Trans Mountain Pipeline ULC (Trans Mountain)
Trans Mountain Expansion Project
Certificate of Public Convenience and Necessity OC-065
Application pursuant to section 211 of the *Canadian Energy Regulator Act* – Segment 5.3 (Pipsell area)
CER File: OF-Fac-Oil-T260-2013-03 61

Information Request No. 2
Due Date: September 11, 2023

2.1 Micro-tunnelling

CER Reference

i) C25972-2, Trans Mountain Pipeline ULC (**Trans Mountain**), Response to Commission Information Request (**IR**) No. 1.2(a) and (c), PDF pages 5 to 7 of 8

ii) C25832-4, Trans Mountain, Application, Appendix C – Engagement Summary, PDF page 105 of 109

iii) C26029-2, Trans Mountain, Reply submissions, Paragraph 24, PDF page 7 of 12

iv) C25972-8, Trans Mountain, Response to Commission IR No. 1.2(d), Attachment 1.2-2 – Geotechnical Investigation for Microtunneling Installation Jacko Lake Area, Appendix A – Drawings, PDF page 15 of 20

CER Preamble

In Reference i), Trans Mountain indicates the following:

- A varying level of vertical deviation was identified over approximately the first 53 metres (**m**) of the tunnel drive, with the largest deviation noted over an approximately 20 m section. The intermediate shaft (**Shaft-6**) is positioned roughly 60 m in front of Shaft-1. As such, Trans Mountain anticipates that approximately 53 m of the tunnel will be abandoned between Shaft-1 and Shaft-6, and this 53 m will be open cut.
- If Trans Mountain is successful in completing Shaft-6 and the Commission does not approve the deviation, Trans Mountain would seek to restart tunnelling operations and employ mitigation as required to address any new challenges that are experienced with the tunnelling. However, for the reasons described below, completing this tunnel drive is considered high risk even if Shaft-6 is successfully completed. Trans Mountain notes that it has never attempted to install a shaft above an already installed section of tunnel.
- The challenges faced in resuming micro-tunnelling include (1) avoiding damage to the reinforced concrete jacking pipes (**RCJPs**) that are planned to remain in place and be used in completing the tunnel, (2) inducing vibration in the annular space around the existing RCJP, which could compact the native materials and increase skin friction, and (3) maintaining perfect alignment of the new shaft for the jacking forces to be applied in line with the existing tunnel alignment.
- The micro-tunnel boring machine (**MTBM**) and approximately 500 m of RCJP have been dormant since tunnelling stopped on 14 June 2023 to accommodate construction of Shaft-6 to avoid the hump along the tunnel alignment.
- The shutdown of tunnel progress and the resumption of tunnelling operations create risk related to restoring the annular space as it is anticipated that the bentonite in the annulus has drained off into the rock joints or has been diluted by the surrounding groundwater, causing degradation of the annular space. This is expected to increase the skin friction along the MTBM and the trailing RCJP,

significantly increasing the force required to restart the tunnel.

- In addition to the extensive tunnel length of 1 312 m (the longest drive on the Jacko Lake Major Trenchless Program and one of the longest hard rock drives ever completed by an AVN2000), the tunnel profile features a significant elevation difference of more than 60 m between the deepest part of the drive and the surface.
- In summary, the delays due to the hump (and associated annular space deterioration), the length of the drive, the very hard nature of the rock (with the hardest rock still ahead), fatigue/wear already noted in key mechanical components of the MTBM, and no clear way to access the tunnel boring machine for major repairs/replacement make completing this tunnel drive high risk, even if Shaft-6, currently being constructed for Stage 3, is successfully completed.
- The risks identified above are unpredictable and have the potential to delay tunnel completion by months or jeopardize the ability to complete the tunnel at all.

In Reference ii), Trans Mountain indicates that tunnelling is currently forecasted to resume on 26 August 2023.

In Reference iii), Trans Mountain states that only two drives have been completed at the time of this filing (tunnel drives #1 and #3). The ground conditions being experienced in tunnel drive #2 are different and more challenging than those experienced on tunnel drives #1 and #3. The technical challenges experienced on tunnel drive #2, as described in the application and Reference i), were not reasonably foreseeable at the time that Trans Mountain agreed to pursue micro-tunnelling for this segment of the Trans Mountain Expansion Project (**TMEP**).

Reference iv) is drawing M002-XM05101-01 (Revision 1) titled “Location Plan and Profile Microtunnel Jacko Lake,” which includes the location of the pads but does not include the shafts.

CER Request

a) Provide an update on the construction progress of Shaft-6 and a timeline for the remaining work on Shaft-6.

b) Confirm whether tunnelling resumed on 26 August 2023 as indicated in Reference ii). If not, indicate if and when tunnelling is expected to resume.

c) Provide a sketch illustrating the information described in Reference iii) and including the location of the tunnel drives (pads and shafts), final tie-ins, construction progress, and ground conditions for each tunnel drive.

d) Provide calculations for the force required to restart the tunnel activities and discuss the capability of the MTBM and jacking equipment to achieve the calculated force.

e) Explain why Trans Mountain chose the MTBM AVN2000 (including its cutter heads) to complete the 1 312-m-long tunnel in hard rock.

f) Provide the contractor’s experience in designing and successfully installing pipe using micro-tunnelling in similar conditions as those experienced at Jacko Lake, including a brief description of the work, location(s), and year(s).

g) Provide detailed drawings of Shaft-6 showing the equipment set up in-hole and discuss the potential impacts of the abandoned 53 m on the continued jacking activities.

h) If Shaft-6 and micro-tunnelling are successfully completed, provide details on how Trans Mountain would complete final tie-ins at Shaft-1 and the new Shaft-6.

Trans Mountain Response

a) Excavation of Shaft-6 is not yet complete. Construction activities in the Jacko Lake area were delayed due to poor air quality and proximity of the Ross More Lake wildfire. Demobilization of the shaft contractor is expected to be completed by approximately September 15. Civil work associated with converting the shaft to a jacking pit, installation of the jacking frame and supporting utilities, and the lowering/testing/launching of the MTBM would be expected to take approximately 3 weeks and would therefore be expected to be completed during the first week of October. If Trans Mountain does not receive a decision from the Commission permitting it to proceed with the deviation, Trans Mountain plans to attempt to resume tunneling operations at Tunnel Drive #2 during the week of October 9, 2023.

b) See response to a), above.

c) Refer to supporting documentation in Attachment 2.1c for the status of the four (4) tunnel drives and requested information on the Jacko Lake Micro-Tunneling Program.
   - Supporting Documentation:
     - Jacko Overview.pdf
     - Jacko Lake MTBM Drives Summary.pdf
     - 01-13283-M002-PM0061008_0_IFC.pdf

d) The most recent recorded performance parameters for Tunnel Drive #2 (June 15, 2023) are:
   - Rate of Penetration 2-3 MM/Min
   - Main Jacking Station 950 Ton (68% of design capacity)
   - Intermediate Jacking Station (IJS) # 3 - 520 Ton

   The tunnel has been dormant since June 15, 2023, and readiness for the resumption of tunneling operation is expected around October 9, 2023, following approximately four (4) months of inactivity. During an inactive period, the annular space surrounding the reinforced concrete pipe column is expected to deteriorate due to factors including, but not limited to, settlement of fine cuttings in the annular space, local collapses, and ground water flow. The extent of the deterioration around the tunnel's circumference will vary along the length of the tunnel based on many parameters, including nature of the formation around each section of the tunnel (i.e., clay, sand, gravel, fracture rock, competent rock), height of hydrostatic head, local groundwater flow, and condition of the bentonite mix left in the annular space. While there is no practical way to know or assess the extent of annular space deterioration, the following calculation can be made:

   - Jacking forces at main jacking station prior to shutdown = 950 tons
   - Design capacity of main jacking station = 1400 tons

   For comparison purposes, Tunnel Drive #4 experienced a four-week inactive period earlier this summer. Pre- and post-stoppage values for that tunnel drive are summarized below:

Table 2.1-1: Jacking Forces Required for Tunnel Restart at Tunnel Drive #4

Component	Pre-Stoppage Jacking load (Tons)	Post-Stoppage Jacking load (Tons)
Main Jacking Station	720	550
IJS 3		350
IJS 2		500
IJS 1	400	600
Rate of Production	13 mm / min	14 mm / min

Data from Tunnel Drive #4 suggests that before the stoppage, IJS 1, located approximately 60 m behind the MTBM, was able to advance the cutterhead utilizing 400 T, with the main jacking system pushing ahead the remaining approximately 400 m of pipe column utilizing 720 T. Upon resumption of tunneling operation 4 weeks later, jacking forces needed to advance the cutter wheel increased by 50% to 600 T, while a combined jacking force of 1400 T (among the main jacking station, IJS 3 and IJS 2) was needed to advance the approximately 400 m long concrete pipe column ahead, indicating that the frictional force between the tunnel and the formation surrounding it had doubled during the inactive period.

Trans Mountain is unsure of the exact required force to restart Tunnel Drive #2 after the suspension of forward progress. Based on the findings of Tunnel Drive #4, the jacking force required to advance the tunnel is expected, at a minimum, to double or triple due to the 4-month extended inactive period, to a total of 2000-3000 T (approximately 4-6 T/m). Trans Mountain would seek to apply the necessary force by opening and closing the IJSs located throughout the length of the tunnel. IJS are designed to provide jacking force to overcome the frictional resistance to pipe motion over the distance between them and have a capacity of up to approximately 1,400 kN (1427 T). There are currently three IJS located within the tunnel, spaced approximately 120 to 140 m apart. With maximum of 140 m between adjacent IJS, and approximately 1400 kN (1427 T) available at each IJS, approximately 10 T/m of thrust force is available to resume forward motion. This could be enough to overcome the skin friction if similar increases are seen as on Tunnel Drive #4, however, an average increase of one Kilopascal (~0.15 psi) in the friction between the tunnel and the formation will render the tunnel immobile utilizing the main jacking station, a condition likely to occur following such a long inactive period. If the frictional pressures on the concrete pipe cannot be overcome by the jacking equipment, then the MTBM and tunnel pipe will not be able to be progressed forward. A rescue shaft may have to be investigated; however, the current location of the MTBM is not feasible for such an installation, as described in Trans Mountain's response to CER 1.2c) at PDF page 7 of 8.

e) The utilization of an AVN2000 for the four tunnel drives proposed at the Jacko Like area was recommended by Trans Mountain's specialty tunneling contractor, IPC/ Bothar, in a report entitled "Trenchless Sections Feasibility And Estimates For The Spread 5a - Jacko Lake Area Project, Kamloops, BC" (dated July 15, 2021). Within the report, Bothar recommended the use of an AVN2000, stating: "Based on the available geology information, 2 (two) AVN 2000 slurry-based machines with rock cutting tools are proposed for this project". Attachment 2.1e provides a list of tunnel projects completed utilizing an AVN2000 in hard formations around the world, which supports the recommendation. The decision was also confirmed in consultation with Herrenknecht (MTBM Manufacturer) using a project in Auckland, New Zealand (1,296 m long micro-tunnel) as a case study, where the geotechnical conditions were similar to the geotechnical findings and proposed plans to complete the Jacko Lake Tunnel Drive #2 (highlighted in Attachment 2.1e).

The preliminary design proposed a drive length of 1,272 m between Shaft-1 and Shaft-2. The location of Shaft-2 was later adjusted in discussions with SSN to minimize the overall impact of access roads/pad construction, resulting in a final drive length of 1,312 m. SSN regularly emphasized to Trans Mountain the importance of minimizing the size of the pads. Changing to a larger TBM would have significantly increased the required size of the staging area. For example, a TBM requiring segmental liner would require a staging area of approximately 250 m in length with a width of approximately 125 m (approximately 31,000 m^2), or a six (6) fold increase compared with the area needed to deploy a AVN2000 (approximately 5,000 m^2).

f) The following information (quoted from the website of the Contractor) describes Bothar's experience in designing and successfully installing pipe using micro-tunnelling in similar conditions to those experienced at Jacko Lake. The supporting document, Attachment 2.1f: Bothar Project History – Micro-tunnel, identifies Bothar's project history with completing similar micro-tunnel crossings.

"*The Bothar Group of Companies ("Group") is an international contractor that has over 25 years of cutting edge experience in successfully delivering challenging subsurface engineering solutions to a wide range of clients and market sectors. It has an enviable track record and a highly skilled and diverse capability range that enables it to provide a focused contract solution to all tunnelling projects. The Group has offices in Australia, New Zealand, Canada, Singapore, Qatar, Dubai, Kuwait, South Africa, Ghana and the UK , and is able to support expansion into other geographical areas in the tunnelling contracting arena. Our offerings include shaft construction, microtunnelling, Auger Boring, Tunnel Boring & Pipe Jacking, Direct Pipe, Bothar Built tunnelling machines, Bothar Cranes and HDD. The Group has a strong focus on worker and public safety, ensuring that it minimises its environmental footprint whilst also striving to maintain the public amenities to road, rail, seaway and utility services in meeting with the local community's expectations*".

g) Please see Attachment 2.1g: - Jacko Lake Shaft 6 Shoring Design Drawings, which illustrates the Shaft-1, Shaft-6, and equipment locations. The abandoned tunnel between Shaft-1 and Shaft-6 is not expected to impact the continuation of jacking activities. All utilities needed to support the tunneling activities will be re-routed to Shaft-6. Additionally, Shaft-6 thrust wall was designed to withstand the maximum achievable jacking forces of the equipment. The RCJP immediately east of Shaft-6 have been capped and are to be abandoned in place.

h) Assuming Shaft-6 and micro-tunneling are successfully completed, a riser would be installed at Shaft-6 to bring the NPS 36 carrier pipeline to a 1.2 m depth of cover. The pipe would then be tied-in to the open cut section east to Shaft-1 via conventional open-cut construction for approximately 53 m, through this already disturbed area.

2.2 Horizontal directional drilling and open trench

CER Reference

i) C25972-2, Trans Mountain, Response to Commission IR No. 1.1, PDF page 1 of 8

ii) C25972-2, Trans Mountain, Response to Commission IR No. 1.2(e), PDF page 7 of 8

iii) C25972-21, Trans Mountain, Response to Commission IR No. 1.2(d), Attachment 1.2-3 – Horizontal Directional Drill (**HDD**) Execution Plan, Appendix E – Issued for Construction Design Drawing, PDF page 48 of 48

iv) C26029-2, Trans Mountain, Reply submissions, Paragraphs 26 to 28 and 30, PDF Page 8 of 12

v) C25999-13, Stk'emlúpsemc te Secwépemc Nation (**SSN**), Written submissions, Appendix E, PDF pages 3 and 12 of 66

CER Preamble

In Reference i), Trans Mountain states that its proposed construction through the area includes approximately 880 m of open cut and approximately 450 m of trenchless HDD.

In Reference ii), Trans Mountain states that the risk assessment completed for the HDD portion of the deviation concludes that the HDD is low to low-medium risk. The formations identified within the geotechnical report are suitable for HDD installation methodologies. As a result, Trans Mountain has a reasonably high degree of confidence that HDD installation in this area will be successful.

Reference iii) shows the HDD and micro-tunnel design paths. It appears to the Commission that both methodologies share the same path at the lowest point of the HDD path.

In Reference iv), Trans Mountain states the following:

- The preliminary design at the time of the 2021 slide deck contemplated an 800-m-long HDD. Further, site-specific geotechnical investigations had not yet been completed at the time of this 2021 preliminary report.

- Since the time of the 2021 presentation, Trans Mountain has completed further design iterations and investigative reviews of the HDD for the deviation, which would be approximately 450 m long. Trans Mountain has also completed site-specific geotechnical investigations.

- The findings of the June 2023 geotechnical assessment for the trenchless crossing at Jacko Hill indicate that the proposed HDD installation is feasible, as noted in the application and Trans Mountain's response to Commission IR No. 1.2. That report also notes that the same rock that tunnel drive #2 encountered will be intersected with the proposed HDD. Tunnel drive #2 did not note any highly fractured zones impacting forward progress. The HDD is expected to be successfully installed in this formation, similar to other HDDs completed in similar rock conditions for the TMEP.

- Trans Mountain is currently successfully executing several hard rock crossings with similar rock quality designations over lengths that are much greater than the 450-m-long HDD that is part of the deviation. Based on Trans Mountain's experience completing HDD crossings within bedrock over greater lengths elsewhere along the TMEP route, Trans Mountain expects the proposed HDD crossing of the Jacko Lake Hill will be successful.

In Reference v), SSN provides Trans Mountain's March 2021 slide deck showing the options to complete the Jacko Lake crossing. Option 1 shows the normal footprint with the conventional method and Option 2 illustrates a 20 m restricted footprint with the conventional method.

CER Request

a) Explain why Trans Mountain has a reasonably high degree of confidence that HDD installation will be successful.
b) Clarify why HDD is not the preferred construction method for the complete length of the deviation.
c) Clarify whether Trans Mountain would attempt to use the normal footprint or the 20 m restricted footprint with the conventional method for the deviation.

Trans Mountain Response

a) Trans Mountain has completed, or is currently constructing, 73 major trenchless crossings on the Project. A number of trenchless installations have been completed utilizing Horizontal Directional Drill (HDD) methodology. The significant experience gained through the successful completion of crossings of similar lengths in hard rock formations forms the basis for Trans Mountain's high degree of confidence that the proposed HDD will be successful. In addition, the immense background of HDD knowledge from the Trans Mountain team, Engineer of Record, Geotechnical Consultants, and HDD Contractors all indicate that a successful HDD installation is expected at this location. A list of HDD crossings in similar conditions is provided in Table 2.2-1 below:

Table 2.2-1 Comparable HDD crossings on the Trans Mountain Expansion Project

Location	Crossing Name	Crossing KP	Crossing Length (m)	Geotechnical Data	UCS Results	Status
Spread 5A	Coldwater River #2	966+500	853	Volcanic bedrock (fine grained)	17 to 76 Mpa	Complete
	Coldwater River #4	986+200	839	Igneous rocks (granite and granodirorite)	18 to 118 MPa	Complete
Spread 5B	Dry Gulch	992+900	1,842	Medium to coarse grained and weathered quartz gneiss and schist	100 to 250 MPa	In Progress
	MTN 3	1064+700	2,294	Medium grained bedrock (granodiorite, quartz monoznite)	strong to very strong	In Progress
	Boulderfield	1067+400	1,238	Boulder, gravel, bedrock (fine to coarse granodiorite)	medium to very strong	Complete

Note: "UCS" is unconfined compressive strength

b) An HDD for the entire length between Pad 1 and Pad 2 is not preferred because:
- HDDs require a drag section equal to the length of the crossing. Local topography and right-of-way geometry do not support the establishment of a 1,300-metre long drag section.
- The construction of such a long HDD crossing in hard rock formation would present a significantly higher risk profile in terms of technical viability.
- The construction of an HDD of that length and in the formations present would have a much longer schedule compared with the HDD proposed in the Deviation Application.

c) The 20-m footprint proposed for Option 2 in reference v applied to a full open cut of the 1.3 km Jacko Lake segment that is the subject of this Deviation Application. Trans Mountain is proposing a combination of Open Cut and HDD, as described in this Deviation Application. In implementing the Open Cut/HDD approach, Trans Mountain will attempt to minimize the temporary workspace outside the 18-m permanent easement to the extent practicable. There are sections of the footprint where temporary workspace will be required, however limiting work outside of the 18-m permanent easement has been considered in the execution planning. The total work area required to execute the Open Cut / HDD methodology (matting, strip, grade, ditch, welding, lower-in, backfill, HDD, and pullback) is reflected in Table 2.3-1.

In Trans Mountain's Reply Evidence [C26029], the additional footprint for executing the Open Cut / HDD was indicated as a new surface disturbance area of 4.8 ha. Trans Mountain expects new surface disturbance to total approximately 2.4 ha within this additional 4.8 ha footprint. This is further explained in Trans Mountain's response to CER 2.3.

2.3 Construction methodology comparison

CER Reference

i) C25972-2, Trans Mountain, Response to Commission IR No. 1.2(c), PDF pages 6 and
ii) C25972-2, Trans Mountain, Response to Commission IR No. 1.2(e), PDF pages 7 and 8 of 8
iii) C26029-2, Trans Mountain, Reply submissions, Paragraphs 17 to 19, PDF page 6 of 12
iv) C26029-2, Trans Mountain, Reply submissions, Paragraph 13, PDF page 3 of 12

CER Preamble

In Reference i), Trans Mountain identifies the challenges faced in resuming micro-tunnelling and indicates that completing the tunnel drive is high risk.

In Reference ii), Trans Mountain states that it has a reasonably high degree of confidence that HDD installation in this area will be successful. Should the initial HDD be unsuccessful, the contingency would be to modify the initial HDD geometry to facilitate a successful installation or redrill entirely. Trans Mountain states that even if a contingency HDD installation is necessary, it would be completed much quicker and with significantly lower risk than continuing with micro-tunnelling.

In Reference iii), Trans Mountain states the following:

- Trans Mountain notes that the trenchless construction methodology for the Pípsell/Jacko Lake area that SSN has expressly supported includes sections of open trench and various other types of surface disturbance within the area, including:
  a) approaching from the north, an open cut portion extending for approximately 4 kilometres to pad 1;
  b) an open cut portion south of pad 5 extending for approximately 3.7 kilometres to the southern extent of the Pípsell/Jacko Lake area;
  c) 28 geotechnical boreholes;
  d) 6 pads for tunnel operations; and
  e) 5 roads.
- Regardless of the construction methodology, the TMEP in this area will also require power supply for cathodic protection, including an above-ground power transmission line, 17 power poles, and an above-ground transformer, as well as associated access.
- The pads and roads listed above associated with the micro-tunnelling comprise roughly 5.18 hectares of disturbance (i.e., items d) and e) above, not including items a) through c)). In contrast, the proposed deviation will consist of roughly 4.83 hectares of new disturbance. All of this new disturbance would occur on privately held, previously disturbed lands.

In Reference iv), Trans Mountain indicates that the costs incurred to date in its attempts to address the problem of upward RCJP migration encountered in micro-tunnelling total $32.04 million.

The Commission seeks a comparison of the micro-tunnelling and open cut/HDD construction methods between Kilometre Post (**KP**) 851.60 and KP 852.95 to better understand the implications of each methodology in terms of the total amount of disturbance, cost, and completion timing.

CER Request

Using the guidance below, complete the table following this IR to illustrate the best- and worst-case scenarios (for total disturbance, anticipated cost, and completion date) for both the micro-tunnelling and the open cut/HDD construction methodologies. If preferred, a different format may be used, as long as all requested information is provided. As part of this response, discuss any assumptions used.

For micro-tunnelling, the best-case scenario is intended to refer to a situation where the risks identified by Trans Mountain in Reference i) do not materialize. For HDD, the best-case scenario is intended to refer to the situation where HDD installation is successful without the need for a contingency HDD as identified in Reference ii).

The worst-case scenario for both methodologies should reflect risks materializing short of a failure to complete the pipeline's installation

(i.e., assume the methodology is ultimately successful).

Do not include information that is common to both methodologies

(e.g., the disturbance related to 17 power poles identified by Trans Mountain in Reference iii)).

Provide information regarding costs estimated to be incurred for each methodology going forward. Do not include costs that have already been incurred (e.g., costs identified in Reference iv)).

For the purposes of estimating the timing for completing the pipeline's installation using each methodology, assume the Commission issues a decision on Trans Mountain's application by 1 October 2023.

Trans Mountain Response

Trans Mountain provides in Table 2.3-1 the information requested. Note that Trans Mountain has also included a line item for "Total Footprint (ha)" and revised the "Cost" line item to refer to "Construction Cost". The notes that follow the table provide further explanation regarding the line items included in the Table.

Table 2.3-1 Comparison of best and worst case scenarios

	Combined Open Cut / HDD		Micro-tunneling	
	Best-case	**Worst-case**	**Best-case**	**Worst-case**
Pipeline installation length (m)	1431	1431	1422	1422
Final tie-in length (m)	1431	1431	1422	1422
Total Footprint (ha)	8.34	8.34	3.54	5.04
Temporary workspace area (ha)	5.77	5.77	1.09	2.59
Permanent right-of-way (ha)	2.58	2.58	2.45	2.45
Surface disturbance area (ha)	3.92	4.52	1.52	3.02
Construction Cost	$35,630,000	$40,766,000	$25,700,000	$85,700,000
Completion date	January 2024	February 2024	April 2024	December 2024

For the purposes of this comparison, Trans Mountain has adjusted the KP limits to extend to the northern boundary of Pad 1 at KP 851+630 and to the southern boundary of Pad 2 at KP 852+990. This is an overall increase of 70 m from the KPs indicated in the Deviation Application to capture the entirety of the operations of the Tunnel Drive #2 micro-tunnel. Trans Mountain confirms this has no effect on the

Deviation Application, and there is no change to the KPs indicated in differences mapping or the PPBoR in the Deviation Application.

The difference between the total footprint for the Combined Open Cut / HDD and the micro-tunnel represents an increase in footprint of 4.8 ha for the Open Cut/HDD.

- This additional 4.8 ha of new footprint was identified in Trans Mountain's Reply Evidence [C26029] as new surface disturbance. However, the 4.8 ha is additional footprint. Trans Mountain anticipates that the surface disturbance within the 4.8 ha footprint will be limited to approximately 2.4 ha.

Completion Date represents the Mechanical Completion of the Jacko Lake segment. This does not indicate TMEP In-Service Date. Following Mechanical Completion there are additional filings and commissioning activities that need to be considered prior to flooding the pipeline. This is detailed further in response to CER 2.4(b).

Assumptions Supporting Information Presented in Table 2.3-1

Surface Disturbance

COT/HDD

- Best Case: Following the contractor grade plan, new surface disturbance is expected to be 2.50 ha. Reduction of 0.1 ha may be possible when construction is underway. Total surface disturbance within the Tunnel Drive #2 area in the best case can be expected to be 3.92 ha at a minimum (1.52 ha currently disturbed + 2.40 new disturbance).
- Worst Case: Consideration for additional disturbance within an already approved footprint to mitigate unforeseen risks. Worst case that may be expected is 4.52 ha of total disturbance (1.52 ha currently disturbed + 3.00 ha new disturbance).

Micro-tunnel

- Best Case: No further footprint or disturbances are expected if micro-tunneling is executed successfully. The existing 1.52 ha of disturbance would be unchanged.
- Worst Case: A 1.0-ha rescue shaft would be required to excavate to retrieve MTBM and additional 0.5 ha would be required for access. Depending on the location of a failure and retrieval this area of surface disturbance may be smaller. Worst case expected would be a total of 3.52 ha (1.52 ha currently disturbed + 3.00 ha new disturbance).

Construction Cost
The go-forward costs of the Open Cut/HDD and micro-tunneling are set out in Table 2.3-2 below.

Table 2.3-2: Comparison of Go-Forward Costs for Open Cut/HDD and Micro-Tunneling

	Open Cut / HDD	
	Best Case	**Worst Case**
Open Cut Construction	$14,950,000	$15,950,000
TD2 Abandonment	$13,600,000	$16,320,000
HDD & Waste Hauling	$7,080,000	$8,496,000
Total	**$35,630,000**	**$40,766,000**

- Worst case considers an additional 20% to the best-case estimate.

	Microtunnel	
	Best Case	**Worst Case**
Tunneling	25,700,000	85,700,000
Total	**25,700,000**	**85,700,000**

- Worst case considers a $60M additional forecast in the event there is an MTBM failure, and a rescue shaft is required.

Construction Costs identified in the table are based on labour, equipment, and materials to complete the works. Trans Mountain has not included lost revenues, financial carrying costs, ongoing contractor costs for work at Jacko Lake and standby costs elsewhere on the Project while the Jacko Lake segment is being completed.

The overall cost impact to Trans Mountain of delays to the TMEP In Service Date has not been calculated in this exercise. The monthly financial impacts expected for delay in the In-Service Date, roughly $390 M/month, were described in Trans Mountain's Reply Evidence at paragraph 15 [C26029-2]. Delays of TMEP in service beyond March 31, 2024, could represent a financial impact beyond $390 M per month.

Schedule
Open Cut / HDD

- Best Case: Decision by the CER to proceed by October 1, 2023.
- Worst Case: The rig and associated equipment can be repositioned within the easement to facilitate mitigation measures, if required.

Micro-tunnel

- Best Case: Completion of Shaft-6, no substantial risks materialized or equipment downtime. Rate of penetration is 8.5 m/day. The 8.5 m/day is a best case, it is noted that this average has not been met with Tunnel Drive #1 or Tunnel Drive #3.
- Worst Case: Rescue shaft required. Timelines would be dependent on location and depth of failure. It is estimated that a potential schedule impact of 7 months could be incurred, depending on the location, depth, and shaft methodology utilized to rescue the TBM and relaunch a new TBM to complete the crossing.

2.4 In-service date

CER Reference

i) C26032-1, Trans Mountain, 1 September 2023 compliance filing for Condition 62 of Certificate OC-065 – Construction Schedule, PDF pages 1 and 3 of 4

ii) C26029-2, Trans Mountain, Reply submissions, Paragraphs 15 and 36, PDF pages 5 and 11 of 12

CER Preamble

In Reference i), Trans Mountain provides the forecast of planned activities for the TMEP based on current execution plans for the upcoming six-month period. The schedule for the “Jacko Lake Micro-tunnel & Pipe Installation (KP 852-856)” shows activities continuing through February 2024.

In Reference ii), Trans Mountain states the following:

- Trans Mountain notes that continuing with micro-tunnelling would likely delay the TMEP’s in-service date, for the reasons described in its response to Commission IR No. 1.2. Each month of delay in the TMEP’s in-service date results in roughly $200 million in lost revenues and roughly $190 million in carrying charges for Trans Mountain. Trans Mountain’s shippers and other parties relying on the TMEP will also incur losses with each month that the TMEP is delayed.
- When TMEP construction started in the Pípsell/Jacko Lake area in Q4 2021, tunnel drive #2 was scheduled to be completed by 24 April 2023. The remainder of the micro-tunnelling was to be completed by 17 May 2023, with pipe insertion and final tie-ins to be completed by August 2023 (i.e., approximately 1.5 years after beginning construction in the area). This schedule allowed for micro-tunnelling to be completed in the Pípsell/Jacko Lake area in alignment with the overall TMEP construction schedule.

CER Request

a) Confirm the planned in-service date for the TMEP.
b) Confirm when construction between KP 851.60 and KP 852.95 needs to be completed in order for Trans Mountain to meet the TMEP’s in-service date. Include a discussion on the specific steps that need to be completed following construction and before the TMEP is placed in service.

Trans Mountain Response

a) Trans Mountain’s September 1, 2023 compliance filing for Condition 62 in Reference i) provides a six-month forecast of Trans Mountain’s planned and known construction activities for the Project. This forecast is based on execution plans at a specific point in time and is dependent on a variety of factors including but not limited to changes in construction scope, external risks (e.g., weather) and regulatory and permitting processes and approvals. As a result, the construction execution schedule would be updated with the addition, or removal, of other construction activities as permitting processes move forward, and risks are resolved

   As several key risks for the Project are currently being mitigated through contingency planning with uncertain outcomes, Trans Mountain does not have a specific planned in-service date for TMEP but currently anticipates delivery of first oil late in Q1 2024. Construction between KP 851.60 and KP 852.95 would need to be completed by the end of January 2024 in order for delivery of first oil near the end of Q1 2024.

b) See response a) above. Following the final weld of Test Section 5B of Spread 5A (851+248 – 857+038) which includes the full length of the Jacko Lake micro-tunnel, Trans Mountain and its General Construction Contractor will complete the Turnover Packages for System 19 of TMEP. Once accepted by Trans Mountain operations, Trans Mountain will file the Leave to Open (LTO) with the CER and, upon approval, begin the wet commissioning process. TMEP expects to file the LTO application within 2 weeks of the final weld.

2.5 Mutual Benefits Agreement

CER Reference

i) C25832-4, Trans Mountain, Application, Appendix C – Engagement Summary, PDF page 89 of 109
ii) C26029-2, Trans Mountain, Reply submissions, Paragraph 8, page 4 of 12
iii) C25999-2, SSN, Written submissions, Paragraphs 51 and 68, PDF pages 13 and 17 of 35

CER Preamble

The Commission notes that, in their submissions, including in the references above, both Trans Mountain and SSN refer to aspects of the Mutual Benefits Agreement (**MBA**) executed between the two parties on 30 October 2019 in respect of the TMEP.

The Commission understands the MBA to be a confidential commercial agreement between the parties and, accordingly, it has not been filed with the Canada Energy Regulator. The Commission has not determined the extent to which the MBA is relevant to its decision-making on Trans Mountain's application. However, the Commission seeks additional information from each party regarding the probative value of the MBA.

CER Request

a) Explain the relevance, if any, of the MBA to the Commission's decision-making on Trans Mountain's application.
b) If Trans Mountain is of the view that the MBA (or portions of it) is relevant to the Commission's decision-making, the parties are asked to file the MBA (or the relevant portions) via a joint submission.

Trans Mountain Response

Trans Mountain is of the view that the MBA between Trans Mountain and SSN is relevant to the Commission's decision-making in this proceeding. Trans Mountain and SSN intend to jointly file the MBA with the Commission on a confidential basis and are working together to agree on the extent of any redactions.

The provisions of the MBA provide context and the basis on which SSN agreed to provide consent for the Project, including the portion of the Project in the Pipsell/Jacko Lake area. The existence of the MBA and the provisions of the MBA should be considered by the Commission together with other facts and evidence in this proceeding in its determination of the Deviation Application.

Specifically, the MBA contemplates the possibility of trenched construction in the Pipsell/Jacko Lake area. The MBA allows Trans Mountain to make a determination that trenchless construction is either not technically feasible or is economically infeasible. Thereafter, Trans Mountain is allowed to proceed with a trenched construction methodology and pay to SSN financial compensation in accordance with the agreed to formula for any portion of Project construction in the Pipsell/Jacko Lake area for which Trans Mountain does not use trenchless construction.