# Road access to Cape Christian

# Fish and fish habitat assessment at stream crossings

REPORT

Municipality of Clyde River

August 2008

IMPACT FAUNE inc.

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# Fish habitat assessment at stream crossings

## REPORT

## Municipality of Clyde River

*Prepared by :*

**Sylvain Fleury**
Senior project manager

**Impact Faune inc.**

757 Rang # 4 L'Avenir (QC) J0C 1B0
Phone : 819-394-2819
Fax : 819-394-3368

Submitted to:

**Qikiqtaaluk Environmental Inc.**

3333 Queen Mary, suite 580
Montréal (Québec) H3V 1A2

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# 1.0 BACKGROUND

The environmental consulting firm Impact Faune inc. was mandated by Qikiqtaaluk Environmental Inc. to conduct a fish and fish habitat assessement at nine (9) stream crossings in the Municipality of Clyde River, Baffin Island.

More precisely, the purpose of the assessment relates to the repair of a 16 km road section between Clyde River and Cape Christian. Many benefits are expected from the road improvement, as it will permit easier access to the Cape Christian site for remediation work and, for the long term, it will allow local resident to access their boats in Davis Strait in the spring.

The present report therefore constitutes the central information to the permitting process for compliance with the *Fisheries Act* of Canada (DFO - Eastern Arctic Area).

In an environmental perspective, actual vehicles crossings along the existing road are occurring without bridge or culverts, resulting in a recurrent stream channel disturbance and sediment release in the aquatic habitat. Additionally, because of repeated passages on streambeds, fish passage, at least in low flow conditions, is impaired at several of the crossings assessed. Hence, it is expected that the installation of proper structures may be viewed as a remediation process by bringing long term stability at these crossings and allowing permanent fish passage.

## 1.1 Detailed assessment components

1) Conduct field surveys to verify fish presence in sections where stream crossings are planned;
2) Conduct a detailed aquatic and riparian habitat assessment in a section where crossing will occur;
3) Evaluate potential effects on fish or fish habitat, including area to be impacted, for those species present;
4) Finally, provide indicative guidelines and mitigation measures to avoid important disturbances during sensitive periods or habitat, avoid physical impacts on habitat and to propose mitigation measures to avoid sedimentation and measures to avoid spills.

## 1.2 Study sites

All sites are located along the 16 km existing road, which path appears on 1:20 000 and 1: 50 000 registered topographic maps (Figure 1). Details for the crossings are presented in table 1.

All sites location (coordinates and maps) for assessment and preliminary description were provided by Qikiqtaaluk Environmental Inc.[1] in mid-July 2008.

[1]: *Qikiqtaaluk Corporation (applicant): Application for Land use Permit, Department of Community and Government Services, Government of Nunavut, April 2008. 22 pages.*

**Table 1. Stream crossings localization and structure summary**
(provided by Qikiqtaaluk Environmental Inc., July 2008)

| Crossing No. | Stream name | Coordinates (Lat – Long) | Structure type | Expected culvert diameter (m) |
|---|---|---|---|---|
| | Clyde River | | Bridge | *Na* |
| 1 | Unknown | 70°29'06.73" - 68°30'29.96" | Culvert | 0,31 |
| 2 | Unknown | 70°29'42.94" - 68°28'28.33" | Culvert | 1,22 |
| 3 | Unknown | 70°30'32.04" - 68°24'39.53" | Culvert | 0,91 |
| 4 | Unknown | 70°30'32.78" - 68°23'47.98" | Culvert | 0,91 |
| 5 | Unknown | 70°30'32.29" - 68°23'39.36" | Culvert | 0,91 |
| 6 | Unknown | 70°30'37.52" - 68°21'51.25" | Culvert | 0,91 |
| 7 | Unknown | 70°30'27.00" - 68°20'22.22" | Culvert | 0,61 |
| 8 | Unknown | 70°30'13.34" - 68°19'35.94" | Culvert | 1,22 |

## 2.0 METHODS

The methods used to conduct the assessment followed standard techniques and procedures usually applied for fish and fish habitat studies at road crossings. The methodology utilized reflects the information needs listed in the Fisheries and Oceans Canada *Project Review Information Requirements* (DFO - Eastern Arctic Area) for compliance with the *Fisheries Act.*

Field surveys were conducted between July 23rd and July 27th 2008. Weather conditions were highly favorable to conduct the surveys during this period.

For both survey components, that is fish presence and habitat assessment, sampling and assessment were conducted on a 150 meters (m) section, corresponding at 50 m upstream of the crossing and 100 m downstream of it.

Also, in order to better evaluate fish utilization of the survey streams and the presence of critical habitats, local traditional knowledge was integrated in the assessment.

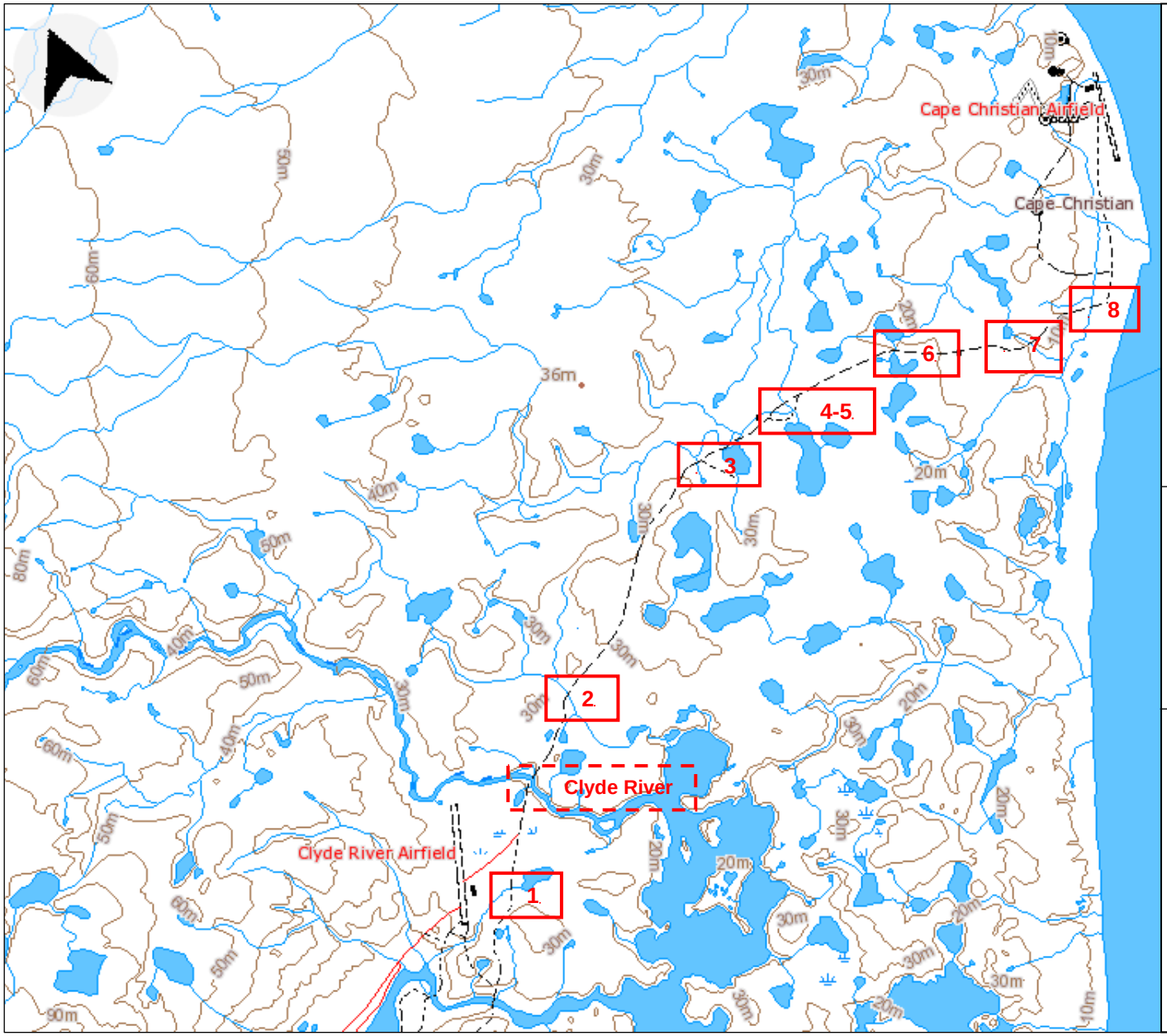



**FIGURE 1**

**Localization of stream crossings**

**LEGENDE**

Existing road (9 km):

Stream:

Lake:

Elevation (m):

Culvert crossing sites: (1-8)

Clyde River crossing: (bridge)

**Base map**

Geotiff SoftMap Technologies

Scale: 1: 20 000

27F/8 - Clyde River
27F/9 - Cape Christian

Surveys conducted July: 2008

Prepared for:

Qikiqtaaluk Environmental Inc.

## 2.1 Fish sampling

The sampling intensity and the variety of gear used reflect the study objectives, which are essentially restricted to fish presence. Sampling gears used consisted in beach seine, trap-net, dip net, rod and reel. Minnow traps were also used in order to estimate, as much as possible, the variety of species and life stages potentially present. Visual observation was also considered a valid confirmation of fish presence. All methods used were live capture gear.

All fish were identified to the species and life stage. A total of three (3 voucher specimens) were kept for identification validation. All other individuals captured were released at the place of capture, and pictures were taken for every species representative individuals.

At every site, fish sampling was conducted prior to habitat assessment, in order to better defined habitat quality in the perspective of the fish species observed.

## 2.2 Habitat assessment

Stream habitat assessment was planed and conducted in the aim of meeting three main objectives:

1) Describe the overall habitat availability and quality for the fish species present;
2) Determine if critical fish habitats occurred in the 150 m section where crossings are planned;
3) Evaluate if bio-physical conditions at crossings sites presented particular or specific issues that need to be considered in the structures installation.

The survey components collected in the field and their description are presented in table 2. For each section, pictures of representative features and conditions were taken for documentation.

## Table 2. Stream habitat assessment components

| Components | Criteria description |
|---|---|
| Channel width | The channel width is the width of the bankfull flood stage (spring levels) of the stream channel.<br>• Included all unvegetated gravel bars in the measurement. These generally show signs of recent scouring or deposition.<br>• Where multiple channels were separated by one or more vegetated islands, the width is the sum of all the separate channel widths (excluding islands).<br>• Several measurements were taken at representative sites along the section. |
| Wetted width | The wetted width is the width of the wetted portion of the stream channel at the time of survey. Where multiple channels occurred, then the separate widths were added together. |
| Depth | Depth measurements were taken in most representative channel features, such as portions of riffles, pools, glide and etc., and documented as such. |
| Gradient | Stream gradient was measured with a clinometers over distances of at least 50 m. |
| Channel morphology | Channel morphology of the section was classified as, glide, riffle-pool, cascade-pool or step-pool. |
| Valley confinement | Confinement is a visual assessment of the degree to which the lateral movement of a river channel is limited by relic terraces or valley walls. Channel confinement was classified as entrenched, confined or unconfined. |
| Flow conditions | Flow condition was classified as either permanent, intermittent of ephemeral. |
| Flow velocity | Water flow velocity was categorized based on appreciation classes corresponding to fast, moderate, low or glide. |
| Turbidity | Water turbidity was categorized based on appreciation classes corresponding (increasingly turbid) clear, moderate, high or opaque. |
| Substrate | Substrate was documented in terms of both type and composition along the survey section. The relative composition (%) of each type present was compiled. Substrate type corresponded to fine material (clay, silt and sand), intermediate (gravel and small cobbles) and large (large cobbles, boulder and bedrock).<br><br>Substrate composition was also recorded for the stream banks. |
| Vegetation | The presence of in-stream was document, as well as the banks and riparian vegetation. |

**Table 2. Stream habitat assessment components** (continued)

| Components | Criteria description |
|---|---|
| Cover | We considered as cover is any structure in the wetted channel or within 1 m above the water surface that provides hiding, resting, or feeding places for fish. Stream cover estimates are obtained from a visual assessment of the type and amount of in-channel covers available for fish.<br><br>Cover was documented in terms of both type and composition along the survey section. The relative abundance (%) of each cover type present was compiled:<br>• Large woody debris is any large piece of relatively stable woody material having a minimum diameter greater than 10 cm.<br>• Boulder stream substrate particles >256 mm in diameter that block stream flow to provide surface turbulence, shade and escape from higher velocity and predation.<br>• Undercut banks that consist of stream bank that has had its base cut away by the water and that overhangs part of the stream.<br>• Deep pool, as a portion of the stream with reduced current velocity at low flow, deeper than the surrounding area, and usable by fish for resting or cover (therefore containing some surface cover of flow turbulence).<br>• Overstream vegetation, as any vegetation that projects over the stream that is less than 1 m above the water surface.<br>• In-stream vegetation that provide protection for fish. |

**Table 3. Habitat quality evaluation scheme at crossings**

| | Critical | Important | Marginal |
|---|---|---|---|
| Definition | Habitat that is critical in sustaining a subsistence, commercial, or recreational fishery, or species at risk because of its relative rareness, productivity, and sensitivity. | Habitat that is used by fish for feeding, growth, and migration, but is not deemed to be critical. This category of habitat usually contains a large amount of similar habitat that is readily available to the stock. | Habitat that has low productive capacity and contributes marginally to fish production. |
| Indicators | The presence of high-value spawning or rearing habitat (e.g., locations with an abundance of suitably sized spawning gravels, deep pools, undercut banks, or stable debris, which are critical to the fish population present). | - Important migration corridors<br>- The presence of suitable spawning habitat<br>- Habitat with moderate rearing potential for the fish species present. | The absence of suitable spawning habitat, and habitat with low rearing potential (e.g., locations with a distinct absence of deep pools, undercut banks, or stable debris, and with little or no suitably sized spawning gravels for the fish species present). |

## 3.0 RESULTS

The study streams belong to two distinct watersheds, as sites No. 1, 2 and the Clyde River itself are part of the Clyde River watershed. Sites No. 3 to No. 8 belong to another watershed (unnamed), which outlet is located just south of the Cape Christian airfield (Figure 1).

### 3.1 Fish sampling

Fish presence was detected at five (5) of the nine (9) sites. A total of 11 individual fish were captured and all were arctic charr parrs (Table 4), ranging from 56 mm to 197 mm total length.

Despite a variety of gears used, no fish were captured in the other four (4) sites. Three of these sites (No. No. 1, 4 and 7) were actually without channel and presented no fish habitat or potential for passage even at higher local spring levels. Site No. 6, although water was present, has essentially no fish habitat even on a yearly basis.

Overall, apart from the Clyde River, the study streams presented poor or no fish habitat. Five of these streams however were fish bearing and fish passage is certain in these, at least when flow conditions are permissive.

### 3.2 Endangered species

In order to verify if rare or endangered species were potentially present in the study streams, the species listed for the Nunavut region was examined by consulting the COSEWIC (Committee on the Status of Endangered Wildlife in Canada).

Only one species was listed for the region, the fourhorn sculpin (*Myoxocephalus quadricornis*) but its designation as Special Concern in April 1989 was reconsidered in November 2003 and placed in the Data Deficient category. The lack of necessary data to evaluate the status of this species, combined with uncertainty regarding taxonomic status, made this change necessary.

Very little data are available on the habitat and biology of the fourhorn sculpin but it is known that the species occurs as a landlocked relict in cold, deep freshwater lakes. The fourhorn sculpin spawn during late in winter.

As a deep lake species, we do not expect the fourhorn sculpin in the habitat where crossings will occur and therefore we do not expect any impact on this species or its habitat.

## Table 4. Summary results of fish sampling surveys

| Crossing No. | Stream name | Gear used | Fish detected | Species | Potential for fish occurrence | Comments |
|---|---|---|---|---|---|---|
| | Clyde River | MNT, TPN VOB, ANG | Yes | Arctic charr (2) | Confirmed | - |
| 1 | Unknown | VOB | No | - | None | No water or channel, unlikely to have fish presence or passage even at spring water level. |
| 2 | Unknown | MNT, DPN VOB | Yes | Arctic charr (3) | Confirmed | - |
| 3 | Unknown | BSE | Yes | Arctic charr (2) | Confirmed | - |
| 4 | Unknown | VOB | No | - | None | No water or channel, unlikely to have fish presence or passage even at spring water level. |
| 5 | Unknown | MNT, DPN VOB | Yes | Arctic charr (3) | Confirmed | - |
| 6 | Unknown | BSE, MNT | No | - | Low | Intermittent flow, low potential for fish presence, with essentially no fish habitat. |
| 7 | Unknown | BSE, MNT | No | - | None | No defined channel; seepage alternating between surface and underground. No fish presence, passage or habitat even at spring water level. |
| 8 | Unknown | TPN, VOB | Yes | Arctic charr (1) | Confirmed | - |

BSE: (beach seine), MNT: (minnow trap), DPN: (dip net), TPN (trap net), ANG: (angling), VOB: (visual observation)

## 3.3 Habitat description

Tables 5 to 13 present the detailed habitat characterization for each crossing site, including pictures of the crossing site, as well as a downstream and upstream view.

Apart from the Clyde River, all other sites were dominated by fine material (sand) and presented low fish habitat quality for arctic charr for rearing and essentially no spawning habitat, all along the sections surveyed for each crossing. In the Arctic region, Arctic charr spawning habitat correspond to large river reaches with gravel beds and deep pools, characterized by depths varying from 1 m to 4,5 m and low velocity current (Scott and Crossman, 1974). Downstream of the Clyde River crossing sites spawning habitat availability is consider low, as for over 100 m the reach consist mostly of shallow rapids.

Habitat evaluation indicates that there are no critical habitats at the study streams, ranging from no habitat to marginal for the eight (8) culvert crossing sites, while the Clyde River was classified has an important habitat category (tables 5 to 13).

Given the very flat topography of the surroundings of the study sites, high spring levels were very difficult to delineate which, in return, rendered very difficult the identification delineation of channel bank widths. Clearly, water levels may exhibit limited rise in elevation and very low water velocity, but most streams surveyed lack of well defined channel so bank widths presented in the tables below must be interpreted with care as an indicator of fish habitat.

As a result of this topography, banks are very low at crossings sites, which has the advantage of lowering instability and impacts on aquatic habitats for the bridge and culverts installation.

Another common dominator to all sites is the important and frequent disturbance on the streams resulting from the actual passage of vehicles (trucks and quads) across the stream channel. Repeated passage is generating important sediments (sand) downstream of the crossings and obstacles for fish passage at the crossings themselves.

## Table 5. Biophysical parameters at the Clyde River crossing site

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| Clyde River | Yes | 40 | 20 | 0,70 | 2,0 | Riffle-pool | Unconfined | Permanent | Rapid | Clear | 10 | 50 | 40 | BLD: 90<br>DPO: 10 | Important |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)

**Upstream** **Crossing** **Downstream**

**COMMENTS**

Some moderate to good rearing habitat upstream and downstream of the crossing. No critical or important spawning habitat observed downstream.

## Table 6. Biophysical parameters at crossing site No. 1

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 1 | No | 0 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA | NA | NA | None |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)
NA: Not applicable

**Upstream** **Crossing** **Downstream**

**COMMENTS**

No channel or water present. Possible surface runoff may occur during snowmelt because the site is location in a terrain depression.

## Table 7. Biophysical parameters at crossing site No. 2

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 2 | Yes | 31 | 11 | 0,10 | 0,5 | Uniform | Unconfined | Permanent | Slow | Clear | 40 | 40 | 15 | ISV: 40<br>BLD: 60 | Marginal |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)

**Upstream** **Crossing** **Downstream**



**COMMENTS**

Very wide wetted areas on both side of the crossing, where the channel is not really defined. Channel width at the crossing (10,0 m) is actually narrower than the overall reach surveyed.

## Table 8. Biophysical parameters at crossing site No. 3

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 3 | Yes | 12 | 2 | 0,20 | 0,5 | Uniform | Unconfined | Permanent | Slow | Clear | 85 | 15 | | BLD: 100 | Marginal |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)

**Upstream**

**Crossing**

**Downstream**

**COMMENTS**

This crossing is located at approximately 10 m downstream of a small lake. Note that the downstream photo view is towards the crossing. Crossing likely represent a barrier to fish passage, at least in low flow conditions. Channel width at the crossing (4,0 m) is actually narrower than the overall reach surveyed.

## Table 9. Biophysical parameters at crossing site No. 4

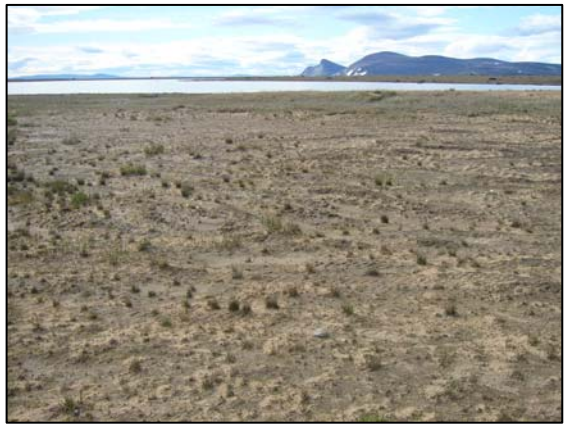
| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 4 | No | 0 | 0 | 0 | 0 | NA | NA | NA | NA | NA | NA | NA | NA | NA | None |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)
NA: Not applicable

**Upstream**

**Crossing**

**Downstream**



**COMMENTS**

No channel or water present. Possible surface runoff over road during snowmelt.

## Table 10. Biophysical parameters at crossing site No. 5

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 5 | YES | 3 | 1,5 | 0,10 | 0,5 | Uniform | Unconfined | Permanent | Slow | Clear | 100 | | | DPO, UBK ISV | None |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)

**Upstream**

**Crossing**

**Downstream**

**COMMENTS**

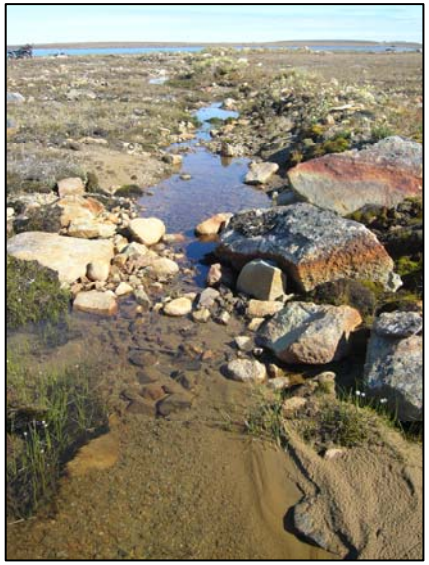
The crossing is located near a small lake (upstream). Fish passage in the downstream section must be occasionally impaired due to the lack of continuous channel, forming isolated water pockets. Habitat quality is considered as none, or marginal at best.

## Table 11. Biophysical parameters at crossing site No. 6

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 6 | No | 2 | 0,15 | 0,05 | 0,5 | Uniform | Unconfined | Intermittent | Slow | Clear | 20 | 40 | 40 | BLD: 100 | None |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)

**Upstream**



**Crossing**

**Downstream**

**COMMENTS**

The crossing is located near a small lake (upstream). As an intermittent flow conditions of the stream, reflect that of habitat availability for fish. In other words, fish usage of this stream may be limited to seasonal passage. On the downstream side, a culvert was observed but it appears functional only occasionally. Habitat quality is considered as none, or marginal at best. Crossing likely represent a barrier to fish passage, at least in low flow conditions.

## Table 12. Biophysical parameters at crossing site No. 7

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 7 | No | Seepage (alternate surface and underground runoff) | | 0,02 | 0,5 | NA | Unconfined | Ephemeral | | NA | NA | NA | NA | NA | None |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)
NA: Not applicable

**Upstream** **Crossing** **Downstream**



**COMMENTS**

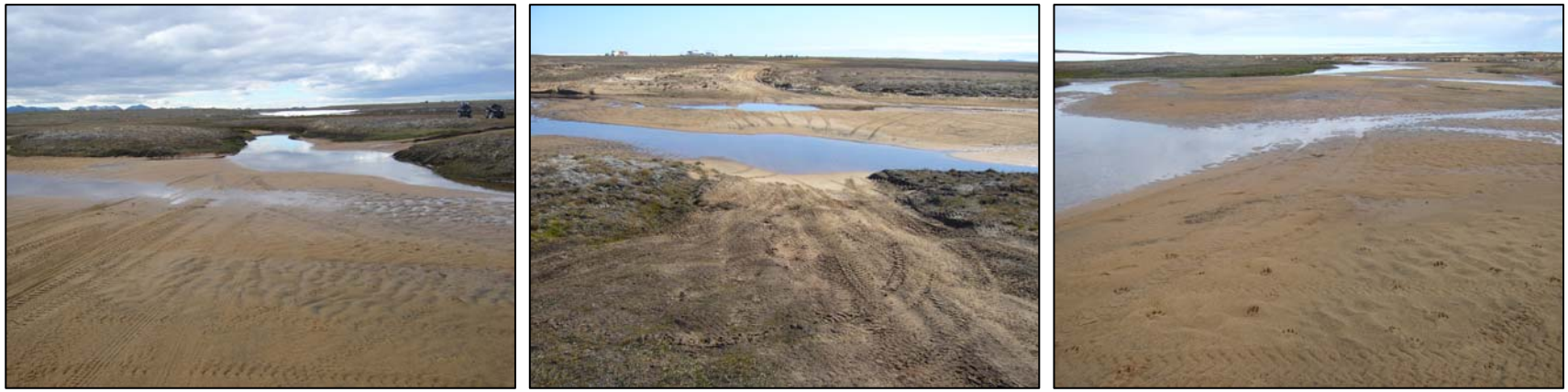
No defined channel. The water is limited seepage alternating between surface and underground. No fish presence, passage or habitat even at spring water level.

## Table 13. Biophysical parameters at crossing site No. 8

| Site No. | Fish Bearing | Width (m) | | Depth (m) | Gradient (%) | Channel morphology | Valley confinement | Flow | | Turbidity | Substrate [1] | | | Cover [2] | Habitat quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Channel | Wetted | | | | | Conditions | Velocity | | FNE | INT | LRG | | |
| 8 | Yes | 29 | 5 | 0,15 | 0,5 | Uniform | Unconfined | Permanent | Slow | Clear | 100 | | | 0 | Marginal |

1: FNE (fine), INT (intermediate), LRG (large)
2: LWD (large woody debris), BLD (boulder), UBK (undercut banks), DPO (deep pool), OVG (overhanging vegetation), ISV (in-stream vegetation)

**Upstream** **Crossing** **Downstream**



**COMMENTS**

Although water level was low at the time of survey, the width of the sand bars and the overall channel setting suggest that spring water volume must be important, although probably not of high velocity. In terms of habitat evaluation, habitat quality is evaluated as marginal, perhaps as ‘‘important’’ at best, because of fish passage to access upper-watershed better habitats.

## 4.0 IMPACTS EVALUATION AND RECOMMENDATIONS

Given the physical conditions and the fish habitat quality at most crossing sites assessed for culvert installation, we evaluate that the impact from the culverts installation will range from low to marginal.

All stream crossings with culvert installation planned have in common the following conditions that significantly reduce potential impacts on fish and fish habitat:

1) Absence of critical fish habitat,
2) Low flow during summer and fall,
3) Less that 0,5% stream slope,
4) Narrow channel at crossing sites due to the presence of the existing road,
5) Low stream banks absent or with very gentle slopes,
6) Absence of riparian vegetation (limiting the impact on this habitat type)
7) Culvert installation will remediate the impacts of the actual and recurrent vehicles crossings on streambed.

The existing road at crossing sites already concentrates water flow in a narrower channel than the bankfull width (see details in Section 3.3 of this report). Hence, measures of fish habitat surfaces underneath culverts and road slope embankement should be measured at actual crossing sites which reflect more accurately fish habitat conditions at crossings.

## Table 14. Summary information on culverts installation at the stream crossings

(Road and structures dimensions were provided by Qikiqtaaluk Environmental Inc., August 2008.)

| Site No. | Channel width at crossings (m) | Culvert [1] | | | Road characteristics at crossings | | | | Total in-stream surface area ($m^2$) [3] |
|---|---|---|---|---|---|---|---|---|---|
| | | Diam. (m) | Lgt. (m) | Area ($m^2$) | Pltaform width (m) | Slope embankement width (m) [1] | Total width (m) | Total surface ($m^2$) [2] | |
| 1 | 0 | 0,31 | 9 | 2,8 | 5 | - | - | - | NA |
| 2 | 10,0 | 1,22 | 9 | 11,0 | 5 | 4 | 9 | 79,0 | 90,0 |
| 3 | 4,0 | 0,91 | 9 | 8,2 | 5 | 3 | 8 | 23,8 | 32,0 |
| 4 | 0 | 0,91 | 9 | 8,2 | 5 | - | - | - | NA |
| 5 | 3,0 | 0,91 | 9 | 8,2 | 5 | 3 | 8 | 15,8 | 24,0 |
| 6 | 2,0 | 0,91 | 9 | 8,2 | 5 | 3 | 8 | 7,8 | 16,0 |
| 7 | 0 | 0,61 | 9 | 5,5 | 5 | - | - | - | NA |
| 8 | 29,0 | 1,22 | 9 | 11,0 | 5 | 4 | 9 | 250,0 | 261,0 |
| **TOTAL** | | | | | | | | **376,4** | **423,0** |

[1]: Based on a 1.5 length : 1.0 height slope ratio

[2]: Road total surface area at crossings: (Total width X Channel width) – Culvert area

[3]: Total in-stream area at crossings: (Total road surface + Culvert area)

**NA: Not applicable, as no channel and flow present.**

## 4.1 Guidelines and mitigation measures

The guidelines and mitigation measures presented below are presented as indicative and do not necessarily encompass all measures to be considered for the installation of crossing structures (bridge and culverts).

### 4.1.1 General

1) For the culverts crossings, since no critical habitats are present, including spawning habitat, the installation work should not be subject to a specific avoidance period. However, to minimize disturbance in streambeds it is recommended that work should be conducted during the low flow season (approximately mid-July to mid-October).

   For the bridge construction of the Clyde River, although no major work in the streambed is planned, the window of opportunity remains the same, to further limit the potential release of sediments from stream banks in the aquatic system (although sediments-catching fences should be installed-see below).

2) Designate a supervisor responsible for the surveillance and the proper application of the environmental protection measures at all sites, throughout the duration of work. The supervisor is also responsible to communicate all necessary procedures and guidelines to the contractor.

3) Delineate in the field the limits of the working area, in order to keep instream equipment activity to a minimum.

4) Delineate in the field the area where refueling, maintenance and cleaning of the machinery and equipment will be restricted. This area should be located at a minimum of 30 m away from the stream banks.

5) All construction equipment shall be inspected daily to ensure that leaks or discharges of lubricants, fuels, or hydraulic fluids does not occur.

6) Ensure that all necessary equipment and all construction materials are present and ready, to avoid any delays during installation work.

### 4.1.2 Culvert installation

1) Install all fence/geotextile where necessary to intercept sediment release and transportation downstream.
2) Prepare and grade the culvert bed to conform to the design elevation and gradient of the stream, using benchmarks, in order to lay the culvert at the same natural stream gradient.

3) The bottom of the culvert should be embedded at 20% below the streambed in fish-bearing streams (at both downstream and upstream ends), in order to allow fish passing at all natural flow conditions. In non-fish bearing streams, culvert embedment can be set at 10%.

4) The culvert foundation, trench walls, and backfill should be free of logs, stumps, limbs, or rocks that could damage or weaken the pipe. All materials used for culvert trench walls and backfill should be compacted to achieve maximum density.

5) Road slope embankements, down to each side of culvert bottom, should be covered with large size rocks (200 to 300 mm diameter), in order to prevent erosion. Thickness of the rip-rap should be 1.5 to 2 times the rock size.

## 5.0 CONCLUSION

We conducted fish and fish habitat assessment at nine stream crossings along a 16 km road between the Clyde River community and Cape Christian. Aside from the Clyde River crossing where a bridge is planned, all other sites will consist in culvert installation.

Fish were detected at 5 of the 9 sites. All were arctic charr parr. Habitat quality ranges from important (for the Clyde River) to none and marginal for the remaining streams.

Several factors contribute to estimate that the impacts relative to the bridge and culverts installation will not be significant. The most important element to consider here is that the most critical impact or disturbance is actually taking place by the passage of all vehicles across the channel. It is our opinion that the installation of the bridge and the culverts represent a short-term imperative, as it will remediate severe habitat degradation and obstruction to fish passage. Secondly, also because the existing road already crosses the streams and narrowed channels, losses of potential fish habitat at these locations will be marginal.

Finally, we propose provisional guidelines and mitigation measure to minimize habitat disturbance during structures installation, as well as general guidelines to ensure proper installation of those to ensure long term fish passage.

## REFERENCES

Scott, W.B et E. J. Crossman. 1974. Les poissons d'eau douce du Canada. Ministère de l'Environnement. Ottawa. Bulletin 184. 1 026 pages.