region. The first initiative to bring the Highway Project to fruition took place in 1974 when Public Works Canada (PWC) identified and surveyed a 140 km land route between Inuvik and Tuktoyaktuk. Preliminary engineering studies were undertaken on this route at that time. Quarry sources were identified and survey maps and design profiles were produced.

In the 1990s, the Government of the Northwest Territories (GNWT) reviewed earlier studies, collected additional environmental and socio-economic information, conducted community consultations, and re-examined the routing and the design. In 1998, GNWT produced a comprehensive report entitled the "Proposed Inuvik to Tuktoyaktuk Road Environmental and Socio-Economic Baseline Report." Further reports, including a Cost Benefit Analysis, were completed in 1999. The October 1999 GNWT Department of Transportation Highway Strategy described the completion of the Highway as a major policy objective of the GNWT.

Building upon the Highway Strategy, the GNWT included the Inuvik to Tuktoyaktuk Highway as a prominent component of succeeding proposals to Canada for infrastructure development including "Investing in Roads For People and Economy" (November 2000), "Corridors For Canada" (May 2002) and "Connecting Canada – Coast to Coast to Coast" (November 2005).

Recent interest from the Federal Government has reinvigorated the Highway Project. On August 20, 2009 the Town of Inuvik and Hamlet of Tuktoyaktuk received confirmation that the Canadian Northern Economic Development Agency (CanNor) would fund the completion of a Project Description Report for the Inuvik to Tuktoyaktuk Highway.

PROJECT PARTNERSHIP

After receiving funding approval by CanNor, the communities and the GNWT Department of Transportation developed a Memorandum of Understanding (MOU), which established a partnership to see the Project Description Report through to completion.

The purpose of the MOU was to describe the roles and responsibilities of the Project Partners – the Hamlet of Tuktoyaktuk, Town of Inuvik and GNWT Department of Transportation (also referred to as the Project Team). In particular, the MOU detailed the work that the Partners would undertake to prepare a Project Description Report for the construction of the Inuvik to Tuktoyaktuk Highway, how this work will be funded, and how overall project management will be implemented. Kiggiak-EBA Consulting Ltd. (Kiggiak-EBA) and its primary sub-consultant, FSC Architects and Engineers (FSC) were retained by the Partners to prepare the Project Description Report.

PROJECT RATIONALE

The Inuvik to Tuktoyaktuk Highway provides the opportunity for major potential benefits for the region, for the North, and for Canada as a nation. The construction of the proposed Highway will achieve the following goals:

- Complete the Highway to the arctic coast and provide year-round overland access to Tuktoyaktuk;
- Decrease the cost of living in Tuktoyaktuk by enabling goods to be shipped year-round;
- Provide Tuktoyaktuk residents with cheaper, easier and safer access to regional services including:
  - Health care;
  - Educational opportunities; and
  - Recreational opportunities.
- Enhance opportunities for family, social, recreational and sporting interactions by providing year-round access between communities;
- Promote the tourism and hospitality industry in Inuvik and Tuktoyaktuk;
- Strengthen Inuvik's role as the regional commercial hub;
- Provide more opportunities for business expansion;
- Reduce costs of onshore oil and gas exploration and development and encourages new activities;
- Reduce the cost of government services delivered to Tuktoyaktuk and the Region;
- Support national security and northern sovereignty objectives; and
- Deliver on current governmental policies to stimulate the economy in response to the present economic downturn.

In summary, the construction of the Highway Project addresses the goals of bolstering Northern economic development; enabling future natural resource exploration, development and production; and reinforcing Canadian sovereignty objectives.

CONSULTATIONS

Meetings and consultation sessions for the proposed Highway were held in Inuvik and Tuktoyaktuk in October 2009 and January 2010. These meetings were an important opportunity to share information about the project with the communities and to hear directly from residents about their interests, questions and concerns.

The first round of meetings and consultations in October served to provide the communities, organizations, and regulatory agencies with an introduction to the proposed Inuvik to Tuktoyaktuk

Highway Project (see Figure 1); to identify the project Partnership, project status, anticipated study and review schedule; to answer preliminary questions; and to receive advice, input and recommendations. Key messages from the October consultations highlighted the importance of the Husky Lakes area to the communities. Some residents of Tuktoyaktuk and Inuvik requested an examination of other possible alignments, in particular, the Upland Route. There was a distinct interest in receiving engineering and preliminary design detail that would be comparable to the primary 2009 Route.

The second round of meetings and consultations, held in January, 2010, allowed the Project Team to respond to questions and issues raised during the October 2009 consultations; to solicit community feedback on the updated project information; and to gauge the perceived acceptability of the 2009 Route for submission to the EISC screening process and associated regulatory reviews. The two community meetings, held concurrently in Inuvik and Tuktoyaktuk on January 14, 2010, were well attended and the consensus arising from both meetings was that participants supported the 2009 Route.

In overview, community members expressed general satisfaction that the Project Team had considered and are willing to implement reasonable mitigation measures to address their concerns. There was a general acknowledgement that the Project Team had made its best efforts to keep the proposed Highway alignment beyond the 1 km setback (with one minor encroachment of less than 2 km in length), as identified in the latest version of the Husky Lakes Management Plan. A number of community members indicated their general confidence in the ability of the Inuvialuit co-management bodies and other regulatory agencies to protect their environmental, cultural, and socio-economic interests in relation to the Highway project.

ROUTE ALIGNMENT ALTERNATIVES

Based on the community input from the October 2009 consultation sessions, the Project Team conducted a more detailed evaluation of several alignment options. The alternatives considered are illustrated in Figure 1 and include:

- Preferred Alignment - the 2009 Route, which is an updated and refined version of the 1977 PWC alignment, but includes a minor encroachment on the Husky Lakes 1,000 m setback;
- Alternative #1 - a Minor Realignment of the 2009 Route to fully achieve the Husky Lakes 1,000 m setback requirements; and
- Alternative #2 - the Upland Route, which diverts west from the 2009 Route about 70 km north of Inuvik and rejoins the alignment near Source 177.

Borrow material quantities and cost estimates were based on the conceptual designs for the alignments considered. Table 1 summarizes the overall quantity and cost estimates for each alignment. The quantity estimates include upgrading the Tuktoyaktuk to Source 177 Access Road, based on the proposed Highway design. Table 1 differentiates between Highway surfacing material and embankment (base or subgrade) borrow material requirements.

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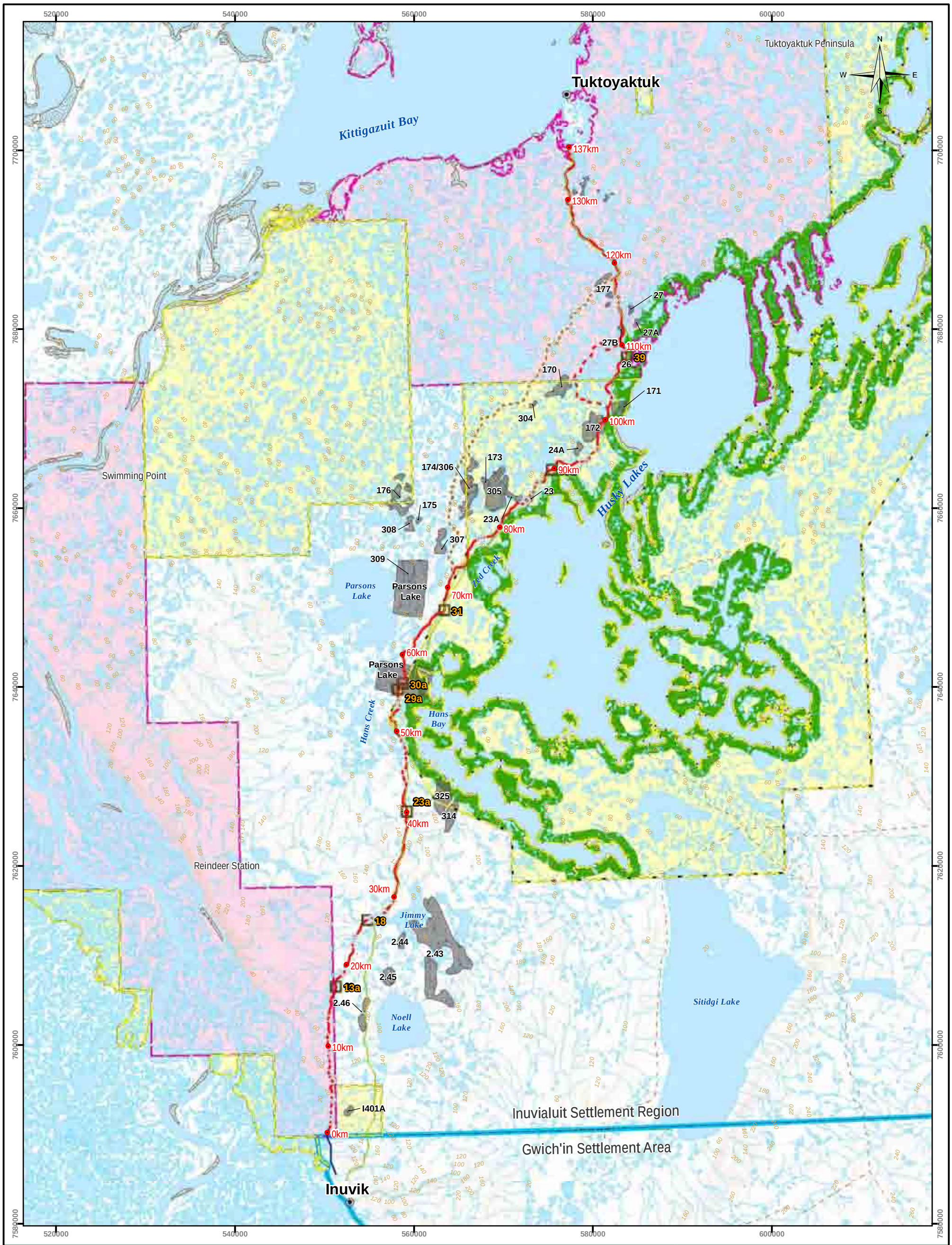


LEGEND

- Stream Crossing
- Stream Crossing - Potential Bridge
- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Borrow Sources
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

Base data source: NTS 1:250,000
Borrow Sources, ILA Lands, Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Preferred Inuvik to Tuktoyaktuk Alignment, Other Alternatives Considered, Priority Borrow Sites, and Proposed Bridges

PROJECTION: UTM Zone 8	DATUM: NAD83
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)	
FILE NO.: V23201098_ES-Map001.mxd	
PROJECT NO.: V23201098	DWN: KWM / CKD: DM / REV: 0
OFFICE: EBA-VANC	DATE: January 18, 2010

Figure 1

TABLE 1: SUMMARY OF QUANTITY AND COST ESTIMATES FOR ALIGNMENTS CONSIDERED			
Element	2009 Route (with encroachment on Husky Lakes Setback)	2009 Route (with realignment to meet Husky Lakes Setback)	Upland Route
Estimated Highway Length	137 km	142 km	134 km
Estimated Embankment Quantity	4.5 million m^3	4.8 million m^3	5.4 million m^3
Estimated Surfacing Quantity	250,000 m^3	259,000 m^3	242,000 m^3
Estimated Capital Construction Cost	$221,000,000	$233,000,000	$258,000,000

The estimated capital construction costs presented in Table 1 do not include royalties or administrative fees associated with materials borrowed from sources that are on Inuvialuit owned lands.

The constructability and cost analysis conducted favour the 2009 Route. The encroachment on the Husky Lake setback area represents a road length of less than 2 km. The other two options presented above were compared to the 2009 Route base case.

The additional cost to undertake the Minor Realignment to accommodate the Husky Lakes setback requirements is approximately 5 to 6% ($12 million) of the overall project cost. To avoid the Husky Lakes setback the realignment adds 5 km in total highway length.

Adoption of the Upland Route meets the Husky Lakes setback requirements, results in a 4 km reduction highway length and results in an increase of approximately 16 to 17% ($37 million) in the overall project cost.

The Project Team's selection of the proposed 2009 Route for the Inuvik to Tuktoyaktuk Highway seeks to capitalize on the technical and economic advantages inherent to the alignment:

- lowest cost alternative for construction;
- requires the least borrow material to construct;
- closer to known borrow sources;
- reduced project footprint (less land disturbance);
- conforms to Husky Lakes Setback with a minor exception;
- traverses less rugged terrain and makes it easier to meet the design requirements for a public highway;
- safer driving; and
- easier and lower cost maintenance.

HIGHWAY DESIGN CONSIDERATIONS

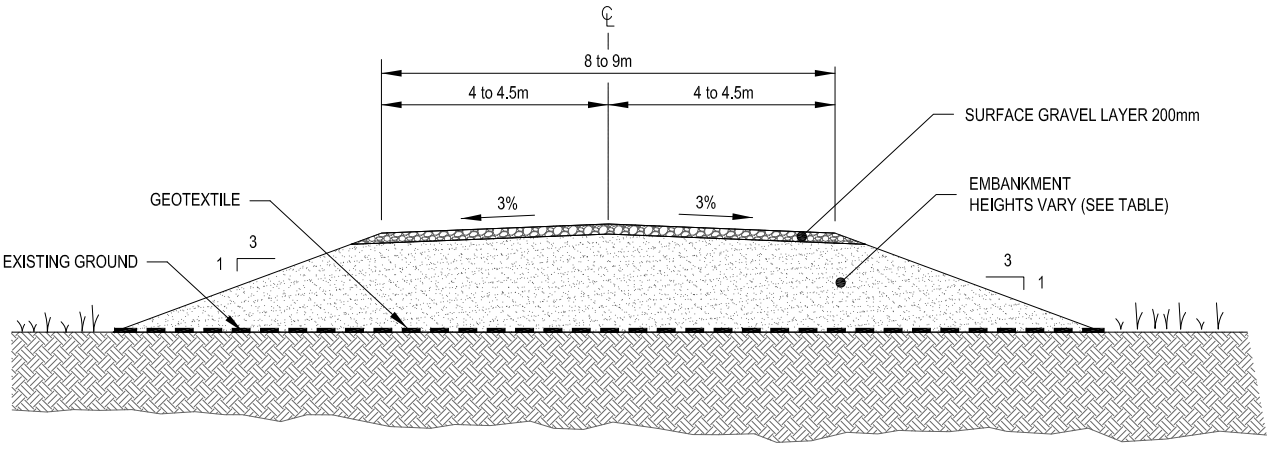
The proposed Inuvik to Tuktoyaktuk Highway will be 138 km long and will be located entirely within the ISR (Figure 1). Approximately 71 km or 51.5 % of the alignment will be located on Inuvialuit private lands which are regulated and administered by the Inuvialuit Lands Administration (ILA). Approximately 67 km, or 48.5 % of the route will be located on Crown lands, which are regulated and administered by Indian and Northern Affairs Canada (INAC). Granular resource requirements for the Highway will be met using gravel and sand from selected borrow sources located in the vicinity of the Highway alignment.

The Inuvik to Tuktoyaktuk Highway will be constructed and operated in conformance with applicable highway standards. The Highway will be a public, all-weather highway under the management and operation of the Government of Northwest Territories Department of Transportation. This will allow for year round use by haul trucks and passenger vehicles according to the size and weight limitations as defined in the Northwest Territories highway regulations. The posted speed limit on the Highway will be 80 km/hr.

The Highway operations will require a two lane gravel roadway (8 to 9 m wide with 3:1 side-slopes) with short span single lane bridges at select stream crossings. Assessments to date have determined that eight stream crossing locations will likely require a bridge. Culverts will be used in most other locations where appropriate and economical.

To protect the permafrost terrain along the proposed Highway alignment, typical 'cut and fill' techniques commonly employed in southern areas of the Northwest Territories and elsewhere will not be used for this project. Such traditional construction methods cut into protective layers of surface vegetation and organics, with the possible results of a thawing in the permafrost below. Therefore, the current design includes only fills. This approach will protect the permafrost layer below the road surface.

The geometric design parameters incorporated during the design process were based on the operational needs of the Highway, the need to protect the permafrost layer below the road surface, and the application of the guidelines for public highways in the Northwest Territories. Figure 2 illustrates the design parameters for a typical highway cross section. Geotextile fabric will be placed between the existing ground and the construction materials along the entire alignment.



TYPICAL HIGHWAY CROSS SECTION

TERRAIN TYPE	DESCRIPTION	EMBANKMENT HEIGHTS
1	DRY (ICE POOR) TILL AND OUTWASH DEPOSITS	1.4 m
2	WET (ICE-MEDIUM TO ICE-RICH) TILL AND OUTWASH DEPOSITS	1.4 to 1.6 m
3	WET SILTS AND CLAYS (ICE-RICH)	1.6 to 1.8 m
4	THICK ORGANIC PEATLANDS AND ICE-RICH PERMAFROST	1.8 m

LEGEND

PROPOSED INUVIK - TUKTOYAKTUK HIGHWAY

TYPICAL HIGHWAY CROSS SECTION

PROJECTION	DATUM

Scale 1:150

1 0 1 3m

FILE NO.
V23201098-Consult01-Typical section.dwg

PROJECT NO.	DWN	CKD	REV
V23201098	SM	RM	0

OFFICE	DATE
EBA-VANC	JANUARY 19, 2010

Figure 2

Q:\Vancouver\Drafting\Environmental\V232\V23201098\Conceptual Design\V23201098-CONSULT02-Typical section.dwg [FIGURE 2 (Exec Summary)] January 19, 2010 - 11:47am adeepwell

The proposed Highway design parameters are presented in Table 2.

TABLE 2: GEOMETRIC DESIGN PARAMETERS FOR THE INUVIK TO TUKTOYAKTUK HIGHWAY	
Design Parameters	
Desired Design Speed	90 km/hr
Minimum Design Speed	80 km/hr
Horizontal Alignment	
Desired Curve Radius	440 m
Minimum Curve Radius	250 m
Desired Sight Distance	500 m
Minimum Sight Distance	180 m
Length of Spiral	160 m
Vertical Alignment	
Minimum Passing Sight Distance	605 m
Minimum Stopping Sight Distance	150 m
Minimum Sag K Value	40
Minimum Crest K Value	50
Minimum Distance between PVI	90 m
Desired Maximum Slope	3%
Maximum Slope Full Speed	6%
Cross-Section	
Desired Finish Top Shoulder Rounding to Shoulder Rounding	9 m
Minimum Finish Top Shoulder Rounding to Shoulder Rounding	7 m
Lane Cross Fall	3%
Superelevation	6%
Side Slopes - All Sections	3:1
Embankment Height	
Dry (ice poor) Till and Outwash Deposits	1.4 m
Wet (ice medium to ice rich) Till and Outwash Deposits	1.4 m to 1.6 m
Wet Silts and Clays (ice rich)	1.6 m to 1.8 m
Thick Organic Peatlands and Ice Rich Permafrost	1.8 m
Thickness of Surfacing Gravel	200 mm

Notwithstanding the work completed by the Project Team to date, it will be necessary to undertake further engineering, environmental and heritage resource studies during the late winter and summer of 2010 to confirm borrow source quality and quantities and to further refine the Highway alignment and stream crossing designs. This information will also be used to support follow-up regulatory applications to permit construction of the Inuvik to Tuktoyaktuk Highway to proceed.

HIGHWAY CONSTRUCTION AND SCHEDULE

A fundamental tenet of the Project's construction methodology is to use primarily winter construction techniques instead of more typical summer construction often use in southern Canada. This strategy offers several advantages:

- allows the use of temporary ice/winter road construction to provide access to borrow sources, without the need to construct costly all-weather access roads.
- allows the placement of construction material directly onto frozen ground. This approach enables the establishment of a frozen core for the Highway and helps protect sensitive and ice-rich terrain.
- minimizes potential effects on vegetation and soils adjacent to the actual roadway that might occur if working under snow-free or wet conditions.
- promotes initial Highway stability through the placement of frozen borrow material directly onto frozen ground (with geotextile separation layer). In the first construction year, it is anticipated that most construction settlements will occur in the top layers of the emplaced borrow material as it thaws, dries and consolidates. Little to no thaw is expected in the lower layers of the embankment in the first few years, leading to greater Highway stability than has been the case with the placement of warm fill on thawed ground in summer construction in this area. This is also expected to reduce potential longer term maintenance problems.

Construction activities will be limited, to the extent possible, within the planned footprint of the Highway. A temporary winter road will run roughly parallel to the alignment and temporary winter road will provide access to borrow sources for the duration of winter construction periods. Before the commencement of construction, the route will be surveyed and staked, and temporary winter roads will be constructed to selected borrow sources. Initially snow cats and small dozers will be used to clear snow from the staked footprint. Dozers used for snow clearing will be equipped with mushroom pads to protect the ground surface on the right-of-way. After the route is staked, the snow is cleared, and adequate material is stockpiled at the borrow source, the construction activities will commence.

Construction material will be loaded at the borrow sources using excavators and hauled along the temporary winter roads using both tractor-trailer units and articulated trucks. Material will be placed by end dump and spread with D6 and/or D7 Cats. An initial lift of approximately 300 mm to 400 mm will be placed, followed by smaller lifts, with the final surface elevation being left some 150 to 200 mm higher than design to accommodate settlements.

Culvert and bridge installation will proceed concurrently with construction of the Highway. As the intended bridge structures are prefabricated single span bridges on binwall abutments, it is anticipated that access to bridge sites prior to Highway construction will not be necessary. Design, ordering and fabrication of bridges will be undertaken months before the scheduled installation so that shipping schedules are achieved and structures and binwall materials arrive on site in time for

installation. Access to opposite sides of the particular stream crossing will be required for ground preparation on binwall assembly before the installation of the bridge structure.

Stream crossings will be accommodated by temporary ice crossings on the adjacent seasonal winter road near the bridge site. Prefabricated bridge structures can be shipped to the individual bridge sites by truck along the constructed portions of the Highway or along the winter road. No specialized equipment will be required for the bridge installations. Specialized equipment is not required. Each year's roadway construction and installation of drainage structures will be carried out in a similar manner. Final compaction, adjustment of grade to correct settlements, and placement of surfacing materials will be undertaken in the year following construction of the Highway embankment.

The Tuktoyaktuk to Source 177 Access Road provides a practical model for how the Highway is anticipated to be constructed:

- the Highway is expected to be built by local and regional contractors;
- construction will proceed from both the north and south ends;
- the Project will take advantage of the winter seasons to develop materials sources and construction;
- construction will begin by placing geotextile and building forward in lifts of granular material;
- construction will continue each winter season until spring demobilization; and
- final shaping, compaction and placement of granular topping will take place in the summer.

Subject to funding and regulatory permitting, the generalized construction schedule for the Inuvik to Tuktoyaktuk Highway is outlined in Table 3.

TABLE 3: PROPOSED PROJECT SCHEDULE

Schedule	Activities
August 2010	Pre-positioning of equipment at Source 177 Potentially commence construction at Inuvik end
October 2010	Strip and develop initial borrow source(s)
November-December 2010	Continue work at borrow sources, construct winter access and haul roads
January-April 2011	Transport, spread borrow material, construct road and install bridges and culverts
June-September 2011	Compact and grade Year 1 embankment
Fall 2011-April 2012	Repeat cycle of construction similar to Year 1
June-September 2012	Compact and grade embankment; substantial completion of Highway
Fall 2012-Fall 2013	Provision of surfacing material, final grading. Highway completion.

ENVIRONMENTAL CONSIDERATIONS AND MITIGATION MEASURES

Climate, Air Quality and Noise

Emissions from diesel engine combustion exhaust and dust generated during the construction phase are considered to be relatively minor. Construction-related emissions are expected to be localized, short-term and intermittent.

Highway construction activities will be intermittent, temporary and transient in nature. Most of the noise dust, and air emissions during the construction phase will be associated with equipment operation and blasting activities, if required, to break up the frozen borrow material during excavation. As indicated in Table 3, the activities that will take place under thawed conditions are the compaction and grading of the Highway. The GNWT *Guideline for Dust Suppression* will be effective in controlling dust created by summer activities.

While there are no local noise regulations that directly apply to construction noises, the contractors will be directed to apply reasonable mitigation to reduce possible effects associated with construction noise. These will include adequate maintenance of their construction equipment, including mufflers. Blasting activities, if required, will be timed to avoid periods when sensitive wildlife species are in the area. Prudent design, best management practices and mitigation can be combined to reduce sound levels during the construction phase.

Examples of prudent design and management practices include:

- limiting construction activity during sensitive periods (based on available background information and recommendations from wildlife monitors) to reduce possible effects on wildlife;
- effective logistics planning to minimize vehicle movements, such as the use of vans or extended cab pick-up trucks to transport workers;
- regular maintenance of equipment and provision of appropriate mufflers for internal combustion engines; and,
- controlling dust caused by construction materials handling, and the grading and compaction of the Highway.

Permafrost Protection and Climate Change Adaptation

The Inuvik to Tuktoyaktuk Highway corridor is located entirely within the zone of continuous permafrost. Ground temperatures are within the range of minus 2°C to 5°C. Permafrost is defined as rock or soil material that has remained below 0°C continuously for two or more years, without consideration of material type, ground ice distribution, or thermal stability. The stability of permafrost and the stability of infrastructure built on it depend on maintaining ground temperatures to minimize the thickness of the active layer, and to impede thaw. The proposed Highway is located within the permafrost region and stability of the infrastructure will be dependent on maintaining the perennially frozen ground.

A risk-based approach for incorporating climate change into design of highway infrastructure on permafrost is now recommended practice. The challenge for design and construction over thaw-sensitive permafrost terrain is to balance the capital cost of constructing the Highway, against the long term maintenance implications. The design parameters and construction techniques take into account consideration of these risks and provide mitigative approaches in the Highway design. The two most significant elements of the design are the use of non-woven geotextile between the existing ground and placed construction material, and maintaining appropriate surface elevation, based on terrain type, to mitigate heat gain that can result in thawing of the permafrost.

Other risk factors that are related to climate uncertainty are precipitation, including both summer rain and winter snow. Key mitigative measures that have been incorporated into the design parameters to manage uncertainty related to future climate trends and extremes in the permafrost region that this Highway will be constructed in include:

- thick embankments that insulate and stabilize the active layer and the use of non-woven geotextiles for reinforcement;
- where available, use of porous construction materials such as coarser gravels to reduce the risk of ponding along the toe of the embankment;
- where such material is not available, the use of culverts to balance surface flow has been included; and
- adoption of construction methods that avoid cuts and minimize disturbance of the natural vegetation before fill is placed.

During the Highway operations phase, given the uncertainty of the events associated with climate change, greater vigilance and effort on the part of maintenance operators will be required including, greater effort for spring culvert clearing and fall protection of culverts and drainage structures, more frequent inspections, and monitoring of the performance of the infrastructure.

Vegetation

The proposed Highway is located predominantly within the Southern Arctic Ecozone, with a small portion of the Highway alignment projecting into the Taiga Plains Ecozone, near Inuvik

The Tuktoyaktuk Peninsula lies within the Southern Arctic Ecozone. The topography is fairly level, rising from sea level to approximately 100 m in elevation at Granular Source 177. Numerous lakes, ponds, and streams are common across the Peninsula. Vegetation grows on a veneer of unfrozen organic or granular substrate overlying the permafrost. The dominant vegetation along the proposed Highway alignment is characterized by a continuous cover of shrubby tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, *Dryas* spp., and sedge tussocks. In wetter areas, sedges, cotton-grasses and sphagnum moss dominate high-centered and low-centered polygons. Drier areas support ericaceous shrubs. Riparian communities include wet sedge communities and taller shrubs.

The proposed Highway also traverses approximately 2.5 km of the Taiga Plains Ecozone near Inuvik. This ecozone is dominated by Canada's largest river, the Mackenzie, and its tributaries. It is

characterised by open, generally slow growing, conifer-dominated forests of predominantly spruce. The shrub component is often well developed and includes dwarf birch, Labrador tea, and willow. Bearberry, mosses, and sedges are dominant understory species. Upland and foothill areas and southerly locales tend to be better drained, are warmer, and support mixed wood forests characterized by white and black spruce, tamarack, white birch, trembling aspen, and balsam poplar.

As indicated in this Project Description Report, the average width of the Highway footprint will be 20 to 28 m (depending on the surface finish width) including the embankment. Considering the 137 km length of the preferred alignment, the total Highway footprint would directly impact approximately 329 ha of terrain and associated vegetation.

Construction of the Highway will involve the excavation of material from borrow sites and the end-dumping of this material over geotextile fabric placed on the frozen ground surface along the right-of-way. These activities will impact the vegetation cover by direct removal at the borrow sites and the burial of vegetation beneath the embankment along the Highway right-of-way.

To minimize direct impacts on the vegetation cover, construction activities will be limited, to the extent possible, to the planned footprint of the Highway. Care will be taken during the operations to keep heavy equipment and trucks within the right-of-way or snow compacted and flooded accesses and turn-arounds. Temporary winter access roads, constructed of snow and ice over the frozen ground, will be used to access the borrow sites. The use of these winter access roads will also assist in minimizing potential impacts on terrain and associated vegetation.

As indicated previously, to reduce possible effects of dust on vegetation, water will be applied. With the application of the proposed mitigation measures, effects on vegetation are generally expected to be limited to the physical footprint and are considered to be minor in the context of the overall project area.

Wildlife

The Tuktoyaktuk Peninsula and Delta area in the vicinity of the proposed Highway supports a wide variety of wildlife.

Records identify 23 terrestrial mammal species that may use the proposed Highway corridor. Key mammal species of greatest interest for harvesting purposes include caribou, moose, grizzly bear, wolf and fox. The local and regional abundance and distribution of these species varies considerably depending on habitat availability and access to terrain suitable for various life history phases, such as calving and denning.

Approximately 137 bird species have been recorded in the region of the Mackenzie Delta and Tuktoyaktuk Peninsula. Most of these bird species, including geese, ducks, swans, are migratory; however, 17 are year round residents, 101 nest and/or moult and remain during the summer and 19 are rare transients or visitors.

Caribou are an important terrestrial mammal species, and have traditionally been harvested by the residents of Tuktoyaktuk and Inuvik. Two caribou herds occur in the Tuktoyaktuk Peninsula area,

the Cape Bathurst herd and the Bluenose-West herd. The Cape Bathurst and Bluenose-West caribou herds' annual ranges overlap that of the proposed Highway alignment.

The proposed road alignment is located south of the traditional summer and fall caribou harvesting areas, but within the spring and winter caribou harvesting areas. As well, the proposed road alignment occurs within the Bluenose-west Winter Range management area. This area provides important winter habitat for the Bluenose-West caribou herd, which are valued for subsistence harvesting year-round by Inuvialuit communities and other aboriginal communities outside the ISR.

Management decisions related to the protection of wildlife and wildlife habitat for the Inuvik to Tuktoyaktuk Highway are based on background information; field investigations; inputs from the Tuktoyaktuk and Inuvik Hunters and Trappers Committees; and the application of, appropriate best management practices. The primary wildlife species of concern to the operation of the proposed Highway are caribou, moose, wolves, wolverines, foxes, grizzly bears, and the high value fur-bearers, such as lynx and marten. The objectives of wildlife management activities along the proposed Highway will be to mitigate potentially negative effects on wildlife in the following general ways:

- minimize loss of habitat and reductions of habitat effectiveness via project design;
- minimize direct mortality due to collisions with vehicles;
- reduce attractants at camps through responsible waste management and effective environmental awareness programs;
- reduce the volume, duration, and frequency of noise producing activities;
- selective timing of Project activities to avoid critical periods for wildlife;
- conformance with pre-determined setback distances from key wildlife habitat features;
- effective transportation, storage and disposal of wastes;
- ensure Project personnel have appropriate levels of wildlife training and awareness; and
- encourage organizations such as the Hunter and Trapper Committees, Wildlife Management Advisory Council and GNWT Department of Environment and Natural Resources to work together to develop guidelines and conditions for Highway usage and follow-up with monitoring of harvesting activities.

The GNWT Department of Transportation's operational policies are designed to mitigate potential impacts on wildlife and wildlife habitat. With the application of the numerous available mitigation measures described in this Project Description Report, effects on wildlife and wildlife habitat are generally expected to be localized and limited and are considered to be minor in the context of the overall project area.

Fish Resources

The proposed Inuvik to Tuktoyaktuk Highway will cross approximately 40 ephemeral and/or permanent streams, and come near many lakes along its route. The proposed Highway alignment is located in the vicinity of the spring, summer, fall, and winter fish harvesting area near Husky Lakes and the Fish Lakes and Rivers management area, an area which provides important fish habitat and historic and current subsistence harvest areas for the people of Inuvik and Tuktoyaktuk.

Limited fish surveys have been conducted previously in streams along the proposed Highway. Generally, these surveys identified the following fish species in some streams along the proposed Highway route: lake whitefish, round whitefish, inconnu, northern pike, Arctic grayling, lake trout, burbot, least cisco, ninespine stickleback, and sculpin. Actual species presence is dependent on several habitat and watershed characteristics, often including the availability and accessibility of upstream lakes that provide feeding, rearing, and/or overwintering habitats. It is unlikely that the streams along the Highway route would provide overwintering habitat due to complete freezing.

A preliminary fish habitat field reconnaissance was carried out in fall 2009. The survey involved low level helicopter flights over the proposed and alternate routes to permit visual observation of watershed conditions upstream and downstream of stream crossing sites. The field crew conducted preliminary ground-based assessments of most of the locations where bridge installations are anticipated. Further site investigations in the coming year will assist with the design of the appropriate stream crossing structures including potential bridges and culverts.

The assessment of the potential effects of road construction on fish and fish habitat, and the development of effective avoidance or mitigation measures, are major components of the proposed Inuvik to Tuktoyaktuk Highway Project. From the perspective of fish and fish habitat protection and management, three categories of streams are recognized along the Highway route:

- non fish-bearing: streams that are not used by fish for any part of their life cycles;
- migratory channels: ephemeral and perennial (except in winter) streams that are used by fish only for migration during open water periods or that contribute to downstream habitat quality; and
- spawning/rearing/feeding streams: ephemeral and perennial streams that are used by one or more life cycle stages of fish during open water periods, in addition to migration.

Based on the September 2009 preliminary field reconnaissance, the project consultants assessed the majority of stream channels to be crossed by the proposed Highway as small, ephemeral streams that generally drain terrestrial upland areas or small, shallow lakes or ponds, most of which do not provide suitable fish habitat features. For these types of stream crossings, appropriately-sized culverts will be installed and sediment and erosion control best management practices will be employed to protect downstream aquatic resources.

At this time, it is also anticipated that for about eight of the larger streams, including Trail Valley Creek, Hans Creek and Zed Creek, single-span bridges are likely to be installed to minimize or prevent potential impacts on fish and fish habitat. To the extent possible, DFO's Operational

Statement for Clear Span Bridges and sediment and erosion control best management practices will be followed. The Project Team is committed to working closely with DFO to design appropriate crossing structures for each stream and to obtain *Fisheries Authorizations*, if determined to be required.

Considerable amounts of water will be required for highway construction and associated aggregate borrow activities. It is proposed that water for these purposes will be extracted from lakes in proximity to the Highway corridor. Since construction will take place in winter, water will necessarily be pumped from water beneath ice cover. It is anticipated that water requirements will exceed 300 m^3/day, which will trigger the need for a Type A Water Licence from the Northwest Territories Water Board.

In addition, water withdrawals from designated lakes along the Inuvik to Tuktoyaktuk Highway route will be conducted in conformance with the *DFO Protocol for Winter Water Withdrawal in the Northwest Territories.*

With the application of the available mitigation measures, effects on fish and fish habitat are generally expected to be localized and limited and are considered to be minor in the context of the overall project area.

Heritage Resources

Within the general study region encompassing the area east of the Mackenzie River and west of the Husky Lakes and from the coast to the southern limits of the project area, 103 archaeological sites have been documented. Types of sites found in this region include lithic scatters and quarry/workshops; stone features such as tent rings, caches and cairns; hearths and fire cracked rock concentrations; cabin remains and semi-subterranean house remains; cache pits; middens; graves; various types of wood features; and cut/worked wood remains. A number of sites have been confirmed to range from the Northwest Microblade tradition (over 5000 years old) to the Paleoeskimo (as old as 4,300 years ago), through Neoeskimo representations (between 1,000 to 200 years old).

There are 12 previously recorded archaeological sites within 5 km of the proposed Highway route, which typically represent Mackenzie Inuit occupations with some small components ascribed to the Paleoeskimo period. Most of these sites are small camps characterized by lithic, bone and artifact scatters, some with structural features such as tent rings, hearths, semi-subterranean house remains, middens and caches.

An archaeological overview assessment of the proposed road route and selected borrow sources was completed in September, 2009. The main goal was to assess the archaeological potential of terrain to be affected by this project. The primary method used to rate archaeological potential was visual assessment of terrain by low and slow helicopter overflight following the proposed alignment using GPS coordinates. The borrow sources were also overflown and the boundaries were roughly approximated using topographic maps. Data gathered during the overview assessment were used to identify specific portions of the Highway project that will require ground reconnaissance surveys before the commencement of construction.

No previously recorded archaeological sites occur within the primary proposed Highway alignment. However, the sections of the Highway route that are closer to Husky Lakes and which cross elevated, dry terrain are judged to have good archaeological potential.

Archaeological sites in the Northwest Territories are protected by law. In the Northwest Territories, new regulations were enacted on June 15, 2001. These regulations provide greater protection for archaeological artifacts and sites and require that archaeological investigations be conducted under permit. The Project Team is committed to ensuring that archaeological and traditional sites are protected in accordance with the terms and conditions of the Northwest Territories archaeological regulations.

Environmental Protection and Incident Response

There exists the potential for accidents or malfunctions to occur in association with any human activity, including those proposed for the construction of the Inuvik to Tuktoyaktuk Highway. Environmental consequences of potential accidents or malfunctions associated with the Highway and associated aggregate borrow and construction camp activities would be primarily limited to those related to:

- vehicle accidents; and
- fuel storage, transportation and handling system failures.

To reduce the potential environmental risks associated with potential vehicle/equipment accidents or malfunctions and/or fuel management activities, several preventative and mitigation measures will be employed. These measures and response activities are detailed in the PDR and PDR Appendices. In overview, preventative and mitigative measures to be employed will include:

- implementation of best management practices to prevent or minimize the occurrence of accidents or malfunctions;
- ensuring that contractors onsite have industry-compliant and satisfactory Health, Safety and Environmental (HSE) policies, programs and manuals and that they are successfully implemented throughout the project:
- compliance with the terms and conditions of the Inuvialuit Land Administration and Indian and Northern Affairs Canada Land Use and Quarry permits and authorizations that will be issues for the construction project; and
- implementation of spill reporting, containment and cleanup protocols in accordance with project-specific spill contingency plans that will be developed by the companies contracted to construct the Highway.

The key strategy will be to prevent accidents and malfunctions through education, monitoring, and follow-up.

Next Steps Towards the Construction of the Inuvik to Tuktoyaktuk Highway

As evidenced by decades of planning, investigation, and consultation, the completion of the proposed Inuvik to Tuktoyaktuk Highway has been a long standing goal of the Town of Inuvik, the Hamlet of Tuktoyaktuk, and the residents of the Inuvialuit Settlement Region. It has also been a major policy objective of the Government of the Northwest Territories.

From the regional perspective, the Highway will mean a dramatic decrease in the cost of living in Tuktoyaktuk and other benefits for Inuvik. It will improve residents' access to healthcare professionals and educational opportunities. The Highway will support year-round social and recreational opportunities and will enable family and community interactions that are currently limited to the winter months when the ice road is open. From a national perspective, completing the Highway and connecting Canada from Coast to Coast to Coast will address Canada's goal of establishing a year round transportation link to the Arctic coastline. The proposed all-weather infrastructure will be integral to protecting Canadian sovereignty in the Arctic and providing diverse economic development opportunities for the future.

The Inuvik to Tuktoyaktuk Highway PDR demonstrates the viability and importance of the Highway. It describes how the anticipated effects of the Highway are manageable. This finding is derived from the scientific and engineering assessments conducted for this PDR and from the knowledge shared and views expressed by the communities of Inuvik and Tuktoyaktuk. Consultations revealed a general satisfaction with the approach and proposals contained within the PDR.

Based on consultation with the environmental screening and regulatory authorities, community organizations, and residents, the Project Partners have a high degree of confidence that that the proposed Highway can proceed efficiently through the regulatory process to permitting, construction, and responsible longterm operation and maintenance. From many perspectives, the proposed Highway will be a key component of the Northwest Territories future transportation system.

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APPENDICES

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1.0 TITLE

Project Description Report for Construction of the Inuvik to Tuktoyaktuk Highway, Northwest Territories.

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3.0 REGULATORY REVIEW AND APPROVALS

Through the Inuvialuit Final Agreement (IFA), settled in 1984, the Inuvialuit received title to approximately 20% of surface lands in the Inuvialuit Settlement Region (ISR), some of which includes ownership of subsurface minerals.

The proposed Highway will be 138 kilometres (km) long and will be located entirely within the ISR. Approximately 71 km or 51.5 % of the alignment will be located on Inuvialuit private lands, which are regulated and administered by the Inuvialuit Lands Administration (ILA). Approximately 67 km or 48.5 % of the route will be located on Crown lands, which are regulated and administered by Indian and Northern Affairs Canada (INAC). Granular resource requirements for the Highway will be met using gravel and sand from selected borrow sources located in the vicinity of the Highway alignment.

The IFA, and its enabling legislation, the *Western Arctic (Inuvialuit) Claims Settlement Act,* requires

> *"…the screening of developments of consequence to the Inuvialuit Settlement Region… that are likely to have a negative impact on the environment, or on present or future wildlife harvesting. It provides for the establishment of the EISC to carry out the preliminary environmental screening of onshore developments."*
>
> (EISC 2004 p.2)

Subsection 11(3) of the IFA establishes the EISC to be comprised of permanent members appointed by Canada and the Inuvialuit. Additional members may be appointed from time to time.

In the fall of 2009, the EISC, ILA, territorial and federal regulatory agencies were consulted with the goal of identifying what their organizations consider to be the key issues related to the proposed Highway project. Regulatory and resource management agency representatives were also asked to describe their organization's anticipated role in screening of the proposed project and to suggest other agencies and organizations that should be consulted. These inquiries confirmed that the Highway would require a screening by the EISC and would also be subject to screening under the Canadian Environmental Assessment Act (CEAA). This Project Description Report has, therefore, been prepared in accordance with the *Environmental Impact Screening Committee – Operating Guidelines and Procedures* (EISC 2004) and contains supplemental information to meet the needs of the EISC and CEAA screening processes.

The EISC guidelines outline the requirements for the content and format of the Project Description Report in Section 4.4 of the Operating Guidelines and Procedures (EISC 2004). In respect of the guidelines, this Project Description Report includes a detailed description and schedule for the proposed development, describes community consultations, provides an environmental overview of the project area, evaluates potential

environmental effects of the proposed project and mitigation measures, and outlines spill contingency and reclamation plans.

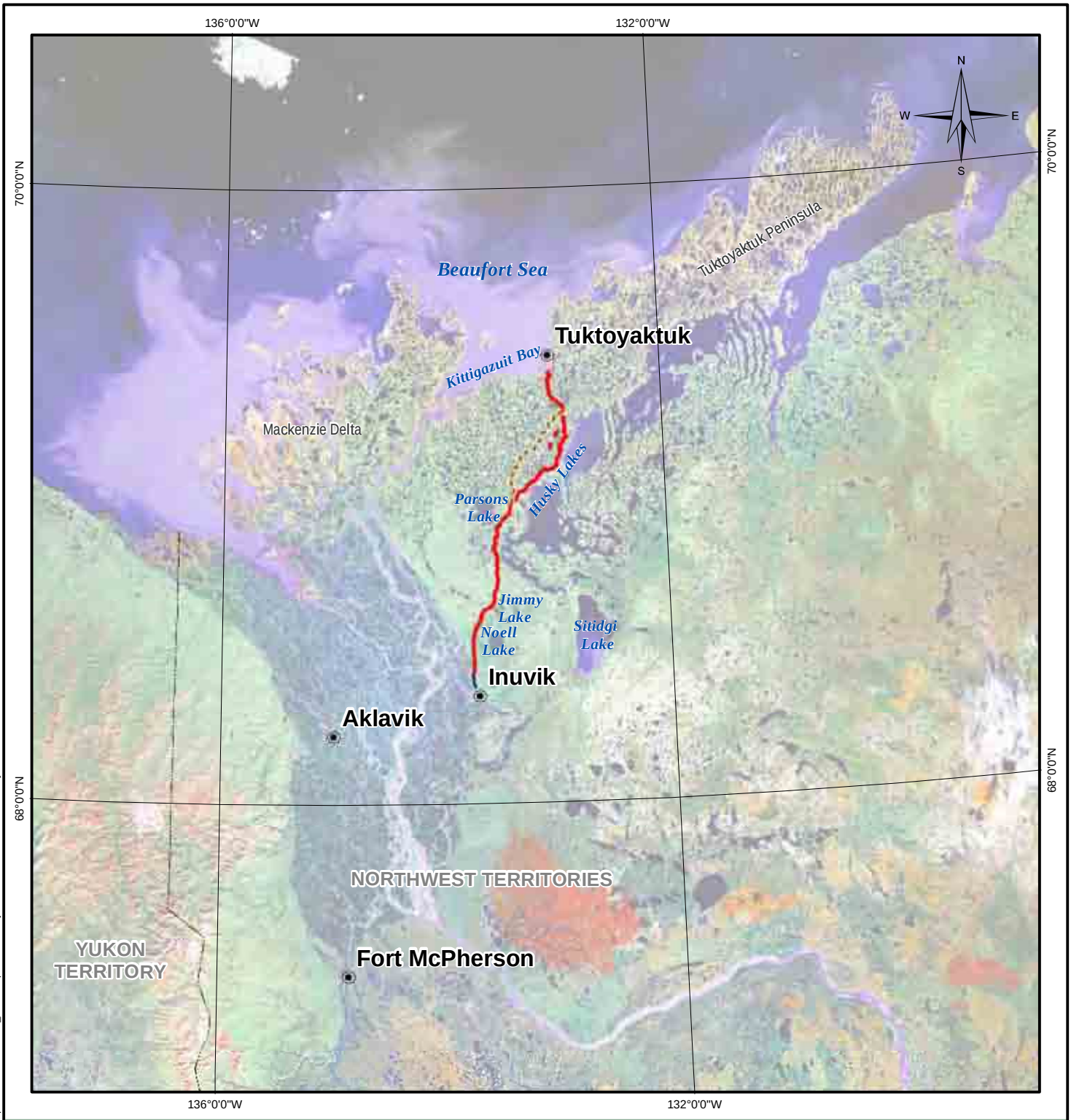
After its review of a Project Description Report, with regard to IFA Subsections 11(17) and 11(18), the EISC will determine if the proposed development could have a significant negative environmental impact. Paraphrasing from the IFA, the EISC will then indicate one of the following views:

- the development will have no such significant negative impact and may proceed;
- the development, if authorized subject to EISC terms and conditions, will have no such significant negative impact and may proceed;
- the development could have significant negative impact and is subject to assessment and review; or
- the development proposal is insufficiently developed and is returned for clarification.

Following EISC and CEAA screening, Inuvialuit and federal permitting authorities will review the decision and associated recommendations from the screening and referral organizations. If the project recommendation is that there will be no significant negative impact and it may proceed, then the ILA and other regulatory agencies will issue permits and licences and prepare accompanying terms and conditions. For the portion of the road traversing Inuvialuit Lands, as part of the permitting process for access and use of Inuvialuit lands, an Access Agreement will be required. The Access Agreement will be between the Government of the Northwest Territories (GNWT) and the IRC and will be binding on the Partners.

Other Inuvialuit, territorial and federal agencies that will play a role in the regulatory approval process will include, but may not be limited to: the ILA, the Northwest Territories Water Board (NWTWB), Indian and Northern Affairs Canada (INAC), Fisheries and Oceans Canada (DFO), GNWT Environment and Natural Resources (ENR), Environment Canada (EC), Transport Canada, Aurora Research Institute, and the Prince of Wales Northern Heritage Centre (PWNHC).

Figure 3-1 depicts the location of the proposed Highway in the context of the Mackenzie Delta area Figure 3-2 identifies the jurisdictional boundaries that indicate which agencies will screen, permit, licence, or otherwise issue decisions and authorizations for the construction of the Highway and associated activities. The location of the project relative to the Inuvialuit Settlement Region, Inuvialuit 7(1)(a) and 7(1)(b) lands, and Crown Lands in the Northwest Territories are of particular relevance to screening and regulatory discussion that follows.



LEGEND

- Communities
- Territorial Boundary
- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road

NOTES

Base data source:
Base imagery, ESRI Data and Maps
Inuvialuit Land Administration - boundaries

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Proposed Project Location

PROJECTION: UTM Zone 8		DATUM: NAD83	
Scale: 1:2,000,000 (10 5 0 10 20 30 40 50 60 70 Kilometres)			
FILE NO.: V23201098_PDR-Map018-Intro-PrjLoc.mxd			
PROJECT NO.: V23201098	DWN: KWM	CKD: XXX	REV: 0
OFFICE: EBA-VANC	DATE: January 14, 2010		

Figure 3-1

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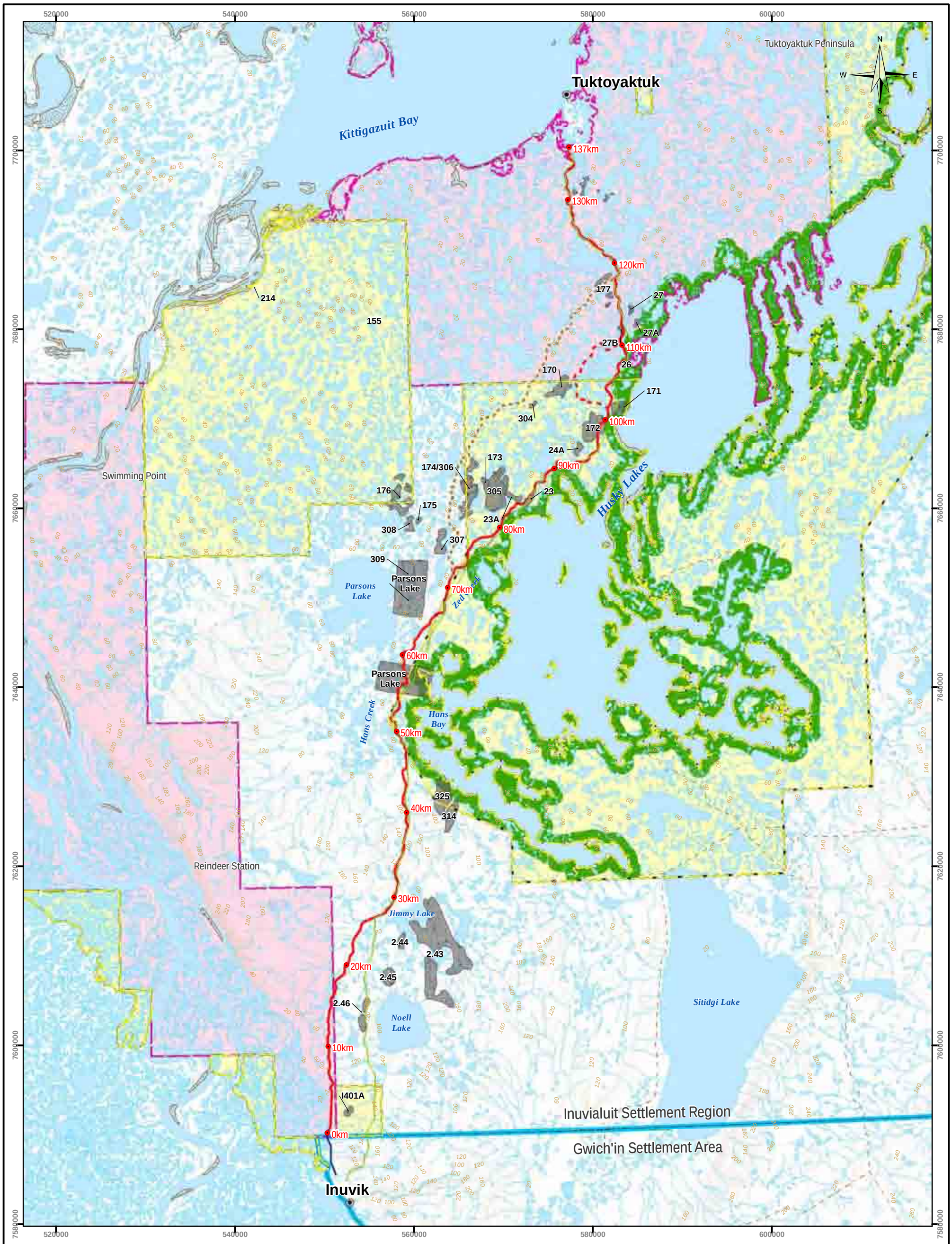
Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201098_TUK-Road-PDR\Maps\PDR\V23201098_PDR-Map004-Dev-GranProp.mxd modified 1/14/2010 by kwarrendorf



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback
- Borrow Sources

NOTES

Base data source: NTS 1:250,000
Borrow Sources: Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Potential Borrow Sources Along the 2009 Route

PROJECTION: UTM Zone 8	DATUM: NAD83
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)	
FILE NO.: V23201098_PDR-Map004-Dev-GranProp.mxd	
PROJECT NO.: V23201098	DWN: KWM / CKD: RM / REV: 3
OFFICE: EBA-VANC	DATE: January 14, 2010

Figure 3-2

3.1 PREVIOUS REGULATORY APPROVALS

Known previous approvals for road construction and/or quarrying in the project area are described below.

In 2000, the ILA granted an approval to E. Grubens Transport Ltd. (EGT) to remove approximately 30,000 m^3 of aggregate material from Source 177. Some of this material was placed on several kilometres of land in the vicinity of the proposed alignment, some of which is now part of the All-Weather Tuktoyaktuk to Granular Source 177 Access Road.

In 2009, the ILA granted approval to the Hamlet of Tuktoyaktuk and the GNWT Department of Transportation to construct the All-Weather Tuktoyaktuk to Granular Source 177 Access Road. The Tuktoyaktuk to Granular Source 177 Access Road serves as a pilot project for the proposed Inuvik to Tuktoyaktuk Highway in regard to environmental review and permitting, cost, schedule, logistics, construction methods, and environmental protection and effects mitigation. The second year of access road construction will begin in 2010. It is, and will remain, the subject of dialogue, observation, and scientific investigation as it is a model of current good, appropriate practice in arctic all-weather infrastructure development.

Additional examples of land use and quarry permits issued in the Inuvik to Tuktoyaktuk corridor pre-date the IFA and the current environmental screening and regulatory regime. Notably, borrow sources were accessed by Gulf Canada Ltd. in the 1970s to create spring/summer well site leases at Parsons Lake natural gas field east of the proposed Highway alignment. As well, Source 168 was quarried by E. Grubens Transport Ltd. (EGT) in the 1980s for shoreline erosion protection in the community of Tuktoyaktuk.

3.2 REVIEW AND APPROVALS PROCESSES

There are several aspects of the proposed Highway project that require regulatory authorizations. The proposed Highway traverses private Inuvialuit lands and Crown lands. It crosses over a number of watercourses. During some phases of construction, the project will require considerable volumes of water and the extraction of large quantities of granular resources. Each of these activities requires a regulatory authorization.

This section provides an overview of the other environmental screenings, reviews, and approval processes that are anticipated for the proposed Highway project including Inuvialuit Land Administration authorizations, screening under the Canadian Environmental Assessment Act, NWTWB water licensing, Indian and Northern Affairs Canada authorizations, Fisheries and Oceans Canada authorizations, a permit for construction within Navigable Waters, and research authorizations for pre-construction field investigations.

The sections that follow seek to integrate regulatory interpretation and consultations with screening agencies and regulators in October 2009 and January 2010. Section 3.2 portrays

the Project Team's resultant understanding of the likely regulatory requirements current to the time of Project Description Report submission.

3.2.1 Inuvialuit Land Administration Authorizations

Access that is more than casual and individual in nature to Inuvialuit lands requires permission from the Inuvialuit. Accordingly, the ILA issues rights to access both 7(1)(a) and 7(1)(b) lands (ILA 2009, IRC 1987). Portions of the Highway project will be located on Inuvialuit 7(1)(a) and 7(1)(b) lands. For these portions of the proposed development, the ILA will be the primary regulatory authority.

Consultations with the ILA have identified the authorizations that will be required to construct the Highway. The anticipated authorizations for the Highway alignment are a temporary right-of-way, a land use permit, and combined land use permit and quarry permits for borrow sources. Supplemental geotechnical and biophysical studies will be conducted in order to fulfill the requirements of the land use and quarry applications. The Partners anticipate securing multi-year authorizations from the ILA to accommodate the duration of Highway construction. The project schedule is discussed in Section 5.9.4.

Along with the above-noted permits, the project will require an Access Agreement. The Access Agreement will be negotiated as part of the permitting process through the ILA.

After screening decisions are taken, the Partners anticipate continuing dialogue with the ILA and other Inuvialuit organizations and authorities. These discussions will include interpretation of project terms and conditions, completion of negotiated agreements, GNWT-Inuvialuit Regional Corporation (IRC) negotiation of permanent land tenure, and other implementation actions, as required.

3.2.2 Screening under the Canadian Environmental Assessment Act

The Canadian Environmental Assessment Act (CEAA) has been reviewed for its applicability to the proposed Highway project and federal agencies have provided input on the anticipated role of a CEAA screening. The basis for CEAA involvement is found in Section 5 of the Act, in relation to a project that is not otherwise excluded and is stated by the federal government (CEAA 2006) as follows:

> The trigger occurs when a federal authority considers providing federal support allowing a project to proceed in whole or in part, by exercising one or more of the following duties, powers or functions:
>
> - Proposes a project as its proponent.
> - Grants money or other forms of financial assistance to the proponent for the purposes of enabling a project to be carried out.
> - Grants an interest in land to enable a project to be carried out.

- Exercises a regulatory duty in relation to the project, such as issuing a permit, license, authorization or approval that is included in the Law List Regulations.

In October 2009 and January 2010, consultations with Inuvialuit and federal authorities in the Inuvialuit Settlement Region supported the Inuvialuit screening process as the first step in the environmental screening of the proposed Highway. Regulatory consultations have indicated that the federal screening process will be initiated concurrently with the Inuvialuit EISC screening process, and is anticipated to be completed after the Inuvialuit process. In practical terms, the CEAA process will receive the EISC's recommendation as one input into the CEAA screening decision.

Affirming the regulatory process that was envisioned in the Rescan (1999) *Proposed Inuvik-Tuktoyaktuk Road: Environmental/Socioeconomic Baseline Report* and the approach indicated in the EISC Operating Guidelines and Procedures, the coordination between the Inuvialuit and federal screenings is stated as follows:

> *"The Settlement Act applies in the event of a conflict or inconsistency between either the Settlement Legislation or the Inuvialuit Final Agreement and the provisions of any other federal, territorial, provincial or municipal law, by-law or regulation [IFA Subsection 3(3)]"*
>
> (EISC 2004)

The remainder of this section describes the goals of CEAA screening process in overview, followed by comments on how it will apply to the proposed Highway.

The CEAA framework comprises a planning and decision-making tool that identifies environmental effects and mitigation, determines if significant adverse effects are likely, and assists federal agencies in deciding whether to support a project (CEAA 2006). The proposed Highway project involves multiple federal agencies. Federal Authorities (FAs) are federal agencies that may have expertise or a mandate relevant to the project. When an FA has the responsibility to exercise power or duty that requires the conduct of an environmental assessment (including a 'screening') that FA becomes a Responsible Authority (RA). The individual responsible for coordinating the involvement of various parties, including the facilitation of communication and cooperation, involved in project screening (or other types of environmental assessments) is the Federal Environmental Assessment Coordinator (FEAC) (CEAA 2006). Through consultation, regulatory agencies have indicated that these roles and the project-specific CEAA assessment will be determined after the potential FAs - INAC, DFO, NWTWB (and others) receive the project description (in this case the Project Description Report).

The following sections provide a brief description of the regulatory triggers for a water licence, land use permit, quarry licence, fisheries authorization, navigable waters permit, explosives authorization, and research authorizations that apply to this project. The Partners remain open to discussions with INAC, DFO, NWTWB, and other federal

agencies to discuss issues that arise and pursue resolution to overlapping Inuvialuit and CEAA requirements.

3.2.3 Northwest Territories Water Board Water Licensing

According to *Northwest Territories Waters Act* Section 12, the Northwest Territories Water Board (NWTWB) is responsible to "…provide for the conservation, development and utilization of waters in a manner that will provide the optimum benefit for all Canadians in general and, in particular, for the residents of any part of the Northwest Territories for which the Board is authorized to issue licences."

The Project Team has reviewed the *Northwest Territories Water Act* and the *Northwest Territories Waters Regulations* for their applicability to the proposed Highway project. The proposed project was evaluated against Schedule II of the *Northwest Territories Waters Regulations,* to classify the undertaking as industrial, municipal, or miscellaneous. Based on this preliminary review, the miscellaneous classification appears to be the most appropriate classification. However, the NWTWB (M. Harlow, pers. comm. December 7, 2009) advised that the Board, upon its review of the project, would decide which classification is most appropriate for the project.

After consulting the NWTWB, the Project Team understands that the project will require one water licence to encompass the various project elements. The licence will authorize watercourse crossings that exceed five metres in width, the anticipated daily water use volumes, and the project construction camps. There are different thresholds for Type A and Type B water licences. The 'triggers' are described below with reference to the relevant regulatory thresholds:

- Water Crossings - The *Northwest Territories Waters Regulations* state that no licence will be required for the construction of a structure across a watercourse that is less than 5 metres wide at the ordinary high water mark at point of construction. The proposed Highway crosses more than one watercourse greater than five metres in width. For municipal and industrial undertakings, these crossings would require a Type B water licence.
- Construction Camps - The *Northwest Territories Waters Regulations* indicate that camps of 50 persons or less do not require a water licence. This project proposes a number of 15-20-person camps in the first year, and in the second year, at least one camp of greater than 50 persons may be added. A Type B water licence would be required to authorize the anticipated camps.
- Daily Water Use - the Northwest Territories Waters Regulations indicate that the direct use of 300 cubic metres (m^3) or more per day for industrial undertakings requires a Type A licence and the direct use of 50 to 2,000 m^3 for municipal undertakings requires a Type B licence. For the construction of the proposed Highway, the water use is anticipated to be 1,000 m^3 or more per day during peak

phases of construction, particularly when establishing temporary winter access roads. As noted above, the NWTWB will classify the activity upon review of the Project Description Report.

The NWTWB has verified that under the *Northwest Territories Waters Act* Subsection 174(1) it is mandatory for the NWTWB to provide the opportunity for a public hearing about projects that require a Type A Water Licence. If the NWTWB determines the need for a Type A Water Licence for this project and there is an intervenor to the water licence application, a public hearing would be held.

In support of the NWTWB's deliberations, the Project Description Report provides information about the water crossings greater than five meters wide, identifies the need for crew accomodations, and provides a construction schedule and preliminary logistics plan. The detailed water requirement estimates, water source identification, construction camp siting, and the location of winter access and haul roads will be submitted subsequent to the Project Description Report. Under appropriate seasonal conditions, the Project Team will conduct further assessment of the proposed water crossing locations and will provide information about watercourse characteristics and proposed crossing structure designs sufficient to meet the requirements of the *Northwest Territories Waters Regulations*. In addition, the DFO *Protocol for Winter Water Withdrawal in the Northwest Territories* will be followed. This will include identification of suitable water withdrawal sources (lakes and streams), assessment of allowable withdrawal quantities per sources, unique source identification, and water withdrawal volume tracking.

3.2.4 Indian and Northern Affairs Canada Authorizations

Indian and Northern Affairs Canada (INAC), in the application of the *Territorial Lands Act*, the *Territorial Lands Regulation*, the *Territorial Land Use Regulation*, and the *Territorial Quarrying Regulation,* holds jurisdiction over Crown lands in the Northwest Territories. Consultations with INAC personnel indicate that a Project Description Report generated in accordance with EISC screening requirements and CEAA screening requirements will meet INAC's information needs. Applicable permit or licence application forms will be submitted, referencing the relevant sections of this Project Description Report.

- Quarry Permit - The project will require quarry permits issued under the *Territorial Quarrying Regulation* for the extraction of borrow materials. It is understood that INAC will review quarry permit applications in the context of INAC's responsibility to manage granular resources on Crown lands in the Northwest Territories. In keeping with this responsibility, INAC will consider requested volumes in the context of the resource requirements of other reasonably foreseeable community, industrial, and other demands for granular resources. At present, INAC licenses borrow sources for a maximum duration of one year; therefore, successive annual licences may be required for some project sources.

- Land Use Permit - A land use permit will be required for the proposed Highway right-of-way and temporary borrow source access roads. Specifically, under the *Territorial Land Use Regulations*, a Class A Land Use Permit will be required to "carry on any work or undertaking that involves the levelling, grading, clearing cutting or snowploughing of any line, trail or right-of-way exceeding 1.5 m in width and exceeding 4 ha in area."

3.2.5 Fisheries and Oceans Canada Authorizations

Fisheries and Oceans Canada (DFO) administers the *Fisheries Act*, which includes provisions that potentially relate to aspects of the Inuvik to Tuktoyaktuk Highway Project. In particular, it is understood that the DFO review of the proposal will focus on the potential effects of construction activities on fish habitat, which is protected under Section 35 of the Act, as follows:

- Section 35(1), prohibits the harmful alteration, disruption, or destruction (HADD) of fish habitat[1]; and
- Section 35(2), which allows the Minister to Authorize a HADD of fish habitat.

To fulfill its responsibilities mandated by *Fisheries Act* Section 35, DFO in 1986 developed a Policy for the Management of Fish Habitat, which provides guidance to protect, conserve and develop Canada's fish habitats. The Policy establishes a Guiding Principle of no net loss (NNL) of productive capacity of fish habitats, as a way of ensuring that developments do not result in a diminishment, in quality or quantity, of fish habitats that support fish production. This NNL principle, however, does provide discretion to the Minister by allowing for the replacement of habitat losses (authorized under Section 35(2) through the provision of approved habitat compensation.

DFO does not issue permits for a project, as this is strictly a provincial or territorial responsibility. However, DFO may issue: a Letter of Advice for projects that are not expected to result in a HADD; or, an Authorization for HADD under Section 35(2). The Letter of Advice normally sets out or refers to guidelines and/or mitigation measures that if followed, would prevent a HADD. An Authorization recognizes that a HADD is likely to occur, and therefore includes an agreement between the project proponent and DFO for compensation that will achieve NNL. In both cases, these documents relieve the project proponent, developer, or owner of concerns over potential legal consequences prescribed in the *Fisheries Act*, provided that the outlined conditions are followed.

In addition, DFO has developed a series of Operational Statements that provide guidance to project proponents regarding specific types of projects. The intention of these

[1] The *Fisheries Act* defines fish habitat to mean "…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."

Operational Statements is to relieve proponents of the need for an approval from DFO, provided that specified requirements and conditions are followed. For example, in the Northwest Territories, DFO has published the following Operational Statements that may be applicable to this project: clear-span bridges; culvert maintenance; ice bridges and snow fills; temporary stream crossings; and, maintenance of riparian vegetation in existing rights-of-way.

The various stream crossings that are necessary as part of this project will be sited and designed to avoid or mitigate adverse effects on fish and fish habitat (i.e. HADD), wherever possible. As such, it is expected that most of the project can be completed through the issuance of Letters of Advice by DFO, or by application of relevant Operational Statements. If there are circumstances where a HADD is unavoidable, DFO will be consulted to discuss and determine suitable compensation strategies so that the necessary application for Authorization pursuant to Section 35(2) of the *Fisheries Act* can be submitted.

3.2.6 Permit for Construction within Navigable Waters

Under the Navigable Waters Protection Act and Regulations, the project will require a permit for construction of bridges or culverts across or over navigable water bodies. Transport Canada is responsible for permits under the Navigable Waters Protection Act. An application will be made once the applicable bridge and/or culvert design information becomes available. It is understood that some of the larger streams in the Husky Lakes area, in particular Hans Creek and Zed creek may constitute navigable waters.

3.2.7 Research Authorizations

Pre-construction studies will include additional environmental and engineering investigations. These scientific activities are administered under the *Scientists Act* and are allowed with the issuance of a research licence by the Aurora Research Institute.

Archaeological investigations are permitted under the *Northwest Territories Archaeological Sites Regulations* made under the *Northwest Territories Act* (Canada). Archaeological permits are issued by the Prince of Wales Northern Heritage Centre. These authorizations will be obtained prior to the conduct of field activities and local Hunters and Trappers Committees and Community Corporations will be notified of proposed work activities.

3.3 INUVIALUIT SETTLEMENT REGION CONSULTATION AND COMMUNICATION

"*A well established system of co-management of resources is in place throughout the ISR… The communities, Hunters and Trappers Committees, co-management bodies, and government agencies are key elements of this system*" (EISC 2004 p.6). As the Partners intend to minimize disturbance to ISR land and the traditional land use and harvesting activities taking place in the ISR, the Partners have initiated consultations with the noted organizations and residents at large, and they intend to continue this consultative process to solicit additional input. Simultaneously,

the Partners intend to solicit the input of authorities, organizations and individuals in the project area. A number of groups have been, and will continue to be given advance notice of studies and construction activities. Examples since the inception of this project include:

- September 2009 Inuvialuit Land Administration, Inuvik and Tuktoyaktuk Hunters and Trappers Committees – Notice of the September 14-18, 2009 Field Study and Consent Form for submission to the Prince of Wales Northern Heritage Centre (in support of Archaeological Permit Issuance) (see Appendix A);
- September 2009 Aurora Research Institute – Telephone inquiry about the need for authorization to conduct the September 14-18, 2009 Field Study;
- October 2009 Inuvik to Tuktoyaktuk Highway Backgrounder (2-page project introduction and map) emailed or faxed to community organizations and regulatory agencies;
- October 2009 Inuvik to Tuktoyaktuk Highway Community and Regulatory Consultations for information gathering purposes;
- November 2009 Notice of Intent to Inuvialuit Regional Corporation Board, November 13, 2009; and
- January 2010 Inuvik to Tuktoyaktuk Highway follow-up Community consultations respond to questions raised in October 2009, update organizations and residents on progress made during Project Description Report preparations and to receive further input before finalizing the Project Description Report.

The Partners expect to receive additional input from community and regulatory agencies that do not issue specific project authorizations. This occurs through the EISC and CEAA screening processes, wherein organizations and agencies receive copies of the Project Description Report and are asked to review and comment on the proposed project. Organizations, agencies, and individuals have the opportunity to provide written input to the screening process. The EISC process, in particular, will append comments to the screening decision. The regulators may choose to incorporate these comments into project terms and conditions.

4.0 LOCATION

As indicated in Section 3.0 of this Project Description Report, the proposed Highway will be 138 km long and will be located entirely within the ISR (Figure 3-1 and 3-2). The corridor between Inuvik and Tuktoyaktuk is situated within the geographic coordinates 68°30' to 69°50'N latitude and 132°45' to 134°0'W longitude. Granular resource requirements for the Highway will be met using gravel and sand from selected borrow sources located in the vicinity of the Highway alignment (Figure 3-2). Temporary winter access/haul roads will be used during the construction phase of this project to access and transport borrow materials.

Inuvik is located on the East Channel of the Mackenzie River Delta. It is accessible by land, via the Dempster Highway, which originates in Yukon Territory, by air from Yellowknife, Whitehorse, Calgary, Edmonton, and regional communities, and by water during the summer months.

Tuktoyaktuk is located on Kugmallit Bay near the Mackenzie River Delta and is the northernmost community on the Canadian mainland. Tuktoyaktuk is located 137 km north of Inuvik. It is accessible by air from Inuvik year-round, by water during the summer months, and by ice road during the winter.

The project area is entirely contained within the Inuvialuit Settlement Region of the Mackenzie Delta-Beaufort Sea Region. To the south of the proposed Highway corridor is the Town of Inuvik and the Gwich'in Settlement Area. To the north, the Highway corridor terminates at the Hamlet of Tuktoyaktuk and the Beaufort Sea. To the east, a portion of the corridor is located near the western shores of Husky Lakes. Ranging in distance between 20 and 50 km to the west of the proposed Highway corridor is the Mackenzie River. The Mackenzie River is the location of the 187 km Inuvik to Tuktoyaktuk Ice Road, which is part of the Mackenzie Delta Ice Roads (Inuvik Area) component of the overall Northwest Territories Public Highway System. The seasonal ice road connects Inuvik and Tuktoyaktuk for approximately three months per year.

5.0 DEVELOPMENT SUMMARY

Currently the only surface transportation access to the community of Tuktoyaktuk is by a 187 km ice road from Inuvik built annually by the GNWT Department of Transportation on the frozen channels of the Mackenzie River Delta and Kugmallit Bay. The ice road is open for three to four months, depending upon the weather, from mid to late December to mid to late April. Tuktoyaktuk has year-round access by air and barge service from Hay River during the summer.

As part of the early 1960s "Northern Vision" of the then prime minister John Diefenbaker for the development of Canada's north, the federal government of Canada, which was then directly responsible for most government programs in the Northwest Territories, implemented an ambitious program of all-weather road construction in the Western Arctic. Achievements of the program included the construction of the Dempster Highway No. 8 connecting Whitehorse, Yukon, to Inuvik; the Mackenzie Highway No. 1 from the Alberta border to Fort Simpson; and the Liard Highway No. 7 connecting Fort Nelson, BC, to the Mackenzie Highway east of Fort Simpson; as well as improvements to the Yellowknife Highway No. 3, and Fort Smith Highway No. 5.

As an ultimate goal, the federal all-weather road program had envisaged the eventual extension of the Mackenzie Highway to Inuvik and onwards to Tuktoyaktuk. Spurred by oil and gas exploration in the Parsons Lake area south of Tuktoyaktuk, the first route surveys for the Inuvik to Tuktoyaktuk all-weather road were undertaken by Public Works Canada (PWC) in 1974, on the basis of which a 140 km all-weather road route was identified. Preliminary engineering and environmental studies were undertaken on this route in 1975-76, which became known as the PWC 1977 route (see Figure 3-2). However, road construction did not proceed due to changes in government policy and the declining pace of industry activity in the region.

Little additional road building was accomplished by PWC in the Western Arctic in the 1970s and 1980s. In the late 1980s, as part of a major devolution of federal programs and their related budgets to the GNWT, the existing Northwest Territories highway system was transferred to GNWT Department of Transportation. It is relevant to note that the roadbed for the Fort Simpson-Wrigley segment of the Mackenzie Highway was built by PWC before program devolution to GNWT; but the segment was completed and opened by GNWT Department of Transportation in the early 1990s. After the program devolution, a combination of economic, fiscal, political and other factors meant that construction of new road corridors in the Western Arctic did not receive the requisite financial support from the federal government.

The need and rationale for new all-weather road corridors in the Western Arctic (namely, the Inuvik to Tuktoyaktuk Highway, the extension of the Mackenzie Highway to Inuvik, and the Slave Province corridor), and the necessity of federal funding assistance, have figured prominently in various GNWT Department of Transportation reports since 1990,

including the NWT Transportation Strategy (1990), the NWT Transportation Strategy Update (1994), Investing in Roads for People and the Economy (2000), Corridors for Canada (2002), Corridors for Canada-II (2005), Connecting Canada: Coast to Coast to Coast (2005), and Northern Connections (2008).

As part of the federal road programs (e.g. National Highway System Improvement Program and Infrastructure Canada Program, various INAC programs), the GNWT has received funding from these national programs for improvements on existing roads in the Northwest Territories (e.g. Highway 3, bridges on the Mackenzie Valley winter road, etc). However, these federal funds were not meant for new road corridors.

More recently, the federal government has shown a renewed interest in developing road and other infrastructure in the arctic with cost shared funding under the Building Canada Fund. The first major new road project in the Northwest Territories under this program is the 19 km all-weather access road from Tuktoyaktuk south to Source 177, along a horizontal alignment that is to become part of the future all-weather highway. Construction on this road began in 2009 and is expected to be completed in the winter of 2010.

5.1 RATIONALE

The Inuvik to Tuktoyaktuk Highway will be the first all-weather road connection in Canada to the Arctic Ocean, and will have substantial benefits at the national, regional and local levels. The main benefits are summarized below.

Cost of Living

The Highway will dramatically reduce the cost of living and doing business in Tuktoyaktuk because goods could be shipped overland year-round. To give an example: according to the latest figures published by NWT Bureau of Statistics (2004), the 2004 Food Price Index for Tuktoyaktuk is 206, compared to 140 for Inuvik (Yellowknife being 100). Thus, food in Tuktoyaktuk is 47% more expensive than in Inuvik. The Highway will allow year-round trucking of most of the items that are flown in most of the year.

Possible effects on the airline industry would be temporary, because the economic stimulus provided by roads to previously isolated communities is expected to help create more business for the airline industry. Changes in demand for service are expected to apply to the barge industry. Nevertheless, Tuktoyaktuk will continue to receive its annual fuel re-supply and other bulk shipments by barge even after the Highway is operating.

Cost of Government Program Service Delivery

The Highway will reduce the cost of providing government services and programs delivered in Tuktoyaktuk and throughout the Region. It is anticipated that there will be a reduction in travel costs, operation and maintenance costs for health, education, social and recreational services, capital programs, and local municipal services and programs.

Social Aspects

The all-weather Highway will provide Tuktoyaktuk residents with cheaper, easier and safer access to regional services, such as health care, education and recreational facilities. The Highway will promote family, community, and sporting interactions by providing year-round access between communities.

Business Opportunities and Competition

The Highway will provide all weather access through the region for Tuktoyaktuk businesses and service providers. It will also allow the Inuvik and other regionally based businesses to compete more effectively for resource related and government business opportunities. This enhanced competition will lead to higher quality and lower cost services for government and resource development sectors.

Tourism Development

The Highway will promote the tourism and hospitality industries in Inuvik and Tuktoyaktuk. A tourism campaign could capitalize on Tuktoyaktuk, the terminus of the all-weather Highway, as the point closest to the Arctic Ocean that can be reached by road from anywhere in Canada, continental USA and Mexico – appreciably closer than northern Alaska which has the only other points in North America on the Arctic Ocean with road access.

Creation of New Business Opportunities

The construction of the Inuvik to Tuktoyaktuk Highway will also create various spin-off business opportunities for Tuktoyaktuk, Inuvik and other regional businesses, such as fuel and gas service stations and highway maintenance services. The increase in tourism and the creation of new business opportunities will provide important year-round employment and training opportunities for local Inuvik and Tuktoyaktuk residents.

Pollution Prevention and Spill Response in the Arctic Ocean

The all-weather Highway can potentially make the Canadian Coast Guard's Tuktoyaktuk-based arctic pollution prevention and spill response planning and operations cheaper and more effective. An all-weather Highway would allow transportation of equipment and materials required to respond to potential spills in the summer/fall Arctic shipping season; at present any emergency equipment and supplies must be flown to Tuktoyaktuk.

National Sovereignty and Security in the Arctic

In the past few years the issue of protecting Canadian sovereignty in the Arctic has received prominent national attention and has become extremely important to Canadians. Construction of the Inuvik to Tuktoyaktuk Highway will establish a permanent transportation link to Canada's arctic coastline, demonstrating to the international community that Canada is prepared to make significant financial investments to protect Canadian sovereignty.

Furthermore, the expected thinning of the ice in the Canadian Arctic Ocean due to climate change could encourage foreign commercial and non-commercial shipping into and through the Northwest Passage. The Inuvik to Tuktoyaktuk Highway would allow easier and cheaper access for sovereignty and security related operations in the western Arctic Ocean, which could be based in Tuktoyaktuk and/or Inuvik.

Arctic Harbour and Port Development

With the potential increase in international marine traffic through the north and the expected intensification of Beaufort oil and gas development, there will be increased marine activity in the Arctic. At present, a deep water port is not available in the Western Arctic region (Canada or the United States) to support the existing and expected increase in marine traffic. A deep water arctic port will be required to support these activities. The construction of the Inuvik to Tuktoyaktuk Highway will facilitate the efficient use of the port in terms of location and costs, and make it more likely that this port will be established in Canada, instead of the United States, which would have multiple economic benefits for the region.

Oil and Gas Exploration and Development

By facilitating all-weather access, the Highway can be expected to reduce the costs of onshore oil and gas exploration and development in the area between Inuvik and Tuktoyaktuk. In addition, it could help reduce the cost of off-shore exploration and development in the Beaufort Sea, as equipment and supplies could be trucked to Tuktoyaktuk, and flown from there to the off-shore exploration sites.

Quantification of Regional Economic Impacts

A study titled "Benefit-Cost and Regional Economic Impact Analysis: Inuvik to Tuktoyaktuk Road" was conducted by Nichols Applied Management for GNWT Department of Transportation in March 1999. The GNWT has commissioned an update to the 1999 study that is scheduled for delivery in early 2010.

Nichols Applied Management (1999) concluded that local hiring of construction workers; spending on wages, materials and equipment during construction of the all-weather road; and increased tourism; would result in regional impacts of $77 million of business and labour income, and 600 person-years of employment. Benefits from potential oil and gas exploration and development, and others listed above, were not quantified in the study. Over time, more opportunities for benefits have become available as prime construction and subsequent operations and maintenance contractors are now located in the region. Therefore, it is anticipated that the regional economic impact of this Project will be greater than $200 million in business and labour income.

5.2 BACKGROUND

5.2.1 Brief History of Alternative Alignments Considered

During the 1980s, interest in the proposed road varied in relation to economic and political factors and two other possible road alignments were considered as alternatives to the original PWC 1977 surveyed route alignment which is discussed in greater detail in the next section.

In 1985, the Inuvialuit Land Administration expressed its opposition to the PWC 1977 route partly because of its proximity to the Husky Lakes; and in 1986 suggested to DIAND a longer route which involved a major shift of the alignment to the west, towards Reindeer Station through the Caribou Hills, and along the East Channel of the Mackenzie River. This road alignment would be located almost entirely within Inuvialuit lands, and was approximately 173 km long, or 33 km longer than the PWC 1977 route. Public Works Canada did not support this proposed alignment because of economic and geometric reasons, but put forward an alternative route that was 27 km longer than the original PWC 1977 route. However, this route was located without field data, and would have required completely new preliminary engineering studies, and because of its longer length, would have been considerably more costly to construct than the original PWC 1977 route.

As part of its Highway Strategy, GNWT Department of Transportation launched a $2 million initiative in May 1998 under which it conducted various planning, environmental, pre-engineering and related studies for each of the three new road corridors that the Department had been promoting for federal funding: Slave Geological Province Transportation Corridor; Mackenzie Highway Extension from Wrigley to Inuvik; and Inuvik to Tuktoyaktuk Road. The results of the studies were published in the "Summary Report of the Highway Strategy, October 1999, GNWT Department of Transportation".

Two of the several studies carried out for the Inuvik to Tuktoyaktuk Road as part of the Highway Strategy dealt with the route alignment issues.

First, the route location was an important question posed and discussed at the community consultation meetings held in January 1999 in Inuvik, Tuktoyaktuk, Aklavik, Fort McPherson, and Tsiigehtchic. In terms of the route alignment for the Inuvik to Tuktoyaktuk Road, there was general agreement by the public with the PWC 1997 route, except that some residents, particularly from Tuktoyaktuk, expressed concern about the proximity of the proposed alignment to the shore of Husky Lakes. Three critical sites were identified where a preference was expressed to relocate the route 2.5 km or more from Husky Lakes (Rescan 1999).

Second, the "Inuvik to Tuktoyaktuk Road Pre-Engineering Update, March 1999, prepared by Highways and Engineering Division, GNWT Department of Transportation" endorsed the PWC 1977 alignment as the most logical route for an all-weather road link between the two communities. This study also provided an update regarding design standards and costs for the road.

The move of the proposed route farther from Husky Lakes as suggested in the 1999 community meetings, and in the 2009 and 2010 community consultations has been considered in the selection of the preferred alignment.

5.2.2 Alignments Considered in the Current Stage of Project Development

As noted above, the specific evaluation and further development of alignments is based on historical studies, a better understanding of the development of transportation infrastructure in permafrost regions and the management of risk that is associated with climatic warming or Climate Change. In addition, the first hand understanding gained during the September 2009 field work of the physical terrain, and the recent stakeholder and regulatory input has been accounted for in the further development of alignments or alignment segments for comparison.

The alignments considered in the current stage of project development are shown in Figure 3-2. The alignments include:

- 2009 Route which is an update and improvement on the PWC 1977 alignment, but includes a minor encroachment on the Husky Lakes 1,000 m setback;
- Minor realignment of the 2009 Route to conform to the Husky Lakes 1,000 m setback requirements; and
- Upland Route which diverts west from the 2009 Route approximately 70 km north of Inuvik and rejoins the alignment near Source 177. This route has been considered in response to requests in the 2009 consultations to consider a suitable alignment that is substantially further than 1,000 m away from Husky Lakes.

A brief description and comparison of these alignments is described in the following subsections.

5.2.2.1 PWC 1977

The PWC 1977 alignment has been the starting point for further development and comparison of alignments at this stage in the project development. Originally developed to a conceptual level by Public Works Canada in 1977, it has been the subject of further minor investigation and comparison with other more westerly alignment concepts through the Mackenzie Delta. The southern limit of the alignment is the northeast quadrant of the Town of Inuvik and the northern limit is the existing hamlet road network in Tuktoyaktuk. The original PWC alignment follows the shores of Husky Lakes and the design/construction approach at the time, considered a balance of cuts and fills. Today, this alignment would not be directly suitable as it encroaches on the 1,000 m setback as recommended by the ILA adjacent to Husky Lakes, traverses lakeshores which are generally softer, less stable ground, and relies on an undesirable approach of cutting into the permafrost to gain an advantage for vertical geometry (Photo 5.2-1).

Photo 5.2-1
Looking west from Husky Lakes to area where PWC 1977 alignment was considered

5.2.2.2 2009 Route

The 2009 Route builds and improves on the original PWC 1977 alignment. Extending from the north end of Navy Road in the Town of Inuvik to the Hamlet of Tuktoyaktuk, it follows a similar alignment to that of PWC 1977 but has been developed to a conceptual design level - one to two iterations of vertical and horizontal alignment design based on:

- minimum/desirable design parameters using a digital elevation model developed from available 1:30,000, 2 m resolution colour air photos);
- 1,000 m setback from Husky Lakes;
- optimum stream crossing locations based on initial field work;
- potential areas of wildlife and vegetation sensitivity;
- areas of archeological potential;
- sensitive permafrost and ice-rich terrain;
- location of potential borrow sources; and
- topography suitable to meet minimum vertical and horizontal geometric requirements with a "fill only" construction approach.

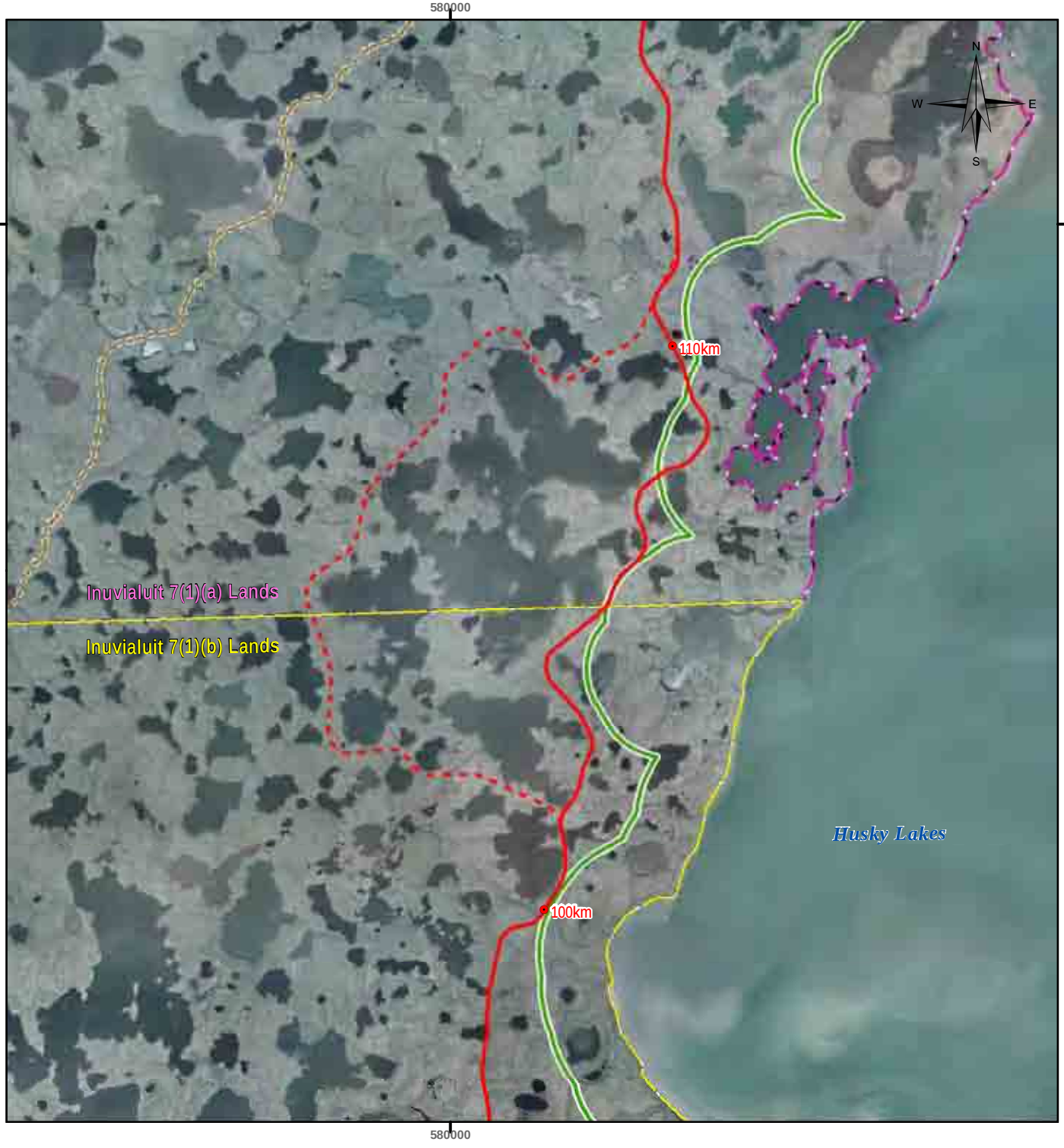
At the south end, the 2009 Route takes advantage of more suitable terrain north of Navy Road than the previous PWC 1977 alignment (Photo 5.2-2). At the north end, the 2009 Route takes advantage of the horizontal alignment of the 19.5 km access road that is currently under construction from Source 177 to Tuktoyaktuk (Photo 5.2-3). The horizontal alignment for this access road meets or exceeds the minimum design parameters for the future highway. Only the road cross section (i.e., width of driving surface) and the vertical profile will need to be upgraded to meet the requirements for the future highway. Minimum and desirable design parameters are discussed in further detail in the next section of this Project Description Report.

Photo 5.2-2
Looking south along 2009 Route near Hans Creek

5.2.2.3 Minor Realignment of 2009 Route to Meet Husky Lakes Setback Requirements

There are two locations where the 2009 Route does not fully meet the 1,000 m Husky Lakes setback. The first is from KM 105+340 to 105+600 where, for a road length of approximately 260 m, the 2009 Route runs just along the 1,000 m setback boundary or has a slight encroachment of 14 m. The second is from KM 107+580 to 109+400, where the 1,000 m setback line runs through the east end of a large lake that is just west of the Husky Lakes system. The 2009 Route encroaches on the setback for a road length of approximately 1,820 m. Through this 1,820 m, the encroachment on the setback ranges from 0 m to 600 m east of the setback boundary. This is illustrated in Figure 5.2-1.

To avoid the encroachments on the Husky Lakes Setback, a minor realignment of the 2009 Route has been considered to the west of a large lake starting at KM 101+200 and rejoining the 2009 Route at KM 111+700. This realignment is also shown in Figure 5.2-1.



LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Husky Lakes 1000m Setback

NOTES

Base data source:
NTS 1:250,000
Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Minor Realignment - 2009 Route

PROJECTION: UTM Zone 8	DATUM: NAD83
Scale: 1:85,000 (1 0.5 0 1 2 Kilometres)	
FILE NO.: V23201098_PDR-Map021-DevRealig.mxd	
PROJECT NO.: V23201098	DWN: KWM / CKD: TS / REV: 0
OFFICE: EBA-VANC	DATE: January 14, 2010

Figure 5.2-1

Q:\Vancouver\GIS\ENVIRONMENTAL\V232\V23201098_TUK-Road-PDR\Maps\PDR\V23201098_PDR-Map021-DevRealig.mxd modified 1/15/2010 by kwarrendorf

Photo 5.2-3
Partially complete access road from Tuktoyaktuk to Source 177

5.2.2.4 Upland Route

The Upland Route diverts northwest from the 2009 Route at KM 71 and rejoins the 2009 Route at KM 118, near Source 177. The route has been considered in response to requests to find a suitable alignment that is substantially further than 1,000 m away from Husky Lakes. Initial review of the Upland Route was based on the historical power line alignment and input from community members who frequently travel the route by snowmobile for recreational and harvesting activities. As a result of the consultations, the Upland Route has been developed to the same conceptual design level as the 2009 Route, accounting for the same factors as noted above. The Upland Route is found to be through more rugged terrain than the 2009 Route, which poses challenges in constructability, an increase in material quantities to meet the minimum design parameters, and higher fills that could result in maintenance and operational issues (Photos 5.2-4 and 5.2-5). More direct comparison of the alignments is presented in further sections of this Project Description Report.

Photo 5.2-4
Looking south along Upland Route at typical terrain.

Photo 5.2-5
Looking south along Upland Route at typical terrain

5.3 DESIGN PARAMETERS FOR THE ALL-WEATHER HIGHWAY

The Highway will be a public, all-weather highway under the management and operation of the Government of Northwest Territories Department of Transportation. This will allow for year round use by haul trucks and passenger vehicles according to the size and weight limitations as defined in the Northwest Territories highway regulations. The posted speed limit on the Highway will be 80 km/hr.

The Highway operations will require a two lane gravel roadway (8 to 9 m wide with 3:1 sideslopes) with short span single lane bridges at stream crossings that require protection of fisheries. Culverts will be used where appropriate and economical.

In southern areas of the Northwest Territories it is common for road designs to incorporate both 'cuts and fills' to level terrain along the road alignment. However, in permafrost areas, cutting into the surface vegetation can disturb the permafrost regime, resulting in thaw and unstable ground. It is not recommended. Therefore, the design includes only fills with heights based on terrain type. This will be sufficient to protect the permafrost layer below the road surface.

Design parameters for the Highway were developed based on the operational needs of the Highway and the need to protect the permafrost layer below the road surface. The design parameters are defined as follows:

5.3.1 Design Embankment

The embankment is the main component of the Highway to be constructed. Figure 5.3-1 shows a cross section of the Highway and indicates the embankment. Although the original work by PWC considered a balance of cuts and fills in the highway design and construction (PWC 1981a), the current Project Team recognizes that for this type of terrain there is a lack of suitable material for construction along the alignments considered. In addition, a design and construction approach that utilizes cuts could result in future stability concerns for the Highway and cut slopes, unless those cuts were in ice-poor materials or bedrock.

Similar to the access road that is currently being constructed from Tuktoyaktuk to Source 177, the approach for the Highway will focus on using fills to build the Highway on existing ground.

It is believed that a minimum embankment (or fill) height of 1.4 m will be required to construct the Highway using ice-poor, quality granular materials, to the level expected without incurring substantially higher operation and maintenance costs. Construction could use less fill, but maintenance effort will be greater and additional fill materials will ultimately be required.

When the Highway traverses over borrow areas and drier, ice-poor upland terrain, then the minimum embankment height should provide sufficient structural strength to carry the anticipated traffic loading. Increased embankment heights would be required through low

lying, wet areas and areas of ice-rich polygonal patterned ground (Photo 5.3-1) that cannot be avoided and would most likely be in the 1.8 m to 2.0 m range.

Photo 5.3-1
Ice-rich polygonal patterned ground along the 2009 Route

Some sensitive, slide prone locations were identified during the September 2009 field work along the alignments considered. The slides identified were described as retrogressive thaw flow slides. These occur in regions of high ice content soil, particularly where the active layer is thickening and slopes are over steepened. In this region the over steepened slopes develop around expanding thermokarst lakes, along hummocky terrain and along stream channels and terraces (Photo 5.3-2).

Photo 5.3-2
Thermokarst lakes and hummocky terrain along 2009 Route

Table 5.3-1 provides the design parameters for embankment fill thickness by terrain type for the alignments considered.

TABLE 5.3-1: DESIGN PARAMETERS FOR EMBANKMENT FILL THICKNESS

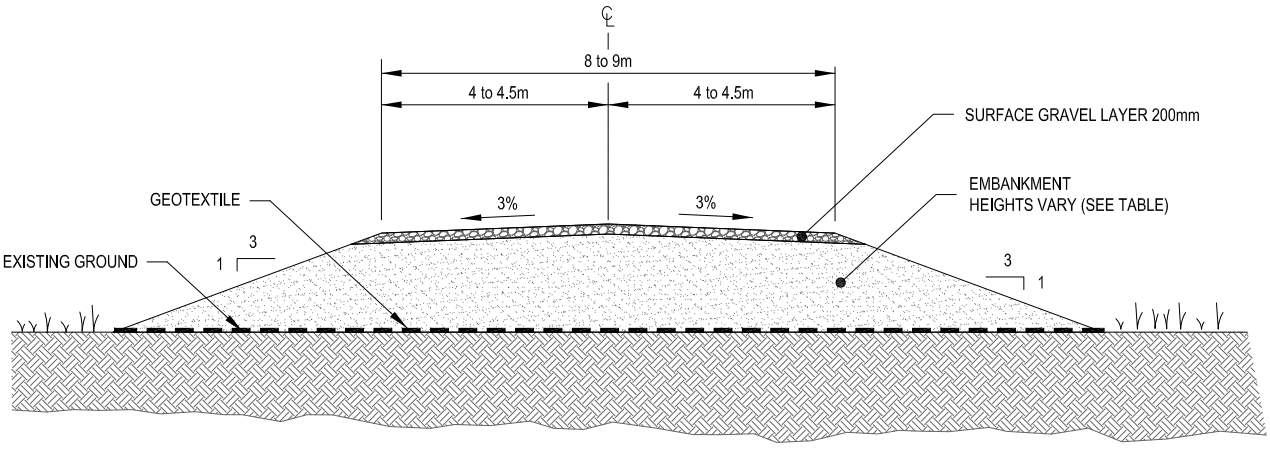
Terrain Type	Terrain Description	Embankment Fill Thickness
1	Dry (Ice-poor) Till & Outwash Deposits (relatively dry, stable, upland till and outwash deposits, overlain by a thin organic cover)	1.4 m
2	Wet (Ice-medium to Ice-rich) Till & Outwash Deposits (relatively wet, with some expression of ice-rich permafrost conditions, overlain by a thin to moderate organic cover)	1.4 m - 1.6 m
3	Wet Silts & Clays (Ice-rich) (lacustrine, silt and clay, deposits with distinct expressions of ice-rich permafrost conditions, moderate organic cover)	1.6 m - 1.8 m
4	Thick Organic Peatlands & Ice-Rich Permafrost	1.8 m

5.3.2 Geometric Design

Taking into account the operational needs for the Highway, desired and minimum geometric design parameters have been developed based on appropriate guidelines for public highways in the Northwest Territories. These parameters are presented in Table 5.3-2 and Figure 5.3-1 illustrates the design parameters in a typical highway cross

section. The figure shows geotextile between the existing ground and the embankment. This is a feature that will be included along the entire alignment.

TABLE 5.3-2: GEOMETRIC DESIGN PARAMETERS FOR THE INUVIK TO TUKTOYAKTUK HIGHWAY	
Design Parameters	
Desired Design Speed	90 km/hr
Minimum Design Speed	80 km/hr
Horizontal Alignment	
Desired Curve Radius	440 m
Minimum Curve Radius	250 m
Desired Sight Distance	500 m
Minimum Sight Distance	180 m
Length of Spiral	160 m
Vertical Alignment	
Minimum Passing Sight Distance	605 m
Minimum Stopping Sight Distance	150 m
Minimum Sag K Value	40
Minimum Crest K Value	50
Minimum Distance between PVI	90 m
Desired Maximum Slope	3%
Maximum Slope Full Speed	6%
Cross-Section	
Desired Finish Top Shoulder Rounding to Shoulder Rounding	9 m
Minimum Finish Top Shoulder Rounding to Shoulder Rounding	7 m
Lane Cross Fall	3%
Superelevation	6%
Side Slopes - All Sections	3:1
Embankment Height	
Dry (ice poor) Till and Outwash Deposits	1.4 m
Wet (ice medium to ice rich) Till and Outwash Deposits	1.4 m to 1.6 m
Wet Silts and Clays (ice rich)	1.6 m to 1.8 m
Thick Organic Peatlands and Ice Rich Permafrost	1.8 m
Thickness of Surfacing Gravel	200 mm



TYPICAL HIGHWAY CROSS SECTION

TERRAIN TYPE	DESCRIPTION	EMBANKMENT HEIGHTS
1	DRY (ICE POOR) TILL AND OUTWASH DEPOSITS	1.4 m
2	WET (ICE-MEDIUM TO ICE-RICH) TILL AND OUTWASH DEPOSITS	1.4 to 1.6 m
3	WET SILTS AND CLAYS (ICE-RICH)	1.6 to 1.8 m
4	THICK ORGANIC PEATLANDS AND ICE-RICH PERMAFROST	1.8 m

LEGEND

PROPOSED INUVIK - TUKTOYAKTUK HIGHWAY

TYPICAL HIGHWAY CROSS SECTION

PROJECTION	DATUM

Scale 1:150

1 0 1 3m

FILE NO.
V23201098-Consult01-Typical section.dwg

PROJECT NO.	DWN	CKD	REV
V23201098	SM	RM	0

OFFICE	DATE
EBA-VANC	DECEMBER 14, 2009

Town of Inuvik

Northwest Territories

KIGGIAK - EBA

Figure 5.3-1

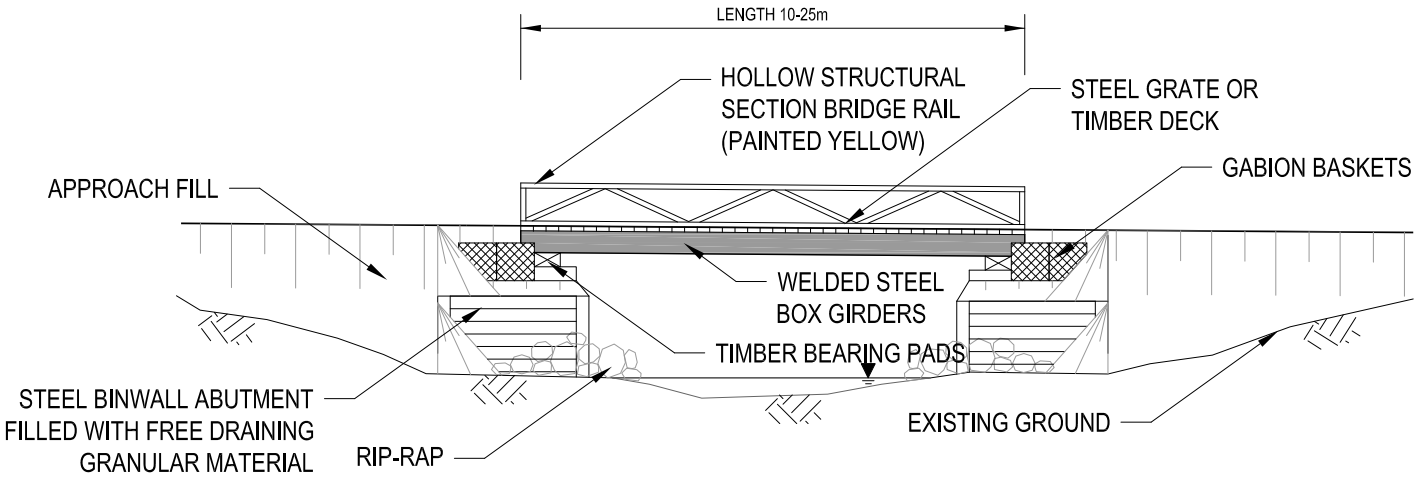
5.3.3 Stream Crossing Design Considerations

The preferred 2009 Route crosses many minor diffuse drainage paths and many are ephemeral (dry) for most of the year. Defined but still minor stream crossings that do not comprise fish habitat will be accommodated using culverts. In the case of known or potential fish-bearing streams, simple prefabricated bridges will be considered. The specific locations and bridge spans are discussed in a later section which introduces the preferred alignment.

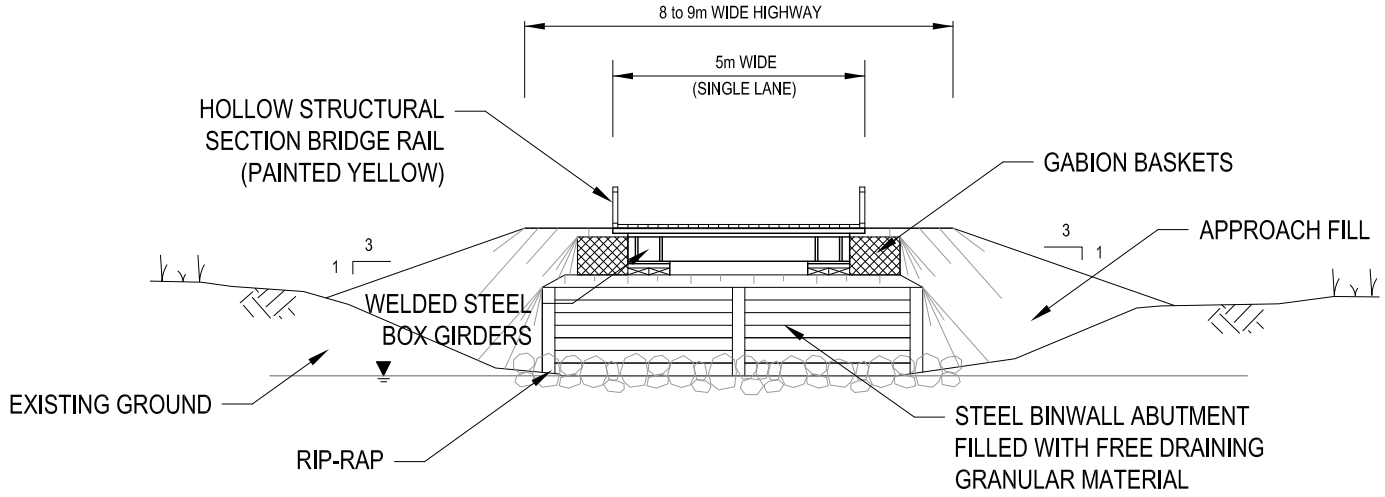
The concept for culvert installation is similar to that currently being used on the Tuktoyaktuk to Source 177 access road. Culverts of appropriate size are laid in place with little disturbance to the existing ground, at locations where drainage paths have been identified in the detailed design. Fill material is placed around and over the culverts in the continuation of the construction. In some cases, multiple smaller diameter culverts may be used instead of single large diameter to avoid having to cut into the existing ground to maintain the vertical grade or creating a crest curve in the roadway where the embankment is constructed over the culvert. Appropriate culvert sizing and location will be confirmed in the detailed design stages of the work.

The concept for the bridges, ranging from 10 to 25 m in length, is illustrated in Figure 5.3-2 and Photo 5.3-3.

Photo 5.3-3
Single span, prefabricated bridge on gravel filled binwall abutments.



BRIDGE ELEVATION



ABUTMENT ELEVATION

LEGEND

PROPOSED INUVIK - TUKTOYAKTUK HIGHWAY

GENERAL ARRANGEMENT
PRE-FABRICATED STEEL BOX GIRDER BRIDGE

PROJECTION	DATUM		
Scale: NTS			
FILE NO. V23201098-Consult01-Typical section.dwg			
PROJECT NO. V23201098	DWN SM	CKD RM	REV 0
OFFICE EBA-VANC	DATE DECEMBER 15, 2009		

Figure 5.3-2

Such bridges are used extensively throughout the Northwest Territories and Nunavut for both permanent and temporary installation.

The bridge concept includes:

- Single lane bridge (5 to 6 m wide);
- Prefabricated welded steel box girder with timber or steel grade deck;
- Placed on timber bearing pads on gravel filled corrugated steel binwall abutments;
- Shipped by road to Inuvik or by barge to Inuvik or Tuktoyaktuk then transported by truck or even dragged (on skids) to site;
- Installed using typical construction equipment and local labour; and
- Spans stream width but for some crossings may encroach on wetted width (to minimize length) with approach fill construction.

Section 10.6 of this Project Description Report discusses the fish and fish habitat issues that have and will continue to be considered to ensure that the appropriate stream crossing structures are selected for each of the streams to be crossed by the Highway.

To minimize risk of travel over single lane bridges, site selection and approach grades will be managed to assure appropriate site distance requirements.

5.4 COMPARISON OF ALIGNMENT OPTIONS

The following comparison of options was based on the conceptual designs for the alignments. The quantity and cost estimates are summarized and presented in Table 5.4-1.

The quantities are estimated design volumes based on conceptual design without factors for bulking or shrinkage. The quantities are estimated for construction of the new Highway alignment and the upgrade of the Tuktoyaktuk to Source 177 Access Road to the Highway design. Estimated Capital Construction Costs presented in the table for each alignment option include:

- Pit development, material production and load, haul, place, compact and grade embankment and surfacing gravel materials;
- Supply and place non-woven geotextile between the embankment and natural ground, along the entire alignment;
- Fabricate and install pre-fabricated bridge structures ranging from 10 to 25 m in length on gravel-filled steel binwall abutments;
- Supply and install culverts at defined stream crossings (non fish bearing), ephemeral streams and at frequent locations to balance seasonal surface flows;
- Mobilization;

- Contingency; and
- Engineering (including preliminary survey, detailed geotechnical investigation, environmental studies, detailed design, and construction administration.

Proportional and unit rates for individual items are based on experience, engineering judgment, published industry guidelines, and historical costs for similar construction projects in northern Canada. Rates for mobilization, contingency and engineering are as follows:

- Mobilization is 10% of construction costs not including contingency;
- Contingency is 20% of construction costs (including mobilization); and
- Engineering (as described above) is 4.6% of construction costs including contingency.

The Estimated Capital Construction Costs shown do not include royalties or administrative fees associated with materials borrowed from sources that are on Inuvialuit owned lands. This is discussed in a section below.

TABLE 5.4-1: SUMMARY OF QUANTITY AND COST ESTIMATES FOR ALIGNMENTS CONSIDERED

Element	2009 Route (with encroachment on Husky Lakes Setback)	2009 Route (with realignment to meet Husky Lakes Setback)	Upland Route
Estimated Highway Length	137 km	142 km	134 km
Estimated Embankment Quantity	4.5 million m^3	4.8 million m^3	5.4 million m^3
Estimated Surfacing Gravel Quantity	250,000 m^3	259,000 m^3	242,000 m^3
Estimated Capital Construction Cost (See description above)	$221,000,000	$233,000,000	$258,000,000

The estimated capital construction costs presented in Table 1 do not include royalties or administrative fees associated with materials borrowed from sources that are on Inuvialuit owned lands.

The constructability and cost analysis conducted favour the 2009 Route. The encroachment on the Husky Lake setback area represents a road length of less than 2 km. The other two options presented above were compared to the 2009 Route base case.

The additional cost to undertake the Minor Realignment to accommodate the Husky Lakes setback requirements is approximately 5 to 6% ($12 million) of the overall project cost. To avoid the Husky Lakes setback the realignment adds 5 km in total highway length.

The Upland Route meets the Husky Lakes setback requirements, results in a 4 km reduction highway length and an increase of approximately 16 to 17% ($37 million) in the overall project cost.

5.4.1 Identification of Preferred Alignment

The constructability and cost analysis conducted for this Project Description Report favours the 2009 Route (with encroachment on Husky Lakes Setback) as shown in the table above. The encroachment on the Husky Lake setback area is for a road length of less than 2 km.

Of the three options considered, the preferred 2009 Route (with encroachment on Husky Lakes Setback) is not the shortest route, but it requires the least material and is estimated at a lower cost to construct. From a strictly technical perspective, the 2009 Route (with encroachment on Husky Lakes Setback) is also a stronger option for meeting several key transportation criteria. These criteria include more accessible borrow sources, a reduced project footprint, a reduced environmental impact as a result of lower embankment heights and lesser volumes of materials, and easier operations and maintenance.

In reality, scientific and economic factors are only part of a development decision. The technical teams who assessed the options maintained an awareness of the values held by the community about Husky Lakes, as described in Sections 7.4 and 7.5. These values and interests were discussed in the October 2009 and January 2010 consultation meetings. Those that were brought forward for consideration are summarized in Section 8.0 and Appendix A. The intent has been to integrate those values, while delivering key technical information to decision-makers and stakeholders to review and to draw their own conclusions about the acceptability of the proposed Highway project.

The Highway proponents have reviewed the previous project studies, the 2009-2010 assessment, the current opportunity to fund and construct the Highway, and the community views presented during the October 2009 and January 2010 consultation proceedings. After reviewing these factors, the 2009 Route (with encroachment on Husky Lakes Setback) was selected as the preferred alignment. The next sections of this Project Description Report describe the preferred alignment in greater detail.

5.5 TERRAIN CONDITIONS ALONG PREFERRED ALIGNMENT

Terrain conditions observed along the preferred alignment, beginning at the north end of Navy Road (KM 0) and traveling north to Source 177 (KM 118) are described in Table 5.5-1 below. A detailed discussion of the surficial geology landforms is presented in Section 9.2.2. Construction of the access road from Tuktoyaktuk to Source 177 commenced in 2009 and is ongoing.

TABLE 5.5-1: TERRAIN CONDITIONS ALONG PREFERRED ALIGNMENT		
Kilometre		Description of Terrain Conditions
0	4	The proposed route departs Inuvik from the terminus of Navy Road traveling north along subtle coalescing alluvial fans that slope toward the Mackenzie River. The route crosses several drainage channels supporting fish habitat requiring culverts.
4	10	The route ascends onto an elevated rolling moraine plain (late Wisconsinan stage) and crosses a series of drainage channels that will require culverts, but do not appear to support fish habitat.
10	27	The route crosses onto a morainal blanket (early Wisconsinan stage), travels along a narrow strip of ice-rich polygonal patterned ground between two lakes and parallels along the east side of a chain of lakes from KM 13 to KM 19, about 2 km to 3 km east of Douglas Creek. The soils appear to be clayey/silty tills. At about KM 25, the route descends in elevation toward the lowlands adjacent to Jimmy Lake and crosses several drainage channels along the way.
27		At about KM 27 the alignment crosses the abandoned NCPC (Northern Canadian Power Commission) power transmission line and an overland winter road cutline.
27	34	The alignment travels 1 to 2 km west of Jimmy Lake for 1 to 2 km crossing wet, polygonal ground and numerous drainage channels that drain to the lake. The route then begins ascending in elevation onto relatively dry terrain from about KM 29 to KM 34, and further climbs a section of steep terrain from KM 32 to KM 34.
34	39	The alignment continues along a section of irregular, hummocky ground on a morainal blanket for about 1 km, then from KM 35 to KM 38 the route crosses a relatively smooth moraine veneer, before thickening again and approaching the first significant creek crossing at KM 39 (unnamed Crossing 23A in the field map book). The crossing is incised and mapped as having colluvial slopes along its banks.
39	52	Surficial mapping shows the alignment to transition away from the unnamed creek and associated colluvial materials at KM 40 and back onto a rolling moraine plain with patterned polygonal ground to KM 52. From about KM 40 to KM 46, the route descends the east extension of the Caribou Hills toward the south end of Husky Lakes. Between KM 46 and KM 51, the alignment crosses ice-contact transitional terrain between the moraine plain to the west and Husky Lakes to the east. The ice contact terrain is irregular and hummocky with kame and kettle complexes and thermokarst modified outwash plains. The route crosses drainage channels through this section and ice-rich polygonal patterned ground. There are signs of thermokarst activity and associated slumping.
52	56	The route leaves the hummocky ice-contact terrain and crosses a glaciofluvial outwash plain with little relief for a few kilometres before approaching Hans Creek at about KM 56.
56		Hans Creek is a major stream on the route containing extensive deposits of alluvial outwash sands and gravels along the south facing (north) terrace. This material source has been investigated and reported by others (RKL 1972). Hans Creek discharges water from East Hans Lake and associated tributaries into Husky Lakes. The terraces have historically slumped, particularly the north facing terrace, and are clearly sensitive to disturbance, but there are no signs of recent instability.
57	67	North of Hans Creek the route climbs onto a north-east trending ice-contact deposits and crosses through an area of higher ground with lakes on either side. The Highway parallels a series of thermokarst lake beds and pingos are developing in the area.

TABLE 5.5-1: TERRAIN CONDITIONS ALONG PREFERRED ALIGNMENT		
Kilometre		Description of Terrain Conditions
67		The route crosses Zed Creek which is the outlet to Parson Lake discharging into Husky Lakes. The local area is characterized by thermokarst lakebeds and evidence of sensitive terrain.
67	90	North of Zed Creek the route climbs onto a north-east trending glaciofluvial outwash plain that appears reasonably well-drained and at about KM 76 crosses a wet, ice-rich, lowland area at the north end of Zed Lake. Along this section, the route skirts the eastern limits of an ice contact deposit and alternates between the ice contact deposit and a glaciofluvial outwash deposit to the east. The terrain is irregular and hummocky at times. The route crosses areas of ice-rich polygonal patterned ground and overall the terrain is characterized as poorly drained.
90	95	The route crosses a complex geologic intersection of ice-contact, glacial outwash, moraine and lacustrine deposits. Overall the area is characterized as being wet and ice-rich containing numerous lakes and occasional pingos. A description of deposits along this section based on the mapping by Rampton (1987) is as follows: KM 87 to KM 90 ice contact deposit, KM 90 to KM 91 lacustrine, KM 91 to KM 92 moraine, KM 92 to KM 93 lacustrine, KM 93 to KM 95 moraine.
95	114	At KM 95 the route moves onto lowland lacustrine deposits along Husky Lakes. The terrain is smooth, but wet and ice-rich. This section of the alignment comprises lacustrine deposits lain down during high water phases of Husky Lakes or in a proglacial or glacially dammed basin environment. There are sections of relatively good terrain to cross, but for the most part the terrain is wet and polygonal terrain is common.
114	118	Near KM 114 the alignment moves off the abandoned lake-bed of Husky Lakes onto thermokarst modified ice-contact and moraine terrain to KM 118 (Source 177). The landscape is marked by pot-hole lakes and abrupt elevation changes. The till subsoil generally contains extensive and erratic massive ground ice.
118	138	The route from Source 177 to Tuktoyaktuk continues on outwash hills and ridges. Northward of Source 177 the terrain becomes more subdued. The area has many thermokarst lakes and pingos.

Morainal materials generally provide suitable foundation conditions to construct a road. These materials are typically moderately well drained and comprise a fraction of sand, gravels and cobbles. They present few limitations to road construction except in areas with steep slopes or where drainage is poor and ice-rich.

Most glacial outwash materials provide a suitable foundation for roads as drainage is generally considered to be good. In addition, some outwash deposits provide good construction material sources. Ice-contact deposits also provide suitable foundation conditions for roads but the irregular and hummocky terrain can be a challenge and require higher fill volumes to construct a road.

Lacustrine sediments present limitations for road construction and maintenance due to their fine-textured nature; these sediment types are generally found in lowland adjacent to existing lakes such as Husky Lakes. Their limitations are due to their wetness and high settlement potential. Fill thicknesses are typically greatest over lacustrine sediments and

thick organic terrain. Thick organic deposits and ice-rich patterned ground was avoided as much as possible as disturbance to these accumulations can result in significant rutting, compaction and alterations to hydrologic conditions.

Alluvial and colluvial deposits comprise a small percentage of the materials to be encountered along route. These materials are transported and deposited by streams and gravity and are found along water courses and steeper slopes. From an engineering perspective, alluvial deposits represent potential borrow sources, however, these materials are often located in sensitive areas near waterbodies, are of small volume, and are mostly unmapped, so they should not be relied upon as significant material sources.

5.6 KEY HIGHWAY GEOTECHNICAL ISSUES

5.6.1 Permafrost

Permafrost occurs throughout the Project area. Melting of permafrost can result in substantial thaw settlement, the loss of the soil structural integrity, and potentially affect the Highway foundation. Minimizing disturbance to permafrost is important. Common permafrost-related features in the Project area include ice-rich polygonal ground, retrogressive thaw-flow slides, thermokarst and peatland.

The term "permafrost" describes a ground thermal condition where the soil or rock remains below 0°C for two or more years, without consideration of material type, ground ice distribution, or thermal stability. The Inuvik to Tuktoyaktuk corridor is located entirely within the continuous permafrost zone of the Northwest Territories. Ground temperatures are within the range of minus 2 to 5.

Frozen ground can contain excess ice, where the amount of water contained in the soil matrix in a frozen state is higher than would be retained in the soil in an unfrozen state. The excess ice can be found mixed (disseminated, non-visible) within the soil matrix, or can be in the form of pure ice, ice lenses or ice wedges. These ice-rich soils are sensitive to thermal disturbance and can result in significant thaw settlement and instability.

5.6.2 Sensitive Terrain

The majority of the proposed alignment is located in the Mackenzie Delta of the Pleistocene Plain, a region of limited topographic relief. The southern portion of the route is located on the Caribou Hills, with rolling terrain and steeper slopes. There are various landforms and specific areas along the alignment identified that would be sensitive to construction activities along the route for both the PWC 1977 route and the Upland Route. A major routing design consideration was to avoid problematic or sensitive areas and to design accordingly to mitigate impact. Also, construction over ice rich permafrost terrain requires substantial quantities of materials to maintain a grade with continuous thick fill over thaw sensitive terrain.

The following subsections describe the landforms identified as being sensitive to construction activities and disturbance.

5.6.2.1 Polygons

Polygons are recognizable as a type of patterned ground found primarily in low-lying poorly drained areas (i.e. drained lakebeds). These features are commonly classified as high or low centered. Low centered polygons consist of central flat terrain enclosed by relatively dry ridges. During the winter, water that has filled the cracks in the ice wedges cracks in the ice wedges. In this manner ice wedges grow progressively. Ice wedge growth pushes up the surface soil to form linear ridges. Intersecting ridges give the surface of the ground a polygonal appearance. Over time low centered polygons can become high centered polygons. This ice-rich patterned ground was avoided when possible.

5.6.2.2 Thick Organics (Peatland)

Generally these deposits occur as peat or fen, peat-fen complexes, usually as cover over the underlying mineral soil, typically on flat terrain. Peatlands are wetlands with massive deposits of peat that are typically greater than 0.5 m thick and may be several metres thick. There are many classes of Peatland, but most in the Mackenzie Valley are bogs and fens. Bogs are a form of peatland, having a water table at or near the surface, where the waters are virtually unaffected by nutrient rich groundwater from the surrounding terrain. Most bogs are affected by permafrost and take the form of peat plateaus, polygonal peat plateaus and plazas (Tarnocai et al. 2003). Fens on the other hand support nutrient rich waters that originate from mineral soil. Thick organic terrain identified during the field reconnaissance and from orthophotos has been avoided.

5.6.2.3 Thermokarst

Thermokarst refers to surface subsidence and expression resulting from the melting of ice rich permafrost, particularly massive ice lenses. Thermokarst is a slow natural process that can be aggravated and accelerated if not cautious. As ground ice thaws and the resulting water can not drain away and contributes to further degradation of the permafrost, the result is the creation of small ponds and lakes, expressing in the numerous kettle lake topography seen along the route. Old thermokarst lake beds occur where fine-grained clay, silt, peat, and local sand deposited in low, flat areas previously occupied by lakes/ponds become exposed. These lake beds often support an organic cover and the areas tend to be very wet. Ice content is generally high is these fine-grained, organic materials. These areas often exhibit thermokarst subsidence with erosion along ice wedge cracks and pingos are commonly associated with this environment. These areas have been avoided when possible.

5.6.2.4 Retrogressive Thaw Flow Slides

These are characterized by unique landslides that occur only in ice-rich soils in permafrost regions. Retrogressive thaw flows develop in ice-rich, fine-grained sediments and result from the thawing and subsequent flow of water-saturated ground. These failures can occur on very gentle slopes and hundreds of these features line the river banks and tundra lakes in

the project area. These landslides are typically relatively small, but over time can retreat some distance back from the rim and from the escarpment. These slides would have a significant impact on a road if one were to occur. The likelihood of a retrogressive thaw slide impacting the Highway is reduced by purposely routing away from existing slides and steeper slopes that would be susceptible to failure.

5.6.2.5 Pingos

Pingos are ice-cored hills that are forced up by the hydrostatic pressure in a wet area underlain by permafrost. Pingos may be up to 50 m high and have a base of up to 600 m in diameter. Mackay (1963) reported the existence of some 1,400 pingos in the Delta Area. Several particularly large pingos are located near Tuktoyaktuk and to the west of the proposed Highway alignment near the Beaufort coastline. Pingos are cultural and heritage resources that have been avoided entirely.

The drainages of Hans Creek and Zed Creek, and the wetland north of Zed Lake have been identified as being particularly sensitive to disturbance and construction activities given their environmental settings. Particularly careful design and construction will be undertaken in these areas.

5.7 DETAILED QUANTITY ESTIMATES FOR THE PREFERRED ALIGNMENT

Quantity estimates have been developed for the 2009 Route based on the conceptual design. The estimated fill quantities by topography and terrain are presented in Table 5.7-1.

TABLE 5.7-1: ESTIMATED FILL QUANTITY BY TOPOGRAPHY AND TERRAIN

Alignment segment	Length	Surfacing Gravel (m^3)	Embankment (m^3)	Average Embankment Fill Estimated per km (m^3)	Remarks on Topography and Terrain
KM 0 - KM 10	10	19,000	391,000	37,767	Elevation climb out of Inuvik
KM 10 - KM 44	34	62,000	969,000	28,416	Higher ground with drops to creeks
KM 44 - KM 90	46	82,200	1,801,000	39,275	Lower ground twisting around Husky Lakes
KM 90 - KM 118	28	52,300	863,000	30,648	Flatter terrain
KM 118 – KM 137 (Tuktoyaktuk)	19	33,800	476,000	25,677	Upgrade access road to Highway

There are many stream crossings identified along the 2009 Route. It is anticipated that most will be served by culverts and select locations will be crossed using bridges. At the time of Project Description Report preparation, and prior to summer 2010 field surveys,

eight locations have been identified as potential bridge crossings. This is based on the preliminary field investigation completed in September 2009 and the conceptual design completed to date. The specific design of drainage structure (i.e., bridge or culverts) will be confirmed in the next steps of field investigation and detailed design.

The estimated lengths for the eight potential bridge crossings are presented in Table 5.7-2, and locations are illustrated in Figure 5.7-1.

TABLE 5.7-2: ESTIMATED LENGTHS FOR POTENTIAL SINGLE SPAN, PRE-FABRICATED BRIDGES

Location	Stream Crossing No.	Estimated Length (m)	Remarks
KM 17	13a	15	Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 26	18	20	Jimmy Creek
KM 40	23a	20	Trail Valley Creek, Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 55.5	29a	20	Hans Creek tributary, Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 56.5	30a	25	Hans Creek
KM 67.5	31	25	Zed Creek
KM 89.5	35a	10	Potential Bridge Crossing, Fish Habitat to be Confirmed
KM 109	39	10	Potential Bridge Crossing, Fish Habitat to be Confirmed

Culverts are required at many locations along the 2009 Route. Specific sites and estimated lengths based on the conceptual design have been identified where ephemeral creeks were identified in the 2009 field work. Additional nominal quantities of culvert length have been included in the construction cost estimates to account for culverts that may be incorporated in the detailed design to equalize surface flow from one side of the Highway to the other, and including propsed culvert extensions for the Tuktoyaktuk to Source 177 Access Road upgrade.

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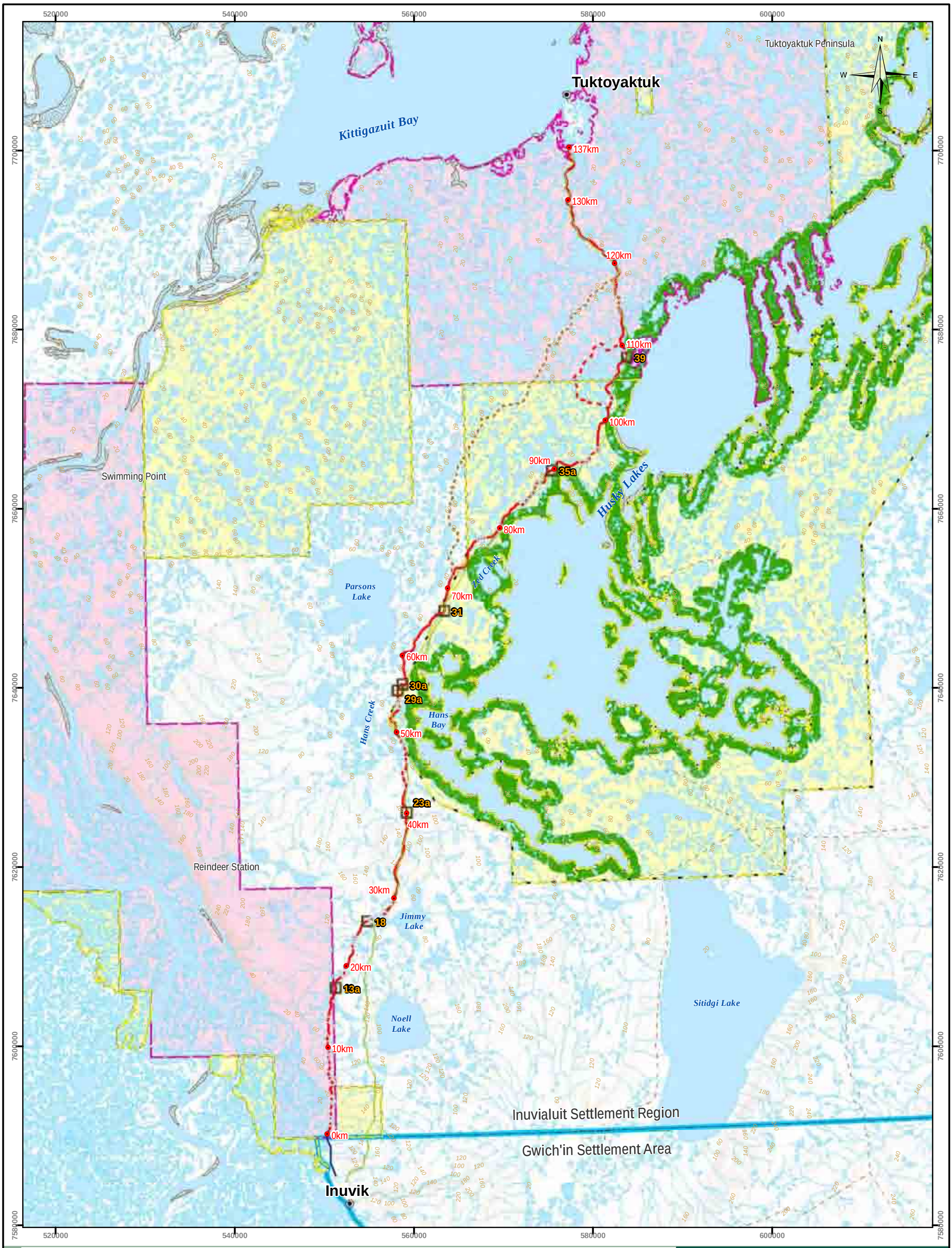

LEGEND

- Stream Crossing
- Stream Crossing - Potential Bridge
- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

Base data source: NTS 1:250,000
Borrow Sources, ILA Lands, Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Potential Bridge Locations

PROJECTION: UTM Zone 8		DATUM: NAD83	
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)			
FILE NO.: V23201098_PDR-Map026-BridgeX.mxd			
PROJECT NO.: V23201098	DWN: KWM	CKD: DM	REV: 0
OFFICE: EBA-VANC	DATE: January 18, 2010		

Figure 5.7-1

5.8 BORROW SOURCES

5.8.1 General Information on Borrow Sources in the Area

The early work in the investigation and evaluation of granular material resources in the Mackenzie Delta Region was carried out by Roger Brown and Hank Johnston of the National Research Council (NRC) during the planning, development and construction of the new town of Inuvik and its related infrastructure in the 1950s (Fujino 1993).

Beginning in the 1960s, generic sources of granular materials were identified in the Mackenzie Delta Region as part of the surficial geology and terrain mapping activities by the Geological Survey of Canada (GSC). This mapping work served as a foundation for future studies and investigations for granular materials conducted by industry and government agencies. The most recent surficial geology mapping of the project study area, and the one used to perform this work, was prepared by Rampton (1987).

In the 1970s and early 1980s, numerous, extensive granular material investigations were undertaken by private industry resource development groups and government agencies, primarily under the direction of the Department of Indian and Northern Affairs (DIAND). Many industry groups had significant interests in the development of energy resources in the Mackenzie Delta Region with parallel demands for granular materials.

Granular material investigations carried out by Ripley Klohn Leonoff International Ltd. (RKL) in 1972-73 for INAC has served as a comprehensive data base for more recent granular material investigations by numerous groups. Subsequent investigations by EBA Engineering Consultants Ltd., Hardy Associates (1978) Ltd., Terrain Analysis and Associates Ltd., Northern Engineering Services Ltd., Public Works Canada, and Hardy BBT have provided further ground-truthing and confirmation of selected granular material sources and quarry sites in the Mackenzie Delta Region.

During the 1980s and early 1990s, the focus of the various studies and investigations of granular materials was directed to issues dealing with aboriginal land claims. In this regard, the work in the Mackenzie Delta Region was primarily directed to the Inuvialuit Final Agreement (IFA). The granular materials inventory work completed by EBA Engineering Ltd. (EBA) in 1987 for Indian and Northern Affairs Canada (INAC) formed part of the Inuvialuit Final Agreement (IFA). The comprehensive granular materials inventory was assembled for resources within the Inuvialuit Settlement Region (ISR) using the available information collected over the years.

Under the Inuvialuit Final Agreement (IFA), signed between the Government of Canada and the Inuvialuit in 1984, ownership of most of the accessible granular deposits in the Western Arctic Region was transferred to the Inuvialuit (IRC 1987). Management of this resource is now the responsibility of the Inuvialuit Land Administration (ILA) in consultation with local groups such as the Community Corporations and Hunters and Trappers Committees. Several studies of granular resources in the Inuvialuit Settlement

Region have been conducted over the years to refine the database/inventory of the resource.

The comprehensive inventory of granular materials for the Inuvialuit Settlement Region (ISR) was provided to the Project Team by the ILA. The inventory includes granular resources in the settlement region including areas outside of the Project area and the Mackenzie Delta Region. The material sources within proximity to the Project area are summarized in figures and tables herein and form the basis of the borrow areas identified for construction of the proposed Highway.

5.8.2 Available Information on Borrow Sources in the Area

Figure 5.8-1 shows all known borrow sources in the general area between Inuvik and Tuktoyaktuk.

Many of the borrow sources listed below were identified by PWC between 1976 and 1980 specifically along the 2009 Route and could be selected as potential borrow areas for constructing a Highway along the current preferred alignment. These borrow sources were previously assessed by PWC (1981a; 1981b) and were deemed to be suitable and available. The materials identified for embankment construction were judged to be of generally fair to poor quality. Most of the materials contain high ice content that might be above the liquid limit of the soil, and could require select harvesting to obtain the best available material for use in construction. Thirty years later, these sources have not been further investigated. Except for a few sources in close proximity to Husky Lakes (which are not available for use), the borrow sources identified by PWC are assumed to still be acceptable.

The 2009 field program did not include further examination of the proposed borrow source areas that PWC had identified, but fly-overs were completed to confirm that the areas appeared to be viable borrow sources.

Table 5.8-1 summarizes available information on borrow sources along the proposed 2009 Route.

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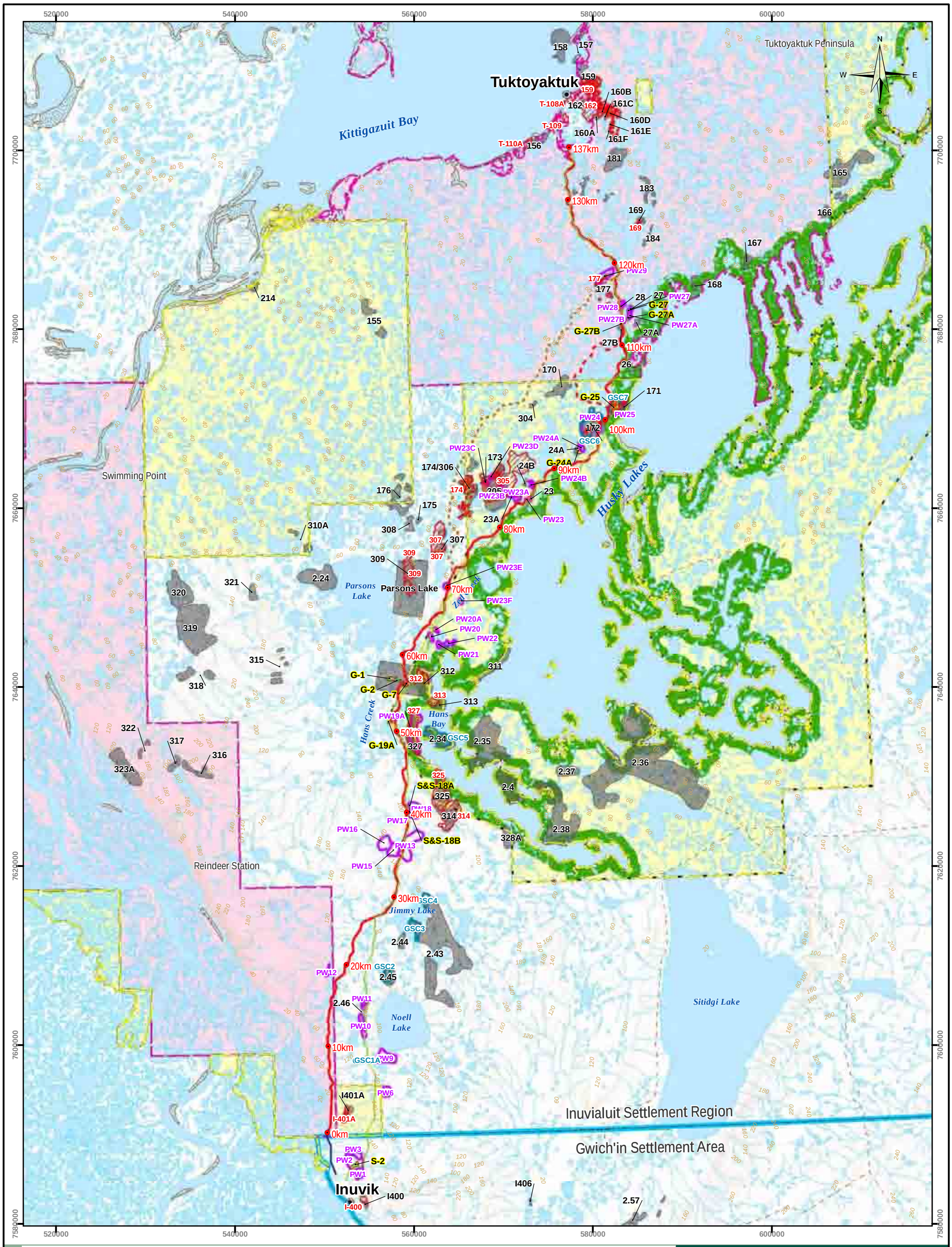

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- INAC Borrow Sources
- Geological Survey Borrow Sources
- Public Works Borrow Sources
- Highway Borrow Sources
- Borrow Sources
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Trail
- Contour
- Watercourse
- Sand
- Wetland
- Waterbody
- Husky Lakes 1000m Setback

NOTES

Base data source: NTS 1:250,000
Borrow Source: ILA, Public Works, GSC, INAC

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Available and Potential Borrow Sources Along the Proposed Route

PROJECTION: UTM Zone 8	DATUM: NAD83
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)	
FILE NO.: V23201098_PDR-Map019-Dev-AllGranular.mxd	
PROJECT NO.: V23201098	DWN: KWM / CKD: XXX / REV: 0
OFFICE: EBA-VANC	DATE: January 14, 2010

Figure 5.8-1

TABLE 5.8-1: INFORMATION ON BORROW SOURCES ALONG 2009 ROUTE

Source Name	Land Owner	Location	Geo-morphologic Setting	Landform	Approximate Area (km²)	Recoverable Volume (m³) from ILA Inventory
2.43	Crown	28 km NE of Inuvik	Unknown	Outwash plain	12	180,000,000
2.44	Crown	30 km NE of Inuvik	Unknown	Glaciofluvial outwash	0.17	0
2.45	Crown	25 km NE of Inuvik	Unknown	Glaciofluvial outwash	2	0
2.46	Crown	20 km NE if Inuvik	Unknown	Kames/ crevasse filling	0.0125	0
I401A	Crown	10 km N of Inuvik	Hillblocks bisected by streams	Kame field	1.1	1,020,000
170	Inuvialuit	32 km S of Tuktoyaktuk	Hummocky, thermokarst	Glaciofluvial outwash plain	2	4,580,000
171	Inuvialuit	35 km S of Tuktoyaktuk	Hummocky, near Husky Lake	Glaciofluvial outwash/ kames	2	1,520,000
172	Inuvialuit	37 km S of Tuktoyaktuk	Hummocky, near Husky Lake	Glaciofluvial outwash/ kames	2	918,000
173	Inuvialuit	45 km S of Tuktoyaktuk	Hummocky plain	Kame complex	2	688,000
174	Inuvialuit	48 km S of Tuktoyaktuk	Hummocky, rough terrain	Kame complex/ outwash	2	3,280,000
175	Inuvialuit	50 km SW of Tuktoyaktuk	Hummocky, rolling terrain	Glaciofluvial outwash	1	1,530,000
176	Inuvialuit	50 km SW of Tuktoyaktuk	Thermokarst plain	Glaciofluvial outwash plain	2	6,100,000
177	Inuvialuit	22 km S of Tuktoyaktuk	Hummocky thermokarst plain	Glaciofluvial outwash	1	1,902,000
23	Inuvialuit	42 km S of Tuktoyaktuk	Hummocky plain	Kames, outwash plain	0.115	350,000
23A	Inuvialuit	42 km S of Tuktoyaktuk	Hummocky plain	Kame field	1.2	1,900,000
24A	Inuvialuit	37 km S of Tuktoyaktuk	Hummocky plain	Kames, outwash plain	0.72	150,000
27	Inuvialuit	42 km S of Tuktoyaktuk	Flat plain, polygonal	Glaciofluvial outwash	0.225	40,000
27A	Inuvialuit	24 km S of Tuktoyaktuk	Flat plain, polygonal	Glaciofluvial outwash	0.18	190,000

TABLE 5.8-1: INFORMATION ON BORROW SOURCES ALONG 2009 ROUTE

Source Name	Land Owner	Location	Geo-morphologic Setting	Landform	Approximate Area (km²)	Recoverable Volume (m³) from ILA Inventory
27B	Inuvialuit	24 km S of Tuktoyaktuk	Flat plain, polygonal	Glaciofluvial outwash	0.23	40,000
304	Crown	35 km S of Tuktoyaktuk	Thermokarst plain	Esker remnants	0.018	46,000
305	Inuvialuit	42 km S of Tuktoyaktuk	Hummocky with many ponds	Kames on outwash plain	20	230,000
306	Inuvialuit	42 km S of Tuktoyaktuk	Thermokarst plain	Kame field	11.5	115,000
307	Crown	55 km S of Tuktoyaktuk	Hillocks, small ponds	Kame field	5	115,000
308	Crown	50 km S of Tuktoyaktuk	Outwash plain	Terrace remnants and kames	0.55	15,000
309	Crown	56 km S of Tuktoyaktuk	Ponds, low lying	Kame field	7.5	1,500,000
314	Inuvialuit	79 km S of Tuktoyaktuk	Terrace adjacent to stream	Post-glacial fluvial terraces	1.1	2,300,000
325	Inuvialuit	76 km S of Tuktoyaktuk	Lake shore deposit	Glaciofluvial terrace	7.5	750,000
Parsons Lake 1	Inuvialuit	60 km S of Tuktoyaktuk	Riverbanks	River terrace	0.25	1,000,000
Parsons Lake 10	Inuvialuit	60 km S of Tuktoyaktuk	Low lying plain	Kame/outwash plain	0.02	135,000
Parsons Lake 2	Inuvialuit	60 km S of Tuktoyaktuk	Low terrace	River terrace	0.1	230,000
Parsons Lake 3	Inuvialuit	60 km S of Tuktoyaktuk	Low lying terrace	River terrace	0.2	400,000
Parsons Lake 4	Inuvialuit	60 km S of Tuktoyaktuk	Flat lying terrace	River terrace	0.05	150,000
Parsons Lake 5	Inuvialuit	60 km from Tuktoyaktuk	Lake shoreline	Small kame	0.0225	30,000
Parsons Lake 6	Inuvialuit	60 km S of Tuktoyaktuk	Lake shoreline	Small kame	0.03	7,500
Parsons Lake 7	Inuvialuit	60 km S of Tuktoyaktuk	Flat lying terrace	River terrace	0.28	20,000
Parsons Lake 8	Inuvialuit	60 km S of Tuktoyaktuk	Flat-lying terrace	River terrace	0.7	75,000
Parsons Lake 9	Inuvialuit	60 km S of Tuktoyaktuk	High river terrace	River terrace	0.045	38,000

5.8.3 Borrow Material Requirements

These preliminary material volume estimates are based on preliminary horizontal and vertical geometric designs using the embankment cross section presented in Figure 5.3-1.

Figure 5.8-1 shows all known potential borrow sources in the general area between Inuvik and Tuktoyaktuk. Many sources that are not near the preferred alignment will not be considered for use in the construction as they are inefficient to haul from due to the distance that they are away from the alignment. Borrow sources proposed for construction of the Highway are highlighted in Figure 5.8-2 and estimated quantities from each source based on the conceptual design are presented in Table 5.8-2.

TABLE 5.8-2: ESTIMATED QUANTITIES FROM POTENTIAL BORROW SOURCES

Highway Segment	Estimated Borrow Quantity (rounded to nearest 1,000 m^3)	Potential Borrow Source (Land Owner)
KM 0 - KM 5	198,000	I401A (Crown)
KM 5 - KM 10	198,000	2.46 (Crown)
KM 10 – KM 21	351,000	2.45 (Crown)
KM 21 - KM 34	351,000	2.43 (Crown)
KM 34 - KM 45	329,000	325 Outside of Husky Lakes Setback (Crown)
KM 45 - KM 56	445,000	Parsons Lake - West of alignment only (Crown)
KM 56 - KM 69	671,000	309 (Crown)
KM 69 - KM 83	516,000	307 (Crown)
KM 83 - KM 100	563,000	173/305 and 174/306 (Inuvialuit)
KM 100 - KM 112	363,000	172 and 170 (Inuvialuit)
KM 112 - KM 118	244,000	27B (Inuvialuit)
KM 118 – KM 137 (Tuktoyaktuk)	510,000	177 (Inuvialuit)

Sources of competent borrow materials that can be used at in-situ ice contents are limited along the alignments and as a whole throughout the project area.

The project area has been extensively studied over the years and the likelihood of locating additional sources of quality granular material near the alignment is considered to be limited. Efforts will be undertaken in early 2010 to collect additional information, qualitative and quantitative, from the known borrow areas to confirm material volumes and quality and importantly ground ice conditions to confirm that the material can be used as planned.

The estimated construction costs presented earlier, in this section of the Project Description Report, do not include royalties or administrative fees paid on materials extracted from borrow sources on Inuvialuit owned lands.

Ongoing discussions regarding Inuvialuit owned lands will include discussion of royalties and administrative fees.

5.8.4 Further Investigation of Borrow Sources

Borrow sources are required to provide materials needed to construct the proposed Highway. The sources would be developed during the winter months when the ground is frozen. Temporary winter access roads and work pads would be used. Drill and blast methods may be used to excavate the required volumes of material for construction from frozen borrow sources.

Potential borrow sources have been identified along the 2009 Route based on the granular material studies and investigations that have been undertaken over the years by industry and government agencies discussed in the previous Section.

The resources near the communities of Inuvik and Tuktoyaktuk have been ground-truthed and proven to a spatial extent. Many of the resources along the 2009 Route are not proven and are described as probable or prospective - material resources whose existence and extent have been inferred or speculated. The use of these materials will need to be proved up through additional site investigation (Figure 5.8-2).

The 2009 Route is preferred because the flatter topography will result in less terrain disturbance and reduced borrow material volumes, thereby also reducing construction costs. Also, more borrow sources are identified along the 2009 alignment than have been identified elsewhere.

5.8.5 Site Evaluation Criteria

Criteria used to identify borrow sources included the following:

- Proximity to the proposed alignment
- Quantity, quality and availability of borrow materials required
- Geographic distribution of sites
- Environmental considerations
- Supply needs along route
- Potential to expand and supply project needs

Prior to opening a borrow pit, the sites will be surveyed and investigated to ensure the expected quantity and quality of material is available. Borrow pits will be developed, operated and decommissioned in full compliance with all regulatory requirements.

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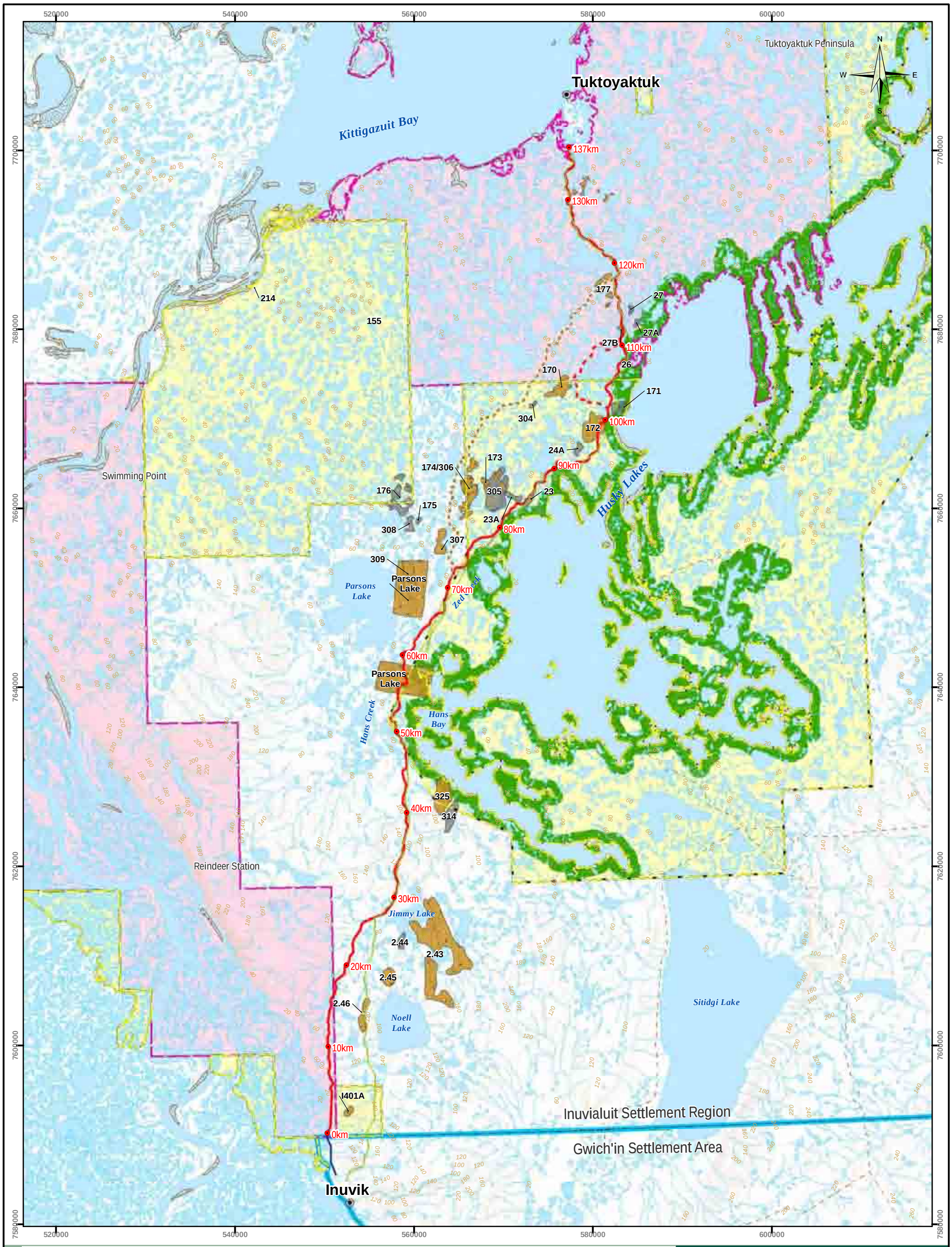

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback
- Borrow Sources
- Borrow Sources - (further investigation and potential use in construction)

NOTES

Base data source: NTS 1:250,000
Borrow Sources: Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Potential Borrow Sources Requiring Further Investigation For Potential Use

PROJECTION: UTM Zone 8	DATUM: NAD83
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)	
FILE NO.: V23201098_PDR-Map020-Dev-GranInvest.mxd	
PROJECT NO.: V23201098	DWN: KWM / CKD: RM / REV: 4
OFFICE: EBA-VANC	DATE: January 19, 2010

Figure 5.8-2

5.8.6 Pit Development Plans

Pit Development Plans will conform to the applicable regulatory guidelines. Plan content will include documentation of site conditions (including estimated resource quantity, quality and ice content), source and temporary access road design, a description of the development approach, a map, mitigation measures to address potential environmental concerns, and operational and reclamation plans.

Proposed borrow sources will typically be developed during the fall and winter months when the ground is frozen. Winter pit development will employ drilling and blasting, if required. The decision to use these methods will depend on the quality and moisture content of the granular material in the source and the quantity of material needed from the source. Drilling patterns and powder factors will be adjusted as required to optimize the size of blasted material being produced.

Borrow pits will be closed as soon as they are no longer required and reclaimed in a progressive manner as soon as possible. Areas required for the maintenance of the Highway during operation will remain open while in use, and will be reclaimed after they are no longer required.. The disturbed areas will be contoured, at closure. Borrow pits will be designed to prevent entrapment of wildlife at closure. These details will be identified in the specific Pit Development Plans.

5.8.7 Winter Access Roads

Temporary winter access roads will be constructed to access borrow sources since most of the earth moving construction activities will take place during the winter months when the frozen ground is more accessible. Winter access roads are constructed according to methods developed over the years designed to provide a solid, effective road access while at the same time minimizing environmental disturbance to the ground surface. First the access route is dragged with a long ground pressure rubber tracked machine such as a snow cat. After dragging, an initial flood of the surface with water is undertaken using a low pressure rubber tired vehicle such as a Delta 3 with a mounted water tank. After the surface is made passable, water trucks are used to flood the access. Snow is moved into holes and depressions as required with either a loader or with small dump trucks. The snow and water is mixed together. Several layers of the snow/water mixture are applied to the surface. The surface is continually dragged with either a loader or low ground pressure tracked machine. Through the application of successive layers of snow and ice the winter road is constructed. The final product is basically an ice road of sufficient thickness, built over land to prevent damage to the underlying tundra.

5.9 CONSTRUCTION

5.9.1 Winter Approach to Construction

A fundamental tenet of the construction methodology is to utilize winter construction techniques rather than more typical summer construction as used in southern Canada.

Advantages of Winter Construction

- Winter construction allows the use of temporary ice/winter access to borrow sources, without the need to construct costly all-weather access roads.
- Winter construction allows the placement of construction material directly onto frozen ground. This approach enables the establishment of a frozen core for the Highway and helps protect sensitive and ice-rich terrain.
- Winter construction minimizes potential effects on vegetation and soils adjacent to the actual roadway that might occur if working under snow-free or wet conditions.
- Winter construction promotes initial Highway stability through the placement of frozen borrow material directly onto frozen ground (with geotextile separation layer). In the first construction year, it is anticipated that the majority of construction settlements will occur in the top layers of the emplaced borrow material as it thaws, dries and consolidates. The lower layers are not expected to thaw much if at all in the first years, leading to greater Highway stability than has been the case with the placement of warm fill on thawed ground in summer construction in this area. This will reduce maintenance problems in the future.

Disadvantages of Winter Construction

- Work is difficult, with temperatures of -35°C or colder common at the beginning of construction in late December and early January. This is challenging for both personnel and equipment.
- At the start of construction in February, there is little daylight, as we are just past the 24 hrs of darkness period in late December.
- Excavating frozen material may require the use of drill and blast methods to be able to source the required volumes of material for construction from existing largely frozen borrow sources.
- Excavating and placing frozen material directly on the existing surface makes it more difficult to achieve desired compaction of the embankment layers.
- There is a shorter construction season from approximately late December to the beginning of May.

5.9.2 Construction Overview

The Tuktoyaktuk to Source 177 Access Road, currently under construction, presents a model for how the remainder of the Highway is anticipated to be constructed.

The Tuktoyaktuk to Source 177 Access Road construction schedule proceeded as follows:

- Early February: Mobilization of pioneer crew and initial winter access road construction to Source 177.
- Mid February: Mobilization to Source 177 of surveyors and drillers. If blasting is required, initial blast layout will be staked and drilling will commence.
- Surveyors then stake the initial several kilometres of the Highway and a temporary winter access road is constructed paralleling the permanent alignment.
- Late February: Construction of the Highway begins. Geotextile is placed from toe to toe of embankment and material is directly dumped and spread on the geotextile. An initial lift of approximately 300 mm to 400 mm is placed, followed by smaller lifts, with the embankment being left some 150 to 200 mm higher than design to accommodate settlements.
- Construction proceeds, with surveyors responsible for providing 'ground-truth' original ground surveys back to the design team to allow adjusting of the design to match the actual ground elevations rather than the design remote sensing information.

This is an approach that would be considered reasonable to consider for the construction of the Inuvik to Tuktoyaktuk Highway. The Highway is expected to take two to three years to complete. Further discussion of the segmenting and construction approach is presented in the following sections.

5.9.3 Construction Activities

The aggregate will be placed by end-dumping directly on the existing ground surface without disturbance to the vegetative ground cover.

Construction activities will be limited, to the extent possible, within the planned footprint of the Highway, with the exception of the temporary winter road that parallels the alignment, and temporary winter roads providing access to borrow sources. Prior to the commencement of construction, the route will be surveyed and staked, and temporary winter roads will be constructed to identified borrow sources (Photo 5.9-1). Initially snow cats and small dozers will be used to clear snow from the staked footprint (Photos 5.9-1 and 5.9-2). Dozers used for snow clearing will be equipped with mushroom pads to ensure that the vegetative layer on the right-of-way is not disturbed. After the route is staked, the snow is cleared, and adequate material is stockpiled at the borrow source, the construction activities will commence.

Photo 5.9-1
Example of winter road access constructed parallel to highway alignment
Tuktoyaktuk to Source 177 Access Road, 2009)

Photo 5.9-2
Winter construction approach, note grader in the distance clearing
snow from embankment footprint. (Tuktoyaktuk to Source 177 Access Road, 2009)

Geotextile will be placed between the existing ground and the embankment (fill) material (Photo 5.9-3). This is a common design technique in permafrost regions to provide additional stability over perennially frozen ground. Workers will spread out rolls of non-woven geotextile onto the cleared Highway footprint ahead of the placement of embankment materials.

Photo 5.9-3
Example of geotextile placement and end dumping method of construction.
(Tuktoyaktuk to Source 177 Access Road, 2009)

Material will be loaded at the borrow sources using excavators and hauled along the temporary winter roads using both tractor-trailer units and articulated trucks. Material will be placed by end dump and spread with D6 and/or D7 Cats. An initial lift of approximately 300 mm to 400 mm is placed, followed by smaller lifts, with the embankment being left some 150 to 200 mm higher than design to accommodate settlements.

Culvert and bridge installation will proceed along with construction of the embankment. As the bridge structures will be prefabricated single span bridges on binwall abutments, it is anticipated that access to bridge sites in advance of the embankment construction will not be necessary. Design, ordering and fabrication of bridges will need to be undertaken months in advance of the scheduled installation, to ensure that shipping schedules are achieved, and structures and binwall materials arrive on site in time for installation. Access to opposite sides of stream crossing will be required for ground preparation on binwall assembly prior to the installation of the bridge structure.

This will be accommodated with an ice crossing component of the temporary winter road near the bridge site. Prefabricated bridges structures can be shipped to the individual bridge sites by truck along the constructed embankment or temporary winter road. Bridges will be installed with typical construction equipment that is in general use for the Highway construction. Specialized equipment is not required.

Highway construction and installation of drainage structures will be carried out each year in a similar manner. Final compaction, adjustment of grade due to settlements and placement of surfacing gravel will be undertaken in the year following construction of the embankment.

5.9.4 Production Rate, Construction Staging and Overall Schedule

The proposed construction timing and staging is based on the premise that construction will proceed from both the north (Source 177) and south (Inuvik). Embankment construction will include installation of culverts and bridges. The high level milestones by month and year are:

March/April 2010: Survey control will be extended each way along the route to be able to complete a proper survey to enable detailed design to progress. This would be done using GPS and control points every 5 to 10 km to be within good working range of the base station. After control is established, a survey of the recommended centreline will proceed, as will further geotechnical investigation, and baseline data collection necessary to support detailed design. Detailed design will commence in the spring of 2010, as will design of bridge structures and culvert installations, in preparation for commencement of construction.

August 2010: Position equipment at Source 177 when permitting is in place and continue development of this active borrow source for initial construction requirements.

November/December 2010: Construct winter access and haul roads to borrow sources at both north and south ends of the highway construction. Commence with development of borrow sources and stockpiling of material.

January to April 2011: Construct Highway, moving both northward from Inuvik area and southward from Source 177. Equipment at borrow sources will include drilling/sampling equipment for further geotechnical investigation, drilling/blasting/ excavating equipment for working frozen material, loaders, dozers, water trucks and 15 to 24 person camps. It is anticipated that there will be three to four borrow sources under development and being worked in any given construction period. There are likely to be four construction equipments spreads working in any given construction period, two from the north and two from the south, each with sufficient equipment and personnel to haul and place material at a rate of over 400,000 m^3 per season.

June to September 2011: Construction from January to April will ensure that segments of the Highway are connected to either other segments of Highway or the existing all weather access road. This will provide opportunity for grading and compaction of the embankment that was constructed in the earlier winter construction season in the summer months of the same year without the concern of equipment travelling over unfrozen ground.

November 2011 to April 2012: Construction will continue through this fall and winter season in the same manner described above. Additional work will include placing the surfacing gravel on the embankment that was constructed, graded and compacted in the previous year.

June to September 2012: Grading and compaction of embankment constructed in the previous winter.

Fall 2012 and Early Winter 2013: Placement of remaining surfacing gravel on embankment and upgrade of Tuktoyaktuk to Source 177 Access Road.

5.9.5 Anticipated Equipment and Personnel

The equipment proposed for construction of the Highway will be similar to that used on the current Tuktoyaktuk to Source 177 Access Road construction. There will likely be four (4) equipment spreads or operations. Each spread is expected to consist of the following equipment:

(2) D8T or D9N bulldozers with rippers

(2) D6R and/ or D6N bulldozers (drop D7G and D6D bulldozers)

(2) BR-180 or BR-400 snowcats

(2) EX-300 excavators

(2) 966 or 950 loaders

(8) to (12) tractor trucks with end-dump trailers

(2) 140 or 14 graders

(2) vibratory self-propelled packers

(4) water trucks with 3000 g tanks

(2) Delta 3 all-terrain vehicles with water tanks

(4) light stands

(2) to (4) 13,000 litre double walled fuel sloops

(10) to (14) dump trucks (either tandem trucks or articulated dump trucks)

(4) to (8) crew cab trucks

(1) to (2) service trucks

(1) crew bus

(2) to (4) snowmobiles

As stated in the equipment estimate, the Highway will be constructed using four (4) spreads, two working at the Tuktoyaktuk end and the other working at the Inuvik end. Table 5.9-1 identifies the personnel estimate per spread. A wide variety of positions will be available, including supervisors, environmental monitors, scouts, clerks, engineers, and a variety of other positions.

TABLE 5.9-1: ESTIMATED PERSONNEL REQUIREMENT PER SPREAD

	Activity	Personnel
I.	Winter Road Construction	30 to 35
II.	Winter Gravel Haul	55 to 65
III.	Summer Grade and Compact	10 to 15
IV.	Fall/Early Winter Pit Development and Material Production	15 to 20

5.9.6 Winter Access/ Haul Roads

5.9.6.1 Construction

Winter access/haul roads will need to be constructed to access borrow sources since it is expected/planned that most of the earth moving construction activities will take place during the winter months when the frozen ground is more accessible.

5.9.6.2 Water Usage

The overall daily water usage for winter road construction is expected to range from at least 500 m^3/day to more than 1,000 m^3/day. During the long term operational phase of the Highway, the average daily water usage during the summer is anticipated to be in a similar range. Procedures and mitigative measures for water usage and water extraction are described in later sections of this document.

6.0 PROJECT TIMETABLE

The proposed Project review and approvals schedule and generalized construction schedule for the Highway is provided in Table 6-1.

TABLE 6-1: PROPOSED SCHEDULE OF ACTIVITIES

Activities	Approximate Dates
Environmental Screening	
Submit Project Description Report for Screening	February 2010
EISC Screening Review Process	March 2010 to April 2010
Partners Presentation to EISC	April 2010
EISC Screening Decision	April 2010
Permits, Licences and Other Approvals	April 2010 to August 2010
Field Investigations and Highway Design	
Undertake engineering and environmental field investigations. Complete detailed design for 50% of alignment	Spring to Fall 2010
Undertake remaining field investigations and detailed design.	Spring to Fall 2011
Highway construction	Spring 2010 to Winter 2013
Construction	
Pre-positioning of equipment at Source 177 Potentially commence construction at Inuvik end	August 2010
Strip and develop initial borrow source(s)	October 2010
Continue work at borrow sources, construct winter access and haul roads	November-December 2010

TABLE 6-1: PROPOSED SCHEDULE OF ACTIVITIES	
Activities	Approximate Dates
Transport, spread borrow material, construct road and install bridges and culverts	January-April 2011
Compact and grade Year 1 embankment	June-September 2011
Repeat cycle of construction similar to Year 1	Fall 2011-April 2012
Compact and grade embankment; substantial completion of Highway	June-September 2012
Placement of remaining surfacing material on embankment and upgrade of Tuktoyaktuk to Source 177 Access Road.	Fall 2012- Early Winter 2013

7.0 TRADITIONAL AND OTHER LAND USES

The Tuktoyaktuk Peninsula, the Mackenzie Delta, and the Husky Lakes area have been occupied for several thousand years by the Inuvialuit, with recent in-migration by westerners. There are several areas with traditional land use significance, and areas that are specially managed. Due to the rich natural resources in the area, industrial, transportation, and recreational land uses are prevalent and/or proposed for the future. Amongst the natural resources are wildlife, waterfowl, fish, and berries that continue to be harvested by the Inuvialuit.

Information regarding traditional and other land uses in the area of interest along the proposed alignment of the Inuvik to Tuktoyaktuk Highway has been drawn from a number of sources. In October 2009 and January 2010, consultations and discussions were held with elders, hunters and trappers, and community residents for this project, as described in Section 8.0. In addition, information gathered during the consultation process for the Tuktoyaktuk to Source 177 Access Road Project Description Screening Report (Kiggiak-EBA 2008) was reviewed and incorporated. Further traditional knowledge information was collected from the Proposed Inuvik to Tuktoyaktuk Road Environmental/ Socioeconomic Baseline Report (Rescan 1999). Other key sources of information include the Tuktoyaktuk Community Conservation Plan (TCCP) (Community of Tuktoyaktuk et al. 2000) and the Inuvik Inuvialuit Community Conservation Plan (IICCP) (Community of Inuvik et al. 2000).

7.1 TUKTOYAKTUK PENINSULA

Tuktoyaktuk is located on a peninsula extending into Kugmallit Bay, just east of the Mackenzie River Delta, on the arctic coast. The name in Inuvialuktun means "resembling a caribou". It was formerly called Port Brabant, and the present name is commonly abbreviated to "Tuk". Tuktoyaktuk is located 122 km (76 mi.) by air or 177 km (110 mi.) by river north of Inuvik. In 1934, the Hudson's Bay Company chose this site as an alternative to Herschel Island and as the most suitable harbour in the region for shipping freight down

the Mackenzie River for distribution along the arctic coast (Community of Tuktoyaktuk et al. 2000).

For thousands of years, the Inuvialuit have inhabited the coastline from the United States (Alaska)-Canada border to Cape Bathurst. The primary land use patterns of the Inuvialuit in the Tuktoyaktuk region have centered on the Tuktoyaktuk-Kitigaaryuit area. Prior to 1890, the Inuvialuit had minimal contact with westerners and a traditional harvesting lifestyle was led by all Inuvialuit with very little disturbance. This changed with the arrival of the whaling ships at Herschel Island in 1890.

The influence of the westerners and the spread of various diseases dramatically affected the local population and disrupted previous traditional subsistence patterns. The large settlement at Kitigaaryuit was abandoned just after the turn of the century. The previous local groupings of Inuvialuit became blurred as intermingling of the local Inuvialuit population occurred with whalers and Alaskan Inupiat who had come into the region with the whalers. With the collapse of the whaling economy around 1910, the region suffered a major economic downturn. Many of the westerners who travelled north with the whaling ships remained in the region establishing trading and fur posts.

In the 1920s, high fur prices and an increase in schooner ownership facilitated the expansion of trapping areas. During the 1950s, the decline of fur prices and the beginning of DEW-Line construction at Tuktoyaktuk caused a shift in land use from the surrounding areas into the community. This resulted in a temporary contraction of the areas used for hunting and trapping. However, with the introduction of the snowmobile, the Inuvialuit have re-expanded into these areas (Community of Tuktoyaktuk et al. 2000).

During the 1970s and 1980s, oil exploration created major changes in the region. The continued decline in the fur market and the availability of employment with industry shifted large numbers of people into a wage based economy. The decline of the oil and gas industry in the late 1980s created a high level of unemployment. Guided sports hunting in the winter and other forms of tourism during the summer have provided employment for a few people. The future potential for tourism in the region remains strong due to the location of Tuktoyaktuk on the Beaufort Sea coast of the Arctic Ocean and its proximity to Inuvik and access to the South (Community of Tuktoyaktuk et al. 2000).

The majority (75%) of households continue to supplement their wage earnings by deriving a portion of their food from hunting and fishing. Wage employment generally limits the time available to travel to weekends and holidays. This increases the residents' dependence on hunting/fishing areas that are located close to the community, within 100 km (62 miles) (Community of Tuktoyaktuk et al. 2000).

A profile of Tuktoyaktuk's population, demographics and community services is provided in Section 9.8.1.

7.2 INUVIK

Inuvik is located on the East Channel of the Mackenzie River Delta. It lies within the northernmost reaches of the tree-line and is located 97 km (60 mi.) south of the Beaufort Sea. The name "Inuvik" means "living place".

The Inuvik town site was first surveyed in 1955 and a permanent settlement was established in 1958 when the federal government moved its regional offices from Aklavik to the present site of Inuvik, due to yearly flooding and erosion. It was originally intended that all government services and employees, as well as the local population would be relocated from Aklavik to the new Town of Inuvik. However, many of the Aboriginal residents decided to remain in Aklavik and the settlement continues to exist today. The Mackenzie Hotel, Recreation Hall, Polaris Theatre, RCMP Building and numerous "512s" were some of the first buildings to be built in Inuvik, but many of the residents remained living in tents by the river until public housing was completed (Community of Inuvik et al 2000).

Most of the Inuvialuit that moved to Inuvik were from the Mackenzie Delta Region, but had family ties with other settlements around the Western Arctic and even Alaska. John Keevik was the last elected Inuvialuit Chief for the Mackenzie Delta in approximately 1953, before any land claims or politics had arisen (Community of Inuvik et al 2000).

The Armed Forces moved to the community after it was established and left in 1986, when satellites replaced their function (Community of Inuvik et al 2000). During the 1960s, people remember turning on their radios for the first time to listen to Wally Firth and Nellie Cournoyea for messages and announcements (Community of Inuvik et al 2000).

During the 1970s and 1980s, Inuvik flourished with oil and gas exploration. The oil patch industry left Inuvik temporarily; however, there is a renewed interest in natural gas development in the region (Community of Inuvik et al 2000) and continues to be the main headquarters for the oil and gas industry operating in the Beaufort Sea/Mackenzie Delta (Town of Inuvik 2009).

Inuvik is the government centre, and transportation and recreation hub for the Canadian Western Arctic. The airport, government services, recreational programs and hospitality industry attract residents from neighbouring communities and those traveling to and from other communities. A profile of Inuvik's population, demographics and community services is provided in Section 9.8.2.

The Inuvialuit traditionally hunted and fished in the region where Inuvik is now situated. Historically, trapping muskrat, fox and other furbearers created employment and prosperity in the area. This culturally supported opportunity has been significantly reduced over time as a result of declining fur prices. Although many Inuvialuit do not trap as regularly or as extensively as in past times, they still trap occasionally on weekends and during springtime for muskrats in the Delta. Subsistence harvesting of animals and plants remains of vital importance to the Inuvialuit community (Community of Inuvik et al 2000).

7.3 HERITAGE RESOURCES

Heritage resources are non-renewable and finite. They are important sources of historical knowledge and cultural identity. They are considered of value to local communities, scientists and the Governments of the Northwest Territories and Canada. Consequently, they are protected by legislation. It is illegal to disturb an archaeological site, burial or artifact, and no land use activity is permitted within 30m of a known or suspected heritage site.

The following summary is based on research of available archaeological documentary data as well as the preliminary field reconnaissance of the proposed Highway alignment conducted in September, 2009. Sources that were consulted include: archaeological site inventory records held by the Northwest Territories government, early fur trader/explorer accounts, ethnographic/anthropological studies, and reports on past archaeological studies. The methods employed to assess archaeological potential along the proposed alignments is detailed in Section 7.3.3. Traditional knowledge studies and pertinent palaeogeological and paleoenvironmental information were incorporated to form a detailed knowledge base in order to assess the potential for heritage resources.

7.3.1 Human History Summary

7.3.1.1 Prehistory

Unlike many other coastal areas of the Arctic, the low lying nature of the terrain in the Mackenzie Delta region has resulted in land subsidence and coastal erosion that is thought to have obliterated many of the earliest archaeological sites. Northwest Microblade tradition (as old as 6,000 years) has been recognized by the presence of distinctive burins, blades and microblades at sites in the Mackenzie valley, eastern Mackenzie Delta and as far north as Cape Bathurst (Morrison 1987). This is said to represent seasonal northward movement of interior people over the arctic coastal plain to hunt caribou and muskox (Le Blanc 1994). This group predates and possibly overlaps Paleoeskimo sites, represented by Pre-Dorset or Arctic Small Tool tradition (ASTt). The ASTt began an extremely rapid expansion from western Alaska eastward across the Canadian Arctic about 4,500 years ago. The Paleoeskimo period is sparsely represented in the Mackenzie region, probably mainly due to severe coastal erosion. The sites that are known suggest a regionally distinct variant with western influences (Betts 2008). An early regional variant of the Arctic Small Tool tradition called the Inuvik Phase, dating to 4,300 to 3,400 years ago, has been suggested (Pilon 1994a) for the southeastern portion of the Mackenzie region. ASTt is characterized by microblades and burins with specific characteristics and small, very finely worked bifaces.

Dorset culture expanded across the High and Eastern Arctic from Foxe Basin about 3,000 years ago. Dorset sites have not been identified in the Mackenzie region. It is speculated that due to the warm climate of this period, southern aboriginal groups expanded north to near the arctic coast, particularly in the forested Delta area, and prevented Dorset people from exploiting the mainland (McGhee 1978).

Approximately 1,000 years ago, another series of rapid eastward migrations from northwestern Alaska began. This was Thule, a culture focused on whaling. Work in Alaska resulted in the definition of a regionally distinct Western Thule culture characterized by multiple room houses built of wood, curvilinear stamped pottery, Thule Type 2 harpoons, and arrowheads with knobbed tangs (Betts 2008). Most researchers now recognize an early and a late Thule period (Betts 2008). The term Neoeskimo (also known as Siglit) is typically applied to cultural remains in the Western Arctic dating between 1,500 and 150 years ago. It includes western Thule, the earliest group, and Mackenzie Inuit, thought to have derived from Thule. Mackenzie Inuit, dated to between 600 and 150 years ago, are associated with the appearance of large whaling villages on the East channel of the Mackenzie River and along the coast east and west of the mouth of the river. Their lifestyles are detailed below. Current Inuvialuit residents of the Mackenzie Delta are considered to have descended from remnants of the Mackenzie Inuit following their decimation by disease and Alaskan Inupiat who migrated to the Delta in early historic times (Betts 2008).

7.3.1.2 Historic Period

Alexander Mackenzie in 1789 travelled up the Mackenzie River's East Channel on his return journey from the mouth of the river but had no contact with aboriginal people. A number of subsequent explorers recorded ethnographic details of their encounters with Mackenzie Inuit and later Delta residents:

- 1826 - John Richardson, part of John Franklin's second polar expedition, explored and mapped the East Channel of the Mackenzie River and the arctic coastline to the east (Franklin 1828).
- late 1860s - missionary Emile Petitot (1887) worked in the Mackenzie region.
- 1906-1912 - the Stefansson-Anderson Arctic Expedition travelled from Alaska to Coronation Gulf; the expedition wintered in the Delta the first year (Stefansson 1919).
- 1913-1918 - the Canadian Arctic expedition was led by V. Stefansson, accompanied by ethnographer Diamond Jenness (1991).
- 1924 - the western team of the Fifth Thule expedition was led by Dr. Knut Rasmussen who made notes and ethnological collections from western Inuit groups (Mathiassen 1930; Rasmussen 1942).

Direct trading for European goods began in earnest in 1889 when whalers came into the Mackenzie Delta-Beaufort sea area (Bockstoce 1986). They frequently traded with the Inuit from their ships, and later established a post on Herschel Island. Whaling in the Beaufort Sea ceased in 1907, but various independent trading posts continued. In 1912, the Hudson Bay Company opened a trading post at Kittigazuit, a former focal point for Mackenzie Inuit. This post operated until 1934 when the Hudson's Bay Company moved to Tuktoyaktuk (Usher 1971). Several independent traders continued operations at Kittigazuit until 1940.

7.3.1.3 Inuvialuit Ethnography

Prior to the 1890s, the Mackenzie Inuit were perhaps the most numerous Inuit in Canada. They were culturally most closely related to the Inupiat of Alaska (Morrison and Arnold 1994). Their range extended east and west along the coast from the Delta and south to the head of the Delta and some distance south of Husky (also called Eskimo) Lakes (Stefansson 1919). The rich resource base of the Mackenzie region, anchored by beluga whale, caribou, muskox and fish, permitted the Mackenzie Inuit to develop a semi-sedentary lifestyle.

Historically, the Mackenzie Inuit were reportedly clustered into at least five more or less distinct territorial groups. Each group was centred on a resource focal point that provided sufficient resources for the establishment of a seasonally permanent village. There may have been two or three additional subgroups that had disappeared prior to the arrival of European and Canadian explorers; one of those was Imaryungmiut ("Eskimo Lake people") who inhabited the Husky Lakes area and focused on caribou hunting and fishing (Betts 2008). After that group's disappearance, this territory was exploited by the Kitigaaryungmiut who seasonally utilized the entire area from the lower Tuktoyaktuk Peninsula to the southern Husky Lakes and were probably among the Mackenzie Inuit who annually went as far south along the Mackenzie drainage system as Arctic Red River to trade with the Dene. Trade with Alaskan Inuit was conducted at Barter Island. The Kitigaaryungmiut main winter village, Kittigazuit, located at the mouth of the East Channel served as a summer beluga whale hunting station and winter gathering locale from which sealing and fishing was carried out. They were also reported to make occasional boat trips some 200 miles further up the Mackenzie River to obtain slate from a quarry near the Ramparts (McGhee 1974).

The following subsistence cycle summary is based mainly on Stefansson (1919). During dark winter months, people were relatively sedentary in the larger coastal villages, subsisting on dried or frozen whale, fish and caribou meat and conducting shorter hunting and trapping trips. In June, people dispersed in small family groups inland to hunt and fish at the larger lakes. From late July through August, moderate sized groups of people gathered at whaling camps. These gatherings were usually at the winter villages, but whale hunting also occurred in the Husky Lakes. Stefansson (1919) identified a winter and summer camp location at the southern narrows of Husky Lakes (not identified archaeologically to date). Focus was on caribou hunting in September and October when the animals were well fed and the hides were in prime condition. Cooperative hunting activities commonly included whaling, weir fishing, caribou drives and floe-edge sealing.

Food was generally stored in permafrost pits although raised platforms were also recorded. Fish was eaten raw or frozen, or dried and sometimes partly smoked. Meat was usually stored directly in the pits although some may have been dried. Fats and oils of sea mammals accompanied most meals and sometimes food was preserved in oil. According to Stefansson's informants, the Mackenzie Inuit ate much less raw food than their Alaskan neighbors (Stefansson 1919). Various berries were used, as well as edible roots of young willow and knotweed.

The vast quantities of driftwood available in the Mackenzie Delta meant that, contrary to most of the arctic, people living in the Delta region used wood for construction as well as fuel. The commonly used winter house was a semi-subterranean structure built of wood, often with whalebone, and covered with sod; multiple chambers were connected to a large central area. Such a structure would have been shared by two or more families. Snowhouses were used only when travelling and generally were built for one nuclear family. Skin covered tents were used on summer hunting trips. Winter travel was by dog team and sled. Water travel in summer was by larger whale skin covered boats called umiaks, and the smaller kayaks were used for sea mammal hunts.

Tools comprised more wood components than elsewhere in the Arctic. Most implements were composed of combinations of wood, bone, antler and stone. Harpoon shafts and fish hooks were made of bone. Wooden bows and arrows were used. Projectile points, endblades and knives were made of chipped or polished chert or slate. Labrets, beads and various ornaments were made of polished steatite, antler or ivory. Cooking pots of steatite were traded from the east (Smith 1984).

Burial usually involved placing the body, wrapped in skins, on a low hill and covering it with driftwood. Personal possessions were placed in, near or on top of the grave.

7.3.2 Previous Archaeological Studies

A considerable amount of archaeological research has been conducted in certain areas of the Mackenzie Delta-Tuktoyaktuk Peninsula region. Many of the early explorers commented on seeing old camps or graves as they travelled through the region (i.e., Franklin and Richardson; Franklin 1828). The first excavations were conducted as part of ethnoarchaeological research during two arctic expeditions: in 1911 by Stefansson and in 1914 by Jenness.

Beginning in the 1950s, several archaeological research projects were aimed at elucidating the early culture history of the Mackenzie region, for example, MacNeish in 1954 and McGhee in 1974. These studies comprised both surveys and excavations conducted at sites on the Mackenzie River and adjacent coastlines. They studied the prehistoric cultural relationships between the Mackenzie Delta and Alaska. Robert McGhee spent several years excavating at Kittigazuit and a nearby smaller site, and developed a preliminary cultural synthesis for the Mackenzie Inuit (McGhee 1974).

Most archaeological investigations since the 1980s related to Mackenzie oil and gas projects (Cinq-Mars and Pilon 1991; Pilon 1994b; Hanna 2002; Clarke et al. 2004). These studies again included both surveys and excavations and provided a substantial body of data relating to the early human history of the Mackenzie region. Two research projects of specific interest to this study are an archaeological survey and testing of several sites in the interior Tuktoyaktuk Peninsula (Swayze 1994), and survey and excavations conducted on limited portions of the Husky Lakes (Morrison and Swayze 1991; Morrison and Arnold 1994). In 2001, the Mackenzie Delta Heritage Resource Survey conducted revisits of 117

previously recorded site locations and found 70 more sites (Hanna 2002). In 2003, archaeological work associated with the Mackenzie Gas Project revisited/recorded 12 sites in the Inuvialuit portion of their study (Clarke et al. 2004). In 2009, an archaeological impact assessment was completed of a portion of the northern 19 km of road alignment for which construction had already been initiated; no sites were recorded (IMG-Golder 2009a).

Previous studies focused on specific areas, largely the coastal region, the Mackenzie Delta and River, and portions of the Husky Lakes. The latter includes essentially the entire present project footprint, excluding the northern 19 km. However, substantial portions of the region remain unexamined. In particular, the region south of the Husky Lakes and east of the Mackenzie River has not been subjected to any previous archaeological investigation.

7.3.2.1 Recorded Heritage Resources

Given the limited areas previously subjected to archaeological surveys, the site inventory is quite significant, both in terms of numbers of sites and site remains. Within the general study region encompassing the area east of the Mackenzie River and west of the Husky Lakes and from the coast to the southern limits of the project area, there are 103 previously recorded sites (Figure 7.3-1). Types of sites found in this region include: lithic scatters and quarry/workshops; stone features such as tent rings, caches and cairns; hearths and fire cracked rock concentrations; cabin remains and semi-subterranean house remains; cache pits; middens; graves; various types of wood features; and cut/worked wood remains. Excavated sites have revealed cultural deposits often to 30cm below surface and some remains are as deep as 60 cm. Dates from a number of sites confirmed the time periods represented range from Northwest Microblade tradition over 5000 years old and Paleoeskimo as old as 4,300 years ago, through Neoeskimo representations between 1,000 to 200 years old.

There are 12 previously recorded archaeological sites within 5 km of the proposed Highway route, four of which are within prospective gravel sources; one additional site is within a possible borrow source further from the route (Table 7.3-1; Figure 7.3-1). These sites typically represent Mackenzie Inuit occupations with some small components ascribed to the Paleoeskimo period. Most of these sites are small camps characterized by lithic, bone and artifact scatters, some with structural features such as tent rings, hearths, semi-subterranean house remains, middens and caches.

Artifacts that have been found at some of these sites include harpoon parts, projectile points of flaked stone, fish hooks, net sinkers, and pottery. The Cache site, on a large, unnamed lake along the western upland route alternative, contains remains of several different occupation periods, from Paleoeskimo to Inuvialuit; remains include wood house remains, hearth, a range of artifacts and numerous animals remains, predominantly fish, waterfowl and caribou. One of the sites on Big Lake also revealed prehistoric pottery. These are the types of site features and artifacts that can be expected to be present within the Project Study Area.

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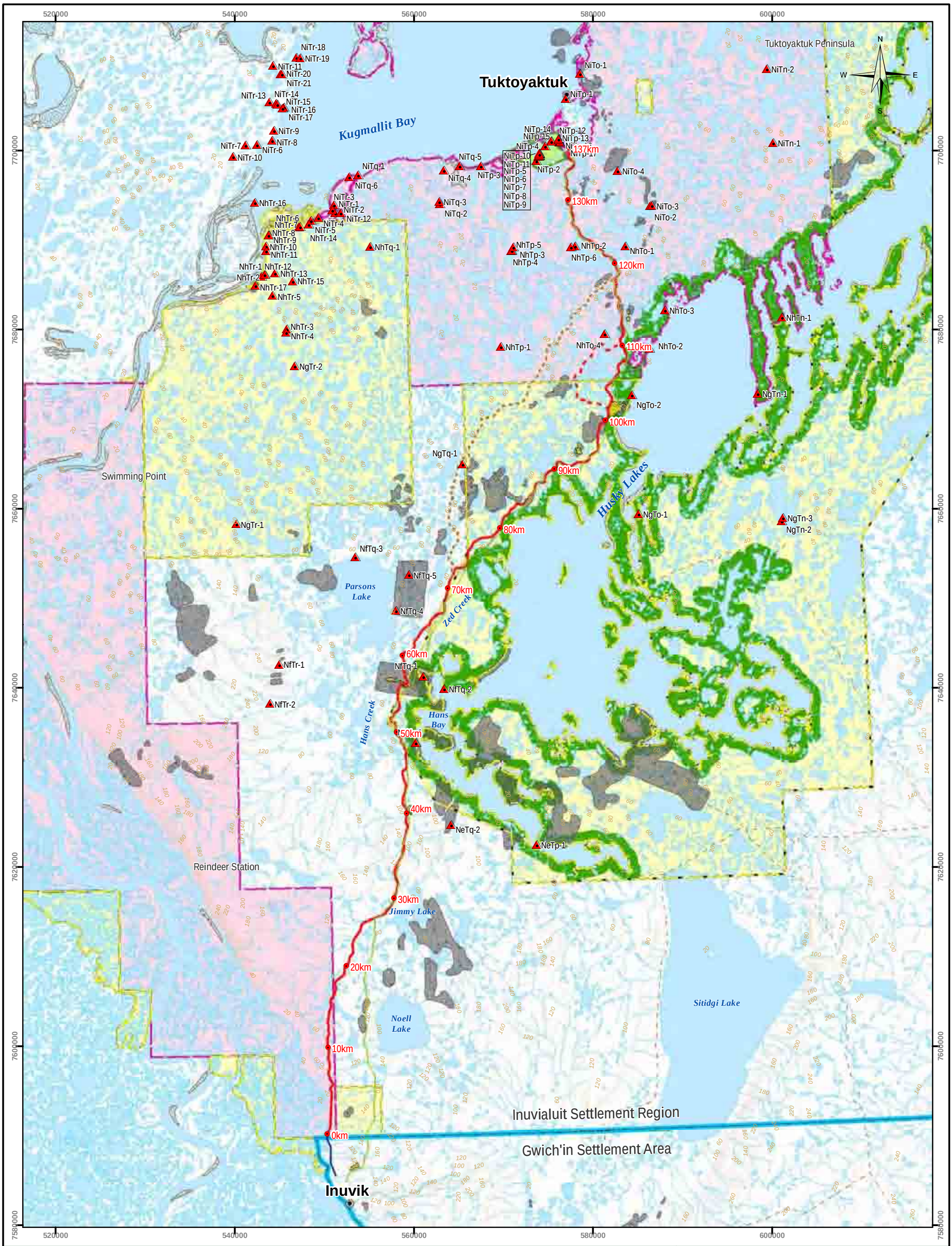

LEGEND

- Archaeological Sites
- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)a Lands
- Inuvialuit 7(1)b Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Highway Borrow Sources
- Borrow Sources
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

Base data source: NTS 1:250,000

Borrow Sources, ILA Lands, Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Archaeological Sites Previously Recorded

PROJECTION: UTM Zone 8		DATUM: NAD83	
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)			
FILE NO.: V23201098_PDR-Map001-Arch-Sites.mxd			
PROJECT NO.: V23201098	DWN: KWM	CKD: GP	REV: 1
OFFICE: EBA-VANC	DATE: January 14, 2010		

Figure 7.3-1

TABLE 7.3-1: ARCHAEOLOGICAL SITES NEAR PROJECT COMPONENTS				
Site	Location	Distance to Highway	Type	Features
NeTq-1	Husky Lakes	1.4km+b	tool making	scatter (lithic)
NeTq-2	S. Husky Lakes	borrow	trail	trail
NfTq-1	Husky Lakes	800m+b	campsite	bone scatter; tent ring (fire cracked rock)
NfTq-4	Parsons Lake	3.3km+b	camp	scatter (lithic); sub. house
NfTq-5	large unnamed lake	2.5km+b	tool making	lithic scatter
NgTo-2	Husky Lakes	2 km	isolated find	lithic flake
NgTq-1	large unnamed lake	150m	tool making, campsite	scatter (fire cracked rock), scatter (lithic)
NhTo-1	Sukunnuk Narrows	1.8km	campsite	bone scatter
NhTo-2	Husky Lakes	2.4km	campsite	scatter (bone)
NhTo-4	west of Husky Lakes	1.8km	tool making	scatter (lithic)
NhTp-1	large unnamed lake	4.8km	campsite	cache pits, house, midden, lithic remains, pottery
NhTp-2	Big Lake	1.5km	campsite	midden, bones, pottery
NhTp-6	Big Lake	4.5km	isolated find	harpoon frag/wood debris

Note: +b = in proposed borrow source

7.3.3 Archaeological Overview Assessment

An archaeological overview assessment of the proposed road route and selected borrow sources was completed in September 2009. The main goal was to assess the archaeological potential of terrain to be affected by this project. The primary method used to rate archaeological potential was visual assessment of terrain by low and slow helicopter overflight following the proposed alignment using GPS coordinates. The route was depicted on topographic maps at a scale of 1:25,000. The borrow sources were also overflown, but the boundaries were roughly approximated using topographic maps. Data gathered during the overview assessment were used to identify specific portions of project components that will require ground reconnaissance surveys during the next phase of study.

The best potential terrain types include level and dry banks, terraces or benches along major streams or lakes. Areas with good potential include well defined, elevated landforms adjacent to larger water bodies. Low lying expanses of tussock tundra or wet muskeg have limited potential for archaeological resources.

7.3.3.1 Findings

No previously recorded archaeological sites occur within the primary proposed Highway alignment, assuming a typical right-of-way width. The sections of the Highway route that are close to Husky Lakes and cross elevated, dry terrain (Photo 7.3-1) are judged to have

good archaeological potential. Elevated terrain features such as moraines, knolls, pingos, esker remnants, and ridges (Photo 7.3-2) all have good potential. Major creek crossings are suggestive of good archaeological potential. These sections of the Highway route were roughly outlined on preliminary topographic maps (Figure 7.3-2 and 7.3-3). It is estimated that about one quarter of the route will require ground reconnaissance.

Photo 7.3-1:
Terraces and benches along Husky Lakes suggestive of good archaeological potential

Photo 7.3-2:
Checking surface exposures on a good potential ridge to be used as a borrow source

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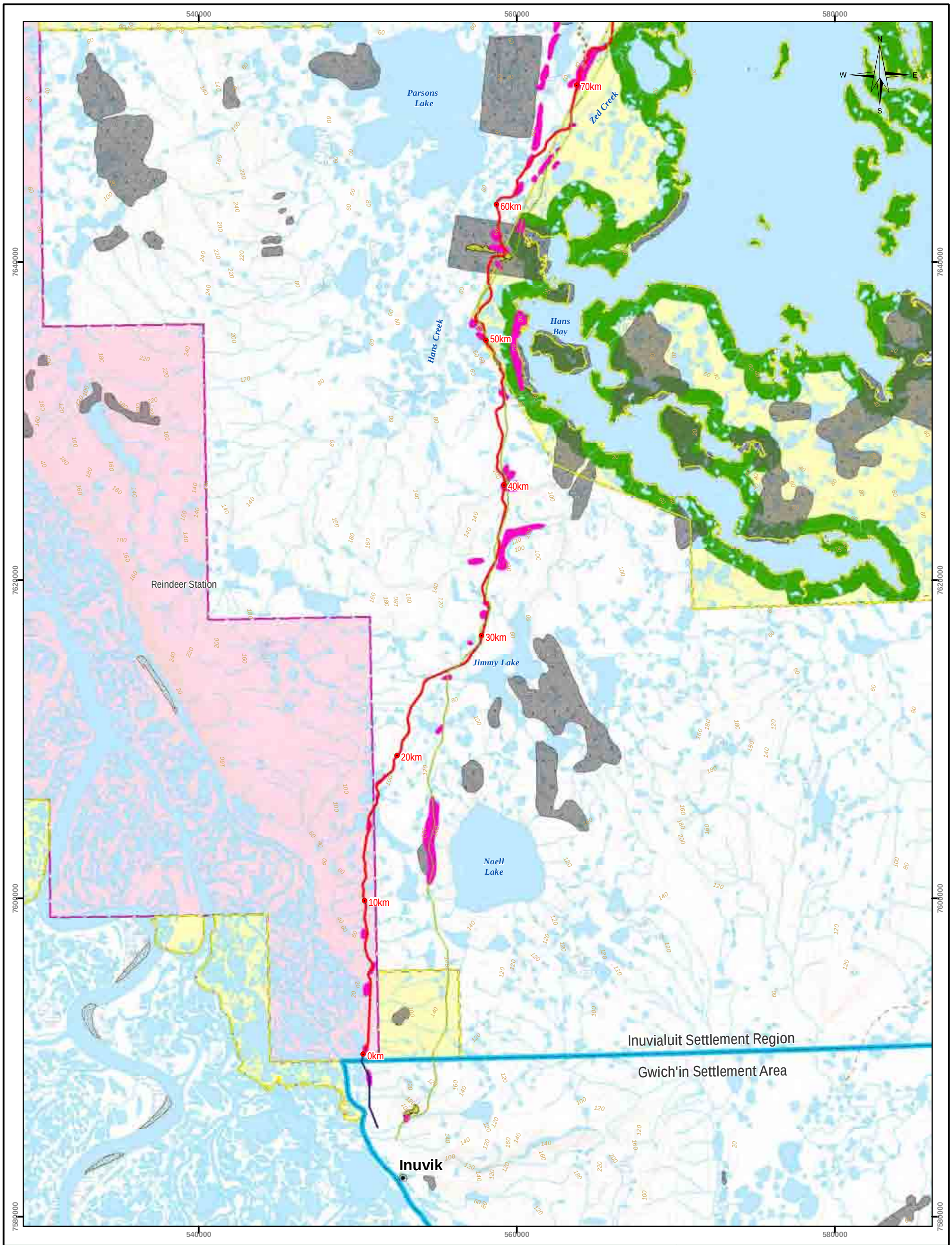

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Highway Borrow Sources
- Borrow Sources
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback
- Archaeological Potential Area

NOTES

Base data source: NTS 1:250,000

Borrow Sources, powerline, ILA Lands, Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Archaeological Potential Areas
(Map 1 of 2 - Southern Portion)

PROJECTION	DATUM
UTM Zone 8	NAD83

Scale: 1:225,000

1 0.5 0 1 2 3 4 5 6 7

Kilometres

FILE NO.
V23201098_PDR-Map002-Arch-Areas1.mxd

PROJECT NO.	DWN	CKD	REV
V23201098	KWM	GP	1

OFFICE	DATE
EBA-VANC	January 14, 2010

Figure 7.3-2

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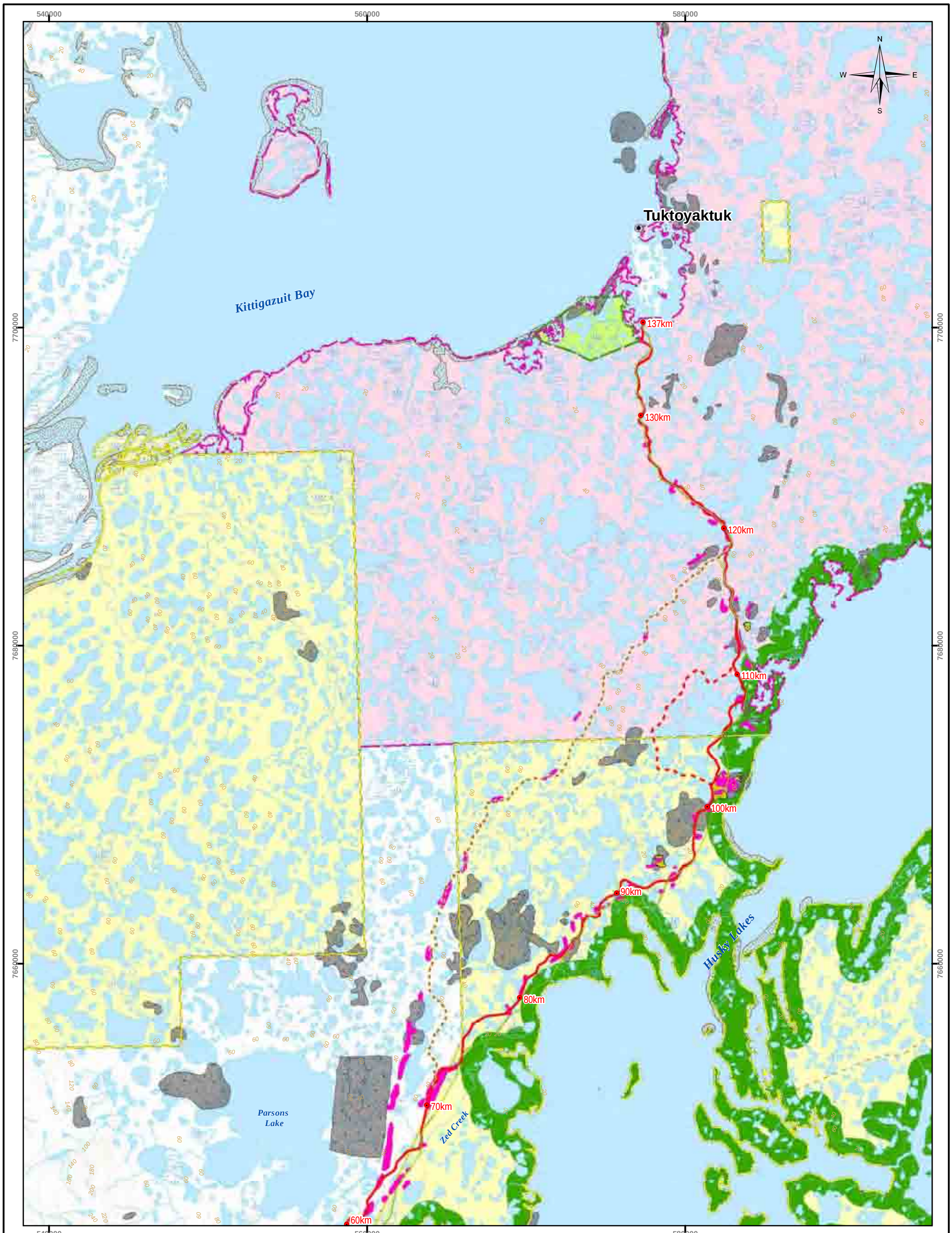

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Borrow Gravel Sources
- Borrow Sources
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback
- Archaeological Potential Area

NOTES

Base data source: NTS 1:250,000

Borrow Sources, powerline, ILA Lands, Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Archaeological Potential Areas (Map 2 of 2 - Northern Portion)

PROJECTION: UTM Zone 8	DATUM: NAD83		
Scale: 1:225,000 (1 0.5 0 1 2 3 4 5 6 7 Kilometres)			
FILE NO.: V23201098_PDR-Map003-Arch-Areas2.mxd			
PROJECT NO.: V23201098	DWN: KWM	CKD: GP	REV: 1
OFFICE: EBA-VANC	DATE: January 14, 2010		

Figure 7.3-3

Borrow sources were not assessed south of Hans Creek in September 2009 as they had not yet been identified at that time, as well as the time limitations during the September 2009 field investigation. One site is located within or immediately adjacent to Borrow Area 19, and several more may fall within borrow sources that were not assessed. All of the proposed borrow sources that were examined are situated on elevated terrain features that include sections suggestive of good archaeological potential; therefore, ground reconnaissance will be necessary in most of the sources.

Areas with the best potential terrain types include level and dry banks, terraces or benches along major streams or lakes, particularly along Husky Lakes, in close proximity to the Mackenzie drainage system, Zed Creek and Hans Creek; however, any well defined, elevated landforms adjacent to larger water bodies have good potential. Low lying expanses of tussock tundra or wet muskeg have limited potential for archaeological resources. A few such areas should be sampled during ground reconnaissance to ensure that all types of terrain are considered.

7.3.3.2 Heritage Expectations

The background research and visual assessment conducted of the areas in close proximity to the proposed Highway route and borrow sources provides the basis for some preliminary statements on expected heritage resources.

7.3.3.3 Heritage Site Locations

Heritage sites on the Tuktoyaktuk Peninsula and in the Husky Lakes area have most often been recorded on outlet creeks at larger lakes and along the Husky Lakes shoreline. It must be emphasized that this distribution is likely at least partly due to the fact that the research strategies of past studies focused on examination of these high potential locations. Since those are high potential locations, sites can be expected on elevated ridges, hills and terraces adjacent to larger lakes and streams. Besides Husky Lakes, of particularly good potential would be Parsons Lake, the lake known locally as Big Lake, Hans and Zed creeks, and elevated terrain close to channels of the Mackenzie drainage. Old sites have been found on pingos in northern Alaska (Lobdell 1986); therefore, such features are also considered to have archaeological potential.

7.3.3.4 Heritage Site Types

Based on ethnographic research and known heritage sites, the types of heritage sites to be expected could include various types of structural remains, stone tools and flakes, a variety of bone and wood artifacts, and bone concentrations. Mounds could be semi-subterranean houses or middens, that is, refuse accumulations. Piles of driftwood could represent graves or house remains. Pits could have been used as caches for food or belongings. Rock piles could represent caches or cairns marking a particular location or feature. The typically dense vegetation cover and the subtle nature of the some types of remains will necessitate

particularly intensive investigation strategies, involving closely spaced pedestrian transects to ensure thorough ground inspection as well as subsurface testing.

7.3.4 Heritage Resources Conclusions

1. The combination of background documentary data and overview terrain assessment has resulted in the identification of specific areas with sufficient potential for archaeological resources that ground reconnaissance is recommended.
2. To adequately complete intensive archaeological inventory survey, the Highway route must be finalized within a 100m wide corridor and boundaries of all associated components such as borrow sources, work staging areas, construction camps must be identified prior to field work.
3. Due to dense ground cover typical over most of the project footprint and the buried nature of archaeological resources in this area, intensive systematic subsurface testing will be required in most areas judged to be suggestive of good archaeological potential.
4. Mitigation measures will be designed as appropriate for each individual site. These may include avoidance (the preferred mitigation), temporary site protection, or systematic data recovery. It is expected that most archaeological sites found will be small and could be readily avoided with a minor project realignment or footprint adjustment. GNWT Department of Transportation and the Hamlet of Tuktoyaktuk, along with the selected contractor, will make every effort to avoid and protect recorded and unrecorded archaeological and heritage resources during the conduct of this project. In the unlikely event that project relocation is not feasible and a site will be impacted, recommended site mitigation will likely comprise detailed mapping, recording and excavation of a sufficient number of units to ensure a representative sample of the site contents is obtained. This ensures that knowledge of that site is available for future generations.

7.4 TRADITIONAL LAND USE AREAS

Information from the Tuktoyaktuk Community Conservation Plan (TCCP)(Community of Tuktoyaktuk et al. 2000) and the Inuvik Inuvialuit Community Conservation Plan (ICCP) (Community of Inuvik et al. 2000) are summarized in the following sections. Representatives from each community organization, including the Tuktoyaktuk Hunters and Trappers Committee (HTC), Inuvik HTC, Tuktoyaktuk and Inuvik Community Corporations, Elders, and other community representatives coordinated development of the original TCCP and IICCP in 1993. In 2000, updated editions were prepared by the Tuktoyaktuk HTC, Inuvik Inuvialuit HTC, the newly established Community Conservation Plan Working Group, the Wildlife Management Advisory Council (NWT), and staff from the Joint Secretariat.

There are several areas in the vicinity of the proposed 2009 Route that are used for traditional purposes between Inuvik and Tuktoyaktuk.

Gungi – Gungi, also spelled gunny, roughly translated means "bottom of the bay." During the consultations held in the community of Tuktoyaktuk on November 21, 2008 for the proposed access road to Source 177 (Kiggiak-EBA 2008), many residents indicated that the area to the south of Tuktoyaktuk, including the Gungi area at the south end of Tuktoyaktuk Harbour and further south towards Big Lake, is used regularly during the summer months for picnicking and berry picking. The residents indicated that the road would allow them to carry on these activities more easily in the future.

Husky Lakes Area – is considered by the residents of Tuktoyaktuk and Inuvik to be very important for year-round hunting, trapping, fishing, and recreation and for seasonal berry picking. The lakes provide spawning habitat for herring and lake trout. The Tuktoyaktuk Community Conservation Plan (TCCP) (Community of Tuktoyaktuk et al 2000) reported that fish harvesting has been typically concentrated in the upper parts of Husky Lakes around Saunatuk, Zieman Cabin and Stanley Cabin. Community of Tuktoyaktuk et al (2000) also suggests that harvesting use has been more limited to the west of Husky Lakes (including the vicinity of the Inuvik to Tuktoyaktuk Highway alignment). Information for the harvest locations of key species is found in Section 7.8.

Fishing Areas – Big Lake, Ilkaasuat (or "fishing area") was identified as a popular fishing area for lake trout and pike. Residents stated that the road would allow easier access to this fishing area (Kiggiak-EBA 2008; Rescan 1999). In 1999, residents from Tuktoyaktuk suggested that people do not fish along the proposed route, but they do fish further to the east, so the road would not affect their fishing areas. Inuvik residents identified Husky Lakes as important fishing areas, and were concerned that traffic and industrial activity associated with the road may negatively affect the lakes. They suggested that the road be moved further from the lakes. Fish lakes include Jimmy Lake, Noell Lake, and Parsons Lake. Further information about the fish harvesting area located near the proposed Highway is found in Section 7.8.

Hunting and Trapping Areas – Tuktoyaktuk residents stated that there is little hunting from Inuvik to Husky Lakes, but that hunting usually occurs around Parsons Lake. It was further stated that the road would be good for hunters and trappers. Inuvik residents identified that there were traplines along the proposed 1999 route, and that signage was necessary if/when the road crossed a trapline (Rescan 1999). Harvest locations and information are described further in Section 7.8.

Caribou Feeding Areas – According to the Tuktoyaktuk elders Traditional Knowledge interviews conducted in 1999, the main feeding area for caribou is along the shore of Husky Lakes. It was further mentioned that the caribou migrate along the shore of the lake, and not on higher ground (where the proposed road is) as there is not much food available at the higher elevation. Several elders stated that the proposed 1999 alignment would not affect caribou (Rescan 1999). More information about caribou related to harvesting is found in Section 7.8.

Creek Crossings – According to the Tuktoyaktuk and Inuvik HTCs, the proposed road crosses several creeks where fishing has taken place. These include Jimmy Creek, Trail Creek, Hans Creek and Zed Creek. Further information regarding creeks along the proposed Highway alignment is available in Section 9.7.

Culturally Significant Sites – According to Tuktoyaktuk residents, and supported by historical and archaeological records, the area around Husky Lakes was subject to intermittent, violent conflict between Dene and Inuvialuit individuals and groups. Saunatuk, although well removed from the proposed alignment of the Inuvik to Tuktoyaktuk Highway, is a particularly important and culturally significant site. It is located on a long sandspit that separates the second Husky Lake from the third Husky Lake. Archaeological work conducted at the site validates the traditional stories of violent conflict between the Dene and the Inuvialuit. More information about the heritage resources in the area is available in Section 7.3.

7.5 SPECIAL MANAGEMENT AREAS

According to the Tuktoyaktuk and Inuvik Inuvialuit Community Conservation Plans, the proposed Highway alignment passes through several special management areas. In general, the Highway is located in the areas with Management Categories "B" and "C" (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

Management Category "B" means that the "lands and waters where there are cultural or renewable resources of some significance and sensitivity but where terms and conditions associated with permits and leases shall assure the conservation of these resources" (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

Management Category "C" means that the "lands and waters where cultural or renewable resources are of particular significance and sensitivity during specific times of the year. These lands and waters shall be managed so as to eliminate, to the greatest extent possible, potential damage and disruption" (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

The special management areas that the proposed Highway is located in, or in the vicinity of, are described below, and are shown on Figure 7.5-1. Information regarding these areas is drawn from the Tuktoyaktuk Community Conservation Plan (Community of Tuktoyaktuk et al. 2000) and the Inuvik Inuvialuit Community Conservation Plan (Community of Inuvik et al. 2000).

Grizzly Bear Denning Areas – 322C

Grizzly bears make their dens over an expansive area between October and May each year. The proposed Highway is located within this area.

Bluenose-West Caribou Herd Winter Range – 701B

This area provides important winter habitat for the Bluenose-West caribou herd, which are valued for year-round subsistence harvest. The proposed Highway is located within the Bluenose-West caribou's winter range.

Caribou Hills – 702B

The Caribou Hills management area is an area in the Middle Mackenzie Delta, with a unique transition zone between alluvial taiga and low tundra habitats. It has a unique successional plant life and is an important subsistence berry picking and harvesting area.

Fish Lakes and Rivers – 704C

The northern portion of the proposed Highway is located within Fish Lakes and Rivers management area. This area includes the rivers and lakes along the shoreline west of Tuktoyaktuk, inland to their headwaters, and includes Parsons and Yaya Lakes. These lakes and rivers are used by the residents of Tuktoyaktuk and Inuvik for subsistence harvesting.

Husky Lakes – 705D

The Husky Lakes management area is adjacent to a portion of the proposed route of the Inuvik to Tuktoyaktuk Highway. In accordance with anticipated revisions to the Husky Lakes Criteria which are in the process of being updated by the EIRB and specific directions received from the ILA, the alignment of the proposed Highway has been re-routed as necessary to maintain a minimum setback of at least 1 km from the boundary of the Husky Lakes Special Management Area with one encroachment.

The EIRB (2009) has prepared a draft guidance document for proposed developments in the Husky Lakes Area entitled "Criteria for Establishing Environmental Standards and Criteria for Evaluating a Developer's Standard of Performance in the Husky Lakes Area (Area Number 2, Annex D, Inuvialuit Final Agreement)". This document is a draft update from the previously adopted in 2002.

This Project Description Report outlines the methods that will be employed to conform to EIRB's criteria for establishing environmental standards. EIRB's draft criteria are:

Traditional and Beneficiary Usage

Developments shall not produce air conditions, vibrations, noise levels, or any other disturbance that interfere with beneficiaries' use of the HLA.

Development Footprint

Developments shall be carried out so that the area occupied by the project site is no larger than necessary. Ideally, after final remediation, there will remain no evidence of environment disturbance in and about the development site.

Land-Use Conflicts

Developments shall avoid conflicts with community and beneficiary use of the land. Traditional land use activities will have priority over development activities.

Archaeological and Heritage Resources

Developers must take all reasonable steps to identify, locate and protect known and unknown heritage resources in the Husky Lakes Area.

Flora

Developments will be carried out in such a manner that plants are preserved and undisturbed to the greatest extent possible. Reasonable efforts must be taken to identify and protect areas of rare, at risk, and traditional use plants in the Husky Lakes Area

Water Quality

Developments in the Husky Lakes Area must not result in any adverse impact to the ambient hydrological regime–taking into consideration seasonal variations.

Air Quality

Air emissions resulting from a development in the Husky Lakes Area must meet the most current Canadian and Northwest Territories air quality standards.

Soils

Developments must proceed in such a manner that the native soils and any imported project materials (e.g. aggregate, rock, crushed stone) are used in the most appropriate manner to minimize soil degradation and not significantly affect other lands, water bodies, or marine areas. Every effort shall be made to preserve native soils.

Sediments

Developments must not disturb benthic soils and organic/inorganic materials in any manner that would adversely impact the water quality and/or quantity of that water body or feeding/receiving waters beyond seasonal variations.

Kugmallit Bay – 714C

The area managed under category 'C' consists of the eastern portion of Kugmallit Bay. Whales concentrate in these shallow, warm, brackish and highly turbid waters to calve, rear calves, moult and/or socialize. The area is an important past and present beluga whale subsistence harvesting area from June 15 to August 15.

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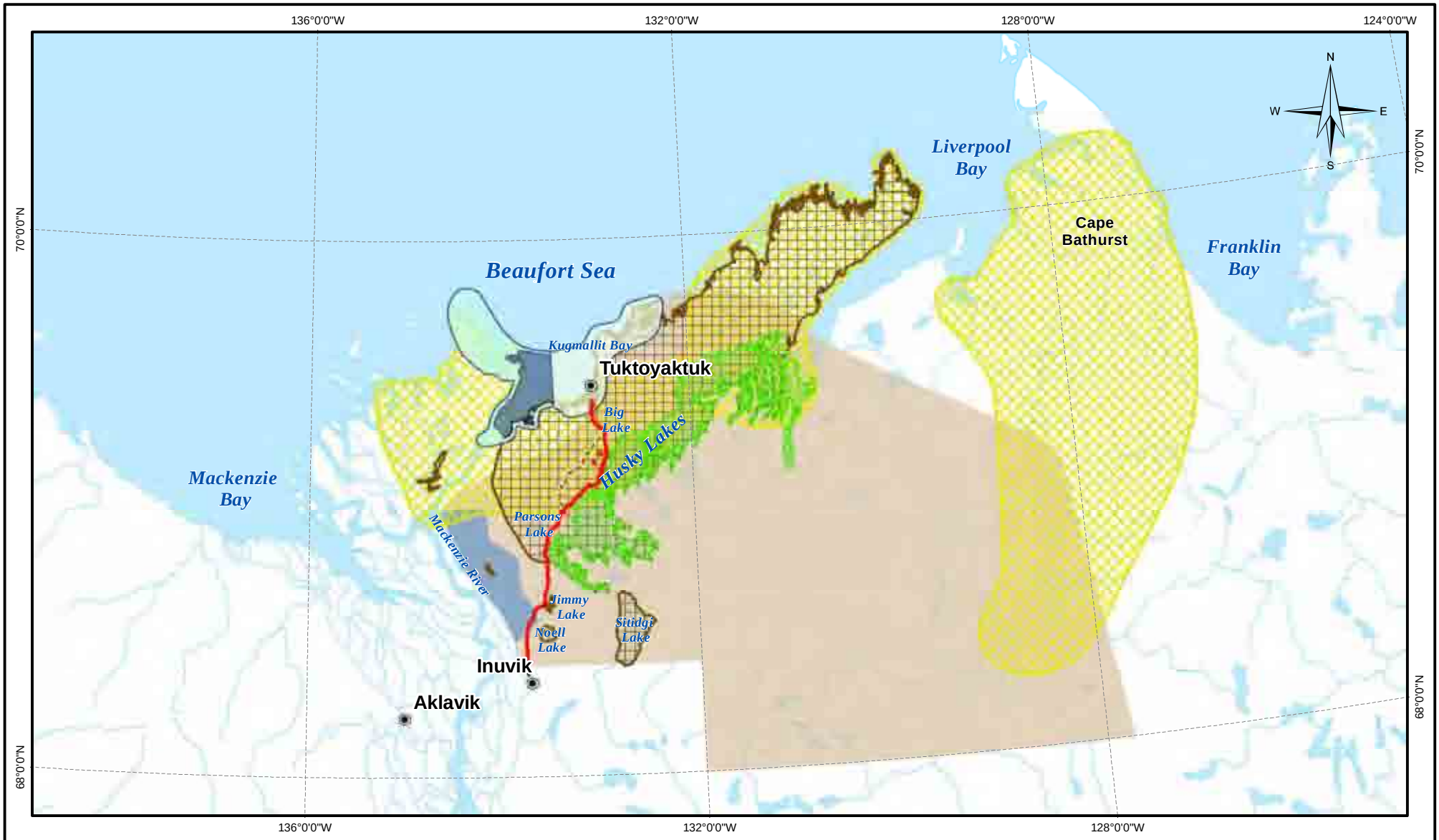

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road
- 322C - Grizzly Bear Denning Areas
- 701B - Bluenose-west Winter Range
- 702B - Caribou Hills
- 704C - Fish Lakes and Rivers
- 705D - Husky Lakes
- 728D - Pingo Canadian Landmark
- 714C - Kugmallit Bay
- 714D - Kugmallit Bay
- 714E - Kugmallit Bay
- Watercourse
- Waterbody

NOTES

Base data source: National Atlas Management Areas - Joint Secretariat Maps

ISSUED FOR USE

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70

Kilometres

PROJECTION	DATUM
Canadian Lambert Conf. Conic	NAD83

FILE NO. V23201098_PDR-Map028-SpecialMngt.mxd

Town of Inuvik | Northwest Territories | KIGGIAK - EBA

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Special Management Areas

PROJECT NO.	DWN	CKD	REV
V23201098	KMW	TS	2

OFFICE	DATE
EBA-VANC	January 19, 2010

Figure 7.5-1

Pingo Canadian Landmark – 728D

The area around Tuktoyaktuk has the greatest concentration of rare geological landforms consisting of ice-cored hills called pingos. In particular, the Ibyuk Pingo is 50m (164 ft) tall, and is approximately 1,000 years old. This area is protected under the *National Parks Act* and *Western Arctic (Inuvialuit) Claims Settlement Agreement*.

Wildlife, Waterfowl and Fish Harvest Areas

Specific areas related to wildlife, waterfowl and fish harvesting are identified in the Natural Resources Harvesting section of the Project Description Report (Sections 7.8.1 to 7.8.3).

7.6 PAST AND EXISTING LAND USES

The land between Inuvik and Tuktoyaktuk is currently used for a variety of purposes, which are described in this section. Figure 7.6-1 identifies the location of existing land uses.

7.6.1 Ikhil Gas Development and Pipeline Project

The Ikhil Gas Development and Pipeline Project consists of two producing gas wells, associated feeder lines, a small gas processing plant and a 50 km (30 miles) long, 168.3 mm (6 inch) diameter buried gas pipeline. The gas production site is located approximately 50 km north of Inuvik in the Caribou Hills, and extends south from there to a pressure regulation and metering facility near the Northwest Territories Power Corporation power plant in Inuvik. The project was developed during the period 1997 to 1999 and is expected to be in service for the foreseeable future.

The buried gas pipeline approaches the proposed Inuvik to Tuktoyaktuk Highway alignment at KM 5 and then runs parallel to the proposed Highway alignment heading south towards the end of Navy Road in Inuvik.

7.6.2 Tuktoyaktuk to Source 177 Access Road

The Tuktoyaktuk to Source 177 Access Road is a 19 km long road that is currently under construction. The proposed road alignment follows the same general route as originally selected for the northernmost 19 km of the proposed all-weather Highway between Inuvik and Tuktoyaktuk. The alignment is located entirely on Inuvialuit Private Lands.

7.6.3 Winter Access Trails

Since the introduction of snow machines, winter access trails have been developed each winter as needed, to allow residents of Tuktoyaktuk and Inuvik to pursue their traditional recreational, hunting, trapping and other activities on the Tuktoyaktuk Peninsula and in the Mackenzie Delta, including the general area of the proposed Inuvik to Tuktoyaktuk Highway. Several series of routes that becomes established every winter are the traditional routes from Tuktoyaktuk and Inuvik to the Husky Lakes area (Figure 7.6-1).

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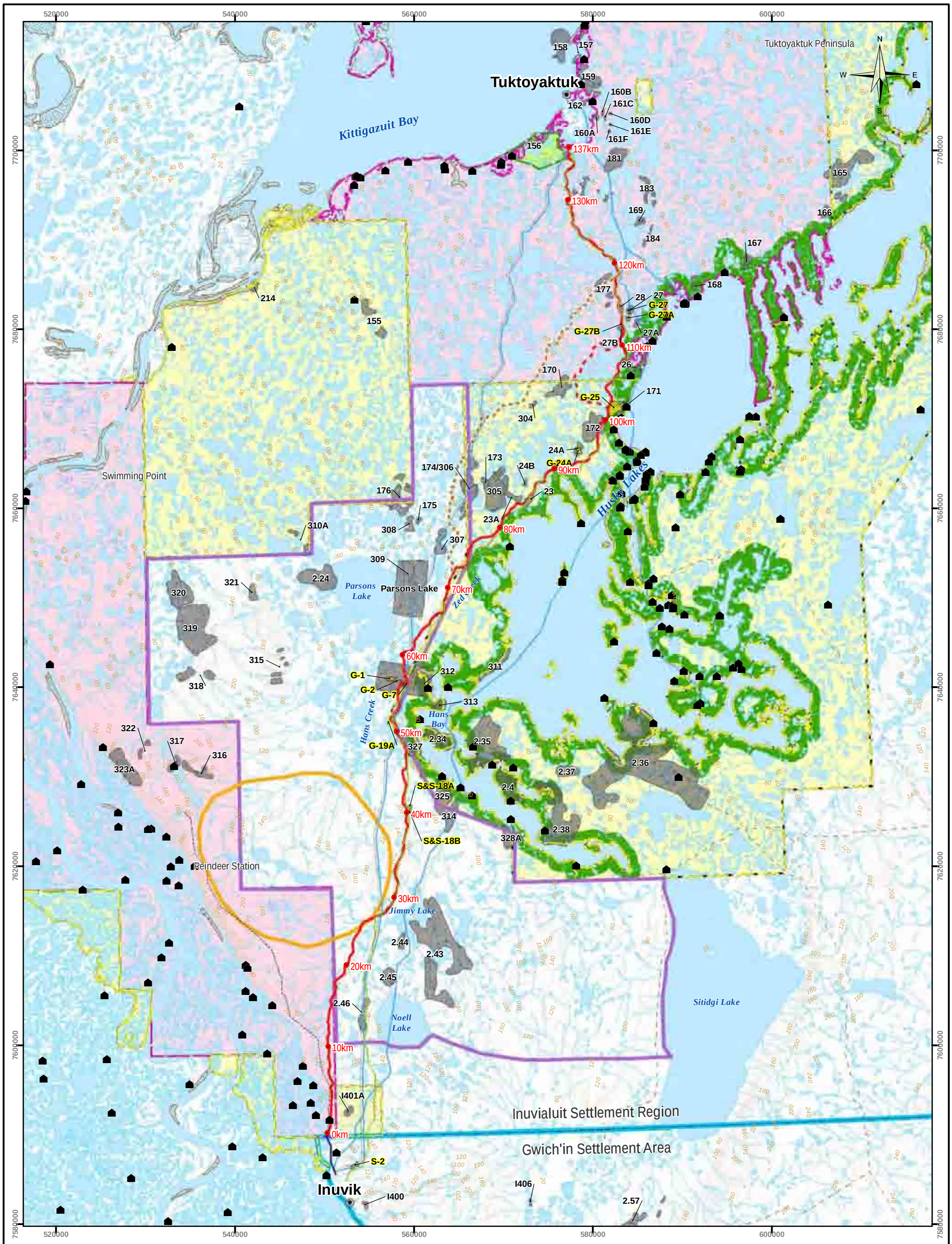

LEGEND

- Residential Leases
- 2009 Route
- Other Alignments Considered
- Upland Route
- Proposed Alignment (PWC'77)
- Navy Road
- Snowmobile Trails
- Highway Borrow Sources
- Borrow Sources
- Approximate Winter Reindeer Range
- Approximate Allotment B
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Former Powerline
- Ikhil Gas Pipeline
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand
- Husky Lakes 1000m Setback

NOTES

Base data source: NTS 1:250,000
Borrow Sources, powerline, ILA Lands, Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Existing Land Uses

PROJECTION: UTM Zone 8	DATUM: NAD83		
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)			
FILE NO.: V23201098_PDR-Map016-Dev-ExistLanduse.mxd			
PROJECT NO.: V23201098	DWN: KWM	CKD: RH	REV: 1
OFFICE: EBA-VANC	DATE: February 12, 2010		

Figure 7.6-1

The consultations sessions held in October 2009 confirmed that many families have and continue to use the traditional winter routes to the Husky Lakes. The consultations also identified a second, more overland route, which generally followed the alignment of the former Northern Canada Power Commission (NCPC) power line right-of-way (ROW) that extended from Inuvik to Tuktoyaktuk (Figure 7.6-1).

7.6.4 Husky Lakes Area

The Husky Lakes area is considered by the residents of Tuktoyaktuk and Inuvik to be very important for year-round hunting, trapping, fishing, and recreation and for seasonal berry picking. The lakes provide spawning habitat for herring and lake trout. The TCCP (Community of Tuktoyaktuk et al. 2000) reported that fish harvesting has been typically concentrated in the upper parts of Husky Lakes around Saunatuk, Zieman Cabin and Stanley Cabin. Community of Tuktoyaktuk et al. (2000) also suggests that harvesting use has been more limited to the west of Husky Lakes (including the vicinity of the Inuvik to Tuktoyaktuk Highway alignment).

According to ILA records, there are currently 118 registered leases located throughout the Husky Lakes area with the heaviest concentrations of cabins present in the narrows northwest of Five Hundred Lakes and to a lesser extent around Whale Point and Portage Point at the southern limit of Husky Lakes (Figure 7.6-1).

The Husky Lakes Integrated Management Planning Study completed in 2001 suggested that the area was already under pressure and that the local people were concerned about the deterioration of the "specialness" of Husky Lakes due to increased garbage and crowding of Husky Lakes related to the increasing number of cabins and residential leases (Hoyt 2001). At that time there was already a concern that land use activities may affect the traditional ways of life. As reported in Hoyt (2001), the region was considered to be vital to the community as a place where families could spend time together and pass on the skills and culture of the Inuvialuit.

7.6.5 Former Northern Canada Power Commission (NCPC) Power Line

In 1972, a 144 km wood pole power (transmission) line (69 kV) was constructed by the NCPC from Inuvik to Tuktoyaktuk, the only line of its type in the world north of the Arctic Circle (NTPC 2009). The route of this former power line is illustrated in Figure 7.6-1.

Due to high maintenance costs, this line was abandoned and salvaged in the late 1980s. The former power line ROW was used as a winter trail between Tuktoyaktuk and Inuvik and also served to help harvesters on the land to determine their location (G. Colton, NTPC Pers. Com. 2009). Today little physical evidence remains of the former NCPC power line.

7.6.6 Seismic Lines

Since the 1960s the most extensive non-traditional land use that has occurred in the Mackenzie Delta, including the area in the vicinity of the proposed Inuvik to Tuktoyaktuk Highway, has been seismic exploration. As an example, in the 41,105 ha Parsons Lake Study Area defined for the Mackenzie Gas Project, approximately 1.5% of that Study Area had been subjected to seismic lines and associated activities (IOL et al. 2004). Although from the air the vegetation along the seismic lines sometimes appears to have a different colour, on the ground, little physical evidence remains of these historic seismic programs.

7.6.7 Oil and Gas Well Sites

A number of exploratory oil and gas wells were completed by Imperial Oil near the proposed Highway right-of-way near Tuktoyaktuk on the Tuktoyaktuk Peninsula. For example, 13 wells were drilled in the mid-1980s during Imperial Oil's Tuktoyaktuk Tertiary program. In addition, Gulf drilled a number of exploratory and development wells in the Parsons Lake area in the early 1970s.

7.7 PROPOSED FUTURE LAND USES

Figure 7.7-1 identifies the locations of known proposed future projects that may be developed in the region.

7.7.1 Mackenzie Gas Project

Developing a natural gas pipeline from the Mackenzie Delta through the Northwest Territories to southern markets has been contemplated for many years. Various pipeline projects have been proposed during the last 30 years that consider economics, regulatory requirements, socio-economic and environmental conditions, and engineering and geotechnical issues in the decision-making process (IOL et al. 2004).

The proponents of the proposed Mackenzie Gas Project include Imperial Oil Resources Ventures Limited Partnership (IOL), ConocoPhillips Canada (North) Limited (ConocoPhillips), ExxonMobil Canada Properties (ExxonMobil), Shell Canada Limited (Shell) and Mackenzie Valley Aboriginal Pipeline Limited (MVAPL) partnership.

The purpose of the proposed project is to develop three onshore natural gas fields (anchor gas fields) in the Mackenzie Delta and to transport natural gas and natural gas liquids (NGLs) by pipeline to market (Figure 7.7-1).

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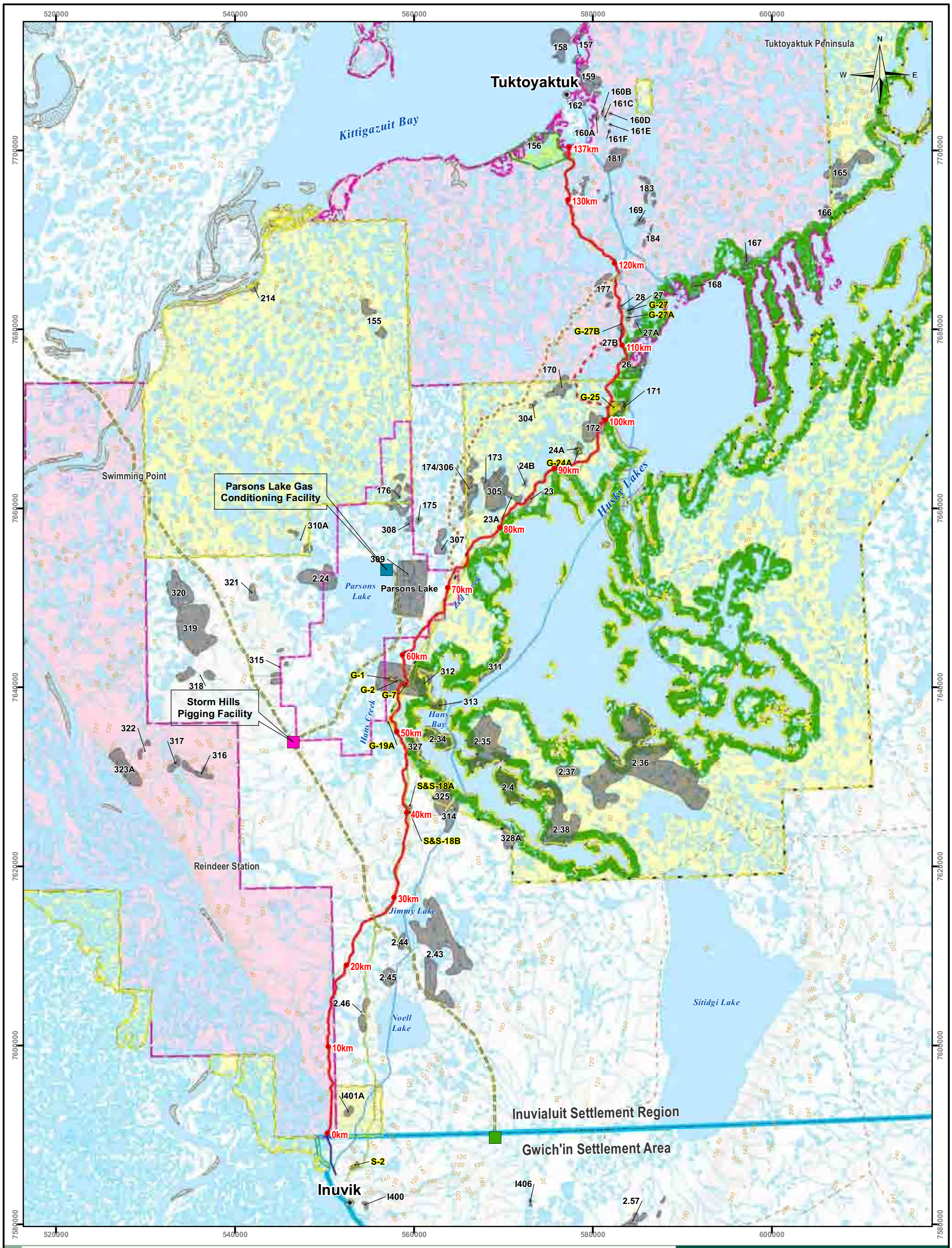

LEGEND

- Facility Site
- Gas Conditioning Facility
- Pigging Facility Site
- Route of Gathering Pipelines
- Significant Discovery Licence Area
- 2009 Route
- Other Alignments Considered
- Upland Route
- Proposed Alignment (PWC'77)
- Navy Road
- Snowmobile Trails
- HighwayBorrow Sources
- Borrow Sources
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Pingo Park
- Gwich'in / Inuvialuit Boundary
- Husky Lakes 1000m Setback
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES

Base data source: NTS 1:250,000
Borrow Sources, powerline, ILA Lands, - Inuvialuit Land Administration
Mackenzie Gas Project 2004

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Proposed Future Land Uses

PROJECTION: UTM Zone 8		DATUM: NAD83	
Scale: 1:400,000 (5 2.5 0 5 10 Kilometres)			
FILE NO.: V23201098_PDR-Map017-CE-PropLanduse.mxd			
PROJECT NO.: V23201098	DWN: KWM	CKD: RH	REV: 0
OFFICE: EBA-VANC	DATE: January 25, 2010		

Figure 7.7-1

7.7.2 Parsons Lake Gas Field Associated Infrastructure and Gathering Pipeline

The Parsons Lake gas field, currently operated by ConocoPhillips, is located about 55 km southwest of Tuktoyaktuk and 70 km north of Inuvik (Figure 7.7-1). The main production facilities at the Parsons Lake field will be located on two main gravel pads, the most northerly and larger of the two near the northeast shore of Parsons Lake. The north pad, which will accommodate the gas conditioning facility, camp, fuel storage, and other associated infrastructure, is proposed to be built first. The connection to the Mackenzie Gas gathering system will also be located at the north pad. The second, smaller well pad will be constructed about five or six years later and will be located about 14 km from the north pad at a location south of Parsons Lake. An elevated two-phase flow line will transport natural gas from the south pad to the north pad's gas conditioning facility (ConocoPhillips 2004).

The Parsons Lake gathering pipeline (Parsons Lake lateral) will originate from the gas conditioning facility located on the north pad and will head south around Parsons Lake. From there, the buried lateral will continue southwest between West Hans Lake and East Hans Lake to the Storm Hills Junction (Figure 7.7-1).

7.7.3 Tuktoyaktuk Harbour Project

The harbour at Tuktoyaktuk is the only existing natural and active port along the Canadian Beaufort Sea coastline. Historically it has served as the primary base for offshore oil and gas exploration in the 1970s and 1980s when the oil and gas exploration companies were active in the area. With the recent renewed interest in Beaufort Sea exploration and the possible development of the Mackenzie Gas Project, Tuktoyaktuk harbour may again play an important role as an offshore logistics and service centre for the oil and gas industry.

The Tuktoyaktuk Harbour, however, can only be used by vessels with a draft of 13 feet (4 m), or less. Therefore the larger drillships, ice breakers and supply boats cannot presently enter the harbour. With the projected thinning of the polar ice caps, the expected increase in global marine traffic through the north and the anticipated intensification of Beaufort oil and gas exploration and possible development, there will be an important requirement to provide a suitable harbour for deeper draft vessels. Both Government and industry have expressed an interest in developing the Tuktoyaktuk Harbour to support deeper draft vessels and proposals for such potential development may be forthcoming.

The potential option to bring modules for the Parsons Lake gas field through the Beaufort Sea to Tuktoyaktuk is currently under study by ConocoPhillips. To date no formal proposal for the development of Tuktoyaktuk harbour has been put forward.

7.8 NATURAL RESOURCES HARVESTING

The traditional culture of the Inuvialuit is unique due to the adaptations to every day challenges posed by the harsh northern environment in which they have evolved (IOL et al. 2004). Traditionally the people have lived off the land and relied on a variety of wildlife and plant species for sustenance. The ability to survive in such an environment has shaped

Inuvialuit behaviour and activities, creating a focus on harvesting game, fish and fowl for food because the supply of available plant foods was too limited and seasonal to sustain life (IOL et al. 2004). Despite the continued importance of harvesting to the Inuvialuit culture, these activities have diminished in recent years (IOL et al. 2004; NWT Bureau of Statistics 2008a and 2008b).

Traditional activities which, above all others, sustain the full expression of the Inuvialuit values and identity include hunting, fishing and trapping (IOL et al. 2004). The Inuvialuit use local resources to provide traditional foods and their hunting, fishing and trapping activities convey a tradition-based and fundamental relationship between the Inuvialuit and their environment. Species that the Inuvialuit have traditionally relied upon for sustenance includes beluga whale, seal, caribou, fur-bearing animals, fish and birds. The most important food sources to the Inuvialuit are caribou and whale (IOL et al. 2004).

The data presented in the following section is primarily derived from the Inuvialuit Harvest Study 1988-1997 (Joint Secretariat 2003). This study has not been updated since it was originally published.

Harvest data between 1988 and 1997 presented in this section have been reported separately for Inuvik and Tuktoyaktuk.

7.8.1 Wildlife

7.8.1.1 Caribou

Inuvialuit communities rely on the Cape Bathurst and Bluenose-West herds of barren-ground caribou which occupy the northern portion of the Northwest Territories and western Nunavut (Community of Inuvik et al. 2000 and Community of Tuktoyaktuk et al. 2000). For the period July 1, 2008 to June 30, 2009, Area I/BC/07 (which includes the area of the proposed Highway) was closed to all hunters for barren-ground caribou hunting. Hunting for barren-ground caribou is still permitted to occur between June 16 and March 31 in Area I/BC/08 located to the north and west of Tuktoyaktuk on the Tuktoyaktuk Peninsula. This area is closed from April 1 to June 15 of each year to allow the Cape Bathurst caribou herd to migrate back to their calving grounds along the coast.

Figure 7.8-1 depicts the seasonal caribou harvesting areas. In particular, the area near Caribou Hills provides important wintering habitat (IOL et al. 2004).

Inuvik

In the Inuvik area between 1988 and 1997 the Inuvialuit annual caribou harvest fell from 1,589 to 275 caribou per year (Figure 7.8-2). The sharpest decline followed the 1988 hunting season of 1,589 caribou to 635 the following year. Since 1989, caribou harvesting has continued to decline to 275 in 1997.

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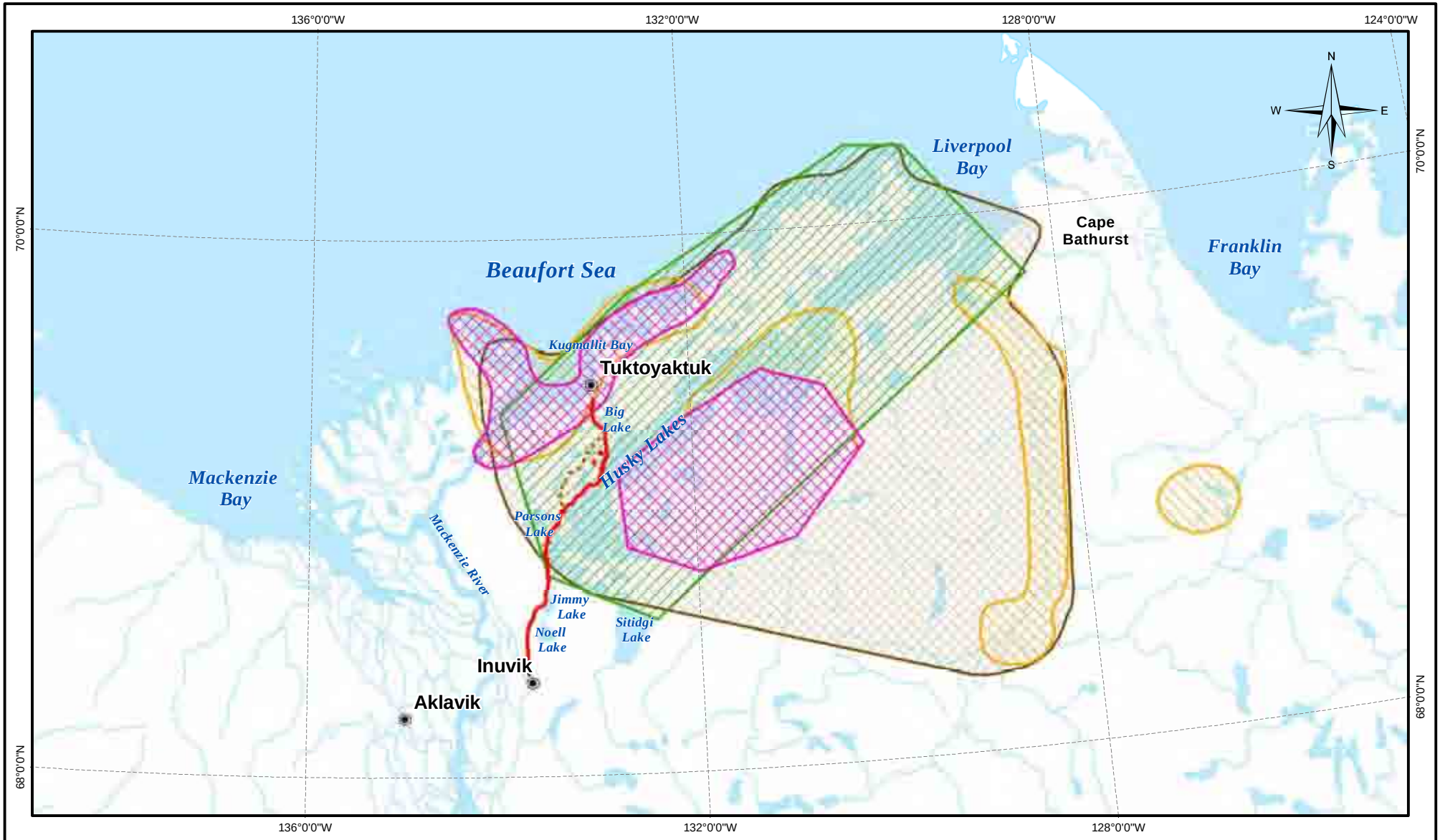

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road
- 302C - Spring Caribou Harvest Area
- 306C - Summer Caribou Harvest Area
- 309C - Fall Caribou Harvest Area
- Winter Caribou Harvesting Area
- Watercourse
- Waterbody

NOTES

Base data source: National Atlas
Caribou Harvest Areas - Joint Secretariat Maps

ISSUED FOR USE

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70

Kilometres

PROJECTION	DATUM
Canadian Lambert Conf. Conic	NAD83

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Town of Inuvik · Northwest Territories · KIGGIAK - EBA

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Caribou Harvesting Areas
Spring, Summer, Fall, Winter

PROJECT NO.	DWN	CKD	REV
V23201098	KMW	TS	0

OFFICE	DATE
EBA-VANC	January 2010

Figure 7.8-1

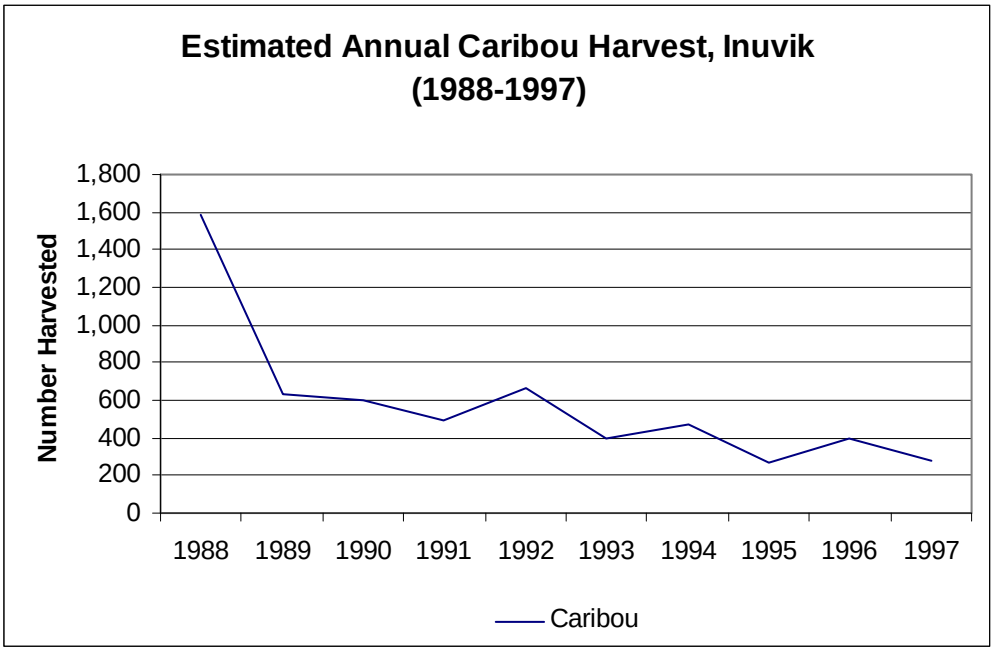

Figure 7.8-2
Estimated Annual Caribou Harvest, Inuvik (1988-1997)

More recent barren-ground caribou harvest estimates for the ISR were not available. However, the GNWT Department of Environment and Natural Resources has conducted NWT Resident Hunter Harvest Surveys from 1984 to 2006 in the Inuvik region for Woodland Caribou. Survey data indicate approximately 68 caribou were harvested between 1997 and 2006, ranging from approximately two in 2002 to approximately 13 in 2005 (GNWT ENR 2006c).

Tuktoyaktuk

Between 1988 and 1997, the annual caribou harvest near Tuktoyaktuk fluctuated from a high of 1,398 caribou in 1992 to a low of 586 caribou in 1989 (Figure 7.8-3; Community of Tuktoyaktuk et al. 2000). The sharpest decline followed the 1988 hunting season of 1,589 caribou to 635 the following year. With the exception of the 1991 and 1992 harvest years, annual caribou harvests have remained below 1,000 caribou per year in the Tuktoyaktuk region.

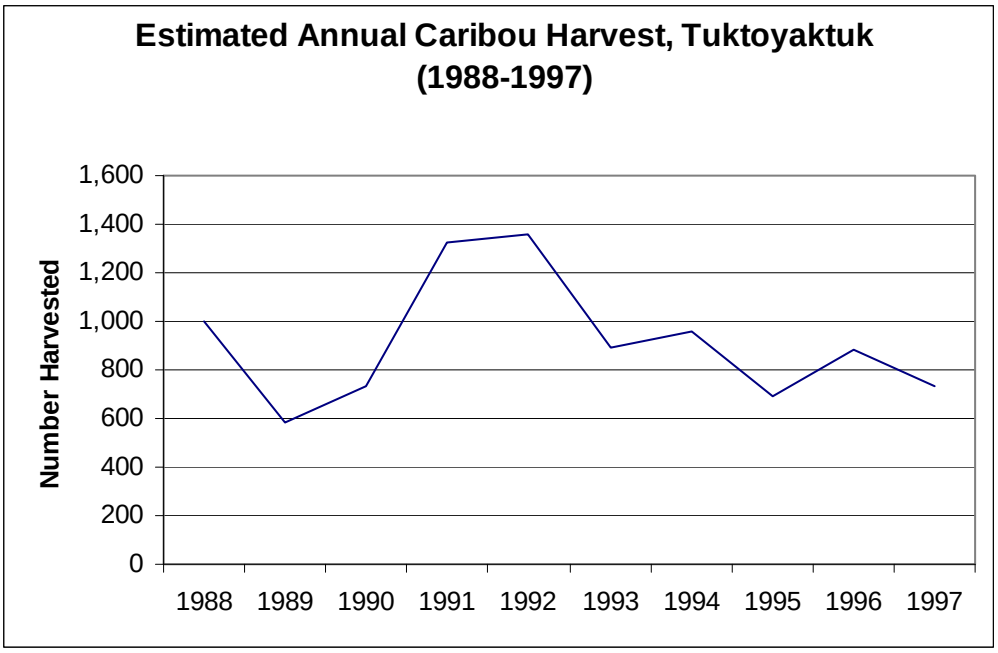

Figure 7.8-3
Estimated Annual Caribou Harvest, Tuktoyaktuk (1988-1997)

Residents of Tuktoyaktuk have expressed concern that hunting pressure on caribou and other wildlife may increase as a direct consequence of building the Highway. To protect wildlife, organizations such as the HTCs, Wildlife Management Advisory Council (WMAC) and GNWT Department of Environment and Natural Resources will need to work together and develop guidelines and conditions for use of the Highway. The success of this approach would require a high level of voluntary compliance from the users of the proposed Highway. Consequently, this process would require a public education program to be undertaken, including the use of signage along the highway alignment highlighting hunting and other restrictions, to discourage excessive hunting along the corridor.

7.8.1.2 Big-Game

Other big-game annually harvested include moose, and to a lesser extent grizzly bear and black bear. Moose are an important alternate food source when caribou are not available, and are also used for clothing and tools (Community of Inuvik et al. 2000). Figure 7.8-4 depicts the spring time moose harvesting areas.

The Inuvialuit have exclusive harvesting rights to grizzly bear within the Inuvialuit Settlement Region. In 1987 the Tuktoyaktuk HTC expressed concern about over-harvesting of grizzly bears (Community of Tuktoyaktuk et al. 2000). The organization suggested that a quota be established, and the process of implementation began (IRDC n.d.). Grizzly bears have traditionally been used only as a furbearer and are typically hunted between April 1 to June 15 and August 15 to September 30 each year (Community of Tuktoyaktuk et al. 2000).

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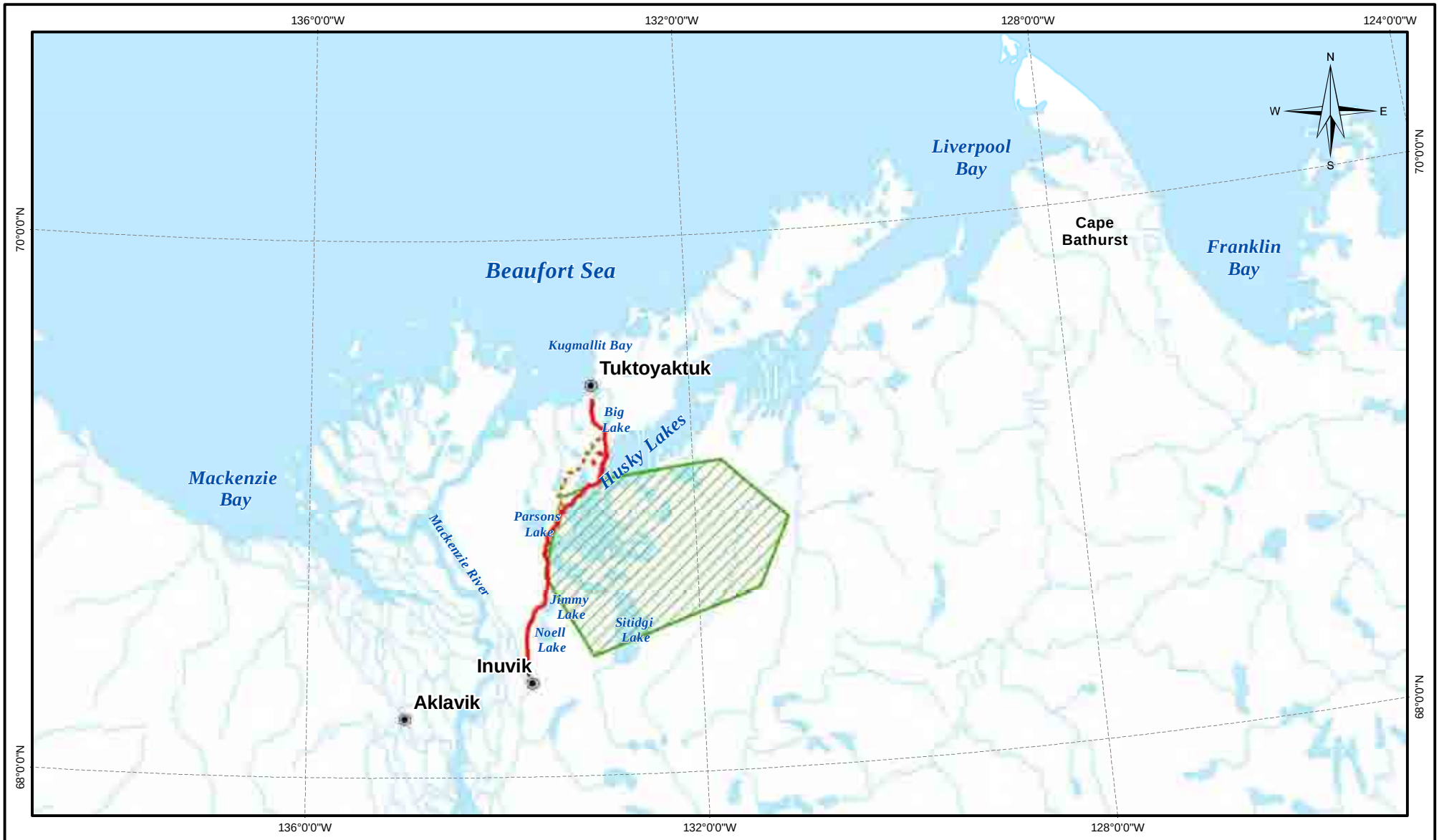

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road
- 303B - Spring Moose Harvesting Area
- Watercourse
- Waterbody

NOTES

Base data source: National Atlas
Moose Harvest Areas - Joint Secretariat Maps

ISSUED FOR USE

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70

Kilometres

PROJECTION	DATUM
Canadian Lambert Conf. Conic	NAD83

FILE NO.
V23201098_PDR-Map011-Trad-MooseHarv.mxd

Town of Inuvik · Northwest Territories · KIGGIAK - EBA

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Moose Harvesting Areas Spring

PROJECT NO.	DWN	CKD	REV
V23201098	KMW	TS	0

OFFICE	DATE
EBA-VANC	January 14, 2010

Figure 7.8-4

Inuvik

Moose hunting typically occurs between February 1 to March 31 and August 1-31 each year in the Inuvik Planning Area (Community of Inuvik et al. 2000). As indicated in Figure 7.8-5, between 1988 and 1997 the Inuvialuit annual moose harvest near Inuvik declined from 41 in 1988 to 8 in 1997. The sharpest decline followed the 1988 hunting season of 41 moose to 18 moose the following year. Between 1989 and 1997 moose harvest near Inuvik fluctuated from 8 to 15 moose. According to a recent NWT Resident Hunter Harvest Survey conducted in the Inuvik region (GNWT ENR 2006c), 317 moose were harvested between 1997 and 2006, ranging from 10 in 2001 to 40 in both 1997 and 2006.

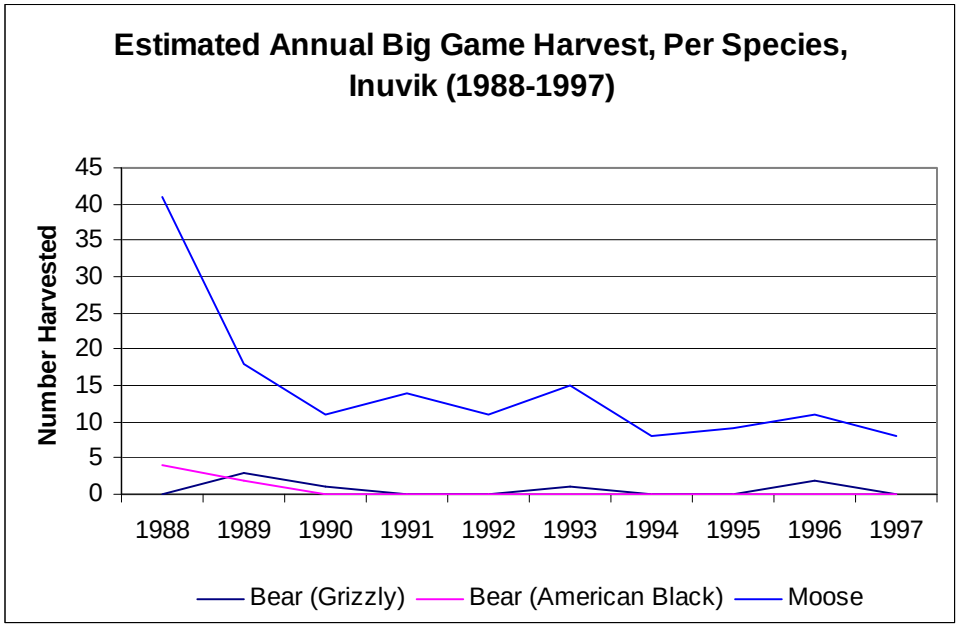

Figure 7.8-5
Estimated Annual Big-game Harvest, Per Species, Inuvik (1988-1997)

As indicated in Figure 7.8-5, the Inuvialuit harvested seven grizzly bears in the Inuvik area between 1988 and 1997 with the highest number (four) harvested in 1989. No grizzly bears were harvested in the Inuvik area during 1988, 1991, 1992, 1994, 1995, or 1997. More recent data indicate that between July 2003 and June 2008, 129 grizzly bears were harvested (GNWT 2008). Despite the increase from the earlier data, the harvest between 2003 and 2008 was less than the sustainable harvest level (GNWT 2008).

Near Inuvik, it is estimated that less than five black bears were harvested during 1988 and 1989 (Figure 7.8-5).

Tuktoyaktuk

The annual harvest of big-game in the Tuktoyaktuk area has shown fluctuation over time for grizzly bear, moose and muskox (Figure 7.8-6). All species have been harvested at rates of six or fewer individuals per year with the exception of the moose harvest in 1993 when 10 moose were harvested.

Muskoxen are typically harvested between April 1 to May 31 within the Tuktoyaktuk Planning Area (Community of Tuktoyaktuk et al. 2000).

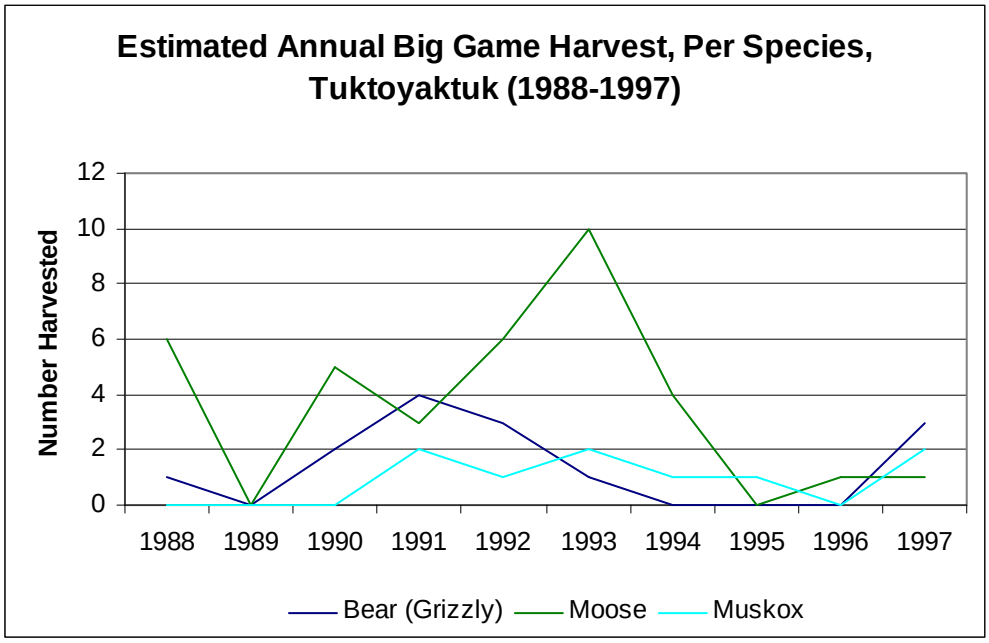

Figure 7.8-6
Estimated Annual Big-game Harvest, Per Species, Tuktoyaktuk (1988-1997)

More recent big-game harvest estimates for the ISR region were not available.

7.8.1.3 Furbearers and Small Mammals

Active trapping by the Inuvialuit near Inuvik has also been in decline. Fur-bearing species harvested include fox, American mink, hare, wolf (also classified as big-game), marten, wolverine and muskrat. These species are highly valued fur-bearing species, while the hare are also considered an important food source (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000).

Inuvik

In the Inuvik area, fur bearers are typically harvested between January 1 to May 15 and November 1 to December 31 of each year (Community of Inuvik et al. 2000). Muskrat are specifically harvested March 5 to June 15 each year (Community of Inuvik et al. 2000).

As shown in Figures 7.8-7 and 7.8-8, harvest rates have decreased between 1988 and 1997. An exception is the hare harvest in 1990, which increased sharply in 1990. Wolf and wolverine had the fewest individuals harvested each year (Joint Secretariat 2003). Figure 7.8-9 depicts the winter harvesting areas for wolverine.

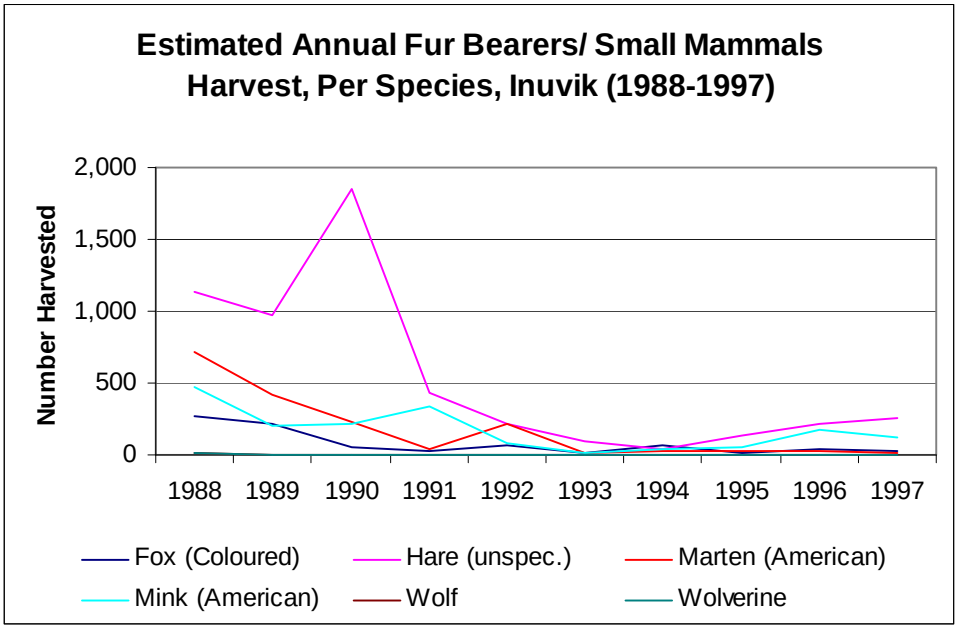

Figure 7.8-7
Estimated Annual Fur Bearers / Small Mammals Harvest, Per Species, Inuvik (1988-1997)

Muskrat harvesting has also declined between 1988 and 1997 with the sharpest decline from 38,136 individuals in 1988 to 6,305 in 1989. Between 1989 and 1997 the muskrat harvest fluctuated from 698 to 6,314.

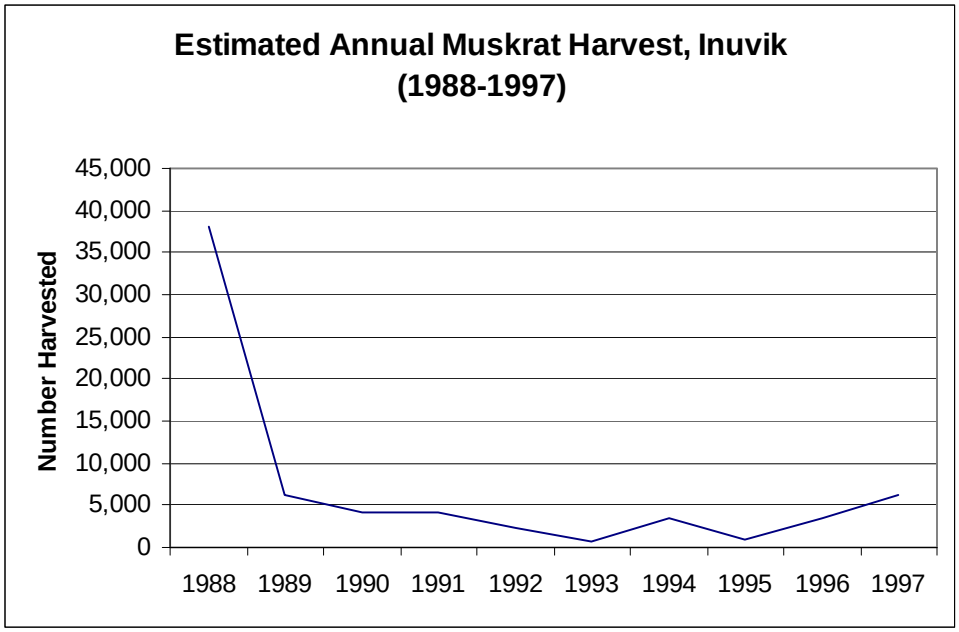

Figure 7.8-8
Estimated Annual Muskrat Harvest, Inuvik (1988-1997)

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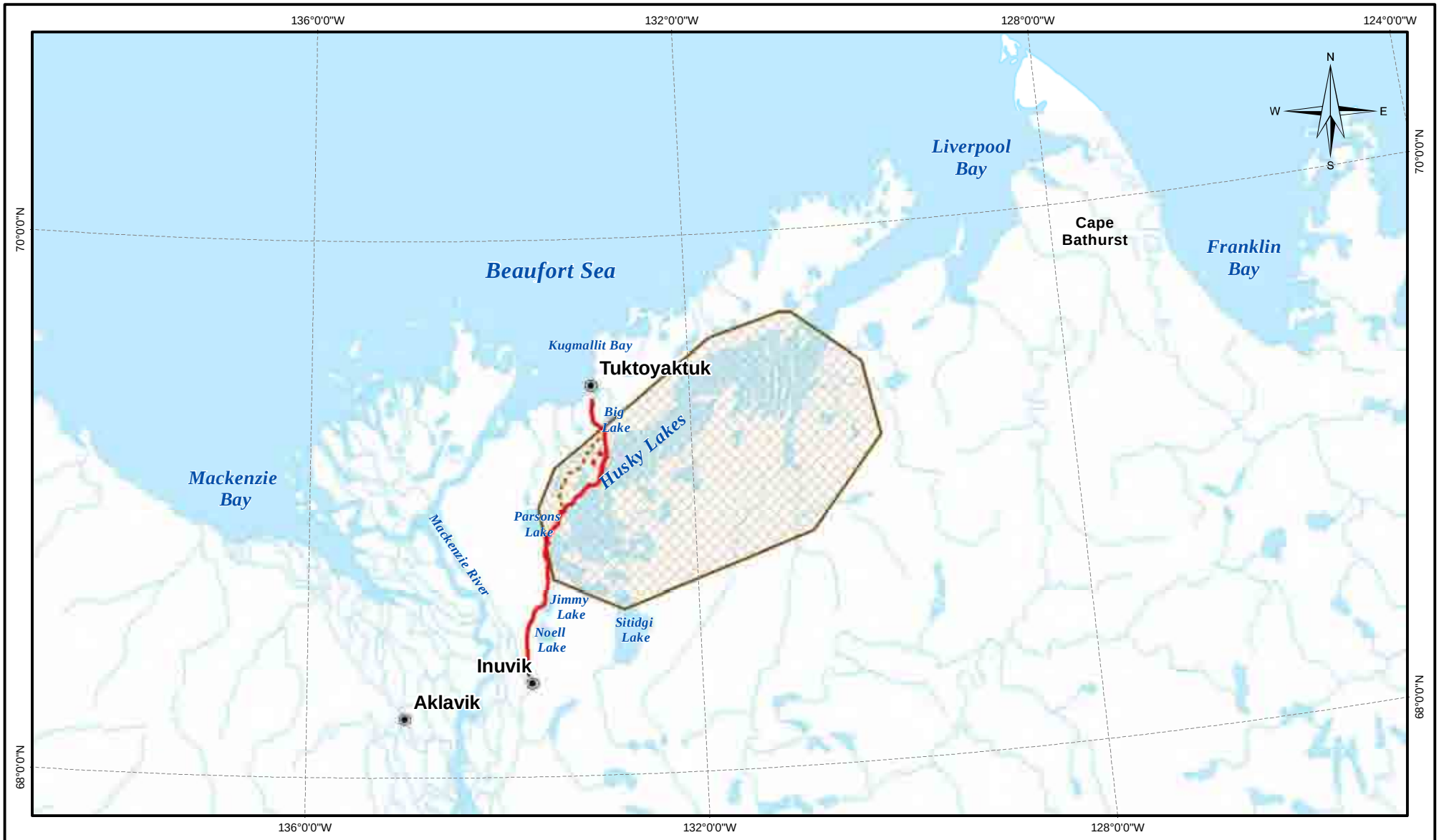

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road
- 314C - Winter Wolverine Harvesting Area
- Watercourse
- Waterbody

NOTES

Base data source: National Atlas
Wolverine Harvest Areas - Joint Secretariat Maps

ISSUED FOR USE

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70
Kilometres

PROJECTION	DATUM
Canadian Lambert Conf. Conic	NAD83

FILE NO.
V23201098_PDR-Map012-Trad-WolverineHarv.mxd

Town of Inuvik · Northwest Territories · KIGGIAK - EBA

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Wolverine Harvesting Areas Winter

PROJECT NO.	DWN	CKD	REV
V23201098	KMW	TS	0

OFFICE	DATE
EBA-VANC	January 14, 2010

Figure 7.8-9

Tuktoyaktuk

Active trapping by the Inuvialuit near Tuktoyaktuk has fluctuated over the period from 1988 to 1997 (Figure 7.8-10). Fur-bearing species harvested include fox, American mink, hare, wolf, marten, wolverine and muskrat. These species are highly valued, fur-bearing species, while the hare is also considered an important food source (Community of Tuktoyaktuk et al. 2000; Community of Inuvik et al. 2000). In the Tuktoyaktuk Planning Area fur bearers are typically harvested between January 1 to April 15 and November 1 to December 15 of each year (Community of Tuktoyaktuk et al. 2000). Muskrat are specifically harvested between March 5 to May 31 each year (Community of Tuktoyaktuk et al. 2000).

As indicated in Figure 7.8-10, mink and hare harvest rates have decreased between 1988 and 1997. Other species have generally fluctuated over this time period (Figures 7.8-10 and 7.8-11 (Joint Secretariat 2003).

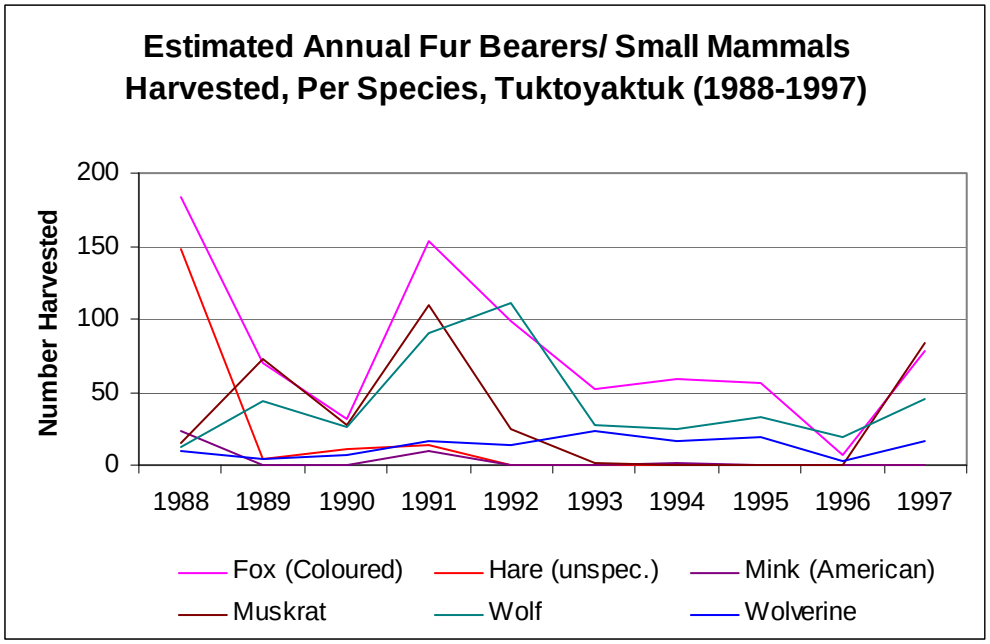

Figure 7.8-10
Estimated Annual Fur Bearers/ Small Mammals Harvest, Per Species, Tuktoyaktuk (1988-1997)

The number of Arctic fox and marten harvested near Tuktoyaktuk reduced substantially between 1988 and 1990 and then rose steadily again until 1996.

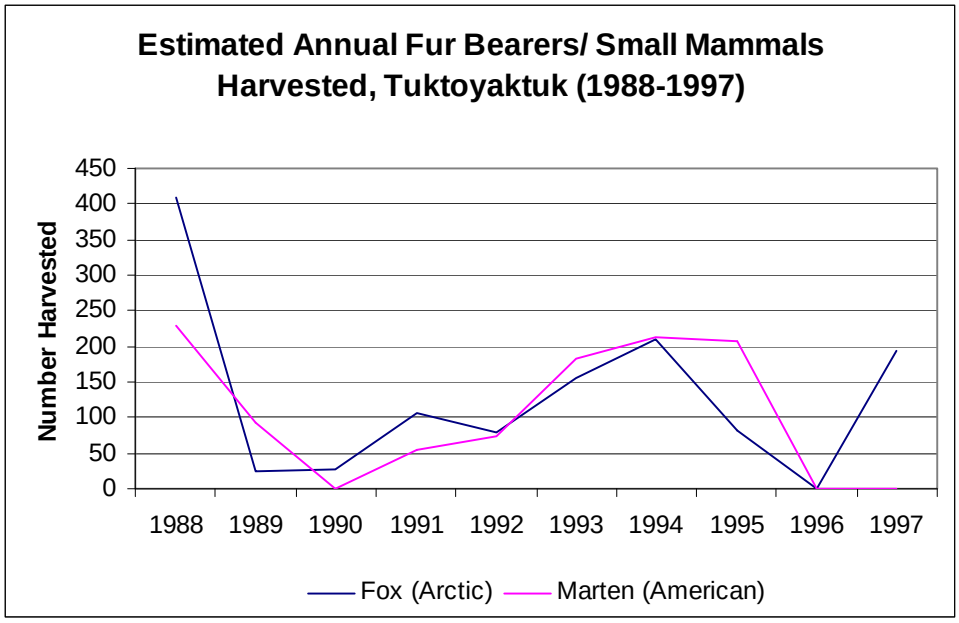

Figure 7.8-11
Estimated Annual Fur Bearers / Small Mammals Harvest, Per Species, Tuktoyaktuk (1988-1997)

7.8.2 Waterfowl

Waterfowl are an important food source for the Inuvialuit during the spring and fall and down is traditionally used in pillows and blankets (Community of Inuvik et al. 2000). Figure 7.8-12 depicts the spring, summer and fall goose harvesting areas.

Inuvik

As shown in Figure 7.8-13, the annual harvest rate of the greater white-fronted goose, snow goose and mallard near Inuvik have fluctuated considerably between 1988 and 1997 (Joint Secretariat 2003). Overall, harvest levels declined between 1988 and 1995 but increased again in 1996 and 1997.

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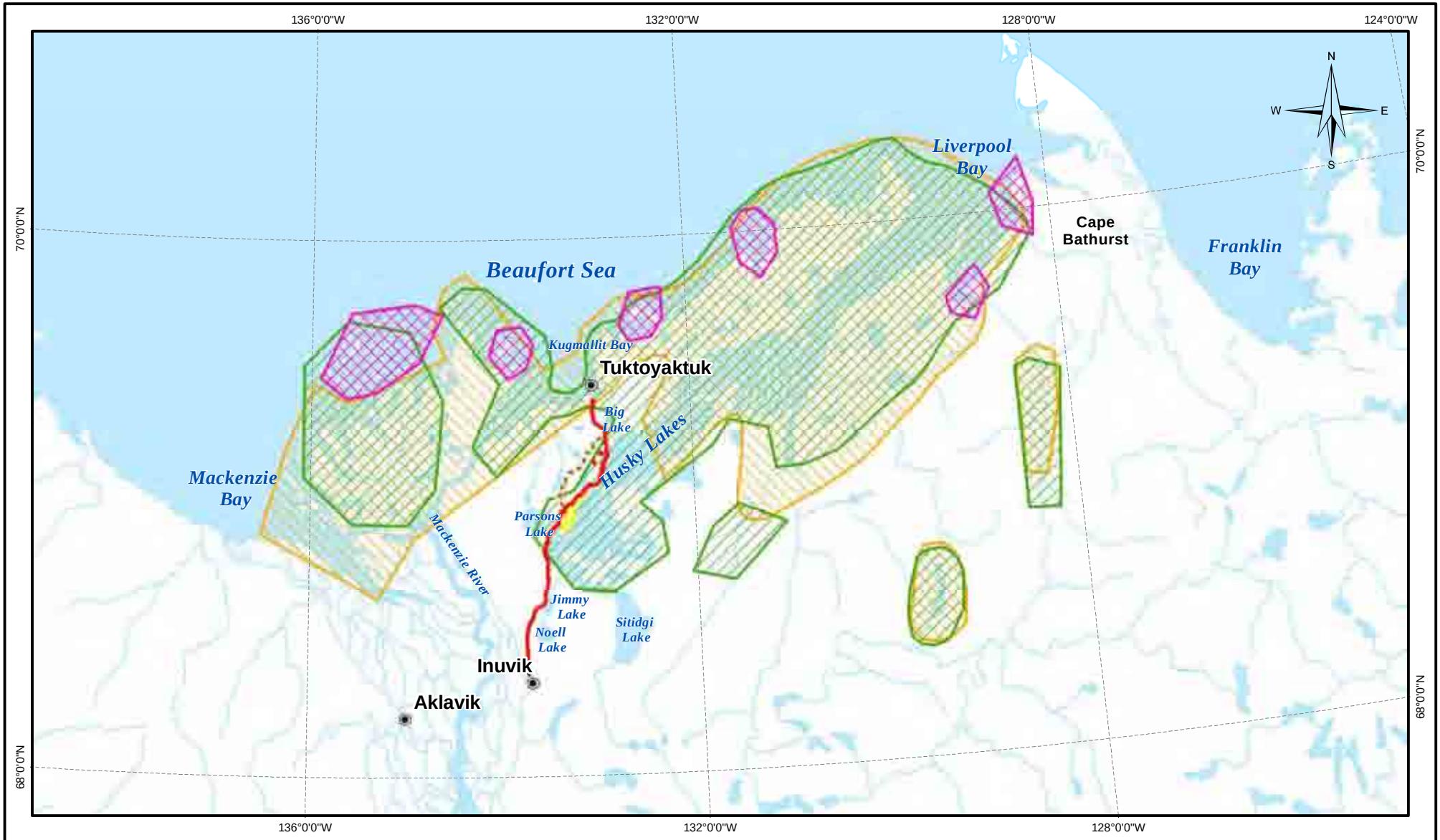


LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road
- 304C - Spring Goose Harvesting Area
- 308C - Summer Goose Harvesting Area
- 312C - Fall Goose Harvesting Area
- Area Where Geese Congregate
- Watercourse
- Waterbody

NOTES

Base data source: National Atlas
Goose Harvest Areas - Joint Secretariat Maps
Area of Geese Congregation - Community Consultation, Oct. 2009

ISSUED FOR USE

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70
Kilometres

PROJECTION	DATUM
Canadian Lambert Conf. Conic	NAD83

FILE NO.
V23201098_PDR-Map010-Trad-GooseHarv.mxd

Town of Inuvik · Northwest Territories · KIGGIAK - EBA

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Goose Harvesting Areas Spring, Summer, Fall

PROJECT NO.	DWN	CKD	REV
V23201098	KMW	TS	0

OFFICE	DATE
EBA-VANC	January 14, 2010

Figure 7.8-12

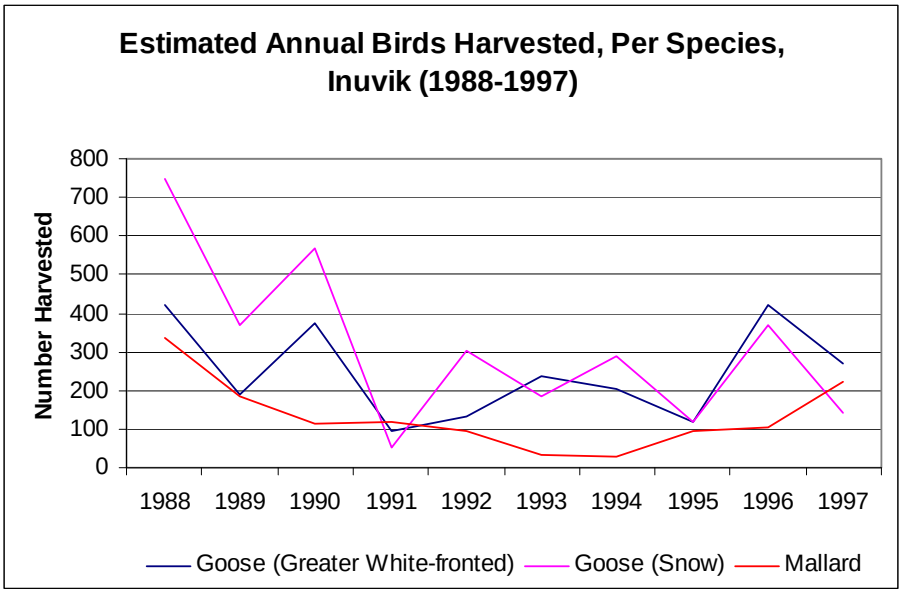


Figure 7.8-13
Estimated Annual Bird Harvest, Per Species, Inuvik (1988-1997)

Tuktoyaktuk

Birds are harvested in the Tuktoyaktuk Planning Area from May 1 to June 30 and August 1 to September 30 each year (Community of Tuktoyaktuk et al. 2000). As shown in Figure 7.8-14, the annual harvest rate of the greater white-fronted goose, snow goose and ptarmigan near Tuktoyaktuk have fluctuated considerably between 1988 and 1997 (Joint Secretariat, 2003).

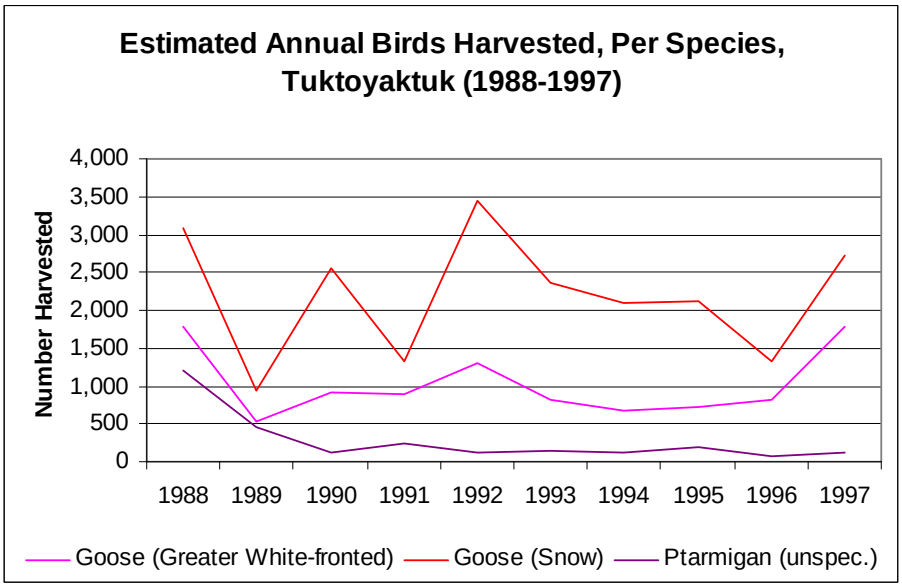


Figure 7.8-14
Estimated Annual Bird Harvest, Per Species, Tuktoyaktuk (1988-1997)

As shown in Figure 7.8-15, the annual harvest rates of eider and mallard ducks near Tuktoyaktuk have fluctuated considerably year to year between 1988 and 1997 (Joint Secretariat 2003). According to the available records, no mallards were harvested near Tuktoyaktuk between 1993 and 1997.

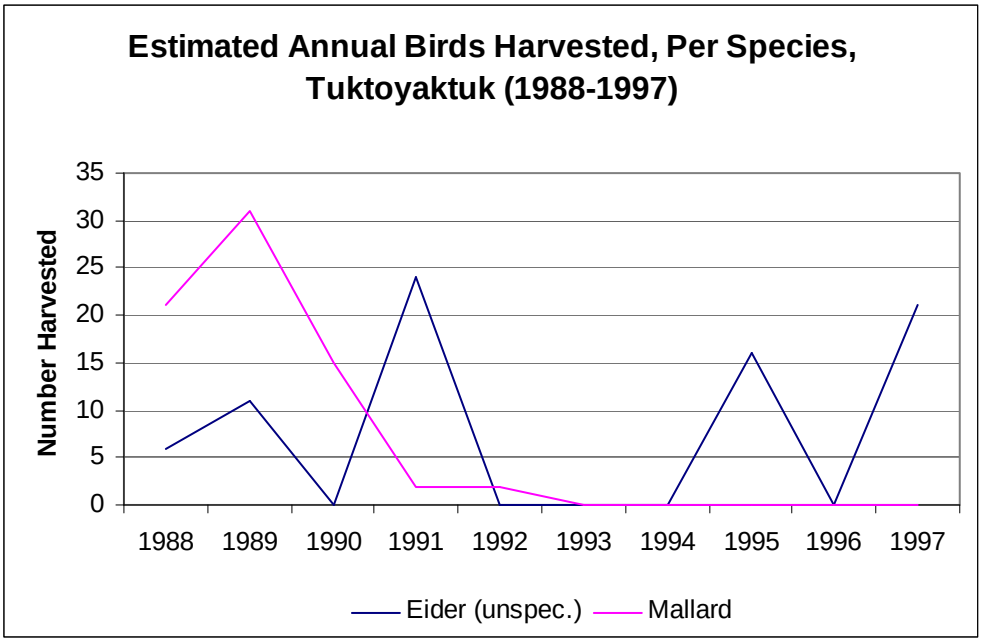


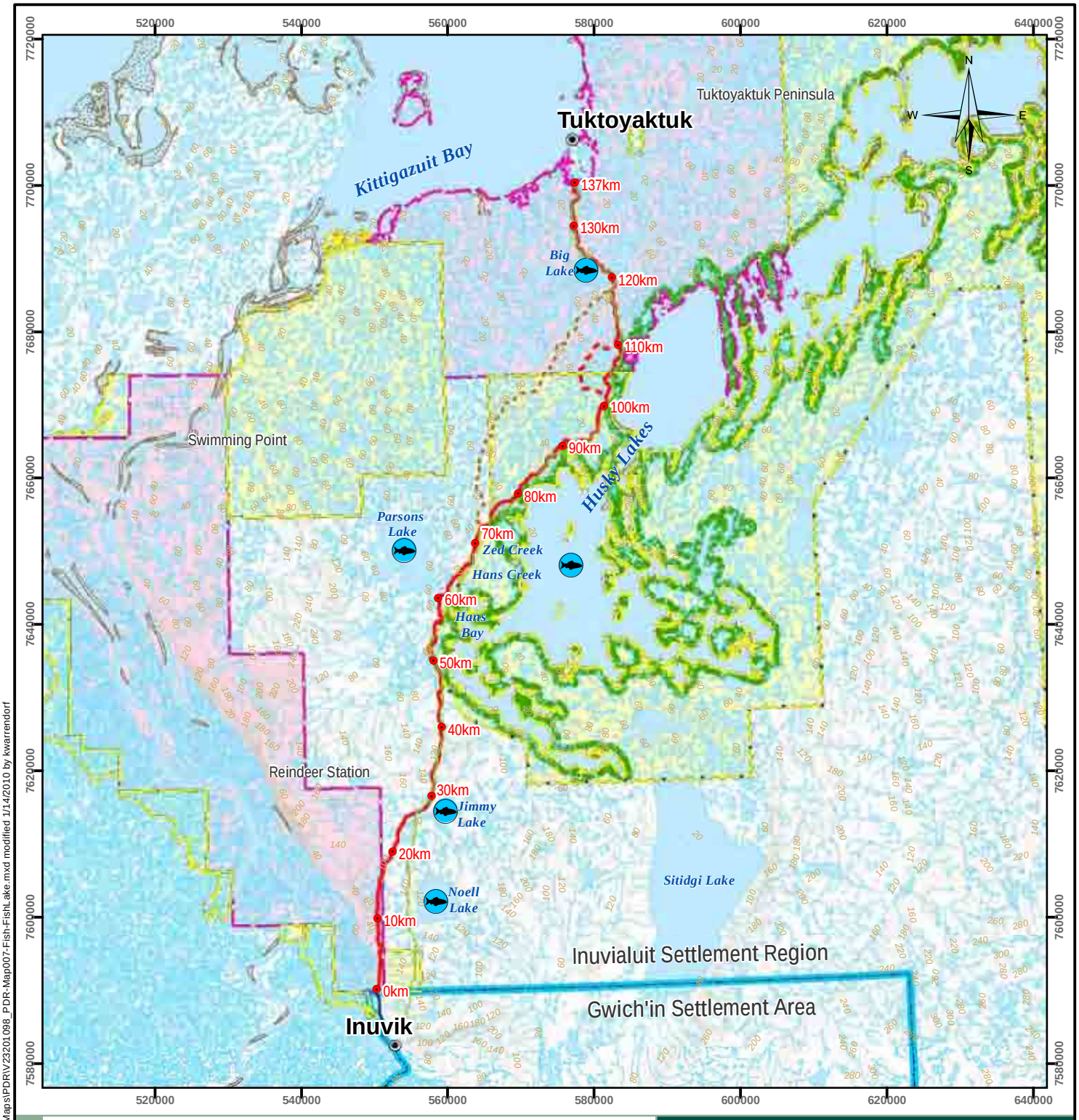
Figure 7.8-15
Estimated Annual Bird Harvest, Tuktoyaktuk (1988-1997)

7.8.3 Fish

Fish are an important food source for the Inuvialuit. The main fish bearing lakes along the proposed Highway alignment are depicted in Figure 7.8-16 while fish harvesting areas are depicted in Figure 7.8-17. Fish bearing lakes were identified by Rescan (1999) and IOL et al. (2004), while the fish harvesting areas are identified in the Tuktoyaktuk Community Conservation Plan (Community of Tuktoyaktuk et al. 2000).

Inuvik

Fish species harvested near Inuvik between 1988 and 1997 included Arctic grayling, inconnu, northern pike, lake trout, burbot, lake whitefish and broad whitefish. In general, the harvest of all fish species near Inuvik declined over the reported timeframe. As shown in Figures 7.8-18 and 7.8-19, the greatest reductions in harvest occurred in broad whitefish, from 21,557 in 1988 to 1,149 in 1997; lake whitefish, from 19,094 in 1988 to 261 in 1997; and burbot, from 8,772 in 1988 to 216 in 1997. The 1990 harvest year saw a considerable increase in the harvest of broad whitefish, burbot, and inconnu from the previous year (1989) before further declines were recorded from 1991 onwards.



LEGEND

- Fish Bearing / Ilkaasuat
- 2009 Route
- Other Alignments Considered
- Upland Route
- PWC 1977
- Navy Road
- Inuvialuit 7(1)(a) Lands
- Inuvialuit 7(1)(b) Lands
- Gwich'in / Inuvialuit Boundary
- Husky Lakes 1000m Setback
- Contour
- Watercourse
- Waterbody
- Wetland
- Sand

NOTES

Base data source:
NTS 1:250,000
Husky Lakes 1000m - Inuvialuit Land Administration

ISSUED FOR USE

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Fish Bearing Lakes Along the Proposed Alignment

PROJECTION: UTM Zone 8		DATUM: NAD83	
Scale: 1:750,000 (5 2.5 0 5 10 15 20 25 Kilometres)			
FILE NO.: V23201098_PDR-Map007-Fish-FishLake.mxd			
PROJECT NO.: V23201098	DWN: KWM	CKD: TS	REV: 0
OFFICE: EBA-VANC	DATE: January 14, 2010		

Figure 7.8-16

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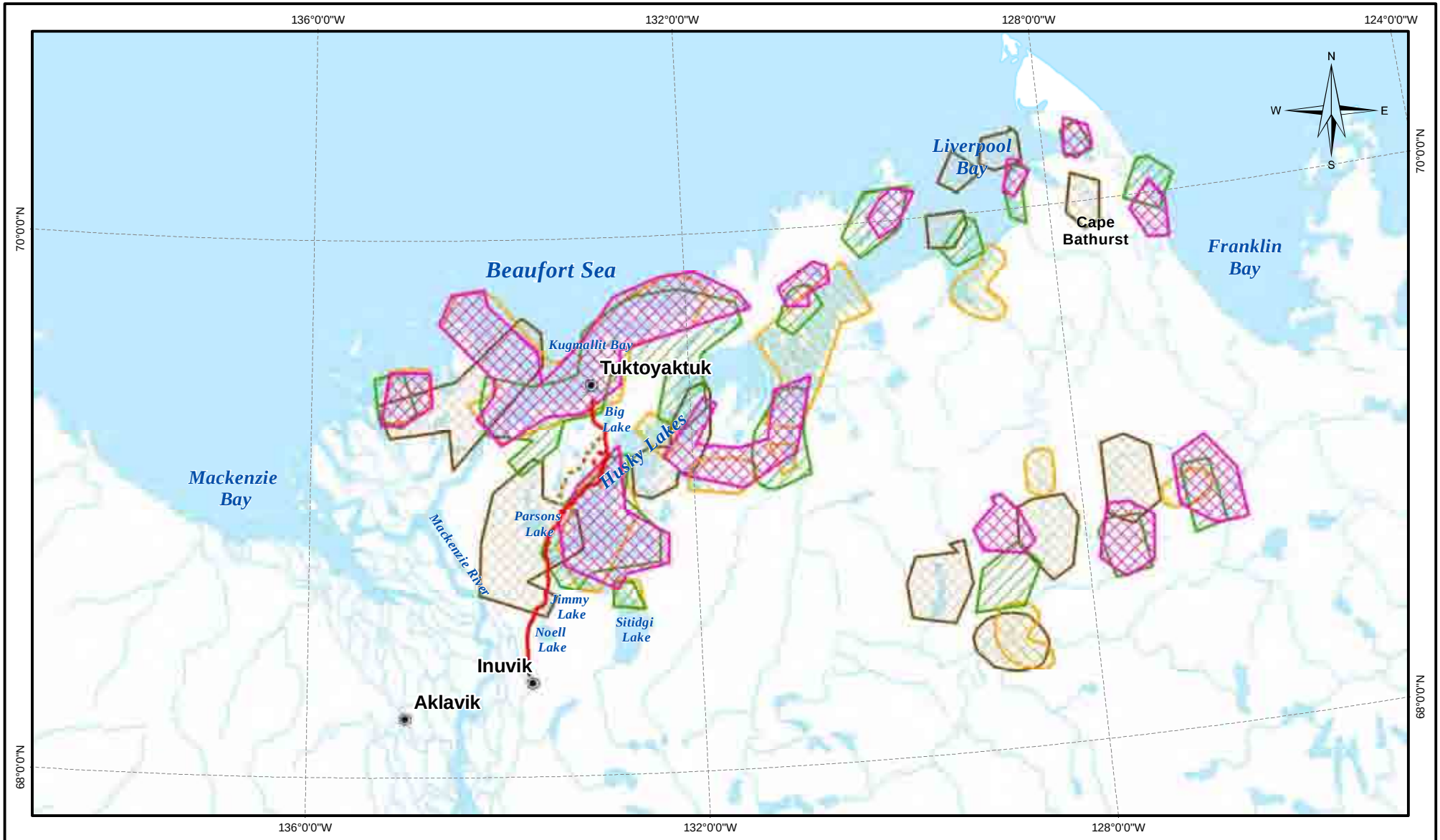

LEGEND

- 2009 Route
- Other Alignments Considered
- Upland Route
- Navy Road
- 305C - Spring Fishing Harvesting Area
- 307C - Summer Fishing Harvesting Area
- 310C - Fall Fishing Harvesting Area
- 316C - Winter Fishing Harvesting Area
- Watercourse
- Waterbody

NOTES

Base data source: National Atlas
Fishing Harvest Areas - Joint Secretariat Maps

ISSUED FOR USE

Scale: 1:2,250,000

10 5 0 10 20 30 40 50 60 70

Kilometres

PROJECTION	DATUM
Canadian Lambert Conf. Conic	NAD83

FILE NO.
V23201098_PDR-Map009-Trad-FishHarv.mxd

Town of Inuvik · Northwest Territories · KIGGIAK - EBA

PROPOSED INUVIK-TUKTOYAKTUK HIGHWAY

Fish Harvesting Areas
Spring, Summer, Fall, Winter

PROJECT NO.	DWN	CKD	REV
V23201098	KMW	TS	0

OFFICE	DATE
EBA-VANC	January 14, 2010

Figure 7.8-17

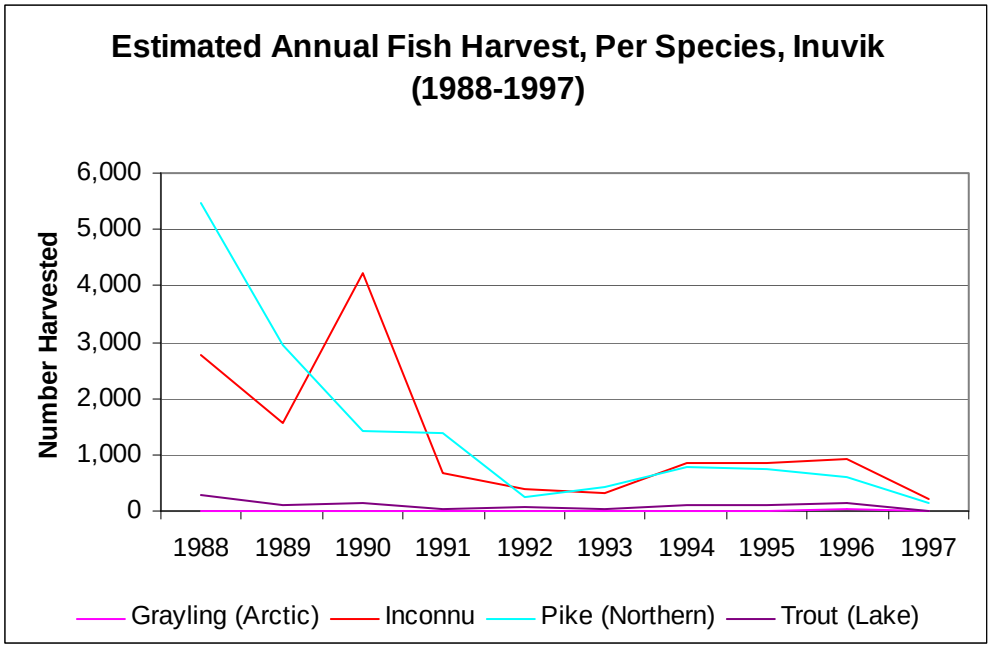

Figure 7.8-18
Estimated Annual Fish Harvest, Per Species, Inuvik (1988-1997)

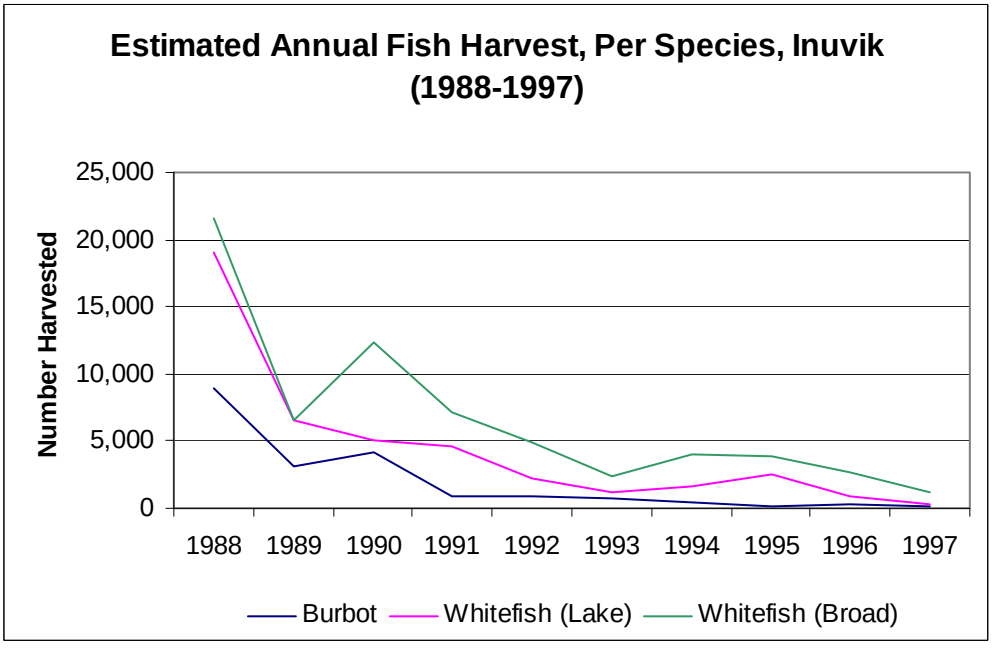

Figure 7.8-19
Estimated Annual Fish Harvest, Per Species, Inuvik (1988-1997)

Tuktoyaktuk

Fish species harvested near Tuktoyaktuk between 1988 and 1997 included inconnu, northern pike, lake trout, burbot, lake whitefish, broad whitefish and cisco. In general, the harvest of cisco near Tuktoyaktuk declined significantly over the reported timeframe. As shown in Figures 7.8-20 and 7.8-21, all other species showed minor fluctuations in the number harvested. Between 1989 and 1990, there was a considerable increase in the harvest of unspecified whitefish from 1988. Inconnu harvesting increased sharply in 1991, and declined again in 1992.

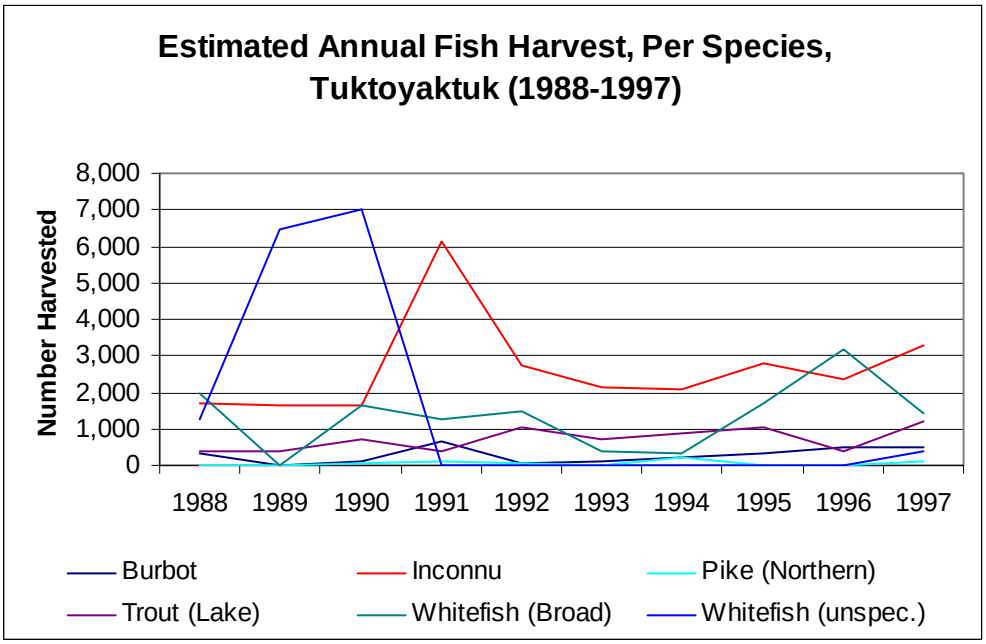

Figure 7.8-20
Estimated Annual Fish Harvest, Per Species, Tuktoyaktuk (1988-1997)

7.8.4 Berries

Berry (asiat) picking is an important summer activity (IOL et al. 2004; Kiggiak-EBA 2008). Key berry species include blueberry (*Vaccinium uliginosum* ssp. *alpinum* and ssp. *Microphylum*), or asivit, and salmonberry or cloudberry (*Rubus chamaemorus*), or aqpik. During the October 2009 consultation sessions held for the proposed Inuvik to Tuktoyaktuk Highway, a number of participants at Inuvik and Tuktoyaktuk identified berry picking as an important summer family activity. The participants also indicated that the future highway will help families to access new berry picking areas along the highway that they cannot get to at this time. Furthermore, several of the Tuktoyaktuk participants in the October 2009 consultation sessions also indicated that during the summer of 2009, a number of families drove down the completed portion of the Tuktoyaktuk to Source 177 Access Road to pick berries along the new road.

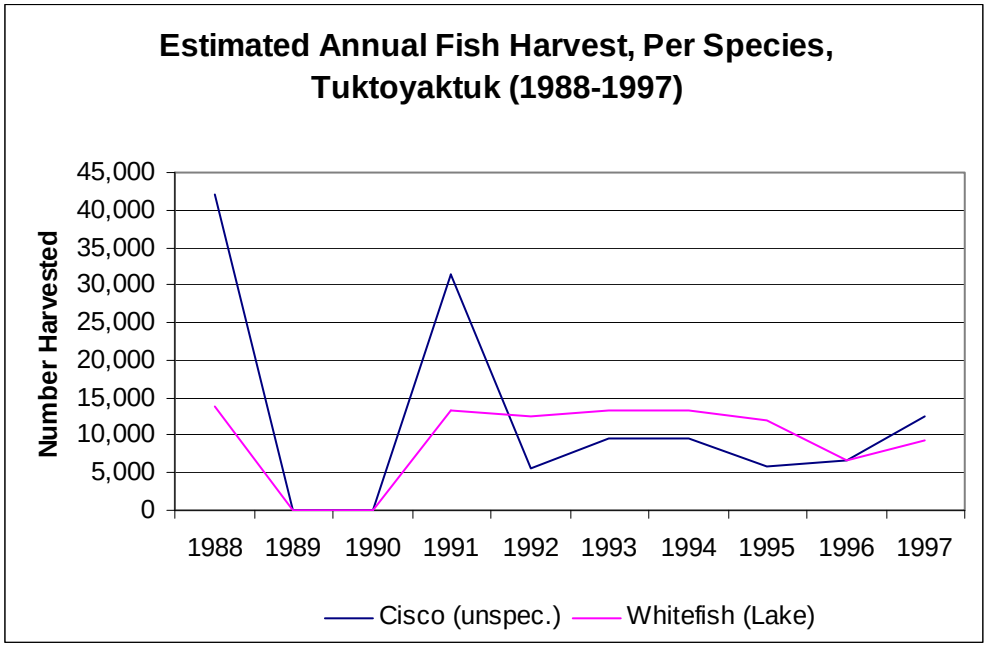

Figure 7.8-21
Estimated Annual Fish Harvest, Per Species, Tuktoyaktuk (1988-1997)

8.0 COMMUNITY CONSULTATIONS

Meetings and consultation sessions for the proposed Highway were held in Inuvik and Tuktoyaktuk in October 2009 and January 2010. These meetings were an important opportunity to share information about the project with the communities and to hear directly from residents about their interests, questions, and concerns. The October consultations provided insights that the Project Team incorporated into project planning and the development of the Project Description Report. The following section provides a brief description of the meeting content and outcomes. Detail about the parties consulted, meeting dates, discussion highlights, questions asked, and responses provided appear in Appendix A.

8.1 OCTOBER 2009 CONSULTATIONS

Planning and scheduling for the October 26-30, 2009 consultations began in September 2009. Organizations were contacted to establish availability and to open communication about any questions or comments on the prospect of the Highway. Once meeting dates were set, organizations were provided with confirmation of the meeting place, date, and time, and were also sent a Backgrounder (see Appendix A) that provided a preliminary overview of the proposed Project.

The community meetings in Inuvik and Tuktoyaktuk were publicized using notices on bulletin boards and television advertising in each community. The community meetings allowed approximately 1-2 hours before the presentation, and as much time as needed afterward for residents to view maps and posters and engage in discussion with the GNWT Department of Transportation and consultant representatives. Markers and maps were available to note harvesting areas; locations where traditional land use activities take place; heritage values; camps and cabin sites; recreation areas; route preferences; and any areas of concern. Usually, groups of three to five residents gathered around the maps and discussed areas and activities that are familiar and important to them. The presentation sessions lasted approximately two and three hours in Inuvik and Tuktoyaktuk, respectively. Questions and answers were encouraged throughout.

The first round of meetings and consultations were intended to provide the communities, organizations, and regulatory agencies with an introduction to the proposed Inuvik to Tuktoyaktuk Highway, to identify the project Partnership, project status, anticipated study and review schedule, answer preliminary questions, and receive advice, input and recommendations. The second round of meetings and consultations served to respond to questions from the October 2009 consultations, solicit community feedback on the updated project information, and gauge acceptability of the 2009 preferred route to put forward for EISC screening and subsequent regulatory review

Photo 8-1
Tuktoyaktuk Community Meeting, October 27, 2009

Photo 8-2
Tuktoyaktuk Community Meeting, October 27, 2009

Photo 8-3
Inuvik Community Meeting, October 28, 2009

Photo 8-4
Tuktoyaktuk Community Meeting, October 27, 2009

Photo 8-5
Inuvik Community Meeting, October 28, 2009

Photo 8-6
Project Team meeting with ILA in Tuktoyaktuk, October 27, 2009

In the summary provided in Appendix A, the main areas of interest discussed during community and regulatory consultations are broadly categorized as follows:

- Application of the Inuvialuit Final Agreement to the proposed Highway,
- Protection of special areas, in particular, the Husky Lakes area,
- Project-specific regulatory review and decision-making process,
- Possible subsequent developments,
- Route and route alternatives,
- Traditional land use and related cultural considerations,
- Project proponent,
- Project economics,
- Granular resource / borrows,
- Project schedule,
- Community social, economic, and cultural considerations,
- Associated infrastructure maintenance and allocation of responsibilities,
- Public safety,
- Reference to the Tuktoyaktuk to Granular Source 177 Access Road,
- Consultation approach,
- Areas for further investigation,
- Land tenure,
- Protection of wildlife, birds, and fisheries resources and habitat,
- Environmental and socio-economic mitigation and management planning,
- Construction specifications, and
- Items for discussion in January 2010.

The October 2009 consultations expanded views held by the Steering Committee and the Partners' about the acceptability of various alignment options. The prospect of development near the Husky Lakes was met with approval from some residents and concern from others. For the Project Team's consideration the communities, organizations, and agencies brought forward specific references and data to help assess the Highway project:

- the Inuvialuit Final Agreement, Sections 8, 13, and 14;
- the EIRB (2002; 2009) Husky Lakes Management Plan / Husky Lakes Criteria
- mapping data from the Inuvialuit Land Administration, including the 1 km Husky Lakes setback, granular resources data, and the location of registered cabins.

The follow-up items identified during the October 2009 sessions included the following:

- an invitation to the EISC to come to the January 2010 Highway meetings in Tuktoyaktuk;
- further investigation into the volumes, cost, and construction considerations for the Upland Route alternative to enable reasonable comparison to the 2009 Route. This effort took place in November and December 2009 to support the January 2010 consultations;
- elaboration in the Project Description Report regarding the history of Inuvik to Tuktoyaktuk highway proposals and studies;
- providing October 2009 consultation notes to the communities of Inuvik and Tuktoyaktuk prior to the January 2010 meetings;
- video conference presentation to a joint meeting of the EISC and EIRB in November 2009, and teleconference presentation to WMAC (NWT) in December 2009; and
- ongoing discussion with Inuvialuit and Federal regulatory agencies to establish the regulatory path for the project review.

8.2 JANUARY 2010 CONSULTATIONS

On December 18, 2009, community organizations were emailed advance notification that dates would soon be announced in Inuvik and Tuktoyaktuk for meetings during the week of January 11-15, 2010. On January 5, 2010, the community meetings were announced as concurrent evening sessions on Thursday, January 14, 2010. Bulletin board notices, television advertising and email notifications were sent out on January 5, 2010. As an additional awareness raising measure, the meetings were advertized on CBC Radio and CKLB FM on the Tuesday, Wednesday, and Thursday prior to the meetings.

The second round of meetings and consultations served to respond to questions and issues raised in the October 2009 consultations, to solicit community feedback on the updated project information, and to gauge acceptability of the 2009 Route to put forward for EISC screening and subsequent regulatory review.

On January 13, 2010, Indian and Northern Affairs Canada (INAC) hosted a meeting between a group of federal regulatory agencies and the Project Team. The agencies represented were Indian and Northern Affairs Canada, Fisheries and Oceans Canada, the NWT Water Board, and the Inuvialuit Land Administration. At the beginning of the meeting, Mr. Russell Newmark, a Steering Committee member, provided a statement about the 30 year history of the proposed Inuvik to Tuktoyaktuk Highway. The Project Team presented a project update and then responded to questions. The discussion addressed topics including sources of funding, water crossings, potential fisheries authorizations, the preferred and alternative alignments, the project cost estimate, proposed borrow sources (volumes, quality, and ice content), the proposed use of geotextile fabric for permafrost

protection, highway construction standards, a request for construction and maintenance phase sediment and erosion control plans, recommended additional studies, and a request for borrow source pit management plans.

The Project's regulatory timeline raised a number of questions during the January 13, 2010 regulatory meeting. For example, the Project Team was asked if the timeline considered the potential involvement of the Environmental Impact Screening Committee, the Environmental Impact Review Board, and screening under the Canadian Environmental Assessment Act (CEAA). As well, the Project Team was reminded that the review could take longer if a trigger for a 'comprehensive study' (a more rigorous federal assessment than a screening) under CEAA was invoked. The Project Team was advised that the federal CEAA process would start concurrently with the EISC screening, but there will be a point where the CEAA process must wait for input from the Inuvialuit process. In any event, the federal agencies must receive the Project Description in order to determine what their trigger is and how federal coordination, scoping, and staging would be done.

The Project Steering Committee was invited to meet with the Inuvik and Tuktoyaktuk Community Corporations, and the Inuvik and Tuktoyaktuk Hunters and Trappers Committees on January 13, 2010. The meeting provided an opportunity to discuss a variety of topics including the anticipated regulatory process, the alternative alignments, fisheries and water crossing concerns, the ban on caribou hunting additional information sources (e.g., fisheries data, potentially sensitive cultural sites), water sources, social concerns, existing camps and cabins at Husky Lakes, and traditional use.

Positive effects of the project were also discussed. Community Corporation representatives identified contracts, employment, and training benefits that would spread over several years. Mayor Gruben reported that the Tuktoyaktuk to Source 177 Access Road is regarded as "The Happy Road" because people are happy to be working on it and excited to see it becoming a reality. Candidate land tenure arrangements were suggested, along with identification of possible precedents. The meeting ended with final comments from each participant. There was an expression of support for the project to move forward to EISC screening and a commitment to on-going Project Team consultations with the Community Corporations and Hunters and Trappers Committees.

The two community meetings, held concurrently on January 14, 2010, were well attended and the clear consensus arising from both meetings was that the participants were generally supportive of the 2009 Route (Photo 8-7). Discussion points from the January meetings are presented in Appendix A. The outcomes of the meetings are summarized below.