Meeting Report: GNWT-DOT – Tłı̨chǫ All Season Road – EA-1617-01-2016

Tłı̨chǫ All Season Road GNWT-DOT Working Group Meeting with Federal Government

Main Issue: Watercourse Crossings and Potential Impacts on Fish and Fish Habitat

Meeting date: December 15, 2016

Attendees:

1) Tara Schweitzer, Fisheries Protection Biologist, Fisheries and Oceans Canada (via teleconference)
2) Vincent Harper, Senior Fisheries Protection Biologist, Fisheries and Oceans Canada (via teleconference)
3) Martyn Curtis, A/Regulatory Review Manager, Fisheries and Oceans Canada
4) Melissa Pink, Manager, Project Assessment Branch, Department of Lands, GNWT
5) Stu Niven, Director Environmental Affairs, Department of Transportation, GNWT
6) Katie Rozestraten, Environmental Analyst, Department of Transportation, GNWT
7) Damian Panayi, Project Manager/Biologist, Golder Associates Ltd.
8) Paul Vecsei, Golder Associates Ltd.
9) Sarah Robertson, Project Officer, Northern Projects Management Office
10) Cam Stevens, Golder Associates Ltd.

Summary of Discussion:

On December 15, 2016, staff from the Government of the Northwest Territories (GNWT) (including the Department of Transportation (DOT) and Department of Lands – Project Assessment Branch (DOL-PAB) met with Fisheries and Oceans Canada (DFO), Golder Associates Ltd. (Golder) and the Northern Projects Management Office (NPMO) to discuss fish and fish habitat issues related to the watercourse crossings for the proposed Tłı̨chǫ All-Season Road. The meeting was held in response to DFO's previous request for clarification and additional information from DOT regarding the proposed watercourse crossings and fish habitat information provided to date. DOT provided video footage of the watercourses to be crossed by the All-Season Road, and DOT, DFO and Golder discussed the outstanding information required by DFO that would clarify potential impacts to fish and fish habitat. DFO provided a table to DOT outlining the information required to proceed with determination of potential impacts to fish and fish habitat as a result of the Tłı̨chǫ All-season Road project.

Developer's commitments: DOT committed to providing the requested information and clarification that DFO outlined in the table provided to DOT.

Outstanding issue for the party: N/A

Action Items: DOT to provide DFO with required information, in January 2017.

Update:

DOT provided information to DFO on January 25, 2017 which has clarified a number of the outstanding issues DFO had concerns with, as identified and discussed in the meeting on December 15, 2016. DFO has concluded that many of the watercourse crossings can be either self-assessed out, or will be considered low risk to fish and fish habitat. DFO acknowledges that DOT has committed to providing final designs to DFO prior to constructing the other watercourse crossings and/or where construction will take place below the Ordinary High Water Mark at crossings where there is the potential to support large-bodied fish. At that time and following the MVEIRB review, an appropriate regulatory response (e.g., Letter of Advice or Authorization) will be provided to DOT by DFO. Based on the information provided to date, DFO has determined that as the review under Mackenzie Valley Environmental Impact Review Board (MVEIRB) moves forward, there will likely be no significant adverse environmental effects to fish and fish habitat resulting from the proposed works. DOT and DFO will work closely to ensure clarity of requirements, and ongoing effective communication continues as we move through the board process.

Signature of party representative (DFO): _____

Martyn Curtis
Regional Manager, Regulatory Reviews
Fisheries Protection Program - Fisheries and Oceans Canada

Date: March 17/17

Signature of developer representative (GNWT-DOT): _____

Stu Niven
Director – Environmental Affairs Division
Department of Transportation

Date: March 17/17

Table 1: Conceptual Crossing Type, Mitigation for Work Below High Water Mark, and Restricted Activity Period

Water Crossing ID[a]	Water body Name	Crossing km	Conceptual Crossing Type	Construction Below High Water Mark[b]	Mitigation for Activities Below the High Water Mark[b]	Restricted Activity Timing Window[c]
1.1	Unnamed	2	1x900 corrugated steel pipe culvert	Yes	Use isolation techniques if flowing and install outside restricted timing windows. Use of ice bridge/snow fill or clear-span temporary bridges where needed for equipment crossings or work platforms.	April 1 to July 15
1.2	Unnamed	2.4	1x1200 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
2	Unnamed	3.2	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
3	Unnamed	7.9	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
4	Unnamed	13.2	3x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
5	Unnamed	16.5	1x2430 structural plate corrugated steel pipe culvert	Yes	As above	April 1 to July 15
6	Unnamed	19.4	2x2430 structural plate corrugated steel pipe culvert	Yes	As above	April 1 to July 15
7	Unnamed	23.6	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
8	Duport River	40.4	48 m bridge	No	Construct bridge (including pier installation) during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental erosion and sediment control, as needed.	September 15 to July 15
9	Unnamed	45.2	24 m clear-span bridge	No	Construct bridge during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental control measures for erosion and sediment control, as needed.	September 15 to July 15
10a	Unnamed	48.2	3660x1910 arch culvert	Yes	Construct crossing during low-flow periods, where possible; use clear-span temporary bridges and/or ice bridges for equipment crossings. Install and maintain erosion and sediment control measures.	April 1 to July 15
10	Unnamed	48.3	1x1200 corrugated steel pipe culvert	Yes	Use isolation techniques if flowing and install outside restricted timing windows. Use ice bridge/snow fill or clear-span temporary bridges where needed for equipment crossings or work platforms.	April 1 to July 15
11	Unnamed	54.5	2x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
13	Unnamed	62.7	3x1400 corrugated steel pipe culvert	Yes	As above	April 1 to July 15
14	James River	68.7	80 m bridge	No	Construct bridge during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental control measures for erosion and sediment control, as needed.	September 15 to July 15
15	La Martre River	85.4	100 m bridge	No	Construct bridge (including pier installation) during low-flow periods, where possible; use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental erosion and sediment control, as needed.	September 15 to July 15

a) Crossing 1.1 and 1.2 are on the same watercourse; Crossing 10a and 10 are on the same watercourse.

b) Construction activities (including placement of temporary or permanent fill) below the High Water Mark was determined from the Major Bridge and Culvert Conceptual Designs 2016 (PR#7, Appendix I). Bridge piers and riprap are all above the 'edge' of water or active channel in figures, though some are within the 5-year floodplain.

c) Restricted in-water activity timing window determined based on fish species likely to be present (Table 3.1-2) and NWT Zone 1 (DFO 2013).

DFO Comments on Watercourse Crossings for GNWT-DOT-Tlicho All Season Road

Crossing No. & Name	Crossing Description	GNWT-DOT Information Provided	DFO Comments	GNWT-DOT Response
1 - Unnamed	2-1200 mm diameter x 24 m long	No defined floodplain, dry channel. Assessed by helicopter fly-by.	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info not likely required.	Note this crossing includes Crossing IDs 1.1 and 1.2 in Tables 1 to 3. Bed and banks are poorly defined, habitat connectivity was determined to be minimal, and flow hydroperiod was determined to be ephemeral at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be unlikely for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
2 - Unnamed	2- 1400 mm diameter x 35 m long	Poorly defined channel and floodplain. Dry channel with an estimated flow width of 3-5 m. Some basic site info from 2014 survey.	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info is likely not required.	Bed and banks are poorly defined, habitat connectivity was determined to be minimal, and flow hydroperiod was determined to be ephemeral at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be low for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
3 - Unnamed	2-1400 mm x 25 m long	Poorly defined channel and no defined floodplain. Assessed by helicopter fly-by	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info is likely not required.	Bed and banks are poorly defined, habitat connectivity was determined to be low, and flow hydroperiod was determined to be ephemeral at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be low for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
4- Unnamed	3-1400 mm x 25 m long	Defined, ephemeral channel. Assessed by helicopter fly-by	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info is likely not required.	Habitat connectivity was determined to be minimal and flow hydroperiod was determined to be ephemeral-to-intermittent at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be low for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
5 - Unnamed	1-2430 mm structural plate corrugated steel pipes	Poorly defined channel. Assessed by helicopter fly-by in July 2014	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info is likely not required.	Bed and banks are poorly defined, habitat connectivity was determined to be minimal, and flow hydroperiod was determined to be ephemeral at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be low for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
6 - Unnamed	2-2430 mm x 51 m long	Channel and floodplain not defined. Assessed by helicopter fly-by in July 2014	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info is likely not required.	Bed and banks are poorly defined, habitat connectivity was determined to be minimal, and flow hydroperiod was determined to be ephemeral at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be low for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
7 - Unnamed	2-1400 mm diameter x 25 m long	Ponding occurs downstream. Assessed by helicopter fly-by in July 2014	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info is likely not required.	Bed and banks are poorly defined, habitat connectivity was determined to be minimal, and flow hydroperiod was determined to be ephemeral at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be unlikely for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
8 - Duport River	48 m total length bridge. 2-24 m spans. 1 pier will be centered between main channel and oxbow pond but located in floodplain	Major crossing, assume fish present and fish habitat. Erosion of braided channel, 50-75 m floodplain. Portions could offer overwintering habitat as they have acceptable depth. Basic site info from July 2014 survey.	Can potentially be self-assessed out as long as no new temporary or permanent fill placed below the HWM. If a temporary bridge is required (i.e., trestle bridge) for construction access for the new bridge or the construction of the mid-channel pier requires temporary working platforms below the HWM, then further DFO review may be required and an explanation of how and when construction will take place such that all impacts will be avoided should be provided. If construction methodology and sequencing is currently unknown, then indicate such and that DFO will be notified for further review if any construction practices require work occurring below the HWM.	Construction activities (including the placement of temporary or permanent fill) are not anticipated below the ordinary high water mark (OHWM) (Table 1), although the pier will be installed within the floodplain (or 1 in 5 year flood level). The expected timing window for construction (including the installation of any piers) will be in the winter when an ice bridge/snow fill crossing will be used for construction access. A clear-span temporary bridge will be deployed for a temporary crossing or work platform, as needed (no work below the OHWM). Each bridge crossing will be constructed within one winter season (approximately 10 weeks or less). Additional details on the installation procedure can be located in the Project Description Report. As no temporary or permanent fill will be placed below the OHWM, it is not anticipated that this crossing will require review by DFO.
9 - Unnamed tributary	Clear span, single span 24 m long bridge	Major crossing, assume fish present and fish habitat. Well-defined ephemeral stream as outlet for upstream lake. No floodplain, defined channel. Basic site info from July 2014 survey.	Can potentially be self-assessed out as long as no new temporary or permanent fill placed below the HWM. If a temporary bridge is required (i.e., trestle bridge) for construction access for the new bridge then further DFO review may be required and an explanation of how and when construction will take place such that all impacts will be avoided should be provided. If construction methodology and sequencing is currently unknown, then indicate such and that DFO will be notified for further review if any construction practices require work occurring below the HWM.	Construction activities (including the placement of temporary or permanent fill) are not anticipated below the ordinary high water mark (OHWM) (Table 1). The expected timing window for construction will be in the winter when an ice bridge/snow fill crossing will be used for construction access. A clear-span temporary bridge will be deployed for a temporary crossing or work platform, as needed (no work below the OHWM). Each bridge crossing will be constructed within one winter season (approximately 10 weeks or less). As no temporary or permanent fill will be placed below the OHWM, it is not anticipated that this crossing will require review by DFO.

DFO Comments on Watercourse Crossings for GNWT-DOT-Tlicho All Season Road

Crossing No. & Name	Crossing Description	GNWT-DOT Information Provided	DFO Comments	GNWT-DOT Response
10a - Unnamed	3660 m span arch, 1910 mm rise	As above in 10. Second crossing at this site with a small defined channel. Assessed by helicopter survey in July 2014	Appears to span the channel width? Does it in fact span the channel width? Will construction works occur below the HWM? Will isolation be required? Any infill below the HWM?	The arched culvert is expected to span most, if not all of the active channel, however, some construction may occur below the OHWM where temporary or permanent fill may be required (Table 1). Mitigation includes construction during winter (as expected for all crossings) and the isolation of the construction area if the stream is flowing at the time of construction works below the OHWM. A temporary clear-span bridge or ice bridge/snow fill will be used for equipment crossings and work platforms. Erosion and sedimentation control measures will also be used and maintained. As there will be work below the OHWM, GNWT will provide final designs for this crossing to DFO for their review prior to construction, as required.
10 - Unnamed	1-1200 mm diameter x 25 m long	Ponding area with no defined channel approx 15-20 m wide. Small meandering well-defined rocky channel directly to the south. Assessed by helicopter survey in July 2014	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info not likely required.	Bed and banks are poorly defined, habitat connectivity was determined to be minimal, and flow hydroperiod was determined to be ephemeral at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be unlikely for forage fish and unlikely for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3).
11 - Unnamed	2-1400 mm x 25 m long	Ponding area with no defined channel. Assessed by helicopter fly-by. Two small lakes upstream and downstream of crossing.	Are the lakes suitable for fish presence, indicating fish could be moving through this crossing between the two lakes?	The lakes upstream of the crossing locations are assumed to be fish-bearing and to provide suitable overwintering habitat for fish (Table 2), however, upon further evaluation of the crossing location, the next downstream lake of potential fish-bearing status is approximately 6,800 m downstream. The evaluation of habitat connectivity at the crossing location was deemed low, in part, because of the ephemeral to intermittent hydroperiod expected for this stream.The likelihood of fish occurrence was determined to be moderate for forage fish and low for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3). As there is work below the OHWM and there is a potential for large-bodied fish, GNWT will provide final designs for this crossing to DFO for their review prior to construction, as required.
12 - Unnamed	1-1000 mm	Well defined wide, meandering channel. Basic site info from July 2014 survey.	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info not likely required.	The updated road alignment submitted with the Project Description Report avoids this stream.
13 - Unnamed	3-1400 mm diameter x 25 m long	Assessed by helicopter survey in July 2014. Marsh area bounded by small lakes. Assessed by helicopter survey in July 2014	Gives no indication of connection to downstream waterbodies or watercourses. If there are permanent or intermittent waters downstream, there is likelihood that fish could move upstream to utilize these habitats. Or perhaps there is no connection to more permanent waters or the distance is too great (20+ km) and/or there are obstacles, or it is only suitable as forage fish habitat? If so, please explain. Depending on that outcome, fish passage design information, including design species and footprint of new culvert may be required. If it is determined that this crossing does not contribute to a CRA fishery or only serves as habitat for forage fish than further info not likely required.	Habitat connectivity was determined to be low-to-moderate and hydroperiod was determined to be ephemeral-to-intermittent at the crossing location (see Table 2). The likelihood of fish occurrence was determined to be moderate for forage fish and low for large-bodied species that are part of a commercial, recreational, or Aboriginal (CRA) fishery (see Table 3). As there is work below the OHWM and there is a potential for large-bodied fish, GNWT will provide final designs for this crossing to DFO for their review prior to construction, as required.
14 - James River	80 m long total length bridge. 1-40 m span, 2-20 m jump spans on end. Piers will be in floodplain but away from active main channel	*Important river used for trapping and fishing (mainly grayling).* Well defined meandering channel with riffle-pool sequences. Undercut channel banks. Basic site info from 2014 survey.	Can potentially be self-assessed out as long as no new temporary or permanent fill placed below the HWM. If a temporary bridge is required (i.e., trestle bridge) for construction access for the new bridge or the construction of the mid-channel pier requires temporary working platforms below the HWM, then further DFO review may be required and an explanation of how and when construction will take place such that all impacts will be avoided should be provided. If construction methodology and sequencing is currently unknown, then indicate such and that DFO will be notified for further review if any construction practices require work occurring below the HWM.	Construction activities (including the placement of temporary or permanent fill) are not anticipated below the ordinary high water mark (OHWM) (Table 1). The expected timing window for construction will be in the winter when an ice bridge/snow fill crossing will be used for construction access. A clear-span temporary bridge will be deployed for a temporary crossing or work platform, as needed (no work below the OHWM). Each bridge crossing will be constructed within one winter season (approximately 10 weeks or less). Additional details on the installation procedure can be located in the Project Description Report. As no temporary or permanent fill will be placed below the OHWM, it is not anticipated that this crossing will require review by DFO.
15 - La Martre River	100 m long total length bridge. 1-40 m span, 2-30 m jump spans on each end. Two piers will be adjacent to active main channel.	*Flows all year round. Set of falls located 3-4 km downstream of crossing. Fish and fish habitat assessments have been conducted on La Martre River from a previous hydroelectric facility study... Important river for source of food and resources to the Tlicho people. In order to mitigate fisheries concerns, a clear span bridge will be constructed. Though in-water construction of the bridge is unexpected, if it is required, it will also occur between the appropriate fishery window to reduce the possibility of disturbance.* Basic site info from 2014 survey.	Can potentially be self-assessed out as long as no new temporary or permanent fill placed below the HWM. If a temporary bridge is required (i.e., trestle bridge) for construction access for the new bridge or the construction of the mid-channel pier requires temporary working platforms below the HWM, then further DFO review may be required and an explanation of how and when construction will take place such that all impacts will be avoided should be provided. If construction methodology and sequencing is currently unknown, then indicate such and that DFO will be notified for further review if any construction practices require work occurring below the HWM.	Construction activities (including the placement of temporary or permanent fill) are not anticipated below the ordinary high water mark (OHWM) (Table 1), although the piers will be installed within the floodplain (or 1 in 5 year flood level). The expected timing window for construction (including the installation of any piers) will be in the winter when an ice bridge/snow fill crossing will be used for construction access. A clear-span temporary bridge will be deployed for a temporary crossing or work platform, as needed (no work below the OHWM). Each bridge crossing will be constructed within one winter season (approximately 10 weeks or less). Additional details on the installation procedure can be located in the Project Description Report. It is currently anticipated that no work will take place below the OHWM; however, if work is required, GNWT will submit the detailed design to DFO for review.

DFO General Comments on Fish and Fish Habitat Provided by GNWT-DOT

1. Although limited fish surveys have been conducted previously in streams along the proposed corridor, the Traditional Knowledge Study provides a history of Tlicho fishery in proximity to the proposed road.	GNWT-DOT has assumed that all watercourses are fish bearing, which is fine; however, then DFO needs some info to determine potential impacts to those areas impacted by the crossings. Are tributary streams utilized by grayling, suckers, pike for spawning in fall or spring? Is habitat appropriate for these species? The Project Description notes that the proposed road " passes by numerous small lakes which like provide little to no overwintering habitat but can provide feeding and rearing habitat" - what is this assumption based on? Is there channel connectivity to these small or more permanent downstream lakes to the proposed crossing locations, what is the distance to more permanent waters, are those waters fish bearing? Once additional information is received, as recommended above, the watercourses may then be classified as low, med to high likelihood of contribution to a CRA fishery? The assessment done gives no indication of the crossing sites value as fish habitat.	Additional details for the classification of fish-bearing status of crossing locations are provided in Tables 2 and 3.
2. 17 potential fish species occur within the area with Arctic Grayling being the most valued species to be affected by the road construction, as they utilize stream habitat for spawning, juvenile rearing and adult life stages. Require well-oxygenated gravel-cobble substrates for spawning. Likely the minor streams along the alignment would not provide overwintering due to complete freezing.		n/a
3. Survey in 2014 by low-level helicopter flight to permit visual inspection. Only 6 watercourses were assessed at this time (Crossings 2, 8, 9, 12, 14 & 15). Basic site info for those 6 sites include: bankfull width and depth at crossing, bank vegetation, substrate at crossing, floodplain description.		n/a
4. Of the 15 identified watercourse crossings, only 4 were deemed suitable to support CRA fish. The remaining crossings were identified as ephemeral and mostly dry at time of fieldwork but these streams could provide fish habitat…		n/a
5. Culverts will be embedded 10% below invert and will be designed to pass fish.	Embedment - Good. DFO just asked to confirm the design details to ensure that fish passage design has been incorporated. In the *TliCho Road Alignment, Hydrologic and Hydraulic Study*, Stantec Report, in Section 6.2, it notes " the minor crossings have velocities that range from 2.0 to 3.3 m/s", DFO requires clarification that these culvert crossings will provide fish passage (if large bodied fish present) as these velocities suggest that they do not. Further in Appendix E of that document, the Culvert Design Reports do not correspond with the recommended crossing structure outlined in the project description report	A summary of conceptual design details are provided in Table 1, including updated predictions for culvert velocities (also see attached memo; Golder 2017). The crossing designs consider fish passage criteria at locations where there is the potential for large-bodied fish.
6. Assessment concludes no destruction of fish habitat	Watercourses crossings with proposed culvert installations are a potential destruction of habitat, as it is infilling and a new permanent footprint below the HWL. DFO wants to ensure that those crossings do not impact potential pike, sucker or grayling spawning/rearing habitat or fish passage or if impact cannot be avoided then it may require Authorization under the Fisheries Act.	Serious harm to fish may result from the installation of the road crossings where temporary or permanent fill is placed below the OHWM in a stream where large-bodied fish may be present (e.g., crossing 10a, 11, and 13). However, proposed mitigation combined with the selected design features for the crossings will minimize, if not eliminate, any effects to fish and fish habitat. Residual serious harm to fish is not expected at any of the proposed crossings along the road alignment. For crossings where works will occur below the OHWM and that existing habitat is considered suitable for large-bodied fish species, information will be provided to DFO for their review prior to construction.

Table 1: Summary of Construction Details for Proposed Watercourse Crossings

Water Crossing ID	Location Coordinates (UTM, NAD 83, Zone 11)	Waterbody Name	Crossing KM	Crossing Type	Construction Below OHWM?[1]	Mitigation for Any Activities Below the OHWM[2]	Expected Timing Window for Construction[2]	Estimated Culvert Length[3]	Stream Slope at Culvert Crossing Location[4]	Estimated Maximum Culvert Velocity (m/s)[5]	Other Culvert Mitigation Details[2]
1.1	524536E 6928280N	Unnamed	2	1x900 CSP	Yes	Install culvert when dry/frozen to bed, isolate if flowing within restricted timing windows for fish in NWT. Use of ice bridge/snow fill or clear-span temporary bridges where needed for equipment crossings or work platforms.	Winter	20-30 m	1.0%	1.43	Culvert embedded 10% as appropriate for species/habitat present; culvert slope will be optimized during construction to reduce velocities; additional erosion mitigation may be applied (e.g., rock reinforcement/armouring), as needed
1.2	524193E 6928262N	Unnamed	2.4	1x1200 CSP	Yes	As above	Winter	20-30 m	1.1%	1.34	As above
2	523370E 6928280N	Unnamed	3.2	2x1400 CSP	Yes	As above	Winter	20-30 m	1.1%	0.80	Culvert embedded 10% as appropriate for species/habitat present
3	518792E 6928205N	Unnamed	7.9	2x1400 CSP	Yes	As above	Winter	20-30 m	0.6%	0.70	As above
4	514358E 6931157N	Unnamed	13.2	3x1400 CSP	Yes	As above	Winter	20-30 m	0.3%	0.76	As above
5	511691E 6933098N	Unnamed	16.5	1x2430 SPCSP	Yes	As above	Winter	20-30 m	1.9%	1.41	Culvert embedded 10% as appropriate for species/habitat present; culvert slope will be optimized during construction to reduce velocities; additional erosion mitigation may be applied (e.g., rock reinforcement or armouring), as needed
6	509976E 6935272N	Unnamed	19.4	2x2430 SPCSP	Yes	As above	Winter	20-30 m	0.3%	1.91	As above
7	508610E 6939192N	Unnamed	23.6	2x1400 CSP	Yes	As above	Winter	20-30 m	0.8%	0.90	Culvert embedded 10% as appropriate for species/habitat present
8	508215E 6955504N	Duport River	40.4	48 m Bridge	No	Construct bridge (including pier installation) during low-flow periods, use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental erosion and sediment control, as needed.	Winter	n/a	n/a	n/a	n/a
9	509484E 6959996N	Unnamed	45.2	24 m Clear-span Bridge	No	Construct bridge during low-flow periods, use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental control measures for erosion and sediment control, as needed.	Winter	n/a	n/a	n/a	n/a
10a	508606E 6962702N	Unnamed	48.2	3660x1910 Arch Culvert	Yes	Construct crossing during low-flow periods, use clear-span temporary bridges and/or ice bridges for equipment crossings. Install and maintain erosion and sediment control measures.	Winter	20-30 m	0.2%	0.36	-
10	508568E 6962757N	Unnamed	48.3	1x1200 CSP	Yes	Install culvert when dry/frozen to bed, isolate if flowing within restricted timing windows for fish in NWT. Use of ice bridge/snow fill or clear-span temporary bridges where needed for equipment crossings or work platforms.	Winter	20-30 m	0.2%	0.36	Culvert embedded 10% as appropriate for species/habitat present
11	507951E 6968773N	Unnamed	54.5	2x1400 CSP	Yes	As above	Winter	20-30 m	0.3%	0.56	As above
13	506823E 6976601N	Unnamed	62.7	3x1400 CSP	Yes	As above	Winter	20-30 m	0.5%	0.92	As above
14	504465E 6982673N	James River	68.7	80 m Bridge	No	Construct bridge during low-flow periods, use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental control measures for erosion and sediment control, as needed.	Winter	n/a	n/a	n/a	n/a
15	501215E 6997791N	La Martre River	85.4	100 m Bridge	No	Construct bridge (including pier installation) during low-flow periods, use ice bridges/snow fill or clear-span temporary bridges for equipment crossings or work platforms. Install and maintain supplemental erosion and sediment control, as needed.	Winter	n/a	n/a	n/a	n/a

'-' data not provided or not available; n/a = not applicable.
[1]Construction activities (including placement of temporary or permanent fill) below the Ordinary High Water Mark (OHWM, or 1:2 year flood flow return level) was determined from the Major Bridge and Culvert Conceptual Designs 2016 (TASR Project Description Report, Appendix I). Any construction at a location where a discernible OHWM is lacking will recognize the 'edge' of water or active channel as a surrogate and any advice provided by an on-site biologist during construction, as required. Bridge piers and riprap are all above the 'edge' of water or active channel in figures, though some are within the 5-year floodplain.
[2]Mitigation for any activities below the OHWM, e.g., timing windows, temporary bridge details, and other design details, were taken from the TASR Project Description Report (main body and Appendix X); note that each bridge is scheduled to be constructed within one winter season based on the conceptual designs (i.e., less than 10 weeks). Though winter construction is scheduled, any open-water season construction will adhere to the DFO in-water timing window (i.e., in-water activity may only occur between July 16 and September 14).
[3]Final road width and length of culvert to be determined by D&C based on guardrail requirement.
[4]Stream slopes at crossing location (%) were calculated using LiDAR data in a GIS platform. Lines were drawn along the path of the watercourse determined from the LiDAR data (from approximately 100 m upstream to 100 m downstream of each crossing) and the resulting path profile of the drawn line was used to measure the stream slope.
[5]Velocities calculated using a Microsoft Excel-based culvert program developed by Golder Associates Ltd. The program was calibrated using 100-year flood data from the Stantec hydrologic and hydraulic study (TASR Project Description Report, Appendix R) and velocities were estimated using 2-year discharge estimates from the same study and updated culvert numbers/sizes from the TASR Project Description Report. Maximum estimated velocities were determined using LiDAR estimated slopes and conservatively estimated water depths. These velocities make several assumptions and are only presented as a rough estimate for use in determining fish passage only.

Table 2: Watercourse Characteristics, Including Habitat Connectivity, at Proposed Crossing Locations

Water Crossing ID	Waterbody Name	Crossing KM	Drainage Area (km^2)	Stream Slope Within Vicinity of Crossing Location	Channel (Bed and Banks) Definition	Main Channel Width (m)	Crossing Location Substrate	Expected Hydroperiod[1]	Potential Fish-Bearing Lake Upstream of Crossing Location[2]	Downstream Distance to Potential Over-Wintering Habitat (m)[2]	Habitat Connectivity Evaluation[3]
1.1	Unnamed	2	1.2	1.0%	Poorly Defined	-	Silt/sand	Ephemeral	No	1,100	Minimal
1.2	Unnamed	2.4	1.2	1.1%	Poorly Defined	-	Silt/sand	Ephemeral	No	1,100	Minimal
2	Unnamed	3.2	2.1	1.1%	Poorly Defined	-	Silt/sand	Ephemeral	No	800	Low
3	Unnamed	7.9	5	0.6%	Poorly Defined	-	Silt/sand	Ephemeral	No	5,200	Minimal
4	Unnamed	13.2	9.9	0.3%	Defined	-	Silt/sand	Ephemeral to Intermittent	No	3,000	Minimal
5	Unnamed	16.5	3.7	1.9%	Poorly Defined	-	Silt/sand	Ephemeral	No	12,000	Minimal
6	Unnamed	19.4	51.3	0.3%	Poorly Defined	-	Silt/sand	Ephemeral	No	13,000	Minimal
7	Unnamed	23.6	6.9	0.8%	Poorly Defined	-	Silt/sand	Ephemeral	No	n/a	Minimal
8	Duport River	40.4	287.4	-	Braided, Meandering, Oxbow Ponds	8.3	Organics/silt	Perennial	Yes	700	High
9	Unnamed	45.2	116.8	-	Defined	11.5	Cobble/gravel/sand/silt	Intermittent	Yes	3,600	Moderate
10a	Unnamed	48.2	N/A	0.2%	Defined, Meandering	-	-	Intermittent	Yes	600	Moderate
10	Unnamed	48.3	0.5	0.2%	Poorly Defined	-	Organics/silt	Ephemeral	No	n/a	Minimal
11	Unnamed	54.5	5.2	0.3%	Poorly Defined	-	Organics/silt	Ephemeral to intermittent	Yes	6,800	Low
13	Unnamed	62.7	10	0.5%	Poorly Defined	-	Organics/silt	Ephemeral to intermittent	Yes	400	Low to moderate
14	James River	68.7	647.8	-	Defined, Meandering	12.2	Gravel/cobble/sand/silt	Perennial	Yes	0	High
15	La Martre River	85.4	13,900	-	Well Defined, Meandering	27	Boulder/cobble/gravel	Perennial	Yes	0	High

'-' = no data available; n/a = not applicable because the crossing location does not intersect within a stream identified in the 1:50,000 Government of Canada topographic database.
[1]Hydroperiod defined based on habitat information provided in the TASR Project Description Report, Appendix R; "Intermittent streams" are assumed to support flowing water periods during the wet season (spring) but are normally dry during summer months; intermittent streams do not have continuous flowing water year-round; "ephemeral streams" have less flow than intermittent streams, are typically shallow, and have flowing water for a brief period in spring or in response to high precipitation events. Ephemeral streams are normally dry for most of the year. In contrast to an ephemeral or intermittent stream, a "perennial watercourse" is a stream or river (channel) that has continuous flow in parts of its stream bed all year round during years of normal rainfall.
[2]Fish-bearing waterbody (i.e., potential overwintering habitat) identified as a 10 ha or larger lake identified within a 1:50,000 Government of Canada topographic database for streams and lakes. Downstream distances to overwintering habitat were calculated as the downstream (fluvial) distance to a 10 ha or larger lake using 1:50,000 GIS topographic layers for streams and lakes; however watercourses that may contain overwintering habitat (i.e., perennial watercourses) were assigned a downstream distance of 0 m, and watercourse locations with no discernible connection on the 1:50,000 layer were identified as isolated habitats (not applicable).
[3]General ranking approach for connectivity of crossing locations are as follows: minimal= ephemeral stream, greater than 1 km upstream of 10 ha lake, and not downstream of a 10 ha lake; low = ephemeral stream, less than 1 km upstream of 10 ha lake, and not downstream of 10 ha lake; moderate = intermittent stream, and downstream of 10 ha lake; and high = perennial stream.

Table 3: Expected Fish Use and Habitat Functions at Proposed Watercourse Crossing Locations

Water Crossing ID	Waterbody Name	Crossing KM	Confirmed Species in Watercourse	Potential Species at Crossing[1]	Likelihood of Forage Fish Species at Crossing[2]	Likelihood of Large-Bodied Species at Crossing[2]	Potential Habitat Functions for Forage Fish Species	Potential Habitat Functions for Large-Bodied Species
1.1	Unnamed	2	-	NNST	Unlikely	Unlikely	Minimal value	Minimal value
1.2	Unnamed	2.4	-	NNST	Unlikely	Unlikely	Minimal value	Minimal value
2	Unnamed	3.2	-	NNST	Low	Unlikely	Seasonal foraging, rearing, migration	Minimal value
3	Unnamed	7.9	-	NNST	Low	Unlikely	Seasonal foraging, rearing, migration	Minimal value
4	Unnamed	13.2	-	NNST	Low	Unlikely	Seasonal foraging, spawning, rearing, migration	Minimal value
5	Unnamed	16.5	-	NNST	Low	Unlikely	Seasonal foraging, rearing, migration	Minimal value
6	Unnamed	19.4	-	NNST	Low	Unlikely	Seasonal foraging, spawning, rearing, migration	Minimal value
7	Unnamed	23.6	-	NNST	Unlikely	Unlikely	Minimal value	Minimal value
8	Duport River	40.4	WALL (Stewart 1997)	ARGR, BURB, LNSC, NRPK, NNST, SLSC, WHSC	High	High	All habitat functions (overwintering uncertain)	Seasonal foraging, rearing, migration; NRPK spawning
9	Unnamed	45.2	-	ARGR, BURB, LNSC, NRPK, NNST, SLSC, WHSC	High	Moderate	Seasonal foraging, rearing, migration	Seasonal foraging, rearing, migration; ARGR/LNSC/NRPK/WHSC spawning
10a	Unnamed	48.2	-	ARGR, BURB, LNSC, NRPK, NNST, SLSC, WHSC	Moderate	Low	Seasonal foraging, spawning, rearing, migration	Seasonal foraging, rearing, migration; ARGR/LNSC/NRPK/WHSC spawning
10	Unnamed	48.3	-	NNST	Unlikely	Unlikely	Minimal value	Minimal value
11	Unnamed	54.5	-	NNST, NRPK, WHSC	Moderate	Low	Seasonal foraging, spawning, rearing, migration	Seasonal foraging, rearing, migration; NRPK spawning
13	Unnamed	62.7	-	NNST, NRPK, WHSC	Moderate	Low	Seasonal foraging, spawning, rearing, migration	Seasonal foraging, rearing, migration; NRPK spawning
14	James River	68.7	ARGR, LKTR, LKWH, NRPK, RNWH (TG 2016)	ARGR, BURB, LNSC, LKWH, NRPK, NNST, RNWH, SLSC, WHSC	High	High	All habitat functions	Foraging, rearing, migration; ARGR/LNSC/NRPK/WHSC spawning and overwintering
15	La Martre River	85.4	ARGR, BURB, INCO, LKCH, CISC, EMSH, LKTR, LKWH, LNSC, NNST, NRPK, RNWH, SLSC, SPSH, TRPR, WALL, WHSC (Bond 1973; Chang-Kue et al., 1987; ARI 2012)	ARGR, BURB, LKCH, CISC, LKTR, LKWH, LNSC, NNST, NRPK, RNWH, SLSC, WHSC	High	High	All habitat functions	All habitat functions

'-' = no data available.
Species codes: ARGR = Arctic Grayling, BURB = Burbot, INCO = Iconnu, LKCH = Lake Chub, CISC = Cisco, EMSH = Emerald Shiner, LKTR = Lake Trout, LKWH = Lake Whitefish, LNSC = Longnose Sucker, NNST = Ninespine Stickleback, NRPK = Northern Pike, RNWH = Round Whitefish, SLSC = Slimy Sculpin, SPSH = Spottail Shiner, TRPR = Trout Perch, WALL = Walleye, WHSC = White Sucker.
[1]Potential species at crossing based on previously reported catch data where available (crossings 8, 14, and 15). If no available catch data, this column was populated based on the type of habitat available (TASR Project Description Report, Appendix R), and the habitat requirements of species potentially in the area (TASR Project Description Report, Table 6-13), which considered previously reported species distributions at the nearby NICO project (Golder 2011).
[2]High = Fish confirmed or expected to be present at watercourse location based on habitat characteristics and existing baseline data; moderate = watercourse location contains suitable habitat for fish on a seasonal basis and may be connected to a waterbody with the potential to support fish (i.e., to provide overwintering habitat); low = watercourse location contains habitat for occasional use of fish, however, poor connectivity to overwintering habitat may preclude fish presence; unlikely = watercourse location contains marginal habitat for fish and lacks connectivity to overwintering habitat

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