NATIONAL ENERGY BOARD

IN THE MATTER OF

the *National Energy Board Act*,
R.S.C. 1985, c. N-7, as amended,
and the Regulations made thereunder;

AND IN THE MATTER OF

an application by Trans Mountain Pipeline ULC
as General Partner of Trans Mountain Pipeline LP
pursuant to Section 21 of the *National Energy Board Act*
for a change to the approved pipeline corridor for the
Trans Mountain Expansion Project
in Proceeding OH-001-2014 and
Certificate of Public Convenience and Necessity OC-064

TRANS MOUNTAIN REPLY EVIDENCE

Chilliwack BC Hydro Route Realignment
Hearing Order OH-001-2017
File Number OF-Fac-Oil-T260-2013-03 13

January 8, 2018

To: The Secretary
National Energy Board
Suite 210, 517 10th Avenue SW
Calgary, AB T2R 0A8

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PART A - INTRODUCTION

Trans Mountain Pipeline ULC as General Partner of Trans Mountain Pipeline LP (collectively Trans Mountain) is providing Reply Evidence in response to evidence filed with the National Energy Board (NEB) by intervenors in regard to Trans Mountain's application pursuant to section 21 of the *National Energy Board Act* (NEB Act) for a change of the approved pipeline corridor for the Trans Mountain Expansion Project (the Project or TMEP) in Proceeding OH-001-2014 and Certificate of Public Convenience and Necessity OC-064 with respect to the Chilliwack BC Hydro Route Realignment (the Application). Trans Mountain also responds in this Reply Evidence to issues raised in letters of comment filed by commenters.

Trans Mountain relies on the evidentiary record established to date and provides this Reply Evidence in respect of issues raised by intervenors and commenters in their written evidence[1] and letters of comment,[2] respectively. Trans Mountain does not accept or agree with all statements made by intervenors in their written evidence or commenters in their letters of comment. However, Trans Mountain does not respond to every point or position asserted by intervenors or commenters with which it disagrees. Trans Mountain's silence on any matter does not indicate acceptance or endorsement of any particular position and Trans Mountain reserves the right to address any relevant matters in argument.

In some cases, intervenors and commenters filed written evidence and letters of comment, respectively, relating to topics that are outside the NEB's List of Issues for the Application or beyond the NEB's legislated mandate. Trans Mountain does not provide reply to these matters as they are not within the scope of the NEB's assessment of the Application.

This Reply Evidence is organized by topic as noted in the above Table of Contents. Each section begins with a brief summary of the issue and the intervenor's position, followed by Trans Mountain's reply.

[1] City of Chilliwack, Written Evidence, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88033 and A88037); S'ólh Téméxw Stewardship Alliance, Written Evidence, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88040 and A88041); and, The WaterWealth Project, Written Evidence, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88039).

[2] Rachel Bullock, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88971); Daphne Clegg, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88944); Dan Coulter, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88981); Erin Coulter, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88985); April Davies, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88935); Michael Hamilton-Clark, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88867); Laurea Palmantier, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88982); Pamela Pederson, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88978); and, Helen Shilladay, Letter of Comment, Chilliwack BC Hydro Route Realignment (OH-001-2017) (A88958).

PART B - ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS

1. Introduction

This section of Trans Mountain's Reply Evidence addresses a number of topics related to the potential environmental and socio-economic effects of the proposed Chilliwack Realignment, as set out in the NEB's Filing Manual, on which certain intervenors submitted evidence. The topics covered and the intervenors to whom this Reply is addressed include:

- Vulnerability of Sardis-Vedder Aquifer: evidence of the City of Chilliwack and evidence of the WaterWealth Project (WaterWealth)
- Well Capture Zones: evidence of the City of Chilliwack
- Trans Mountain Investigation and Risk Assessment: evidence of the City of Chilliwack

The following sections deal with the above topics in the sequence presented.

2. Vulnerability of the Sardis-Vedder Aquifer

The written evidence for the City of Chilliwack [Filing ID A5X3A4] asserts that the Sardis-Vedder Aquifer is extremely vulnerable. The City of Chilliwack states that it has commissioned studies to investigate and determine ways to protect the Sardis-Vedder Aquifer and in paragraphs 14(a) through (g) of their written evidence provides a list of these studies. The City of Chilliwack states that the studies have concluded the Sardis-Vedder Aquifer is extremely vulnerable and susceptible to contamination.

The written evidence of WaterWealth [Filing ID A5X3T0] provides numerous quotes from a report titled "Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects, and Response" authored by the National Academy of Sciences (the "NAS Report") and one quote from Trans Mountain's Response to Province of BC IR No. 2.09(g) [Filing ID B316-34 at page 39] from the OH-001-2014 hearing. WaterWealth draws the conclusion from the materials quoted, as well as the experience with an oil spill that occurred into groundwater at what is now the Bemidji Crude-Oil Spill Research Site near Bemidji, Minnesota, that placing an oil pipeline over groundwater drinking water sources is not safe. WaterWealth states that in Bemidji, a pipeline 3 metres deep in an outwash plain spilled into groundwater where the water table was 8 metres below the surface and that the site could not be remediated and so was turned into a research site. WaterWealth submits that the Bemidji case conditions were similar to what is being proposed in Chilliwack.

The written evidence of S'ólh Téméxw Stewardship Alliance (STSA) [Filing ID A5X3T2] states that STSA is concerned by the disregard of concerns relating to the protection of the Sardis-Vedder Aquifer. STSA is concerned that there is a high potential for contamination, including wells currently used for private homes, irrigation, and other uses, as a result of development (digging, removal of gravel, plants and soils) of the pipeline, or any sort of leak, spill, or eruption within the Sardis-Vedder Aquifer's protected and high sensitive areas.

STSA states that given the hydrologic and geotechnical features of the area, STSA is concerned with horizontal contamination as water flows from the aquifer into smaller creeks and the Vedder River which has the potential to adversely affect a number of salmon species on which rely. STSA submits that this concern was previously raised in the Integrated Cultural Assessment of Stó:lō Collective (2014).

Trans Mountain Response:

Trans Mountain recognizes that the Sardis-Vedder Aquifer (#8) underlying both the approved pipeline corridor and the proposed Chilliwack Realignment is mapped by the Province of BC as a heavily developed and highly vulnerable aquifer (IA) with an aquifer ranking value of 15 on a scale between 5 and 21, with the aquifer ranking value based on physical aspects of the aquifer; including, productivity, vulnerability, and aquifer area.

In addition to the BC Government aquifer mapping initiatives, vulnerability assessments of the Sardis-Vedder Aquifer have been completed using several other techniques which include the GOD method (Groundwater occurrence; Overall aquifer class; Depth to water) applied by Golder (1997)[3] and the BC comprehensive drinking water source-to-tap assessment guideline applied by Golder (2017);[4] all of which have identified the Sardis-Vedder Aquifer, in the area of the Chilliwack Realignment, as highly vulnerable.

Trans Mountain is committed to protecting groundwater resources encountered by the Project. It should be noted that, any linear infrastructure, including, but not limited to, pipelines, roadways and rail lines, following higher density population corridors will inevitably cross watercourses and unconfined aquifers that are exploited as community water supplies. As such, this section of pipeline is being considered under the same design specification as a surface watercourse crossing, afforded the highest level of protection through advanced engineering practices. Further discussions with respect to the nature and vulnerability of the aquifer are included in the Sardis-Vedder Aquifer Report, Part J of this Reply Evidence.

The fate, effects, and response of contaminants in the subsurface are controlled by the intrinsic properties of the porous media, the hydraulic gradient, the nature of the contaminant and its source, and the reaction of the contaminant in the subsurface. As these conditions vary significantly between sites, largely controlled by the depositional environment that defines the porous media character, the fate and transport of a contaminant at a specific site are considered unique to the site. Although the principles of flow through porous media and contaminant transport can be applied to every site, the unique nature of a contaminated site makes it impractical to directly apply any meaningful comparative study to the Chilliwack Realignment. In this respect, the conclusions drawn by WaterWealth based on the reference materials quoted, are not considered comparable to the Sardis-Vedder Aquifer, with the exception that a pipeline release has the potential of contaminating groundwater.

[3] Golder Associates Limited, 1997. Final Report on Groundwater Protection Plan. District of Chilliwack. Included in the City of Chilliwack's Written Evidence, Appendix D.

[4] Golder Associates Limited, 2017. Sardis-Vedder Aquifer Groundwater Model Update Study. City of Chilliwack. Included as the City of Chilliwack's Written Evidence.

Particularly with respect to the Bemidji site, the comparison has little relevance. The Bemidji is an Enbridge pipeline crude oil spill that occurred in 1979 in a remote area of Minnesota that is removed from anthropogenic receptors. Although the majority of the source was reclaimed shortly following the spill, remediation techniques used 38 years ago left about 400,000 litres of crude oil in the ground. Subsequently, Enbridge did not abandon the site, but rather, through support of the United States Geological Survey (USGS), the site became one of the most significant research centres focussed on the study of crude oil released to the subsurface. This centre continues to be very active over three decades following the spill. The research has led to the publication of hundreds of scientific papers that have supported environmental policy development, and the evolution of contaminants at the site has become a primary example of natural attenuation that limits subsurface migration of dissolved hydrocarbon constituents. This research has further demonstrated that a pipeline release does not result in widespread contamination of an aquifer and that the degradation of a hydrocarbon plume can occur naturally through biological activity in the subsurface (USGS, 2018).[5]

3. Well Capture Zones

The written evidence of the City of Chilliwack [Filing ID A5X3A4] asserts that the Chilliwack Realignment falls within the City of Chilliwack's well capture zone. The City of Chilliwack further asserts that Trans Mountain has not used the best available data in reaching its conclusion that the Chilliwack Realignment is outside the City of Chilliwack's well capture zone.

The City of Chilliwack claims to have extensive data measure capture zones and travel-time sub-zones, which it has provided to Trans Mountain. The City of Chilliwack provides a list of studies from paragraphs 25(a) through (e). The City of Chilliwack asserts that Trans Mountain appears to have relied on the 2011 AMEC figure to define the City of Chilliwack's well capture zone and that this figure does not provide sufficient basis for the NEB's decision. The City of Chilliwack further asserts that the 2017 Golder Report is a more recent and accurate analysis of the capture zones and travel-time sub-zones, noting that based on the 2017 Golder Report a spill from the TMEP would reach wells 1 and 2 in about 126 days, and wells 6 and 7 in about 132 days.

The City of Chilliwack also asserts that due to the location of the TMEP within the City of Chilliwack's well capture zone, any potential spill from the TMEP would flow toward the wells, contrary to Trans Mountain's previous submission that a potential spill would flow in a northerly direction away from the wells. The City of Chilliwack further asserts that a spill may reach the wells in under 200 days, relying on the 2017 Golder Report for support for the position.

The City of Chilliwack states that Trans Mountain acknowledges that, based on the consequences of a spill, which include a major impact for a large population, potential long-term health effects associated with the consumption of contaminated water, and the requirement for a significant modification to the operation and management of the water supply system, the Chilliwack Realignment would be classified as a High Risk hazard for the City of Chilliwack's water supply system.

[5] USGS, 2018. Online: https://mn.water.usgs.gov/projects/bemidji/results.html.

The City of Chilliwack further asserts after 2021, the City of Chilliwack's water system capacity will likely have to increase to keep up with the growing population. The City of Chilliwack further asserts that capture zones may expand as a result of increased pumping, as well as climate change and seasonal variations, relying on the 2017 Golder Report for support for this position. The City of Chilliwack further asserts that the increased capture zone means the TMEP will be more deeply embedded in the City of Chilliwack's well capture zone, thereby increasing the risk of contamination.

The City of Chilliwack further asserts that it has expressed its concerns to Trans Mountain on numerous occasion and that Trans Mountain's responses have been inadequate given the importance of the Sardis-Vedder Aquifer.

Trans Mountain Response:

The capture zone refers to the three-dimensional region that contributes the groundwater extracted by one or more wells or drains (EPA, 2008).[6] Extensive capture zone analysis has been completed for the City of Chilliwack by professional consultants over several iterations beginning in 1997 (Golder, 1997). The most recent evaluation was completed by Golder in 2017; 20 years following the initial assessment. These, and the interim studies, represent important steps in the management of the municipal water supply while supporting land use planning and future sustainable development. Contrary to the City of Chilliwack's assertion, Trans Mountain has closely considered all important data sources made available through the public domain, and as shared by the City of Chilliwack. In evaluating these important data sets, Trans Mountain has endeavored to link concepts developed over 20 years of investigation with environmental protection objectives endorsed at the municipal, provincial and federal levels.

A significant change in sustainable water resource development occurred in BC when the *Water Sustainability Act* (WSA) came into force on February 29, 2016. This is the first BC legislation to address groundwater use in context of water resource management, protection and licensing. In rolling out the legislation, existing users, such as the City of Chilliwack, are included in a transition period to bring in approximately 20,000 existing non-domestic groundwater users into the current water licensing scheme and its first-in-time, first-in-right priority system. An application made during the transition period authorizes existing non-domestic groundwater users to continue to divert groundwater for its intended purpose until water extraction licenses can be allocated. Once the backlog of new license applications is resolved, the approving authority will begin to focus on existing non-domestic groundwater users, such as the City of Chilliwack, that have made application for water diversion under the WSA.

The WSA addresses the important dynamic relationship between surface water and groundwater. In this respect there is a significant emphasis placed on the health of aquatic ecosystems which is factored into the decision to grant use approvals on streams or aquifers under the WSA. This relationship refocuses groundwater resource management from sustainable well yield to safe aquifer yield.

[6] United States Environmental Protection Agency, 2008. A systematic approach for evaluation of capture zones at pump and treat systems. Final project report. EPA 600/R-08/003.

Numerical modeling that supported capture zone analysis began to address safe aquifer yield in 2003 with the Emerson study.[7] At that time, there was a recognition that the Sardis-Vedder Aquifer groundwater resource development was limited by safe aquifer yield, rather than water demand as a function of population growth. The 2003 Emerson study indicated that the aquifer performance, based on numerical assessments, became non-linear once extraction rates exceeded about 750 litres/second. This response indicated that recharge was being overcome by extraction. In the most recent model update study completed by Golder (2017), the impacts to creek baseflow were further evaluated as part of the numerical analysis. In this respect, significant impacts to creek baseflow were predicted outside the capture zones as part of the 'Base Case' scenario.

The City of Chilliwack asserts that capture zones will expand as a result of increased pumping, as well as climate change and seasonal variations, and that the expansion of the footprint of capture will under-lap the Chilliwack Realignment, thereby increasing the risk of contamination to the well field. This assertion does not appear to recognize the limits of aquifer safe yield, the consideration of environmental flow needs, and stronger protection strategies for aquatic ecosystems mandated under the WSA and listed as an important aspect of the City of Chilliwack 2040 Official Community Plan.

Any impact to the municipal water supply caused be a pipeline leak, as asserted by the City of Chilliwack, is predicated on the fact that the release occurs within the municipal well field capture zone. If safe aquifer yield limits the footprint of capture such that the capture zone does not under-lap the Chilliwack Realignment, then the well field is not at risk from a release from the pipeline. As capture is defined as a three-dimensional region that contributes the groundwater extracted by one or more wells or drains (EPA, 2008), vertical capture may not reach the water table within the two-dimensional foot print of capture.

The City of Chilliwack's written evidence challenges Trans Mountain's assertion that the fact the municipal wells have not been compromised over 50 years of operations supports the hypothesis that capture may not reach the water table. Known sources of contamination were identified within the footprint of capture as part of the Golder 1997 and 2017 contaminant inventory assessments, and the City of Chilliwack's water supply has received numerous awards for quality excellence. However, capture that extends to the water table would be expected to draw all existing and future sources of shallow contamination residing at the water table to the extraction points. It is this assumption that is applied to the analytical spill modelling completed by Golder (2017). Therefore, unless high quality groundwater extraction is currently maintained through dilution, capture does not yet likely extend to the water table. Nevertheless, it should be recognized that both vertical and horizontal capture are expanded as the groundwater extraction rates are increased, to the extent that increased extraction is sustainable. This means that vertical capture could be expanded such that shallow contamination begins to be captured and drawn to the source wells, potentially compromising the excellence of the municipal water quality as well field production is expanded. Capture would also expand non-linearly if extraction overcomes recharge. In addition, the 200-day travel time capture zones that are intended to address the risk to the water supply by the migration of water-borne pathogens and protozoa have the potential to

[7] Emerson Groundwater Consultants Inc., 2003. Sardis Aquifer Yield Assessment. Submitted to the City of Chilliwack. Included as the City of Chilliwack's written Evidence Appendix E.

compromise the quality of the groundwater supply. This false sense of security would be apparent if infiltrating surface water through storm water infrastructure, that is deemed to be captured, is the source of the pathogens.

Further discussions with respect to capture are provided in Part J.

4. Trans Mountain Investigation and Risk Assessment

The written evidence of the City of Chilliwack [Filing ID A5X3A4] asserts that Trans Mountain has overstated its investigations of the Sardis-Vedder Aquifer and understated the risks associated with the Chilliwack Realignment. The City of Chilliwack states that it is only aware of four Trans Mountain studies on the Sardis-Vedder Aquifer, stating that three of which do not consider the Chilliwack Realignment specifically. The City of Chilliwack further asserts that the Waterline Report is sparse and does not substantiate Trans Mountain's conclusions about the safety of the Chilliwack Realignment. The City of Chilliwack further provides the aspects of the Waterline Report it deems inadequate in paragraphs 46(a) through (j). The City of Chilliwack further asserts that Trans Mountain has done no field work to investigate the Sardis-Vedder Aquifer, appears to have relied heavily on the British Columbia aquifer classification system, has not completed targeted groundwater modelling for the Sardis-Vedder Aquifer area, has not confirmed where alternative sources will be located and for how long or at whose expense, has not provided a comprehensive leak detection system, and states that it is uncertain whether the overland modelling relied on by Trans Mountain is adequate to assess a subsurface, water-based spill in the Sardis-Vedder Aquifer.

Trans Mountain Response:

Trans Mountain did not complete any intrusive investigations of the Sardis-Vedder Aquifer along either the P1/P1A or the P2 proposed realignment common to the existing Trans Mountain pipeline (TMPL) right-of-way, as it was not required since Trans Mountain was able to assess the risks associated with the Chilliwack Realignment based on a significant body of technical documentation that extended over decades of study. Field programs focused on field reconnaissance and field verification of active water wells. These programs were included as part of the regional pipeline assessment, completed as part of the environmental and socio-economic assessment (ESA), and in compliance to NEB Condition 93, Water Well Inventory. In evaluating the route alignments across the Sardis-Vedder Aquifer, Waterline reviewed publicly available data sources and technical reports provided to Trans Mountain by the City of Chilliwack. With the exception of the Golder (2017) model update study, the technical documents included as written evidence were made available to Trans Mountain early in the process.

The high quality technical information that was made available through public sources, and the sharing of information between affected parties, gave Waterline the ability to associate varying ideas and study objectives, in evaluating vulnerability and risk. For example, the groundwater protection plans that were supported by numerical models, capture zone analysis, and contaminant inventory work, beginning in 1997 and extending to 2017, allowed Waterline to associate ideas developed through the evolution of this technical work. The reproduction of historical aquifer assessments through numerical analysis, or undertaking concurrent studies paralleling current initiatives of the City of Chilliwack was not considered as necessary to assess the risks to the aquifer associated with the Chilliwack Realignment.

The Waterline technical reports referenced by the City of Chilliwack, including the December 14, 2016 and the February 23, 2017 memoranda, were intended as short-form summaries provided to the City of Chilliwack for specific purposes. The December 14, 2016 technical memorandum represented a summary of water related information for the City of Chilliwack, including responses to intervenor requests. The February 23, 2017 technical memorandum was provided in response to a direct request by the City of Chilliwack following a meeting on February 15, 2017. The intent of the memorandum was to illustrate points of meeting discussion, particularly related to the environmental benefits of open trench construction above the water table, versus a deeper horizontal directional drill that would extend below the water table, placing the pipeline directly within the Sardis-Vedder Aquifer. In the context of paragraphs 46(a) through (j) of its written evidence, the City of Chilliwack has overstated the objectives and associated content of the February 23, 2017 technical memorandum as the Waterline Report (February 23, 2017 technical memorandum) was never intended as definitive work to substantiate Trans Mountain's conclusions about the safety of the Chilliwack Realignment.

PART C -APPROPRIATENESS OF THE ROUTE

1. Introduction

This section of Trans Mountain's Reply Evidence addresses a number of topics related to the appropriateness of the general route and land requirements for the proposed Chilliwack Realignment, on which certain intervenors submitted evidence. The topics covered and the intervenors to whom this Reply is addressed include:

- Investigation of the P1A Alternate Route: evidence of the City of Chilliwack
- Investigation of the Trans-Canada Highway Alternate Route: evidence of the City of Chilliwack
- Appropriateness of the proposed Route Realignment: evidence of WaterWealth
- Appropriateness of relocating the existing TMPL onto the P1A Alternate Route: evidence of WaterWealth

The following sections deal with the above topics in the sequence presented.

2. Investigation of P1A

The written evidence of the City of Chilliwack [Filing ID A5X3A4] asserts that Trans Mountain has not adequately investigated the P1A route.

Trans Mountain Response:

Trans Mountain disagrees with the City of Chilliwack's assertion and submits it has sufficiently investigated the P1A route. The written evidence of the City of Chilliwack correctly points out that the P1A route would locate TMEP within 8 metres of 25 homes [Filing ID A5X3A4]. These are dwellings that are not previously directly impacted by the existing TMPL and which are

highlighted in the application as a factor on why Trans Mountain did not select this route [Filing ID A5J8D6]:

> Under this alignment option, a number of residents would have the existing TMPL located immediately to the south of their property and TMEP immediately to the north of their property.

The dwellings that would be surrounded by the two oil pipelines if the P1A route was approved would be the 19 unit strata development off Balmoral Avenue that would be within 8 metres. The proposed P2 route would be on south side of the existing TMPL, further away from the strata with the closest home on the east end being 12 metres with separation distance increasing to 30 metres on the west end of the strata.

The P2 route was selected as an alternative to the P1 and P1A route alignments based on the identified routing criteria, and included in the TMEP application. The route assessment and selection process for the Chilliwack corridor was conducted over the course of 2 years to provide the information necessary to support the TMEP application and required extensive effort to complete. During the route selection process undertaken by Trans Mountain, a hierarchy of routing options was established. In descending order of preference, these were:

- where practicable, co-locate the TMEP on or adjacent to the existing TMPL easement to:
    - reduce land use fragmentation,
    - reduce the use of unencumbered lands by utilizing the existing TMPL right-of-way for location of the TMEP and construction workspace, and
    - leverage the existing pipeline protection program and landowner knowledge of the location and nature of the existing TMPL to maximize pipeline integrity and safety;
- where co-location with the existing TMPL was not practicable, minimizing the creation of new linear corridors by installing the TMEP segments adjacent to existing easements or rights of way of other linear facilities including other pipelines, power lines, highways, roads, railways, fibre optic cables and other utilities;
- if co-location of TMEP with an existing linear facility was not feasible, install the TMEP segments in a new easement selected to balance safety, engineering, construction, environmental, cultural and socio-economic factors; and
- in the event a new easement was necessary, minimize the length of the new easement before returning to the existing TMPL easement or other rights of way.

Based on the hierarchy of routing options, the P2 alignment of the TMEP with the existing TMPL represents the top option in the hierarchy, and either P1 or P1A would align with the second option in this hierarchy. It is evident in the consultation and technical studies completed in support of the P1 and P1A alignment that these were given extensive consideration, including selection of P1A as the preferred route through the TMEP hearing. It was only after completion

of the BC Hydro studies and final delineation of the P1A alignment, that Trans Mountain reconsidered the P2 alignment.

In para 53c of the City of Chilliwack's evidence, it asserts that Trans Mountain did not undertake any scientific studies of the P1A route and re-route. Trans Mountain did undertake soil resistivity tests studies on P1A route for the AC Mitigation modelling undertaken by BC Hydro to determine if P1A route could be moved closer to BC Hydro infrastructure. In addition, Trans Mountain also completed two boreholes along P1A route to determine technical feasibility for horizontal directional drill (HDD) method to increase below ground separation distance from electrical system towers and conductors. As noted below in an excerpt from the BC Hydro letter filed with the Application (Appendix B [Filing ID A82269-4]), use of the HDD method to locate TMEP closer in a horizontal direction was not acceptable:

> The proposal to install the new pipeline closer than 12m to BC Hydro towers but at greater depths by using horizontal drilling (9.5m and 14m depth) does not meet the electrical safety criteria, and would restrict BC Hydro's ability to repair, replace and upgrade tower foundations in the future (for example the use of pile foundations).

Trans Mountain contends that the studies completed in support of the route considerations for the P1, P1A, and P2 route alternatives were thorough, that they were completed by qualified professionals with multiple areas of expertise, and that based on the multiple factors and considerations for routing of the pipeline, including the Sardis-Vedder Aquifer, the P2 alignment was selected as the better alternative.

3. Investigation of Trans-Canada Highway

The written evidence of the City of Chilliwack [Filing ID A5X3A4] asserts that Trans Mountain has not adequately investigated the Trans-Canada Highway route.

Trans Mountain Response:

As a practice, determination of routing feasibility for the entire TMEP included consideration of a range of factors including constructability, long-term geotechnical stability, and environmental, cultural, and socio-economic suitability. These studies included a mix of desktop studies, field investigations, and vehicular and aerial observations.

Based on changes to land use in the Chilliwack segment as well as the broader Fraser Valley following construction of the existing TMPL, Trans Mountain identified and assessed preliminary alternative routes to the existing TMPL alignment. The TransCanada Highway (TCH) was identified very early on in the routing process as a route alternative, as it aligned with the second of the routing hierarchy options to follow existing rights-of-way or linear disturbance. The introduction on page 1 of the Chilliwack Highway 1 Corridor Route Assessment [Filing ID A85579-4] summarizes the assessment of the alternative route completed from mid-2012 through to 2013:

> The assessment and selection of a proposed pipeline corridor to form the basis of the application to the National Energy Board (NEB) was one of the key first tasks for the Trans Mountain Expansion Project (TMEP). Starting in mid-2012 and going through 2013, the existing Trans Mountain Pipeline (TMPL) right-of-way was assessed for its suitability for the construction of an additional pipeline.

> In areas where feasibility was questionable or where other logical route corridors were present, alternate routes were also assessed. Within the vicinity of the City of Chilliwack, the primary alternate route considered early in the project was the Highway 1 corridor through the Fraser Valley east of Sumas Mountain. This route was primarily assessed though desktop mapping and imagery studies, along with field reconnaissance.

The purpose of the report prepared for the City of Chilliwack in July 2017 was to summarize the considerations for the TCH route alternative undertaken by Trans Mountain and its consultant, UPI, in late 2012 as part of the assessment of proposed pipeline corridors for the TMEP application. This included an assessment of the feasibility of the TCH route alternative.

The UPI report reflects the multiple considerations to construct the TMEP within or adjacent to the TCH which includes existing land use, geotechnical conditions, and constructability issues for the corridor. The restrictions to the TCH route alternative were further communicated to the City of Chilliwack by way of letter dated February 15, 2017, included in the Application, Appendix C, Part 1 to 12 [Filing ID A82269-16]:

> During Project development, Trans Mountain completed extensive routing studies within the Chilliwack area, with multiple alternative routes considered. These studies included a review of routing along Highway 1. These studies determined routing along Highway 1 would be impractical as it would potentially restrict MOTI's future ability to expand the highway. In addition there were several locations where the existing development of the highway did not allow enough room for the expanded 36" pipeline or presented engineering design and construction challenges which would be impractical for TMEP to address. These include:
>
> - Overpass at Gibson Road
> - Overpass at Prest Road
> - Underpass at Young Road
> - Railway overpass at Vedder Road
> - Vedder Road overpass
> - Evans Road overpass
> - West of Lickman Road
> - Crossing of drainage canal at No. 2 Road
> - No. 3 Road overpass and interchange

Assessment of the TCH route also included discussion with the BC Ministry of Transportation and Infrastructure (MOTI). Both the UPI report and the letter to the City of Chilliwack indicate significant restrictions and potential impact associated with routing within or adjacent to the MOTI Highway 1 infrastructure. In the response to Rachel Symington Information Request No. 1, IR No. 1.1h [Filing ID A87441-2], the MOTI position with respect to routing of TMEP references the MOTI Pipeline Conditions and Guidelines [Filing ID A87441-3], which was summarized in the response as:

> MOTI have been consistent in stating that pipeline crossings of their roads and highways would be permitted, but paralleling of their road within their rights of way or within 30 metres is not permitted pursuant to MOTI Pipeline Conditions and Guidelines.

Trans Mountain's response to the City of Chilliwack Information Request No. 1, IR 1.3b) [Filing ID A87439-2] further states:

> The pipeline alignment conflicts with stated Ministry of Transportation and Infrastructure ("MOTI") policies in regard to proximity and crossing angles and assumptions were made that variances from said policies would require MOTI approval. MOTI has stated, however, that a pipeline route paralleling within 30 metres of the right-of-way or inside the-right-of way would only be considered if Trans Mountain demonstrated that there was no other feasible route.

Based on the identified routing criteria, the multiple restrictions and technical feasibility of the TCH route, the existing TMPL or alternative BC Hydro transmission corridor were determined to be the preferred alternatives, with both route alternatives considered to be feasible and included in the TMEP application.

Trans Mountain's response to the City of Chilliwack Information Request No. 1, IR 1.3b) [Filing ID A87439-2] lists the multiple assumptions included in the UPI report. The assumptions underlying the report are based on the judgement and experience of the professionals engaged in the route assessment and selection for the Chilliwack corridor route alternatives, and are consistent with the routing criteria and selection process established for the 980 kilometers of new pipeline extending from Edmonton, AB to Burnaby, BC.

Irrespective of the route selected (TCH, BC Hydro, or the existing TMPL), all route alternatives cross the Sardis-Vedder Aquifer, along with the Chilliwack-Rosedale aquifer in the case of the TCH route, and location relative to the aquifer was not the determining factor in the selection of the preferred route alternative. Location within the aquifer and proximity to the City of Chilliwack municipal water wells is mitigated through the risk based design and the risk mitigation measures employed such as heavy wall pipe, an additional isolation valve, and deeper depth of cover. The UPI report does not address pipeline design, which would have been incorporated as part of the risk based design had the TCH route been selected as the preferred corridor.

4. No Support for P2 Alignment

The written evidence of WaterWealth [Filing ID A5X3T0] asserts that there is no support for the Chilliwack Realignment (P2 Alignment) and that WaterWealth is not aware of a single landowner who favours the Chilliwack Realignment (P2 Alignment).

Trans Mountain Response:

Trans Mountain's response to NEB Information Request No. 1, IR 1.2a), Table 1.2 Summary of Consultation Activities with Landowners [Filing ID A84596-2], provides a summary of the consultation activities with the 75 landowners directly affected by the Chilliwack Realignment (P2 Alignment). As indicated in the response to IR 1.2b), as of the date of the IR response, Trans Mountain had reached voluntary agreement for land acquisition with 60 of the 75 directly affected landowners. Trans Mountain has continued to engage with landowners for the

Chilliwack Realignment, and has now reached agreement with 67 of the 75, or approximately 90% of landowners. This level of landowner agreement is in direct contradiction to the assertion made by WaterWealth.

5. Appropriate Route is to Move TMPL onto P1A

The written evidence of WaterWealth [Filing ID A5X3T0] asserts that the proper approach would be to move the existing TMPL to join the TMEP on the P1A route option.

Trans Mountain Response:

The regulation of the existing TMPL system is outside of the scope of this proceeding. Nevertheless, Trans Mountain submits that the existing TMPL is appropriately managed and monitored in accordance with the relevant NEB standards including the *National Energy Board Onshore Pipeline Regulations* and CSA Z662 and that the means and measures employed in maintaining and operating the pipeline (including robust integrity management and maintenance programs) provide assurance for continued safe operation of the pipeline. There is no evidence that indicates that the TMPL segments identified by WaterWealth are nearing the end of their useful life nor is there evidence to suggest that the pipeline should be replaced.

PART D - SUITABILITY OF THE DESIGN

1. Introduction

This section of Trans Mountain's Reply Evidence addresses a number of topics related to the suitability of the design of the proposed Chilliwack Realignment, on which certain intervenors submitted evidence. The topics covered and the intervenors to whom this Reply is addressed include:

- Pipeline Depth: evidence of WaterWealth

2. Pipeline Depth

The written evidence of WaterWealth [Filing ID A5X3T0] notes the experience with an oil spill that occurred into groundwater at what is now the Bemidji Crude-Oil Spill Research Site near Bemidji, Minnesota. WaterWealth asserts that placing an oil pipeline over groundwater drinking water sources is not safe. WaterWealth states that in Bemidji, a pipeline 3 metres deep in an outwash plain spilled into groundwater where the water table was 8 metres below the surface and that the site could not be remediated and so was turned into a research site. WaterWealth asserts that the Bemidji case conditions were similar to what is being proposed in Chilliwack.

Trans Mountain Response:

Trans Mountain agrees that placing an oil pipeline over a potable groundwater source involves a certain level of risk, but is confident that the risk can be mitigated. Almost any anthropogenic activity above a vulnerable aquifer, such as Sardis-Vedder Aquifer, comes with some element of risk. Transportation and municipal infrastructure, that supports community development, must

cross water courses and vulnerable aquifers. Therefore, it is inevitable that risks are accepted; however, risk management must adequately protect those water resources.

The Bemidji Minnesota site is a unique setting that has been exploited for research purposes. Although there is a certain resemblance of the Bemidji site to the Sardis-Vedder Aquifer, there is not a direct comparison. The spill of crude oil at Bemidji occurred in 1979, and the site is considered remote and removed from anthropogenic receptors. Although most of the source (over 75%) was reclaimed shortly following the spill, remediation techniques used 38 years ago left about 400,000 litres of crude oil in place.

Under Minnesota environmental regulations, the Minnesota Pollution Control Agency (MPCA) would not allow the residual oil to be left in place; therefore, in the early 2000s MPCA planned a major final cleanup of the site. However, the research community expressed opposition, in order to maintain the world-class study site, benefitting the theoretical and practical knowledge of dealing with the hydrocarbon contamination. This view was ultimately accepted by MPCA, as the spill site was not threatening drinking water supplies (MPR News Update, June 4, 2014).[8] Although the Bemidji site has become an important research facility, the direct comparison to the Sardis-Vedder Aquifer conditions, as well as to potential remedial measures, has limited relevance.

PART E - POTENTIAL IMPACTS ON ABORIGINAL INTERESTS

1. Introduction

This section of Trans Mountain's Reply Evidence addresses a number of topics related to the potential impacts of the Chilliwack Realignment on Aboriginal interests, on which certain intervenors submitted evidence. The topics covered and the intervenors to whom this Reply is addressed include:

- Aboriginal Consultation: evidence of the STSA
- Potential Impacts on Cultural Practices, Spirituality and Rights: evidence of the STSA
- Archaeological Impact Assessment: evidence of the STSA
- Traditional Knowledge: evidence of the STSA
- Traditional Ecological Knowledge: evidence of the STSA
- Impacts of a Spill on Salmon Species: evidence of the STSA

The following sections deal with the above topics in the sequence presented.

[8] MPR News Update, June 4, 2014: https://www.mprnews.org/story/2014/06/03/bemidji-oil-spill-site-research.

2. Aboriginal Consultation

The written evidence of STSA [Filing ID A5X3T2] asserts that rather than sending a notification of the Chilliwack Realignment directly to Tzeachten First Nation Chief and Council or Ts'elxweyeqw Tribe, or other STSA member communities, Kinder Morgan/Trans Mountain only sent the notification to 100 individual Tzeachten First Nation members. STSA submits that this is not sufficient for Aboriginal Consultation and Engagement as the process does not recognize First Nations as rights and title holders.

STSA asserts that Trans Mountain's response to IR 1.3(ai) is a gross misrepresentation of the work done between STSA and Trans Mountain to date. STSA asserts that the agreement entered into between STSA and Trans Mountain did not, nor did it ever have the intent to, derogate from the obligation of Trans Mountain to engage with Ts'elxweyeqw Tribe regarding Federal Applications or variations to the current Certificate of Public Convenience and Necessity for the TMEP. Rather, STSA asserts that, for the purposes of the NEB related items (non-provincial permitting), Ts'elxweyeqw Tribe requested to receive all pertinent information regarding routing/re-routing and information that directly affects or impacts the member First Nations, to which Trans Mountain and the STSA agreed. In addition, STSA asserts that Trans Mountain identified the local First Nations as "stakeholders" wherein Trans Mountain shared 100 letters of notification to individual Tzeachten First Nation members through the Tzeachten Band Office. STSA asserts that letters of notification supplied to local landowners and stakeholders do not constitute engagement or consultation on a level that is suitable for Aboriginal rights and title holders.

Trans Mountain Response:

Trans Mountain began consultation on the TMEP through the 16 members of the STSA registered as intervenors in the name of the Stó:lō Collective. During the hearing process, membership of the Stó:lō Collective diminished, as some members left to negotiate separate standalone relationships with Trans Mountain. On March 27, 2017, Trans Mountain received direction from Stó:lō Collective in an email, that all engagement related to provincial permits was to be directed through the People of the River Referral Office (PRRO). Trans Mountain was also advised that consultation for all development activities must be conducted in accordance with the S'ólh Téméxw Stewardship Alliance Land Use Consultation and Decision-Making Policy. Guidelines and the Final Terms of Reference executed between STSA, the BC Oil and Gas Commission (OGC) and Trans Mountain provided that the PRRO would be the lead for the review of all NEB plans and condition reports going forward.

Trans Mountain is not aware of any direction to engage with 7 members of the Ts'elxweyeqw Tribe post TMEP approval. In a few instances where the individual bands of STSA were contacted, the STSA Chair repeatedly directed Trans Mountain to engage solely with STSA and PRRO both for land and resource issues, as well as economic issues such as employment and procurement opportunities. By way of example, on February 9, 2017, Trans Mountain referred the Sumas Tank Farm route realignment to the Ts'elxweyeqw Tribe for review. The STSA Chair responded stating Trans Mountain was to stand-down and in no way contact anyone other than STSA-PRRO.

Trans Mountain respected this direction and, accordingly, referred the Chilliwack Realignment to STSA only, as requested. On February 28, 2017, Trans Mountain sent information on the

proposed Chilliwack Realignment to STSA-PRRO and asked for review and comments/questions. Trans Mountain requested that STSA-PRRO contact Trans Mountain if any of its members had concerns with the proposed realignment. No response was received regarding the Chilliwack Realignment, and STSA continued to focus on negotiations surrounding a series of agreements to guide consultation on BC government permits.

As such, Trans Mountain disagrees with the suggestion that Trans Mountain used the agreement entered into by STSA, the OGC, and Trans Mountain to derogate from Trans Mountain's responsibility to consult through Ts'elxweyeqw Tribe. Trans Mountain's approach was the result of communication from STSA during discussions regarding Trans Mountain consultation efforts.

3. Potential Impacts on Cultural Practices, Spirituality and Rights

The written evidence of STSA [Filing ID A5X3T2] states that STSA is concerned about the cumulative negative effects of such developments on their cultural practices, spirituality, and rights, as a result of the increased developments and potential increase of environmental degradation within their Traditional Territory. STSA states the area has significant cultural connectivity that has been greatly impacted due to development.

Trans Mountain Response:

An evaluation of the significance of the Project's contribution to cumulative effects was conducted for each indicator determined to have a likely combined residual effect associated with the Project. Furthermore, an evaluation of the significance of the Project's contribution to cumulative effects was also conducted for each element where more than one likely cumulative effect may act in combination.

Trans Mountain acknowledges the importance of the environment and the resources within STSA traditional territory, and understands that the ability to participate in traditional land use activities is an important component of the exercise of STSA rights. The assessment of potential adverse effects of the Project considered the following valued components that support Aboriginal rights and interests:

- employment and economy;
- infrastructure and services;
- individual, family and community well-being;
- social and cultural wellbeing;
- Traditional Land and Resource Use (TLRU) / Traditional Marine Resource Use (TMRU);
- community health;
- visual and aesthetic resources; and,
- species and habitats required to maintain a traditional lifestyle.

The methodology used to assess potential adverse effects of the Project on valued components supporting the exercise of Aboriginal rights and interests considers: the potential environmental and socio-economic effects of the Project; ways in which these effects can be minimized or avoided altogether; and key mitigation strategies in place that would further reduce these effects. Trans Mountain included Aboriginal participation in its environmental field program to incorporate Aboriginal views and additional traditional knowledge of the land into the consideration of potential Project-related environmental effects, and to provide Aboriginal community members with the opportunity to provide traditional ecological knowledge (TEK) information to inform the ESA.

The assessment of traditional land and resource use in Volume 5B of the Facilities Application and related filings concluded that the predicted Project-related residual and cumulative effects would not be significant (Section 7.2.2 of Volume 5B [Filing ID A3S1S7], Section 8.2 of Volume 5B [Filing ID A3S1T0], ESA Update [Filing ID A4F4Z3], and responses to NEB IR No. 2.041 [Filing ID A3Z4T9] and NEB IR No. 3.025 [Filing ID A4H1V2]). The Project assessment team reviewed the information gathered on the proposed Chilliwack Realignment in the context of the original ESA and related filings and determined that the significance conclusions of the ESA in regards to traditional land and resource use remain unchanged. The predicted Project-related effects and cumulative effects of the Realignment on traditional land and resource use are not significant.

In this regard, the NEB Report on TMEP states:

> The Board finds Trans Mountain's approach to assessing the potential effects on Aboriginal interests is acceptable. Trans Mountain has assessed the effects related to construction, operations, and potential accidents and malfunctions including spills that may impact biophysical resources and socio-economic components within the Project area, and the Aboriginal uses, practices and activities associated with those resources.[9]

Trans Mountain submits the above conclusion applies equally to the Chilliwack Realignment.

4. Archaeological Impact Assessment

The written evidence of STSA [Filing ID A5X3T2] notes that in response to IR 1.1(a), Trans Mountain stated that Theresa John and Ashley Reid from the Stó:lō Research and Resource Management Centre (SRRMC) participated in the Archaeological Impact Assessment (AIA) for the Chilliwack Realignment. STSA asserts that employing member First Nation archaeological field assistants does not necessarily equate to employing traditional knowledge holders, especially given the large Traditional Territory of Stó:lō and the localized experiences of each community within it. STSA submits this is an unacceptable qualification of Traditional Knowledge that was brought forth in their written evidence submission during OH-001-2017. STSA states they are greatly concerned with the lack of incorporation of Traditional Knowledge by Trans Mountain throughout their proceedings.

[9] National Energy Board, Trans Mountain Expansion Project, National Energy Board Report - OH-001-2014 (May 2016) (A77045) at 51.

Trans Mountain Response:

Trans Mountain provided an opportunity for the Stó:lō Research and Resource Management Centre (SRRMC) to participate in the Archaeological Impact Assessment (AIA) completed to date for the Chilliwack Realignment. The SRRMC selected two of their representatives to participate in the AIA fieldwork for the Chilliwack Realignment on July 11 and 12, 2017 and September 2 and 3, 2017. While STSA states that it does not consider information shared by SRRMC field participants qualifies as traditional knowledge [Filing ID A5X3T2], the opportunity to inform the AIA was provided to SRRMC, and shared information will be incorporated in the AIA. The AIA for the Chilliwack Realignment is on-going. Trans Mountain has reviewed the Chilliwack Cultural Heritage Overview Assessment (CHOA) which was provided by SRRMC and the information provided in the CHOA confirms a high archaeological potential rating for the realignment footprint. The CHOA for the Chilliwack Realignment informs the AIA. The AIA is being completed under Heritage Conservation Act Heritage Inspection Permit 2015-0258 and Stó:lō Heritage Investigation Permit 2015-100. Evidence of trial travel routes will be sought and any 'old river/creek channels' will be examined (Brendzy 2017). Confirmation that a Sxwôxwiyám, and one Halq'eméylem Place Name is within the study area may also result in a more intensive assessment. The reported location of the Sxwôxwiyám in the Realignment footprint is considered to be of high archaeological potential and will be further assessed with greater intensity.

5. Traditional Ecological Knowledge

The written evidence of STSA [Filing ID A5X3T2] asserts that there is a continued absence of Stó:lō TEK included in the TMEP technical review of the Chilliwack Realignment and the potential impacts therein.

Trans Mountain Response:

Trans Mountain's approach for collecting TEK tried to ensure a free, informed and ongoing process that meets Canadian ethical research standards. Translators were made available in the field upon the request of a given community, as warranted. Over 200 participants reviewed, collected, and discussed information in the field during survey as well as potential Project-related effects and mitigation strategies. Trans Mountain also acknowledges that STSA did not participate in the biophysical field studies. Results of information gathered from field surveys was summarized and provided to Aboriginal communities to review to ensure that concerns raised and mitigations strategies provided were approved by the community and to provide an opportunity for the removal of any confidential information.

Trans Mountain also provided funding for Aboriginal communities to participate in TLRU studies. STSA completed an Integrated Cultural Assessment (ICA) for the Project. Information received from STSA in the form of the ICA was reviewed and summarized in the Supplemental TLRU Technical Report [Filing IDs A3Z4Z2, A3Z4Z3, A3Z4Z4, and A3Z4Z5], including specific sites and Project concerns. The complete ICA, with the exception of confidential information, was also filed with the NEB as Appendix B of the Supplemental TLRU Technical Report, with all sites, concerns, and mitigation measures, for review. Specific sites and Project concerns identified in the ICA were reviewed for the Chilliwack Realignment and incorporated into the ESA. Some information on TLRU sites and watercourse crossing information was not

included in TLRU reporting but this information was provided to appropriate Trans Mountain personnel to inform Project planning and design.

Furthermore, NEB Condition 97 requires Trans Mountain to file a Traditional Land Use (TLU) and TMRU report for approval, at least 2 months prior to commencing construction, a report describing pre-construction TLU and TMRU investigations that were not reported during the OH-001-2014 proceeding and that relate specifically to the Project (up to and including the foreshore lands and boundaries of the water lease for the Westridge Marine Terminal). Trans Mountain is open and willing to work with STSA on identifying any sites that were not reported during the OH-001-2014 proceeding.

Other applicable NEB Conditions whereby STSA concerns will be considered include, but are not limited to, the following:

- NEB Condition 3 (Environmental Protection) Trans Mountain must implement or cause to be implemented, at a minimum, all of the policies, practices, programs, mitigation measures, recommendations, and procedures for the protection of the environment included in or referred to in its Project Application, its subsequent filings, the evidence it provided during the OH-001-2014 Proceeding, or as otherwise committed to during questioning or in its related submissions.

- NEB Condition 72 (Pipeline EPP) Trans Mountain filed with the NEB for approval, at least 3 months prior to commencing construction, an updated Project-specific Pipeline EPP for the construction of the pipeline. The Pipeline EPP includes Aboriginal Monitors with the purpose of working with the Environmental Inspectors to provide Traditional Knowledge to the construction program to ensure protection of the environment. Consultation on NEB Condition 72 with Aboriginal groups commenced in September 2016. This includes reclamation plans and plans for monitoring water quality, wildlife, and fish.

- NEB Condition 78 (Facilities EPP) Trans Mountain filed with the NEB for approval, at least 3 months prior to commencing construction, an updated Project-specific Facilities Environmental Protection. The Facilities EPP includes Aboriginal Monitors with the purpose of working with the Environmental Inspectors to provide Traditional Knowledge to the construction program to ensure protection of the environment. Consultation on NEB Condition 78 with Aboriginal groups commenced in November 2016. This includes reclamation plans and plans for monitoring water quality, wildlife, and fish.

- NEB Condition 151 (Post-construction Environmental Monitoring Reports) Trans Mountain is required to file a post-construction environmental monitoring report, on or before 31 January that will summarize Trans Mountain's consultation with potentially affected Aboriginal groups, including any issues and concerns raised, and how Trans Mountain has addressed or responded to them.

6. Impacts of a Spill on Salmon Species

The written evidence of STSA [Filing ID A5X3T2] states that given the hydrologic and geotechnical features of the area, STSA is concerned with horizontal contamination as water flows from the aquifer into smaller creeks and the Vedder River which has the potential to

adversely affect a number of salmon species on which Stó:lō rely. STSA submits that this concern was previously raised in the Integrated Cultural Assessment of Stó:lō Collective (2014).

Trans Mountain Response:

There are no watercourses or wetlands crossed by the Chilliwack Realignment. The Ground Water Technical Report in Volume 5C of the Facilities Application [Filing ID A3S1U8] identified that the Project study corridor and the Chilliwack Realignment overlay the Sardis-Vedder Aquifer (#8 IA) system up-gradient of fish bearing creeks where baseflow is supported by groundwater discharge. The open trench construction method proposed for the Chilliwack Realignment is the preferred option for protection of both groundwater and surface water resources.

The issues and concerns associated with construction and operation of the Project in the Chilliwack Realignment are consistent with those previously identified and addressed for surface and groundwater quality and quantity in Section 7.0 of Volume 5A of the Facilities Application [Filing ID A3S1Q9]. New mitigation beyond that identified during the OH-001-2014 proceeding will be implemented to provide additional protection to the Sardis-Vedder Aquifer and surface water bodies supported by groundwater discharge, by incorporating the same design specification as a surface watercourse crossing for the Chilliwack Realignment. The additional measures are proposed due to the characteristics of the aquifer (*i.e.*, unconfined and highly transmissive), the proximity of the pipeline to the municipal water intake system, the importance of the aquifer to provide water for the City of Chilliwack and other domestic users, and the importance of the aquifer to augment creek baseflow in the down-gradient reaches of the alluvial fan where groundwater discharges to surface. Trans Mountain has committed to the use of heavy wall pipe of 14.7 mm wall thickness over the aquifer which is the wall thickness that TMEP uses for watercourse crossings. Trans Mountain also plans to use bio-degradable hydraulic fluid on the heavy equipment during pipeline installation in this area. In addition, mitigation measures identified during the OH-001-2014 proceeding will apply, which are included in the updated Pipeline EPP (NEB Condition 72). Prior to commencing operations, groundwater monitoring plans will be designed for all Project facilities in order to fulfill NEB Condition 130. Trans Mountain will consider installation of monitoring wells in strategic locations along the pipeline route, such as highly vulnerable aquifers, where and if it is deemed beneficial to monitoring and protecting groundwater. Pertinent groundwater data collected during construction activities will be incorporated into the geo-database maintained by Kinder Morgan Canada Inc., and used to develop a post-construction monitoring plan, where applicable. The Project Environmental Alignment Sheets will be updated for the Chilliwack Realignment.

Other applicable NEB conditions developed to minimize and mitigate the potential impacts of spills on salmon species include:

- NEB Condition 43 (Watercourse Crossing Inventory) Trans Mountain filed with the NEB, at least 5 months prior to commencing any watercourse crossing construction activities, including a description of how Trans Mountain has taken available and applicable Aboriginal TLU and TEK into consideration in developing the watercourse crossing designs. Additionally, Trans Mountain provided site-specific mitigation and habitat enhancement measures, for each non-trenchless watercourse crossing to be used to minimize impacts on fish. In completing the work for this NEB Condition, spawning surveys were completed at the appropriate sites.

- NEB Condition 72 (Pipeline EPP) Trans Mountain filed with the NEB for approval, at least 3 months prior to commencing construction, an updated Project-specific Pipeline EPP for the construction of the pipeline. The Pipeline EPP includes Aboriginal Monitors with the purpose of working with the Environmental Inspectors to provide Traditional Knowledge to the construction program to ensure protection of the environment. Consultation on NEB Condition 72 with Aboriginal groups commenced in September 2016. This includes reclamation plans and plans for monitoring water quality, wildlife and fish.

- NEB Condition 78 (Facilities EPP) Trans Mountain filed with the NEB for approval, at least 3 months prior to commencing construction, an updated Project-specific Facilities Environmental Protection. The Facilities EPP includes Aboriginal Monitors with the purpose of working with the Environmental Inspectors to provide Traditional Knowledge to the construction program to ensure protection of the environment. Consultation on NEB Condition 78 with Aboriginal groups commenced in November 2016. This includes reclamation plans and plans for monitoring water quality, wildlife and fish.

- NEB Condition 89 (Emergency Response Plan for Construction) Trans Mountain must file with the NEB, at least 2 months prior to commencing construction, a Project-specific Emergency Response Plan, including spill contingency measures that Trans Mountain will employ in response to accidental spills attributable to construction activities, 24-hour medical evacuation, fire response and security.

- NEB Condition 94 (Consultation Reports – Protection of Municipal Water Sources) Trans Mountain must file with the NEB, at least 2 months prior to commencing construction, and on or before 31 January of each year during construction and of the first 5 years after commencing Project operations, a report on Trans Mountain's consultations with municipalities, communities and Aboriginal groups related to the protection of municipal and community water sources.

- NEB Condition 110 requires Trans Mountain to report on authorizations under paragraph 35(2)(b) of the *Fisheries Act* and *Species at Risk Act* permits (pipeline).

- NEB Condition 108 requires Trans Mountain to report on contingency watercourse crossings.

- NEB Condition 130 (Groundwater Monitoring Program) Trans Mountain must file with the NEB for approval, at least 3 months prior to commencing operations, a Groundwater Monitoring Program that will summarize Trans Mountain's consultation with potentially affected Aboriginal groups, including any issues and concerns with respect to the Groundwater Monitoring Program and how Trans Mountain has addressed or responded to them.

- NEB Condition 151 (Post-construction Environmental Monitoring Reports) Trans Mountain is required to file a post-construction environmental monitoring report, on or before 31 January that will summarize Trans Mountain's consultation with potentially affected Aboriginal groups, including any issues and concerns raised, and how Trans Mountain has addressed or responded to them.

PART F - POTENTIAL IMPACTS ON LANDOWNERS AND LAND USE

1. Introduction

This section of Trans Mountain's Reply Evidence addresses a number of topics related to the potential impacts of the Chilliwack Realignment on landowners and land use, on which certain intervenors submitted evidence. The topics covered and the intervenors to whom this Reply is addressed include:

- Water Quality and Quantity: evidence of the City of Chilliwack
- Property Value and Potential Construction Damage: evidence of WaterWealth
- Potential for Future Development: evidence of WaterWealth

The following sections deal with the above topics in the sequence presented.

2. Water Quality and Quantity

The written evidence of the City of Chilliwack [Filing ID A5X3A4] notes that the City of Chilliwack draws 98% of its water from the Sardis-Vedder Aquifer. The City of Chilliwack further submits that the City of Chilliwack expects to reach the maximum currently allowed capacity of its water wells by around 2021. The City of Chilliwack further submits that the Sardis-Vedder Aquifer yields water of excellent quality, receiving numerous awards, including 5th place at an international water tasting competition. The City of Chilliwack asserts that if it were required to use surface water or water from the Chilliwack-Rosedale Aquifer it would have to incur the cost of building substantial additional treatment facilities.

Trans Mountain Response:

The Sardis-Vedder Aquifer (Aquifer) is an important natural resource that requires stewardship, management and protection to ensure the integrity of the resource is maintained for all stakeholders and to ensure the City of Chilliwack can rely on the Aquifer to supply high quality water for its current and future needs. Trans Mountain fully recognizes this value, and is committed to protect this vulnerable resource throughout construction and operation of the TMEP and support ongoing management efforts.

The ultimate capacity of the Aquifer is of obvious interest to the City of Chilliwack, and it is only natural that it will be proactive in managing the resource including alternative water sources when needed. The maximum currently allowable capacity of the municipal wells, or any expansion thereof, will require the City of Chilliwack to consider safe Aquifer yield and surface aquatic resources, as protected under the WSA and addressed by the 2040 Official Community Plan.

The extraction of excellent quality groundwater, as referenced above, may be currently enhanced through dilution, if capture extends to the water table as suggested by Golder (2017). If high quality groundwater has historically, or is currently being maintained because capture is not reaching the water table where known sources of contamination exist, this condition could change as the City of Chilliwack source water demand increases with population growth. This

changing condition is related to the expansion of both vertical and horizontal capture as diversion rates increase to meet the demand of population growth. As indicated in Part B3, the 200-day travel time capture zones that address the risk to the water supply by the migration of water-borne pathogens and protozoa may be misleading. If capture currently extends to the water table as suggested, or will extend to the water table as the well field extraction demand increases over time, then infiltrating surface water through storm water infrastructure, deemed to be captured, may become the primary source of the pathogens, rather than the Vedder River. This realization may become the immediate driving force for building substantial additional treatment facilities.

If the Chilliwack Realignment is located outside municipal well capture that is limited by safe Aquifer yield rather than the maximum currently allowed capacity of its water wells, the TMEP could not be considered a potential source of contamination that compromises the municipal water supply in the future. The maximum currently allowable capacity of the municipal wells, or any expansion thereof, will have to consider safe Aquifer yield and surface aquatic resources, protected under the WSA and addressed by the 2040 Official Community Plan.

3. Property Values and Potential Construction Damage

The written evidence of WaterWealth [Filing ID A5X3T0] notes that in Trans Mountain's response to NEB IR No. 1 [Filing ID A84596-2] Trans Mountain states that "[as] the proposed pipeline will be installed within an existing Right-of-Way, there should not be any negative impact to property value." WaterWealth asserts that this is only true if there is never a spill in the area.

WaterWealth asserts that the Sommerville/Wetzel Report relied on by Trans Mountain is not specific to the circumstances found in Chilliwack. WaterWealth submits that Chilliwack is a rapidly growing city where growth is constrained by Agricultural Land Reserve, mountains and floodplains. In addition, WaterWealth asserts that the Chilliwack Realignment is in an area of older homes with larger lots. WaterWealth further asserts that the area is desirable for families due to its proximity to certain amenities.

Trans Mountain Response:

As part of the NEB hearing process for TMEP, Trans Mountain commissioned four reports by Dr. Tsur Somerville regarding the potential effects of TMEP upon the property values for directly affected and adjacent landowners. Those reports are:

- Compensation Report. Trans Mountain Pipeline Impact Study. Property Values 1998 – 2013 - Landcor Data Corp. (November 13, 2014) [Filing ID A4H8G0]

- Landowner Compensation. Trans Mountain Pipeline Effects. Phase Three - Landcor Data Corp. (July 22, 2015) [Filing ID A4S7H5]

- Pipelines and Property Values: A Review of the Academic Literature. Nadlan Consulting (May 22, 2014) [Filing ID A5S4Q1]

- Westridge Spill and Clean-Up: Effect on Local Property Values. Nadlan Consulting (Aug. 11, 2014) [Filing ID A4A4I7]

As part of the research for these reports, Dr. Somerville and his research associates examined previous studies investigating the potential impacts upon property values, compared property values before and after the Westridge pipeline rupture, and compared the values of properties both with and adjacent to the existing TMPL within BC. Through their research, they were unable to find any scientific support for a conclusion that the values of properties were affected by the presence of the existing TMPL. This research included examining property values in the City of Chilliwack as well other municipalities in the Fraser Valley.

Respecting concerns related to the impact of an oil spill on affected properties, Dr. Somerville's research indicated that while a temporary reduction in property value could occur, no long term impact was found, either in his research or that of other researchers, so long as a spill was an isolated event, and there was no pattern of continuous spills at that location with the same pipeline system.

Trans Mountain submits these conclusions apply equally to the Chilliwack Realignment.

4. Potential for Future Development

The written evidence of WaterWealth [Filing ID A5X3T0] asserts that in order to consider impacts to landowners and the City of Chilliwack consideration must be had for not only the sale of a home as is, but the potential for future development on the properties.

Trans Mountain Response:

The P2 alignment includes the co-location of Line 2 within the TMPL right-of-way for the full length of the re-alignment, with no new lands required. Potential impacts upon future development are currently addressed in acquisition of land rights for TMEP as part of the market value calculation used as the basis of determining compensation for land rights required on any property. The market value determination incudes valuations for the highest and best use of the lands at the time of acquisition – this includes any value the market may assign to the potential future development potential of the property. As part of the easement agreement, land use restrictions are identified and compensation is provided for any land rights acquired, including diminution of land value. Development restrictions are included within the easement agreement, however no development restrictions are imposed as a result of TMEP on any adjacent lands not having an easement. As indicated above, Trans Mountain has been unable to find evidence that the presence of the TMEP would affect the value of adjacent properties.

For lands containing permanent easements, the easement agreement will specify the activities that are allowed within the easement. In general, activities which might either damage or cover the pipeline are not allowed. Trans Mountain will have no rights to direct land use outside of the easement. For lands within the 30 metre Prescribed Area required under Section 112 of the NEB Act, landowners are required to notify Trans Mountain in advance of any ground disturbing activities or excavation using mechanical equipment or explosives. The NEB publication, "Pipeline Regulation in Canada: A Guide for Landowners and the Public" contains further information on the safety zone requirements.

PART G - EMERGENCY RESPONSE

1. Introduction

This section of Trans Mountain's Reply Evidence addresses a number of topics related to emergency response planning for spills, accidents or malfunctions, during construction and operation of the Chilliwack Realignment, on which certain intervenors submitted evidence. The topics covered and the intervenors to whom this Reply is addressed include:

- Emergency Supply and East Chilliwack Aquifer: evidence of the City of Chilliwack
- Fire or Explosion: evidence of WaterWealth
- Emergency Access to the Chilliwack Alignment: evidence of WaterWealth

The following sections deal with the above topics in the sequence presented.

2. Emergency Supply

The written evidence of the City of Chilliwack [Filing ID A5X3A4] notes that the City of Chilliwack has an emergency water supply located in the eastern part of Chilliwack (Elk Creek and Dunville Creek). The City of Chilliwack states that before it can bring these water sources online, the City of Chilliwack will be required to make substantial upgrades to its water supply system. As a result, the water source from the emergency water supply system will not be immediately available and would be of inferior quality to the water sourced from the Sardis-Vedder Aquifer. The City of Chilliwack further states that this emergency water supply does not have the capacity to serve the City of Chilliwack's residents in the short or long term. The City of Chilliwack further states that another potential source of emergency water supply, the Chilliwack-Rosedale Aquifer, has elevated levels of iron and manganese that would need to be treated prior to being used as a drinking water supply. The City of Chilliwack further states that another potential source of emergency water supply, the East Chilliwack Aquifer, is traversed by the existing TMPL, which means the aquifer would not be available in the event of a catastrophic oil spill in the region.

Trans Mountain Response:

Trans Mountain recognises that the City of Chilliwack has other potential sources of water supply that require substantial upgrades and infrastructure modifications to be readily available in the event of contamination of the aquifer from any sources of contaminants. Trans Mountain also recognises that, as a utility providing services to its clients, the City of Chilliwack needs to have alternative sources ready as an emergency water supply in the event of contamination by any sources of contaminants or pollution from activities that are taking place in the surrounding area of the Sardis-Vedder Aquifer.

In the unlikely event of a pipeline release that may impact water supply, Trans Mountain will identify alternate drinking water sources, treatment mechanisms, and delivery/distribution contingent upon the site-specific conditions and characteristics. In the unlikely event that a pipeline release somehow impacted aquifer conditions around one of the City of Chilliwack

community wells, Trans Mountain is committed to work with the City of Chilliwack to identify alternative water sources, which could include surplus capacity from other wells in the system, while suitable replacement alternatives are established and implemented.

Trans Mountain has sufficient financial capacity to fund restoration efforts and compensate those affected based on estimates of pipeline spill costs.

3. Fire or Explosion

The written evidence of WaterWealth [Filing ID A5X3T0] states that in the event of a spill residences may be exposed to fire or explosion risk. WaterWealth provides a quote which states "[this] indicates that standard Dilbits can pose a flammability hazard up to a few days after the spill. Enhanced C4 Dilbits will pose a greater hazard, but for a shorter time. Cleanup crews are advised to use explosimeters in dealing with Dilbit spills."

Trans Mountain Response:

The potential for fire or explosion risks was discussed in detail in Trans Mountain's response to Wright K IR No. 1.2.4 [Filing ID A3X6W5] during the TMEP regulatory proceeding.

With respect to the potential for ignition of released product, it is important to bear in mind that the product being transported in the proposed pipeline infrastructure is crude oil. Industry experience has shown that crude oil does not readily ignite during a pipeline release, even in contemplation of a worst-case scenario full-bore rupture. By way of illustration, in the report by Dr. Franci Jeglic, of the NEB, [Filing ID A3X6W6] it was concluded that no ignition of spilled product had occurred in any of the pipeline ruptures involving low vapour pressure products, including crude oil, over the 20-year period from 1984 to 2004 covered by the review.

In the very unlikely event that a fire does occur following a pipeline release, Trans Mountain will work with the local emergency responders to provide an effective and rapid response through its existing emergency management system.

Trans Mountain has a robust health and safety program that has controls in place for safe work practices. All operations staff carry a portable gas detector when responding to the incident and part of their daily job.

4. Emergency Access to the Chilliwack Realignment

The written evidence of WaterWealth [Filing ID A5X3T0] notes the Chilliwack Realignment Application states "[t]hrough Chilliwack in the Sardis area, the TMEP routing along the existing TMPL corridor presented alignment challenges for twinning" and that new corridors chosen in the TMEP included "routing in a nearby BC Hydro RoW to avoid construction through fenced backyards." WaterWealth further notes that in Trans Mountain's Response to NEB IR No. 3, Trans Mountain states that for construction non-permanent structures such as decks, above ground pools, and sheds would need to be removed. WaterWealth asserts that the same is true for maintenance or emergency access and that accessing the TMEP between houses will delay spill response.

Trans Mountain Response:

Trans Mountain is committed to a timely and safe response to any incident and has a proven history of procuring the resources required at the time of the event. Kinder Morgan Canada Inc. uses the Incident Command System for incident planning which is adaptable to different emergency scenarios and allows for quick identification of resources.

In the event of an incident, emergency responders ensure the safety of all workers and public in the area for the spill and take appropriate actions to mitigate any impacts to life, safety, the environment, and property.

To access a spill site, responders will remove non-permanent structures such as decks, above ground pools, fences, and sheds. Permanent structures may also have to be removed if required. Damaged and undamaged structures will be removed to provide a safe access to the site. At the clean-up stage, all structures will be restored as to the original state or in better conditions.

Trans Mountain has an emergency management plan (EMP) which is resourced with manpower and equipment to ensure expedient response to a spill and will respond to the emergency with all regionally available resources, while procuring additional resources from outside of the region. The resources employed would ensure a safe approach and timely response in the event of a spill.

PART H - SAFETY AND SECURITY

1. Introduction

This section of Trans Mountain's Reply Evidence addresses a number of topics related to the safety and security during construction of the proposed Chilliwack Realignment and operation of the Chilliwack Realignment, including emergency response planning and third-party damage prevention, on which certain intervenors submitted evidence. The topics covered and the intervenors to whom this Reply is addressed include:

- Leak Detection System: evidence of the City of Chilliwack
- Construction Within Densely Populated Areas: evidence of WaterWealth

The following sections deal with the above topics in the sequence presented.

2. Leak Detection System

The written evidence of the City of Chilliwack [Filing ID A5X3A4] asserts that Trans Mountain has not provided a comprehensive analysis of its leak detection system. The City of Chilliwack further notes that some of the system components – such as fiber optic technology – were not brought to the City of Chilliwack's attention until Trans Mountain's response to the City of Chilliwack's Information Request No. 1 [Filing ID A87439-2]. The City of Chilliwack asserts that this suggests Trans Mountain has not designed a comprehensive leak detection system for the Sardis-Vedder Aquifer.

Trans Mountain Response:

Trans Mountain has been active in the research and development of external to the pipe leak detection systems over the course of the last five years with joint industry-government participation in research as indicated in City of Chilliwack Information Request No. 1, 3.5b) [Filing ID A87439-2]. The research projects included the testing of multiple applications and technologies applied external to the pipe within a controlled test apparatus and documentation of results for each application under simulated pipeline leak conditions.

Based on the results of the research project, further assessment of an external fibre optic leak detection technology has confirmed its potential capability for distributed real time sensing of acoustical, vibration, temperature, and strain changes along the length of an approximately one kilometre long pilot installation undertaken by Kinder Morgan Canada Inc.. It was not possible to accurately simulate a product release from a through-wall defect along the pilot installation but two simulation techniques were tested. One of the simulation methods – based solely on detecting the sound of a release from a through-wall defect – was inconclusive. A second simulation method, which involved the controlled discharge of water at a point along the pipeline, using acoustical, temperature, and strain signals, was successful. The results of the pilot project and field investigation and advancement of the fibre optic-based external leak detection system technology will provide an effective external leak detection system over the Sardis-Vedder Aquifer. While this technology is still in the developmental stages, Trans Mountain is confident in its application and effectiveness and plans to install the system between block valves at Kinkora golf course and the Vedder River.

The external pipe leak detection system is additional to the standard leak detection systems planned for the TMEP, and currently in use on the existing TMPL. The TMEP leak detection will include two computational pipeline monitoring applications. The proposed computational pipeline monitoring applications are currently in use on the existing TMPL system and extensive analysis has been performed to confirm their suitability for leak detection on hazardous liquid transmission pipelines.

3. Construction Within Densely Populated Areas

The written evidence of WaterWealth [Filing ID A5X3T0] states that the safety of residents and particularly children cannot be assured during construction. The written evidence of WaterWealth includes alleged photos of a Trans Mountain excavation site to illustrate a lack of security. WaterWealth further states there were no signs indicating that "the curious should stay out of the site" and that the author of WaterWealth's written evidence was not challenged upon entry.

Trans Mountain Response:

Trans Mountain takes the safety of the public and workers employed during construction of paramount importance. The pipeline construction right-of-way will be fenced off using mobile construction fencing, as well as six foot, lockable vehicle and main gates. The fence proposed for TMEP and the Chilliwack Realignment will provide clear delineation between the work site and private land use while isolating the public from construction hazards. More details are provided in the response to NEB IR No. 3 [Filing ID A87475-2] and demonstrated in the form of sketches in Attachment 1 Mitigating Construction Footprint [Filing ID A87475-3].

WaterWealth is correct in identifying open excavations as a risk and in Trans Mountain's construction risk assessment as provided in response to NEB IR No. 2.1a [Filing ID A86555-2], it identifies security measures to be undertaken in accordance with the TMEP Security Plan and General Contractor Security Plan.

PART I - TERMS AND CONDITIONS TO BE INCLUDED

1. Summary

This section of Trans Mountain's Reply Evidence addresses a number of topics related to the terms and conditions to be included in any approval the Board may issue in relation to the Chilliwack Realignment, on which certain intervenors submitted evidence. The following terms and conditions have been requested by intervenors should the Chilliwack Realignment be approved:

- *The written evidence of the City of Chilliwack [Filing ID A5X3A4] requests that Trans Mountain be required to carry out a detailed analysis of the City well capture zones and the impact of locating the TMEP and the TMPL within or very near such capture zones.*

Trans Mountain Response:

Capture zone analysis has been undertaken on behalf of the City of Chilliwack by:

- Emerson Groundwater Consultants Inc., 1997. Groundwater Flow Model for the District of Chilliwack. August 6, 1997 (Provided by the City of Chilliwack).
- Golder Associates Ltd., 1997. Groundwater Protection Plan. District of Chilliwack. November 4, 1997 (Provided by the City of Chilliwack).
- Emerson Groundwater Consultants Inc., 2000. Groundwater Model Update. December 19, 2000 (Provided by the City of Chilliwack).
- Emerson Groundwater Consultants Inc., 2003. Sardis Aquifer Yield Assessment. January 2003. (Provided by the City of Chilliwack).
- Golder Associates Ltd., 2001. Capture Zone Analysis and Review of Monitoring Program City of Chilliwack, B.C. March 2001 (Provided by the City of Chilliwack).
- AMEC Earth & Environmental, 2007. Sardis Aquifer 60 Day Capture Zone. Figure 1 provided by the City of Chilliwack. December 2007 (Provided by the City of Chilliwack without supporting documentation).
- Golder Associates Limited, 2017. Sardis-Vedder Aquifer Groundwater Model Update Study; Draft. City of Chilliwack. (Provided by the City of Chilliwack).

Given the extensive capture zone studies commissioned by the City of Chilliwack to date, Trans Mountain would not advocate additional analysis that is considered a reproduction of work

completed by others. Based on the review of the model update study (Golder, 2017), capture zone analysis appears to have been founded on projected source water demand as determined by City of Chilliwack development objectives, including population growth estimates, rather than the safe Aquifer yield. Safe Aquifer yield can be considered using the updated model.

- *The written evidence of the City of Chilliwack [Filing ID A5X3A4**]** requests that Trans Mountain be required to prepare a targeted groundwater management plan for the Sardis-Vedder Aquifer and the City wells.*

Trans Mountain Response:

Trans Mountain is of the view that municipalities, not project proponents, are best placed to manage the groundwater resource and extraction wells on behalf of the resource user.

- *The written evidence of the City of Chilliwack [Filing ID A5X3A4] requests that Trans Mountain be required to prepare thorough, site-appropriate spill modelling for the Sardis-Vedder Aquifer and the City wells.*

Trans Mountain Response:

Trans Mountain has thoroughly assessed and considered the risks associated with spills (*i.e.*, accidents and malfunctions) and does not support this proposed condition. Trans Mountain completed a risk based design for the pipeline and associated facilities to identify, prevent and reduce the frequency of potential releases as well as employed reduction measures, such as leak detection, containment and valve placement. Furthermore, an assessment of the behaviour of spilled oil was completed which was relevant to assessing spill response and the consequences of a spill. A strong focus was placed by Trans Mountain on prevention, preparedness, and response, and the likelihood of accidents and malfunctions. Trans Mountain discussed the potential environmental effects of a spill, including the potential socio-economic effects. The NEB Report for the TMEP acknowledges that achieving zero risk is impossible for most developments. The NEB concluded that there is very low probability of a Project spill (*i.e.*, from the pipelines, tank terminals, pump stations or the Westridge Marine Terminal) that may result in a significant effect (high consequence).[10] Trans Mountain is of the view that no further site-specific spill modelling is required for the Sardis-Vedder Aquifer and the City of Chilliwack wells. Trans Mountain is preparing plans in accordance with NEB Conditions 89, 93, 94, 117, 119, 120, 124, 125, 126, 129, 130, 135, 136, and 153, all of which are related to groundwater protection, spill preparedness and response and continuous improvement. These condition plans and exercises take further precaution to protecting the groundwater and enhance the prevention measures considered by Trans Mountain for spills.

Spill modelling is intended to link source, pathway, and receptor. In cases where the source, or the pathway, or the receptor cannot be resolved, the link is broken. Under these conditions, site-appropriate spill modelling for the Sardis-Vedder Aquifer and the City wells cannot be undertaken with any degree of confidence in the predictive analysis.

[10] National Energy Board, Trans Mountain Expansion Project, National Energy Board Report - OH-001-2014 (May 2016) (A77045) at 11.

- *The written evidence of the City of Chilliwack [Filing ID A5X3A4] requests that Trans Mountain be required to prepare a site-specific emergency management plan for the Sardis-Vedder Aquifer and the City wells.*

Trans Mountain Response:

Trans Mountain has a comprehensive EMP in operation that covers all aspects of preparedness, response, and recovery. The EMP provides a documented, structured approach to ensuring readiness to respond to all potential emergency scenarios that may occur. Trans Mountain will be further enhancing the EMP, as part of the TMEP. In addition, NEB Conditions 125 and 126 require Trans Mountain to file its Emergency Response Plan 6 months prior to commencing operations. Accordingly, this additional condition is not warranted.

- *The written evidence of the City of Chilliwack [Filing ID A5X3A4] requests that Trans Mountain be required to design, and provide a comprehensive analysis of, the leak detection system to be used in the Sardis-Vedder Aquifer.*

Trans Mountain Response:

Trans Mountain has committed to implementing a comprehensive leak detection system for the TMEP segment crossing the Sardis-Vedder Aquifer using three independent leak detection products. These products include two computational pipeline monitoring applications and a fibre optic based external leak detection system. The proposed computational pipeline monitoring applications are currently in use on the existing TMPL system and extensive analysis has been performed to confirm their suitability for leak detection on hazardous liquid transmission pipelines.

It is not possible to perform a comprehensive analysis of the planned external leak detection system until after it is installed, configured, and tested. It is expected that similar to the computational pipeline monitoring systems, the development and improvement of the external leak detection system will be a continual process with experience operating and testing the system. This expectation is supported by experience with a pilot installation of the proposed fiber optic system which has been monitored continuously by the vendor and the Trans Mountain leak detection group on a 1 kilometre length of operational pipeline since October 2016. During this monitoring a number of improvements have been identified and several tests have been completed. Trans Mountain intends to continue monitoring and testing the system to support the further development and enhancement of the detection and characterization capabilities of the system and to improve the quality of the event reporting to our control centre. Based on the analysis performed through the pilot system, we believe this technology has the potential to significantly improve leak detection capability.

- *The written evidence of the City of Chilliwack [Filing ID A5X3A4] requests that Trans Mountain be required to provide details and cost analysis of locating, treating and delivering alternate sources of drinking water in the event of a spill or water degradation in the Sardis-Vedder Aquifer.*

Trans Mountain Response:

Trans Mountain is committed to rectify any impacts to municipal water supply that result from the unlikely event of a pipeline release. Detailed cost analysis of locating, treating, and delivering alternate sources of drinking water in the event of a spill or water degradation in the Sardis-Vedder Aquifer is premature, and the mitigation strategy will entirely depend on the nature of the release and impact to the aquifer and municipal source wells. For these reasons, Trans Mountain submits this is not an appropriate condition.

- *The written evidence of the City of Chilliwack (Filing ID A5X3A4) requests that Trans Mountain be required to, to the extent not yet done, commit to comply with the recommendations contained in the City's 2015 submission to the Board [Filing ID A72026], attached as Appendix S.*

Trans Mountain Response:

Trans Mountain is of the view that the mitigation measures it is proposing for the Chilliwack Realignment, in combination with the existing Certificate of Public Convenience and Necessity conditions, are sufficient to ensure the safe construction and operation of the pipeline in this area.

- *The written evidence of WaterWealth [Filing ID A5X3T0] requests that Trans Mountain be required to use extra heavy wall pipe (19 mm) for the segment defined as sensitive by the City of Chilliwack, subject to further definition by the City of Chilliwack about what section of the Chilliwack Realignment is extra sensitive.*

Trans Mountain Response:

As described in Attachment A to Preliminary Risk Results for TMEP Line 2 and New Delivery Lines (Filing ID A3Z8G1) ('the Failure Frequency Report'), wall thickness is a variable that is used in the determination of third party damage rupture frequency. In order to demonstrate the effect of increased wall thickness on third party damage rupture frequency, a sensitivity analysis was completed on the three P2 segments identified in the response to NEB IR No. 5.4 a):

i. Start (m): 1,095,390 – End (m): 1,096,153

ii. Start (m): 1,096,247 – End (m): 1,096,305

iii. Start (m): 1,096,841 – End (m): 1,097,284

The sensitivity analysis was completed assuming a 1.2 metre depth of cover, as committed to in the response to NEB IR No. 5.4 b), and the results are presented in the Table below.

Sensitivity Analysis on Wall Thickness for 3 Segments Evaluated as Part of Response to NEB IR 5.4 a)

Route	Start (m)	End (m)	Depth of Cover (m)	Wall Thickness (mm)	3rd Party Damage Rupture Frequency (per km.yr)	Incremental Reduction in Rupture Frequency (per km.yr)
P2	1,095,390	1,096,153	1.2	11.8	5.61×10^{-06}	-
				14.7	1.93×10^{-06}	3.68×10^{-06}
				19.0	3.76×10^{-07}	1.55×10^{-06}
P2	1,096,247	1,096,305	1.2	11.8	5.60×10^{-06}	-
				14.7	1.93×10^{-06}	3.67×10^{-06}
				19.0	3.75×10^{-07}	1.56×10^{-06}
P2	1,096,841	1,097,284	1.2	11.8	5.58×10^{-06}	-
				14.7	1.92×10^{-06}	3.66×10^{-06}
				19.0	3.74×10^{-07}	1.55×10^{-06}

As can be seen from the above Table, incremental reductions in third party damage rupture frequency are associated with increases in wall thickness. Nevertheless, as illustrated in the last column of the Table, greater incremental reductions in third party damage rupture frequency can be achieved by increasing wall thickness from 11.8 mm to 14.7 mm than can be achieved by increasing the wall thickness from 14.7 mm to 19.0 mm. Specifically, an increase in wall thickness from 11.8 mm to 14.7 mm corresponds to a reduction in third party damage rupture frequency of approximately 3.7×10^{-06} per km.yr, whereas an increase in wall thickness from 14.7 mm to 19.0 mm corresponds to a reduction in third party damage rupture frequency of approximately 1.6×10^{-06} per km.yr for the three segments identified. This more than two-fold incremental reduction in third party damage rupture frequency associated with an increase in wall thickness from 11.8 mm to 14.7 mm relative to the effect of an increase in wall thickness from 14.7 mm to 19.0 mm is despite the fact that the increase in wall thickness from 11.8 mm to 14.7 mm (Δ=2.9 mm) is less than the increase in wall thickness from 14.7 mm to 19.0 mm (Δ=4.3 mm). This illustrates the fact that a point of diminishing returns exists on wall thicknesses above 14.7 mm.

It is important to note that a review of US Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) Hazardous Liquids incident data for the 16-year period 2002 – Present shows that over this timeframe there has never been a failure due to excavation damage in an onshore hazardous liquids transmission pipeline having a wall thickness as great as 14.7 mm.[11] Consistent with this finding, the 8th Report of the European Gas Pipeline Incident Data Group (EGIG), which tracks and trends failures on European transmission pipeline infrastructure over the 40-year period between 1970 and 2010 (representing 3.55 million km-yrs

[11] PHMSA Pipeline Incident Flagged Files, Hazardous Liquids Pipelines, https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-flagged-files, downloaded January 4, 2018.

of operation) shows that there have never been any failures attributed to third party damage on pipelines above the wall thickness category of 10-15 mm.[12]

Trans Mountain's standard wall thickness is 11.8 mm for NPS 36 Grade 483 MPa for a design pressure of 9,930 kPa. As an outcome of Trans Mountain's risk-based design initiative, Trans Mountain has adopted a practice of installing 14.7 mm wall thickness pipe in populated areas (*i.e.*, those that are more susceptible to third party interference). This is in recognition of the benefit that increasing wall thickness has on mitigating risk associated with third party damage, as well as the point of diminishing returns on risk mitigation that exists beyond wall thicknesses of 14.7 mm. This is consistent with the risk-based design objective of managing risk to levels that are commensurate with As Low As Reasonably Practicable (ALARP) as detailed in the response to NEB IR No. 2.110 a) [Filing ID A3Z4T9]:

> The types of risk mitigation measures that will be considered in the risk-based design process include both failure prevention and spill mitigation measures to ensure that risk is managed to levels that are As Low As Reasonably Practicable (ALARP). Inherent within the ALARP principle is acknowledgement that risk is associated with virtually all human endeavours. The management of risk to levels that are commensurate with ALARP requires a systematic means of identifying and measuring risks, along with the associated drivers of risk so that risk-appropriate means can be selected to manage those risks. The ALARP principle also recognizes the prioritization of resources and diminishing levels of return associated with the implementation of risk mitigation techniques.

- *The written evidence of WaterWealth [Filing ID A5X3T0] requests that Trans Mountain be required to conduct thorough modelling of likely spill scenarios as requested by the Province of BC in its IR No. 2 in the Project facilities hearing.*

Trans Mountain Response:

On January 10, 2017, the BC Environmental Assessment Office (BC EAO) issued an environmental assessment certificate for the TMEP. The decision was made after considering the NEB's Report which included a comprehensive environmental assessment as well as various federal and provincial reports, submissions from Aboriginal groups, and the recommendations of the BC EAO Executive Director. The BC EAO certificate is subject to 37 conditions in relation to areas of provincial jurisdiction and are in addition to and designed to supplement the NEB's required 157 conditions. The 37 conditions respond to concerns raised by communities and Aboriginal groups during consultation and to the key areas of provincial interest and jurisdiction. Conditions 30 to 37 specifically address the concerns raised by WaterWealth. No additional requests or conditions were made by the Province of BC to provide additional modelling of spills beyond those already completed as part of the original facilities application.

On March 1, 2017, Trans Mountain filed with the NEB the updated risk assessment in accordance with Condition 15 [Filing ID A3Z8G5]. The updated risk assessment shows a general decrease in overall failure frequencies, consequence index and risk index, which is largely attributable to a reduction of natural hazards and third party damage. Risks posed by natural

[12] 8th Report of the European Gas Pipeline Incident Data Group. Doc. Number EGIG 11.R.0402, December, 2011.

hazards have been mitigated through routing changes and design changes (such as the additional heavier walled pipe and extra burial depth). Risks posed by third party damage have been mitigated through additional heavier walled pipe, increased depth of cover and buried marker tape. Through two rounds of valve optimization, the first to establish outflow volumes to ALARP, and the second to confirm that ALARP has been met, Trans Mountain has substantially reduced the maximum modelled outflow volumes from those presented in the 2014 Report. Trans Mountain has utilized a consequence-weighted approach, amplifying areas of environmental sensitivity, which has yield distributed Environmental Risk Score values. A comparison of the 2014 report to this update has resulted in a 91% reduction of integrated environmental risk scores. The post-mitigation design of the Project has effectively reduced the pre-mitigated integrated environmental risk scores by 91%.

PART J - APPENDIX

1. Sardis-Vedder Aquifer Report

Sardis-Vedder Aquifer, Trans Mountain Expansion Project, Chilliwack Realignment, NEB Hearing Order OH-001-2017, Waterline Resources Inc., January 8, 2018