Natural Resources Canada | Ressources naturelles Canada

File OF-Fac-Oil-T260-2013-03 02
12 May 2014

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Dear Mr. Stoness and Mr. Denstedt:

Hearing Order OH-001-2014
Trans Mountain Pipeline ULC (Trans Mountain)
Application for the Trans Mountain Expansion Project (Project)
Information Request (IR) No. 1 to Trans Mountain

Please find attached IR No. 1 on behalf of the Government of Canada.

In some cases, federal departments are satisfied that at least some of their interests have been captured in the IRs already submitted by the Board to the Proponent. For example, Environment Canada has noted that the Board has provided IRs to the Proponent that relate to departmental interests in the behaviour and fate of diluted bitumen in water. Based on the Proponent's responses to all IRs, federal departments will consider the need to pose follow-up IRs in September.

If you have any questions, please contact me at 613-995-7545 or tim.archer@nrcan.gc.ca.

Sincerely,

Original signed by

Tim Archer
Major Projects Management Office
Natural Resources Canada

Attachment

Canada

OH-001-2014
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Table of Contents

Federal Department	Page
Environment Canada	3
Natural Resources Canada	78
Aboriginal Affairs and Northern Development Canada	101
The Parks Canada Agency	105
Government of Canada	113
References	115

Information Requests from Environment Canada

Question #	Subject/Reference	Preamble/Rationale	Information Request
GENERAL			
1.	Pre-Hearing Order information request	EC had a preliminary Pre-Hearing Order IR exchange with the Proponent on the topics of air quality, wildlife, and disposal at sea. This request is intended to put that exchange on the record.	EC requests that the Proponent's April 17, 2014 Responses to Pre-Hearing Order Information Request from EC be provided.

Question #	Subject/Reference	Preamble/Rationale	Information Request
WATER			
SURFACE WATER			
Marine Meteorology			
2.	Meteorological Data Volume 8C_Termpol_Reports.pdf Section TR 8C-10 S2 PDF Page #907 and #930 Doc #S2, Termpol Study Supports 3.5/3.12 (A56023) Volume 8C: Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion, EBA File: V13203022 (A56023)	The consideration of available meteorological data collected by EC as an expert federal authority is an important element of an assessment of how the environment could affect the project as required under CEAA 2012. Hourly fog data is available in the national archive for EC climate stations in the project area including the following: • Victoria Gonzales HTS, Pachena Point, Vancouver Int 'l A, Victoria Harbour CS, Amphitrite, Victoria Marine Lighthouse reports are available for the following climate stations in the project area: • Estevan, Amphitrite, Cape Beale, Pachena, Carmanah, Chrome, Merry, Entrance,	EC requests that the Proponent: a) clarify how fog was analyzed; b) clarify why hourly fog data available from EC climate station records in the national archive was not considered; and c) clarify why lighthouse reports were not considered to support an examination of fog occurrence.

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		Tsawwassen and Trial Island	
3.	Meteorological Data V8C_Termpol_Reports.pdf Section TR 8C-10 S2 PDF Page #930 Doc #S2, Termpol Study Supports 3.5/3.12 (A56023) Volume 8C: Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion, EBA File: V13203022	Lighthouse reports are available for the following locations in the project area: • Estevan, Amphitrite, Cape Beale, Pachena, Carmanah, Chrome, Merry, Entrance, Tsawwassen and Trial Island Environment Canada considers the reports from these stations to be of high quality and representative of climatological conditions in the project area.	EC requests that the Proponent incorporate climatologically representative, high quality, lighthouse report information into the pertinent analysis of environmental conditions that could affect the project (e.g., wind, visibility, fog, sea state, waves).
4.	Meteorological Data V8C_Termpol_Reports.pdf Section TR 8C-10 S2 PDF Page #930 Doc #S2, Termpol Study Supports 3.5/3.12 (A56023) Volume 8C: Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion, EBA File: V13203022 (A56023) pdf page number 1115 of 2659 pages in V8C_TERMPOL_REPORTS.pdf	It is understood that the Proponent intends to use thirty-second gust data (5 and 25-year return periods) as wind speed thresholds for cargo transfer and berthing It is further understood that the Proponent intends to establish operating limits based on maximum wind gusts for different return periods. However, it is unclear what wind data have been included in the analysis. For example, there is no mention of gusts or peak winds experienced at the weather stations and buoys. The following wind data elements are available in the national archive: • Daily data → direction, speed and hour of extreme gusts • Hourly data → gust speed and direction	EC requests that the Proponent specify which peak wind and wind gust data from local meteorological station(s) will be used for assessments of operating limits including the "maximum operating condition" and the "extreme condition".

Question #	Subject/Reference	Preamble/Rationale	Information Request
	EBA File: V13203022	These wind data elements are available from the following climate stations: • Discovery Island, Esquimalt Harbour, Kelp Reefs, Race Rocks, Saturna CAPMoN CS, Saturna Island CS, Sheringham Point, Trial Island, Victoria Gonzales Hts and CS, Victoria Harbour A Victoria Marine, Ballenas Island, Entrance Island, Amphitrite Point, Estevan Point and CS, Point Atkinson, Sandheads CS, Tsawwassen Ferry Auto, Vancouver Int'l A, Vancouver Harbour CS and other Georgia Strait climate stations	
5.	Meteorological Data Volume 8C, EBA FILE V13203022 Section 3.1.1, (A56023) V8C_TR_8C_10_TR_S02_01_OF_04_MET_OCEAN_DATA_-_A3S4U6.pdf – V8C_Termpol_Reports.pdf Section TR 8C-10 S2 PDF Page #1078 Doc #S2, Termpol Study Supports 3.5/3.12 Volume 8C: Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion,	A single year of data (2011) was reported for 23 climate stations for hourly surface air temperature, dew point and visibility (Appendix C), and 25 climate stations for hourly wind speed and direction (Appendix A, not including wind roses). It is understood the Proponent selected the 2011 dataset because it represented the year with the most complete dataset for the entire station network (page 4, paragraph 7). However, data from 2011 may not be representative of longer term meteorological conditions in the area. Hourly averages calculated from the full period of record for all climate stations in the project area would be more representative of mean and extreme meteorological conditions that could be encountered.	EC requests that the Proponent: a) present data for the full periods of record for all climate stations in the area of interest; b) provide an analysis of data completeness and the likely representativeness of the data for conditions affecting marine transportation; and c) specify what climate station(s) were used for the analysis referenced in Section 3.1.5 of Termpol 3.7 (i.e., "according to available wind records, this threshold was exceeded only 0.2% of the time between January 1953 and December 2012."). .

Question #	Subject/Reference	Preamble/Rationale	Information Request
	EBA File: V13203022 (A56023) V8C_Termpol_Reports.pdf Section TR 8C-5 Termpol 3.7 Section 3.1.5 PDF Page #250 Transit Time and Delay Survey		
6.	Met Ocean Volume 8C, EBA FILE V13203022, Section 3.1.2, (A56023) Page 908 of 2659 pages V8C_TR_8C_10_TR_S02_01_OF_04_MET_OCEAN_DATA_-_A3S4U6.pdf – page 13 of 93 pages	3m diameter buoy wave sensors record waves for only about 25 minutes out of any given hour. Meteorological sensors on 3m diameter buoys sample for 10 minutes in any given hour. Also, given the maintenance ship costs and the extreme operating environment of buoy instruments, there are gaps in data that can last several months. The impact of incomplete data on the assessment of wind and wave data, especially extreme wave data, is not stated. This can lead to an underestimate of the frequency of large wave and strong wind conditions.	EC requests that the Proponent discuss the limitations of buoy data along with the limitations of any analyses relying on these data.
7.	Met Ocean In Volume 8C, EBA FILE V13203022, Section 4.1.4.3 Wave Climate, (A56023) V8C_TR_8C_10_TR_S02_01_OF_04_MET_OCEAN_DATA_-_A3S4U6.pdf.	Accurate wave height data, especially maximum wave height, is important to an understanding of the wave climatology affecting the project In considering 17 months of wave data for Burrard Inlet near West Vancouver, the Proponent identifies the largest significant wave height and maximum wave height as 2.0m and 1.3m respectively. By definition, the maximum wave height must be larger than the maximum significant wave height.	EC requests that the Proponent: a) clarify the largest significant wave height and maximum wave height for Burrard Inlet near West Vancouver and b) discuss the limitations of considering only 17 months of wave data to identify the maximum wave heights that may be encountered.
8.	Met Ocean A3S4J7, Document 8B	Table 4.2 provides data and meta-data for 3 buoys. The rationale for using a test bed buoy (C46134) in a	EC requests that the Proponent provide data and meta-data in Table 4.2.1.3 for

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Marine Resources; Table 4.2 Wave Observations in the Marine RSA., PDF page 33 A3S4X6, Section 4.2.1.4.2 – Table 4.2.1.3, PDF page 8:	sheltered Bay (Pat Bay within Saanich Inlet) is unclear. Such an environment is not representative of conditions in the more exposed shipping lanes to the east of the Saanich peninsula. Available data from the United States National Oceanographic and Atmospheric Agency (NOAA) buoys in Juan de Fuca Strait would be more representative of the conditions that would be encountered during project operations.	NOAA buoys in Juan de Fuca Strait – Neah Bay (46087) and New Dungeness (46088).
9.	Met Ocean A3S4J7, Document 8B Marine Resources; Table 4.2 Wave Observations in the Marine RSA, PDF page 33. A3S4X6, Section 4.2.1.4.2 – Table 4.2.1.3, PDF page 8	Table 4.2 provides data and meta-data for 3 buoys. The maximum significant wave height for buoy C46206 La Perouse Bank is given as 19.51m. This is a data value coded as erroneous on the Department of Fisheries and Oceans web site (the stated source of the data). Accurate maximum and maximum significant wave height data is important to the assessment of the conditions where ships enter the Pacific from Juan de Fuca Strait.	EC requests that the Proponent identify the correct maximum significant wave height and the maximum wave height for the period of record at buoy C46206.
10.	Met Ocean A3S4T4 Document 8C TERMPOL Reports, Westridge marine Terminal 2013 Interim Meteorological Report, Section 2 (PDF p. 6) and Appendix A section 6 (PDF p. 24)	The Westridge Marine Terminal 2013 Interim Meteorological Report indicates that the meteorological station "is installed on the deck at the end of the Dock 59 at the Kinder Morgan Westridge Terminal located on the south shore of Burrard Inlet approximately five kilometers east of the Second Narrows Bridge. The station has good exposure to winds from all directions." Burrard Inlet's outer and inner harbours are oriented east to west and east winds dominate the wind rose for the Vancouver Harbour meteorological station. However winds from the weather station at dock 59	EC requests that the Proponent: a) describe the value of establishing a wind sensor (monitoring wind and gust data) in a more-exposed location representative of winds in the primary approach/manoeuvering areas offshore from the Westridge terminal and b) examine whether another location at the Westridge terminal might provide improved wind exposure compared to the sensor location at

Question #	Subject/Reference	Preamble/Rationale	Information Request
		report only infrequent winds from the east through southeast. The wind speeds at the dock 59 weather station are also weaker than those at the Vancouver Harbour station. The wind rose Diagram for 8 February 2013 to 16 September 2013, Figure1.2 shows a distinct lack of the easterly and south-easterly winds that prevail in the Burrard Inlet. The location of the wind instrument is largely sheltered for wind from the east to south quadrant by Burnaby Mountain (370m elevation), located immediately east-southeast of the weather station. This lack of wind from the southeast quadrant is apparent when the station's wind rose diagrams are compared with either the meteorological stations at Vancouver Harbour (which is located in the Inner Harbour of Burrard Inlet) or the Vancouver International Airport. It is important that the wind speed and direction data (including gust data) used to support operational activities is representative of conditions that would be encountered. For example, the Cates Park/Roche Point area, directly across the Burrard Inlet, would offer exposure that is more representative of mid-channel wind conditions. For the Westridge terminal, it is expected that an anemometer located in a more exposed location (such as at the eastern end of the present main dock) would capture more representative wind data than a sensor	dock 59.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		located at dock 59.	
11.	Met Ocean A3S4T4 Document 8C TERMPOL Reports, Westridge Marine Terminal 2013 Interim Meteorological Report, Section 1 (PDF p, 6)	The Westridge Marine Terminal 2013 Interim Meteorological Report indicates that the Westridge terminal meteorological station was established to enable the collection of site-specific meteorological data in support of the design process for the proposed expansion of the Westridge Marine Terminal. Wind statistics and especially extremes should be based on long, continuous datasets recorded at stations with representative wind exposure. The Westridge meteorological station (dock 59) is located close to shore in a bay sheltered by Burnaby mountain (370m elevation). The station is almost completely sheltered from easterly through to southerly winds. Wind speeds would be expected to increase from dock 59 to points further offshore past the potential docking areas and out into the main channel. In addition, the Westridge station only has a one-year data record which is of limited value to the analysis extreme wind values. Lengthy (multi-decade) observing programs that have captured multiple extreme wind events can be the most valuable and reliable information to consider in understanding conditions which could affect the project. Long-term wind values (especially extremes) of relevance to the project area have been collected for	EC requests that the Proponent indicate what meteorological data will be used to inform terminal design and whether this will include long-term meteorological records (including wind extremes).

Question #	Subject/Reference	Preamble/Rationale	Information Request
		the Vancouver Harbour or Vancouver International Airport stations. Data for these EC meteorological stations are available at: http://climate.weather.gc.ca/index_e.html	
12.	Wave conditions A354U7, Volume 8C Part 1 Figure A 64, PDF page45	It is important to ensure correct wave information is used in the assessment.	EC requests that the Proponent: a) for Figure A 64, verify that the wind rose diagram for La Perouse Bank buoy (46206) is correct, but mislabelled; b) for Figure B.6, verify that the wave rose diagram for La Perouse Bank buoy (46206) is correct but mislabelled; and c) indicate whether any adjustments related to a) or b) result in changes to the assessment.
Climate Change			
13.	Climate change (Volume 5A, section 7.10 - PDF pages 127-139, VSA_ESA_13OF16_BIOPHYSICAL_-_A3S1R0.pdf) PDF page 133	There is potential for changes in climate parameters to adversely affect climate sensitive aspects of the Project, and in turn the surrounding environment. The Proponent indicates that changes in climate over the lifetime of the Project may affect extreme flood events, droughts and wildfire which may potentially affect soil cover over the pipeline or, in the case of extreme flood events, potentially render the pipeline buoyant. The Proponent indicates that over the past 60 years extreme flood events have occurred that have resulted in exposure of the existing pipeline.	EC requests that the Proponent provide detailed information on the projected changes of project-sensitive climate parameters (including precipitation and floods) over the lifetime of the Project which could be based on a consideration of published literature for the area.

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14.	Climate change (Volume 5A, section 7.10 - PDF pages 138, VSA_ESA_13OF16_BIOPHYSICAL_-_A3S1R0.pdf)	The Proponent indicates that the marine terminal will be designed to accommodate a 0.5 m increase in local sea level by 2100. Global sea level rise is projected to be much higher in the latest Intergovernmental Panel on Climate Change (IPCC) report (RCP 8.5; IPCC AR5, Chapter 13, p. 13-4). Projections for the Vancouver area based on 'extreme high' estimates of global sea level rise (with consideration of local vertical land movement) are also much higher than the value identified by the Proponent (Bornhold, 2008). Given the uncertain nature of sea level rise projections, it is common practice to consider a range of possible sea level change reflecting the range of plausible global climate and sea level change and local sea level response. Since there is no context or citation provided, it is unclear if the 0.5 m projection presented by the Proponent represents an average of available projections, or an estimate from the low or high end of available projections.	EC requests that the Proponent provide details on: a) the origin of the 0.5 m projection for local sea level rise that is presented in the Application along with a discussion of the representativeness of that projection (considering a range of plausible sea level rise projections) and b) the potential influence of both climate change and mean sea level change on storm surges.
Disposal at Sea			
15.	Disposal at sea	Requested details could be determinative in identifying potential need for a disposal at sea permit under the *Canadian Environmental Protection Act* and are required for EC to comment on project-related effects. This is a follow up question to EC's Pre-Hearing Order IR 25.	EC requests that the Proponent indicate whether disposal at sea will be sought for any terrestrial debris resulting from blasting activities or any excavated terrestrial overburden.
16.	Disposal at sea page vii of Vol. 5C TR 5C-12	Requested details could be determinative in identifying potential need for a disposal at sea permit	EC requests that the Proponent describe proposed methods and

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	(Marine Sediment and Water Quality)	under the *Canadian Environmental Protection Act* and are required for EC to comment on project-related effects. This is a follow up question to EC's Pre-Hearing Order IR 26.	equipment to be used in displacing marine sediments during construction and maintenance activities and the fate of these sediments, or indicate when this information will be available.
17.	Disposal at sea page 1.1 of Vol. 5C TR 5C-12 (Marine Sediment and Water Quality)	An understanding of the volume of material proposed for disposal allows EC to assess the design and sufficiency of sampling required at the dredge (load) site. This is a follow up question to EC's Pre-Hearing Order IR 27.	Given the existing berth design, please specify the quantity of material (in cubic metres) that is associated with the reference to a "small amount of dredging", or indicate when this information will be available.
18.	Disposal at sea Vol. 5C TR 5C-12 (Marine Sediment and Water Quality)	An understanding of the volume of material proposed for disposal will allow EC to assess the design and sufficiency of sampling required at the load site and is also required for EC to comment on project-related effects. This is a follow up question to EC's Pre-Hearing Order IR 28.	EC requests that the Proponent identify the maximum volume (cubic metres) of dredged or excavated material to be disposed at sea, or indicate when this information will be available.
19.	Disposal at sea Vol. 5C TR 5C-12 (Marine Sediment and Water Quality)	An understanding of the physical and chemical characteristics of load site material allows EC to assess its suitability in terms of a proposed disposal site. This information is also required for EC to comment on project-related effects. This is a follow up question to EC's Pre-Hearing Order IR 29.	EC requests that the Proponent identify the disposal site(s) to be used or if a new disposal site will be proposed such as disposal adjacent to the dredge footprint.
20.	Disposal at sea	This information is required for EC to comment on project-related effects. This is a follow up question to EC's Pre-Hearing Order IR 30.	EC requests that the Proponent describe and assess the potential effects of any disposal at sea activities related to the proposed project, based on maximum volumes to be dredged

Question #	Subject/Reference	Preamble/Rationale	Information Request
			and sediment characteristics, alternatives to disposal such as re-use, and alternatives to disposal at sea.
21.	Disposal at sea Vol. 5C TR 5C-12 (Marine Sediment and Water Quality)	Requested details will allow EC to assess the design and sufficiency of sampling required at the load site.	EC requests that the Proponent provide diagram(s) of surface area within the water-lot that may be dredged. Diagram(s) should include locations of surface and core sediment sampling stations.
22.	Disposal at sea Vol. 5C TR 5C-12 (Marine Sediment and Water Quality)	Requested details allow EC to assess the design and sufficiency of sampling required at the load site.	EC requests that the Proponent provide diagram(s) of the dredge prism illustrating the location (vertical and horizontal) of core sediment sampling stations and of surface sediment sampling stations within the proposed dredge prism.

Question #	Subject/Reference	Preamble/Rationale	Information Request
TERRESTRIAL			
SPECIES AT RISK, MIGRATORY BIRDS and WETLANDS			
23.	Impacts to federally listed species and critical habitat	There is an obligation to identify impacts to listed wildlife species under section 79(2) of the *Species at Risk Act* (SARA). If impacts to listed species are not identified as part of the Application, then clear justification needs to be provided. In April 2014, information on critical habitat (including	For all federally listed species potentially impacted by the Project, EC requests the Proponent to: a) assess Project impacts on species individually, consistent with SARA S79(2) and b) provide mitigation plans specific to

Question #	Subject/Reference	Preamble/Rationale	Information Request
		candidate and proposed) for species occurring in shoreline habitats within the marine spill areas was provided to the Proponent through a data sharing agreement. Information on critical habitat biophysical attributes and activities likely to destroy critical habitat for these species was also shared with the Proponent at that time. Critical habitat destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of activities over time. To protect critical habitat in a manner consistent with SARA, EC advises avoidance of those activities that are likely to destroy the biophysical attributes associated with critical habitat as described within the final Recovery Strategy for listed species. Proposed, but not yet final, recovery strategies may provide important information on candidate critical habitat that may soon become final. It is important to highlight the possibility that critical habitat for listed species may be identified in a final recovery strategy under SARA within a timeline that would overlap with that of the Project environmental assessment, and subsequent implementation phases as applicable. SARA critical habitat provisions will apply once recovery strategies are finalized. Items 1.4 and 2.1 of Table 7.2.9-3 of Section 7 of	each species. For all federally listed species potentially impacted by the project with identified critical habitat (draft, proposed, and final posted), EC requests the Proponent to: a) assess the critical habitat potentially impacted by the Project in terms of the biophysical attribute impacts and activities likely to destroy (ALTD) critical habitat criteria. Specifically, develop a table for each federally listed species which has critical habitat identified within the Project's right of way and list: i. the biophysical attributes of the species' critical habitat (one per row) ii. the Project activities (all phases and including activities related to accidents and malfunctions) that have potential to interact with each of the species' specific biophysical attributes iii. a description of the interaction between Project activities and the species' biophysical attributes iv. a determination of whether Project activities are likely

Question #	Subject/Reference	Preamble/Rationale	Information Request
		Volume 5A do not reference protection and avoidance of critical habitat (including candidate and proposed). Of particular concern are Pacific Water Shrew, Toothcup and Oregon Forestsnail, in that complete avoidance of the entire critical habitat polygons is the only way to avoid irreversible direct destruction of critical habitat for those species. For most other species, avoidance of destruction would generally involve avoiding particular biophysical attributes within bounds of critical habitat and/or other measures for mitigation/avoidance, timing, etc. Section 5.6 of Volume 8A evaluates environmental effects of an oil spill from a tanker on marine birds and their habitat, including shoreline habitats. The Application does not evaluate the marine spill effects to plant species of special conservation status potentially occurring on shoreline habitats. EC would not consider impacts arising from Project activities that are ALTD critical habitat as having low significance. For listed wildlife with identified critical habitat, the Application does not consider impacts to critical habitat as a criterion within its current significance of effects determination.	to destroy the biophysical attributes within critical habitat v. for the Project activities which are considered ALTD critical habitat, provide: i. a description of how these activities will be avoided or modified to avoid destruction of critical habitat ii. an approximation of the total area of overlap between the proposed Project corridor and critical habitat; b) provide a reference to the protection and avoidance of critical habitat (including candidate and proposed) in items 1.4 and 2.1 of Table 7.2.9-3 of Volume 5A; c) consider critical habitat impacts in their respective determination of significance assessment.
24.	Insufficient spatial coverage of surveys and impact assessments	Section 3.7.2 of the Wildlife Technical Report of Volume 5C notes that: • Winter Track surveys were used to assess potential impacts on upland bird species. However, inventories for birds over a large portion of the Darfield to Hope segment could not be conducted due to an inability to access private	EC requests that the Proponent: a) validate model assumptions and predictions with additional survey data, identifying the following habitat types and features used by listed wildlife: i. Non-winter habitats (i.e.

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		land. • Winter track surveys were limited by land access along the Hargreaves to Darfield segment. In addition, no transects were completed along the Hope to Westridge segment and within the Coast and Mountains Ecoprovince along the Black Pines Segment due to insufficient snowfall in these areas. Section 7.7 of Volume 5A states that: potential effects are possible for federally listed plants and lichen if there are occurrences on the existing Right of Way due to the potential need for clearing activities: "*The pipeline reactivation activities are not expected to have a measurable impact on wildlife and wildlife habitat. Habitat disturbance will be limited to a similar level of sensory disturbance as would occur during pipeline maintenance activities. Any potential effects will be short-term and of low magnitude*." As habitat loss is a known effect of clearing, it remains unclear from this section why reactivation activities are anticipated to have no measurable impacts on wildlife or federally listed species. Additionally, the Darfield to Black Pines section contains candidate critical habitat for federally listed species (i.e. American Badger and Lewis's Woodpecker). Table 7.2.10-14 of Volume 5A indicates Rubber Boa potentially uses a variety of habitats in the southern interior and south coast ecoprovinces, and may occur in the Project area from Black Pines to Westridge.	Leks) for upland birds; ii. Darfield to Hope segment for birds; iii. Hargreaves to Darfield, Hope to Westridge, and Black Pines segment for mammals; iv. Reactivation-only areas for all wildlife and vegetation indicators between the Darfield to Black Pines segment; and v. Black Pines to Westridge segment for Rubber Boa; b) provide a rationale as to how the survey methodology that will be used to conduct these surveys is appropriate for each species; c) assess impacts for each federally listed species individually and migratory birds using results from these surveys; and d) provide mitigation measures for each federally listed species individually and to migratory birds based on the above impact assessments.

Question #	Subject/Reference	Preamble/Rationale	Information Request
25.	Data deficiencies for federally listed species and migratory birds	From the Wildlife Technical Report of Volume 5C, it was identified that no surveys were conducted specifically for these species: a) Owls and Woodpeckers, including Flammulated Owl, Western Screech Owl, Lewis's Woodpecker and Williamson's Sapsucker, (breeding bird surveys are unlikely to detect them) (Volume 5C Section 3.7.6). b) Bats (not referenced in the Wildlife Survey section within Volume 5C 3.7 nor in Volume 5A). c) Townsend's Mole (Section 8.9.6 of Volume 5A) d) Oregon Forestsnail (not referenced in the Wildlife Survey section within Volume 5C 3.7 nor in Volume 5A). Inappropriate methodology was identified for the following species: e) Insufficient survey effort for Sharp-tailed Grouse (Section 3.7.4 of the Wildlife Technical Report of Volume 5C) and waterbirds (Section 3.7.3 of the Wildlife Technical Report of Volume 5C). The level of effort for the waterbird surveys does not enable development of a sense of variation and error with the data and therefore EC does not have enough information to determine the likely impacts of the Project on waterbirds. f) Inappropriate techniques were used for Bank Swallow and Black Swift (Section 3.7.6 of the Wildlife Technical Report of Volume 5C). It is recommended the Proponent refer to the most appropriate and current sampling methods for aerial insectivores.	EC requests that the Proponent: a) conduct additional surveys for federally listed species and migratory birds, as identified in the preamble/rationale; b) provide a rationale as to how the methodology that will be used to conduct these surveys is appropriate for each species; c) assess impacts to each federally listed species individually and to migratory birds; and d) provide mitigation measures for each federally listed species individually and for migratory birds.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		g) Survey techniques for Common Nighthawk and Short-eared Owl do not follow current standards (Section 3.7.7 of the Wildlife Technical Report of Volume 5C). h) Timing of breeding bird point counts is too late for some species (e.g. Long-billed Curlews) (Section 3.7.6 of the Wildlife Technical Report of Volume 5C) In order to undertake a thorough assessment of the potential impacts of the Project on federally listed species and terrestrial migratory birds, there should be stronger scientific rigour in sampling methodology and effort for these species.	
26.	Clarify survey methodology	Survey locations along the Black Pines to Hope segment were surveyed by aerial overflight, unlike the surveys for other segments (Volume 5C Section 3.7.1-3.7.3). No methods were described for how Upland Game Birds were assessed by Winter Track Surveys (Volume 5C Section 3.7.2). Volume 5C- Wildlife Modelling and Species Accounts Technical Report indicates that habitat suitability ratings for the Pacific Water Shrew (PWS) were based on the *Species Account and Preliminary Habitat Ratings for Pacific Water Shrew (Sorex bendirri) using TEM data* (Craig 2009). The *Best Management Practices for Pacific Water Shrew in Urban and Rural Areas* (Craig et al. 2010) states that ground surveying to identify potential habitat for PWS must be	EC requests that the Proponent: a) describe how winter track survey results along the Black Pines to Hope segment may differ compared to the other pipeline segment surveys (i.e. level of detection, error); b) describe how upland game bird species along the Right of Way were surveyed using the winter track survey methodology; c) provide further information on the methodology used for assessing habitat suitability for Pacific Water Shrew, including field assessments; d) provide information on what methodology will be used to

Question #	Subject/Reference	Preamble/Rationale	Information Request
		conducted within each 100 m section along watercourses, and that at least one habitat plot must be placed within each 100 m linear section of habitat (p. 16). It is not specified in the Application whether ground surveys were conducted in compliance with these recommendations. Volume 5A, Table 7.2 10-3 does not indicate what methodology will be used to detect PWS presence. The *Best Management Practices for Pacific Water Shrew in Urban and Rural Areas* (Craig et al. 2010) specifies that where moderate or high capability habitat is not present, the site must be surveyed for the presence of PWS. For habitat areas ranked as high or moderate, the Proponent must consult with the BC Ministry of Environment to determine whether shrew sampling is required. Section 3.7.5 of Wildlife Technical Report of Volume 5C, states that surveys were targeted for previously unsurveyed core habitat of the western rattlesnake bordering Lac du Bois Grasslands Protected Area. One survey location was selected at Lac du Bois over three days to assess snake distribution and habitat use within the Wildlife LSA. It is unclear how this level of effort is sufficient to assess snake abundance throughout the LSA given that the SARA-listed Rubber Boa, Western Yellow Bellied Racer and Great Basin Gopher Snake have ranges which extend beyond the Lac du Bois Grasslands Protected Area and may overlap with the project's wildlife LSA. EC could not locate the reference: *Den Survey and Population Assessment of Northern Pacific Rattlesnake*	detect PWS presence, and indicate whether the Ministry of Environment (MOE) has been consulted with regards to its recommendations; e) Provide more detail to justify the use of a single survey location and surveys over three days to assess snake abundance. provide a copy of the *Den Survey and Population Assessment of Northern Pacific Rattlesnake in BC – Final Report (Hobbs 2013)* that was referenced in Section 3.7.5 of Wildlife Technical Report of Volume 5C; f) for the at-risk gastropods in the Lower Mainland (including Oregon Forestsnail), the Application must refer to the most recent draft version of the "Gastropod Best Management Guidebook: Oregon Forestsnail and Other Land Snails in the Coastal Lowlands", developed by the BC Ministry of Environment; g) provide details on the surveys performed for Tailed Frogs and Pacific Giant Salamanders to confirm that the parameters referenced in the RISC standard were adhered to; h) demonstrate how the methodology used for the

Question #	Subject/Reference	Preamble/Rationale	Information Request
		in BC – Final Report (Hobbs 2013). The Proponent modified this Guide's methods to design the snake surveys. To better understand how the snake surveys were modified from this source, EC requests a copy. Volume 5C, Table 6.1.1 of the Application refers to the recommended mitigation measures for Oregon Forestsnail from the 2007 draft of the Best Management Practices. To EC's knowledge, the latest draft version was from 2012. The applicant must contact the BC Ministry of Environment for an updated version. Volume 5C10 Section 3.7.10.2 of the Application provides information on the surveys for Stream-Dwelling Amphibian Survey. Potential survey streams were referenced as being identified through a review of 1:20,000 base maps, aerial photos, and professional knowledge. The RISC standards for stream-dwelling amphibians note that: *"Recent research suggests that the distribution of Tailed Frogs may largely be governed by geology (Dupuis and Steventon 1999; Dupuis et al., in press; Sutherland et al., in prep.). For the Pacific Giant Salamander, stratify streams on the basis of forest cover, elevation (under 100 m), and stream width."* It is not clear how geology was considered in Tailed Frog survey design. Many of the potential rare species are annual plants that have natural fluctuations in timing and distribution. One year of survey (i.e., one or two days in each area) is not sufficient to determine	vegetation surveys was considered sufficient and appropriate to assess the whole suite of potential vascular plant, moss, and lichen species potentially occurring within the Project area. In the absence of a strong rationale, EC recommends that more surveys be conducted for vegetation, using appropriate methodology; and i) confirm that appropriate methods (i.e. *RISC standards #11 Inventory Methods for Raptors Version 2.0*) were used to sample Northern Goshawk and Peregrine Falcon.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		presence/absence of species. Further, it is not clear that surveys took place at seasonally appropriate times to enable positive identification of each of the potentially occurring federally listed vegetation species. Volume 5C Section 5.2.1 noted that a Peregrine Falcon nest was found on aerial over flight, but no specific survey methods for Northern Goshawk or Peregrine Falcon were provided. However, the Common Nighthawk and Short-eared Owl surveys referenced the use of raptor inventory methods. It is recommended that the most appropriate and current sampling methods are used for falcons and raptors.	
27.	Habitat use by Wildlife	Habitat features critical or limiting for many federally listed species (including snags, presence of secondary cavities, proximity of nest sites adjacent to foraging sites, proximity to fresh water, stand density, shrub density, hibernacula, migration corridors, patch size, connectivity, food resources including invertebrate composition and density, etc.) are not represented by most TEM polygons and are unlikely to represent actual habitat used by listed species. Model validation appears to be subjective, using literature review, some field data and professional opinion without using novel data to test model assumptions. Surveys results, both wildlife and habitat, must be overlaid spatially (nest sites, intact natural habitats, congregations of animals, locations and abundance of species of special conservation status) to indicate locations to avoid and potential for mitigation.	EC requests that the Proponent collect additional targeted, novel field data to: a) validate assumptions and predictions in habitat use models built using TEM polygons; b) identify areas of significant ecosystem value when making micro-routing decisions and developing effective mitigation plans; and c) validate model assumptions and predictions with survey data identifying the habitat types and features used by listed wildlife.

Question #	Subject/Reference	Preamble/Rationale	Information Request
28.	Data deficiencies for federally listed species – American Badger *jeffersonii subspecies*	In April 2013, the Proponent committed to record incidental observations of badger burrow/den presence during field surveys in grassland/open forest habitats. However, den searches, bait/scent stations, or habitat suitability modelling to quantify Badger habitat change were not planned. Volume 5A ESA – Biophysical states that the area from Black Pikes to Hope supports a small population of American Badger as well as indicates that 26 incidental observations of Badger were made, confirming Badger presence within the Project study area. Volume 5A ESA – Biophysical p.7-227 indicates American badger was subsequently scoped out of a wildlife assessment due to the expectation that mitigation measures would eliminate or reduce potential Project effects to negligible levels. Given that American badger is federally listed, has candidate critical habitat along the right of way, and was encountered during field surveys, an effects assessment should be conducted. EC also notes that Project impacts on these species are unlikely to be negligible given the incidental occurrences.	EC requests that the Proponent: a) conduct an effects assessment on American Badger and b) provide rationale of how it was determined that the potential Project impacts to American badger would be negligible.
29.	Impacts to federally listed Species	Section 7 of Volume 5A assesses the effects of the Project on species of special conservation status that have the potential to occur in the Project area. However not all federally listed species are represented by an indicator species or indicator communities in this assessment. There is an obligation to identify impacts to listed wildlife species under Section 79 (2) of SARA. If impacts to listed species are not identified as part of the Application, then clear	EC requests that the Proponent: a) provide a rationale as to how potential Project impacts on federally listed species that have the potential to occur in the study area, but are not included as Indicators, are assessed in the Application; b) provide a rationale as to how

Question #	Subject/Reference	Preamble/Rationale	Information Request
		justification needs to be provided. The Proponent's response to Question 18 from the EC Pre-Hearing Order Information Request does not provide a clear explanation as to how federally listed species, which are not included as an Indicator, are assessed for Project effects within the Application. Results of field studies and mitigation planning do not replace an assessment of effects. Rather, mitigation planning must be based on the assessment of effects, which must be based on the results of field studies. In an April 2013 meeting with TERA, EC emphasized that species of special conservation status must not be over-stated in the selection of Wildlife Indicators, and that general species more representative on the landscape must not be ignored. This point must also be considered when selecting habitat models to be created for the Application. The preferred approach is to consider Project impacts when selecting federally listed species as indicators, and also to assess more frequently occurring species that may be affected by the Project. The suite of bird species selected as community wildlife indicators are too large in number, broad in ecological requirements and varied in population status to represent any single valued ecosystem component. In addition, for many species, especially waterbirds and those throughout the Fraser Valley, indicators must be based on abundance, richness, and distributions in winter and migration, not breeding alone.	potential Project impacts on Indicator species will be assessed when they were not surveyed for specifically; c) if these species are assessed through community indicators, indicate which and provide a rationale as to how this community indicator is appropriate to assess effects on the species; d) re-organize the list of bird species used for community wildlife indicators by focusing on only those species that have ecological requirements that are highly representative of each ecosystem component; e) provide a strong scientific rationale for the attribution of these species to the ecosystem components; f) provide a rationale for selecting Rusty Blackbird as a wildlife indicator; g) explain in detail how the results from the assessment of Rusty Blackbird will be used to assess other landbird species, and provide the species or group of species which would be assessed under the Rusty Blackbird indicator; and h) provide rationale for the inclusion of Northern Rubber Boa in the arid snake community, given its

Question #	Subject/Reference	Preamble/Rationale	Information Request
		Wildlife indicators that are not preferred or do not need models are: Great-Blue Heron (habitat is feature-based and management/conservation is focused on protection of colonies); band-tailed pigeon and American bittern (not representative of other species). In addition, Rusty Blackbirds are too few in distribution and numbers to adequately model in BC. Therefore they may not be a suitable representative species to assess Project impacts on other land birds. Volume 5A: ESA - Biophysical (Section 7.2.10.12) states that the arid habitat snake community was selected for the assessment of potential Project effects on reptiles. Species for the Arid Habitat-based community indicator include Northern Rubber Boa. While Rubber Boa can potentially occupy a variety of habitats, it tends to avoid dry, hot areas enjoyed by many other snake species, preferring instead humid mountainous areas (Reptiles BC). Thus, the Project's assessment on Rubber Boa may not identify all impacts on these species as it was conducted outside its preferred habitat. Reference: BC Reptiles Report on Rubber Boa: http://www.bcreptiles.ca/snakes/rubberboa.htm	difference in preferred habitat.
30.	Effects on marine birds related to shipping activity	In Question 24 of the Responses to Pre-Hearing Order Information Request from EC, the Proponent provided a literature review reporting that the responses to disturbance by vessels vary considerably between marine bird species and that studies of cumulative effects of large vessel traffic have been few. The Proponent states that the cumulative effects of vessel traffic on marine birds are nearly unknown and	To properly evaluate the potential impacts of an increase in vessel traffic on marine bird species, EC requests that the Proponent: a) provide supporting evidence for the claim that 'a degree of habituation has likely already occurred'; b) present evidence that habituation is a valid interpretation of a lack of

Question #	Subject/Reference	Preamble/Rationale	Information Request
		yet there is no evidence that "the Project's incremental increase in marine vessel traffic would contribute to population-level cumulative effects". Further, the Proponent states that there is "already a substantial amount of marine vessel traffic in the Marine Birds local study area and Marine regional study area". The Proponent suggests, without any substantiating evidence, that "a degree of habituation has likely already occurred". As the Proponent was not able to demonstrate a relationship between responses to disturbance and cumulative impacts the true impacts of vessel disturbances remain equivocal.	cumulative impact; and c) provide evidence that vessel traffic does not impose cumulative impacts on marine birds.
31.	Assessment of bird strikes to vessels	Section 8.4 of Volume 8B Ecological Risk Assessment of Marine Transportation Spills Marine Transportation Technical Report should include a quantitative assessment of added mortality to marine birds due to strikes against vessels rather than the qualitative assessment provided. Given that the increased number of vessels due to Project operations can be estimated, this information can be incorporated with a measure of strike rate to provide a more rigorous assessment of the effects of marine vessel traffic operations. To fully evaluate the potential impacts of vessel traffic on marine birds along the entire length of the marine shipping route, a quantitative assessment of the impacts of vessel strikes to marine birds is suggested.	EC requests that the Proponent provide a quantitative assessment of marine bird mortality due to strikes with Project-related vessel traffic.
32.	Impacts on forage fish and marine birds	The Application does not include a consideration of effects to marine birds as a result of impacts on prey	EC requests that the Proponent provide an assessment, based on scientific

Question #	Subject/Reference	Preamble/Rationale	Information Request
		fish. The presence of active gull and cormorant colonies indicates that sufficient prey fish exist to support piscivore populations, and therefore the review of marine birds should consider Project effects on prey fish on which the birds depend. Information on impacts to prey fish is already included in the Application (Volume 8b, Marine Resources Report Marine Transportation Technical Report) and should be integrated with the marine bird section. To fully evaluate the potential impacts of the Project on marine birds, an assessment of the role that a decline in forage fish species will have on marine bird populations is suggested.	evidence, of the potential effects on marine birds as a result of Project impacts to forage fish prey.
33.	Impacts to marine birds in Burrard Inlet	In order to fully evaluate the potential impacts of catastrophic releases of oil on marine birds in Burrard Inlet, a reassessment of the impacts at the population level is suggested. In the Application (Volume 7 Section 8.3.3.1.3), consideration of the effects of a release of oil at the Westridge marine terminal on marine birds indicates that the number of birds that could be affected is small because the area covered in oil would be less than 15% of the total area of the Burrard Inlet Important Bird Area. Since marine birds are unevenly distributed around Burrard Inlet, EC contends that 15% does not represent the true risk to seaducks. A release of oil could affect a large proportion of the total population depending on its timing. The Application (Volume 7 Section 8.3.3.1.3), states that at the population level, lost individuals would	EC requests that the Proponent provide a reassessment of the level of impact on marine birds in Burrard Inlet in the event of a catastrophic spill. In particular: a) reassess population-level risk to marine birds taking into account how the birds' aggregative behaviour affects the risk to the overall population of marine birds using Burrard Inlet and b) provide evidence to support the claim that seaduck populations will recover within one to two years

Question #	Subject/Reference	Preamble/Rationale	Information Request
		likely be 'compensated for by natural processes within one to two years', but no evidence is presented to support this statement. Seaducks and other large marine birds have populations with inherently slow growth rates, and develop with long times to maturity.	
34.	Choice of ecological receptor species in oil spill Ecological Risk Assessment	In the Application (Volume 7 Section 7.1.5), evaluation of a scenario where a spill on the Fraser River by the Port Mann Bridge (Scenario 4) includes western sandpiper as a potential ecological receptor and the effect magnitude is ranked as Low because the species is only present on the Fraser River during short amounts of time. Evaluating this species will incorrectly estimate the potential effects of such a spill on the shorebirds on Roberts Bank. In addition, although the Application cites a hydrological study that suggests that such a spill would bypass Roberts Bank, it remains uncertain that the spill would behave this way. EC recommends that the Proponent consider using dunlin, which is similar to western sandpiper, but is a winter resident that occurs in high numbers throughout much of the year, and would thus better represent shorebirds as a guild. The probability of a spill occurring while western sandpiper is present is much smaller than while dunlin is present. Although a smaller proportion of dunlin are present compared to western sandpiper (i.e., risk to species is lower) they are present for a longer window of time. In order to fully evaluate the potential impacts of	EC requests that the Proponent consider using as an ecological receptor in evaluation of oil spill Scenario 4.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		catastrophic releases of oil on marine birds, a suitable indicator species that represents the shorebird guild in all seasons should be considered.	
35.	Effects on Woodland Caribou, Southern Mountain Population (SMC)	Woodland Caribou is a mammal indicator for this Project and is absent from the Predicted Change in Habitat for Mammal Indicators in the Wildlife LSA Table. EC advises that the Project's proposed routing may impact key habitat areas for SMC, including areas that are included as candidate critical habitat in the proposed recovery strategy. Critical habitat identification for SMC is anticipated in May 2014 with the posting of the recovery strategy. SARA critical habitat provisions will apply once the recovery strategy is finalized (See SARA Sections 56 to 63).	EC requests that the Proponent include Woodland Caribou in the Predicted Change in Habitat for Mammal Indicators within the Wildlife LSA Table 7.2.10-7 (Volume 5C Section 7.2.10.9).
36.	Effects on SMC	Extending the length of HDD or bored crossings, where this crossing method was proposed, was noted as a recommended Caribou mitigation measure in Section 7.2.10.6 (Recommended Mitigation for Wildlife and Wildlife Habitat Table 7.2.10-3); however it is not fully explained how this measure will be used to reduce impacts. Re-routing the Right of Way away from SMC Ungulate Winter Range would reduce Project impacts on this federally listed species.	EC requests that the Proponent describe how Project effects on SMC Ungulate Winter Range (UWR) specifically could be avoided or minimized: a) using Horizontal Directional Drilling (HDD) and b) re-routing of the Right of Way away from SMC UWR.
37.	Effects on SMC	To evaluate the Project's potential impacts on Woodland Caribou, the spatial extent of Project components is suggested. The Application notes that the Right of Way width may vary between 45m to 150m in width.	EC requests that the Proponent confirm the Right of Way width (permanent and construction) and spatial information for other Project components (e.g. ancillary infrastructure, staging areas) for (1) SMC herd ranges and (2)

Question #	Subject/Reference	Preamble/Rationale	Information Request
			Ungulate Winter Ranges crossed by the Project.
38.	Effects on SMC	Volume 5A Section 7: The effects assessment for SMC amalgamates the discussion of Project impacts for both the Groundhog and Wells Gray herds. However, the Project will affect the herds differently because their habitat types and population conditions are not equivalent (for instance, the Project overlaps with higher quality habitat (Ungulate Winter Range) for the Wells Gray herd than the Groundhog herd). The magnitude assessment criteria for SMC may under estimate overall Project impacts on caribou as it is difficult to ascertain which magnitude criteria pertains to which caribou herd.	EC requests that the Proponent provide a separate effects assessment for the Groundhog and Wells Gray herds of SMC to distinguish specific Project impacts on each herd.
39.	Wetland functions assessment and evaluation of impacts	It is important to note that the Federal Policy on Wetland Conservation (FPWC) (available at: http://publications.gc.ca/site/eng/100725/publication.html commits all federal departments to the goal of no net loss of wetland functions (i) on federal lands and waters, (ii) in areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels, and (iii) where federal activities affect wetlands designated as ecologically or socio-economically important to a region. In addition, the FPWC's no-net-loss of wetland functions applies to the temporary loss of wetland functions. EC highlights the fact that the proposed Project will overlap with both ii) and iii) above, and therefore the goal of no net loss will need to be addressed as part of this environmental assessment.	EC requests that the Proponent describe natural processes of potentially impacted wetlands (physical, chemical, and biological) and perform an assessment of potential impacts and proposed mitigation for each potentially impacted wetland. Hanson et al. (2008) 'Wetland Ecological Functions Assessment: An Overview of Approaches' (http://publications.gc.ca/site/eng/343283/publication.html) should be reviewed before undertaking a wetland functions assessment.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		Section 3.6.4 of the Wetland Technical Report of Volume 5C states that "*Wetland functions documented during the existing condition (i.e., pre-construction) evaluation will be compared to wetland functions observed along the reclaimed (i.e., post-construction) construction right-of-way. The results of this comparison will be used to measure the effectiveness and efficiency of mitigation and reclamation measures, and provide support to the determination of loss or 'no net loss' of wetland function*." While EC supports post-construction monitoring as a means to inform the success of mitigation and reclamation measures, this monitoring will aim to address the no-net-loss of wetland functions *after* impacts will have occurred. Section 6 of the Wetland Technical Report of Volume 5C, and Appendices K of Volume 6B and 6C, do not include a wetland functions assessment *specific* to each wetland potentially impacted by the Project. In addition, these sections and appendices do not include a description of mitigation measures specific to each wetland. A detailed assessment of wetland functions and potential impacts from the Project, in advance of the Project construction, is suggested to ensure that the goal of no-net-loss of the FPWC will be met and that no wetland functions will be temporarily lost.	

Question #	Subject/Reference	Preamble/Rationale	Information Request
40.	Wetland Compensation Plan	Section 6 of the Wetland Technical Report of Volume 5C, and Appendices K of Volume 6B and 6C do not include a Wetland Compensation Plan. To address impacts to wetlands, EC recommends that a Wetland Compensation Plan be submitted as part of an environmental assessment application.	EC requests that the Proponent submit a Wetland Compensation Plan (WCP), pursuant under the FPWC, for review in the environmental assessment process. The draft WCP should, amongst other things: a) identify wetland ecological community types (bog, fen, swamp, marsh, etc.) encountered by the Project's right of way; b) describe the baseline condition of the wetland ecological communities and functions that the Project would impact and the functions gained at the compensation site(s); c) describe how the Project applied the mitigation hierarchy including efforts to avoid impacts, and identify residual effects; d) describe the process of selecting proposed compensation site(s) and associated baseline condition(s); e) identify the appropriate compensation ratio; f) identify the success criteria; g) list the parties and responsibilities for implementation; and h) provide the monitoring schedule, parameters, plans, and analysis.
41.	Impacts to wetlands	The Federal Policy of Wetland Conservation commits all federal departments to the goal of no net loss of wetland functions (i) on federal lands and waters, (ii)	EC requests that the Proponent: a) provide a list of all wetland locations within the proposed

Question #	Subject/Reference	Preamble/Rationale	Information Request
		in areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels, and (iii) where federal activities affect wetlands designated as ecologically or socio-economically important to a region. It is important to note that red- and blue-listed vegetation communities found within wetlands are not the only indicators of wetlands designated as ecologically or socio-economically important to a region under (ii) above. Furthermore, for any wetlands occurring in areas where the continuing loss or degradation of wetlands has reached critical levels, all wetlands in those areas, whether natural, degraded, or artificial, would be deemed to be "ecologically or socio-economically important to a region" under (iii). As this Project is undergoing a review for an Application for which an authorization would be issued by the National Energy Board, the Federal Policy on Wetland Conservation (FPWC) applies to this Project. <u>Page ii of the Executive Summary of the Wetland Evaluation Technical Report of Volume 5C</u> indicates that the proposed Project corridor will cross a number of wetlands. It is unclear from the Application which, and how many, wetlands fall within an area where continuing loss or degradation of wetlands has reached critical levels and which wetlands fall within a designation of ecologically or socio-economically	pipeline corridor that fall within the geographic areas where the documented continuing loss or degradation of wetlands has reached critical levels, defined as: • Lower Mainland / Fraser Valley region • East Vancouver Island and Gulf Islands • Okanagan Valley; b) provide a list of all wetland locations within the proposed pipeline corridor that correspond to wetlands designated as ecologically or socio-economically important to a region, defined as areas of Continental or Regional Significance to Waterfowl within the three Joint Venture planning boundaries of British Columbia red- and blue-listed wetland ecological communities; and c) additionally, for each of the two above requests, provide: i. the total area of wetlands that fall within each category or area, prior to compensation measures and ii. a map showing a reasonable representation of the size of each wetland and associated riparian habitats and a clear indication of the designation

Question #	Subject/Reference	Preamble/Rationale	Information Request
		important to a region. The most up to date guidance from EC, Pacific and Yukon Region, on the Federal Policy on Wetland Conservation can be found in Appendix 1 - References of this document.	of each of these wetlands.
42.	Wetlands – Baseline data	The Wetland Evaluation Technical Report of Volume 5C (e.g., page ii of the Executive Summary) frequently refers to ground-truthing surveys where "land access was available". The fact that wetlands have been surveyed only where land access was available may create a serious sampling bias that does not favour settled areas, where land access may be reduced due to the large amount of private lands compared to unsettled areas. The report does state that all wetlands will be visited before construction to collect baseline data for post-construction monitoring; however the timing of these proposed visits may be too late in the Project to allow a meaningful evaluation of potential impacts from the proposed activity.	EC requests that the Proponent provide clarification on how baseline data will be used to meaningfully evaluate potential impacts from the proposed Project activities, given that wetlands that were not visited (ground-truthed) in 2013 due to lack of land access and will only be visited prior to construction.
43.		Section 3.5 of the Wetland Evaluation Technical Report of Volume 5C makes reference to the methods used for the Literature/Desktop review to identify wetlands. Although some references are cited, it is unclear which layers were used in the desktop analysis for the BC Freshwater Atlas database.	EC requests that the Proponent provide clarification on whether the wetlands layer of the BC Freshwater Atlas Lakes data was used in the Literature/Desktop Review. (Although the BC Freshwater Atlas Lakes data was referenced in section 8.3, but it is unclear if the wetland layer was used). If this layer was not used, provide a rationale for why not.

Question #	Subject/Reference	Preamble/Rationale	Information Request
44.		Page 3-1 of the Wetland Evaluation Technical Report of Volume 5C provides a statement on wetland indicators that is unclear. In order to evaluate impacts to wetlands, this statement should be clarified.	EC requests that the Proponent: a) provide clarification on the following bold section of this statement from the Application and in what way this was determined to be appropriate and by whom: *"Input on the proposed wetland indicators was also sought from AESRD, BC MOE, (BC MFLNRO) and EC (Section 2.0). All four agencies were in agreement that the proposed wetland indicators were appropriate and suggested no additional indicators for consideration. Through discussions with the Project team, it was determined that wetlands of special concern will be addressed under the vegetation indicators (i.e., vegetation communities of concern). To reduce assessment duplication of the same indicator it was decided that wetlands of special concern will be presented in the Wetland Evaluation Technical Report (Volume 5C) but will be addressed within the scope of the vegetation study as an indicator (i.e.,*

Question #	Subject/Reference	Preamble/Rationale	Information Request
			vegetation communities of concern). The wetland-specific results are presented in the Wetland Evaluation Technical Report (Volume 5C). ***Therefore, only one indicator of wetland loss or alteration will be assessed in the wetland component of the ESA****. These changes were discussed during consultation with EC and were deemed appropriate with no additional suggestions being made."* and b) confirm that the following wetland functions will be assessed in the wetlands effects assessment: hydrological, habitat, and biogeochemical.
45.	Ecologically sensitive areas	As referenced in Section 5.10 of Volume 5A of the Application, the proposed Project corridor will overlap with various protected areas. However this information is fragmented throughout the Application and does not include all designated ecologically sensitive areas and all areas currently being considered for routing. Protected areas are important to EC because of their role in supporting federally listed species, migratory birds and habitat. Furthermore, many areas protected for ecological conservation purposes have received funding from EC for conservation projects. While such funding has	EC requests that the Proponent: a) provide a list of all Provincial, regional and municipal environmentally or ecologically sensitive areas with designations or bylaws that will be or have the potential to be impacted by the proposed Project footprint or activities, either temporarily or permanently, including areas where the existing pipeline will be reactivated only. These designations should include, but

Question #	Subject/Reference	Preamble/Rationale	Information Request
		often been used in parks, it has also been used on private land. One important aspect of conservation projects for which EC issued funding is the agreement that these areas be left in perpetuity. Cheam Lake Regional Park is an example of an area that received conservation funding. Colony Farm Regional Park has also received funding for conservation purposes. This Project resulted from construction of the parallel runway at the Vancouver International Airport on Sea Island which resulted in the loss of habitat important for raptors, herons, songbirds, and waterfowl. Project approval was granted in 1992 subject to commitment by Transport Canada to provide compensation so that "no net loss" of habitat capability would result. The Vancouver Airport Habitat Compensation Program (VAHCP) is administered by EC to ensure the goal of "no net loss" is achieved through land securement, private land stewardship, and enhancement activities. The Wildlife Habitat Enhancement Program (WHEP) was initiated in 1996 to administer the enhancement portion of the compensation program. The goal of WHEP is to enhance habitat values of selected lands to provide habitat for raptors, herons, songbirds and waterbirds without loss of the original ecological value of the target lands. Habitat enhancement activities undertaken through WHEP funding include vegetation planting, removal of exotic vegetation, old-field renovations, placement of nesting boxes and perch poles, and wetland creation.	not be limited to: • Regional parks • Municipal parks • Municipal Environmentally Sensitive Areas • Environmental Development Permit Areas • Old Growth Management Areas • Land and Resource Management Plan (LRMP) areas • Wildlife Management Areas; b) with respect to the list referred to above, provide the total area of overlap between the Project and each ecologically designated area; and c) provide detailed information on how impacts to federally listed species, migratory birds, and their habitats, will be avoided in areas of ecological designation and, in particular, for Colony Farm Regional Park.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		As part of the WHEP, enhancement activities were conducted in 1998 at Colony Farm Regional Park, which provides important habitat for raptors, songbirds and waterfowl. This work was completed as part of the compensation for habitat loss from runway construction at YVR. Activities were undertaken to further enhance this important area for wildlife. As the habitat lost at YVR is a perpetual loss, the areas of Colony Farm Regional Park that were subject to compensation activities are required to be in place and protected in perpetuity to ensure that the goal of "no-net-loss" continues to apply. In addition to migratory birds, Colony Farm Regional Park is used by many listed species, including but not limited to Band-tailed Pigeon (SARA - Special Concern), Great Blue Heron (SARA-Special Concern) and Oregon Forestsnail (SARA-Endangered).	
46.	Status of federally listed species	Species conservation statuses within Volume 5 of the Application are current to November 2013, which may not reflect the most up to date status. Pages 5-170, 5-171, 5-172, 5-174, 7-185 and 7-217 of Volume 5C contains several inaccuracies for federally listed species.	EC requests that the Proponent update the status of federally listed species to the current 2014 assessment. The update should reflect the information below: • candidate critical habitat for Whitebark Pine has had one round of internal review • SARA-COSEWIC species also include Alkaline Wing-nerved Moss • there is candidate critical habitat for Toothcup; the recovery strategy is in draft and is in approvals for posting as proposed • there is final critical habitat for

Question #	Subject/Reference	Preamble/Rationale	Information Request
			Haller's Apple Moss; it is posted on the SARA public registry • there is candidate critical habitat for Porsid's Bryum (not mentioned – see also Table 4.3.1-1 of the Vegetation Technical Report of Volume 5C) • the conservation status of Vancouver Island Beggarticks and Peacock Vinyl Lichen is Special Concern; therefore there will be no critical habitat for these species • a minimum 50 m recommended buffer area for federally listed species occurrences will comprise part of the eventual critical habitat identification for Tall Bugbane and Mexican Mosquito Fern.
47.	Vegetation baseline Results	Tables 5.9-5 and 5.9-6 of section 5 of Volume 5A must be set up the same way as Table 5.10-3 to increase clarity.	EC requests that the Proponent provide a column for SARA/COSEWIC species in Tables 5.9-5 and 5.9-6. This should be set up same as Table 5.10-3.
48.	Vegetation surveys	Peacock Vinyl Lichen appears to be missing from the list of potentially occurring species in Table B of the Appendix of the Vegetation Technical Report of Volume 5C.	EC requests that the Proponent add Peacock Vinyl Lichen to the list of potentially occurring species in Table B.
49.	Survey Effort for Spotted Owl and Sowaqua spotted owl wildlife habitat area (WHA)	Volume 5C TR 5C-10 Section 3.7.9 notes that Spotted Owl transects were based on known locations of owls within the Wildlife Habitat Area (WHA) and mapped suitable habitat. EC understands that there may be additional potential Spotted Owl habitat located between Hope and Merritt. Accordingly, EC requests confirmation that the Spotted Owl assessment is	EC requests that the Proponent: a) confirm that Spotted Owl surveys were conducted where all suitable Spotted Owl habitat exists along the Project's right of way; b) provide options for avoidance of the Sowaqua WHA and provide

Question #	Subject/Reference	Preamble/Rationale	Information Request
		comprehensive and is reflective of all areas where suitable habitat exists along the Project's right of way. This WHA is identified as a long-term owl habitat area (LTOHA), and a policy of **no net loss** of Spotted Owl habitat applies as per the General Wildlife Measures. When critical habitat has not been fully identified for Spotted Owl, it must be characterized according to the (provincial) surrogate definition of suitable habitat that contains known currently occupied sites and any newly discovered sites, and that there is a high level of concern associated with suitable habitat within WHAs.	justification if avoidance is not possible; and c) provide details of specific mitigation plans for Spotted Owl.
50.	Use of personal communications as reference	The interpretation of some referenced material is attributed to personal communications with EC. It is important to ensure the cited personal communications and the interpretations offered by the Proponent can be verified in the context of the Application review.	EC requests that the Proponent identify all instances where personal communications involving EC are referenced in the Application and provide records of those communications.
51.	Species and habitat mapping	It is unclear from the Application where, within the LSA, federally listed species were detected.	EC requests that the Proponent provide maps showing clear representations within the local study area of: a) locations of all observations for species with special conservation status and their associated habitats; b) areas of contiguous old growth and grasslands; and c) all parks and protected areas where these species are observed.
52.	Impacts due to habitat change for Wildlife	Tables 7.2.10-7 and 7.2.10-10 of Volume 5A appear to be an incorrect characterization of habitat change in the Project area, especially since few wildlife surveys were conducted to quantify habitat used by wildlife.	EC requests that the Proponent correct the content of Tables 7.2.10-7 and 7.2.10-10 of Volume 5A by reassessing the impacts of changes to habitats by

Question #	Subject/Reference	Preamble/Rationale	Information Request
		The habitat must be represented in the context of habitat currently available for each species within its current distribution. In addition, for federally listed species, removing or fragmenting important habitat features such as nest sites, food and water resources, or wintering areas can effectively remove the function of the entire habitat polygon.	considering habitat use by species within their current distribution.
53.	Incidental Take	Tables 5.2.13 and 14 of Volume 5A of the Application reference EC's recommendation of scheduling clearing and construction activities outside the migratory bird breeding season of March 15 to August 15. However, immediately afterwards, there is reference to conducting nest searches in the event that clearing or construction activities are scheduled during the migratory bird breeding season. EC does not support active migratory bird nest surveys. To remove the interpretation of EC supporting active migratory bird nest surveys, remove personal communications references related to migratory bird nest surveys within the Application.	EC requests that the Proponent correct text on EC's Incidental Take of migratory birds approach. Refer to EC's Incidental Take website to obtain correct information, including appropriate nesting windows. Incidental Take website: http://ec.gc.ca/paom-itmb/default.asp?lang=En&n=C51C415F-1 Pay particular attention to: http://ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1
54.	Presentation of mitigation techniques	The current presentation of mitigation methods, which repeats the same mitigation actions repeatedly throughout various sections of the text, makes it unclear which methods will be applied for which species and ecosystems. A clear presentation of mitigation techniques, in a manner as to easily identify if a technique proposed for one species (or group of species) may either benefit or impact another species, should be provided.	EC requests that the Proponent reformat the list of mitigation techniques to improve clarity for reviewers. List each mitigation method once and add columns highlighting the target species, ecosystems, and areas for mitigation. In addition, add a column that lists species other than the target species and indicate where each mitigation technique may either:

Question #	Subject/Reference	Preamble/Rationale	Information Request
			a) have negative effects on a non-target species or b) be beneficial to a non-target species.
55.	Mitigation methods for vegetation	The Application does not provide adequate details to assess whether proposed mitigation is appropriate to avoid impacts to vegetation. In addition, EC does not support the cutting, mowing, and walking down of shrubs and small diameter deciduous trees at ground level to facilitate rapid regeneration as referenced in Volume 5A, Table 7.2.8-2. These methods fail to re-create the same branch structures within the shrub and tree community as the branch structures that occur with no growth interference. This can affect nesting opportunities for birds. EC recommends retention of native deciduous species, unless biologically supported by a federal recovery document for that particular area.	EC requests that the Proponent: a) provide clarity on where natural recovery will be used as the preferred method of reclamation instead of planting native species and b) correct mitigation methods for vegetation.
56.	Pacific Water Shrew mitigation	Volume 5A, Table 7.2 10-3 outlines recommended mitigation measures for potential PWS impacts, and states that "if Pacific water shrew are identified, a capture and release may be required to temporarily/permanently relocate individual shrews". As salvage options are not outlined in the *Best Management Practices for Pacific Water Shrew in Urban and Rural Areas* (Craig et al. 2010), EC recommends the Proponent consult with the BC MOE to determine whether shrew sampling is required. Volume 5A, Table 7.2 10-3 also indicates that the Proponent will "replant native vegetation (shrubs and	EC requests that the Proponent: a) provide a rationale as to how the capture and release of PWS is an adequate mitigation measure as well as references to consultations on this topic with the BC MOE; b) provide details on how adequate temporary or permanent relocation sites will be identified in advance of the proposed salvage activities; c) provide a rationale as to the selection of a distance of 30 m from the water for restoration of

Question #	Subject/Reference	Preamble/Rationale	Information Request
		trees) within 30 m of the stream or wetland to replace any cleared vegetation; and where replanting is not feasible, coarse woody debris must be placed within 30 m of the stream or wetland". While the *Best Management Practices for Pacific Water Shrew in Urban and Rural Areas* (Craig et al. 2010) state that vegetation restoration efforts must concentrate on habitat within 30 m of the stream or wetland, it also states that the PWS are most often captured within 60 m of water bodies.	vegetation activities, given that the PWS is most often captured within 60 m of water bodies; and d) identify any stream and wetland crossings in potential PWS habitat to inform mitigation of water features within the habitat. As habitat fragmentation is a threat to PWS movement, the *Best Management Practices for Pacific Water Shrew in Urban and Rural Areas* (Craig et al. 2010) recommends that mitigation measures (e.g., bridges and large culverts) be applied to any stream and wetland crossings.

Question #	Subject/Reference	Preamble/Rationale	Information Request
AIR QUALITY			
57.	Air Quality – Marine Emissions TR 8B-3 of Volume 8B and TR 5C-4 of Volume 5C (sections on Westridge Terminal)	Notwithstanding the Proponent's response to EC's Pre-Hearing Order IR 13, the Marine Emissions Inventory Tool (MEIT) is available for use by others outside of EC, and EC offers assistance to those licensed to use the tool. In this case, the Proponent's consultant received the MEIT licence and an offer of technical assistance in early September 2013 (reference: emails between EC and RWDI, September 5-9, 2013). EC does not support using the 2005 Corbett (Wang et al, 2008) inventory in its stead as this substantially under-represents emissions, particularly in the Burrard Inlet, and there is more accurate and recent information available. MEIT	EC requests that the Proponent recalculate the marine emissions in the RSA, and the LSA for Westridge using the most accurate and current available data, and that the impacts on air quality be revised as necessary.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		calculates emissions of PM, SOx, NOx, CO, CO2,e, and hydrocarbons that are ~ 10 times higher than what is provided in Tables 4.3, 4.6, and 5.1 in TR 8B-3 of Vol 8B. These higher emissions need to be accounted for in the characterization of Existing Conditions, and their impacts on air quality incorporated in both the Base Case and the Application Case.	
58.	Air Quality – Marine Emissions TR 8B-3 of Volume 8B and TR 5C-4 of Volume 5C (sections on Westridge Terminal)	Baseline air quality is under-represented in the Burrard Inlet for both Technical Reports. EC understands that only the auxiliary engines run while ships are at anchor and berth, but these emissions are substantial in the Burrard Inlet, where anchorages for tankers can last for more than a week (and much longer for bulk carriers). This is another reason Corbett is a poor representation of existing emissions in this area, where anchorages have increased over the past decade to the point of being a substantial source of marine emissions. EC is aware of the BIALAQS study and looks forward to the results as a comparative to MEIT. However EC's MEIT is the best currently available source of marine emissions data for the region and should be used to establish baseline emissions to accurately assess marine emissions "with" and "without" project. Based on the Proponent's response to EC's Pre-Hearing Order IR 8, EC understands that berth and anchorage emissions were considered for the Project case but were omitted from the Base Case.	EC requests that the Proponent re-evaluate the Base Case with berth and anchorage emissions included.
59.	Air Quality - Marine Emissions TR 8B-3 of Volume 8B and TR 5C-4 of Volume 5C (sections on Westridge Terminal)	It is important to understand and assess the emission reduction measures that are to be implemented.	EC requests that the Proponent confirm whether it will commit to all vessels being compliant with the 0.1% S requirement under the Emission Control Area, rather than applying for

Question #	Subject/Reference	Preamble/Rationale	Information Request
			fuel non-availability waivers.
60.	Air Quality – Marine Emissions Tables 4.6 and 5.1 in TR 8B-3 of Vol 8B, and Sections 7 in Vol 5A and 4.3 in Vol 8A	There are notable inconsistencies between Vol 5A, Section 7.0 (Environmental Effects Assessment) and the Section 4.3 in Volume 8A compared to the Technical Report. The results shown in Table 5.1 of Vol. 8B are inconsistent with the conclusions drawn in the air quality sections in Vol 5A. Moreover, as described in IRs 57 and 58 above, EC believes the emissions have been underestimated and should be recalculated.	EC requests that the Proponent: a) add a table to Section 7 in Vol 5A that shows annual emission inventories for Existing Conditions compared to With Project Conditions, for the LSA Westridge; b) add a table to Section 4.3 in Vol 8A, for the RSA marine; and c) explain the negative impact balance in that context.
61.	Air Quality – Marine Emissions Table 3.7 in TR 8B-3 of Volume 8B and Section 8 of 5A.	Auxiliary engines produce emissions while vessels are at anchorage. Anchorages at Port Metro Vancouver are already limited and tankers and other vessels must often wait for a berth. Recent observations of marine traffic have indicated anchorage times for tankers can be in the order of weeks not days. Based on the Proponent's response to EC's Pre-Hearing Order IR 9, it is understood that berthing at Westridge is expected to decrease by about 20% as a result of the Project. However, in pre-Hearing Order IR 9 EC was requesting an estimation of how anchorage times are expected to change as a result of the Project.	EC requests that the Proponent: a) revise Table 3.7 to show time in mode for the Base Case and the Application Case; b) provide a reference that the 20 hr anchorage time quoted is still current today; and c) indicate whether it has considered increased wait-times for vessels bound for Westridge, and considered increased wait times for <u>all</u> vessels as part of the cumulative effects assessment.
62.	Air Quality - Marine Emissions Section 5.2.2 in TR 8B-3 of Volume 8B and Section 8 of Volume 5A	The requested information is important to the assessment of cumulative effects. Marine traffic associated with the Project, the proposed expansion of Deltaport and the YVR Fuel Delivery Project, will use the same shipping channel in the RSA.	EC requests that the Proponent provide a table in Section 8 of Volume 5A that summarizes emission estimates for the proposed Roberts Bank Terminal 2 project and the YVR Fuel Delivery Project, as cumulative effects with the Project.

Question #	Subject/Reference	Preamble/Rationale	Information Request
63.	Air Quality – CACs Volume 5A, Section 7.6.4.7 and Volume 8A, Section 4.3	The summaries in the sections for Environmental Effects Assessment for Westridge and for Marine Emissions indicate there are no situations of high magnitude air emissions that cannot be technically mitigated. However, the mitigation measures for marine (such as low sulphur fuel and vapour recovery) have already been used in the characterization of the emissions for the Project, which are still showing some substantial increases in pollutants including VOC.	EC requests that the Proponent clarify which emission reduction measures were used for source characterization in the assessment versus those which can be used to mitigate a high emission scenario.
64.	Air Quality – CACs TR 5C-4 of Volume 5C – Exec Summary, and TR 5C-4 of Volume 5C, Appendix C Tables 4.1-4.4	This section states that some marine-related emissions are expected to grow up to year 2030. The response to EC Pre-Hearing Order IR 12 states that: "The projected emissions for the YVR Fuel Delivery Project were 60% of the sulphur dioxide (SO2) emissions associated with existing Trans Mountain marine vessel traffic…". The conclusions presented in the Exec Summary on Cumulative Effects seem inconsistent with emissions estimates. As a consequence it is unclear whether increased emissions from anchorages, Roberts Bank T2, and the YVR Fuel Delivery Project have been included in the assessment of cumulative effects.	EC requests that the Proponent: a) explain why the YVR Fuel Delivery Project is not included in those tables, which do include estimates for Roberts Bank Terminal 2 and b) specify which marine-related emissions are expected to grow by year 2030 and by how much (as per data provided in Appendix C Tables 4.1 to 4.4).
65.	Air Quality – VOCs and Ozone Table 3.9 in TR 8B-3 of Vol 8B and Table 3.18 in TR 5C-4 of Vol 5C.	Using the corrected throughput values supplied in the Proponent's responses to EC's Pre-Hearing Order IR 3, annual fugitive VOCs from marine sources will be 2,695 tonnes/yr with the Project. Table 5.2 in TR 8B-3 of Vol 8B reports a total of 983 tonnes/yr fugitive VOCs. This represents in an annual average recovery rate of fugitive VOCs from ships of 64%. In a region that is VOC-limited with respect to ozone formation, a	EC requests that the Proponent: a) explain why 90% of fugitive VOCs are collected, yet 36% are emitted to atmosphere and b) confirm whether the Project will be using the best technology available for reducing fugitive VOC emissions due to ship loading.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		12-fold increase in VOCs appears to be a substantial effect, and the proposed vapour recovery technology appears inadequate.	
66.	Air Quality – VOCs Section 3.4.2 and table 3.18 in TR 5C-4 of Vol 5C.	EPA-42 Section 5 specifies a reduction factor to be used to account for methane and ethane	EC requests that the Proponent provide the reduction factor used to remove from all TOC emission estimates to calculate VOC emissions for reporting and modelling.
67.	Air Quality – VOCs Table 5.2 in TR 8B-3 of Vol 8B	Without VEC (Vapour Emissions Control), the potential exists for fugitive VOC emissions to be higher than what is presented in Table 5.2.	EC requests that the Proponent confirm that only VEC-equipped tankers and barges will be allowed to berth and transfer oil products.
68.	Air Quality – VOCs and Ozone (Photochemical Modelling) Section 5.5.2 in TR 8B-3 of Volume 8B and Sections in TR 5C-4 of Vol 5C related to Westridge	The prediction that little ozone would be produced as a result of the Project is unexpected given the large additional VOC emissions released in a known VOC-sensitive region (Ainslie et al. 2013). One possible explanation is that the additional NOx emissions are counter-acting the additional VOC emissions. If this were the case, higher ozone concentration outside of the LFV (where the airmass becomes NOx-limited) would be expected. Also, crude oil barges have a higher VOC emission factor for loading than tankers due to having a shallower draft. So it is possible that over a 1-hr averaging period loading a barge may be worse than loading a tanker in terms of VOC emissions, and that the scenario described in Section 3.4.3.2 in Vol 8B may not be sufficiently conservative for estimating effects on ozone formation. There are several apparent inconsistencies in emission estimates provided for Westridge and marine vessel	EC requests that the Proponent: a) indicate what scenario was modelled in terms of number of tankers and barges loading and transiting, and provide an explanation as to how that constitutes a sufficiently conservative approach; b) confirm that in the Burrard Inlet, the Application Case emissions of VOC's are 1109 t/y and the remaining 533 tonnes/y are released throughout the rest of the RSA as a result of transit losses, and that the total VOC emissions including combustion for Westridge Terminal and the shipping routes combined is 1,642 tonnes/yr; c) confirm that the total Application Case NOx emissions in the Burrard

Question #	Subject/Reference	Preamble/Rationale	Information Request
		activity between various tables in TR 8B-3 of Volume 8B and TR 5C-4 of Volume 5C.	Inlet are 218 tonnes/yr and the total Application Case NOx emissions for the Burrard Inlet plus the shipping route are 1,868 tonnes/year; and d) provide the modeled NOx and selected VOC species concentrations (with and without the Project) at Metro Vancouver monitoring stations around Burrard Inlet (T09, T26, T01,T32, T18).
69.	Air Quality – CACs TR 5C-4 of Volume 5C, Appendix C, Tables 4.2 – 4.4	Entries for "TMEP Marine Vessels" contain possible errors, omissions, and/or incorrect labelling of emission sources, and the emissions reported in these tables are inconsistent with those reported in Tab TR 8B-3 Volume 8B and TR 5C-4 of Volume 5C, and it is not clear if all Project-related emission sources have been included in the CMAQ modelling. It is also not clear why certain emissions have been omitted from these tables, such as tugs and the YVR Fuel Delivery Project..	EC requests that the Proponent: a) explain why the addition of emissions from Table 5.1 in Vol8B to emissions from Table 5.16 in Vol 5C does not match the addition of Westridge Terminal and Marine emissions in Table 4.2 in Appendix C of Volume 5C (not including Burnaby and Sumas emissions); b) add tug emissions to the tables for the CMAQ modelling or provide rationale for their absence; c) explain why there are no emissions for the YVR Fuel Delivery Project in Tables 4.3 and 4.4; d) confirm the actual total Project emissions for Westridge plus marine vessel activity, including tugs; e) confirm which emissions are being considered in CMAQ modelling and cumulative effects, the

Question #	Subject/Reference	Preamble/Rationale	Information Request
			magnitude of their effect, and the impact of regulatory changes (e.g. ECA and NOx Tier III) assumed for the assessment; and f) If there are errors and omissions please provide a corrected table, or provide rationale for the omissions and inconsistencies.
70.	Air Quality – GHGs TR 8B-3 of Volume 8B, Section 6 and Table 6.1.	As recognized in the report, Corbett under-represents CO2,e. A more accurate assessment of increase in GHGs as a result of the Project should be provided.	EC requests that the Proponent quantify the under-representation CO2,e, and adjust the table accordingly, or revise using CO2,e estimates from MEIT.
71.	Air Quality – GHGs TR 8B-3 of Volume 8B Section 6, Table 6.1	Barge emissions are a source of GHGs related to the Project, even though they are not increasing as a result of the Project.	EC requests that the Proponent revise the table to show GHG emissions for the Base Case compared to the Application Case, as opposed to reporting GHG emission minus the Base Case.
72.	Air Quality – GHGs TR 5C-4 of Volume 5C, Section 6.2.4	It is understood that a significant source of CO2 has been eliminated by replacing the VCU by the VRU, but it is unclear how the VRU is powered. It seems unlikely that a 3-fold expansion in capacity will result in a negative impact on GHGs once all sources, including indirect sources like electrical consumption, are considered.	EC requests that the Proponent: a) revise GHG emissions by using electricity consumption, as provided by BC Hydro along with standard emission factors for CO2,e, to determine indirect GHGs and b) clarify how the "de-minimus" conclusion was reached.
73.	Air Quality – GHGs TR 5C-4 of Volume 5C, Section 6.2.4, Table 6.7	It is not clear whether major source transport-related CO2 emissions were included in Table 6.7.	EC requests that the Proponent identify which "transportation-related" GHGs are omitted.
74.	Air Quality – GHGs TR 8B-3 of Volume 8B,	Volume 8A indicates no mitigation measures were considered in the marine GHG assessment.	EC requests that the Proponent explain why the adoption of the Energy

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Section 6 and Volume 8A, Section 4.3.4.4		Efficiency Design Index for new builds was not considered.
75.	Air Quality – Photochemical Modeling A3S1U3 PDF Page 41 Appendix C Section 2.2 Model Period (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	The photochemical modeling does not explore the full range of meso-scale meteorological variability seen in the Lower Fraser Valley (LFV), B.C. during ozone episodes. Steyn et al. (2013) referenced in the Application looks at four different ozone episodes whereas only a single episode (June 2006) has been modeled by the Proponent. The June 2006 event is characterized by ozone maxima in the eastern part of the LFV: *"The highest modelled ozone concentrations are found between Abbotsford and Hope on all three days, and within the valley and not along the tributary valleys. "* Each episode can produce surface ozone maxima in different locations within the Georgia Basin (Ainslie and Steyn, 2007 their figures 5, 6, 7 and 8). Different meso-scale circulation regimes could substantially impact the magnitude and location of the ground-level ozone footprint. The Proponent should examine an ozone event where the ozone maximum occurs over the Burrard Inlet area (e.g. the August 2001 or the July 1985 events simulated by Steyn et al. (2013)). Modeling an ozone episode post-2008 (e.g. August 13-23, 2012) would allow consideration of EC's Visibility monitoring network to evaluate light extinction output.	EC requests that the Proponent: a) model, at a minimum, one additional summer ozone episode – one where the ozone plume travels eastward over the Burrard Inlet before heading north into the major tributary valleys of the Coast Mountains around the Pitt River area and b) predict environmental effects during meteorological conditions other than those associated with the highest ozone concentrations, since days with high $PM_{2.5}$ do not always occur under the same meteorological conditions as days with high ozone concentrations.
76.	Air Quality – Photochemical Modeling	Confidence in the model results presented is strengthened when model output is validated against observations. The modeling set-up used in the	EC requests that the Proponent: a) supply a model evaluation of the CMAQ photochemical modeling

Question #	Subject/Reference	Preamble/Rationale	Information Request
	A3S1U3 PDF page 52, Appendix C-section 6. Modelling Results (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	Application is not quite the same configuration as the UBC modeling (Steyn et al. 2013) effort referenced in the Application. The modeling domain used by the Proponent is smaller (93x93), as UBC used a 172x103 sized 4km-domain. Also, UBC used 47 vertical levels whereas only 34 are used by the Proponent. The UBC modeling used WRFV3.3.1 whereas the Proponent used WRFV3.4.1. Also, the UBC effort used SMOKEv2.5 whereas SMOKEv3.1 was used by the Proponent. Overall, there are sufficient differences between the two modeling efforts to justify provision of a documented model evaluation of the new modeling results (meteorological + photochemical).	system for a minimum of 5 stations in a transect across the LFV (e.g. T31, T18, T27, T33 and T12) and a minimum of 5 stations around the Burrard Inlet (e.g. T01, T26, T04, T09, and T32). As in Steyn et al. (2013), the evaluation would consider the model's ability to reproduce observed CO, NOx, $PM_{2.5}$ and ozone quantified using standard statistical measures (e.g., root mean square error, mean bias, correlation coefficients); b) evaluate the modeled VOC concentrations because of the importance of VOC emissions both with respect to the Project and with respect to the airshed's VOC-sensitivity. . There are NAPS speciated VOC canister samples available during the modeled 2006 episode: June 29th at S100111 (T09), June 28th at S100133 (T22), S100134 (T31) and S100137 (T24); and c) supply a model evaluation of the WRF meteorological output at both the Vancouver International (YVR) and Abbotsford Airports. Such an evaluation would consider the model's ability to reproduce temperature and relative humidity. Hodographs at YVR (as shown in Steyn et al. 2013) should be supplied

Question #	Subject/Reference	Preamble/Rationale	Information Request
			to show how well WRF captures the onshore flow seen throughout the episode
77.	Air Quality – Photochemical Modeling A3S1U3 PDF page 45, Appendix C Section 4 Emissions Table 4.1 (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	The prediction that little ozone would be produced as a result of the Project is unexpected given the large VOC (1518 tonnes) emissions released in a known VOC-sensitive region (Ainslie et al. (2013)). Photochemical modeling by EC reveals that the amount of ozone stemming from the loading of oil tankers is very sensitive to assumptions about the volatility of the product being loaded. Information in Table 3.20 (A3S1U0 PDF Page 78) is insufficient to assess the volatility of the fugitive emissions. Mass emission rates by VOC species (in addition to the COPCs) are needed to assess the ozone forming potential of the emissions.	EC requests that the Proponent: a) confirm whether the tankers will be loading crude (Peace Rive Sour or Cold Lake Blend) or diluted bitumen; b) provide the SMOKE speciation profiles (gspro) used for the chemical speciation of the fugitive VOC emissions (crude and/or diluted bitumen) from tanker loading and for the Vapour Recovery Unit (VRU); and c) provide any available ambient VOC data sampled around the Westridge terminal so as to help verify the suitability of the VOC speciation profiles Ideally, such samples would be obtained on days before, during and after tanker loading operations and would be from whole air samples (WAS) and contain a full suite VOC species. In the absence of such data (from either the Burnaby or Edmonton terminal) EC requests any other speciated ambient VOC data that would be consistent with a diluent/bitumen signature. In the absence of any such WAS data, a list of days when Westridge tanker loading has occurred over the last 10-years might allow the NAPS VOC

Question #	Subject/Reference	Preamble/Rationale	Information Request
			samples taken at Burnaby North (T24) to be used to estimate the fugitive emission signatures.
78.	Air Quality – Photochemical Modeling A3S1U3 PDF page 42, Appendix C Section 4 Emissions (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	Fugitive sources from ship operations can account for a notable amount of emissions in the model domain (Table 5.16 A3S1U1 PDF page 121 - Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report).In predicting the air quality impacts of these emissions, it is important to know how fugitive emissions were treated in the modeling, especially under worst case scenarios.	EC requests that the Proponent provide the following clarifications related to how the fugitive emissions were estimated in the modeling: a) whether emissions were assumed to be uniform throughout the day; b) whether daily emissions from each source were assumed to be 1/365th of annual emissions during the modeled episode. Presumably, emissions are greater when ships are loading and under transit, which are not a daily occurrence right now. Thus, modeling daily emissions assuming that there are ships constantly loading, berthed and underway, would be the correct choice to estimate impacts under meteorological conditions conducive to ozone formation. Confirm whether this was done throughout the 10-day period, and c) whether worst case assumptions were made (i.e. three ships at berth, one loading, two in transit) for the entire modeled episode.
79.	Air Quality – Photochemical Modeling A3S1U3 PDF	The requested information if important to interpretation of model results. For example, the CMAQ output given in Figures 6.1-6.10 is difficult to interpret, given the large spatial scale of the plot.	EC requests that the Proponent: a) provide additional figures showing the ozone and $PM_{2.5}$ impacts over the same domain as presented for

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Appendix C Section 4 Model Results (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)		the dispersion modeling (A3S1U2 PDF Pages 2-33, 5C Figures (4.52-4.67 and 5.1-5.16). (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report) and b) plot ozone and $PM_{2.5}$ isopleths overtop of the urban landuse maps (as has been done for the dispersion modeling), with semi-transparent filled contours.
80.	Air Quality – Photochemical Modeling A3S1U3 PDF page 42, Appendix C Section 4 Emissions (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	The UBC modeling used an emissions inventory based on 2000 which was scaled to 2006 levels using the Metro Vancouver forecast and backcast emissions inventories. Since the time of the UBC work, a newer 2010 inventory is available. The inventory used by the Proponent is dated and uses older marine shipping emissions. Using the newer 2010 inventory would eliminate the known deficiencies in the marine emissions inventory that was used in the analysis.	EC requests that the Proponent estimate what the influence of using the newer 2010 inventory with the most updated marine emissions on concentrations of O_3 and $PM_{2.5}$. EC can supply the 2010 inventory by request.
81.	Air Quality – Photochemical Modeling A3S1U3 PDF page 45, Appendix C Section 4 Emissions Table 4.1 (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas	The vapour combustion unit (VCU) emissions at the Westridge terminal are expected to result in $PM_{2.5}$ exceedences in Metro Vancouver. In addition, vapour recovery unit (VRU) emissions of VOCs are predicted to exceed 800 tonnes/year.	EC requests that the Proponent indicate how the VCU and VRU units were modeled as point sources (e.g., what were the stack diameters, exit velocities and exit temperatures) used as point source inputs into the model.

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Technical Report – Appendix C)		
82.	Air Quality – Photochemical Modeling A3S1U3 PDF page 42 Appendix C Section 3 Meteorological Modelling (WRF & MCIP) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	The fate of the morning rush-hour emissions, which tend to be centered in the downtown Vancouver region (including the Burrard Inlet), determines where in the LFV the afternoon ozone maxima will occur. Ensuring the wind speed and direction is correct at the coast near the downtown (e.g., Vancouver International Airport) is critical to accurately model the ozone plume.	EC requests that the Proponent supply hodographs, showing the hourly evolution of winds at Vancouver International Airport (as presented in Steyn et al. 2013) to enable a determination ofhow well WRF/MCIP captures the onshore flow seen throughout the 2006 episode.
83.	Air Quality – Photochemical Modeling A3S1U3 PDF page 52 Appendix C Section 6 Modelling Results (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	The UBC modeling effort documented a NOx bias in the model, where the CMAQ output consistently under-predicts daytime NOx concentrations, especially around the downtown Vancouver and Burrard Inlet areas. This has the effect of underestimating ozone downwind into the eastern LFV.	EC requests that the Proponent indicate how the known CMAQ model NOx bias, referenced in Steyn et al. (2013) affects the conclusions in the Application.
84.	Air Quality -Photochemical Modeling A3S1U3 PDF page 40 Appendix C Section2 Model Domains and Period	High ozone and $PM_{2.5}$ concentrations have been measured around the Edmonton terminal (Appendix E), with measurements sometimes exceeding Alberta 1-hour 80 ug/m3 standard for PM25 (Figures E1; E3; E5; E7; E9; E11 and E13) and the Alberta 1-hour 82 ppb for ozone (Figures E223; E225; E227 and E229). The area around the Edmonton terminal already	EC requests that the Proponent: a) explain why photochemical modeling of ozone and $PM_{2.5}$ was not performed over the Edmonton terminal and b) provide an estimate of the Project's potential impact on local ozone and

Question #	Subject/Reference	Preamble/Rationale	Information Request
	(Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report – Appendix C)	records exceedence levels of ozone and $PM_{2.5}$ and the Project will be adding more VOCs to the area.	$PM_{2.5}$ concentrations
85.	Air Quality – Landside Dispersion Modeling A3S1U1 PDF Page1, Table 3.30 (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	It is stated that the Burnaby Burmount (T22) is the only National Air Pollution Surveillance (NAPS) station monitoring VOCs in the Burnaby/Westridge RSA. In fact there are 4 NAPS stations: T09 (NAPS ID 100111), T18 (100119), T22 (100133) and T24 (100137) monitoring VOCs. In addition, the Burmount station often measures lower BTEX concentrations. For benzene, in 2011, average concentrations (in ug/m3) were 0.62 (T09), 0.55 (T18), 0.60 (T22) and 1.14 (T24). Given the exceedences (> 30 ug/m^3) predicted by the CALPUFF model for 1-hour maximum benzene concentrations (Figure 5.16), it is important to establish the correct background benzene concentrations	EC requests that the Proponent establish a conservative benzene background estimate to using the North Burnaby (T24) mean value.
86.	Air Quality – Landside Dispersion Modeling A3S1U0 PDF Page 104,Section 3.4.4.4 Determination of Background (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	It is important that the modeling effort be consistent across the assessment of the Project. All industrial emission sources (reporting to the NPRI) within a 5km radius of both the Westridge and the Burnaby terminals should be included in an estimate of local background concentrations (as was performed for the Edmonton terminal).	EC requests that the Proponent model background emissions for the Edmonton and the Burnaby/Westridge terminals.

Question #	Subject/Reference	Preamble/Rationale	Information Request
87.	Air Quality – Landside Dispersion Modeling A3S1U1 PDF Page 100,Section 4.3.1 (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	The requested information is important to adequately assess impacts on air quality.	EC requests that the Proponent present the CALPUFF modeling results for the 1-hour averaging period as maximum hourly values at both the Edmonton and Westridge/Burnaby terminals. Retain plots showing the 9th highest value around the Edmonton terminal (in agreement with Alberta practices).
88.	Air Quality – Landside Dispersion Modeling A3S1U0 PDF Page 86,Section 3.4.4 Modelling (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	The dispersion modeling over the Burnaby and Westridge terminals has been performed for only a single year. Given the high modeled pollutant concentrations, and the known year to year meteorological variability along the Pacific Northwest, a longer modeling period would better capture the meteorological influence on the Project's potential air quality impacts and would be consistent with the Edmonton terminal modeling. While extending the modeling timeframe in this way may not impact the original assessment's findings concerning annual averages, exercising the model with a longer meteorological dataset can potentially impact the Proponent's conclusions for the shorter (1- and 24-hour) averaging periods.	EC requests that the Proponent extend the modeling period to 4 years over the Burnaby/Westridge Marine RSA. The extended modeling period does not have to use WRF output, and the CALMET meteorological fields can be developed from surface station data. EC can assist by providing hourly upper air data from the Squamish Airport RASS wind profiler (2008-2013) as needed.
89.	Air Quality – Landside Dispersion Modeling A3S1U0 PDF page 104, Section 3.4.4.4 Determination of Background (p 77) (Volume 5C, Biophysical Technical Report 5C4, Air	The estimation of background concentrations should be performed in a consistent manner at both the Edmonton and Burnaby/Westridge terminals. Presently, the 98th percentile is used for Burnaby/Westridge and the 90th percentile for the Edmonton terminal	EC requests that the Proponent use a consistent (and suitably conservative) approach in estimating background concentrations at both the Edmonton and Burnaby/Westridge terminals.

<table>
<tr><th>Question #</th><th>Subject/Reference</th><th>Preamble/Rationale</th><th>Information Request</th></tr>
<tr><td></td><td>Quality and Greenhouse Gas Technical Report)</td><td></td><td></td></tr>
<tr><td>90.</td><td>Air Quality – Landside Dispersion Modeling

A3S1U1 PDF Page 66, Section 4.1.2.3
(Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)</td><td>NAPS VOC samples are quality controlled. Two BTEX samples from the T22 station were removed from the analysis. Without more detail, it cannot be precluded that these concentrations are not representative of extreme but actual conditions in the area.</td><td>EC requests that the Proponent provide additional details about the size of the BTEX samples used when calculating observed concentrations at T22, before and after the two samples were removed. EC further requests calculated yearly values with these outliers included as well as a discussion on how the inclusion would alter the findings.</td></tr>
<tr><td>91.</td><td>Air Quality – Landside Dispersion Modeling

A3S1U2 PDF Pages 2-33, 5C Figures (4.52-4.67 and 5.1-5.16)
(Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)</td><td>Contour plots are required to spatially assess the potential for air quality exceedences within the modelled domains.</td><td>EC requests that the Proponent provide contour plots for each of the species given in the table below. The plots should be performed with output from both the Edmonton and Westridge terminals and for both the baseline and Project cases. All the plots should use the standards given in the table for setting the colour scales.
<table>
<tr><th>Species</th><th>Averaging Period</th><th>Standard</th></tr>
<tr><td rowspan="2">TSP</td><td>24-hr</td><td>120</td></tr>
<tr><td>1-year</td><td>60</td></tr>
<tr><td rowspan="2">PM10</td><td>24-hr</td><td>50</td></tr>
<tr><td>1-year</td><td>20</td></tr>
<tr><td rowspan="3">PM2.5</td><td>1-hr</td><td>80</td></tr>
<tr><td>24-hr</td><td>28</td></tr>
<tr><td>1-year</td><td>10</td></tr>
<tr><td rowspan="2">CO</td><td>1-hr</td><td>15000</td></tr>
<tr><td>8-hr</td><td>6000</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Question #</th><th>Subject/Reference</th><th>Preamble/Rationale</th><th>Information Request</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td></td><td>1-year</td><td>6000</td></tr>
<tr><td rowspan="3">NO2</td><td>1-hr</td><td>200</td></tr>
<tr><td>24-hr</td><td>200</td></tr>
<tr><td>1-year</td><td>60</td></tr>
<tr><td rowspan="3">SO2</td><td>1-hr</td><td>450</td></tr>
<tr><td>24-hr</td><td>150</td></tr>
<tr><td>1-year</td><td>30</td></tr>
<tr><td rowspan="2">Benzene</td><td>1-hr</td><td>30</td></tr>
<tr><td>1-year</td><td>3</td></tr>
<tr><td rowspan="2">Toluene</td><td>1-hr</td><td>1880</td></tr>
<tr><td>24-hr</td><td>400</td></tr>
<tr><td>Ethylbenzene</td><td>1-hr</td><td>2000</td></tr>
<tr><td rowspan="2">Xylenes</td><td>1-hr</td><td>2300</td></tr>
<tr><td>24-hr</td><td>700</td></tr>
<tr><td rowspan="2">H2S</td><td>1-hr</td><td>14</td></tr>
<tr><td>24-hr</td><td>4</td></tr>
<tr><td rowspan="2">TRS</td><td>1-hr</td><td>7</td></tr>
<tr><td>24-hr</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>92.</td><td>Air Quality – Landside Dispersion Modeling
A3S1U2 PDF Pages 2-33, 5C Figures (4.52-4.67 and 5.1-5.16)
(Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)</td><td>Contour plots are required to spatially assess the potential for air quality exceedences within the model led domains. The inset isopleth plots found in Figures 4.52-4.67 and 5.1-5.16 only show parts of the LSA region and are too small. These inset plots often chop off parts of contours showing exceedence level concentrations.</td><td>EC requests that the Proponent provide full page, colour isopleth plots as presented in Figures 4.52-4.67 and 5.1-5.16 (but for all of the pollutants and averaging times noted above) and in addition, full page, colour plots over only the LSA region. The filled contours in all of the isopleth plots should have a lower opacity so that the underlying geographic and urban features can be detected.</td></tr>
<tr><td>93.</td><td>Air Quality – Landside Dispersion Modeling</td><td>Modeled concentrations represent the sum of marine and landside emissions. Understanding how each</td><td>EC requests that the Proponent:
a) provide additional information</td></tr>
</table>

Question #	Subject/Reference	Preamble/Rationale	Information Request
		source contributes to any exceedence is important in assessing the environmental impacts. However, interpretation of the modeling results is uncertain. It is EC's understanding that the combined case plots represent the sum of: background concentration + marine-based concentrations + landside-based concentrations. Yet, examination of the individual plots does not seem to support this conclusion. For example, the predicted maximum hourly marine NO2 footprint (Figure 4.26 A3S4J8 -Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report) shows at maximum concentration of 292 ug/m3 over land and 226 ug/m3 over water. It is stated in the caption that this plot does not include any background concentrations. The combined plot for the base case hourly NO2 (Figure 4.62 A3S1U2 PDF Pages 2-33, 5C Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report) show a maximum of only 241 ug/m3. It is stated in the figure caption that a background value of 111 ug/m3 has been added to the concentrations and that the marine-based concentrations have been included. Conservatively, it would seem that a lower bound for the maximum for the combined base would be 292+111= 403 ug/m^3 (i.e. no contribution from the land-based emissions).	about how the marine- and land-based concentration fields were added to the estimated background concentrations to produce the Combined case plots and b) provide two additional plots for every modeled pollutant showing an exceedence (regardless of averaging time) in relation to the Burnaby/Westridge terminal: one showing the CALPUFF output, without background, at the time of the maximum, from the marine modeling (interpolated to the Burnaby/Westridge RSA); and the other the CALPUFF output (without background) from the Burnaby/Westridge emissions, again at the time of the maximum. The sum of these two plots, plus the calculated background will produce the Combined base case plot.
94.	Air Quality – Landside Dispersion Modeling A3S1U0 PDF Page 104, Section 3.4.4.4 Determination of	Data from the air quality monitoring stations around the Edmonton and Burnaby terminals (Appendix E) show a wide range of variability. There are 5 air quality monitoring stations in the Edmonton terminal RSA (Figure 3.8) and 10 in the Burnaby/Westridge RSA (Figure 3.11) that measure a variety of CACs. There	EC requests that the Proponent incorporate observational data from all air quality monitoring stations in each of the RSAs (with possibly the exception of Burnaby Mountain (T14) in the Burnaby RSA) in the calculation of

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Background (page 77) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report) And A3S1U2 PDF Page 13, 5C Figure 4.63 (Annual NO2 Combined Base Case) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	are 4 monitoring sites in the Burnaby/Westridge RSA that have NAPS measured VOC concentrations (not 1 as erroneously reported). Additionally, the predicted annual NO_2 concentrations plotted in Figure 4.63 (A3S1U2 PDF Page 13, 5C Figure 4.63 (Annual NO_2 Combined Base Case)(Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)) shows a maximum value of 21.4 ug/m^3 over the Westridge terminal and a small region of NO_2 concentrations between 20.5 and 22.6 due east. However, annual average 2011 NO_2 concentrations have been observed in the RSA at the following locations: T04 (21.1 ug/m^3), T06 (25.0), T09 (23.6), T18 (26.3), T26 (21.3), and T32 (20.0). The observed values at T09, T06 and T18 are all higher than the modeled Westridge peak, suggesting that the reported estimate of background NO_2 concentrations may be too low.	background concentrations.
95.	Air Quality – Landside Dispersion Modeling A3S1U0 PDF 104, Section 3.4.4.4 Determination of Background (page 77) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	Annual average concentrations have been calculated using the 50th percentiles. This calculation reflects median values which are statistically lower than average values. The average should be used in line with the true definition of the metric and in keeping with a more desirable conservative approach.	EC requests that the Proponent use the mean to calculate the annual average.
96.	Air Quality – Landside Dispersion Modeling A3S1U0 PDF Page 104, Section 3.4.4.4 Determination of	The requested information is important to an adequate assessment of potential impacts and has relevance to the proposed operational management plan.	EC requests that the Proponent: a) provide plots showing the frequency of exceedences for all species and at all averaging times, where a model exceedence is predicted;

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Background (page 77) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)		b) provide a list of sensitive receptors impacted by modeled concentrations exceeding air quality standards (applicable to all species and averaging times); and c) discuss the meteorological conditions contributing to the modelled air quality exceedence in all cases where the model predicts an exceedence (for any species and at any averaging time).
97.	Air Quality – Landside Dispersion Modeling A3S1U2 PDF Page 10, A3S1U1 PDF Page 96, 5C Figure 4.60 and Table 4.33 (Hourly PM25 Combined Base Case) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	The CALPUFF modeling shows $PM_{2.5}$ exceedences under the baseline (Figure 4.60). To better assess the validity of these modeling results, a more thorough investigation of the modeling system is needed. Given the large proportion of $PM_{2.5}$ emissions coming from the Westridge Terminal in the LSA (35.3% as per Table 4.33), $PM_{2.5}$ polar bivariate plots (Carslaw and Beevers, 2013) showing hourly $PM_{2.5}$ versus hourly wind speed and direction would be useful to gauge the veracity of the model output.	EC requests that the Proponent provide polar bivariate plots of hourly $PM_{2.5}$ versus hourly wind speed and direction at Metro Vancouver monitoring station locations T04, T06, T09, T18 and T26 using both observed and predicted $PM_{2.5}$/wind speed/wind direction values.
98.	Air Quality – Landside Dispersion Modeling A3S1U2 PDF Page 10, A3S1U1 PDF Page 96, 5C Figure 4.60 and Table 4.33 (Hourly PM25 Combined Base Case) (Volume 5C, Biophysical Technical Report 5C4, Air	The meteorological fields used to drive the CALPUFF dispersion model are an important source of uncertainty in the model. The veracity of the meteorological model must be demonstrated before it can be accepted as fit for the assessment.	EC requests that the Proponent provide a detailed description of the WRF modeling effort (e.g. how often the model was re-initialized, parameterizations used (c.f. convective, PBL processes), if any nudging was used) as well as a detailed model evaluation using observed meteorological measurements.

<table>
<tr><th>Question #</th><th>Subject/Reference</th><th>Preamble/Rationale</th><th>Information Request</th></tr>
<tr><td></td><td>Quality and Greenhouse Gas Technical Report)</td><td></td><td></td></tr>
<tr><td>99.</td><td>Air Quality – Landside Dispersion Modeling

A3S1U2 PDF Pages 14-16, 5C Figure 4.64-4.66 (Hourly, 24-hr and annual SO2 Combined Base Case)
(Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)</td><td>The predicted baseline SO_2 concentrations plotted in Figures 4.64 (hourly maximum), 4.65 (24-hr maximum) and 4.66 (Yearly mean) all seem to underestimate observed 2011 concentrations. The table below shows CALPUFF modeled maxima along with observed SO_2 concentrations at the 10 stations within the RSA.
<table>
<tr><th>Source</th><th>1-hr Max</th><th>24-hr Max</th><th>Annual Average</th></tr>
<tr><td>CALPUFF</td><td>73.2</td><td>20.2</td><td>2.8</td></tr>
<tr><td>T04</td><td>170</td><td>10</td><td>3.1</td></tr>
<tr><td>T06</td><td>125</td><td>16</td><td>5.3</td></tr>
<tr><td>T09</td><td>63</td><td>8</td><td>3.1</td></tr>
<tr><td>T14</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>T18</td><td>31</td><td>4</td><td>1.8</td></tr>
<tr><td>T22</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>T23</td><td>195</td><td>13</td><td>4.3</td></tr>
<tr><td>T24</td><td>201</td><td>31</td><td>7.6</td></tr>
<tr><td>T26</td><td>82</td><td>7</td><td>3.6</td></tr>
<tr><td>T32</td><td>-</td><td>-</td><td>-</td></tr>
</table>
Calculated peak hourly SO_2 concentrations are about 1/3 of the observed maximum at the North Burnaby (T24) station; calculated peak 24-hour averaged concentrations are about 2/3 of the observed T24 maximum (based on rolling 24-hr average); and about 1/3 of the T24 annual mean value.</td><td>EC requests that the Proponent evaluate the modelling inputs for predicted baseline SO_2 concentrations since the modelled values are too low compared to measured 2011 values.

This mismatch could be due to the following: 1) the modeling period may be too short and not able to capture the full meso-scale variability; 2) the estimate of background SO_2 concentrations maybe too low; 3) the landside emissions maybe underestimated; or 4) the marine emissions are underestimated.</td></tr>
<tr><td>100.</td><td>Air Quality – Review of</td><td>• It is not clear what the information presented</td><td>EC requests that the Proponent:</td></tr>
</table>

Question #	Subject/Reference	Preamble/Rationale	Information Request
	existing air quality A3S1U1 PDF Page 41, Section 4.1.1.7 Overview (page 119) and A3S1U1 PDF Page 72, Section 4.1.4.1 Overview (page 150) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	represents. For example:It is not clear what the bars represent in Figures 4.38 (PM10), 4.39 ($PM_{2.5}$), 4.40 (CO), 4.41 (NO_2), 4.42 (SO_2). Are they maxima, minima, 50th percentiles, means? • It is not clear what the bars represent in Figures 4.51. Are they maxima, minima, 50th percentiles, means? If they are an f annually-averaged value, it is not clear why the 1-hour and 8-hour standards would be added to the plots • The red bars in the plots (figure 4.51) are rolling 8-hour averages, yet they are larger than the blue 1-hr averages. This appears to be an error	a) thoroughly review the ambient data analysis to correct errors such as the apparent discrepancies between 1-hour and 8-hour averages and b) provide box and whisker plots for the existing observational datasets. These plots should show the mean, median, inter-quartile range (IQR), 1.5*IQR and outliers using all of the data (not as in Appendix E, where the data has been segregated by season or hour). The plots should clearly state the range of dates used in each box plot.
101.	Air Quality – Review of existing air quality A3S1U1 PDF Page 73, Table 4.11 (page 151) (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	It is unclear why the Kamloops, Hope, Chilliwack and Abbotsford area data were compared against the 15 ppb National Maximum Desirable Level (24-hour) ozone objective. This value is lower than North American background concentration (Vingarzan, 2004). The National Maximum Acceptable Level of 26 ppb would be more appropriate, yet even this value is likely dated.	EC requests that the Proponent: a) thoroughly review the ambient data analysis to correct errors and use consistent ozone objectives for both BC and Alberta stations; b) explain why the other BC stations were not compared against National Maximum Desirable Level standard; and c) explain why the Kamloops, Hope, Chilliwack and Abbotsford area data was compared against a 51 ppb (1 hour) objective while the other BC (and Alberta) stations were compared against an 82-ppb (1-hour) objective.

Question #	Subject/Reference	Preamble/Rationale	Information Request
102.	Air quality – Landside Dispersion Modeling A3S1U4 PDF Page 39, Volume 5C - Air Quality and GHG Technical Report from RWDI: Figure D.16 (Modelled wind fields at Burnaby)	If Terrad is set too high, influence of Burnaby Mountain is neglected and model may indicate winds over Westridge terminal as easterly when in fact the winds would be north-easterly with terminal emissions moving southwest to nearby urban receptors. For the neutral case request date/time when winds are from the predominant easterly direction, as indicated by the wind roses in Figure D.8, the choice of 5 km for Terrad (Table D.8) may be too high to resolve winds northeast of Westridge Terminal.	EC requests that the Proponent consider setting Terrad=4 (same as Sumas) in conducting landside dispersion modelling for Westridge Terminal Site and identify the changes to modelling results.
103.	Air quality – Landside Dispersion Modeling A3S1U4 PDF Page 44, Volume 5C - Air Quality and GHG Technical Report from RWDI: Figure D.20 (Modelled Mixing Heights at Burnaby)	Confidence in dispersion modelling results is dependent on use of correct winds and vertical mixing at low levels. Land cover characterization in the Application identifies Burrard Inlet as forest or urban.	EC requests that the Proponent: a) confirm that the landuse classification for Burrard Inlet is indeed as depicted in the Modeled Mixing Height Figure D.20; b) provide re-simulation of the landside dispersion in the case of incorrect Burrard Inlet landuse classification; and c) provide individual large scale plots for **both** landuse **and** elevation at each of the four modeling domains (Edmonton, Kamloops, Sumas and Burnaby). The spatial distribution of the remaining geophysical fields (surface roughness, albedo, Bowen ratio, soil heat flux, leaf area index and anthropogenic heat flux) can be inferred from the information given in Tables D1-6.

Question #	Subject/Reference	Preamble/Rationale	Information Request
104.	Air Quality – Marine Dispersion Modeling Inclusion of BPIP details A3S4J7 PDF Page 52, Section 3.4.3.2 under subhead *Building Effects* in *Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report* from RWDI (page 51)	Building downwash has an important effect on the dispersion characteristics for emissions near building structures. Typically, it is a best practice within dispersion modelling reports to provide detailed information and supporting figures for how building downwash was modelled. For dispersion modelling with CALPUFF, it is primarily the BPIP model that is used to generate BPIP-PRIME input for the CALPUFF model. Information on the inputs for the BPIP model is not included in the Application.	EC requests that the Proponent provide a diagram or annotated CAD drawing for the relevant emission sources and nearby structures included as inputs for BPIP. The input script for BPIP should be included as an Appendix item.
105.	Air Quality – Marine Dispersion Modeling Source grouping A3S4J7 PDF Page 54, Section 3.4.4.3 under subhead *Model Output Interpretation* in *Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report* from RWDI (page 71)	Grouping several CALPUFF dispersion models together (typically, models with single sources) allows for combined models (with several sources) that represent a specified condition (e.g., base case, Project case). While grouping is required to represent different modelling cases, care must be taken to descriptively name the cases and state which sources and conditions were included in each grouping. Based on the information presented in the Application, it is unknown which emission sources were grouped and what purpose each grouping served. It is stated that "emissions sources were grouped into numerous model runs based on the speciation profiles discussed in Section 3.4.2.2", but a specific table reference for the profiles has not been provided.	EC requests that the Proponent provide information on the groupings of emission sources and how they relate to the model runs.
106.	Air Quality – Marine Dispersion Modeling VOC scaling factors A3S4J7 PDF Page 54, Section 3.4.3.2 under subhead	CALSUM is a simple application included as part of the CALMET/CALPUFF modelling system that takes individual dispersion models (i.e., one modelled source per model) and combines these into a single model with all sources included. The application	EC requests that the Proponent include a table that explicitly states which scaling factors were applied in CALSUM.

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Determination of Combined Effects for CACs and Total VOC in *Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report* from RWDI (page 72)	allows for scaling factors to be included within the input file. Without knowing what the individual scaling factors are, it is difficult to understand what the combined model represents. It is noted in the Application that "scaling factors are applied in CALSUM to account for total product throughput at the Trans Mountain terminals", however, there are neither tabular data nor input files that indicate which values were chosen.	
107.	Air Quality – Marine Dispersion Modeling Potentially erroneous dry deposition velocity A3S4J7 PDF Page 53, Section 3.4.3.2 under subhead *Wet and Dry Deposition* in *Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report* from RWDI (page 70)	As CALPUFF is a mass-conserving model, accurate estimates of deposition velocities for emissions are essential for accurate estimates of ambient concentrations at receptors. Improper settings for dry or wet deposition may adversely affect the modelling outcomes. In the Application, bulk dry deposition velocities are substantially different between TSP/PM_{10} (1.67 cm/s) and $PM_{2.5}$ (0.167 mm/s). The text of the referenced article (cited as *Tombach and Brewer*, 2005) does not supply any information on particle dry deposition velocities.	EC requests that the Proponent provide corrected bulk dry deposition velocities for TSP, PM_{10}, and $PM_{2.5}$ with a corrected citation to support the values.
108.	Air Quality – Marine Dispersion Modeling Fenceline outlines (greater detail required) A3S4J7 PDF Page 51, A3S4J7 PDF Page 49, Section 3.4.3.2 under subhead *Receptor Locations* in *Marine Air Quality and Greenhouse Gas Marine*	The BC Modelling Guidelines state that each fenceline boundary must be composed of receptors not more than 20 m apart. The fenceline represents the publicly accessible area closest to the facility that contains the emissions sources. The boundaries for the terminal locations are difficult to see and the receptors that are placed along the fenceline cannot be examined. A combination of factors adds to the difficulty: (1) the large width of the	EC requests that the Proponent add separate figures for each of terminal boundaries provided in Figures 3.8 to 3.11 (Edmonton Terminal, Kamloops Terminal, Sumas Terminal, Burnaby Terminal, Westridge Marine Terminal). The scale of each new figure should allow each of the fenceline receptors to be readily detected.

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Transportation Technical Report from RWDI (page 66)	yellow lines used to mark the fenceline, and (2) the scale of the map figures.	
109.	Air Quality – Marine Dispersion Modeling Identification and tabular output for sensitive receptors (schools, hospitals, etc.) A3S4J7 PDF Page 51, Section 3.4.4.2 under subhead *Receptor Locations* in *Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report* from RWDI (page 66)	The BC Modelling Guidelines recommend the identification of sensitive receptors. Commonly, dispersion modelling reports provide a frequency distribution of expected concentrations at selected sensitive receptor locations in addition to supplying the maximum predicted concentrations at these locations. The Application states that "in addition to the gridded receptors described above, a number of discrete receptors were modelled for the Screening Level Human Health Risk Assessment of pipeline and facilities".	EC requests that the Proponent: a) provide a table that identifies the sensitive receptors by name and location and b) report maximum concentrations at these receptors in the model result section.
110.	Air Quality – Marine Dispersion Modeling Equation for converting 1-hour concentrations to 10-min and 3-min concentrations. A3S4J7 PDF Pages 80-88, Sections 4.3.1, 5.2.1, and Tables 4.9, and 5.3. in Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report from RWDI.	Odorous or nuisance compounds are typically given objective or threshold values that are sub-hourly. In the case of mercaptans, there is a 10-minute averaging period applied in Ontario (where the objective concentration is 13 µg/m^3). Data from AIHA (American Industrial Hygiene Association) and various journal articles have provided a dataset for odour detection threshold values for a range of odorous compounds as 3-minute maximum concentrations. Given that receptor concentrations from CALPUFF dispersion modelling are frequently hourly values, a conversion method must be followed to convert a 1-hour concentration to a sub-hourly concentration (e.g., 3-minute, 10-minute)	EC requests that the Proponent: a) provide the methodology for converting 1-hour concentrations of mercaptans to 10-min concentrations for comparison to the 10-minute Ontario AAQC value for mercaptans and b) provide an explanation of how 1-hour concentrations of various VOCs are converted to 3-min concentrations.
111.	Air Quality – Marine Dispersion Modeling A3S1Q9 PDF Page 353,	The screening level assessment of fugitive VOC emissions is given as a percentage of ambient air quality objectives for BTEX, mercaptans, and benzene,	EC requests that the Proponent: a) provide the actual emission rates of total VOCs expected from the pump

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Section 7.4.4.1 Potential Effects and Mitigation measures (Volume 5A: ESA-Biophysical Section 7.0 Environmental Effects Assessment)	without identifying the actual emission rates that will be emitted from the pump stations. Other expected VOC emissions are not identified. It important that actual emissions are considered in the context of the total VOC emissions in the area. It is also important to recognize that lighter VOCs may be emitted more readily than BTEX due to their higher vapor pressure.	stations and b) specify the emission rates of VOCs other than BTEX expected from the pump stations.
112.	Existing Air Quality Conditions – Marine A3S4J7 PDF Page 60, 4.1.1.1 Overview of existing conditions Figure 4.6, 4.7, 4.8 and 4.9 A3S4J7 PDF Page 72, Section 4.1.2.1 Table 4.2 A3S4J7 PDF, Page 72, Section 4.1.2.2 Vancouver Ozone Analysis Figure 4.17 (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	It is not clear what the information presented represents, but can offer the following observations: • It is difficult to understand the bar charts in Figure 4.6 and what has been plotted (e.g., annual mean, maximum). • The Note associated with the chart in Figure 4.6 says no data from 2011 at Kitsilano is available but this data can be readily downloaded from: http://envistaweb.env.gov.bc.ca/. • Table 4.2. shows ozone exceedences at T02 3.4% of the time for the 1-hr objective (82 ppb) and 32.9% for the 8-hr objective (65). EC's calculations show no 1-hr or 8-hr exceedences during 2011 at T02. • It is unclear how the 8-hr average can be higher than the 1-hr average (Figure 4.17). EC finds that the highest 1-hr ozone value recorded at T02 during 2011 was 51.8 ppb, not the 90 ppb shown in Figure 4.17 and the maximum 8-hr average was 50.2 not the 90+ppb. • In Figure 4.18, the 8-hr averages are higher than the 1-hr averages, which should not be the case.	EC requests that that Proponent conduct a thorough review of the existing data analysis to correct errors and revise the presentation of the data so as to remedy the apparent anomalies in data and identify the station(s) used in calculating exceedence frequencies in Table 4.2.

<table>
<tr><th>Question #</th><th>Subject/Reference</th><th>Preamble/Rationale</th><th>Information Request</th></tr>
<tr><td>113.</td><td>Air Quality –
Marine Dispersion Modeling

A3S1U2 PDF Pages 2-35, 5C Figures (4.52-4.67 and 5.1-5.16)
(Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)</td><td>Isopleth plots found in Figures 4.19-4.28 and 5.1-5.10 do not show enough detail around the Burrard Inlet area to facilitate interpretation of findings.</td><td>EC requests that the Proponent:
a) provide full page, colour isopleth plots for information presented in Figures 4.19-4.28 and 5.1-5.10 and full page, colour plots over the Burrard Inlet region (e.g. 475000 to 525000 UTM E and 5 440 000 to 5 470 000 UTM N);
b) use a lower opacity for filled contours in all of the isopleth plots so that the underlying geographic and urban features can be readily detected; and
c) for clarity, use contouring levels (colour bar) in the marine plots which match those used in the Combined plots.</td></tr>
<tr><td>114.</td><td>Air Quality –
Marine Dispersion Modeling

A3S4J8 PDF Pages all, Figures 4.19-4.28 and Figures 5.1-5.10
(Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)</td><td>To assess modeled impacts, additional spatial plots are required to assess the model impacts.</td><td>EC requests that the Proponent prepare spatial plots of the following species/averaging time pairs (over the entire marine RSA as well as over the Burrard Inlet area):

<table>
<tr><th>Species</th><th>Averaging Period</th><th>Standard</th></tr>
<tr><td rowspan="2">TSP</td><td>24-hr</td><td>120</td></tr>
<tr><td>1-year</td><td>60</td></tr>
<tr><td rowspan="2">PM10</td><td>24-hr</td><td>50</td></tr>
<tr><td>1-year</td><td>20</td></tr>
<tr><td rowspan="3">PM25</td><td>1-hr</td><td>80</td></tr>
<tr><td>24-hr</td><td>28</td></tr>
<tr><td>1-year</td><td>10</td></tr>
<tr><td>CO</td><td>1-hr</td><td>15000</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Question #</th><th>Subject/Reference</th><th>Preamble/Rationale</th><th>Information Request</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><td></td><td>8-hr</td><td>6000</td></tr>
<tr><td></td><td>1-year</td><td>6000</td></tr>
<tr><td rowspan="3">NO2</td><td>1-hr</td><td>200</td></tr>
<tr><td>24-hr</td><td>200</td></tr>
<tr><td>1-year</td><td>60</td></tr>
<tr><td rowspan="3">SO2</td><td>1-hr</td><td>450</td></tr>
<tr><td>24-hr</td><td>150</td></tr>
<tr><td>1-year</td><td>30</td></tr>
<tr><td rowspan="2">Benzene</td><td>1-hr</td><td>30</td></tr>
<tr><td>1-year</td><td>3</td></tr>
<tr><td rowspan="2">Toluene</td><td>1-hr</td><td>1880</td></tr>
<tr><td>24-hr</td><td>400</td></tr>
<tr><td>Ethylbenzene</td><td>1-hr</td><td>2000</td></tr>
<tr><td rowspan="2">Xylenes</td><td>1-hr</td><td>2300</td></tr>
<tr><td>24-hr</td><td>700</td></tr>
<tr><td rowspan="2">H2S</td><td>1-hr</td><td>14</td></tr>
<tr><td>24-hr</td><td>4</td></tr>
<tr><td rowspan="2">TRS</td><td>1-hr</td><td>7</td></tr>
<tr><td>24-hr</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>115.</td><td>Air Quality – Marine Dispersion Modeling
A3S4J7 PDF Page 47 3.4.3.1 CALMET
(Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)</td><td>The meteorological fields used to drive the CALPUFF dispersion model are an important source of uncertainty in the model.</td><td>EC requests that the Proponent provide details about the WRF modeling set-up (e.g. how often the model was re-initialized, parameterizations used (c.f. convective, PBL processes), if any nudging was used, etc.) as well as a full model evaluation are requested.</td></tr>
<tr><td>116.</td><td>Air Quality – Marine Dispersion Modeling
A3S4J7 PDF Page 47, 3.4.3.1 CALMET</td><td>The dispersion modeling over Marine RSA has been performed for only a single year. Given the high modeled concentrations, a longer modeling period is needed to capture sufficient meteorological variability</td><td>EC requests that the Proponent use a 4-year modeling period (to be consistent with the Edmonton terminal modeling) and present the results. The extended</td></tr>
</table>

Question #	Subject/Reference	Preamble/Rationale	Information Request
	(Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	to characterize the potential air quality impacts resulting from the Project.	modeling period does not have to use WRF output, and the CALMET meteorological fields can be developed from surface station data. EC can assist by providing hourly upper air data from the Squamish Airport RASS wind profiler (2008-2013) if needed.
117.	Air Quality – Marine Dispersion Modeling A3S4J7 PDF Page 50, 3.4.3.2 CALPUFF (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	The presence of buildings or other obstructions influences how emissions from stacks are mixed near the release point. Such mixing can greatly influence surface concentrations.	EC requests that the Proponent provide a detailed description of any near field obstructions influencing the marine stack emissions when marine vessels are at berth.
118.	Air Quality Marine Dispersion Modeling A3S4J7 PDF Page 54, 3.4.3.3 Model Output Interpretation (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	Application of scaling factors will assist in understanding interpretation of model outputs.	EC requests that the Proponent use scaling factors to relate the output from the worst-case scenarios to the 24-hour and annual average concentrations.
119.	Air Quality – Marine Dispersion Modeling A3S4J7 PDF Page 58, 3.4.3.4 Determination of Background (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	It is unclear why the single Kensington Park station was used to define the background concentration for criteria air contaminants and BTEX. Representative background concentrations should be added to the dispersion modeling results to assess the full impact of the Project on the ambient air quality.	EC requests that the Proponent consider all representative stations in the area in determining the representative background concentration.

Question #	Subject/Reference	Preamble/Rationale	Information Request
120.	Air Quality – Marine Existing Air Quality A3S4J7 PDF Page 71, Section 4.1.1.8 Robson Square BTEX concentrations & 4.1.1.9 Saturna Island BTEX concentrations (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report) And A3S1U1 PDF Page 166, Section 4.1.2.3 Burnaby to Westridge Segment (Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report)	NAPS VOC samples are quality controlled. One BTEX sample from Robson Square, two BTEX samples from the Saturna Island station and two BTEX samples from the Vancouver Burmount station were removed from the analysis. Without more detail, it cannot be concluded that these concentrations are not representative of extreme but otherwise valid conditions in the area.	In terms of the Robson Square (4.1.1.8), Saturna Island (4.1.1.9) and Burmount (4.1.2.3) BTEX datasets, EC requests that the Proponent: a) provide additional detail about the size of BTEX samples used when calculating the existing concentrations at T01, Saturna Island and Vancouver Burmount, (before and after the 'outliers' were removed); b) specify how many standard deviations these outliers are from their long term station means; and c) provide calculated yearly values with these outliers included as well as a discussion on how their inclusions would alter the findings.
121.	AQ Modeling – Marine Dispersion A3S4J7 PDF Page 80, Section 4.3 Model Results (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	Correct interpretation of the modeling results is dependent on an understanding of the emissions used in the modeling. It is unclear what sources were modeled and how the transient nature of the modeling was handled.	To better understand how the marine base case emissions were set-up, EC requests that the Proponent provide a table of which sources (point, area or line) were modelled (ships, barges, tugs), in connection with which activity (loading, transiting, anchoring, berthing), and describe in detail the spatial and temporal allocation of emissions from each source. Please include additional information such as degree of vapour recovery assumed.

Question #	Subject/Reference	Preamble/Rationale	Information Request
122.	AQ Modeling – Marine Dispersion A3S4J7 Section 3.4.3.2 CALPUFF PDF Page 51. (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	Ozone and $PM_{2.5}$ formation involve complex non-linear chemical processes. As a result, although the Project is not expected to result in in changes in jet fuel transport activity, the impact of the fugitive emissions from the jet fuel barges likely will not "cancel out between existing conditions and projected future conditions". Rather it is important to consider the highly volatile nature of jet fuel and the non-linearity in the ozone photochemistry. In addition, crude oil barges have a larger VOC emission factor than tankers, and it is anticipated that during crude oil barge loading, short term increases in VOC emissions are possible.	If jet-fuel barge emissions were not modeled in the CMAQ scenarios, EC requests that the Proponent undertake new CMAQ runs that include jet-fuel barge emissions, and report on the results.
123.	AQ Modeling – Marine Dispersion A3S4J7 PDF Page 54, Section 3.4.3.3 Model Output Interpretation (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	It is important to understand how the daily and annual concentrations fields were developed from the CALPUFF modeling.	EC requests that the Proponent clarify the following passage: *"Since the CALPUFF modelling was based on a worst-case scenario of one Aframax vessel travelling in and out along the shipping routes, a direct summation of the results from all model runs yielded maximum expected 1-hour average concentrations. 20-hour average concentrations from the CALPUFF modelling represents a total of 24 Aframax vessels travelling in and out along the shipping routes, and annual average concentrations from the CALPUFF modelling represent a total of 8760 Aframax vessels travelling in and out along the shipping routes for the Project; therefore, 24-hour and annual*

Question #	Subject/Reference	Preamble/Rationale	Information Request
			average concentrations were estimated by applying scaling factors using the CALSUM post-processing software." The clarification should explain use of a 20-hour 24 Aframax ship total and specify the scaling factors used in the CALSUM software.
124.	Air Quality – Marine Dispersion Modeling A3S4J7 PDF Pages 80-88, Sections 4.3.1 and 5.2.1 CACs and VOCs and Tables 4.9 and 5.3. (Volume 8B Technical Report 8B-3 Marine Air and Greenhouse Gas Marine Transport Technical Report)	The modeled 1-hour average NO_2 for both the marine base and application cases shows concentrations higher than the 200 ug/m^3 standard. Clarification is required to facilitate an adequate assessment of potential impacts and has relevance to the operational management plan.	EC requests that the Proponent: a) provide plots showing the frequency of exceedences for any species and at any averaging times, where a model exceedence is predicted; b) provide a list of sensitive receptors impacted by modeled 1-hr NO_2 concentrations exceeding the 200 ug/m^3 air quality standard; and c) provide a discussion of the meteorological conditions contributing to the NO_2 exceedences.
125.	Air Quality – CACs Table 4.3.3.3 in Vol 8A	It is important to have a consistent basis for comparisons between current and Project conditions and to be clear about the magnitude of Project impacts on air quality. Based on the information presented in the Application, it is not possible to draw a comparison between net changes as a result of the Project and the Ambient Air Quality Objectives (AAQO).	EC requests that the Proponent revise all air quality comparative Tables in Volumes 5A and 8A to show max modelled concentrations with and without Project as compared to AAQO. It is optional to include net changes.
126.	Air Quality – CACs	The conclusions drawn on significance in Volume 5A Section 7 are inconsistent with the modelling results	EC requests that the Proponent explicitly reference and consider results

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Section 7 in Volume 5A	provided in Section 5 of Volume 5C.	from Table 5.21, Volume 5C in the assessment effects on air quality reported in Volume 5A.
127.	Air Quality – CACs Volume 5C – Exec Summary	It is important to understand how AAQO have been applied to determine exceedences and interpret impact significance.	EC requests that the Proponent clarify the statement "Project-related concentrations were less than application ambient air quality objectives" in the context of exceedences shown for SO_2, $PM_{2.5}$, and NOx in the isopleths.

List of References (copies of documents without a link can be found in Appendix 1)

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Information Requests from Natural Resources Canada

Question #	Subject/Reference	Preamble/Rationale	Information Request
Marine Geoscience (IR 1.0 – 1.5)			
1.0	Tsunami Hazard (i) Trans Mountain Expansion Project Volume 4A - Project Design and Execution - Engineering p. 4A–93 (ii) Trans Mountain Expansion Project Volume 5A – Environmental and Socio-Economic Assessment – Biophysical, Section 7.10.1 Environmental Conditions Not Considered p. 7-530-531; 7.10.1.6 Tsunami p. 7-531. References: K. W. Conway, R. B. Kung, J.V. Barrie, P.R. Hill, and D.G. Lintern, "A preliminary assessment of the occurrence of submarine slope failures in coastal British Columbia by analysis of swath multibeam bathymetric data collected 2001-2011", Natural Resources Canada, Geological Survey of Canada, Open File 3748 (2013): 38 p. L.J. Leonard, G.C. Rogers and R.D. Hyndman, "Annotated bibliography of references relevant to tsunami hazard in Canada", Natural Resources Canada, Geological Survey of Canada, Open File 6552 (2010): 269 p.	The proponent states in Volume 4A that "*A review of publicly available information suggests that hazard from local tsunamis is 'very low' for the area. A landslide at the head of Indian Arm may be a possible source of a tsunami type event; however, there are no records of such an event ever occurring.*" NRCan was unable to locate any references or analysis provided to support this statement. The lack of a record may only indicate that such an event has not been documented within historical times. There are reports of significant tsunamis resulting from submarine landslides and sidewall slides having occurred in other BC fjords, notably Kitimat Arm, in Alaskan fjords and in Norwegian fjords (Leonard et. al., 2010). Conway et. al., (2013) identified several possible submarine slides on the sidewalls of Indian Arm and Burrard Inlet that are visible on the seabed in multibeam sonar bathymetric images. One of the possible submarine landslide features is approximately 2 km west of the Westridge terminal. In Volume 5A, a reference is made to a tsunami generated from a block slide occurring on the Fraser Delta but there does not appear to be any information on submarine slides in Indian Arm and Burrard Inlet.	Please provide detailed supporting evidence and a rationale for the "very low" tsunami hazard evaluation. This should include: (a) Identification of potential tsunamigenic submarine landslide sources in Indian Arm and Burrard Inlet; (b) Estimation of the potential tsunami wave height that could be generated by the identified landslide sources; (c) Evaluation of the potential for propagation of tsunami waves from these sources to the Westridge site; (d) If necessary, a revised evaluation of the tsunami hazard.

Question #	Subject/Reference	Preamble/Rationale	Information Request
1.1	Tsunami Risk along the Transport Route (i) Trans Mountain Expansion Project Volume 8A – Marine Transportation Section 4.3.14.2 Potential Effects and Mitigation Measures p. 8A-442. (ii) Trans Mountain Expansion Project Volume 8C – TERMPOL TR 8C-12 TERMPOL 3.15 General Risk Analysis and Intended Methods of Reducing Risks December 2013 References: Leonard, L.J., Rogers, G.C., and Hyndman, R.D. 2010. Annotated Bibliography of References Relevant to Tsunami Hazard in Canada; Geological Survey of Canada, Open File 6552, 269 p. Leonard, L.J., Rogers, G.C., and Mazzotti, S., 2012. A preliminary tsunami hazard assessment of the Canadian coastline; Geological Survey of Canada, Open File 7201, 126 p. doi:10.4095/292067	In this section it is stated that: "*An earthquake, either on land or under the ocean, would not produce a mechanism by which Project-related marine traffic could become affected. The marine shipping lanes are not in close enough proximity to the shoreline that an earthquake-related tsunami would produce a noticeably large wave (see TERMPOL 3.15 in Volume 8C [TR 8C-12] for more information)".* In the TR 8C-12 report, "*General Risk Analysis…*", it is stated that, according to the Emergency Management BC web site: "*Port Metro Vancouver and terminals in the Burrard Inlet have not been identified as at risk locations*" for tsunamis. It is further stated that vessels at sea would not face any challenges from tsunamis due to the long wavelength and low amplitude of a tsunami wave. The above statements refer to the case of an earthquake-triggered tsunami generated offshore of Vancouver Island that would only propagate weakly into the Strait of Georgia. As acknowledged in the report, local tsunamis can also be generated by rockfalls and submarine landslides. Leonard et. al., (2012) have conducted a thorough review of tsunami hazard in Canada, including coastal BC and the transportation route. They made the following statements: "*The Strait of Georgia, including low-lying parts of greater Vancouver, is also potentially at risk from submarine landslide tsunamis, particularly from the foreslope of the Fraser River delta". Modelling of tsunamis from theoretical 0.23 and 0.75 km3 failures of delta foreslope sediments can produce peak-to-trough wave amplitudes of up to 8 and 18 m, respectively, across the strait on the east coasts of Mayne and Galiano Islands; smaller waves (1-4 m) result for the mainland coast due to bathymetric reflection of the initial wave*". "*With no frequency-size data available for potentially tsunamigenic local landslides on the Pacific coast, we cannot include these sources in the probabilistic tsunami analysis. However, all Pacific coastlines are considered at risk from locally-generated waves due to the high susceptibility of these areas to landslides, or proximity to high-susceptibility areas*". Leonard et. al., (2010) also provide an annotated bibliography of papers and reports related to tsunami risk.	Please provide a detailed analysis of the tsunami risk along the transportation route, including: (a) A review of all potential sources and effects of tsunamis along the route; (b) A more detailed analysis of the tsunami hazard and resultant oil spill risk; (c) If warranted based on the above analysis, a statement of the possible mitigation actions.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		Whereas a tanker in open water would likely be safe from harm, a tanker travelling through the more constricted sections of the transportation route, notably the narrow passages between the Strait of Georgia and Haro Strait, might be affected by extreme currents associated with a series of tsunami waves and by localized breaking of the waves on shoals and shores, thus increasing the risk of grounding and oil spill. Because submarine landslides are more likely to occur when triggered by large earthquakes, there is a potential scenario whereby a tsunami-caused oil spill occurs at a time of major earthquake damage when emergency response may be more difficult to enact. It is therefore important to thoroughly assess the hazard of tsunamis from different sources and to include this in the risk analysis.	
1.2	Turbidity and Silt Curtains – Mitigation Measure (i) Trans Mountain Expansion Project Volume 6D, Westridge Marine Terminal Environmental Protection Plan, (ii) Appendix F: Drawings; Drawing 4, p. 2 of 2.	It is acknowledged that detailed operational considerations concerning the installation of turbidity curtains are provided in Drawing 4. Turbidity/silt curtains are a proposed mitigation measure for reducing sediment and water quality impacts during dredging. Turbidity/silt curtains are likely to suffer reduced functionality when surface waves are high and/or bottom currents are strong. It is important to understand if this mitigation measure will be effective under all the environmental conditions likely to be encountered during dredging operations or whether the mitigation measure could be compromised under conditions of high surface waves or strong bottom currents.	(a) Please indicate the range of acceptable operational conditions for use of turbidity/silt curtains. (b) Please provide information with respect to the actual environmental conditions (waves and currents) likely to be encountered. (c) Please indicate which technical guidelines or standards will be adhered to when using turbidity/silt curtains as a mitigation measure.

Question #	Subject/Reference	Preamble/Rationale	Information Request
1.3	Environmental Protection Plan Trans Mountain Expansion project Volume 6D, Westridge Marine Terminal Environmental Protection Plan, p. 7.2, Extreme Weather/Poor Oceanographic Conditions, 15. Monitor weather patterns and oceanographic conditions daily	Mitigation measure 15 indicates that the proponent's contractor will "*Monitor weather patterns and oceanographic conditions daily to allow for schedule changes and contingency planning*". Mitigation measure 17 indicates that work would be suspended "*if … poor oceanographic conditions occur onsite that may pose risks to the environment or environmental protection measures*". With respect to oceanographic conditions, there is a wide range of possible monitoring levels, from visual observation to real time monitoring of waves and currents etc. These conditions may change on an hourly basis depending on wind and state of tide. For management of sedimentation issues during construction and dredging operations, monitoring of oceanographic conditions such as currents and waves may therefore be required more frequently than the daily monitoring that is indicated.	Please provide details on: (a) The intended oceanographic monitoring techniques; (b) The frequency of planned measurements/observations during construction and dredging operations; (c) Justification for the approach with respect to the managing of sedimentation issues during construction and dredging operations.
1.4	Water Quality Management Plan (i) Trans Mountain Expansion project Volume 6D, Westridge Marine Terminal Environmental Protection Plan, (ii) Appendix C: Management Plans, Table C5-1 and p. C-19 to C-20.	The water quality management plan refers to "*background levels*" of total suspended solids (TSS) and turbidity under clear and turbid conditions but does not explain how these levels are determined. Considerable variability of ambient turbidity might be expected over hourly to monthly time scales due to tidal effects. Knowledge of this ambient variability would be required to adequately manage water quality events and avoid the situation where the reference level varies during the water quality management period. This may also avoid taking unnecessary actions caused by misunderstanding of occasional point measurements.	Please provide either: (a) A summary of measurements that capture the TSS or turbidity variation over hourly to monthly time scales close to the project site; or (b) A section in the management plan to establish this variability in advance of construction operations.
1.5	Oil Mineral Aggregation Trans Mountain Expansion Project Volume 7, Pipeline Facilities Technical Reports, Ecological Risk Assessment of Westridge	This section refers to OMA (oil-mineral aggregation): "*Sedimentation of oil can occur when dispersed oil enters the water column, if it combines with suspended particulate matter, and settles to the bottom. Testing carried out in support of the Project showed that CLWB did not sink by itself after ten days exposure on brackish water (Witt O'Brien et. al., 2013). Oil spill modeling indicated that negligible amounts of oil would become suspended as droplets in the water column, as a result of the sheltered nature of Burrard Inlet*	(a) Please provide a literature review related to the concentration of suspended sediment particles that is required for OMA to be effective and compare this to empirical data from Burrard Inlet. (b) Please add a similar analysis of the potential

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Marine Terminal Spills Technical Report, p. 7-1 to 7-2	*and the relatively viscous characteristic of the oil. Very little suspended sediment is present in the waters of Burrard Inlet. Taking these factors into consideration, formation of OMA and sinking of oil is an unlikely scenario*." NRCan notes that no reference is made to this process in the previous section when discussing the effects of the 160 m^3 scenario. NRCan could find no information on the level of suspended sediment particles required for OMA to be effective in order to evaluate the assertion.	role of OMA in section 6.
Seismicity (IR 2.0 – 2.17)			
2.0	National Building Code of Canada - updates Trans Mountain Expansion Project Volume 4A - Project Design and Execution - Engineering- Section 2.9.3 Seismic Hazards, p. 4A-12	"*The TMEP Line 2 pipeline and facilities, including tanks, will be designed for seismic loading corresponding to a two per cent probability of exceedance in 50 years (equivalent to a return period of 2,475 years), which is consistent with the current requirements of the National Building Code of Canada*." NRCan notes that the National Building Code of Canada will be updated in 2015.	Please confirm that the "current requirements" refer to the codes in effect at the time of design/construction of the Project.
2.1	National and Provincial Building Codes (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 1.2 Performance Standard p. 2	*"TMPL Line 2 pipeline facility upgrades and design will be consistent with the 2006 Building Code of British Columbia (BCBC) and the 2010 National Building Code of Canada (NBCC)."* NRCan notes that the British Columbia Building Code (BCBC) was updated in 2012 and the National Building Code of Canada (NBCC) will be updated in 2015.	Please confirm that the latest building codes (in effect at the time of design/construction) will be utilized
2.2	Seismic Hazards (i) Trans Mountain Expansion Project Volume 4A - Project Design and Execution – Engineering, Section 2.9.3	"*As part of preliminary studies, a screening level assessment of two of the most dominant seismic hazards, liquefaction potential and seismically induced landslides, has been completed along the entire pipeline corridor and is included in the Seismic Assessment Desktop Study Report in Appendix J. Those areas along the route identified as having elevated liquefaction or landslide potential will then have site-specific studies and investigations undertaken during*	Please provide details on the studies to be undertaken.

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Seismic Hazards, p. 4A-12. (ii) Appendix J Seismic Assessment Desktop Study Report	*the detailed engineering and design phase to ensure the adequacy of the pipeline design.*" NRCan notes that these site-specific studies to be undertaken will be critically important to Project design.	
2.3	Faults Trans Mountain Expansion Project Volume 4A - Project Design and Execution – Engineering, 2.9.3 Seismic Hazards, p. 4A-12.	"*Although no active faults (where rupture has occurred in the last 11,000 years) have been identified in BC, studies will be conducted as part of the detailed engineering and design phase in an attempt to further confirm the presence or absence of active faults crossing or running close to the route. In the event that a potentially active fault is discovered, the pipeline design will be site specifically modified to accommodate the direction and possible magnitude of movement across the fault.***"**	Please provide more details on the proposed studies. (a) Will LiDAR data be collected and analysed? (b) If a potentially active fault is discovered, what techniques will be used to estimate the direction and magnitude of movement?
2.4	Potential Faulting along the Pipeline Route (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J. Seismic Assessment Desktop Study p. i	"Y*oung faults, particularly those that have been active within the past 10,000 to 16,000 years (the interval since the last Cordilleran glaciers disappeared), pose the greatest hazard to the TMPL Line 2 and related facilities. The hazard stems from strong ground motions and permanent ground displacement due to surface fault rupture. Owing to glacial and post-glacial geological processes, dense forest cover, and human activity, most evidence that might constrain fault activity is obscured or obliterated, and thus the location of young onshore faulting is poorly understood. The TMPL Line 2 corridor does not intersect any known postglacial faults, but intersects or approaches four faults with suspected Quaternary or post-glacial activity:* • *The Sumas fault (SF) around RK 1115* • *The Vedder Mountain fault (VMF) between RK 1075 and 1106* • *The Fraser River-Straight Creek fault system (FRSC) around RK 1045* • *The Rocky Mountain Trench (RMT) between RK 505 and 525"* NRCan agrees with this statement.	Please provide details on: (a) How potential faulting will be identified along the pipeline route in general, and, specifically at the four potentially active faults mentioned. Will LiDAR be used along the entire pipeline corridor? (b) How will potential displacement and recurrence rates be estimated?

Question #	Subject/Reference	Preamble/Rationale	Information Request
2.5	Bedrock Faults (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 2.3.2 Crustal and In-slab Earthquakes p. 16	*"A fault is considered active if there is clear evidence for post-glacial slip and potentially active if evidence for post-glacial activity is uncertain or equivocal. The TMPL Line 2 corridor crosses many other mapped bedrock faults: these have no demonstrable relation to contemporary tectonics and no evidence for post-glacial activity, and thus do not present a surface-rupture hazard."* NRCan notes that, as described on p. i of Appendix (J), "*Owing to glacial and post-glacial geological processes, dense forest cover, and human activity, most evidence that might constrain fault activity is obscured or obliterated, and thus the location of young onshore faulting is poorly understood."*	How can the proponent rule out other "hidden faults" that may pose a surface-rupture hazard along the corridor? Will LiDAR data be collected and analyzed for the entire length of the corridor?
2.6	Foundation Design Standards Trans Mountain Expansion project Volume 4A - Project Design and Execution – Engineering, Sections 3.4.2, 3.4.3, 3.4.4	NRCan notes that the Proponent has indicated the Sumas, Burnaby, and Westridge Terminals, tanks and their foundations will be designed in accordance with API 650 and the CCME Guidelines.	Please confirm that site effects (soil effects) will be considered and accounted for in the design. For the Burnaby tank farm, located on the side of Burnaby Mountain, please confirm that potential "topographic effects" that may amplify ground shaking are considered and being accounted for.
2.7	National Building Codes (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 1.2 Performance Standard p. 3	"TMPL Line 2 pipeline facility upgrades and design will be consistent with the 2006 Building Code of British Columbia (BCBC) and the 2010 National Building Code of Canada (NBCC)". NRCan notes that the British Columbia Building Code (BCBC) was updated in 2012 and the National Building Code of Canada (NBCC) will be updated in 2015.	Please confirm that the latest building codes (in effect at the time of design/construction) will be utilized.
2.8	Hazard Assessment - 1872 Earthquake (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment	*"A major earthquake in 1872 near Lake Chelan, Washington, caused damage and yielded moderate shaking intensities around Seattle, Vancouver, and Victoria (Stover and Coffman, 1993). Magnitude estimates range from 6.8 (Stover and Coffman, 1993) to 7.4 (Earthquakes Canada, 2013b)."* NRCan notes that the 1872 Washington State earthquake was followed by numerous	Please use this latest work on the 1872 earthquake in hazard assessments.

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Desktop Study, Section 2.3.2 Crustal and In-slab Earthquakes p. 8 Reference: http://assets.pnsn.org/HIST_CAT/SSA01274.pdf	aftershocks and is interpreted as a shallow event. The most recent article on this earthquake is Bakun et. al., published in BSSA in 2002 (please see the reference).	
2.9	Seismic Events resulting from Oil and Gas Activities (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 2.3.2 Crustal and In-slab Earthquakes p. 8	*"Clusters of small (MW<5) earthquakes in the east side of the Rocky Mountains could be associated with oil and gas withdrawal, and do not likely represent tectonic activity (Wetmiller, 1986)."* NRCan agrees that these are not likely tectonic events, but nonetheless these represent seismic events that produce ground shaking.	Please examine the latest seismicity in the vicinity of oil and gas extraction and describe the current state of knowledge for potential induced seismic events associated with ongoing oil and gas activities in the region.
2.10	Site Specific Investigations (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 2.3.2 Crustal and In-slab Earthquakes p. 16	*"Site-specific geological investigations to constrain the location, recurrence, and magnitude of surface rupture displacement at each of these suspected-active crossings have not been completed. These parameters could be sufficiently well constrained to permit pipeline crossing design through a review of remote-sensing data (e.g., aerial photographs or LiDAR imagery), site geological mapping, and subsurface investigations.* *Where post-glacial surface-rupture activity is confirmed by a site investigation, mitigation options for pipeline fault crossings might include:* • *Enlarged trench excavations and granular or light-weight engineered backfill;* • *Above-ground crossings* • *Protective or slip casings; or* • *A combination of the above."*	Please confirm that these studies (LiDAR and others described, as required) will be conducted.

Question #	Subject/Reference	Preamble/Rationale	Information Request
2.11	National Building Codes of Canada (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 2.3.2 Crustal and In-slab Earthquakes p. 17	**"***Peak ground and spectral accelerations were obtained from the GSC's 2010 NBCC PSHA update."* NRCan notes that the NBCC seismic provisions are being updated, and will be incorporated in the 2015 NBCC.	Please use ground shaking values from the appropriate NBCC (likely the 2015 NBCC update).
2.12	Ground Motions (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 2.3.2 Crustal and In-slab Earthquakes p. 21	*Median ground-motion predictions for the Sumas, Vedder Mountain, and Rocky Mountain Trench scenarios are larger than the 1:2475 APE ground motions. Scenario earthquake recurrence is therefore important in evaluating the relevance of the deterministic estimates.* *Detailed paleoseismic studies of these faults, and other suspected-active faults near the alignment, might help resolve uncertainties about the magnitudes and recurrence intervals for characteristic earthquakes."* NRCan agrees.	Please describe how this will be addressed. Will LiDAR and/or detailed paleoseismic studies be conducted to help resolve these issues?
2.13	Hazard Deaggregation - Westridge Terminal (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study, Section 5.2.1 Peak Ground Acceleration Deaggregations p. 26	"Hazard deaggregations were obtained for 15 locations along the TMPL Line 2 corridor" NRCan notes that these results (summarized in Table 5.2) are used to assess liquefaction opportunity.	Please clarify as to why are the calculations not done for the Westridge Terminal site? NRCan requests that this calculation be undertaken.
2.14	Site Specific Investigations (i) Trans Mountain Expansion Project Volume 4A	"*Detailed, site-specific geotechnical investigations should be undertaken to support the seismic design of TMPL Line 2 facilities, including the pipeline itself, where they may be exposed to strong ground motions or permanent ground displacement due to surface fault rupture,*	Please confirm that these investigations will be undertaken as this site is situated in a region of highest seismic hazards for the proposed route.

Question #	Subject/Reference	Preamble/Rationale	Information Request
	(ii) Appendix J Seismic Assessment Desktop Study, Section 5.2.1 Peak Ground Acceleration Deaggregations p. 39	*liquefaction, or seismically induced landsliding. The results presented in this report may serve to guide the selection of sites and facilities for detailed investigation.*" NRCan agrees.	
2.15	Site Specific Soil Conditions Impacting Ground Motions (i) Trans Mountain Expansion Project Volume 4A (ii) Appendix J Seismic Assessment Desktop Study	Throughout this appendix, shaking values referenced to Site Class C soil conditions (firm soil or soft rock) are utilised. Site effects based on Vs30 are utilized for landslide opportunity (as described on p. 33-34). As described on p. 38 of this Appendix, "*The ground-motion predictions described above are for reference site conditions (very dense soil and soft rock). Actual site conditions vary with the changing geology and terrain along the TMPL Line 2 corridor. Softer or firmer soils beneath a site may amplify or damp incoming seismic energy, yielding higher or lower peak ground-motion amplitudes. Similarly, the steep slopes affect ground motion amplitudes at each site. Seismic design for specific facilities or crossings should reference site-specific ground-motion estimates based on site geological conditions*."	Please confirm that site effects (for varying site conditions) will be considered for seismic shaking levels, and describe the methodology (or methodologies) to be used.
2.16	Instrumentation Trans Mountain Expansion Project Volume 5A, Section 7.0 Environmental Affects Assessment, Section 7.10.2 Potential Effects and Mitigation Measures	In Table 7.10.1 (p. 533) the risk of seismic hazards is discussed. "*3. Seismic hazards All Soil LSA • Suspend work immediately in the event of a seismic event. Refer to Volume 4B, Section 5.4 for the Emergency Response Plan for further response measures to be taken in the event of seismic activity occurring during construction [Section 7.0].* *• Implement KMC's Natural Hazards Management Program.* *• Further assessments will be conducted along the proposed pipeline corridor to assess site-specific seismic potential.* *• Pump stations will be equipped with vibration monitoring equipment.* *• Seismic activity may damage the pipeline or facilities."* NRCan notes that pump stations will be equipped with "vibration monitoring equipment".	Please describe the "vibration monitoring equipment". Will this be earthquake monitoring instruments (strong motion) that can provide engineers with information on the level of shaking the facility experienced?

Question #	Subject/Reference	Preamble/Rationale	Information Request
2.17	Site Specific Studies – Implications on Existing Infrastructure Trans Mountain Expansion Project Volume 5A, Section 7.0 Environmental Affects Assessment, Section 7.10.4 Significance Evaluation of Potential Residual Effects p. 538	*"The commitment of Trans Mountain to reduce the earthquake risk to the existing TMPL is ongoing and includes several investigations and major construction mitigation measures. Further seismic assessments along the proposed pipeline corridor and existing TMPL will include site-specific assessment of: ground shaking amplification; the potential and anticipated displacement due to liquefaction and land sliding triggered by shaking; and the location, likelihood and anticipated displacement at fault crossings (see Volume 4A for further details)."* NRCan notes the importance of this approach and this work.	Please provide details on the assessment of ground shaking amplification. Will existing infrastructure be retrofit if site-specific studies reveal higher hazard than considered in the original design?
Terrain Hazards (IR 3.0 – 3.7)			
3.0	Terrain Mapping and Hazards (i) Trans Mountain Expansion Project Vol. 4A; (ii) Appendix H Terrain Mapping and Geohazard Inventory; Section 1.2 Scope, p 3	In the documents reviewed the proponent states in Volume 4A that "*Where the pipeline parallels large rivers, such as the Fraser River, mapping was completed only on the side of the river on which the pipeline is located*". NRCan is concerned about this unilateral decision as hazards such as long run-out rock avalanches could also impact the pipeline integrity on the opposite side of the steep river valley.	Please provide evidence and technical reasoning why hazards such as rock avalanches originating on the opposite side of a steep river valley will not affect the pipeline or its integrity.
3.1	Terrain Stability (i) Trans Mountain Expansion Project Vol. 4A (ii) Appendix H Terrain Mapping and Geohazard Inventory; Section 2.3 Terrain Stability Interpretations, p 4	In Volume 4A the proponent states "*Terrain stability refers to the potential for slope instability or erosion within the polygon following disturbance by construction*" It is NRCan's understanding that this working definition is inadequate as it does not include slope instability which has the potential to be impacted by the construction activities. Such a definition impacts the working premise of the study to exclude natural processes.	Please explain the need for this restrictive definition which excludes slope instability from natural processes.
3.2	Physiographic Areas and Terminology	In the "Table 3.1 Field Checking by Physiographic Area" NRCan is unclear of the column titles	Please provide an explicit definition that has been used for each of the five columns in this table and

Question #	Subject/Reference	Preamble/Rationale	Information Request
	(i) Trans Mountain Expansion Project Vol. 4A (ii) Appendix H Terrain Mapping and Geohazard Inventory; Section 3.0 Field Surveys, p 11	that are used for description of the physiographic areas along the pipeline corridor. An explanation is requested for a better understanding of the resultant numbers.	the derivation procedure used to calculate the two percentage columns for ground observations and field checking total.
3.3	Offshore Geotechnical Considerations (i) Trans Mountain Expansion Project Vol. 4A (ii) Appendix H Terrain Mapping and Geohazard Inventory; Section 3.4.4.2.2; Earthworks; p 4A-90	In Volume 4A, the proponent states "*During the detailed engineering and design phase, a detailed topographical survey will be completed ….geotechnical survey of both the shore and seabed…risk of liquefaction of the existing fill soils, in the foreshore area*.." NRCan agrees with these concerns but it is not clear to NRCan if the proponent is giving due consideration to all facets.	(a) Please clarify what geotechnical considerations will be given to the 100 m plus of onshore deposits skirting the facilities (type and depth of drilling, sampling, when and type of testing?). (b) Please explain the likely construction model that will be built during expansion of the foreshore, front slope gradient, projected thickness of the fill, and the type of assessment to the underlying marine sediments to be undertaken.
3.4	Seabed Integrity (i) Trans Mountain Expansion Project Vol. 4A (ii) Appendix H Terrain Mapping and Geohazard Inventory; Section 3.4.4.2.3; Dock Pile Foundations, p 4A-90	In Volume 4A the proponent states "*Based on the assumptions regarding the existing seabed, the preliminary configuration of piles….and trestles*" certain pipe piles are being proposed for construction by the proponent. NRCan is unclear about the statement and would like to have more information about the assumptions regarding the existing seabed. NRCan notes that this could influence the subsequent decision making in the selection and configuration of the piles used for construction. It is important for NRCan to have this information for a proper evaluation of the selected decisions.	Please provide details of the assumptions regarding the existing seabed at this location, so that there is a better understanding of the decision process in the selection of the piles based on these assumptions.

Question #	Subject/Reference	Preamble/Rationale	Information Request
3.5	Terminology (i) Trans Mountain Expansion Project Vol. 4A (ii) Appendix H Terrain Mapping and Geohazard Inventory; Section 6.0, Geohazard Inventory; p 23	Vol. 4 A Appendix H "Terrain Mapping Geohazard Inventory Section 6.0 "Geohazard Inventory" p.23 , a reference is mentioned for "Geohazards, 2006" but a full citation is missing. This citation will help NRCan understand the concept of the geohazard used for this project.	Please include the full citation for this reference which is not present on page 32 under References of Appendix H.
3.7	Pipeline Integrity and Safety (i) Trans Mountain Expansion Project Vol. 4A. (ii) Appendix H Terrain Mapping and Geohazard Inventory; p. 23	In volume 4A, on page 23, the proponent identifies a total of nine river crossings for the pipeline which they recognize as being of high risk to various natural hazards. NRCan was unable to locate a proposed program or protocol that will be adopted for real time monitoring of the natural hazards that could impact the nine river crossings.	Please provide information regarding the methods and technology that will be adopted for real time monitoring of the nine high risk river crossing sites as they pertain to the potential natural hazards.
Groundwater Contamination (IR 4.0 – 4.1)			
4.0	Groundwater Contamination Groundwater Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, REP-NEB-TERA-00004, prepared for Trans Mountain Pipeline ULC, prepared by Waterline Resources Inc., December 2013.	In Table 3.2-1 (Assessment indicators and measurement endpoints for groundwater quality and quantity) and in Table 5.1-1 (Potential effects and mitigation measures of pipeline construction and operations on groundwater indicators), the proponent identifies aquifers or wells vulnerable to possible future contamination from a spill during construction. NRCan agrees that this is an important groundwater indicator. NRCan notes, however, that the proponent has not extended this indicator to include spills during the operations period. The potential for pipeline and facility leaks or ruptures during operations is not mentioned in the Groundwater Technical Report or in key sections of the EIS that deal with groundwater (e.g., Volume 5A, Sections 5.3.3 and 7.2.3). It is unclear why the proponent did not address this potential source of groundwater contamination. One method of assessing the potential for pipeline and facility leaks and ruptures during	(a) Clarify if the potential for pipeline and facility leaks or ruptures during operations was assessed. If not, please provide this information. (b) Clarify if the historical record of spills on the existing Trans Mountain Pipeline was assessed for the potential for pipeline and facility leaks and ruptures during operations. If not, please provide such an assessment, ensuring that the following questions are considered: • Did any of the recorded spills impact groundwater quality? • How were the effects of these spills on

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Reference (i) Trans Mountain Expansion Project Volume 4C - Project Design and Execution Operations and Maintenance	operations is to examine the historical record for pipeline and facility leaks and ruptures. There were 78 recorded spills on the existing Trans Mountain Pipeline since 1961. It is unclear if the proponent has examined these records to assess if any of these spills caused an impact to groundwater, how the effects of these spills were mitigated, what lessons were learned and can be applied to the proposed project, and how this information could be used to predict the likelihood of spills on the proposed new pipeline and reactivated segments. Additionally, it was unclear how the proponent plans to communicate the leak or rupture to nearby well users who could potentially be affected.	groundwater mitigated? • What lessons were learned that can be applied to groundwater protection for the proposed expansion project? • How can this information be used to predict the likelihood of spills on the proposed new pipeline and reactivated segments during operations? (c) Provide a discussion of the planned protocols for notifying groundwater users of any operations phase leaks/ruptures to groundwater. Specify the maximum distance between a potential pipeline leak/rupture and well users that will be considered for notifying potentially affected well users. Provide justification of the distance criteria used.
4.1	Groundwater Assessment Groundwater Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, REP-NEB-TERA-00004, prepared for Trans Mountain Pipeline ULC, prepared by Waterline Resources Inc., December 2013.	In Sections 3.4 to 3.6 of the Groundwater Technical Report, the proponent describes the existing hydrogeological conditions determined from a literature review and hydrogeological field investigations. The proponent also stresses the need to characterize the aquifers in the immediate vicinity of the pipeline in terms of aquifer vulnerability (Section 4.0 of Groundwater Technical Report). NRCan agrees to this approach. It is unclear if the proponent plans to log the geologic materials removed during excavation for the pipeline in order to verify the existing vulnerability assessment for each segment of the pipeline. For example, the exact location of high-permeability features such as buried channels is not always known. If such deposits were encountered during excavation, this information could be used to update the vulnerability assessment for that segment of the pipeline. It is noted that the proponent has committed to have a trained person on site during excavation to make observations that will allow for the identification of existing contaminated sites.	Clarify if the proponent plans to log the geologic materials removed during excavation for the pipeline in order to verify the existing vulnerability assessment for each segment of the pipeline.
Forest Soils			
	(i) Soils Technical Report RK811.8 to RK	The soils technical report (i) indicates that selected soils were sampled for laboratory analyses	Please provide the analytical data for this segment

Question #	Subject/Reference	Preamble/Rationale	Information Request
5.0	1043.7 (Black Pines to Hope segment) (ii) Appendix E Laboratory results pages 77-82.	at 22 sites (page 5). Data was to be presented in Appendix E (ii). However, in the current documents there are no data (blank pages).	of the proposed pipeline.
5.1	(i) Volume 6B Section 13.0 Wet/thawed Soils contingency plan (Page B-29)	The report indicates that "*Soils are considered to be excessively wet when the planned activity could cause: damage to soils either due to rutting by traffic through the surface material into the subsoil; soil structure damage during soilhandling; or compaction and associated pulverization of surface material due to heavy traffic.*"	Will the indicators be based solely on visual observations when construction activity occurs or will some other quantitative measurement be used? Also will the soils at high risk to compaction be identified prior to construction? Some additional details on the contingency plan would be useful.
5.2	(i) Volume 5A – Section 5.2.2 Soil degradation (all segments, Page 5-31-34. (ii) Soils Technical Reports (all segments) – Section 3.7 Soil compaction and Table 7 (Soil characteristics and their implications to pipelining (all segments).	The soils technical report provides an excellent overview of the soils along the proposed pipeline corridor. While the reports identifies the soils susceptible to soil compaction and rutting as a result of drainage (i.e., poorly, very poorly and imperfectly drained soils), soils susceptible to compaction because of their texture (e.g., fine-textured) are not identified (Table 7 in soil technical reports) unless they are also poorly drained. Soils that are poorly drained will likely be susceptible to compaction and rutting for longer time periods; however, fine-textured soils are also at high risk to be compacted if the appropriate moisture conditions exist. Thus, soils susceptible to compaction and rutting also need to include fine-textured soils.	Please provide considerations as related to fine-textured soils in the criteria for determining what soils are susceptible for compaction.
Forest Biodiversity			
6.0	(i) Volume 5C: Wildlife and Wildlife Habitat	Details on how fallen dead wood (logs) will be dealt with and protected have not been provided. Highly decayed logs with loose bark and cavities are used by a variety of wildlife as habitat (e.g. foraging, dens, overwintering). Those in close proximity to watercourses and wetlands are frequently used for amphibian overwintering.	Please provide details as to how large diameter, highly decayed logs may be protected as wildlife habitat.
6.1	(i) Volume 5A, Table 7.2.9.2	The distances of listed plant species from the pipeline need to be more precise in some instances. E.g., <1km is not precise enough as this could mean 10m (of higher concern) or 950m lesser concern).	Please provide more precise distances, when describing the locations of the listed species in relation to the pipeline.
6.2	(i) Volume 5A, page 5-156	The proponent reported that there are no provincial guidelines for mapping ecological units in Alberta. NRCan suggests that the following document can be referenced and used as guidance: Beckingham, J.D.; Corns, I.G.W.; Archibald, J.H. 1996. Field guide to ecosites in west-central Alberta. Canadian Forest Service, Northern Forestry Centre, Edmonton, Special Report 9.	Please clarify why these guidelines were not used for the ecological classification and mapping described in reference (i).

Question #	Subject/Reference	Preamble/Rationale	Information Request
Wildfire			
7.0	(i) Trans Mountain Pipeline ULC Application, Volume 1 – Summary, Project Description. Page 1–19 (ii) Trans Mountain Pipeline ULC Application, Volume 4C Project Design and Execution - Operations and Maintenance, s.10.2.6.2.1 Emergency Response Plan Review and Update, p 43	Reference (i) indicates that above ground infrastructure will be constructed including pump stations, sending/receiving traps, and powerlines. Reference (ii) indicates that an Emergency Response Plan will be developed for infrastructure.	Please clarify that, where above ground infrastructure is located in forested areas that may be exposed to wildfire, that measures to minimize fire risk will be considered in infrastructure location, design, and site preparation/maintenance. Please clarify that the emergency response plan (Reference ii) will consider the risk of wildfire to above ground infrastructure that may be located in forested areas.
7.1	(i) Trans Mountain Pipeline ULC Application, Volume 4B, pages 4B-53,54 (ii) Trans Mountain Pipeline ULC Application, Volume 6B, Pipeline EPP, section 8: Pipeline-Specific Construction Mitigation Measures, Slash Disposal pages 8-9, 8-10 (iii) Trans Mountain Pipeline ULC Application Volume 4C Project Design and Execution – Operations and Maintenance, s10.2.,1 page 36	Reference (i) indicates that a Fire Prevention Plan (FPP) and Fire Contingency Plan will be developed. Reference (ii) lists mitigation measures that will be used for right of way debris disposal. Reference (iii) indicates that the proponent uses the Incident Command System for emergency response.	Please clarify that, in addition to complying with provincial regulations regarding the types of activities undertaken and hours of work during times of wildfire risk, that the FPP will include provisions to liaise with the appropriate fire management authorities in the operating area to maintain awareness of wildfire danger conditions during the fire season, and that the fire management agency will be made aware of the location of the work camps or crews operating in remote areas that might require evacuation in the event of a wildfire. Please clarify that the debris disposal mitigation measures identified in Reference (ii) will be incorporated in the Fire Prevention Plan. Please clarify that the Incident Command System will be implemented in the event of a wildfire as per Reference (iii).

Question #	Subject/Reference	Preamble/Rationale	Information Request
Forest Management			
8.0	(i) Trans Mountain Expansion Project Application, Volume 5B – ESA – Socio-economic, Section 7.0 Socio-economic Effects Assessment, Page 7-78. (ii) Trans Mountain Expansion Project Application, Volume 5D – ESA – Socio-economic Technical Reports, Managed Forest Areas and Forest Health Technical Report, Pages 36 and 38. (iii) Trans Mountain Expansion Project Application, Volume 6B - Pipeline EPP, Section 8 – Pipeline-Specific Construction Mitigation Measures, Page 8-7 (iv) Trans Mountain Expansion Project Application, Volume 6C - Facilities EPP, Section 8 – Facility-Specific Construction Mitigation Measures, Page 8-6	The Application states in various places that Douglas-fir and spruce stumps will be 45cm or less to minimize forest health concerns. However, AB utilization standards and BC merchantability specifications both specify a 30cm stump height (with some exceptions) for all species. See: AESRD. 2012. Timber Harvest Planning and Operating Ground Rules Framework for Renewal. Section 4.2.3 http://esrd.alberta.ca/lands-forests/forest-management/forest-management-planning/documents/TimberHarvest-OperatingGroundRules-Jun2012.pdf BCMFR. 2013. Provincial Logging Residue and Waste Measurement Procedures Manual, Section 1.2.1 http://www.for.gov.bc.ca/hva/manuals/rwprocedures.htm	Please clarify if the applicable provincial utilization standards or merchantability specifications will be used when operating on Provincial Crown land? Will specifications/standards be different on other lands (e.g. private, Federal)?
Forest Health			
9.0	(i) Volume 6B, Pipeline EPP, Section 7: General Pipeline Construction Mitigation Measures, PDF Vol_1of2_Pipeline_epp – A3S2S3.pdf (ii) (iii) Volume 6C, Facilities Environmental Protection Plan for the Trans Mountain	Propagules of pathogenic organisms can be transported from infested sites to non-infested sites through the movement of soil particles on contaminated vehicles, construction equipment and work boots. The result is the potential infestation of a previously clean site and subsequent impacts on plant health. With reference to vehicle cleaning (mitigation measures 70, 74, 84, 86, 87, 88, 93 of Volume 6B Section 7; mitigation measures 44, 55, 56, 57 of Volume 6C Section 7): All pertain to vehicles arriving at a new site in a "clean" condition. Vehicle cleaning and disinfection can be considered as good practice for the prevention of movement of infectious organisms, whether	a) Pertaining to mitigation measure 86 (page 7-8, Volume 6B), measure 56 (page 7-5, Volume 6C): There is no species "Phytophthora morum". Please clarify that the correct species name is: Phytophthora ramorum. b) Please explain why the various mitigation measures that have been noted are all

Question #	Subject/Reference	Preamble/Rationale	Information Request
	Pipeline ULC Trans Mountain Expansion Protect, PDF V6C_1of2_Facilities_EPP – A3S2S6.pdf	they are fungi that infect plants, organisms that cause disease of animals, or weed seeds. Rather than "arrive clean", the safest method of preventing accidental movement of organisms is to clean equipment to the highest standard that can be achieved prior to movement to a new site. Ensuring that vehicles, equipment and footwear arrive on site free from soil after disinfection with an appropriate disinfection solution would reduce the probability of organism transport.	different. Please clarify whether vehicle cleaning and disinfection will occur prior to movement to a new site. Will this measure apply to all site types, whether agricultural or forestry?
9.1	(i) Managed Forest Areas and Forest health Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, V5D_TR_5D4_Forest_Areas_Health – A3S2J9.pdf	Forest health conditions were assessed along the proposed pipeline corridor. The proponent collected field data along the corridor using an aerial field survey. It is also proposed that a timber cruise of the construction right of way be conducted (Section 5.1, page 29) to assess merchantable timber. This timber cruise would provide an opportunity to establish baseline forest health conditions prior to construction (as noted in Section 5.3, page 36). This is necessary to develop mitigation plans to avoid pathogen spread during construction.	Please elaborate on the Field Data Collection (Section 3.5, page 19) methods and findings. Was any ground truthing conducted? Were bark beetles and defoliators the only forest health agents that were assessed? Were any forest pathogens assessed? Will the planned timber cruise be used to establish baseline forest health conditions and be used to develop mitigation plans to avoid pathogen spread?
9.2	(i) Managed Forest Areas and Forest health Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, V5D_TR_5D4_Forest_Areas_Health – A3S2J9.pdf	Forest health issues are identified as a potential problem following construction if mitigation measures are not employed during construction (Section 5.3, page 36; Section 5.3.2, Table 19, page 38). The application outlines several standard, sound, management practices that can reduce the incidence of forest disease. NRCan agrees with the recommendations provided within the document; and recommends that the proponent commit to following the listed practices.	Please clarify whether there will be a commitment to follow the forest health recommendations contained in the Managed Forest Areas and Forest Health Technical Report?
9.3	(i) Managed Forest Areas and Forest health Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, V5D_TR_5D4_Forest_Areas_Health – A3S2J9.pdf	Forest insects and pathogens are often referred to by common names; however, common names can lead to confusion. In section 3.4.3 Forest Health (page 19), the common and scientific names of several forest insects are listed. On page 19, Armillaria is mentioned and in Table 18, "laminated root rot" is listed. Laminated root rot is not caused by Armillaria.	Please clarify exactly which pathogens are being referred to, using scientific names.
9.4	(i) Managed Forest Areas and Forest health Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project,	Soil borne forest pathogens and weeds can be transported through the movement of soil. Movement of soils and cleaning of equipment is well described for the prevention of club root disease (for example, as noted in Volume 6B, Section 5, Table 5.2-1) and Phytophthora ramorum (Volume 6B, Section 7, page 7-8). The proponent should analyse the risk of	Please clarify whether the risk of transportation of soil borne forest pathogens has been analysed and, if so, provide the relevant recommendations.

Question #	Subject/Reference	Preamble/Rationale	Information Request
	V5D_TR_5D4_Forest_Areas_Health – A3S2J9.pdf	transportation of soil borne forest pathogens and a recommendation added to Table 19 of Volume 5D (page 38). This would also reduce the risk of movement of the seeds of invasive weed species.	
9.5	(i) Trans Mountain Expansion Project Application, Volume 5D – ESA – Socio-economic Technical Reports, Managed Forest Areas and Forest Health Technical Report	The applicant considers the implications of the project on the health of forests adjacent to the proposed corridor and outlines actions for mitigation and monitoring of potential impacts. Authors conducted an ad-hoc forest survey of the forests affected by the proposed corridor and provide a summary of the existing conditions. This assessment covered an area of up to 15 km from the corridor. The proponent considered all major potential pest problems in the affected area. Mitigation actions are adequate, including appropriate measures for the disposal of slash (potential breeding grounds for bark beetles). However, fragmentation and geographically continuous disturbance could provide avenues for movement of exotic insects, diseases and mammals.	Please confirm whether the proposed post construction monitoring includes monitoring the corridor as a potential pathway for invasive alien species.
Pipeline Materials/Integrity			
10.1	Volume 4A: Project Design and Execution – Engineering (i) S 3.2.7 Stress Analyses p. 21	Strain-based design is mentioned in the document but the detail design guidance for the strain-based design is not provided.	Please provide the strain based design guideline that will be used.
10.2	Volume 4A: Project Design and Execution – Engineering (i) S 3.2.8 Pipe Material, Grade, and Category, p. 21-22	TMEP proposes to use Grade 483 steel. The steels will be Category II and Category III. The application reports that "*As such, all pipe material to be installed below grade for the proposed Line 2 pipeline will be Cat II pipe and all pipe material to be installed above grade will be Category III (Cat III) pipe*". According to Z245.1, Cat II pipes with OD>457 mm require both drop weight tear test (DWTT) fracture appearance (all-lot average of minimum 85% shear area) and Charpy absorbed energy of 40J, while Cat III pipes require only Charpy absorbed energy equal to or greater than 18J (no fracture appearance requirement). Also, specifying a design temperature of -5°C for buried pipe does not require mandatory weld toughness testing; if the design temperature were -6°C then the welds would have to be Charpy tested.	a. Cat III pipes will be used aboveground with a design temperature of -45°C, necessitating a higher toughness requirement than the buried pipes which will be designed for -5°C. It is understandable that satisfying the DWTT toughness requirement of Cat II pipes at -45°C might be difficult; however does the proponent plan to use a stricter toughness acceptance criterion for Cat III pipes than is required by CSA Z245.1? b. Please clarify whether the weld toughness

Question #	Subject/Reference	Preamble/Rationale	Information Request
		To reconnect and repair the two reactivated pipe segments in Line 1, some additional NPS 24 pipes, likely to be electric welded, will be required. Note that the new CSA Z245.1-2014 requires mandatory weld notch toughness tests for electric weld pipes with design temperature lower than -5°C; while this requirement was optional (if specified in purchase order) in the previous CSA Z245.1 standard	test will still be conducted for the buried submerged arc welded pipes? This would provide confidence in the toughness of the pipes c. Will the two currently deactivated NPS 24 pipe segments undergo the CSA Z245.1 testing protocols before reactivation? d. Will any NPS 24 pipes be installed above grade? If so, is the notch toughness requirement for electric welded pipe considered? e. For additional Cat II NPS 24 electric welded pipes, does the proponent plan to do weld toughness tests anyway even though the minimum design temperature is -5°C? This would be highly recommended because the electric welded pipes are normally more susceptible to flaws and may have low toughness.
10.3	Volume 4A: Project Design and Execution – Engineering (i) S 3.2.14.1 Welding of linepipe, p. 23	The proponent indicates that the specifications for the production welding of the pipeline using a Shielded Metal Arc Welding (SMAW), a Flux Core Arc Welding (FCAW), and a Mechanized Welding will be developed during the detailed engineering and design phase. Welding processes and procedures indicated can exhibit a wide range of weld metal and HAZ (heat affected zone) properties, With regard to the NDT (non-destructive testing) of tie-in welds, 18 hours of delay time was proposed**.** The delay time may need to be increased, especially if low hydrogen processes and procedures are not always implemented.	Please provide additional available welding process information along with the proposed weld qualification and toughness testing programs, especially for production welding on steep slopes, where the application of ECA (Engineering Critical Assessment) is important, or in cases that require strain-based design. Please provide further available welding procedure information to support the limited delay time of 18 hours before NDT of both tie-in and repair welds.

Question #	Subject/Reference	Preamble/Rationale	Information Request
10.4	Volume 4A: Project Design and Execution – Engineering i. S 3.2.14.2 Welding of fabricated assemblies, p. 24	The application indicates that the welding specifications of the fabricated assemblies will be developed during the detailed engineering and design phase.	The proponent is asked to provide further available welding process information along with the proposed weld qualification and toughness testing programs
10.5	Volume 4A: Project Design and Execution – Engineering i. S 3.2.14.3 Tie-in Welding and Required Carbon Equivalent, p. 24	This section indicates that the existing TMPL has a carbon equivalent (CE) of less than 0.50 percent which is quite high already but it is also mentioned that this could be even higher for tie-in locations. The application also mentions that Kinder Morgan is currently developing welding procedure for welding of liquid filled pipeline with CE less or equal to 0.52 percent The quoted CEs are quite high based on the formula included in Table 5 of CSA Z245.1.	The proponent is requested to provide additional information on the welding procedure being developed.
10.6	Volume 4A: Project Design and Execution – Engineering, Section 3.2.21. Corrosion Control i. S 3.2.21.2 Coatings p. 27-28	This section indicates that where additional mechanical protection is required, the proponent will opt for 2 or 3 layer coatings. It is also indicated that field girth weld coating will be coated in accordance with a Two-part Spray Applied Coating Specification.	a. Please provide the design criteria to switch from the FBE (fusion bond epoxy) CP (cathodic protection)-compatible coating to the more protective coatings. b. How will the compatibility between the plant-applied external coating and the field applied coating be ensured? c. Is there any intention of using ISO 21809-3: Field Joint Coatings Standard? Also, a CSA Standard – CSA Z245.30 “Field-applied external coatings for steel pipeline systems” is expected to be published in 2015.
10.7	Volume 4A: Project Design and Execution – Engineering, Section 3.2.21. Corrosion Control P. 27-29. i. S 3.2.21.2 Coatings p. 27-28	In the application, it has been discussed that special coatings will be selected for areas requiring additional mechanical protection, but the proponent did not mention the consideration to be given to possible CP shielding areas for coating with polyethylene outer layer. The proponent also states that all coating systems will be applied by qualified and approved applicators.	a. Will any consideration be given to possible CP shielding areas? b. Please provide the qualification and approval criteria for the coating applicators

Question #	Subject/Reference	Preamble/Rationale	Information Request
10.8	Volume 4A: Project Design and Execution – Engineering, Section 3.2.21. Corrosion Control i. S 3.2.21.3 Cathodic protection system p. 28	In this reference the proponent mentions that the CP system for the pipelines will be designed and installed in accordance with the applicable codes and regulations. The application also indicates that old existing pipe segments are to be electrically connected to the new proposed segments, there is some clarification required on how these pipe steels coated with different coatings, will affect each other, especially under no or deficient CP situations.	a. Please comment on whether there is any possibility of traversing sporadic or mountain permafrost along the proposed pipeline path and if encountered what contingencies or pipeline design changes including CP system design and coating selection would have to be made? b. Please provide information of the coatings on the existing pipe segments (Line 1), i.e. coating type and condition. c. Should the CP system have a problem, both pipes would be susceptible. Plus, the impressed current could be preferentially consumed by one pipe over the other (as a function of distance from the ground-beds, the soil wetness, and the pipelines will have different coatings, pipe1 being old, pipe 2 being new). Please provide clarification on this: will the rectifiers be calibrated per pipeline, or will it really be a single rectifier calibrated to the averaged response of both pipelines. How will the system be calibrated?

References (copies of documents without a link can be found in Appendix 1)

Seismicity
William H. Bakun, Ralph A. Haugerud, Margaret G. Hopper and Ruth S. Ludwin, "The December 1872 Washington State Earthquake", Bulletin of the Seismological Society of America, 92,8.(December 2002): 3239-3258.

Marine
K. W. Conway, R. B. Kung, J.V. Barrie, P.R. Hill, and D.G. Lintern, "A preliminary assessment of the occurrence of submarine slope failures in coastal British Columbia by analysis of swath multibeam bathymetric data collected 2001-2011", Natural Resources Canada, Geological Survey of Canada, Open File 3748 (2013): 38 p.

L.J. Leonard, G.C. Rogers and R.D. Hyndman, "Annotated bibliography of references relevant to tsunami hazard in Canada", Natural Resources Canada, Geological Survey of Canada, Open File 6552 (2010): 269 p.
L.J. Leonard, G.C. Rogers, and S. Mazzotti, "A Preliminary Tsunami Hazard Assessment of the Canadian Coastline", Natural Resources Canada, Geological Survey of Canada, Open File 7201 (2012): 126 p.

Forest Biodiversity
Beckingham, J.D.; Corns, I.G.W.; Archibald, J.H. "Field guide to ecosites of west-central Alberta" (paperback). Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta. Special Report 9. 1996: 540 p.

Forest Management
Province of B.C. Ministry of Forests and Range, Provincial Logging Residue and Waste Measurement Procedures Manual, Amendment No. 19, Section 1.2.1 (15 July, 2011).

Province of Alberta, Alberta Environment and Sustainable Resource Development, Forest Management Branch, Alberta Timber Harvest Planning and Operating Ground Rules Framework for Renewal (June 2012).

Information Requests from Aboriginal Affairs and Northern Development Canada

Question #	Subject/Reference	Preamble/Rationale	Information Request
Reserve land use			
1.1	i) A3S0R0, Application Volume 2 – Project Overview, Economics and General Information, Section 5.0 – Land Relations, Rights and Acquisition, PDF pages 30 to 36 of 43 ii) A3S0U5, Application Volume 3B – Aboriginal Engagement, Section 1.3.2 – Geographic Location of Aboriginal Communities, PDF page 30 of 97 iii) A3S0Y8, Application Volume 4A – Project Design and Execution – Engineering, Section 2.8.1 – Pipeline Corridor Selection Objectives, Strategies and Criteria, PDF page 34 of 110 iv) A3S1A3, Application Volume 4A – Project Design and Execution – Engineering, Appendix E – Route Maps, PDF pages 5 and 6 of 7; A3S1A4, Application Volume 4A – Project Design and Execution – Engineering, Appendix E – Route Maps, PDF pages 6 to 9 of 12	Reference i) indicates that the proposed project would require land use for: pipeline right-of-way, temporary workspace, temporary construction facilities, pump stations, valves, cathodic systems, terminals, and power lines. Reference ii) indicates that the project would cross the following 10 reserves in British Columbia: Grass #15, Joeyaska #2, Matsqui Main #2, Ohamil #1, Peters #1, Peters #1A, Popkum #1, Tzeachten #13, Zoht #4, and Zoht #5. AANDC notes that reference i) indicates that applications for rights-of-way and temporary workspace on reserve land would be submitted where required; however, references i) and ii) do not clearly specify the nature of uses of reserve land associated with the proposed project. AANDC infers from reference i) and other sections of the Application that use of reserve land may be limited to rights-of-way/easements and temporary workspace for the 10 indicated reserve crossings, but this is not clearly stated in reference i) or ii). Reference iii) indicates that wherever	Please provide a full description of all potential uses of reserve land for each reserve associated with the proposed project, including: a) The nature of proposed use(s) (i.e. right-of-way/easement, safety zone, temporary construction workspace, or any other type of use); and b) An indication of whether new pipeline segments (i.e. Line 2) would be constructed within, adjacent to, or outside of existing rights-of-way/easements at each identified reserve crossing.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		feasible, Line 2 segments would be installed on or adjacent to the existing Trans Mountain Pipeline system easement and where that proves not feasible, other routing options (e.g. installation in a new easement) would be selected. AANDC notes that reference i) indicates that until engineering design is complete, the full or partial use of the existing pipeline right-of-way for Line 2 is undetermined. However, route maps in reference iv) appear to indicate that: • at 2 of 10 identified reserve crossings (i.e. Peters #1 and Peters #1A), Line 2 would not be installed within or adjacent to existing easements; and • at the remaining 8 reserve crossings, Line 2 would be installed either within or adjacent to existing easements. A clear, in-text indication of whether Trans Mountain anticipates installing Line 2 segments within, adjacent to, or outside of existing easements/rights-of-way at the 10 identified reserve crossings is not provided in reference i), ii), iii), or iv).	
1.2	i) A3S0R0, Application Volume 2 – Project Overview, Economics and General Information, Section 4.2.3 – Proposed Pipeline Corridor, PDF pages 23 to 26 of 43 ii) A3S0R0, Application Volume 2 – Project Overview, Economics and	Reference i) states that minor deviations in pipeline routing are being considered including those that would avoid the following reserves included in the proposed route for Line 2: Zoht #5, Zoht #4, Joeyaska #2, Ohamil #1, Peters #1A, Popkum #1, Grass #15, Tzeachten #13, and Matsqui Main #2. Reference i) does not indicate whether	Please provide the following information on reserve land uses associated with the project: a) An indication of whether deviations in pipeline routing are being considered at the intersection of Line 2 and Peters Reserve #1, given that potential deviations are indicated in the

Question #	Subject/Reference	Preamble/Rationale	Information Request
	General Information, Section 5.2.1 – Right-of-Way, PDF pages 31 and 32 of 43 iii) A3S0U5,, Application Volume 3B – Aboriginal Engagement, Section 1.5.2 – Aboriginal Engagement by Community and Group, PDF pages 48 to 91 of 97 iv) A3S1L4, Application Volume 5A – Environmental and Socio-Economic Assessment – Biophysical, Section 4.2.3 – Black Pines to Hope Segment, PDF pages 12 and 13 of 39 v) A3S0U5, Application Volume 3B – Aboriginal Engagement, Section 1.3.2 – Geographic Location of Aboriginal Communities, PDF page 30 of 97	deviations are being considered at Peters Reserve #1, which reference v) indicates is also included in the proposed route for Line 2. Reference ii) states that: • the segment of existing pipeline between the Darfield and Kamloops Pump Stations has been previously looped; • Line 1 would be reactivated between the Darfield and Black Pines Pump Stations; and • acquisition of new permanent land rights is not anticipated though this segment. Kamloops Reserve #4 and Whispering Pines Reserve #4 are located within this segment of the existing pipeline system. It is not clear whether temporary use of reserve land may be required in this segment. Reference iii) indicates that the existing pipeline system runs through 15 reserves in British Columbia. Reference v) states that 10 of these 15 reserves would be crossed by the proposed project. Reference ii) indicates that the segment of existing pipeline between the Darfield and Kamloops Pump Stations, which includes 2 of these 15 reserves, has been previously looped. Reference iv) provides rationale for deviations in pipeline routing at 2 of the remaining 3 reserves crossed by the existing pipeline (i.e. Coldwater #1 and	Application for the other 9 reserves crossed by the proposed route for Line 2. If deviations are not being considered at this location, provide the rationale for this decision; b) An indication of whether reserve land use may be required for those reserves located in previously looped segments of the route (i.e. Kamloops #4 and Whispering Pines #4) where reactivation of existing pipeline is required; and c) The rationale for the proposed route for Line 2 avoiding Popkum Reserve #2, akin to that which was provided for Coldwater #1 and Kawkawa Lake #16.

Question #	Subject/Reference	Preamble/Rationale	Information Request
		Kawkawa Lake #16). It is not clear why deviations in pipeline routing have been proposed at the remaining reserve crossed by the existing pipeline, Popkum Reserve #2.	

Information Request from The Parks Canada Agency

1.1 Context

Parks Canada's focus in this request is the proposed scope of work and potential effects associated with the reactivation of 80 km of the 24-inch pipeline in Jasper National Park, which was deactivated in 2008.

In Jasper National Park, the *Canada National Parks Act* (CNPA) and its Regulations apply to Trans Mountain Expansion Project. The CNPA mandates Parks Canada to consider the ecological integrity of Jasper National Park of Canada as the first priority when making decisions about management of parks.

Ecological integrity means "with respect to a park, a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes".

Jasper National Park is also highly valued cultural setting for Aboriginal peoples and euro-Canadian history (1810 to recent). There are several locations on the 24-inch pipeline that cross significant archaeologic sites. The historic context of the Athabasca and Miette River Valley, and extending on through the Yellowhead Pass National Historic Site to Moose River is noteworthy. We anticipate that the pipeline crosses uncharted pre-contact burial sites. Significant historical railway and Japanese internment camp sites also exist in the Yellowhead Pass.

The cultural circumstances of Jasper National Park include consideration of the traditional territories, interests and assertions of the Aboriginal communities that share historical ties with the Park, from both sides of the continental divide. Parks Canada maintains an ongoing working relationship with over 20 Aboriginal communities through the Jasper Aboriginal Forum, and with the Upper Athabasca Valley Elders Council.

Jasper National Park and Mount Robson Provincial Park are part of a 20,000 km^2 UNESCO Canadian Rocky Mountains World Heritage Site, one of the world's largest blocks of protected areas that includes Banff, Yoho and Kootenay National Parks, and BC's Mount Assiniboine and Hamber Provincial Parks.

1.2 Pipeline Integrity

Reference:

i. Vol. 4A, Sec. 3.6.

ii. OILMAP Land Model: Vol. 7, Sec. 3.1.7,

iii. Vol. 7, Appendix D, Simulations of Hypothetical Oil Spills from the Trans Mountain Expansion Project Pipeline – P1 V6 Route

iv. The Release Volume Study – NPS 24 TMPL Reactivated Segments

Preamble:

Vol. 4A, Sec. 3.6.2 indicates that a preliminary engineering assessment has been completed as a first step in satisfying the requirements of the *OPR* for reactivation.

The OILMAP Land Model outlined in Appendix D, Simulations of Hypothetical Oil Spills from the Trans Mountain Expansion Project Pipeline references the new 36-inch pipeline segments but not the 24-inch pipeline reactivation segments.

The Release Volume Study – NPS 24 TMPL Reactivated Segments was provided to Parks Canada but is not submitted as part of the Application.

Request:

1. It should be noted that the proposed scope of work and potential effects associated with the reactivation activities will only be known with more accuracy after the final engineering assessment.

2. Please explain or address what areas in Jasper National Park have had a greater history of anomalies than others.

3. Please clarify or address whether there are to be valves and detectors at each side of major river crossings.

4. Please clarify or address what volume of product would continue to be pumped between detection of a leak and closing of valves.

5. Please clarify or address what volume of product might be released from between valves.

6. Please explain what quantity of spill can be detected by the 'Computational Pipeline Monitor', and how it shuts down the system.

7. Please explain what and where cathodic protection or similar systems are anticipated to be required. What implications will these systems have on the environment?

8. Has a risk assessment been conducted recently to identify location-specific events and/or conditions that could lead to the 24-inch pipeline failure, and provide an understanding of the likelihood and consequence of an event?

   If so; what are the findings and does the risk assessment identify the nature and location of the most significant risks to the pipeline?

b. If no recent risk assessment; when was the last one completed and what were the findings?

9. As the operator of a 61 year old pipeline with pressure fluctuations is metallurgical fatigue a concern?

10. When was the last ILI run of the 24-inch pipeline?

11. Has stress corrosion cracking been identified in the 24-inch pipeline and if so what is the current status?

12. Are there any threats?

    a. of immediate concern?

    b. timed concern?

13. Please explain why automating all the existing manual valves in Jasper National Park is not proposed as the preferred scenario and clearly describe the proposed scenario for Jasper National Park.

Please confirm that the Release Volume Study–NPS 24 TMPL Reactivated Segments will be submitted as a record and part of the NEB Facilities Application.

1.3 Biophysical

Reference:

i. Summary: Vol.1, Sec. 3.2

ii. Environmental ESA – Biophysical: Vol. 5A, Sec. 6.12.6, Sec. 7.7.

iii. Environnemental Compliance: Vol 6A, Sec. 5.0 to 9.0

iv. Pipeline EPP: Vol. 6B, Sec. 7.0 and 8.0

v. Facilities EPP: Vol. 6C, Sec. 7.0 and 8.0

Preamble:

EPPs, Sect 7.0 and 8.0 indicate that mitigation measures will be implemented by Trans Mountain, its Contractors and subcontractors prior to and during construction and will be followed by detailed specifications for each reactivation/construction phase, access road, temporary construction camp, borrow site and ancillary site.

Vol. 5A, Table 7.7-1 states that there are no potential effects associated with physical environment indicators anticipated to result from pipeline reactivation activities.

Vol. 5A, Sec. 7.7.1.1 states that pipeline reactivation activities in Jasper National Park along the Hinton to Hargreaves Segment will follow the Jasper National Park Operations and Maintenance Environmental Protection Plan (TERA 2009).

Vol.1, Sec. 3.1.3.4 indicates that a Post-Construction Environmental Program will be conducted for a period up to the first five complete growing seasons (or during years one, three and five) following commissioning of the Project and as a consequence of conditions that may be attached to the CPCN.

Request:

1. Please clarify or address how the ecological integrity of Jasper National Park is considered and incorporated into the ESA.

2. Please properly reflect the international status of Jasper National Park and Mount Robson Provincial Park as part of a World Heritage Site in the Summary, the ESA and any decision-making. Note that UNESCO and the World Conservation Union (IUCN) may take a strong interest in the ESA process and its results.

3. Please clarify and confirm that the restoration program will be based on classifications according to the recognized and meaningful soil and vegetation types developed in the Ecological Land Classification system for Jasper National Park.

4. Jasper National Park Operations and Maintenance Environmental Protection Plan should be revised and updated. Please confirm that pipeline reactivation activities in Jasper National Park will follow the updated Jasper National Park Operations and Maintenance Environmental Protection Plan.

5. Parks Canada will work collaboratively with Trans Mountain in developing a Post-Construction Monitoring Program for Trans Mountain Pipeline Expansion Project, Management Objectives and Desired End Results (MO/DERs) to be followed.

6. Please confirm that restoration will accomplish, at a minimum, the restoration Desired End Results of:

> Vegetation General: That disturbance is minimized following the principle of prevention before restoration. If disturbance is necessary all disturbed areas are restored to conditions that reflect the historic range of variability in terrestrial and riparian areas regarding composition, structure, and dynamics of native plant communities as closely as possible.
>
> Vegetation Composition: That active prevention and control measures are taken such that moderate and high priority (i.e. more invasive) non-native plant species do not become established or set seed on the Kinder Morgan Canada (KMC) easement or temporary work areas, or spread off of the easement or temporary work areas.

Vegetation Composition: That active prevention and control measures are taken such that low priority non-native plant species do not occupy more than 2% of ground cover on the KMC easement and temporary work areas.

Vegetation Structure: That mitigation measures achieve the accepted LLWG standard for revegetation success on the easement and temporary work areas:

a) the ground cover of native herbaceous vegetation meets the density requirement of 10 plants (native) per m^2 in 90% of the square meters in any area measuring 10 by 10 meters and,

b) the combined cover of mulch (plant litter) and live native plants is greater than or equal to 80% ground cover of the easement and temporary work areas.

c) Vegetation is capable of maintaining cover and density without the aid of applied fertilizers beyond the time when residual effects have ceased.

Vegetation Structure: That the canopy of forested areas in the temporary work areas and immediately adjacent to the easement reflect the species composition, horizontal strata, and open canopy densities expected of fire-maintained plant communities where this is supported by current knowledge of historic fire regimes.

Vegetation Structure: That the vegetation canopy of riparian areas and the woody content of streams be restored to reflect the species composition, function, and structure of pre-disturbance conditions.

Vegetation Processes: That native plant species recolonize (natural revegetation) such that there is at least a 50% overlap in total plant species composition between the easement and temporary work areas and the adjacent plant communities within 5 years of pipeline reactivation.

Vegetation Processes: That future land disturbance for maintenance purposes is minimized and does not affect the functioning, structure, or dynamics of the reclaimed system.

Vegetation Processes: That expected fire intensity is within the historic range of variability (i.e., low to moderate surface fire in grassland or open forest vegetation types).

Vegetation Processes: That the probability and extent of forest insect and disease occurrence is no higher than what would occur within forests given knowledge of the historic range of variability or concerns of adjacent land management agencies.

Riparian Vegetation: That all disturbed areas is restored to conditions that reflect the historic natural undisturbed range of variability in terrestrial and riparian areas regarding composition, structure, quantity, function and dynamics of native plant communities.

Riparian Vegetation Structure: that the vegetation canopy of riparian areas and the woody content of streams reflect the species composition, structure, quantity and function of predisturbance conditions.

Aquatic Ecosystems: That natural levels and patterns of surface and subsurface hydrologic flow, natural composition, structure, quantity, and dynamics of wetland vegetation and growing conditions are maintained and that there is no alteration or loss of wetland function for a period greater than five years.

Soil and Terrain: That soils of the right-of-way and temporary work areas provide historic natural undisturbed growing conditions, and continue the natural rates and patterns of cycling of biomass and nutrients and other ecological functions, or alternatively for previously disturbed areas that are used for stockpile/storage.

Wildlife Habitat: That habitat and browsing or grazing relationships between vegetation and native wildlife be perpetuated on the right-of-way in a manner that replicates the natural range of variability. Nests or dens on the right-of-way are not disturbed.

Wildlife Populations: That restoration does not alter predator-prey relationships such that herbivore populations do not increase as a result of the vegetation restored such that predator populations artificially increase. Restoration should be conducted such that a wildlife attractant is not created.

Visual and other sensory-Human: That there is no additional notable visual anthropogenic linear scar on the landscape.

Spill Response: That during reactivation/construction, the target is no leaks or spills. The threshold is no leaks or spills that are in sensitive or uncontained areas and cannot be fully cleaned up and remediated in the short-term. This threshold shall not be exceeded. That during operation, there is to be negligible risk of leaks or spills from the pipeline in sensitive or uncontained areas, and low risk in other areas and that there is no increase in the risk of injury or mortality to JNP visitors, residents, or staff in relation to the reactivation/construction, operation and maintenance of the pipeline.

Monitoring: That future conditions can be conclusively (including quantification as appropriate) shown (either directly or through reasonable surrogate) to have accomplished all desired end results that are stated above or that have been committed to by Trans Mountain.

7. Please clarify or address the length of time of post-construction monitoring, given that it appears that restoration measures will require greater than 5 years before they will become fully ecologically effective, and given the time it will take for relevant indicator criterion to be manifested. Specific disciplines for which there appears to be proposed a shorter period of monitoring / follow-up include reestablishment of vegetation and related microclimates, prevention of non-native and invasive plant species (note that the seeds of some invasive species survive and continue to germinate for 10 or more years), stabilization of wildlife habitat (such as closed canopy forest), re-establishment of rare species and plant communities, and stabilization of soil. Please also take into consideration the time required to meet the standards for acceptance of an area as stabilized, as established in the Line Leaseholders Working Group (AXYS, 1998).

1.4 Heritage Resources

Reference:

i. Vol.1, Sec. 3.3.1

ii. Vol.5B, Sec. 5

Preamble:

Summary- Vol. 1, Sec 3.3.1 indicates that heritage resources considered include archaeological, palaeontological, and heritage (historic) resources.

Socio-Economic -Vol.5B, Sec. 5 does not reference cultural recourses and commemorative integrity of the area within Jasper National park.

Request:

1. The commemorative/cultural integrity of the area within Jasper National Park needs to be more comprehensively addressed, and additional information is required.

2. Vol.5B, Sec. 5 does not describe the extent to which the proposed reactivation activities would affect the commemorative integrity of Yellowhead Pass National Historic Site. Commemorative Integrity describes the health and wholeness of a national historic site. A national historic site possesses commemorative integrity when: 1) the resources directly related to the reasons for designation as a national historic site are not impaired or under threat; 2) the reasons for designation as a national historic site are effectively communicated to the public; and 3) the site's heritage values (including those not related to designation as a national historic site) are respected in all decisions and actions affecting the site.

3. Please confirm that restoration will accomplish, at a minimum, the restoration Desired End Results of:

> Cultural resources, commemorative integrity and paleontological resources: That the historic context of the Athabasca and Miette River Valley, extending on through the Yellowhead Pass to Moose River, the burial sites in the Miette River valley and the distinguishing historic features of the rail bed and its ancillary features, as manifested by their profiles, grades, sizes, scales, compositions, locations, relationships to one another and to the linear viewscape are respected, protected and maintained.

Information Requests from the Government of Canada

Question #	Subject/Reference	Preamble/Rationale	Information Request
Aboriginal Engagement/Consultation			
1.1	i) A3SOU6, Application Volume 3B, Aboriginal Consultation, Appendix A – Engagement Logs – entire document ii) A3S1L3, Application Volume 5A - ESA–Biophysical - TABLE 3.2-2 – Summary of Interests or Concerns Identified Through Engagement Activities with Aboriginal Communities for the Projects, PDF pages 129-138 of 150	i) In the reference, Trans Mountain provides detailed information on engagement activities conducted up to the date the application was filed for each Aboriginal community and Aboriginal group. ii) In the reference, Trans Mountain provides information regarding issues and concerns identified through Project-related meetings with Aboriginal communities and a response summary.	Please provide updated information since the application was filed on December 16, 2013 about engagement activities including: • interests and concerns raised by each group; and • Trans Mountain's response summary to the associated interest and concerns.

Question #	Subject/Reference	Preamble/Rationale	Information Request
1.2	A3S0U5, Application Volume 3B – Aboriginal Engagement, Section 1.1 – Introduction, PDF pages 24 and 25 of 937	In the reference, Trans Mountain states that it "is seeking to provide procurement, employment, and workforce development opportunities, and consider Mutual Benefit Agreements. A $1.5 million funding program has been established to contribute to education and training initiatives that focus on pipeline construction and related skills that are transferable and allow for employment in many work environments. Through our Aboriginal Procurement Policy, Trans Mountain is actively working to connect with Aboriginal businesses offering services or products relevant to Project construction or operation. Where new investment in oil spill preparedness and response capacity is required, Trans Mountain will seek to maximize the benefit to Aboriginal communities along the pipeline or marine route."	NRCan requests that Trans Mountain provide details regarding the amount of direct funding to date that has been provided to each Aboriginal group for community and/or economic development initiatives and for community investment contributions as well as an estimate of future funding for these initiatives. Also provide information on what Aboriginal groups/communities have, or intend to, enter into a Mutual Benefit Agreement and where possible the details of these agreements. Where the full details of an Agreement cannot be provided, please provide as much information on the Agreement as possible, and an explanation as to why the full details are unavailable. If more details may become available at a future date, please provide a commitment to making those details available at that time

APPENDIX 1

REFERENCES