

Dempster Fibre Project

Management Plan: Inspection and Maintenance

Type A Land use permit: MV2019X0027

Type B Water Licence: MV2019L8-0013

Submitted by:

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Introduction and Background

This document is submitted to comply with Land Use Permit MV2019X0027 (Condition 73) and Water Licence MV2019X0027 (Condition B.21), both of which require the proponent to submit an Inspection and Maintenance plan.

This document provides a high-level framework for managing the inspection and maintenance of the Dempster Fibre Line once it becomes operational. The line is being built by the Government of Yukon, but will be operated and maintained by NWTel for a 20-year term.

Once the Dempster Fibre Line is operational, this document may be revised to integrate into NWTel's inspection and maintenance program, and to conform to future preferred practices.

Inspection and Maintenance Plan Parameters

Regular inspection and maintenance of a fibre network the size and complexity of the Dempster Fibre Line will be challenging but will be necessary to ensure that problem areas which could impact both the technical performance of the network and the environment are detected and addressed early.

Traditionally in fibre optic networks, the network operations inspection and maintenance plan will consist of a "Preventative" maintenance component and a "Corrective" maintenance component. Network Operations Centre (NOC) technology has the capability to monitor the network performance on a real time basis with sophisticated online tools that identify specific problems, the impact, and the location along the network. This allows for the dispatching of the appropriate network technician skill set to respond quickly and efficiently, addressing and resolving the problem before it becomes customer impacting. Preventative maintenance also includes a field component where visual and physical checks are completed on an annual basis along the cable route to spot any obvious outside plant infrastructure issues which could cause connectivity damage to the cable or conduit along the network. Cable which is buried in conduit is generally considered better protected than cable strung on poles. Corrective actions result from disruptions or negative impacts that occur from a deviation which was not detected during the preventative maintenance program. A corrective maintenance response in the form of a Service Level Agreement (SLA) normally contains detailed standards of performance correlated against the impact of the service disruption. The speed of the Technical Operation's response is directly proportional to the size and scale of the disruption.

The Dempster Fibre Line is not a traditional fibre cable Installation. The complexity of the terrain, the permafrost, the importance of the vegetation, ground cover, and the often severe and unpredictable northern weather extremes, make this installation much more complex than typical.

The construction complexity along the Dempster highway is challenged by a myriad of terrain constraints from loose gravel, to sandy soil, to bedrock, to water crossings between the starting point in Dawson, YT and the end point in Inuvik, NWT. Most of this long-haul network will be buried underground at various depths due to changing permafrost active layer depths encountered along the route. Climate change can impact permafrost behaviour, resulting in changing environmental conditions impacting the Dempster Fibre Line installation.

Given the many variables which are present in this complex build, there is a need to consider both preventative and corrective maintenance programs during the operations cycle to ensure that potential environmental issues are detected early to minimize any long-term environmental impacts.

Monitoring and Response Framework

Matrix

The Dempster Fibre Line project team has developed a matrix which is intended to frame the key components of the required Inspection and Maintenance Plan (see Appendix 1). There is also a sample high-level network checklist which has supported NWTel's field preventative maintenance program in a different, but similarly challenging, location (see Appendix 2). The matrix and sample checklist may inform a further developed Inspection and Maintenance plan after completion of the fibre build.

The matrix considers the key environmental areas which could be impacted by the construction of this fibre network and provides an indication of the direction of inspection efforts as well as potential maintenance responses in the event of an identified concern or fault during operations. This information is presented at a high level for the purpose of this pre-construction submission and the operator may develop associated Standards of Performance in a more detailed plan once the construction has been completed.

Schedule

Inspection schedules have not been established but a potential format may include a spring inspection followed by remediation in the summer, followed by a spring inspection of remediation efforts in the subsequent year.

The purpose of the spring inspection would be to identify locations or areas in need of maintenance due to occurrence of erosion, deep ruts, significant settling, heaving, potholes, sink holes, or other indication of environmental impacts caused by the fibre line construction or by natural processes along the trench route. Areas for maintenance could be documented in a spring inspection report as corrective action items to be implemented before a subsequent inspection. Action items could be triaged and prioritized according to scale and timing of potential impacts to safety, fibre line operation, and the environment. All documented corrective action items may not be addressed within the same year of observation. Lower priority corrective action items could be scheduled for a subsequent season.

Efficacy of corrective actions implemented subsequent to spring would be observed in the subsequent years' inspection to make any adjustments if needed.

The spring inspection report prepared by a qualified geotechnical engineer and/or other qualified professionals could be compiled into an annual report for comment on corrective actions taken, and recommendations for additional corrective actions, if warranted. The annual report could also provide a summary of responses and/or follow-up actions taken based on professional recommendations provided in the previous annual report, and the professional's opinion on the adequacy of the corrective actions and recommendations on final close-out of the corrective action.

Records and Database

Once construction has competed, NWTel will integrate the Dempster Fibre Line into its inspection and maintenance portfolio. General system dimensions that operators consider when managing these activities include developing and maintaining a records database consisting of preventative and corrective actions taken, GPS coordinates of the locations, and photos and video records captured during the inspection cycles. These can serve two main purposes:

1) The operator will use the annual records to establish reference baselines for future year comparisons to identify common or recurring problem areas or trends which need to be addressed to protect the integrity of the fibre network and to address longterm potential impacts to the environment.

2) The operator will also use the records to develop annual reports as required, by the MVLWB and Land Use Authorities or any other authorities having jurisdiction. The annual reports can provide documented details of the Inspection plan findings and any maintenance response activities undertaken during the year.



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А	ppen		inspection	anu	Maintenance	Matrix

	2022-04-21	DFL High Level Inspection and Maintenance Plan - Environmental								
		INSPECTION CATEGORY			P	OST CONSTRUCTION ENVIROMENTA	L CONSIDERATIONS	1		MAINTENANCE RESP
-	11/07 I.D. 1/11	POTENTIAL IMPACT	POTENTIAL INSPECTION	PERMAFROST DEGRADATION	WATER QUALITY	EROSION/DRAINAGE	ANIMALS	VEGETATION	HIGHWAY	
1	U/G Irench Backfill	 Settling of trench backfill, deep ruts, exposed conduit, water erosion, or drainage impacting the cable or conduit. 	*Annual inspection of entire U/G route.			 Inspect for areas where erosion has occurred or drainage patterns have been impacted that expose cable or conduit along fibre optic line route. 	* Inspect for potential trip hazards in areas where the cable or conduit is exposed along the fibre optic line route.	* Inspect for areas of exposed cable or conduit with missing or damaged organics along trench alignment.	* Inspect road crossing points along the route during seasonal drive.	Re-bury any surface exposed cable of conduit along route. Top up trench backfill and level surface in areas of significant cable or conduit becoming exposed as assessed by the Operator Document action item and corrective actions with GPS, Photo Re-visit site during following inspection visit, and close-out a actions as required.
2	Sub-Surface Placement	* Damaged surface organics and vegetation or water erosion impacting the cable or conduit.	* Annual inspection of entire Sub- Surface Placement U/G route.	* Inspect for areas where downslope movements, land slides or trench collapse have occurred along sub-surface placement route that have exposed the cable or conduit. * Inspect for areas of erosion exposing the subsurface mineral soil and missing or damaged organics along trench alignment that have exposed the cable or conduit.		* Inspect for areas where erosion has occurred or drainage patterns have been impacted along route that have exposed the cable or conduit.	* Inspect for potential trip hazards in areas where the cable or conduit is exposed along the fibre optic line route.	* Inspect for areas of exposed cable or conduit with missing or damaged organics along trench alignment.		 * Re-bury any surface exposed cable or conduit along route. * Replant/seed exposed surface areas along trench where vege or conduit. * Document action item and corrective actions with GPS, Photo * Re-visit site during following inspection visit, and close-out a actions as required.
3	Rock Cut Installation	* Settling of trench backfill, deep	* Annual drive of entire rock cut			* Inspect for areas where Bock Cut	* Inspect for potential trip			* Re-bury any surface exposed cable or conduit along route.
5		ruts, exposed conduit, water erosion, or drainage impacting the cable or conduit.	installations along the cable alignment.			work has occurred. Look for drainage pattern disruption or a seismic event has occurred that has exposed the cable or conduit.	hazards in areas where the cable or conduit is exposed along the fibre optic line route.			 Top up trench backfill and level surface in areas of significant cable or conduit. Document action item and corrective actions with GPS, Photo Re-visit site during following inspection visit, and close-out a actions as required.
4	Surface Lay in Water	* Exposed cable in water or exposed conduit leading to crossing, sedimentation impact from Riparian zone runoff.	* Annual inspection of all Surface Lay in Water installations along the cable alignment.		* Inspect Riparian Zone for signs of erosion and runoff channels into the watercourse that has caused exposure of the cable or		* Inspect Riparian Zone for exposed cable or conduit.			* Re-bury any surface exposed cable or conduit along route. * Top up trench backfill and level surface in areas of significant cable or conduit. Only hand tools will be used in Riparian Zone * Replant/seed exposed surface areas along trench where cabl vegetation is missing. * Document action item and corrective actions with GPS. Photo
5	Riparian Zones	*Potential for Riparian area/stream bank de-stabilization and water quality impacts resulting from erosion.	* Annual inspection of all Surface Lay in Water Riparian Zone installations along the cable alignment.	* Inspect for exposed surface with missing or damaged organic layer along trench alignment that has exposed the cable or conduit	conduit.	* Inspect Riparian Zone for signs of erosion and runoff channels into the watercourse that has caused exposure of the cable or conduit.		* Inspect for areas of exposed cable or conduit with missing or damaged organics along trench alignment.		 Re-visit site during following inspection visit, and close-out a actions as required.
6	Pole, Line and Anchor Installation	 Excessive sag at span midpoints could impact animals. Poles which are leaning and not vertical may indicate heaving, permafrost damage or tensioning issues. Loose anchors could result in animal trip hazards Damaged or loose grounding could increase potential for lightning strikes and wildfires. 	* Annual inspection of all installed poles and pole attachments along the entire cable route.	Inspect for evidence of previous wild fires, or lightning strikes and ensure proper grounding of pole line. Inspect pole locations where downslope movements, land slides, ruts or sink holes or evidence of seismic collapse have occurred. Inspect for exposed surface areas with missing or damaged organics at each installed pole location.		* Inspect for pole locations where downslope movements, land slides, ruts or sink holes or evidence of seismic collapse have occurred.	Inspect for potential trip hazards as well as animal interaction at each installed pole location along entire route.	* Inspect for exposed surface areas with missing or damaged organics at each installed pole location.		 Effect any pole/anchor installation repairs required according Effect any repairs to pole line tension to ensure mid span sag secure. Identify any clearance issues on pole attachments and notify Repair and level ground where water erosion or drainage ing of pole installation. Restore natural drainage patterns. Re-bury any surface exposed conduit at handhole locations. Replant/seed exposed surface areas around pole installation Document with GPS, Photos/Videos.
7	Hand Hole Locations	* Settling of handhole, heaving and water erosion, drainage impact, creation of deep ruts, exposed conduit, open lids, leading to potential animal interaction.	* Annual drive of entire alignment inspecting all above and below ground handholes. Late spring (May-June) is preferable.	* Inspect for exposed surface areas with missing or diminished organics around handhole installation.			* Inspect for potential trip hazards as well as animal interaction at each Handhole location along entire fibre optic line route.			 Level handholes and rebuild locations as required if significar water erosion or diversion has occurred. Ensure adequate drainage is occurring inside handhole. Re-bury any surface exposed conduit at handhole locations. Top up trench backfill and level surface in areas of significant Ensure proper grounding connections exist at all handhole loo Document action item and corrective actions with GPS, Photo Re-visit site during following inspection visit, and close-out a actions as required.
8	Fire Tolerance	* Burned out surface vegetation leading to permafrost degradation, heaving or formation of sink holes and water erosion impacting established drainage patterns along cable trench alignment.	* Annual inspection of all handholes and new pole installations, check for proper grounding at those locations or signs of lightning strikes. * Annual inspection to check for fallen trees within 3m of handholes and pole installations.	* Inspect for exposed surface with burned out, missing or damaged organics along cable alignment that has exposed the cable or conduit.		* Inspect for areas where downslope movements, land slides or trench collapse have occurred along all cable trench alignment due to evidence of wildfires that has exposed the cable or conduit.		Inspect for exposed surface with burned out, missing or damaged organics along cable alignment or in the immediate vicinity of new pole installations or Outside Plant handhole locations.		* Repair or replace poles if fire damage has occurred. * Repair or replace handholes if fire damage has occurred. * Re-bury any surface exposed conduit along cable trench align Document action item and corrective actions with GPS, Photo * Re-visit site during following inspection visit, and close-out a actions as required.
9	Restoration/Reclamation	* Damaged surface organics and vegetation, heaving or formation of ruts, pot holes or sink holes, water erosion impacting natural drainage patterns impacting the cable or conduit	* Annual inspection of all significant Restoration/Reclamation areas identified during and following construction.	* Inspect for exposed surface with missing or damaged organics along all Restoration and Reclamation work areas. * Inspect for areas where downslope movements, land slides or trench collapse have occurred along all Restoration and Reclamation work areas.		* Inspect for exposed surface with missing or damaged organics along all Restoration and Reclamation work areas. * Inspect for areas where downslope movements, land slides or trench collapse have occurred along all Restoration and Reclamation work areas.		In all Restoration, Reclamation areas; * Inspect for exposed surface with missing or damaged organics along all Restoration and Reclamation work areas.	In all Restoration, Reclamation areas; * Inspect all horizontal directional drill (HDD) road crossing points along the route during Seasonal Drive.	In all Restoration, Reclamation areas; * Effect any ditch water diversion impacts that may be required as assesed by Northwestel * Re-bury any surface exposed cable or conduit along route . * Top up trench backfill and level surface in areas of significant has been re-buried * Replant/seed exposed surface areas along trench where cablive vegetation is not established * Document action item and corrective actions with GPS, Photo * Revisit site during following inspection visit, and close-out a
		1				1			1	actions as required.

NCE RESPONSE

route

significant settling or deep ruts where there is risk of e Operator

GPS, Photos/Videos.

close-out action item or implement additional correcti

where vegetation is missing and has exposed the cable

GPS, Photos/Videos. close-out action item or implement additional correctiv

g route.

significant settling or deep ruts that has exposed the

GPS. Photos/Videos. close-out action item or implement additional correctiv

f significant settling or deep ruts that has exposed the parian Zone repairs. where cable or conduit has been re-buried and where

GPS, Photos/Videos.

close-out action item or implement additional correctiv

d according to pole Operator/Owner requirements. id span sag requirements are met and anchors are

and notify pole Owners accordingly. rainage impacts have occurred that may affect integrity

nstallation where natural vegetation is missing.

if significant settling, heaving or deep ruts caused by

significant settling or deep ruts exist. andhole locations. GPS, Photos/Videos.

close-out action item or implement additional correctiv

curred. trench alignment. GPS, Photos/Videos.

close-out action item or implement additional correcti

e required to mitigate impact on the cable or conduit

significant settling or deep ruts where cable or conduit

where cable or conduit has been re-buried and

GPS, Photos/Videos.

close-out action item or implement additional correctiv

Appendix 2 - Sample Inspection and Maintenance Field Checklist

Environmental - Fibre Route

NorthwesTel

XX SAMPLE- Notice of Routine Maintenance Completion Environmental – Fibre Route

Frequency: Bi- Annual

Date: ____/ /___mm/dd/yy

Technician: ____

Location: One form submitted for each location. This form for (check box):

□ Segment 1	□ Segment 2	□ Segment 3
□ Segment 4	□ Segment 5	□ Segment 6

	Maintenance Action	Initial Completed	Comment On Condition Found	Further Action Taken or Required
	Fibre Route Inspection			
1.	 Debris: Check for debris not natural to the location. Remove fallen trees if within 10' of any hand hole. 			
2	 Erosion: Check for and document any exposed cable for reporting and subsequent remediation purpose for the following scenarios: Wash outs Erosion Deep ruts Check for blocked culverts and look for signs of water runoff and document/report potential hazards/concerns Check condition of remediation solutions Document and report on undermining of trees and local vegetation 			

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Environmental – Fibre Route

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	Maintenance Action	Initial Completed	Comment On Condition Found	Further Action Taken or Required
3.	 Brush: Check growth of natural vegetation – Brushing on sites where applicable (e.g. handhold locations, existing cleared sites for repair equipment staging) Allow natural vegetation to re-establish in accordance with Closure and Reclamation Plan 			
4.	 Fire Tolerance: Check for exposed fibreglass of the tub in hand holes to ensure coverage Ensure lids are closed Check to ensure no fallen trees or local vegetation within 10' of plant facilities that increase chance of fire damage 			

_			-	
5.	At	bridge structures, check condition of: Cable route markers (at maximum distance of 50m between each marker at all bridges; check for clear visibility of markers) Fibre tags on conduit on bridges Attachments for physical damage		
		Filotograph visible structures		
		Check integrity of steel conduit running on the ground		
6.	Splice Enclosures, Hand holes & Poles and Anchors:			
		Check condition of each splicing chamber:		
		Ensure they are closed properly and sealed		
		For Hand holes, ensure splice enclosures are sealed properly and check for moisture		
		Visual inspection of facilities to report on any physical damage (where applicable)		
		Report any pole damage, brushing requirements etc. to pole owners		

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Environmental – Fibre Route

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	Maintenance Action	Initial Completed	Comment On Condition Found	Further Action Taken or Required
7.	Water Crossings:			
	 Remove obstacles, branches and fallen trees 			
	Check for exposed cables in creek bed as part of visual inspections			
	 Locate and record depth for comparison purposes with construction specs 			
8.	Video/Photo Record:			
	 Check for quality of video/photo recorded 			
	Compare critical sites year over year			

Attach scanned / photographed copy to vFire ticket upon completion of this inspection.



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