

CCI Project No. 2567

June 13, 2024

Gwich'in Land and Water Board
105 Veterans Way, P.O. Box 2018
Inuvik, NT
X0E 0T0

Attention: AlecSandra Macdonald, Regulatory Specialist

RE: Land Use Permit and Water License for Upgrades to Dempster Highway No. 8

On behalf of the Government of Northwest Territories – Infrastructure Branch (GNWT-INF), CCI Inc. (CCI) is submitting three (3) separate applications to conduct culvert upgrades along the Dempster Highway (Highway No. 8) (the Project). The upgrades include replacement of existing culverts to allow for increased flow and grout the existing culverts in-situ. The Project is located at three (3) distinct kilometre points (KM) along the Dempster Highway: KM 40.2; KM 147.0; and KM 266.1. Land Use Permits and Water Licenses are required for each culvert replacement location as workspaces extend past the Dempster Highway easement and the scope of work involves permanent watercourse retrainment to direct the watercourses to the new culvert installations.

Land ownership outside of the Dempster Highway easement includes territorial land and Gwich'in Private Settlement lands. Thus, separate Gwich'in Tribal Council applications for land access have also been filed. The current Gwich'in Land and Water Board (GLWB) applications are utilizing plans initially developed for the GNWT-INF application no. G21E001, such as the Engagement Plan and Waste Management Plan. Additionally, the Project has obtained three (3) separate Letters of Advice from Fisheries and Oceans Canada (DFO) for each culvert replacement location.

Construction will take place either over summer and into winter 2024, or over summer and into winter 2025 as a contingency, with reclamation taking place immediately after construction is completed. GNWT-INF's construction contractor will follow all mitigation measures as described in the Design Memo (CCI, 2023), Watercourse Crossing Environmental Protection Plan (CCI, 2022), and the associated application.

In addition to the completed application forms, CCI is please to provide the following site-specific attachments as part of the submission for each culvert replacement location:

- Watercourse Crossing Environmental Protection Plan (CCI)
- Design Memo (CCI)
- Temporary Workspace Shapefile (CCI)
- Crossing Overview Map (CCI)

To reduce file size, CCI has extracted the appendices from the respective Design Memos, which are saved individually by appendix title:

Edmonton Area Office

17816 – 118 Ave NW
Edmonton, AB T5S 2W3
P: 780.784.1990

Calgary Area Office

2600, 520 – 5th Ave. SW
Calgary, AB T2P 3E7
P: 403.932.0560

Cochrane Area Office

9, 214 Grande Blvd W
Cochrane, AB T4C 2G4
P : 403.932.0560

Vancouver Area Office

Unit 601, 1525 Robson Street
Vancouver, BC V6C 1C3
P : 604.416.3617

Houston Area Office

20445 State Hwy 249 Suite 250
Houston, TX 77070
P: 832.210.1030

- Site Drawing Package (CCI)
- Hydrotechnical Assessment (Tetra Tech/AECOM/Stantec/BluMetric Environmental)
- Geotechnical Report (Tetra Tech/Amec Foster Wheeler Environment & Infrastructure)

Further to the attachments listed above, CCI is pleased to provide the following site-specific attachments for information purposes only:

- Inspection Report (GNWT-INF)
- Fish Habitat Assessment (Kavik-Stantec/Stantec)
- Letter of Advice (DFO)

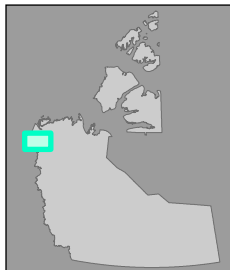
Upon review of the application package and attachments in support of the application, should you have any questions or require additional information please reach out to the undersigned at your convenience.

On behalf of CCI Inc.,

A handwritten signature in blue ink, appearing to read 'K. Sherwin'.

Kyle Sherwin
VP – Environmental Services
CCI Inc.

kyle.sherwin@ccisolutions.ca
587.227.9475



Project Areas

- KM 147
- KM 266
- KM 40

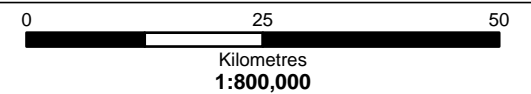
⊙ Populated Place

Highways

Hydrography

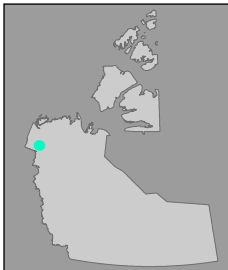
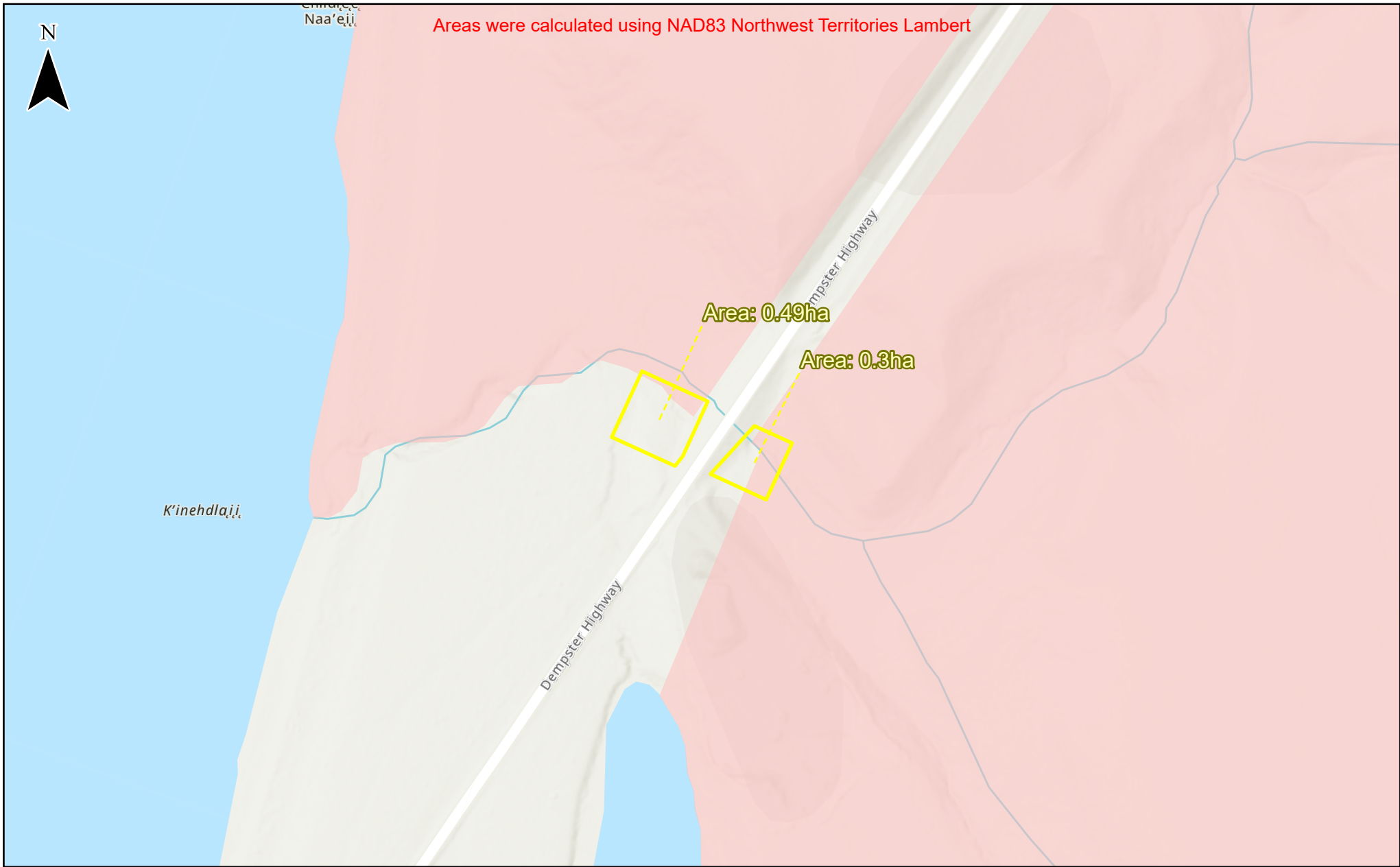


Government of Northwest Territories Dempster Culvert Replacement Location Overview



CCI Project #2567
Date: December 12, 2023

NAD 1983 Northwest Territories Lambert
File: LocView_2567_Dec12_2023
Layout: LocView_2567_Dec12_2023



⊙ Populated Places

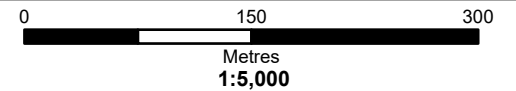
■ Gwich'in Private Land Boundaries

Project Areas

■ KM 147



Government of Northwest Territories Dempster Culvert Replacement Crossing Overview | KM 147



CCI Project #2567
Date: December 12, 2023


NAD 1983 Northwest Territories Lambert
File: LocOView_2567_Dec12_2023
Layout: XingOView_2567_June2024

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID 08C024

Inventory Data

Structure Name	HWY008-KM00147.0			
Structure Location	HWY008-KM00147.0			
Road Number	8	On <input checked="" type="checkbox"/>	Under <input type="checkbox"/>	
Road Name	Dempster Highway			
Watercourse Name	Unknown Name			
Crossing Type:	Road <input type="checkbox"/>	Rail <input type="checkbox"/>	Water <input checked="" type="checkbox"/> Navigable waterway <input type="checkbox"/>	
	River <input type="checkbox"/>	Other <input type="checkbox"/>	Creek <input checked="" type="checkbox"/> Pedestrian <input type="checkbox"/>	
Hwy Direction	3-SOUTH/NORTH			
Owner Category				
Maint.Resp.		Northing	67.48361	
Region	Inuvik	Easting	-133.76694	
District		National Highway System		
Municipality		Highway Designation		
Township		Hwy Functional Classification		
Structure Category	Culvert	AADT	80	No. of Lanes
Main Struct. Subcateg.	Culverts	Trucks (%)	3	Posted Speed
Main Struct. Type	Round Culvert	District Bridge Engineer	002	
Deck Length (Total)	60.00 (m)	Road Authority		
Overall Structure Width	3.66 (m)	Bridge Plan #		
Deck Area (Total)	219.60 (Sq.m)	Min. Vertical Clearance	(m)	
Width (Traffic)	(m)	Detour Distance	(km)	
Skew Angle		Speed on Detour	(kph)	
Number of spans	1	Fill Height	11.70 (m)	
Total Length / Spans (m)	Total = 1.83; (1) = 1.83			

Historical Data

Year Built	1975	Evaluation Year	
Last Biennial Inspection	August 14, 2018	Current Load Limit	
Last Bridge Master Inspection		Current BCI	51.40
Last Condition Survey		Current BCU	43.75
Last Underwater Inspection		Current SI	51.40
Rehab. History 2010-replaced			

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID 08C024

Scheduled Improvements

Regional Priority Number		Programmed Work Year	
Nature of Programmed Work			

Appraisal Indices

Comments

Load Capacity Index	10.0	
Flood Index		
Barrier Index		
Curb Index		
Seismic Index		
Fatigue Index		
Scour Index		
Structure Index		

Suspected Performance Deficiencies

- | | | |
|---|---|------------------------------|
| 00 None | 06 Bearings not uniformly loaded/unstable | 12 Slippery surface |
| 01 Load carrying capacity | 07 Jammed expansion joint | 13 Flooding/channel blockage |
| 02 Excessive deformations (deflections and rotations) | 08 Pedestrian/vehicular hazard | 14 Undermining of foundation |
| 03 Continuing settlement | 09 Rough riding surface | 15 Unstable embankments |
| 04 Continuing movements | 10 Surface ponding | 16 Other |
| 05 Seized bearings | 11 Deck drainage | |

Maintenance Needs

- | | | |
|--------------------------------------|---------------------------------|-------------------------------|
| 01 Lift and Swing Bridge Maintenance | 07 Repairs to Structural Steel | 13 Erosion Control at Bridges |
| 02 Bridge Cleaning | 08 Repair of Bridge Concrete | 14 Concrete Sealing |
| 03 Bridge Handrail Maintenance | 09 Repair of Bridge Timber | 15 Rout and Seal |
| 04 Painting Steel Bridge Structures | 10 Bailey bridges - Maintenance | 16 Bridge Deck Drainage |
| 05 Bridge Deck Joint Repair | 11 Animal/Pest Control | 17 Other |
| 06 Bridge Bearing Maintenance | 12 Bridge Surface Repair | |

Bridge Inspection Form

Struct. ID 08C024

Field Inspection Information

Inspection Date	August 14, 2018	Weather	Overcast
Inspector	Salim Sarwar	Temperature	4
Others in Party	Cameron, Seth, Lyndsay		
Equipment Used	Camera, Probe Rod, Range Finder, Tape, Binoculars, 2 ropes, harness		
Access Equipment Used	Ladder <input type="checkbox"/> Boat <input type="checkbox"/> Bucket Truck <input type="checkbox"/> Hip Waders <input type="checkbox"/> Access Key <input type="checkbox"/> Climbing Inspection <input type="checkbox"/> Under Bridge Inspection Unit <input type="checkbox"/>		

Special Notes

Monitor settlement and deformation; Check permafrost condition in the area, condition deteriorating

Upcoming Inspections and Investigations

Inspection Type	Due Date	Priority	Comment
Biennial	August 14, 2019		

Recommended Inspections and Investigations

Recommended Inspection Type	Due Date	Priority			Estimated Cost (\$)	Comments
		None	Normal	Urgent		
Material Condition Survey:						
Detailed Deck Condition Survey		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Non-destructive Delamination Survey of Asphalt-Covered Deck		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Concrete Substructure Condition Survey		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Detailed Coating Condition Survey		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Detailed Timber Investigation		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Post-Tensioned Strand Investigation		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Underwater Investigation		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Fatigue Investigation		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Seismic Investigation		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Structure Evaluation		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Monitoring						
Monitoring of Deformations, Settlements and Movements		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Monitoring Crack Widths		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

Overall Structure Recommendations:

Work Category	None <input type="checkbox"/>	Minor Rehab <input type="checkbox"/>	Major Rehab <input type="checkbox"/>	Replacement <input checked="" type="checkbox"/>	
Timing	None <input type="checkbox"/>	Urgent <input type="checkbox"/>	< 1 year <input checked="" type="checkbox"/>	1 - 5 year <input type="checkbox"/>	6 - 10 year <input type="checkbox"/>
Est. Total Cost	\$1,200,000				
Comments	Severe settlement and deformation.				

Bridge Inspection Form

Struct. ID 08C024

Element Data

Group	Culverts						Length	60.00 (m)
	Element	Barrels					Width	1.83 (m)
Cell Num							Height	1.83 (m)
Material	Corrugated steel						Count	1.00
Type	Pipe round						Quantity	344.772 (Sq.m)
Env't	Benign <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Severe <input type="checkbox"/>						Not Inspected	<input type="checkbox"/>
Location	Cell					Description	CSP, no bevel, skew 10, thick 4mm	
Condition Data	Unit	Excellent	Good	Fair	Poor	V. Poor	Perform. Deficiencies	Maintenance Needs
	Sq.m	8.619	181.005	86.193	68.954			

Comments

CR = 7

Not accessible, barrel completely sunk and settled, severe deformation, medium rust all through, clearance between water surface & crown 1.5m @ Q0 & 0m Q2, deteriorating condition

Performance Deficiencies

- 1-Load Carrying Capacity
- 2-Excessive Deformations
- 3-Continuing Settlement

Recommended Work

Recommended Work	Category	Timing	Quantity	Unit Cost	Total Cost (\$)
ST411 Replace Metal Culvert (sq.m.)	Replacement	< 1 year	1.000	1200000	1200000

1

Bridge Inspection Form

Struct. ID 08C024

Element Data

Group	Culverts						Length	N/A	(m)
Element	Inlet Components						Width	N/A	(m)
Cell Num							Height	N/A	(m)
Material	Other						Count		
Type	N/A						Quantity	10.000 (Sq.m)	
Env't	Benign <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Severe <input type="checkbox"/>						Not Inspected	<input type="checkbox"/>	
Location							Description		
Condition Data	Unit	Excellent	Good	Fair	Poor	V. Poor	Perform. Deficiencies	Maintenance Needs	
	Sq.m	0.000	2.500	5.000	2.500				
Comments									CR = 5
Jacked up.									
Performance Deficiencies									
4-Continuing Movements									
2									

Group	Culverts						Length	N/A	(m)
Element	Outlet Components						Width	N/A	(m)
Cell Num							Height	N/A	(m)
Material	Other						Count		
Type	N/A						Quantity	10.000 (Sq.m)	
Env't	Benign <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Severe <input type="checkbox"/>						Not Inspected	<input type="checkbox"/>	
Location							Description		
Condition Data	Unit	Excellent	Good	Fair	Poor	V. Poor	Perform. Deficiencies	Maintenance Needs	
	Sq.m	0.000	5.000	2.500	2.500				
Comments									CR = 0
Jacked up.									
Performance Deficiencies									
4-Continuing Movements									
3									

Bridge Inspection Form

Struct. ID 08C024

Element Data

Group	Embankments & Streams						Length	N/A	(m)
Element	Embankments						Width	N/A	(m)
Cell Num							Height	N/A	(m)
Material	N/A						Count	N/A	
Type	N/A						Quantity	2.000	(Each)
Env't	Benign <input type="checkbox"/> Moderate <input type="checkbox"/> Severe <input type="checkbox"/>						Not Inspected	<input type="checkbox"/>	
Location							Description	RW 6.5m Overall 10m	
Condition Data	Unit	Excellent	Good	Fair	Poor	V. Poor	Perform. Deficiencies	Maintenance Needs	
	Each	1.000	0.000	1.000	0.000				

Comments

Medium to severe erosion @ U/S around culvert, light erosion and gullyng

CR = 4

Maintenance Needs

13-Erosion Control at Bridges

Need Timing

1 Year

Performance Deficiencies

15-Unstable Embankments

Bridge Inspection Form

Struct. ID 08C024

Element Data

Group Element	Embankments & Streams						Length	N/A	(m)
	Slope protection						Width	N/A	(m)
Cell Num							Height	N/A	(m)
Material	N/A						Count	N/A	
Type	Crushed stone						Quantity	2.000 (Each)	
Env't	Benign <input type="checkbox"/>		Moderate <input type="checkbox"/>		Severe <input type="checkbox"/>		Not Inspected	<input type="checkbox"/>	
Location						Description	Steep slope and deep		
Condition Data	Unit	Excellent	Good	Fair	Poor	V. Poor	Perform. Deficiencies	Maintenance Needs	
	Each	2.000	0.000	0.000	0.000				

Comments

Steep and deep

CR = 0

Performance Deficiencies

0-None

Bridge Inspection Form

Struct. ID 08C024

Element Data

Group	Embankments & Streams					Length	N/A	(m)
Element	Streams and Waterways					Width	N/A	(m)
Cell Num						Height	N/A	(m)
Material	N/A					Count	N/A	
Type	N/A					Quantity	1.000	(All)
Env't	Benign <input type="checkbox"/> Moderate <input type="checkbox"/> Severe <input type="checkbox"/>					Not Inspected	<input type="checkbox"/>	
Location	Inuvik to the N, upstream coming from E					Description	High water 1.66m, velocity 0.1 m/s	
Condition Data	Unit	Excellent	Good	Fair	Poor	V. Poor	Perform. Deficiencies	Maintenance Needs
	All	0.000	0.000	0.000	1.000			

Comments

CR = 6

Beaver dam @ D/S, 2 channel inlet, water is in dark red color.

Maintenance Needs

Need Timing

11-Animal/Pest Control

Now

Performance Deficiencies

13-Flooding/channel Blockage

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID 08C024

Recommended Work (Element Level)

Element	Repair / Rehabilitation	Time					Estimated Cost (\$)
		None	Urgent	< 1 year	1 - 5 year	6 - 10 year	
Culverts / Barrels / Pipe round	ST411 Replace Metal Culvert (sq.m.)			X			1,200,000
Total Cost							1,200,000

Recommended Work (Structure Level)

Associated Work	Comments	Estimated Cost (\$)
Approaches		
Detours		
Other		
Traffic Control		
Utilities		
Total Cost		
Grand Total Cost:		\$1,200,000

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID 08C024



Description

Elem Grp/Class

Elem Type

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

Embankments & Streams/Embank

File Name 2 Looking from South to North.JPG



Description

Elem Grp/Class

Elem Type

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

Embankments & Streams/Streams

File Name 3.3 Upstream.JPG

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID 08C024



Description

Elem Grp/Class

Elem Type

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

Embankments & Streams/Streams

File Name 4.2 Downstream.JPG



Description

Elem Grp/Class

Elem Type

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

Culverts/Inlet Components

Other

File Name 5.1 Upstream elevation.JPG

Bridge Inspection Form

Struct. ID 08C024



Description

Elem Grp/Class

Culverts/Barrels

Elem Type

Pipe round

Sub Element

Material Type

Corrugated steel

Locator

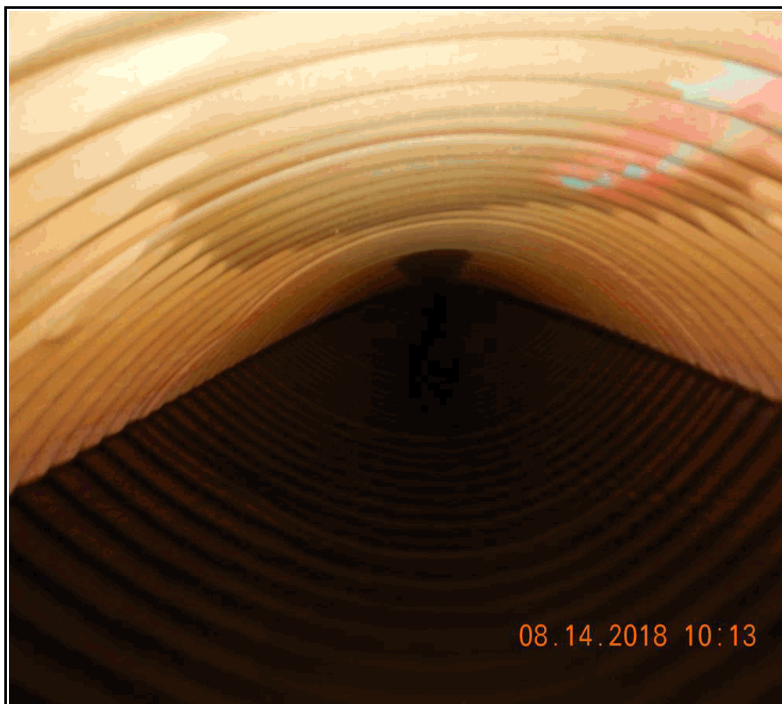
Defect Descript1

Defect Descript2

Defect

Other

File Name 6.1 Culvert looking downstream.JPG



Description

Elem Grp/Class

Culverts/Barrels

Elem Type

Pipe round

Sub Element

Material Type

Corrugated steel

Locator

Defect Descript1

Defect Descript2

Defect

Other

File Name 9 Culvert looking upstream.JPG

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID 08C024



Description

Elem Grp/Class

Culverts/Outlet Components

Elem Type

Sub Element

Material Type

Other

Locator

Defect Descript1

Defect Descript2

Defect

Other

File Name 10.1 Downstream elevation.JPG



Description

Elem Grp/Class

Embankments & Streams/Slope pr

Elem Type

Crushed stone

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

File Name 11 Upstream embankment.JPG

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID 08C024



Description

Elem Grp/Class

Elem Type

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

Embankments & Streams/Embank

File Name 12 Downstream embankment.JPG



Description

Elem Grp/Class

Elem Type

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

Culverts/Inlet Components

Other

Good condition

Erosion

File Name Erosion at inlet 1.JPG

Government of the Northwest Territories

Bridge Inspection Form

Struct. ID

08C024



Description

Elem Grp/Class

Embankments & Streams/Streams

Elem Type

Sub Element

Material Type

Locator

Defect Descript1

Defect Descript2

Defect

Other

File Name

Standing water at downstream 1.JPG

To:	Alexis Campbell, Environmental Analyst	From:	Erica Bonhomme, M.Sc., P.Geo. Project Manager
	Department of Infrastructure Government of the Northwest Territories Box 1320, 5015 – 49 Street Yellowknife, NT X1A 2L9		Stantec Consulting Ltd. 2nd Floor, 4910 – 53 Street Yellowknife, NT X1A 2P3
File:	144930112	Date:	February 8, 2019

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by the Government of the Northwest Territories, Department of Infrastructure (GNWT-INF), to conduct a fish and fish habitat assessment at KM 147.0 of Northwest Territories Highway 8 (Dempster Highway) for replacement of a crossing structure. The objective of the program was to:

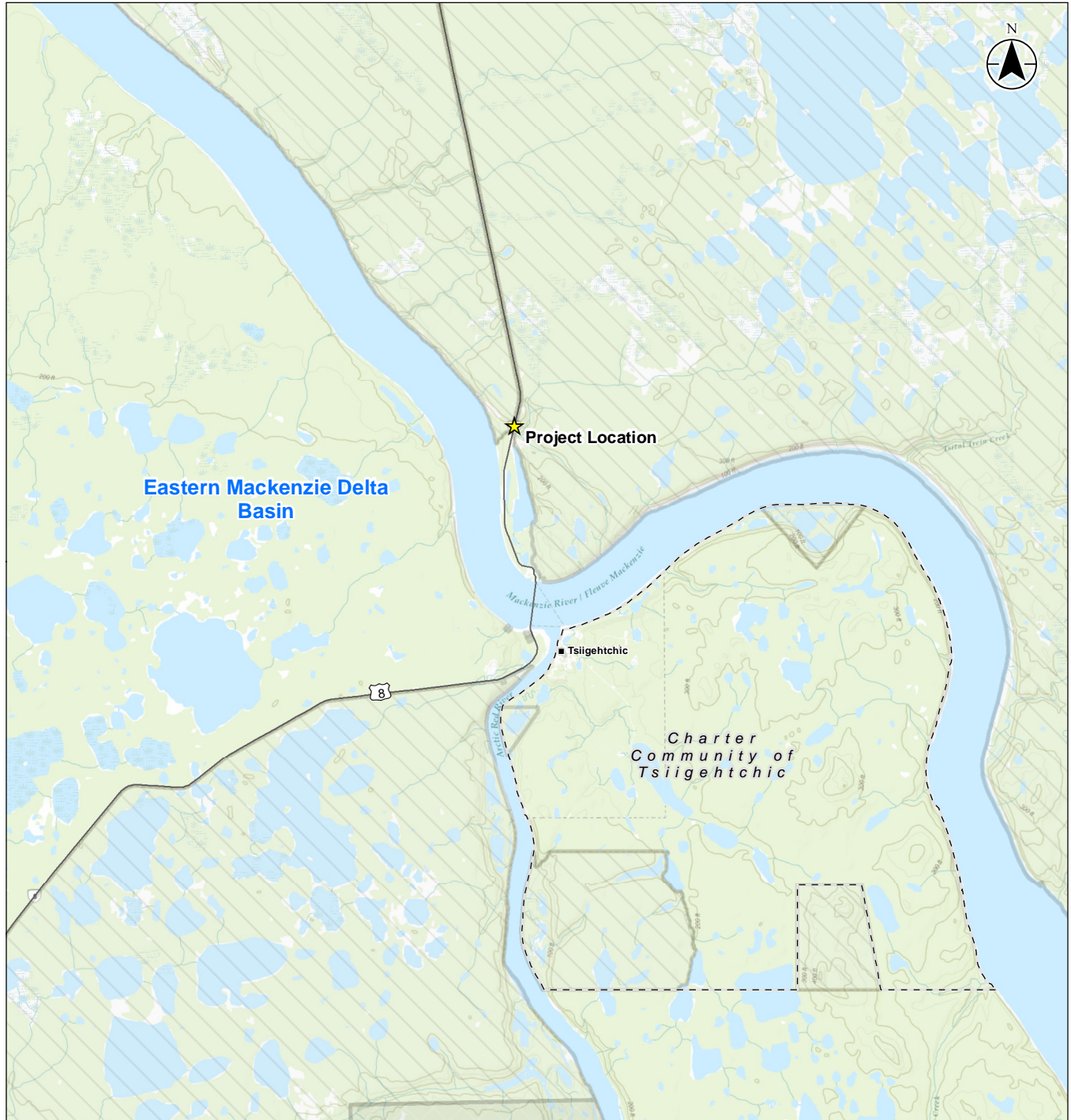
- Complete a field-level assessment of the watercourse and existing crossing location to document the existing conditions of fish habitat potentially affected by the proposed crossing structure replacement.
- Complete a fisheries assessment of the watercourse, including fish collection.

STUDY AREA

The unnamed stream at KM 147.0 is located at 67° 29' 2" N, 133° 46' 1" W (see Figure 1) within the Gwich'in Settlement Area. It is located within the Lower Mackenzie catchment of the Eastern Mackenzie Delta watershed. Upstream of the culvert crossing, a north and south branch is present. These two branches join approximately 5 m upstream of the culvert and continue to flow west into the culvert crossing underneath the Dempster Highway. Downstream of the culvert, the stream flows approximately 450 m southwest into the Mackenzie River. The community of Tsiigehtchic is 4.7 km south of the crossing (Figure 1), located near the south shore of the Mackenzie River, at the confluence of the Arctic Red River with the Mackenzie River.

The stream crossing is situated in the Level IV Arctic Red Plain High Subarctic (HS) ecoregion within the Level II Taiga Plains ecoregion¹. The Level IV Arctic Red Plain HS ecoregion is low-relief with a substrate of till and peat layers. Vegetation in the ecoregion consists of a combination of black spruce and low shrub forests, nearly treeless peat plateaus, shrubby fens and regenerating burn shrublands (GNWT 2009).

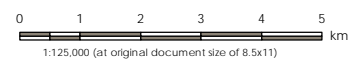
¹ In the Northwest Territories, Level II ecoregions are similar to "ecozones" from the Canadian National Ecosystem Classification Framework (GNWT 2009). On the mainland Northwest Territories, the Southern Arctic ecozone has been split into two Level II ecoregions: Tundra Plains and Tundra Shield (GNWT 2009).



Notes
 1. Coordinate System: NAD 1983 UTM Zone 8N
 2. Data Sources: Base Data:
<http://www.geomatics.gov.nt.ca>, Esri World Topo Map

- City/Town
- Highway
- Road
- Local Street
- Watercourse
- Waterbody
- - - Municipal Boundary
- Eastern Mackenzie Delta Basin
- ★ Project Location
- Aboriginal and Inuit Owned Lands-Gwich'in Settlement Land
- Surface
- Surface/Subsurface

* The map extent is completely within the Eastern Mackenzie Delta Watershed



Project Location: NIS Mapsheet: 106N05
 Project Number 144930112
 Prepared by DJOZSA on 20181025
 Discipline Review by CSIBBALD on 20181025
 GIS Review by IDINNEEN on 20181026

Client/Project
 Government of Northwest Territories
 Fish Habitat Assessments for Crossing Replacement

Figure No.

1

Title
 Site Overview of the Stream Crossing at KM 147.0 of NWT Highway 8

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

METHODS

RESEARCH LICENCING

In advance of obtaining necessary regulatory approvals for the field assessment, an information letter was sent to the Gwich'in Renewable Resource Board (GRRB), Nihtat Gwich'in Renewable Resources Council, and Gwichya Gwich'in Renewable Resources Council (GGRRC) for comment. In response, the GRRB provided several comments on the program related to wildlife presence, species at risk, and safety; and, the GGRRC advised of the requirement to retain a monitor from Tsiigehtchic. An application to access Gwich'in Owned Lands was also submitted to the Gwich'in Tribal Council for review. Notice of exemption was received from the Gwich'in Tribal Council before the field program began. A Scientific Research License (No. 16392) was issued by the Aurora Research Institute; and, a Licence to Fish for Scientific Purposes and an Animal Use Protocol were also issued by Fisheries and Oceans Canada (DFO) in advance of the field program.

FISH HABITAT

Fish habitat surveys were conducted at eight cross-sectional transects as shown in Figure 2. Habitat and channel characteristics were recorded at: 100 m and 50 m upstream of the crossing (in the north and south branches); at the stream crossing (immediately upstream and downstream of the culvert); and, 100 m and 200 m downstream of the crossing. Stantec was unable to complete an assessment 300 m downstream of the crossing, as originally planned, due to safety and time restrictions. Fish habitat collection methods were based on the British Columbia Resource Inventory Committee (RIC) standards for fish and fish habitat data collection (BC RIC 2001) because the Northwest Territories does not have their own established protocols. The BC RIC (2001) standards were developed to collect stream reach data to interpret habitat sensitivity and capability for fish production (BC RIC 2001) and provide sufficient information to assess potential impacts of linear developments (e.g., road crossings). Stantec completed a site card describing fish habitat and watercourse characteristics of the stream at KM 147.0 within the proposed crossing area. The site card includes parameters provided on a standard RIC card and additional relevant information (see Table 1).

Table 1 Channel and Fish Habitat Parameters Surveyed

Parameter	Field and Analysis Methods
Channel characteristics	Recorded at transects with measuring stick, measuring tape, or rangefinder (as appropriate). Gradient recorded with clinometer. Characteristics included: width of bed and top of bank, bankfull depth and average channel water depth (at time of survey), and dominant habitat unit (e.g., riffle, rapid, pool, run)
Substrate composition	Visual estimate of percent composition of channel bed substrates and embeddedness in the surveyed portion of the watercourse.
Bank characteristics	Visual inspection of stream banks along the surveyed stream. Characteristics included: height, slope, stability, percent vegetation cover, and bank materials
Cover	Visual inspection of cover present in the surveyed portion of the watercourse. Includes percent total of instream, overhead and aquatic cover.
Vegetation characteristics	Visual estimate of percent composition and abundance of instream vegetation, riparian width and crown closure.

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

Table 1 Channel and Fish Habitat Parameters Surveyed

Parameter	Field and Analysis Methods
Physical morphology	Visual inspection of channel morphology present in the surveyed portion of the watercourse. Characteristics included: pattern type, bars, coupling, and confinement.
Additional features	Additional observations during the survey including barriers to fish passage, culverts, and other watercourse features.

Photographs were taken at each transect (upstream, downstream, left downstream bank, right downstream bank) and of any noted features along the watercourse. In-situ water quality measurements (e.g., temperature, pH, specific conductivity) were planned but were not collected as the equipment did not arrive in time for the survey.

FISH PRESENCE

Fish collection was planned for the watercourse at KM 147.0, but not completed due to malfunction of the electrofishing equipment. Fish presence records are not available for this watercourse but are available for the downstream Mackenzie River, into which the stream flows. Potential fish presence was determined based on connectivity to other water bodies, quality of habitat surveyed, and observation of barriers to fish passage.

Fish presence data were reviewed from the following documents:

- *Traditional knowledge of fish migration and spawning patterns in Tsiigehtjik (Arctic Red River) and Nagwichoonjik (Mackenzie River), Northwest Territories* (Thompson and Miller 2007)
- *Distributions of Freshwater and Anadromous Fishes from the Mainland Northwest Territories, Canada* (Sawatzky et al. 2007)



Notes
1. Coordinate System: NAD 1983 UTM Zone 8N
2. Data Sources: Imagery: GNWT ATLAS imagery 2004

- Mackenzie Valley Elevation Contours
- ◆ Beaver Dam
- Survey Transect Location

0 25 50 75 100 m
1:2,500 (at original document size of 8.5x11)



Project Location: NTS Mapsheet: 106N05
Project Number: 144930112
Prepared by: DJOZA on 20181025
Discipline Review by: CSBBALD on 20181025
GIS Review by: IDINNEEN on 20181026

Client/Project:
Government of Northwest Territories
Fish Habitat Assessments for Crossing
Replacement

Figure No.

2

Title

Fish Habitat Survey Locations for the
Stream Crossing at KM 147.0 of NWT
Highway 8

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

RESULTS

FISH HABITAT

Two qualified biologists conducted a field survey of the crossing location at KM 147.0 on August 31, 2018. Transect locations are presented in Figure 2 and habitat data for the crossing area are summarized in the attached habitat summary sheet. Photographs at each survey transect are also attached.

At the existing watercourse crossing a 1.8 m diameter 62 m long, round steel corrugated culvert is present. On the upstream side the culvert was measured as being 2.0 m diameter (culvert top to bottom measurement) likely due to the culvert level of embeddedness at this end. The culvert on the downstream side had previously been measured at 1.7 m diameter suggesting the culvert is deformed.

Water depth at the time of assessment was approximately 0.7 m immediately upstream of the culvert and an unknown depth downstream of the culvert (deep pool) but estimated to be greater than 1.5 m given the height of culvert underwater at the downstream end (see Photograph ID 9).

Immediately upstream of the culvert, the channel width was 3.9 m, wetted width was 3.8 m and residual pool depth was 0.31 m. Habitat was primarily run with a gradient of 2%. Immediately downstream of the culvert, the channel and wetted width widened to an estimated 30 m. A deep pool (estimated greater than 1.5 m bankfull depth) was present created by a beaver dam approximately 15 m downstream of the culvert (see Figure 2). The beaver dam was 0.6 m in height and may be a barrier to fish passage.

Immediately upstream and downstream of the culvert, the dominant stream bed substrate was fines, with organic subdominant substrate. Stream banks were moderately stable to stable and less than 1 m in height with sloped banks (3 to 7°) except for a vertically sloped (greater than 45°) downstream left bank. Upstream of the culvert, vegetation cover was 100%, primarily consisting of grasses. Downstream of the culvert, vegetation cover was also 100% but primarily consisted of shrubs. Bank materials were primarily fines upstream and downstream of the culvert. Abundant cover (estimated greater than 70%) was present at the crossing, provided primarily by overhanging vegetation and small woody debris upstream of the culvert, and the deep pool downstream of the culvert.

Spawning habitat for fish species which require gravel substrate for spawning was rated as poor immediately upstream and downstream of the culvert due to a lack of gravel substrate. Fines and instream vegetation present in the beaver dam pool downstream of the culvert may be suitable for northern pike spawning, or other species that prefer dense vegetation. The deep pool downstream of the culvert likely provides good rearing habitat, but overall rearing potential at the existing crossing is rated as moderate. The deep pool downstream may provide overwintering habitat for fish but at the crossing site and upstream of the crossing overwintering potential is rated poor due to shallow depths in these locations. Migration is rated as poor because the beaver dam may be a barrier or partial barrier to fish passage thereby limiting movement between the stream and Mackenzie River.

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

FISH PRESENCE

Fish collection was not completed due to electrofisher malfunction during the field survey. Observations of fish in the pool created by the beaver dam immediately downstream of the culvert could not be verified.

Known and potential fish species present in the Mackenzie River and that have potential to use the unnamed watercourse at KM 147.0 are presented in Table 2. As noted, the watercourse at KM 147.0 flows into the Mackenzie River approximately 450 m downstream of the existing crossing location. Data were compiled from references noted above.

Table 2 Potential Fish Species in Unnamed Stream at KM 147.0 of NWT Highway 8

Species	Scientific Name	Presence in Mackenzie River	Sport Fish	NWT GSRank ³	SARA Status ⁴
Arctic lamprey	<i>Lampetra camtschatica</i>	Known ^{1,2}	No	Undetermined	None
Lake chub	<i>Couesius plumbeus</i>	Known ^{1,2}	No	Secure	None
Spottail shiner	<i>Notropis hudsonius</i>	Known ²	No	Secure	None
Finescale dace	<i>Phoxinus neogaeus</i>	Known ²	No	Undetermined	None
Flathead chub	<i>Platygobio gracilis</i>	Known ^{1,2}	No	Secure	None
Longnose dace	<i>Rhinichthys cataractae</i>	Known ^{1,2}	No	Secure	None
Longnose sucker	<i>Catostomus catostomus</i>	Known ^{1,2}	Yes	Secure	None
Northern pike	<i>Esox lucius</i>	Known ^{1,2}	Yes	Secure	None
Pond smelt	<i>Hypomesus olidus</i>	Known ²	No	Undetermined	None
Rainbow smelt	<i>Osmerus mordax</i>	Known ²	No	Undetermined	None
Cisco	<i>Coregonus artedii</i>	Known ^{1,2}	Yes	Secure	None
Lake whitefish	<i>Coregonus clupeaformis</i>	Known ^{1,2}	Yes	Secure	None
Broad whitefish	<i>Coregonus nasus</i>	Known ^{1,2}	Yes	Secure	None
Least cisco	<i>Coregonus sardinella</i>	Known ^{1,2}	Yes	Secure	None
Round whitefish	<i>Prosopium cylindraceum</i>	Known ^{1,2}	Yes	Secure	None
Dolly Varden	<i>Salvelinus malma</i>	Known ²	Yes	Sensitive	None
Lake trout	<i>Salvelinus namaycush</i>	Known ²	Yes	Secure	None
Arctic grayling	<i>Thymallus arcticus</i>	Known ^{1,2}	Yes	Secure	None
Trout perch	<i>Percopsis omiscomaycus</i>	Known ^{1,2}	Yes	Secure	None
Burbot	<i>Lota lota</i>	Known ^{1,2}	Yes	Secure	None
Ninespine stickleback	<i>Pungitius pungitius</i>	Known ^{1,2}	No	Secure	None
Slimy sculpin	<i>Cottus cognatus</i>	Known ^{1,2}	No	Secure	None
Walleye	<i>Sander vitreus</i>	Known ^{1,2}	Yes	Secure	None

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

Table 2 Potential Fish Species in Unnamed Stream at KM 147.0 of NWT Highway 8

Species	Scientific Name	Presence in Mackenzie River	Sport Fish	NWT GSRank ³	SARA Status ⁴
Northern redbelly dace	<i>Phoxinus eos</i>	Known ^{1,2}	No	Undetermined	None
Spoonhead sculpin	<i>Cottus ricei</i>	Known ^{1,2}	No	Undetermined	None
Brook stickleback	<i>Culaea inconstans</i>	Known ^{1,2}	No	Sensitive	None
SOURCES: 1. Thompson and Miller (2007) 2. Sawatzky (2007) 3. NWT GSRank: species General Status Rank in the Northwest Territories (GNWT 2016) 4. SARA Status: species status under the federal <i>Species at Risk</i> Act (ECCC 2018)					

In general, watercourses are considered fish-bearing by default. To identify a watercourse as non-fish-bearing, a barrier to migration/passage must be present combined with multiple seasons of fish sampling, or uninhabitable conditions upstream of the barrier (e.g., watercourse dries completely or freezes to bottom). The proximity of the existing crossing location to the Mackenzie River (i.e., 450 m) influences the species potentially present in the stream and at the KM 147.0 crossing. However, the beaver dam downstream of the culvert may be a barrier to fish passage and may limit movement from the Mackenzie River to the crossing location and further upstream.

Upstream of the culvert, the north and south branches of the stream were generally shallow (less than 0.40 m depth) riffle or run habitat, at the time of the survey, and may freeze to bottom during winter. This likely precludes the use of the upstream area of the culvert for overwintering by fish, or by fall- and winter-spawning species whose eggs would incubate through the winter period (e.g., whitefish, cisco, trout, burbot). The area upstream of the culvert likely only provides migration habitat during higher flow periods (e.g., spring) if the area is accessible to fish downstream of the culvert, or further upstream of culvert (i.e., beyond the 100 m survey transect, if fish are present).

If accessible to fish from the Mackenzie River, or from further upstream, the deep pool downstream of the culvert may provide habitat throughout the year, including spawning habitat for species such as northern pike, dace, minnows, stickleback, and slimy sculpin (which are all spring/summer spawning fish), and rearing and overwintering habitat for these same species. However, an overwintering habitat survey would be required to verify available overwintering habitat, and fish use, at the crossing.

METHODS TO AVOID OR MITIGATE DISTURBANCE TO FISH HABITAT

Design of the replacement structure for the KM 147.0 crossing has not been finalized but it is assumed construction activities will likely include site preparation, trenching for culvert removal and new structure placement, and stream damming and pump-around if water is present.

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

Potential effects to fish and fish habitat in the stream at KM 147.0 from construction and presence of the crossing structure may include:

- Changes to channel morphology, including flow disruption and blockage of fish passage (if a closed-bottom structure is used)
- Alteration or destruction of fish habitat, including riparian vegetation during installation
- Increased bank erosion and sedimentation of water
- Introduction of deleterious substances (e.g., from hydrocarbon spills, sediments)

A winter construction period at KM147.0 would be the preferred season as it will avoid critical life stages (i.e., spawning and rearing) at the crossing for spring/summer spawning, and fall spawning, fish species that may be present (GNWT 2005). Winter construction would also occur during expected low flow or frozen conditions, and can minimize or avoid potential sedimentation issues. The stream is in Zone 1 of the Fisheries and Oceans Canada (DFO) Restricted Activity Timing Window based on spring/summer and fall spawning use of the stream. Use of the KM 147.0 crossing area by winter spawning fish (i.e., burbot) is unlikely given habitat observed (i.e., shallow depths in late summer/early fall that likely freeze to bottom in winter, and lack of suitable substrates [for burbot spawning] in the deep pool). The Restricted Activity Timing Window is April 1 to July 15 for spring/summer spawning fish and September 15 to June 30 for fall spawning fish (which includes winter egg incubation). Until seasonal fish presence and overwintering habitat conditions at the KM 147.0 crossing can be verified, fish presence in the watercourse must be assumed. Therefore, in addition to the recommendation for a winter construction period, additional mitigations to avoid or mitigate disturbance to fish habitat relevant to the project include:

- Erosion and sediment control:
 - Design and implement an Erosion and Sediment Control (ESC) Plan to minimize erosion and sedimentation of water
 - ESC Plan should include applicable measures including installation, inspection and maintenance of ESC measures; management of water on site; isolation of contact water; and containing waste material
 - ESC measures should remain in place until disturbed substrates have been stabilized, disturbed sediment has settled and water quality of runoff from site is at acceptable levels
- Shoreline/bank re-vegetation and stabilization:
 - Minimize clearing of vegetation (use existing access routes where possible, use prune or top vegetation instead of grubbing/uprooting)
 - Minimize removal of natural stream pieces below the high-water mark (e.g. woody debris, stream and bank substrates) and return to their original location if they are temporarily moved
 - Stabilize stream banks immediately after disturbance to prevent erosion and sedimentation of water, re-vegetate banks with native species, if rip rap is installed use clean and appropriately sized rocks
- Fish protection:
 - Ensure any works do not interfere with fish passage, constrict channel width, reduce flow or result in fish stranding or death
 - Avoid work within the Restricted Activity Timing Windows where possible (i.e., NWT Zone 1); these Timing Windows are guidelines, however, and instream work within the windows may be allowed when the crossing is frozen to the bottom or with appropriate mitigations.

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

- Operation of machinery:
 - Machinery on site is clean and free of leaks, invasive species and noxious weeds; to limit disturbance to the stream bed and banks, operation should be above the high-water mark, where possible, or conducted from a v-notched snow bridge
 - Machinery should be washed, refueled and serviced in a designated area away from the high-water mark to prevent deleterious substances from entering the stream; prepare a Spill Contingency Plan and implement for the duration of the project.

These mitigations can be refined following final crossing design.

CONCLUSION

The stream crossing at KM 147.0 of NWT Highway 8 (Dempster Highway) may provide limited habitat to fish species due to a potential barrier to fish passage present downstream of the crossing. The mouth of the stream and areas downstream of the barrier may provide feeding and rearing habitat.

Replacement of the existing crossing structure has the potential to affect fish and fish habitat although is unlikely to cause serious harm to fish. Replacement of the culvert at KM 147.0 may improve fish passage at this location. Measures to minimize impacts during all stages of the project include winter construction to avoid sensitive life stages and following best practices outlined by DFO (2016) as well as other mitigations, which will be refined upon crossing design, to meet specific project requirements.

February 8, 2019

Alexis Campbell, Environmental Analyst

Page 11 of 12

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

CLOSURE

Stantec has prepared this technical memorandum for the GNWT-INF to document fish habitat conditions encountered during the August 2018 field survey of KM 147.0 at the crossing on Dempster Highway, known or expected fish use of the stream, and measures to avoid or mitigate disturbance to fish and fish habitat during crossing structure replacement activities. We trust the information contained within meets your immediate needs. Should you have any questions or require additional information, please contact the undersigned at your convenience.

Sincerely,

Stantec Consulting Ltd.

Signed on behalf of:

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Attachments: KM 147.0 Habitat Summary Sheet
KM 147.0 Field Photographs

Reference: Fish Habitat Assessment for Crossing Structure Replacement: NWT Highway 8 (Dempster Highway) at KM 147.0

REFERENCES

- British Columbia Resource Inventory Committee (BC RIC). 2001. *Reconnaissance (1:20,000) fish and fish habitat inventory: standards and procedures* (version 2.0). Victoria, BC: Province of British Columbia, 170 pp. Available at: <https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/inventory-standards/aquatic-ecosystems> (October 31, 2018)
- Environment and Climate Change Canada (ECCC). 2018. Species at Risk Public Registry: A to Z Species Index. Available at: https://www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm (October 31, 2018)
- Fisheries and Oceans Canada (DFO). 2016. *Measures to avoid causing harm to fish and fish habitat including aquatic species at risk*. Available at: <http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html> (October 31, 2018)
- Government of the Northwest Territories (GNWT). 2016. NWT Species Infobase (version 2016). Available at: <https://www.nwt-species-at-risk.ca/content/search-infobase> (October 10, 2018).
- Government of the Northwest Territories (GNWT), Department of Environment and Natural Resources. 2009. *Ecosystem Classification Group. Ecological Regions of the Northwest Territories – Taiga Plains*. Yellowknife, NT.
- Sawatzky, C.D., Michalak, D. Reist, J.D., Carmichael, T.J., Mandrak, N.E., & Hunting, L.G. 2007. *Distributions of Freshwater and Anadromous Fishes from the Mainland Northwest Territories, Canada*. Canadian Manuscript Report of Fisheries and Aquatic Science, 2793. Winnipeg, MB: Fisheries and Oceans Canada, 253 pp.
- Thompson, A. and Millar, N. 2007. *Traditional knowledge of fish migration and spawning patterns in Tsiigehtjik (Arctic Red River) and Nagwichoonjik (Mackenzie River), Northwest Territories*. Gwich'in Renewable Resource Board Report 07-01.
- Washington Department of Fish and Wildlife (WDFW). 2003. *Design of Road Culverts for Fish Passage*. Olympia, WA: Washington Department of Fish and Wildlife, 111 pp. Available at https://www.fs.fed.us/biology/nsaec/fishxing/fplibrary/Bates%20and%20others_2003_culvert_manual_final.pdf (accessed 5 November 2018).

Physical Channel Transect Data

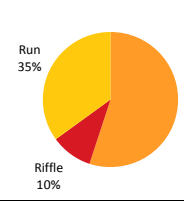
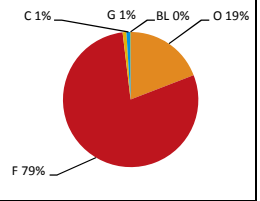
Transect (Location)	↑100 N	↑50 N	↑100 S	↑50 S	↑CL	↓CL	↓100	↓200	↓300
Channel Width (m)	5.7	6.8	2.0	1.9	3.9	30	7.6	3.8	-
Wetted Width (m)	3.2	3.4	1.0	1.2	3.8	30	2.7	3.8	-
Residual Pool Depth (m)	0.40	0.20	0.25	0.05	0.31	unk.	n/a	n/a	-
Bankfull Depth (m)	0.41	0.66	0.60	0.35	0.8	> 1.5	0.65	1.3	-
Avg. Depth (m)	0.18	0.27	0.40	0.17	0.71	unk.	unk.	1.18	-
Gradient (%)	5	2	16	10	2.0	unk.	2	2	-
Pool / Riffle / Run (%)	10 / 80 / 10	30 / 50 / 20	0 / 50 / 50	0 / 100 / 0	10 / 20 / 70	100 / 0 / 0	0 / 10 / 90	0 / 0 / 100	/ /

Stream Bed

Substrate (% of Transect Area)	Organics	Fines	Gravel	Cobble	Boulder	Bedrock	D95 (cm)	D (cm)	Embeddedness (%)
Organics	0	0	0	0	0	0	0	0	-
Fines	20	90	65	20	80	100	100	100	-
Gravel	60	10	25	74	10	0	0	0	-
Cobble	20	<1	10	5	10	0	0	0	-
Boulder	0	0	0	0	<1	0	0	0	-
Bedrock	0	0	0	1	0	0	0	0	-
D95 (cm)	17	8	10	>1	30	n/a	n/a	n/a	-
D (cm)	6	2	2	2	1	n/a	n/a	n/a	-
Embeddedness (%)	50	60	10	10	20	n/a	n/a	n/a	-

Bank Measurements

	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Bank Height (m)	1.1	3	2	2.5	0.5	0.8	0.6	0.8	0.5	0.75	0.15	0.2	1.1	1.1	5	0.6		
Bank Shape	S	S	S	S	S	S	S	S	S	S	V	S	S	S	V	S		
Bank Slope (°)	12	35	23	17	unk.	unk.	4	6	3	4	>45	7	17	6	>45	20		
Bank Stability	MS	MS	S	S	US	US	US	US	MS	MS	S	S	S	S	S	S		
Vegetation Cover (%)	100	100	100	100	90	100	60	60	100	100	100	100	100	100	100	100		
Riparian Width (m)	30	20	1	3	50	100	100	20	3	3	0.5	3	1	3	0	3		
Riparian Veg. Type	S	M	S	S	S	S	S	S	G	G	S	S	S	S	S	S		
Riparian Veg. Stage	SHR	YF	SHR	SHR	SHR	SHR	SHR	PS	PS	PS	SHR	YF	YF	SHR	SHR			
Dom. Bank Texture	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F		
Subdom. Bank Texture	NA	C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		

Habitat Inventory / Reach Data (CL)
Habitat Distribution

Substrate Composition

Cover Characteristics (CL)

%:	Total	LWD	SWD	DP	B	U	OV	IV
↑CL	70	0	20	<1	10	0	60	10
↓CL	100	0	5	90	0	0	5	<1
Instream Veg. Total (%):	10	LWD Function:			None			
Instream Veg. Type:	Vascular	LWD Distribution:			None			
Crown Closure (%):	< 1	Features:			CV BD			

Water Quality Data (CL)

Time of Day (HH:MM):	12:00
Water Temperature (°C):	~ 5
Dissolved Oxygen (mg/L):	n/a
Sp. Conductivity (µs/cm):	n/a
pH:	n/a
Turbidity (NTU):	n/a

Channel Characteristic (CL)

Pattern:	IM
Islands:	N
Bars:	SD
Coupling:	DC
Confinement:	OC
Flow Stage:	Moderate

Fish Habitat Assessment Ratings (CL)

	Quality	Comments
Spawning:	Poor	Pool @ ↓CL may provide habitat (NRPK)
Overwintering:	Moderate	Pool @ ↓CL good but BD present
Rearing:	Moderate	Pool @ ↓CL good but BD present
Passage:	Poor	CV & BD impede passage


Photo 1: Facing upstream at centerline (↑CL); note north (left) and south (right) fork

Photo 2: Facing downstream at centerline (↓CL); note culvert in red-coloured bushes
Fish Sampling Data

Method	Effort	Species	Efish Catch (n)	Trap Catch (n)	Efish CPUE (#fish/100s)	Trap CPUE (#fish/hr)	Rel. Abundance (% of total)
No Electrofishing	- (s)	-	-	-	-	-	-
No Trapping	- (hr)	-	-	-	-	-	-
Electrofisher Settings							
Volts	Freq. (Hz)	Duty Cycle (%)	Dist. (m)				
-	-	-	-				

General Comments

- unk. = unknown/not measured; n/a = not applicable
- Culvert (CV) at CL approx. 2 m by 60 m; very long and with no light, likely impedes passage of fish
- Beaver dam (BD) approx. 15 m downstream of culvert, has formed large, deep pool immediately downstream of culvert; beaver dam (approx. 0.6 m tall) is likely a barrier to fish passage
- Electrofisher non-functional; unconfirmed fish observation within beaver dam pool, immediately downstream of culvert
- DFO restricted activity timing window based on spring/summer spawning use of creek (in Zone 1)



GNWT-INF Fish Habitat Assessment for Crossing Structure Replacement

NWT Highway 8, KM 147.0

UTM Location: 8W 552695 E, 7485837 W Survey Date: August 31, 2018
 Legal Location: n/a Channel Flow: Permanent
 Crew Initials: CS, JMM Restricted Activity Period: April 1 to July 15

Abbreviations & Acronyms

Bank Measurements



Bank Shape	Bank Stability	Bank Texture/Substrate Composition
U Undercut banks, protrude over wetted portion	S Stable	O Organics BL Boulder
V Vertical, steep (45 - 90°)	MS Moderately stable	F Fines BD Bedrock
S Sloping, gradual (<45°)	US Unstable	G Gravel NA Not Applicable/none
O Overhanging, protude over wetted & non-wetted portion		C Cobble
Riparian Veg. Type	Riparian Veg. Stage	
N None	INIT Initial, non-vegetated or initial stage following a disturbance (<5% cover)	
G Grass	SHR Shrub/herb stage, <10% tree cover	
S Shrub	PS Pole-sapling stage, with trees overtopping shrubs. Stand age <20 yrs	
C Coniferous	YF Young forest, self-thinning evident & forest canopy has distinct layers; stand age <80 yrs	
D Deciduous forest	MF Mature forest with canopy gaps and well-developed understory	
M Mixed coniferous and deciduous forest	NA Not applicable, when riparian vegetation is absent, grass or wetland (specify)	
W Wetland		



Cover Characteristics



Cover Types	Features		
LWD Large woody debris	BD Beaver dam	HCE Erosion/Sedimentation	D Dam, general
SWD Small woody debris	BG Crossing, general	FLD Falls (> 2 m)	FSB Subsurface flow
DP Deep pools	BR Bridge	FD Ford	TRB Tributary
B Boulder	C Cascade or chute	GE Groundwater, field evidence	VB Velocity barrier
U Undercut banks	CN Canyon	HD Hydro dam	
OV Overhanging banks	CV Culvert	LS Landslide or bank sloughing	
IV Instream vegetation	FLD Dewatering	X LWD jam	



Channel Characteristics



Pattern	Islands	Bars	Coupling	Confinement
ST Straight	N None	N None	DC Decoupled	EN Entrenched
SI Sinuous	O Occasional	SD Side bar/point bar	PC Partially coupled	CO Confined
IR Irregular, wandering	I Irregular	DG Diagonal bar	CO Coupled	FC Frequently Confined
IM Irregular, meandering	F Frequent	MD Mid-channel bar		OC Occasionally Confined
ME Regular meanders	S Split	SP Span		UN Unconfined
TM Tortuous meander	AN Anastomizing	BR Braided		NA Not Applicable



Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 1			
Photo Location: North tributary of unnamed stream, 100 m upstream of existing culvert (facing upstream)			
Direction: Southeast			
Survey Date: 8/31/2018			
Comments:			
Photograph ID: 2			
Photo Location: North tributary of unnamed stream, 100 m upstream of existing culvert (facing downstream)			
Direction: Northwest			
Survey Date: 8/31/2018			
Comments:			



Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 3			
Photo Location: North tributary of unnamed stream, 50 m upstream of existing culvert (facing upstream)			
Direction: Southeast			
Survey Date: 8/31/2018			
Comments:			
Photograph ID: 4			
Photo Location: North tributary of unnamed stream, 50 m upstream of existing culvert (facing downstream)			
Direction: Northwest			
Survey Date: 8/31/2018			
Comments:			


Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 5			
Photo Location: South tributary of unnamed stream, 50 m upstream of existing culvert (facing upstream)			
Direction: Southeast			
Survey Date: 8/31/2018			
Comments:			
Photograph ID: 6			
Photo Location: South tributary of unnamed stream, 50 m upstream of existing culvert (facing downstream)			
Direction: Northwest			
Survey Date: 8/31/2018			
Comments:			

Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 7			
Photo Location: Immediately upstream of existing culvert at KM 147.0 on unnamed stream (facing upstream)			
Direction: East			
Survey Date: 8/31/2018			
Comments:			
Photograph ID: 8			
Photo Location: Immediately upstream of existing culvert at KM 147.0 on unnamed stream (facing downstream)			
Direction: West			
Survey Date: 8/31/2018			
Comments:			

Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 9			
Photo Location: Immediately downstream of existing culvert at KM 147.0 on unnamed stream (facing upstream)			
Direction: West			
Survey Date: 8/31/2018			
Comments:			
Photograph ID: 10			
Photo Location: Immediately downstream of existing culvert at KM 147.0 on unnamed stream (facing downstream)			
Direction: East			
Survey Date: 8/31/2018			
Comments:			

Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 11			
Photo Location: Beaver dam ~15 m downstream of existing culvert at KM 147.0 on unnamed stream (facing downstream)			
Direction: West			
Survey Date: 8/31/2018			
Comments:			
Photograph ID: 12			
Photo Location: Unnamed stream, 100 m downstream of existing culvert (facing upstream)			
Direction: Northeast			
Survey Date: 8/31/2018			
Comments:			

Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 13			
Photo Location: Unnamed stream, 100 m downstream of existing culvert (facing downstream)			
Direction: Southwest			
Survey Date: 8/31/2018			
Comments:			
Photograph ID: 14			
Photo Location: Unnamed stream, 200 m downstream of existing culvert (facing upstream)			
Direction: East			
Survey Date: 8/31/2018			
Comments:			

Client:	GNWT-INF	Project:	144930112
Site Name:	Stream Crossing at KM 147.0	Site Location:	NWT Highway 8
Photograph ID: 15			
Photo Location: Unnamed stream, 200 m downstream of existing culvert (facing downstream)			
Direction: West			
Survey Date: 8/31/2018			
Comments:			



Government of the Northwest Territories

Bridge Inspection Form

Struct. ID	08C024
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Arctic Region | Région de l'Arctique
301-5204 50th Ave (Franklin)
Yellowknife NT
X1A 1E2

November 14, 2023

Your file Votre référence

Our file Notre référence

22-HCAA-01268

Alina Goldberg
Government of the Northwest Territories
PO Box 1320
5015 – 49 Street
Yellowknife, Northwest Territories
X1A 2L9

**Subject: Culvert Replacement, Unnamed Tributary of Mackenzie River,
Tsiigehtchic – Implementation of Measures to Avoid and Mitigate the
Potential for Prohibited Effects to Fish and Fish Habitat**

Dear Ms. Goldberg:

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on May 13, 2022. We understand that you propose to:

- Replace the existing 1800mm diameter, 61m long culvert will be replaced with a 3000mm diameter, 65m long culvert with substrate holders installed (baffles) with a 20% embedment at km 147.1 of the Dempster Highway.
- Isolate the streamflow from the two upstream channels into the existing 1800mm culvert and install the new 3000mm diameter culvert adjacent to the existing.
- When the new 3000mm culvert is installed, flows from both upstream channels will be directed through the new culvert and the old 1800mm culvert will be isolated and reclaimed.
- Construct fish passage structures in the bottom of the culvert, as well as place natural substrate in the culvert designed to allow fish to pass upstream with no more than a 3 day delay at the 1:10 flow event (3Q10).
- Use salvaged natural substrate to placed over the armour on the inlet and outlet aprons to fill voids and maintain a natural bed.
- The armoured apron will be tied into the natural stream channel with a field-fit low-flow channel to maintain fish passage during low flow periods.

- Instream work is scheduled between July 15th and September 15th 2024 and when the watercourse is frozen.

Our review considered the following information:

- Request for Review Form, signed 12 May 2022.
- 2567 02 WCEPP Culvert Replacement_KM147_Rev 0_IFP.pdf, received on 14 December 2022.
- 2567-CCI-Design Memo-A - Km 147.pdf, , received on 14 December 2022.
- 2567 -DFO_Drawing_Package_KM147-B.pdf, received on 28 January 2021.
- 2567- Dempster Highway Fish Habitat Assessments.pdf, received on 19 December 2022.
- 2567- DFO Photo Request_12 Jan 23, received on 12 January 2023.
- Email regarding the timing of construction received by DFO on 02 May 2023.

Your proposal has been reviewed to determine whether it is likely to result in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*; and
- effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*.

The aforementioned outcomes are prohibited unless authorized under their respective legislation and regulations.

To avoid and mitigate the potential for prohibited effects to fish and fish habitat (as listed above), we recommend implementing the measures listed below:

- Avoid killing fish by means other than fishing.
- Plan in-water works, undertakings and activities to respect timing windows to protect fish, and fish habitat.
 - Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (spawning, rearing, feeding, migrating).
- Maintain fish passage during all phases of works, undertakings and activities.
 - Avoid obstructing and interfering with the movement and migration of fish.
 - Maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish.
 - Several large rocks should be placed extending up from the substrate of the inlet and outlet apron to provide resting places for fish moving upstream.

- Capture and relocate any fish trapped within an isolated/enclosed work area and safely relocate them to an appropriate location in the same waterbody.
 - Dewater gradually to reduce the potential for stranding fish.
- Screen intake pipes to prevent entrainment or impingement of fish.
 - Follow the *interim code of practice: end of pipe fish protection screens for small water intakes in freshwater* (<http://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecraneng.html>)
- Limit impacts on riparian vegetation to those approved for the work, undertaking or activity;
- Replace/restore any disturbed habitat features and remediate any areas impacted by the work, undertaking or activity after construction;
- Use only clean materials (e.g., rock, coarse gravel, wood, steel, snow) for works, undertakings and activities.
- Manage sediment laden water flowing onto or through the worksite.
 - Pump sediment laden water into vegetated area or behind filter fabric dam.
 - Install settling basin and / or filtration systems for water flowing onto the site and water being pumped or diverted from the site.
 - Dewater gradually to prevent sediment resuspension and bank destabilization.
 - Release runoff when suspended sediment has resettled in settling basin and runoff water is clear.
- Develop and implement an Sediment Control Plan to minimize sedimentation of the during all phases of the work, undertaking or activity, including but not limited to:
 - Inspect and maintain regularly the erosion and sediment control measures and structures during all phases of the project;
 - Biodegradable sediment control materials should be used whenever possible;
 - Remove all exposed non-biodegradable sediment control materials once site has been stabilized;
- Develop and implement a monitoring plan and report on conditions imposed by regulatory bodies and verify proponent's predictions;
- Stop work and contact the lead biologist from the Fish and Fish Habitat Protection Program in Yellowknife if any unexpected situation occurs to ensure proper mitigation measures are in place before starting work again;
- Request another review of project if work cannot be completed during timing window proposed.

Provided that you incorporate these measures into your plans, the Program is of the view that your proposal is not likely to result in the contravention of the above mentioned prohibitions and requirements.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (<http://www.dfo->

mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to remain in compliance with the *Fisheries Act*, the *Species at Risk Act* and the *Aquatic Invasive Species Regulations*.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to (<http://www.dfo-mpo.gc.ca/pnw-ppe/contact-eng.html>).

We recommend that you notify this office at least 10 days before starting your project and that a copy of this letter be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your proposal.

Please note that the advice provided in this letter will remain valid until March 2025. If you plan to execute your proposal after the expiry of this letter, we recommend that you contact the Program to ensure that the advice remains up-to-date and accurate. Furthermore, the validity of the advice is also subject to there being no change in the relevant aquatic environment, including any legal protection orders or designations, before the work occurs.

If you have any questions, please contact Paul Harper at (867) 444-0983, or by email at Paul.Harper@dfo-mpo.gc.ca. Please refer to the DFO file number referenced.

Yours sincerely,



José Audet-Lecouffe
Senior Biologist, Regulatory Review
Arctic Region
Fisheries and Oceans Canada

cc:

Alasdair Beattie, DFO-FFHPP
Paul Harper, DFO-FFHPP
Kyle Sherwin, CCI Solutions