Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
NEB Hearing Order OH-001-2014
Responses to Information Request from Metro Vancouver

1.1 Liquid Waste Operations

1.1.01 Criteria or Commentary from Metro Vancouver Considered during Corridor Selection

Reference:

i) Volume 4A - Project Design and Execution – Engineering, section 2.8.2.4.

Preamble:

The proposed Pipeline Study Corridor crosses numerous Greater Vancouver Sewerage and Drainage District (GVS&DD) pipelines, which leads to concerns about impacts on existing GVS&DD infrastructure. In addition, it is unclear whether future infrastructure was included during the corridor selection.

The Pipeline Study Corridor selection process included "*members of … various levels of government, major infrastructure owners, and other stakeholders were engaged to incorporate any additional criteria or commentary on the proposed Line 2 pipeline study corridor.*"

Request:

Please provide:

a) Details of the engagement conducted with Metro Vancouver regarding GVS&DD infrastructure.

b) Details of the feedback that was received from Metro Vancouver in relation to GVS&DD infrastructure.

c) Details of how the feedback was incorporated into the design of the Pipeline Study Corridor.

Response:

a) Please refer to Table 1.1.1.01A-1 for consultation activities related to routing, with Metro Vancouver.

b) Please refer to Table 1.1.1.01A-1 included in the response to Metro Vancouver IR No. 1.1.1.01a.

c) Please refer to Table 1.1.1.01A-1 included in the response to Metro Vancouver IR No. 1.1.1.01a.

TABLE 1.1.1.01A-1

ROUTING CONSULTATION ACTIVITIES WITH METRO VANCOUVER

Stakeholder / Group Name	Date of Activity	Method / Location of Engagement (routing specific)	Summary of Comments / Concerns Expressed by Metro Vancouver	Summary of Trans Mountain Response	Status and any Commitments / Follow-up Actions
Metro Vancouver	June 7, 2012	Trans Mountain phoned Metro Vancouver staff to provide notification about environmental field work	No response		
Metro Vancouver	June 19, 2012	Letter from Trans Mountain providing an introduction to the proposed Trans Mountain Expansion Project	No response		
Metro Vancouver	June 29, 2012	Eblast advising Trans Mountain Expansion Project toll application had been submitted to National Energy Board	No response		
Metro Vancouver	August 23, 2012	Letter from Trans Mountain to local government stakeholders, offering to meet at UBCM	No response		
Metro Vancouver	November 22, 2012	Email invitation from Trans Mountain to attend project introductory Public Information Sessions in Burnaby on November 24 and 26, 2012	No response		
Metro Vancouver: • CAO • Manager, Solid Waste • Manager/Corporate Secretary • Manager, Engineering and Construction • Executive Assistant to CAO • Manager, Utility Planning • Manager, Operations and Maintenance • Manager, Metropolitan Planning, Environment and Parks • Manager, Corporate Relations • Manager, Corporate Services	November 27, 2012	Meeting with Metro Vancouver senior staff. Trans Mountain presented the top five myths about the proposed project and provided an overview of the Project, including the marine components.	Do you have sufficient ROW to twin the line?	Trans Mountain confirmed that the right-of-way has space for both pipes. The original pipe is in 1/3 of the right-of-way, and Trans Mountain has the remaining 2/3 to work within to lay new pipe. Trans Mountain will be looking for alternatives in certain areas such as urban environments.	Feedback documented and issues identified for project disciplines. Potential community benefits documented.
			Where is the route in the lower mainland?	Trans Mountain referred to the map included in the information package distributed at beginning of the meeting.	
			You mentioned that you are not showing pipeline corridor on maps yet. Why is that? Are you trying to keep anxiety down?	Trans Mountain indicated that it is looking at potential pipeline corridor options at this time and will share proposed routing information in the New Year, after it has discussed these options with those parties who may be impacted (along the highway corridor and rail beds)	
			We are interested in discussions around co-locating and if / how your pipeline corridor may impact our existing systems.	Trans Mountain will look at the same corridor, so that new construction would be minimally impacted.	
			We would be interested in using your ROW for trails and to connect trails. If you acquire new ROW we would be interested in discussing this.	Trans Mountain would be pleased to talk about using right-of-way for trails. (Potential community benefit)	
			Is your project subject to municipal bylaws? Noise, stream protection etc.	Trans Mountain is federally regulated by the National Energy Board. Trans Mountain will observe local regulations and bylaws provided they align with federal requirements.	
Metro Vancouver CAO	January 10, 2013	Trans Mountain emailed CAO to provide update on project scope (from 750,000 bpd to 890,000 bpd)	No response		
Metro Vancouver Senior Project Engineer, Regional Planner	March 7, 2013	Metro Vancouver participated in Environment and Socio-Economic Workshop. Routing information provided to obtain input to accidents and malfunctions component of project planning, including local and regional study areas			Feedback received at these sessions and afterwards (including online) was shared with the relevant environmental disciplines and was considered in setting the scope and methodologies for the Project's ESA. Table 1.7.11, Volume 3A of the Application provides information on concerns or issues highlighted for the regional workshop held in Surrey, BC and the applicable section in the Application where that topic is addressed.

TABLE 1.1.1.01A-1

ROUTING CONSULTATION ACTIVITIES WITH METRO VANCOUVER (continued)

Stakeholder / Group Name	Date of Activity	Method / Location of Engagement (routing specific)	Summary of Comments / Concerns Expressed by Metro Vancouver	Summary of Trans Mountain Response	Status and any Commitments / Follow-up Actions
Metro Vancouver Corporate Services Director	April 17, 2013	Lexa Hobenshield emailed to request a meeting with Metro Vancouver to provide an update on all aspects of the project and seek input. Updates include: • Project scope – proposed scope was 750,000 barrels per day. In January of this year, the scope increased to 890,000 barrels per day. With this change comes some differences in infrastructure requirements and tanker traffic bound for our dock. • Routing –now identified potential alternative routes and Trans Mountain would like to seek input on these proposed routes as they may relate to Metro Vancouver infrastructure. • Environment and Socio Economic Assessment – ESA Approach is now available for review on Trans Mountain's website. Requested an opportunity to provide a brief overview. • Engagement – Trans Mountain has completed several Public Information Sessions and a report documenting those sessions is available on the website. Metro Vancouver staff participated in a recent workshop to provide input to the ESA approach. Trans Mountain has upcoming workshops to seek input from stakeholders about topics including the ESA and routing.	No response		
Metro Vancouver Senior Project Engineer, Regional Planner	May 17, 2013	Trans Mountain emailed Metro Vancouver staff to advise Toll Application had been approved by National Energy Board	No response		
Metro Vancouver Corporate Services Director	May 31, 2013	Trans Mountain Invited Metro Vancouver staff to Community Workshops and Open Houses scheduled in Metro Vancouver region during late June 2013.	Metro Vancouver declined and noted preference to meet individually rather than attend multi stakeholder workshop.	Agreed to engage in a way that is best for Metro Vancouver	
Metro Vancouver Corporate Services Director	June 19, 2013	Trans Mountain provided email notification about field studies	No response		
Metro Vancouver Property Negotiator, Engineer	June 25, 2013	Trans Mountain Land Agent and Engineer Teleconference with Metro Vancouver regarding infrastructure in and around the Eaglequest Golf Course.	See next communication		Feedback will be taken into account while selecting the final alignment of the pipeline during the detailed engineering and design phase of the project
Senior Property Negotiator	June 26, 2013	Email from Metro Vancouver to Trans Mountain	Provided details of various statutory rights-of-way in vicinity of Eaglequest Golf Course		Feedback will be taken into account while selecting the final alignment of the pipeline during the detailed engineering and design phase of the project
Metro Vancouver Regional Planner	June 2013	Trans Mountain invited Metro Vancouver to Community Workshops on June 26, 2013 and to provide online input to routing in Burnaby			See Volume 3A, Table 1.7.3 Key Topics of Interest or Concern - Lower Mainland/Fraser Valley (Chilliwack to Burnaby) of the Application for all comments from engagement activities during this phase, including public information sessions, ESA Workshops, community workshops and online engagement.

TABLE 1.1.1.01A-1

ROUTING CONSULTATION ACTIVITIES WITH METRO VANCOUVER (continued)

Stakeholder / Group Name	Date of Activity	Method / Location of Engagement (routing specific)	Summary of Comments / Concerns Expressed by Metro Vancouver	Summary of Trans Mountain Response	Status and any Commitments / Follow-up Actions
Metro Vancouver Corporate Services Director	July 9, 2013	Trans Mountain emailed invite to attend Abbotsford Open House	No response		
Metro Vancouver Property Negotiator	July 20, 2013	Trans Mountain met with Metro Vancouver to deliver the project information package, and discuss consent for survey permissions on a number of parcels.	Metro Vancouver had no questions for Trans Mountain and indicated that they would begin the required master licence.	To date, we have not received the license agreement.	
Metro Vancouver Research Officer	August 28, 2013	Trans Mountain representative emailed Metro Vancouver requesting regional parks GIS shapefile data	No files received		
Metro Vancouver CAO, Chair, Corporate Services Director	September 4, 2013	Trans Mountain emailed to advise that TMEP would be attending UBCM and would be available to meet	No response		
Metro Vancouver	September 11, 2013	Trans Mountain emailed to invited Metro Vancouver to attend Terminals Open House on September 25, 2013 in Burnaby	No response		
Metro Vancouver CAO, Deputy CAO, Chair	December 16, 2013	Trans Mountain emailed to advise that Facilities Application had been filed	No response		
Metro Vancouver Corporate Services Director	December 16, 2013	Trans Mountain phoned to advise that it had filed the Facilities Application and suggested a meeting with Metro Vancouver to discuss routing proposed through regional parks	Metro Vancouver staff indicated that they had been advised by their manager to wait until more definite information available, and then they would determine impacts and mitigation	Trans Mountain will continue to share information with Metro Vancouver Parks staff and request a meeting	
Metro Vancouver consultant	January 9, 2014	Metro Vancouver representative emailed Trans Mountain to request Digital Files for Lower Mainland Pipeline Route.	Consultant reviewing Trans Mountain pipeline corridor with respect to any impacts on Metro Vancouver Parks. Reviewed Interactive Map and plotted regional parks, but would like to prepare a reference map at a scale with more detail. Note that closest possible impacts being on Surrey Bend Regional Park and the Brunette Fraser Greenway.	See below	
Metro Vancouver Consultant	January 14, 2014	Trans Mountain emailed Metro Vancouver consultant and advised: • TMEP routing process is iterative and ongoing. Mapping will likely change as work progresses. • At this time and subject to refinement, proposed routing could impact Brunette, Colony Farms and Surrey Bend Park. Requested meeting to explain routing process and ongoing corridor developments. Would like to learn more about any potential plans Metro Vancouver has for the areas of discussion and potential concerns.	See below		
Metro Vancouver Consultant	January 20, 2014	Metro Vancouver representative responded by email to Trans Mountain	Forwarded your offer of a meeting to ensure that we have a coordinated approach and the right people are able to attend. Likely will be a date after February 11, 2014. Promised to respond with preferred dates as things firm up.		
Metro Vancouver Parks Director	February 11, 2014	Trans Mountain called Metro Vancouver contact to discuss pipeline corridor challenges and regional parks issues (Colony Farms, Surrey Bend Parks); as well as reviewed information contained in application. Trans Mountain discussed the need for a meeting between technical staff.			See next line

TABLE 1.1.1.01A-1

ROUTING CONSULTATION ACTIVITIES WITH METRO VANCOUVER (continued)

Stakeholder / Group Name	Date of Activity	Method / Location of Engagement (routing specific)	Summary of Comments / Concerns Expressed by Metro Vancouver	Summary of Trans Mountain Response	Status and any Commitments / Follow-up Actions
Metro Vancouver: • Regional Parks Director • General Manager, Water Services • Liquid Waste Services • Senior Engineer, Air Quality Policy and Management • Property Division Manager • Director, Air Quality & Environment • Parks Central Area Manager • Senior Project Engineer • Regional Planner	March 12, 2014	Meeting to discuss proposed pipeline corridor routing and other topics *(NOTE: this only includes routing topics covered)* Trans Mountain provided overview of existing operations and background and Project status. Trans Mountain provided routing update and explained that what was filed with NEB was a proposed pipeline corridor that will continue to be refined. Trans Mountain would like an opportunity to study Surrey Bend Park. When Trans Mountain constructed Anchor Loop construction was completed in very narrow footprint *(i.e.* Yellowhead heritage rail bed, where there is also a Telus fibre optic line). Trans Mountain offered aerial imagery and LIDAR that is being collected in June 2014.	Metro Vancouver noted that staff are not able to provide advice or comment on Metro Vancouver position. Metro Vancouver staff will report to environment and parks committee, intergovernmental committee and the Board with regard to impact of Trans Mountain on Metro Vancouver infrastructure. Metro Vancouver has submitted an ATP, staff are gearing up for the process and working through the Application. Metro Vancouver property services have already been involved as Trans Mountain has requested access to Metro Vancouver lands for surveys. Metro Vancouver is about to start construction on a water main project in a similar area of Colony Farms Park. Metro Vancouver noted that Trans Mountain and Metro Vancouver share proposed infrastructure corridors west from 200 Street (Langley) near the treatment plant by Golden Ears Bridge. Metro Vancouver has infrastructure in Surrey Bend Park on the north side. Metro Vancouver advised that survey consent to Surrey Bend Park is currently being arranged. Expected access would be provided shortly.		Input documented & will be considered in selecting the final alignment of the pipeline during the detailed engineering and design phase of the project
			MV asked if a full 18 m ROW is required for the entire pipeline	Depending on location, may be able to work in restricted workspace.	
			Do you envision installing another pipeline in the future?	An additional pipeline not likely due to restrictions from dock/vessel transits/storage.	
			Fraser River water line crossing west of Port Mann bridge follows similar alignment and timeline. 60" diameter pipe. Congested area. Is there a distance required between waterline and your pipeline?	It would be treated as a utility crossing.	
			Metro Vancouver is considering a second phase of the methane capture system on the Eaglequest Golf Course landfill. There are Metro Vancouver trails in the Brunette Conservation Area. Metro Vancouver pipe infrastructure crosses Highway One (from north to south) west of Brunette.	There may be opportunities to to enhance infrastructure (trails) in the area.	
			Metro Vancouver requested digital maps to overlay our infrastructure to identify problem areas.	Trans Mountain committed to providing mapping information. [Trans Mountain provided digital files to Metro Vancouver April 2, 2014 (see below)]	
			What does the process to refine your alignment look like?	Trans Mountain need to confirm a corridor where there are modifications by completing engagement and making supplemental filings (June 2014). Over next 18 months, determine centre-line, construction methods and crossing agreements. On the technical side, when Trans Mountain filed the Application only about 10% of the engineering was complete, the remaining will be completed by June 2015]	
			It is common for us to do pre-builds, but we need to budgets for this. We are heading into 2015 budget cycle in 3 to 4 months. We need to be identifying budget to handle any pre-construction we may need to do where some of our future projects interface with your plans.	Explained the NEB process. Prior to receiving approval landowners get a chance to review and comment on the route. Trans Mountain offered to convene flyover of the corridor for Metro Vancouver.	

TABLE 1.1.1.01A-1

ROUTING CONSULTATION ACTIVITIES WITH METRO VANCOUVER (continued)

Stakeholder / Group Name	Date of Activity	Method / Location of Engagement (routing specific)	Summary of Comments / Concerns Expressed by Metro Vancouver	Summary of Trans Mountain Response	Status and any Commitments / Follow-up Actions
			Metro Vancouver suggested a series of meetings between technical experts. Next step is to identify subject matter experts	This approach has worked with other local government.	
			What is the process for land acquisition?	Trans Mountain has started to generate sketches for the 2000 land parcels along the route. Trans Mountain will start land acquisition in Q2 2014.	
			City of Surrey owns some of the Surrey Bend Park land. MV has sewer infrastructure through Surrey Bend Park. Some land came from the Province but must use is as a park (*i.e.* land covenants on property). MV have lease over the entire property, but administratively with multiple land interests, and combined with the restrictions this may be very challenging. MV will need a long lead time to deal with.	Trans Mountain investigating MOT lands for pipeline right-of-way adjacent to Surrey Bend Regional Park.	
			There is a board adopted plan for Surrey Bend Park. It is posted on the website.		
			We are planning a directional drill somewhere between Port Mann bridge and Langley to accommodate our sewer infrastructure. We can discuss in more detail when we get our disciplines together.		
Metro Vancouver Parks Director	March 14, 2014	Trans Mountain emailed Metro Vancouver requesting a good time to call to discuss next steps and how to work together to share information going forward.			
Metro Vancouver Director, Air Quality & Environment	April 2, 2014	Trans Mountain provided digital files to Metro Vancouver by email			
Metro Vancouver Director, Air Quality & Environment	April 29, 2014	In response to requests to discuss next steps, Metro Vancouver staff called Trans Mountain	Metro Vancouver found recent meeting very useful. It likely reduced the number of IRs we will receive. Metro Vancouver will not meet with Trans Mountain again until after the first round of Intervenor Information Requests, but at that time Metro Vancouver expects to continue to work together. With respect to survey consent for Colony Farms, Coquitlam landfill (Eaglequest) and Surrey Bend Park; the consents are ready but are being held up. Given the contentious nature of the project, the decision will be made at a political level. Metro Vancouver acknowledged that survey consent is simply to explore the option, which may include ruling it out. Burke Mountain Naturalists will present as a delegation to the Metro Vancouver Environment & Parks Committee on June 6th. Expected concerns, that Metro Vancouver should not provide survey consent to Trans Mountain and that a pipeline in the park is not a compatible use	Agreed that we would exchange 'subject matter experts' information to enable information exchange going forward.	

Note: Other non-routing conversations (air quality, marine related, socio-ec) with MV not included here

1.1.02 Foreign Pipeline Crossing Detail

Reference:

i) Volume 4A - Project Design and Execution – Engineering, Section 3.2.18 (Clearance Between Adjacent Facilities)

ii) Volume 4A - Project Design and Execution – Engineering, Appendix C, Page 8, Typical Drawing TMEP PT-6702.

Preamble:

Section 3.2.18 states "*In urban areas a minimum clearance of 0.7 m will apply, where practical, and a precast slab will be installed between the new TMEP pipeline and the adjacent facility. A Typical Foreign Pipeline Crossing drawing is included in Appendix C.*"

The referenced Typical Drawing shows that a pre-cast concrete slab will be placed between all foreign pipelines and the Proposed Pipeline for all crossing types.

Request:

Please provide:

a) Confirmation that the pre-cast slab and marker tape installations will be installed for all crossing types (including Horizontal Directional Drill and Bore).

Response:

a) Trans Mountain only intends on installing the pre-cast concrete slabs and marker tapes at under crossing of foreign pipelines in urban areas that is conducted by open-cut construction installation method. Trans Mountain is unable to confirm the commitment requested in the IR, but will be carrying out a detailed engineering assessment during the Design Engineering and Design Phase of the Project to establish the need for the installed precast concrete slabs between the proposed Line 2 pipeline and existing Metro Vancouver public utilities.

1.1.03 Locating Parallel Utilities and Notice for Work in Proximity to Parallel Utilities

Reference:

i) Volume 4A - Project Design and Execution – Engineering, Section 3.2.19 (Parallel Facilities)

ii) Volume 4A - Project Design and Execution – Engineering, Section 3.2.18 (Clearance Between Adjacent Facilities)

iii) Volume Volume 4B - Project Design and Execution – Construction, Section 5.2.9 (Ground Disturbance Plan)

Preamble:

Section 3.2.18 identifies the clearance that will be maintained between the proposed TMEP pipeline and parallel pipelines.

The method to be used to confirm the location and depth of Adjacent Facilities is clearly identified in the referenced Typical Drawings. There is no information provided regarding the method to be used to identify parallel pipelines.

The notification that will be provided to Owners of existing pipelines in advance of excavation for Adjacent Facilities (crossings) is clearly identified in the referenced Typical Drawings. There is no information provided regarding the notice to be provided to Owners of parallel pipelines.

Request:

Please provide:

a) Method to be used to confirm the location and depth of parallel pipelines.

b) Notification period that will be provided to owners of parallel pipelines and the distance threshold that will be used to determine when a parallel pipeline is “in proximity” of the construction (and the owner will be notified of work taking place within proximity of their infrastructure).

c) Details of precautions that will be taken during construction to ensure that infrastructure that is being crossed or is in proximity to the proposed pipeline is not affected during the construction or operating life of the proposed pipeline. This information may include detailed design information (plans, elevations, profiles, etc.) and construction methodology.

Response:

a) Please refer to the response to Klakowich K IR No. 1.3.2.

b) A preliminary assessment of third party crossings and adjacent parallel facilities including the existing Trans Mountain pipeline has been completed. An engineering survey will be completed during the detailed engineering and design phase to confirm

the exact location of these facilities and identify any other facilities that intersect the construction footprint. This information will be documented on the construction drawings and line lists that are cross referenced to crossing and proximity agreements that will be developed prior to construction. Trans Mountain expects the notification period to be documented and mutually agreed with Metro Vancouver within these agreements.

Pre-excavation protocols will adhere to Trans Mountain's Ground Disturbance Plan (GDP) as described in the NEB application Volume 4B – Project Design and Execution – Construction page 4B-55. An independent third party will complete a sweep of the construction footprint as part of the pre-construction process for each construction segment prior to commencing excavations or ground disturbances.

c) Details of the precautions that will be implemented by Trans Mountain during construction will be established during the Detailed Engineering and Design Phase of the Project. The development of the precautions to be employed will include consultation with infrastructure or utility owners, including Metro Vancouver.

1.1.04 Cathodic Protection

Reference:

i) Volume 4A - Project Design and Execution – Engineering, Section 3.2.21.1 (Cathodic Protection - General)

ii) Volume 4A - Project Design and Execution – Engineering, Section 3.2.21.3 (Cathodic Protection – Cathodic Protection System)

Preamble:

Section 3.2.21 discusses the cathodic protection system to be used for the proposed TMEP pipeline. Some GVS&DD pipelines are equipped with cathodic protection. Adjacent cathodic protection systems have the potential to impact each other.

Request:

Please provide:

a) Methods to be used to identify parallel or adjacent utilities that are equipped with cathodic protection systems and measures that will be taken to ensure that the cathodic protection systems will not interfere with each other.

Response:

a) Part of the cathodic protection design process will include identification and control of interference caused by cathodic protection systems or other sources.

Trans Mountain will follow the guidelines outlined in Appendix C: Control of Direct Current Interference, as part of Canadian Gas Association Recommended Practice OCC-1-2005, “Control of External Corrosion on Buried or Submerged Metallic Piping Systems”.

Reference:

Canadian Gas Association. 2005. Recommended Practice OCC-1-2005, “Control of External Corrosion on Buried or Submerged Metallic Piping Systems”, Appendix C: Control of Direct Current Interference.

1.1.05 Municipal Sewage System Demands (GVS&DD)

Reference:

i) Volume 4A - Project Design and Execution – Engineering, Section 3.4.4.2 (Westridge Marine Terminal – Civil)

ii) Volume 4A - Project Design and Execution – Engineering, Section 3.4.4.6.3 (Westridge Marine Terminal – Mechanical – Potable Water/Sewage System)

Preamble:

Section 3.4.4.2 mentions infrastructure components including "*municipal water and sewage connection*". There is no identification of the new loadings on the municipal sewage system that will result from the construction or operation (including maintenance activities) activities associated with the proposed pipeline.

Request:

Please provide:

a) A summary of all anticipated loading to the municipal sewer system, including an indication of existing loading and new loading that is expected to result from the construction or operation (including maintenance) activities associated with the proposed pipeline.

Response:

a) Additional loading on the municipal sanitary sewer system, from either construction or operations, for the proposed expansion at Westridge Marine Terminal (WMT), is not known at this time. Also refer to the response to City Burnaby IR No. 1.18.06d. It is anticipated that construction related sewage will be handled by truck. Sanitary sewer system loading, if applicable, will be determined during the detailed engineering and design phase. The storm water management system proposed for WMT is described in Section 3.4.4.2.1, Volume 4A of the Facilities Application. Trans Mountain does not anticipate any additional loads to the municipal storm water system from construction or operations.

1.1.06 Impact of Westridge Marine Terminal Operations on Westridge Combined Trunk Overflow

Reference:

i) Volume 4A - Project Design and Execution – Engineering, Section 3.4.4.1.4 (Westridge Marine Terminal – Proposed Expansion). Figure 3.4.13 and Figure 3.4.14.

Preamble:

Sewage outfalls are monitored on a regular basis for deposition and erosion of materials that could either affect the performance of the outfall pipe or could undermine the structural integrity of the outfall pipe. The Westridge Combined Trunk Overflow outfall is located east of North Cliff Avenue, near the western boundary of the "Harbor Headline" shown on Figure 3.4.14.

Changes in activities or structures in marine environments in proximity to GVS&DD outfalls have had significant impacts on the maintenance requirements for these outfalls.

Request:

Please provide:

a) A summary and copies of all studies that have been performed or are planned to determine the impact on the GVS&DD Westridge Combined Trunk Overflow outfall operation and maintenance as a result of all new operating/maintenance activities, new infrastructure and/or construction activities that will occur as a result of the proposed pipeline expansion.

b) Summary and details of all mitigation measures that are being taken to prevent impacts on the GVS&DD Westridge Combined Trunk Overflow outfall operation and maintenance as a result of all new operating/maintenance activities, new infrastructure and/or construction activities that will occur as a result of the proposed pipeline expansion.

Response:

a) Trans Mountain has not conducted a study to determine the potential impact of the proposed expansion of Westridge Marine Terminal (WMT) on the existing GVS&DD Westridge Combined Trunk Overflow outfall operation or maintenance. However, Trans Mountain is continuing to optimize the WMT layout with the intent to keep the extent of the foreshore expansion east of the west boundary of the existing water lot. Please refer to the responses to City Burnaby IR No. 1.18.03a, 1.18.03c, and 1.18.12a. As such, Trans Mountain does not anticipate any material impact on the outfall. Trans Mountain is open to opportunities to meet with Metro Vancouver to discuss any concerns related to the outfall so that appropriate considerations can be made in detailed design and in construction and operations planning.

b) Please refer to the response to Metro Vancouver IR No. 1.1.1.06a.

1.1.07 Buried GVS&DD Utilities

Reference:

i) Volume 4A - Project Design and Execution – Engineering, Appendix D, Table 5.1.17 (Preliminary Buried Cables and Utilities)

Preamble:

This table identifies 5 GVS&DD Metro Vancouver "Drainage" crossings. There are a total of 9 GVS&DD sewage pipeline crossings within the Pipeline Corridor (more depending on detailed routing within the corridor). In addition, there are 8 GVS&DD pipelines that are located in parallel within the proposed pipeline corridor.

North Surrey Interceptor, 104th Avenue Section (parallel).
North Surrey Interceptor, 104th Avenue Section (crossing).
North Surrey Interceptor, CN Section West Section (parallel).
North Surrey Interceptor, CN Section West Section (crossing).
North Surrey Interceptor, 156th Street Section (parallel).
Coquitlam Interceptor, Cape Horn Section (parallel).
Coquitlam Interceptor, Cape Horn Section (crossing).
Maillardville Sanitary Trunk (crossing).
Hart-Austin Sanitary Trunk, Brunette Interceptor to Roderick Avenue Section (crossing).
Brunette Interceptor (parallel).
North Road Sanitary Trunk (crossing).
Lake City Interceptor, Broadway to Government St Section (parallel).
Lake City Interceptor, Broadway to Government St Section (crossing).
Stoney Creek Sanitary Trunk (crossing)
Lake City Interceptor, Broadway to Government St Section, Eastlake Drive (parallel).
Lake City Interceptor, Broadway to Government St Section, Eastlake Drive (crossing).
Lozells Sanitary Trunk, Westridge Forcemain Section (parallel).

Request:

Please provide:

a) Details of the proposed design of each crossing of a GVS&DD pipeline.

b) Additional information as required for each of the crossings and proximal work noted above to demonstrate how the design will mitigate any potential impacts where the proposed pipeline crosses or is in proximity to GVS&DD pipelines. This includes, but is not limited to, additional documentation, geotechnical analyses (e.g. settlement, movement) and detailed engineering design information such as equipment access, construction methods, elevations, plans, profiles for both existing and future GVS&DD pipelines to ensure that construction will not adversely impact these pipelines during and after construction, and will not impact GVS&DD's ability to access the pipelines in the future.

Response:

a) Details of the proposed design of each crossing of a GVS&DD pipeline will be established during the Detailed Engineering and Design Phase of the Project. Please refer to the response to Metro Vancouver IR No. 1.1.1.03c.

b) In the Detailed Engineering and Design Phase for TMEP currently starting, Trans Mountain is willing to work with Metro Vancouver on crossings and proximal work on its infrastructure. Trans Mountain is also willing to accommodate reasonably foreseeable plans for municipal infrastructure in the design and placement of the pipeline. Issues or concerns that may arise in connection with the infrastructure mentioned above will be resolved by Trans Mountain with Metro Vancouver during this phase of the Project. Please refer to the response to FVRD IR No. 1.38d for more detail.

1.1.08 Route Maps

Reference:

i) Volume 4A - Project Design and Execution – Engineering, Appendix E, Route
ii) Maps (Drawing Number 19731-8013-0038, Sheet 53 and 54)

Preamble:

Comments on conflicts between GVS&DD infrastructure and the proposed pipeline corridor are based on GIS information provided by Trans Mountain to Metro Vancouver on April 2, 2014. The routing shown in the GIS data provided on April 2, 2014 differs from the routing shown on the Route Maps contained within the December 6, 2013 National Energy Board Application.

Request:

Please provide:

a) Confirmation that the currently anticipated route aligns with the GIS data provided to Metro Vancouver by Trans Mountain on April 2, 2014.

Response:

a) The GIS data provided to Metro Vancouver on April 2, 2014 aligns with the preliminary route shown in the updated route maps attached to the response to NEB IR No. 1.84a (NEB IR No. 1.84a – Attachment 1). This preliminary route alignment within the proposed pipeline corridor is representative only, with the final positioning for the pipeline to be determined during the detailed engineering and design phase of the Project which is just commencing.

   The route maps attached to the response to NEB IR No. 1.84a also show an update of the proposed pipeline corridor. The corridor matches the data shared on April 2, 2014 with a few minor changes, the most significant of which affects the extension to accommodate temporary workspace at Colony Farms Regional Park, please refer to the response to Metro Vancouver IR No. 1.1.4.01a for details.

1.2 Solid Waste Operations

1.2.01 Proposed Route Alignment, Right-of-Way and Temporary Work Space

Reference:

i) Volume 2 – Project Overview, Economics and General Information Page 2-56 and Pages 2-59 to 2-62

ii) Information provided to Metro Vancouver: 2014-04-02 Trans Mountain Expansion Project – Preliminary Corridor Map with WS and LWS Infrastructure V1.pdf and Application by Trans Mountain For Approval Of The Trans Mountain Expansion Project Volume 4A Appendix E Maps drawing number 19731-8013-0038 sheet 54 of 54

Preamble:

An excerpt from reference (i) above is as follows: "The proposed pipeline corridor follows the Lougheed Highway although a deviation is being considered to traverse existing industrial lands and railway easements within the Brunette River Conservation Area." The information provided to Metro Vancouver [reference (ii)] shows the proposed corridor crosses the Coquitlam Landfill which is located on United Boulevard just west of King Edward. Reference (i) (pages 2-59 to 2-62) indicates the required right-of-way and temporary work space are 18.3 m and 26.7 m respectively.

The Coquitlam Landfill has been closed since 1983 and has been developed on the north side with a tenant with a long term lease. There is a sanitary trunk sewer going through the property as well as environmental infrastructure for the landfill (leachate and landfill gas collection and monitoring systems) throughout the site. GVS&DD also has plans for a new solid waste facility on the south side of the site which is expected to be constructed in the near future.

Request:

Please provide:

a) A more detailed proposed alignment through the Coquitlam Landfill.

b) An explanation of why an 18.3 m wide right-of-way is required if the pipeline is 36 inches in diameter.

c) An explanation of why a 26.7 m wide temporary work space adjacent to the right-of-way is required.

d) Details of the minimum space requirement that could accommodate the pipeline and construction activities.

Response:

a) To date Metro Vancouver has not consented to permit access to the Coquitlam Landfill for routing survey. A more detailed proposed alignment will be prepared after survey access is granted and with consultation with Metro Vancouver.

b) An 18.3 m wide right-of-way is the conventional right-of-way where there are no restrictions limiting the amount of right-of-way that could be acquired. The intent of the width of the right-of–way is to provide access and room to work for operation and maintenances activites. In locations of restricted right-of-way opportunity, Trans Mountain will reduce that width to a negotiated minimum, provided that safe operation and maintenance of the new proposed pipeline can be ensured.

c) The 26.7 m wide temporary workspace adjacent to the right-of-way would be for a conventional footprint where there are no restrictions limiting the amount of temporary workspace that could be acquired.

The 26.7 m temporary workspace comprises the following:

- a working lane for workers and equipment working adjacent to the excavated ditch and the pipe lay-up area;
- a passing lane (often referred to a safety lane for emergency vehicles in the event of an emergency) to allow vehicles and equipment to safely pass around men and equipment parked or working in the work lane;
- some room for grade material storage and its repose;
- room for a portion or all of the topsoil and its repose; and
- buffer space between dissimilar soils.

d) Many factors have to be considered in determining the minimum space requirement that could accommodate the pipeline and construction activities. These factors include, but are not limited to: pipe installation methodology, soil type, topography, geology, length of section, adjacent facilities, land-use, vegetation, crossing type and method. Considering these factors, the minimum space requirement could range from 1.0 m (in a trenchless scenario not including entry and exit locations) to a hundred metres or more at conventionally trenched watercourse crossings. Minimum space requirements will be determined on a case by case basis during the detailed engineering and design phase of the Project. To date we have only developed and assumed a design for restricted work space construction equal to the standard easement width of 18.3 m as submitted to Metro Vancouver for information in an email dated April 29, 2014.

1.2.02 Pipeline Design and Construction

Reference:

i) Volume 4A Project Design and Execution – Engineering Design and Appendices A-D
ii) Volume 4B Project Design and Execution – Construction

Preamble:

References (i) and (ii) provide an overview of the proposed pipeline corridor selection process and engineering design principles, design criteria, and preliminary design for the pipelines, pump stations, terminals, power supplies, and other ancillary facilities.

Additional detail is requested regarding design, construction methods, and scheduling.

Request:

Please provide:

a) For cut and cover construction method, what is a typical trench dimension and pipe position within the trench? Include a typical section with backfill specifications.

b) Is cut and cover construction proposed for the pipeline through the Coquitlam Landfill? Is trenchless technology method a viable alternative for construction? If so, which methods and why?

d) How would a pipeline design and construction on the landfill be modified to accommodate issues related to municipal solid waste beneath the pipe? Issues could include soft foundation, settlement, seismic related displacement, landfill gas, and pipe exposure to leachate.

e) Could the pipeline design (e.g. location and depth) be modified to avoid existing or planned environmental infrastructure at the Coquitlam Landfill?

f) Page 4B-10 shows a construction schedule from April 2016 to November 2017 for Spread BC5. How long would the onsite work at the Coquitlam Landfill require? This proposed schedule might be in conflict with construction planned at the landfill. Could the proposed pipeline construction schedule be changed?

Response:

a) The typical trench dimensions are determined from the pipeline specified minimum depth of covers that are shown in Volume 4A, Appendix 4, Table 5.1.13 and a general requirement to have a minimum separation of 300 mm between pipe and trench walls to allow backfill to flow effectively around the pipe. Additional width will be required if trench needs to be accessed and to comply with regulations for trench safety and where geotechnical engineer specifies greater width dependent on soil strength conditions.

b) Trans Mountain will develop details of the construction methodology, to be used for the pipeline installation through the Coquitlam Landfill, during the Engineering and Detailed Design Phase of the Project.

d) Modifications to the preliminary pipeline design to avoid the existing or planned environmental infrastructure would be considered by Trans Mountain during the Detailed Engineering and Design Phase of the Project. Trans Mountain would like the opportunity to meet with Metro Vancouver Solid Waste division engineers at their earliest convenience to discuss the design, construction methods and any potential impacts of the pipeline construction with the operations at the Coquitlam Landfill.

e) Modifications to the preliminary pipeline design to avoid the existing or planned environmental infrastructure would be considered by Trans Mountain during the Detailed Engineering and Design Phase of the Project. As per the response to Metro Vancouver IR No. 1.1.2.02d, Trans Mountain would welcome meeting to discuss concerns about potential impacts of the pipeline construction with the existing environment infrastructure at the Coquitlam Landfill.

f) The construction schedule for the pipeline will not be finalized until the last stage of the Detailed Engineering and Design Phase of the Project. The duration of onsite work at the landfill site is wide ranging depending on construction methodology through the site itself and across the nearby Brunette Avenue interchange. Trans Mountain commits to consult with Metro Vancouver in the development of the Projects construction schedule within the Coquitlam Landfill site and would like to initiate discussions in Q3 2014.

Summary of New Commitments:

- Trans Mountain commits to consult with Metro Vancouver in the development of the Projects construction schedule within the Coquitlam Landfill site and would like to initiate discussions in Q3 2014.

1.2.03 Pipeline Operations and Maintenance

Reference:

i) Application by Trans Mountain For Approval Of The Trans Mountain Expansion Project Volume 4C Project Design and Execution – Operations and Maintenance

ii) Presentation to Metro Vancouver: Trans Mountain Expansion Project, March 12, 2014, Slide 40 Pipeline ERA Spill Volumes

Preamble:

The frequency and duration for routine pipeline inspection and maintenance is identified on page 4C-15.

Response to Leak Alarms is described on page 4C-23, but does not provide any details other than indicating field personnel will be dispatched to investigate.

Request:

Please provide:

a) Information on whether there are other routine inspection and maintenance activities not listed on page 4C-15. If so, describe and indicate frequency and duration.

b) Details of how soon field personnel would be dispatched in the event of an alarm. Provide details on what activities would be completed to determine if there is a leak.

c) Details of the expected spill response time if a leak is found. What would be the estimated volume of a spill and how is this calculated or estimated (slide 40 indicates 812 to 2,700 m3)? How will a spill be cleaned, particularly if hydrocarbons penetrate into the waste and groundwater? How will landfill infrastructure be protected during a cleanup?

Response:

a) Please refer to Volume 4C, Page 4C-16, Sections 6.4 and 6.4.1 of the Application for information regarding other inspection and maintenance activities.

b) A leak alarm is generated by the computational pipeline monitoring system notifying the Control Centre Operations (CCO) of a possible leak. As described in Section 7.1.11.5, Volume 4C of the Facilities Application, the CCO will follow a documented procedure, within the Control Centre procedures, to determine if the alarm is a probable false alarm or a probable leak. If the evaluation leads to a determination of a probable leak, the CCO will use the SCADA system to shut down the pipeline and immediately dispatch field operations personnel to verify if there is a leak or otherwise identify the cause of the alarm.

   Activities required before the pipeline can be restarted are generally described in Section 7.1.11.6, Volume 4C of the Facilities Application.

c) As described in the response to Allan R IR No. 1.17l, Trans Mountain is undertaking a risk-based design so that risk mitigation measures can be pre-emptively identified and incorporated at the design stage to address principal risks. For the purposes of the risk assessment that will support the risk-based design process, Trans Mountain has employed assumptions involving a most credible worst-case scenario, in which full-bore releases along the pipeline right-of-way are modeled. The outflow modeling process is described in Section 3 of Volume 7 of the Application, and the results of that analysis are presented by pipeline location in Appendix B of Volume 7 of the Application.

With respect to emergency preparedness and response, please refer to the response to Metro Vancouver IR No. 1.1.2.03b for initial actions and response time. Section 4, Volume 7 of Application, outlines the emergency management program which includes emergency response plans. The emergency response plans are comprehensive in their application regarding hazards, potential emergency situations and response methods for various environmental impacts. Section 4.8, Volume 7 of Application outlines the process to enhance Kinder Morgan Canada's (KMC) existing emergency management programs as they relate to the Trans Mountain Pipeline system to address the needs of TMEP. The final programs will be developed in a manner consistent with the NEB's draft conditions 42, 52, 53 and 54.

In the event of a release, following the emergency response phase where free product is collected, Kinder Morgan Canada Inc. (KMC) completes a subsurface investigation to determine impacts to soil and groundwater. A remediation program is then developed and implemented. The program continues until contaminant concentrations reach acceptable government criteria. If the remediation program includes disposal of soil at a landfill, the soil will be tested to make sure it meets criteria for acceptance at the landfill prior to transporting to the facility.

1.3 Water Services Operations

1.3.01 Pipeline Corridor Selection Objectives

Reference:

Volume 4A – Project Design and Execution – Engineering, 2.8.1 Pipeline Corridor Selection Objectives, Strategies and Criteria

i) PDF page 4A-6, Line 1 to 5
ii) PDF page 4A-7, Line 5 to 8
iii) PDF page 4A-7, Line 24 to 26

Preamble:

Reference (i) states that Trans Mountain decided that the Line 2 pipeline segments should be contiguous with the existing 18m (60ft) wide TMPL easement for over 70 percent of the distance, it was not possible in all locations.

Reference (ii) states that the proposed TMPL Line 2 pipeline segments generally require a construction right of way of 45m, Trans Mountain decided to study and apply for a wider corridor (generally 150m).

Reference (iii) states that one of the strategies for the selection of the corridor was to acquire engineering, constructability, geotechnical, environmental, socio-economic, operations, maintenance, and cost data in support of the proposed Line 2 alternative corridor.

The GIS data supplied to Metro Vancouver by Trans Mountain for the proposed pipeline route shows variations in the width for the TMPL easement where it crosses existing and future Metro Vancouver water mains. It is not clear which portions of these easements are present versus which are proposed.

The proposed pipeline and construction right of way interferes with the existing Metro Vancouver's water main system, particularly at the following crossing area locations:

1) Barnston Island Main at 201st St. and 99A Ave.;

2) Port Mann Main No. 1 (existing) and Port Mann Main No. 2 (planned) near the Mary Hill By-pass interchange;

3) Sapperton Main No.1 at Brunette Ave. and Hwy. 1, Sapperton Main No. 2 on the south side of Hwy. 1, and North Road Main on North Road just south of Hwy. 1;

4) East Burnaby Main, parallel section along Lougheed Hwy. and crossing at Gaglardi Way; and North Burnaby Main at intersection of Eastlake Dr. and Underhill Ave.; and

5) North Burnaby Main on Shellmont St. just east of Meadowood Pk.

Metro Vancouver is not in a position to review the potential impacts of the project on its water main infrastructure, due to the lack of detailed information in the NEB application.

Request:

a) Please provide additional information to demonstrate how Trans Mountain will mitigate any potential impacts where the proposed pipeline crosses or parallels Metro Vancouver water mains, to ensure that construction will not adversely impact the water mains (during and after construction), and will not impact Metro Vancouver's ability to access the water mains in the future. This includes, but is not limited to: additional documentation, geotechnical analyses (e.g. settlement, movement) and detailed engineering design information such as equipment access, construction methods, elevations, plans, and profiles for both the existing and proposed future Metro Vancouver water mains.

Response:

a) At this time the proposed pipeline centerline has not been finalised. Detailed engineering and design, site specific geotechnical analysis and detailed construction plans are not completed. This information will be provided to Metro Vancouver in consultation with their appropriate engineering groups.

The Application before the NEB is for a Certificate of Public Convenience and Necessity for the entire Trans Mountain Expansion Project, it is not for a detailed pipeline route. The detailed route in any particular location will be determined through civil surveys completed during detailed engineering which will define the location of the pipeline on each land parcel. Should a Certificate be issued for the Project, this parcel specific information will be incorporated into the Plan, Profile, Book of Reference filed with the NEB and in the NEB Section 34 notices provided to each landowner. Before approving the detailed route, the NEB is required to hear and consider objections raised by landowners on the detailed route or those whose lands would be adversely affected.

1.3.02 Pipeline Study Corridor

Reference:

Volume 4A – Project Design and Execution – Engineering, 2.8.2.4 Pipeline Study Corridor

i) PDF page 4A-9, Line 1 to 8

Preamble:

Reference (i) states that the corridor assessment will involve further detailed assessments by other disciplines once the routing fieldwork is completed on the proposed alternative corridors to ensure that there were no significant impediments to endorsing a particular alternative corridor.

Request:

a) Please confirm whether the results of the additional assessments noted above will be forwarded to Metro Vancouver for review and comment during future design stage(s). Any changes to the proposed pipeline corridor could have significant impacts on Metro Vancouver's water transmission system, as noted above in paragraph 1.3.1 (Pipeline Corridor Selection Objectives).

Response:

a) Once the pipeline corridor is identified, the next step is to continue the detailed engineering and design phase to define the centerline and the construction footprint within the corridor. Consultation with all potentially affected stakeholders, including Metro Vancouver, will take place in order to design and build Line 2 while avoiding or mitigating any future interference with planned infrastructure. Please refer to Section 2.8.3, Volume 4A and to the response to Matsqui FN IR No. 1.02h.

1.3.03 Seismic Hazards

Reference:

Volume 4A – Project Design and Execution – Engineering, 2.9.3 Seismic Hazards

i) PDF page 4A-12, Line 5 to 10

Preamble:

Reference (i) states that a preliminary screening level assessment (i.e. desktop study) of seismic hazards and liquefaction potential and seismically induced landslides was completed along the entire pipeline corridor and the report is attached in Appendix J. Those areas along the proposed route identified as having elevated liquefaction or landslide potential will then have site specific studies and investigations completed during the detailed engineering and design phase to ensure the adequacy of the pipeline design.

Request:

a) A review of the report in Appendix J indicates that Trans Mountain's consultant, BGC, used a Probabilistic Approach to assess and provide preliminary evaluation of liquefaction potential. Please provide clarification on why this approach was used in the preliminary assessment instead of a more commonly used Deterministic Approach. Also, please confirm whether the detailed site-specific studies and investigation will include discussion on the potential impacts such as settlement/movement of the proposed and the existing water mains, and recommendations on any preventive measures that will be used to minimize these impacts. For example, the proposed pipeline crosses the existing Port Mann Main No. 1 and future Port Mann Main No. 2 in areas where poor/soft soil conditions exist. The installation and construction of the proposed pipeline (or temporary access road if required) may have a significant impact on the water mains and should therefore be addressed in the early design stages as it may affect the proposed alignment of the pipeline.

Response:

a) The probabilistic approach employed in the desktop study was deemed appropriate for its purpose, which was to identify areas with the potential for liquefaction triggering under the Project's design-basis seismic loading conditions. The probabilistic seismic hazard assessment approach is more appropriate for regions where all seismic sources are not completely defined and takes into account uncertainties in the earthquake source, and is the recommended method in the National Building Code of Canada (2010) and the Canadian Highway Bridge Design Code (2006).

It is confirmed that the detailed site-specific studies and design will include considerations regarding potential settlement and movement of the proposed and the existing water main crossings in areas of soft/poor soil conditions.

Summary of New Commitments:

- Work with Metro Vancouver to confirm that the existing Port Mann Main No. 1 and future Port Mann Main No. 2 are considered in detailed design.

1.3.04 Clearance between Adjacent Facilities

Reference:

Volume 4A – Project Design and Execution – Engineering, 3.2.18 Clearance between Adjacent Facilities,

i) PDF page 4A-26, Line 4 to 6

Preamble:

Reference (i) states that in urban areas a minimum clearance of 0.70m for open excavation and 2.0m for Horizontal Directional Drill crossing will apply, where practical, and a precast slab will be installed between the new Trans Mountain pipeline and the adjacent facility.

Request:

a) Please provide additional information, such as detailed design information (plans, elevations, profiles, etc.) and construction methodology, that demonstrates how existing water mains and other related ancillary structures will be protected from the installation of the proposed pipeline at the locations where the pipeline crosses or parallels Metro Vancouver water mains mentioned in paragraph 1.3.1 (Pipeline Corridor Selection Objectives) or any other locations should the pipeline corridor be revised.

Response:

a) The requested information will be developed as part of detailed engineering and design and construction planning. However, based on proximity to existing facilities/ infrastructure, Trans Mountain is committed to install the pipe based on the following requirements:

- Application, Vol. 4A, s.3.2.18 - Clearance Between Adjacent Facilities
- Application, Vol. 4A, s.3.2.19 - Parallel Facilities
- Application, Vol. 4A, s.3.2.20 - Crossings
- Application, Vol. 4B, s.5.2.9 - Ground Disturbance Plan.

1.3.05 Second Narrows

Reference:

Volume 4A – Project Design and Execution – Engineering, 3.4.4.1.3 Second Narrows Requirement

i) PDF page 4A-83, Line 1 to 7

Preamble:

Reference (i) states the immersed depth (or draft) of loaded vessels transiting the Second Narrows is limited to 13m, under the current Port Metro Vancouver operating rules. This is expected to increase to 13.5m in the near future.

Request:

a) Please provide confirmation of whether this will require dredging in Second Narrows, as dredging may impact the three existing Metro Vancouver water main crossings at the Second Narrows location (Second Narrows Crossings 1, 2, and 3). Please also confirm Trans Mountain will undertake a detailed assessment to address any potential impacts on the Metro Vancouver water main crossings due to the increase in tanker traffic at the Second Narrows location.

Response:

a) Trans Mountain confirms that dredging is not a requirement of the project and tankers will follow rules and regulation contained in Port Metro Vancouver's Harbour Operations Manual to ensure their safe passage through the Marine Restriction Area, which covers the locations of the water main crossings. A marine risk assessment for the entire sailing route from Westridge to Buoy J is available in Volume 8C -Termpol 3.15. No further analysis will be undertaken.

1.3.06 Pipeline Diameter Confirmation

Reference:

Volume 4A – Project Design and Execution – Engineering, Table 5.1.9, Appendix D-16

Preamble:

Table 5.1.9 shows that the diameter of the proposed pipeline from Edmonton to Burnaby is 914 mm OD, and Burnaby to Westridge is two lines of 768mm OD.

Request:

a) The GIS data supplied to Metro Vancouver by Trans Mountain do not show the diameter of the proposed pipeline within either the present or proposed TMEP right-of-way from Langley to Westridge. Please confirm the diameter of the proposed pipeline(s).

Response:

a) The diameter of the proposed pipelines from Langley to Westridge are specified in Volume 4A, Section 1.1 of the NEB Application.

1.3.07 Construction Schedule

Reference:

Volume 4B – Project Design and Execution – Construction, 3.2 Construction Schedule

i) PDF page 4B-8, Line 7 to 9

Preamble:

Reference (i) states that the trenchless crossing of Fraser River will be constructed during the summer of 2016 and early work activities such as clearing and access road construction will begin after the receipt of the Certificate of Public Convenience and Necessity (CPCN) permit.

The proposed pipeline construction schedule (May to Sept 2016) overlaps with the construction schedule of the future Port Mann Main No. 2 (North), which is expected to be constructed in 2014 to 2016.

Request:

a) Please provide information regarding construction details such as schedule, work space requirements, construction methods and construction equipment working within the proposed work space and/or right-of-way and lay down areas. Provide information such as drawings, elevations, plans and profiles to confirm that construction of the proposed pipeline will not impact the existing Port Mann Main No.1 and the planned Port Mann Main No. 2. Information should also be provided to support the design, such as geotechnical reports addressing potential increased loading, movement/settlement, and any monitoring of the water mains required both during and after construction.

Response:

a) This information will not be available until detailed engineering and design phase is substantially complete. However Trans Mountain is committed to respectful, transparent and collaborative interactions with Metro Vancouver during the detailed engineering and construction planning phase and will continue to share updated project information and address Metro Vancouver's concerns about the TMEP as they arise.

1.3.08 Clarification of Proposed Route (from the north side of the Fraser River to Burnaby Terminal)

Reference:

Volume 4B – Project Design and Execution – Construction, 3.4.1.7 Spread BC5 (See Table 7.1.5 in Appendix A)

i) PDF page 4A-14, Line 11 to 14

Preamble:

Reference (i) states that the majority of the section from the north side of the Fraser River to Burnaby Terminal is to be installed under the travelled lanes of United Boulevard and the Lougheed Highway. From its junction with Underhill Drive, the corridor will pass through or adjacent to industrial land before entering the Burnaby Terminal.

The above description is different from the GIS data/map provided by Trans Mountain to Metro Vancouver on April 2, 2014.

Request:

a) Please provide further clarification of the proposed route, given that the information in reference (i) is not consistent with the GIS data/map.

Response:

a) Please refer to the response to Matsqui FN IR No. 1.02h, as well as the responses to NEB IR No. 1.40a and 1.84a for information on the routing process and updated corridor alignments. Refer also to Technical Update No. 1 due to be submitted to the NEB in Q3 2014.

1.3.09 Temporary Access Roads

Reference:

Volume 4B – Project Design and Execution – Construction, 3.4.3.2 Proposed New Temporary and Permanent Access and New permanent Bypass

i) PDF page 4B-16, Line 1-11

Preamble:

Reference (i) states that a number of proposed new temporary access roads will be required for logging, clearing, and pipeline construction and are summarized in Table 7.1.8 in Appendix A.

Table 7.1.8 does not present a clear picture of whether a temporary access road will be required at the locations where the proposed pipeline construction crosses or parallels existing or future Metro Vancouver water mains.

Request:

a) Additional information is required from Trans Mountain including an assessment of the potential construction impacts, including temporary access roads, on existing and future water mains.

Response:

a) At this time the proposed pipeline centerline has not been finalised. An assessment of potential construction impacts and plans to mitigate them are not completed. The assessment of impact of temporary access roads will be provided to Metro Vancouver in consultation with their appropriate engineering groups.

   Trans Mountain has initiated detailed engineering and design and is open to discussion with Metro Vancouver on issues specific to the pipeline design and construction.

1.4 Regional Parks

1.4.01 Colony Farm Regional Park Temporary Use Area for Fraser River Crossing

Reference:

i) Study Corridor Optimization Coquitlam, engagement materials accessible on Trans Mountain web site, dated March 2014 (attachment)

ii) Colony Farm Land Use Plan (attachment)

Preamble:

The above-noted reference lists the following as selection criteria for the selected corridor that would involve Colony Farm Regional Park:

- It can accommodate a temporary use construction area for the Fraser River crossing trenchless option,
- The temporary construction area is away from the recreational area of Colony Farm Regional Park,
- The use provides opportunities for Colony Farm Regional Park enhancements, and
- The route has less stakeholder impact than the other options considered.

The Colony Farm Land Use Plan [Reference (ii)] provides information about the Colony Farm Regional Park land uses, plans, and constraints, and Metro Vancouver has additional information regarding biological and ecological studies in the Park.

Request:

a) Temporary storage site selection and alternate sites
Please provide rationalization for the selection criteria noted above that resulted in the selection of Colony Farm Regional Park for a temporary storage area during construction. Specifically:
   i) The basis on which the conclusion that Colony Farm Regional Park could accommodate a temporary construction area was made and what factors were considered. (e.g. physical, biological, administrative etc.)
   ii) Confirmation whether Trans Mountain referred to the Colony Farm Land Use Plan when developing the criteria, and if so, how the proposed temporary use fits with the Colony Farm Land Use Plan (park use, environmental and recreational impacts)
   iii) Details of any consultation (or other investigation) carried out with Colony Farm Regional Parks staff, the public and stakeholders to arrive at the conclusions referenced in the selection criteria.

b) If Colony Farm Regional Park is selected, parameters of use for the park lands
Please provide:
   i) A schedule of the proposed duration and timing of the selected temporary construction area use in Colony Farm Regional Park and a discussion of whether

the timing of the use will take into account factors such as peak park use periods, wildlife migration, and habitat factors associated with the birds and other species using that portion of the park.

ii) Confirmation of whether the timing will take into account the scheduling of other construction planned for this same area of Colony Farm Regional Park, namely the Metro Vancouver water main.

iii) Details of the exact area that might be used including details of site preparation (clearing, excavation, surface hardening, etc.) and use (storage, staging, vehicle parking, refueling, etc.).

iv) Details of environmental impact management during construction and restoration after the project is complete.

v) Discussion of the impacts on Colony Farm Road, the main access to the park, owned by Metro Vancouver but shared by a number of parties (Kwikwetlem First Nation, Forensic Psychiatric Hospital, park visitors and staff).

vi) Details of how any damage to the road from heavy construction loads and machinery will be addressed.

vii) Information on what opportunities for park enhancements might be provided as a result of this temporary use.

c) If Colony Farm Regional Park is selected, with reference to tenure requirements
Please provide:

i) A sample tenure document of the type that would be used to secure rights from agencies such as Metro Vancouver for temporary land use for construction, access, staging and any other needs for this site as well as land restoration activities.

ii) Information on the rights that will be needed for the use of road within the park.

Response:

a) Trans Mountain has submitted updated route maps attached to the response to NEB IR No. 1.84a. The updated maps includes a revision to the previously proposed pipeline corridor between RK 1166.8 and RK 1169.4 to resite the proposed Fraser River crossing location to the east side of the Port Mann Bridge. Associated with the Fraser River horizontal directional drill (HDD) crossing is a requirement for a 1.5 km long linear temporary workspace area to construct and test the river crossing segment of the pipeline prior to its installation. As shown on the updated route map 54 of 54, the revised corridor includes an extension to the north which includes a portion of Colony Farms Regional Park and an adjacent CPR rail siding. Trans Mountain is investigating options on both properties to identify a suitable temporary workspace site.

i) Please refer to the response to City of Coquitlam IR No. 1.A.1 for the basis and criteria by which the Colony Farm Regional Park was proposed for a temporary workspace area.

ii) Trans Mountain did not refer to the Colony Farm Land Use Plan when developing the criteria. Trans Mountain did have knowledge of a planned large diameter water main to be constructed in the same area.

iii) Please refer to Table 1.12A.2-70 included in the response to NEB IR No. 1.12a for a summary of the public consultation completed related to the proposed revised pipeline corridor between RK 1166.8 and RK 1169.4, including the temporary use of a portion of Colony Farms Regional Park. Trans Mountain has met with Metro Vancouver staff, including Parks staff. At this time, Trans Mountain understands that Metro Vancouver staff is unable to meet about the Trans Mountain Expansion Project. Trans Mountain will welcome the opportunity to meet when it is possible for Metro Vancouver to continue discussions.

b) As stated in the response to Metro Vancouver IR No. 1.1.4.01a, Trans Mountain has proposed a revised pipeline corridor that accommodates options for siting the temporary workspace required north of the Fraser River either within Colony Farms Regional Park or on the adjacent CPR property.

i) Metro Vancouver has only recently provided the Project permission to access the proposed pipeline corridor. Environmental surveys are not yet completed. Measures and schedules required for the proposed project arising from those surveys will be done in accordance with Provincial and Federal requirements. Factors such as peak park use periods will be considered in construction planning and measures will be taken to protect park users during construction.

ii) Trans Mountain will consult with Metro Vancouver with regard to timing and activity conflicts with the planned Metro Vancouver Water Main project.

iii) Detailed engineering and construction planning is not completed. Trans Mountain will consult with Metro Vancouver with regard to design and construction plans as they develop.

iv) Refer to Section 7.0 and Section 8.0 of Volume 6B of the Application for general and pipeline construction mitigation measures and pipeline-specific construction mitigation measures, respectively. Refer to Section 7.0 of Appendix C of Volume 6B for the Reclamation Management Plan.

v) Trans Mountain recognizes the main access road serves many users and impact to traffic must be kept to a minimum. The temporary workspace can be confined to the west side of Colony Farms Road and the proposed pipeline corridor has been revised to not cross the road. Traffic and Access Management Plans and local Traffic Control Plans will be developed that address the project road use and impacts as described in Section 2.5.1, Volume 4B.

vi) While no damage to the Colony Farm Road is anticipated, the Traffic and Access Control Management Plans will include measures for monitoring and inspection of the road and for addressing any damage that may occur.

vii) Trans Mountain looks forward to discussions with Metro Vancouver on opportunities for park enhancements. Trans Mountain is committed to investing in community benefits initiatives in municipalities and regions crossed by the Project. Trans Mountain intends to contribute to community benefits in

communities where it operates and has initiated discussions with local governments and organizations to explore community benefit opportunities related to its priority areas of community investment, environment, and education. Trans Mountain has met with Metro Vancouver staff, including Parks staff. At this time, Trans Mountain understands that Metro Vancouver staff is unable to meet about the Trans Mountain Expansion Project. Trans Mountain will welcome the opportunity to meet when possible for Metro Vancouver to continue discussions.

c) Please refer to the response to NEB IR No. 1.29 for copies of our easement and land agreements.

1.4.02 Surrey Bend Regional Park Routing

Reference:

i) Study Corridor Optimization Surrey, engagement materials accessible on Trans Mountain web site, dated March 2014 (attachment)

ii) Surrey Bend Management Plan (attachment)

Preamble:

For pipeline routings and routing changes within Metro Vancouver, there are Study Corridor Optimization sections presented in the application which outline the reasons for the selection of the subject route options, the alternate corridor(s) considered, and other options that were considered. In the case of the route that potentially impacts Surrey Bend Regional Park, this information lacks completeness.

Surrey Bend is environmentally sensitive and is the largest natural area within the City of Surrey. Long term plans for the Regional Park are described in the Surrey Bend Management Plan [reference (ii)].

Metro Vancouver understands that once the route is decided, the construction zone will be determined within a 150 meter wide identified corridor. This zone will be 18 meters wide with further 30 meter-wide safety zones on each side of the construction zone.

Request:

a) Potential route through Surrey Bend Regional Park and alternates
   i) Please provide information that includes the criteria for the selection of the route that traverses (runs generally) along the south boundary of Surrey Bend Regional Park including a discussion of the other alternatives considered and why the route within the Regional Park was selected.

b) If the Surrey Bend route is selected, respecting uses and impacts within the Regional Park

   Please explain:
   i) The alternative methods of corridor construction that were considered in order to minimize impacts on Surrey Bend Regional Park - whether for example, horizontal drilling or above-grade pipeline construction is possible and what the environmental and other impacts are compared to trenching.
   ii) Whether there are any post-restoration impacts from clearing activities within the corridor itself or the safety zones and any fencing, signage or other installations or use restrictions that might affect the area's future management and function as a regional park and what the physical use and status of the safety zones is both during and after pipeline construction.
   iii) Whether the standard right-of-way corridor width of 18 meters can be reduced.

iv) What measures will be taken to provide baseline surveys, fish and amphibian salvage prior to construction commencing, and what post construction restoration monitoring and assessments will be conducted.

v) What measures will be taken both during and post construction to control the introduction and spread of invasive species into the park.

vi) What opportunities for park enhancements might be provided if the pipeline goes through the Regional Park.

vii) How impacts to the park will be assessed, mitigated or compensated for if the standards applied by Trans Mountain are not to the standards employed by Metro Vancouver in the management of its parks and greenways.

c) If the Surrey Bend route is selected, tenure requirements and long term management

Please confirm:

i) Whether there will be working easements or staging areas required within Surrey Bend Regional Park and if so, the long term requirements that may be placed on these lands.

ii) Whether Trans Mountain is aware that land within the Regional Park is subject to a Provincial land use covenant that restricts its use to park purposes and whether Trans Mountain has examined the implications of this covenant.

iii) If the pipeline goes through the Regional Park, whether the lands used will be removed from the dedicated park land base or a right-of-way taken with the land remaining parkland.

iv) How Metro Vancouver would be compensated for the right-of-way and for the diminished size and diminished ecological function of the park if the pipeline corridor through the Regional Park is the chosen route.

v) Please explain how Trans Mountain would manage and maintain the corridor and any ancillary land within a regional park and if Metro Vancouver would have input into its plans to manage lands within regional parks.

vi) Please provide sample tenure documents which include terms and conditions pertinent to obtaining rights through a regional park.

Response:

a) Trans Mountain has submitted updated route maps attached to the response to NEB IR No. 1.84a. The updated maps includes a revision to the previously proposed pipeline corridor between RK 1166.8 and RK 1169.4 to resite the proposed Fraser River crossing location to the east side of the Port Mann Bridge. Associated with the Fraser River horizontal directional drill (HDD) crossing is a requirement for a 1.5 km long linear temporary workspace area to construct and test the river crossing segment of the pipeline prior to its installation. As shown on the updated route map 54 of 54, the revised corridor includes an extension to the north which includes a portion of Colony Farms Regional Park and an adjacent CPR rail siding. Trans Mountain is investigating options on both properties to identify a suitable temporary workspace site.

i) Please refer to the response to City of Coquitlam IR No. 1.A.1 for the basis and criteria by which the Colony Farm Regional Park was proposed for a temporary workspace area.

ii) Trans Mountain did not refer to the Colony Farm Land Use Plan when developing the criteria. Trans Mountain did have knowledge of a planned large diameter water main to be constructed in the same area.

iii) Please refer to Table 1.12A.2-70 included in the response to NEB IR No. 1.12a for a summary of the public consultation completed related to the proposed revised pipeline corridor between RK 1166.8 and RK 1169.4, including the temporary use of a portion of Colony Farms Regional Park. Trans Mountain has met with Metro Vancouver staff, including Parks staff. At this time, Trans Mountain understands that Metro Vancouver staff is unable to meet about the Trans Mountain Expansion Project. Trans Mountain will welcome the opportunity to meet when it is possible for Metro Vancouver to continue discussions.

b) i) Trans Mountain has not yet received consent to survey within the Surrey Bend Park so the following is based on visual observation from the 104 Avenue access. The straight alignment alongside the railway will permit the use of a "push station" approach where a welding station would be set up near the 104 Avenue access and pipe would be pushed out into a prepared ditch. This would reduce construction traffic into the park. Horizontal directional drilling was not considered due to length limitations and the lack of space for temporary works. Above grade installation was also not considered due to security concerns.

ii) Trans Mountain has standards for heights of vegetation permitted within certain distances of the pipeline on its right of way (refer to the Trans Mountain Landscaping guidelines page 12). There are no clearing or vegetation restrictions outside the right-of-way in the safety zone. Signage would be subject to discussion with Park authorities. The status of the safety zone is best explained by reference to the NEB "Guide for Landowners and the Public", page 33.

iii) The width of the permanent right-of-way can be reduced to 10 m. However, the construction footprint will exceed this width.

iv) Trans Mountain is continuing with field studies for lands where access was not available in 2013 and along route refinement areas where new lands being crossed in order to confirm literature results and mitigation measures, including those found in the Environmental Protection Plans (Volumes 6B, 6C and 6D). Any additional site-specific mitigation measures resulting from these studies will be provided in the updated Environmental Protection Plans to be filed with the NEB 90 days prior to construction as per NEB Draft Conditions No. 29 to 31 of the NEB's Letter – Draft Conditions and Regulatory Oversight (NEB 2014). Trans Mountain does not intend to file copies of these additional studies. Refer to Section 9.6 of Volume 6A for information regarding post-construction monitoring that Trans Mountain will conduct.

v) Refer to the Weed and Vegetation Management Plan (Section 14.0 of Appendix C of Volume 6B) for information regarding management strategies and mitigation measures that Trans Mountain will use to control the introduction and spread of invasive species during both construction and operations of the Project.

vi) Trans Mountain is committed to investing in community benefits initiatives in municipalities and regions crossed by the Project. Trans Mountain intends to contribute to community benefits in communities where it operates and has initiated discussions with local governments and organizations to explore community benefit opportunities related to its priority areas of community investment, environment, and education. Please refer to the response to Hackett A IR No. 1.2.2d for additional information regarding benefits.

Under the National Energy Board Act (NEB Act) Section 86, when a company acquires lands for its operations, they are responsible for any damages directly related to and caused by the acquisition of lands, construction of the pipeline, and inspection, maintenance or repair of the pipeline. Under Section 86, compensation related to the installation of a pipeline includes compensation for the acquisition of lands, compensation for damages, and indemnification of land owners from all liabilities related to the company's operations. These requirements would apply to the Trans Mountain Expansion Project.

In general, Trans Mountain would expect to reach voluntary agreements with each municipality outlining the company's responsibilities for municipal infrastructure costs and reimbursements. Trans Mountain's practice is to first minimize any potential impacts or damages to the extent practical by using and adapting responsive construction and operations practices; and second, provide mitigation to reverse or treat any remaining impacts. Should residual impacts or damages remain, Trans Mountain would provide commensurate compensation for damages directly related to and caused by the acquisition of lands, construction of the pipeline and inspection, maintenance or repair of the pipeline. Should adjacent municipalities be of the opinion that the operations related to the TMPL have caused them directly related damages as defined in the *NEB Act,* TMPL would look to the municipality to provide the company with information and documentation as to the nature and extent of the perceived damages. That information can be provided to the Manager, Land, Trans Mountain Pipeline. Using the information received, through discussions with the municipality, if Trans Mountain determines that damages resulted from the company's operations, it will provide any commensurate compensation due to the affected municipality in accordance with the *NEB Act*.

c) Lands within the Surrey Bend Park are currently within the proposed pipeline corridor. Should the Trans Mountain Expansion Project (TMEP) receive a Certificate of Public Convenience and Necessity (CPCN) from the National Energy Board (NEB), land rights required within the park would include temporary construction workspace, and permanent statutory right of way (easement). The exact location and size of the required lands would be determined during detailed engineering and design and through the detailed routing process. Lands required for construction would be reclaimed and

restored following construction. Restrictions would remain for those lands with an easement. The applicable restrictions would be contained within the easement agreement. Trans Mountain has been informed that there are restrictive covenants on park lands that would need to be addressed, and should the project receive CPCN, Trans Mountain would intend to work with Metro Vancouver and the City of Surrey to address those covenants, should that be required.

In determining whether and to what extent compensation is applicable to a specific landowner, Trans Mountain is guided by legislative and legal requirements. In general Trans Mountain's practice is to first minimize any potential damages to the extent practical by using and adapting responsive construction and operations practices; and second, provide mitigation to reverse or treat any remaining impacts. Should residual damages remain, Trans Mountain would provide commensurate compensation for damages directly related to and caused by the acquisition of lands, construction of the pipeline, and inspection, maintenance or repair of the pipeline.

Legislative requirements for the TMEP are set out in the National Energy Board Act (NEB Act). The relevant provisions of the NEB Act apply specifically to directly affected parties and include:

- Under Section 75, "[a] company shall, in the exercise of the powers granted by this Act or a Special Act, do as little damage as possible, and shall make full compensation in the manner provided in this Act and in a Special Act, to all persons interested, for all damage sustained by them by reason of the exercise of those powers."

- Under Section 86, when a company acquires lands for its operations, they are responsible for any damages suffered as a result of the operations of the company, including construction of the pipeline, and inspection, maintenance or repair of the pipeline. Compensation related to the installation of a pipeline includes compensation for the acquisition of lands, compensation for damages, and indemnification from all liabilities arising out of the company's operations. These requirements would apply to the TMEP.

- Under Section 97, factors an arbitration committee would consider in a determination of compensation include the market value of the lands taken by the company, loss of use to the owner of the lands, damage to lands in the area of the lands taken by the company that might reasonably be expected to be caused by the operations of the company, and noise and inconvenience that may reasonably be expected to arise from the operations of the company. Trans Mountain is incorporating these factors into the compensation framework that is being developed for the TMEP. Additional information respecting the TMEP compensation framework for directly affected landowners can be found in the responses to NEB IR No. 1.29 and CGLAP IR No. 1.7b.

The NEB Act, and company practice, requires Trans Mountain to minimize and mitigate effects upon workers and community members through a variety of construction and

environmental practices as documented in the application, including the Pipeline Environmental Protection Plan (EPP) and the Facilities EPP. In addition to construction management personnel, the Trans Mountain pipeline system will have environmental inspectors and Aboriginal Monitors in place during construction to ensure EPP measures are implemented as needed and as committed to.

Should the project receive CPCN, Trans Mountain expects that the company would work with park staff to design and execute a restoration program designed for Surrey Bend Park. Trans Mountain would also expect to work with Metro Vancouver and provide input into its plans to manage lands within regional parks during operations. Based on its previous experience with the restoration program conducted for the Anchor Loop Project in Jasper Nations Park and Mount Robson Provincial Park, for which the company received environmental awards, Trans Mountain is confident that Surrey Bend Park lands affected by construction can be successfully restored.

Please refer to the response to NEB IR No. 1.29 for copies of the land agreements and easement documents Trans Mountain would propose to use for the Surrey Bend Park lands.

1.4.03 Brunette Fraser Regional Greenway/ Brunette Fraser Conservation Area

Reference:

i) Volume 5A Section 4

ii) Trans Mountain Expansion Project Study Corridor December 2013 – Section: Burnaby Community Map

Preamble:

An excerpt from reference i notes that urbanization in the cities of Coquitlam and Burnaby has encroached on the existing TMPL right-of-way, making contiguous looping extremely difficult. The proposed pipeline corridor is said to follow the Lougheed Highway with consideration of a deviation to "*traverse existing industrial lands and railway easements within the Brunette Conservation Area*." Through a series of licenses and statutory rights-of-way, Metro Vancouver manages a recreational corridor known as the Brunette Fraser Regional Greenway which adjoins important conservation areas and streams which are the focus of fish habitat enhancement activities.

Request:

a) Route identification and alternatives

Please provide:

i) A map outlining the pipeline route through the Brunette Conservation Area and the Brunette Fraser Regional Greenway.
ii) A summary of lands in the Brunette Fraser Greenway and adjoining conservation lands impacted by the proposed routing.
iii) Information about Trans Mountain's proposed land uses within the area (access, pipeline corridor, staging during construction etc.).
iv) Criteria for selection of the route through a greenway and conservation area.
v) Information about the other routes considered and rejected including a discussion of how the referenced "encroachments due to urbanization" in the cities of Coquitlam and Burnaby preclude the use of the existing right-of-way and if this is due to actual physical (legal) encroachments on the right-of-way or because the bordering areas have become increasingly developed and therefore more problematic for a utility corridor.
vi) Information on the extent of the assessment work that has been carried out on the alternative Burnaby routes to date.

b) If the Brunette – Fraser Route is Selected - Accommodation of the Pipeline Corridor

Please outline or provide information about:

i) The anticipated impacts on the greenway and conservation area during construction and the degree to which public use may be disrupted and the anticipated duration of any disruption.
ii) The standards for environmental management during construction.

iii) The measures that would be undertaken both during and post-construction to control the introduction and spread of invasive species.

iv) Post-construction restoration and any residual unmitigated impacts such as fragmentation of the natural area and restrictions on recreational use and management of the trail and adjoining natural margins.

v) How Trans Mountain would manage and maintain a right-of-way within a regional greenway and whether its management plans would be subject to the review/approval of Metro Vancouver.

c) If Brunette-Fraser Route is Selected - Tenure Requirements

Please provide:

i) a sample tenure document of the type that would be used to secure rights from agencies such as Metro Vancouver for temporary land use for construction, access, staging and any other needs for this route including land restoration activities.

Response:

a) Refer to the maps provided in response to NEB IR No. 1.84a (specifically Map 54 of 54; NEB IR No. 1.84a – Attachment 1). Trans Mountain will provide an update on routing in the Brunette Fraser Regional Greenway area in Technical Update No. 1, to be submitted to the NEB in Q3 2014. The update will include additional information and a map of the proposed and alternative corridors being considered.

Trans Mountain will need to obtain a construction right-of-way consisting of a permanent easement and temporary workspace. Works will include clearing, grubbing, excavating and construction works associated with welding, testing and commissioning the pipeline and restoration. Additional information will be available during the detailed engineering and design phase of the project.

Regarding routing, please refer to responses to City Burnaby IR No. 1.33.04a, 1.44.01a, and 1.44.01d, and Metro Vancouver IR No. 1.5.03c. The Lougheed Highway alternative pipeline corridor option is no longer being considered for use by Trans Mountain. Please refer to the maps provided in response to NEB IR No. 1.84a for the alignment of these pipeline corridors as well as responses to NEB IR No. 1.12 and 1.40a for additional information regarding the changes to the previously proposed pipeline corridor within the City of Burnaby since the Facilities Application was filed in December 2013.

b) Trans Mountain has refined the proposed pipeline corridor through the Brunette Fraser Regional Greenway. Refer to the maps provided in the response to NEB IR No. 1.84a (specifically Map 54 of 54) Trans Mountain will provide an update on routing in the Brunette - Fraser area in Technical Update No. 1, to be submitted to the NEB in Q3 2014. The update will include additional information and a map of the proposed and alternative corridors being considered.

i) The potential effects resulting from the construction and operations of the Project, including those listed in question i) above, have been identified in Section 7.0 of Volumes 5A and 5B.

ii) Refer to Volume 6A (Environmental Compliance) for information regarding Trans Mountain's commitment to Environmental Management during construction and operations of the Project.

iii) Refer to Section 7.0 of the Pipeline Environmental Protection Plan (Volume 6B) as well as the Weed and Vegetation Management Plan provided in Section 14.0 of Appendix C of Volume 6B for mitigation measures regarding the introduction and control of invasive plants and weeds.

iv) Trans Mountain will not have 'residual unmitigated impacts' associated with this Project. All identified potential effects that have been identified have mitigation measures that have been recommended and will be implemented, as warranted, to reduce or avoid adverse effects resulting from the construction or operation of the Project (refer to Section 7.2 of Volumes 5A and 5B. Refer to Section 7.0 of Appendix C of Volume 6B for the Reclamation Management Plan.

v) As a federally regulated entity under the National Energy Board Act, if Trans Mountain Pipeline ULC (Trans Mountain) is granted a Certificate of Public Convenience and Necessity, it will proceed to apply for all permits that are required by law. Trans Mountain will also continue to work with applicable municipalities to understand the applicability of its bylaws and standards to the construction and operation of the Project, and to collaborate on areas of specific interest.

c) Please refer to the response to NEB IR No. 1.29 for copies of the easement and land agreements.

Summary of New Commitments:

- Trans Mountain will provide an update on routing in the Brunette Fraser Greenway area in Technical Update No. 1, to be submitted to the NEB in Q3 2014. The update will include additional information and a map of the proposed and alternative corridors being considered.

1.5 Environment

1.5.01 Environmental Protection Plan

Reference:

i) Volume 1, Section 2.7 (page 1-45)
ii) Volume 6b, 6c, and 6d, (2013) – Pipeline Environmental Protection Plan
iii) Volumes 5A , 5B, 5C, and 5D Environmental and Socio-Economic Assessment (ESA)
iv) Volume 1, Section 2.6 (page 1-44)

Preamble:

In Volume 1 [reference (i)], it states that the Environmental Protection Plan is based on the Environmental and Socio-Economic Assessment (ESA) [reference (ii)]. The ESA is based on field work and extensive literature reviews, and was completed by a number of consultants [reference (iii)]. The conclusion drawn in Volume 1 [reference (iv)], states that the Project "*will not have a significant adverse effect on any biophysical or socio-economic element, provided the proposed mitigation measures are implemented*." The details provided on the mitigation measures are vague in many places. There is nowhere that the Environmental Protection Plan clearly lays out how the Environmental Protection Plan will be completed. There is a lack of commitment or specific implementation for mitigation measures to protect the environment.

Request:

Please provide:

a) Confirmation that Trans Mountain commits to follow all of the recommendations provided in the technical reports filed in support of the Project Application in Volume 5, 2013 [reference (iii)]. If Trans Mountain plans to deviate from any of the recommendations of the consultants, please provide a list where there may be disagreement and provide the supporting rationale for that disagreement.

b) In Volume 1 [reference (i)] and Volume 2 [reference (ii)], Page 1-58, paragraph 2 it states that "*Trans Mountain will implement an environmental inspection and monitoring program that includes management oversight, on-site environmental inspection, various environmental training programs for all on-site personnel and access to other environmental resources (e.g., wildlife biologists, water quality monitors) on an as needed basis*." Please provide information about the environmental training programs and whether these will be offered to all staff that would work in riparian zones and ecologically sensitive areas.

c) Please provide a single Environmental Protection Plan that outlines the commitments that are being made to Environmental Protection in each area outlined in the Tables from Volume 6b [reference (ii)].

Response:

a) Please refer to the response to NEB IR No. 1.38.

b) Yes. The environmental education program, in association with safety training, will be provided to all construction personnel and visitors, including those working in riparian zones and ecologically sensitive areas, and will consist of a variety of levels of environmental awareness and training.

As described in Section 6.0 of Volume 6A, Trans Mountain will develop and implement an environmental education program to ensure that all individuals involved in the construction of the Project understand the environmental requirements of the Project and their role and responsibilities with regard to meeting those requirements.

In addition, Trans Mountain will provide guidance to workers regarding the particular importance of their conduct in parks and protected areas and other sensitive sites to ensure the protection of the physical environment in these areas (refer to the response to NEB IR No. 1.17d).

c) Trans Mountain has committed to implementing the mitigation measures, as warranted, that have been provided throughout the Environmental and Socio-economic Assessment, including those that are provided in the Pipeline Environmental Protection Plan (see Section 7.0 of Volume 5A for a statement to this effect). A commitment tracking table will developed as discussed in Volume 6A and in NEB draft Condition 6 which requires a commitment tracking table be filed with the NEB prior to construction and to be posted on the company's website.

1.5.02 Proposed Route Alignment and Impacts on Sensitive Ecosystems

Reference:

i) Volume 5A – ESA Biophysical (page i)

ii) NEB Website, Interactive Map of Trans Mountain Pipeline (screen shot capture 2014-04-30) (attachment)

iii) Metro Vancouver Sensitive Ecosystem Inventory, 2013 (attachment) http://www.metrovancouver.org/planning/development/ecologicalhealth/sei/Pages/default.aspx

iv) Information provided to Metro Vancouver: 2014-04-02 Trans Mountain Expansion Project – Preliminary Corridor Map with WS and LWS Infrastructure V1.pdf and Application by Trans Mountain For Approval Of The Trans Mountain Expansion Project Volume 4A Appendix E Maps

v) Maps prepared by Metro Vancouver GIS staff showing routing and overlaying Metro Vancouver Sensitive Ecosystem Inventory data based on shape files (Reference ii). (attachment)

Preamble:

The route described in Volume 5A (Reference i) states that "*Pipeline segments that complete a twinning (or "looping") of the pipeline in Alberta and BC*". In the Metro Vancouver region, very little of the proposed new pipeline is twinned. The interactive map that is shown on the current NEB website [Reference (ii)] shows current and alternate routing of the pipeline and it is apparent that it is very different from twinned pipelines. In addition to the map on the current website, Metro Vancouver was supplied with new alternate routing in GIS shapefiles [reference (iv)].

Together with the Province of BC and Environment Canada, Metro Vancouver has recently developed a Sensitive Ecosystem Inventory (SEI) dataset [Reference (iii)], which is available to other municipalities and external agencies. Metro Vancouver GIS staff have compiled the latest shapefiles and layered on the SEI data to create Reference (v), in 7 maps, attached herein.

The existing pipeline covers 90.9 km of pipeline corridor. Metro Vancouver has 12.8 km (14%) of the original route mapped for Sensitive Ecosystems. The proposed Alternate route identifies 1,310 ha of new corridor. Of this, 359 hectares are on lands identified in the SEI [Reference (v)].

Request:

Please provide:

a) Rationale for the selection of the alternative routes shown in the Information provided to Metro Vancouver: 2014-04-02 Trans Mountain Expansion Project – Preliminary Corridor Map with WS and LWS Infrastructure V1.pdf and Application by Trans Mountain for

Approval of the Trans Mountain Expansion Project Volume 4A Appendix E Maps. Specifically:

- The Environmental and Socio-Economic Assessment (ESA) work for this alternate new route [reference (iv)] has not been provided. Generalizations cannot be made based on the existing ESA work with respect to environment and drainage when the route has been changed so significantly. These lands and riparian areas are significantly different, and do include sensitive ecosystems and Species at Risk Act listed species.
- What is the plan for consultation regarding the new route as detailed in Reference (iv)?
- If the ESA work for the new route has not been completed, clarify the timeline for completion and indicate when it will be provided to stakeholders.

b) A more detailed proposed alignment of the Brunette area in Burnaby. Was alternate routing considered along the Brunette Fraser Greenway to the north of Highway to avoid the riparian area and concerns of spills in this region? Please justify why it was preferable to go through the Brunette Fraser Greenway and avoid the Lougheed Hwy corridor right-of-way as was initially shown in the route plans. At this time and given that the ESA has not been provided for this new route, could this routing decision be reconsidered to reflect stakeholders input?

c) The criteria for making the decision to choose a new route after stating earlier and at the beginning of the Application that in general the routes would generally be twinned with existing pipeline. An examination of the map for the Metro Vancouver region shows that there are very few places where the pipeline is twinned, which leads to the question of whether the criteria for putting the alternate routing could have been further north of Metro Vancouver, and thereby reducing all of the routing issues that are currently being caused by the “alternate route”.

d) Information on the extent to which alternate routing has been considered to move the route from inside Surrey Bend Regional Park to across the South Perimeter Road from the park, along the road corridor.

e) Further information on the physical, biological, hydrologic, SARA species recovery plans, ecosystems at risk, administrative factors, etc. that have gone into the alternative routing criteria.

f) Information on what consultation methods (or other investigations) have been carried out with municipalities and Metro Vancouver staff to arrive at the “alternate” routing referenced above in Reference (iv). For clarification purposes, Metro Vancouver were informed of the proposed route changes at a meeting 2014-03-12 and received the shapefiles on 2014-04-02. The meeting between Trans Mountain staff and Metro Vancouver staff was an information meeting, and Metro Vancouver staff stated a number of times that the purpose was to receive information on the proposal of the new route, rather than consultation.

Response:

a) Please refer to the responses to NEB IR No. 1.12a and 1.40a, Metro Vancouver IR No. 1.1.5.03a, and Redwoods Golf IR No. 1.1.3. Trans Mountain will provide an update on routing in portions of the Metro Vancouver area in Technical Update No. 1, to be submitted to the NEB in Q3 2014. The update will include additional information and a map of the proposed and alternative corridors being considered.

b) Yes, an alternative north of Highway 1 was assessed however, the previously proposed pipeline corridor that follows the Lougheed Highway is no longer being considered for use by Trans Mountain. Please refer to Table 1.40A-1 provided in the response to NEB IR No. 1.40a for a list of all deviations from the proposed pipeline corridor that are currently being considered by Trans Mountain.

With respect to the Brunette Fraser Greenway note that the Project intends to use trenchless installation from the east side of North Road to a point west of North Road and between the rail embankment and Highway 1 embankment. As such the railway provides separation from the Greenway on the complete length of the pipeline that was otherwise routed in Lougheed Highway. Refer to the response to City New Westminster IR No. 1.2d. Trans Mountain will provide an update on routing in the Brunette Overpass to Gaglardi Way area in Technical Update No.1 to be submitted to the NEB in Q3 2014. The update will include additional information and a map of the proposed and alternative corridors being considered.

The response to NEB IR No. 1.40a also discusses plans for additional environmental baseline studies along portions of the proposed pipeline corridor that have not yet been investigated in the field.

Stakeholder input regarding the proposed pipeline corridor will continue to be considered throughout the corridor selection process, which is still in progress. Also refer to the response to Matsqui IR No. 1.02h.

c) Please refer to the response to City Burnaby IR 1.01.01a for the reasons why alternate routing further north of Metro Vancouver was not proposed and to the response to Metro Vancouver IR No. 1.1.5.03c for a discussion of routing in Metro Vancouver.

d) The initial corridor evaluation through this area was conducted while the South Fraser Perimeter Road (SFPR) was still under construction. It was thought that the pipeline could be accommodated in the land between the SFPR and the railway; however, as the SFPR construction reached completion it became clear that this was not feasible in the area along the CN intermodal yard. It is feasible between the Port Mann Bridge and the west end of Surrey Bend Park although a short severely restricted area exists at RK 1164 where the SFPR is built on an elevated stabilised earth structure.

A route along the South side of the SFPR immediately adjacent to the road was examined but rejected due to concerns over geotechnical stability under both normal and seismic conditions.

Consultation with the BC Ministry of Transport and Infrastructure (MOTI) indicated that MOTI land extended up on the bench above the bluffs on the south side of SFPR. This permitted a routing which avoided the restriction referred to above and shortened the length of the corridor in Surrey Bend Park. Trans Mountain was made aware of the specially designed bridge structure, installed to protect important habitat in the path of the road and of the environmental compensation provided by the SFPR. Trans Mountain was also advised that MOTI preferred that the pipeline avoid the 104 Avenue junction area due to the possibility of future development.

An alternate corridor which avoided the park was examined in late 2013. This corridor stayed on the south side of the SFPR after leaving the MOTI land. It crossed land owned by the Nature Trust of BC, and the Land Conservancy of BC before entering an industrial park, crossing 104 Avenue and paralleling 173 St to a point that intersected the existing TMPL pipeline.

In addition, please refer to the response to City Surrey IR No. 1.1a.

e) Please refer to the response to Metro Vancouver IR No. 1.5.03a. Trans Mountain is continuing with field studies for lands where access was not available in 2013 and along route refinement areas where new lands are being crossed in order to confirm literature results and mitigation measures, including those found in the Environmental Protection Plans (Volumes 6B, 6C and 6D). The ability to conduct baseline surveys in the field is contingent upon the receipt of approval of landowners for Trans Mountain representatives to access privately owned lands. The results of the additional surveys will be used to further optimize the proposed pipeline corridor throughout engineering and detailed design and will also be used to provide further details to the Environmental Protection Plans. Any additional site-specific mitigation measures resulting from these studies will be provided in the updated Environmental Protection Plans to be filed with the NEB a minimum of 90 days prior to the commencement of construction as per NEB Draft Conditions Nos. 29 to 31 of the NEB's Letter – Draft Conditions and Regulatory Oversight (NEB 2014). Trans Mountain does not intend to file copies of these additional studies.

Reference:

National Energy Board. 2014. Draft Conditions and Regulatory Oversight. Hearing Order OH-001-2014. Trans Mountain Pipeline ULC (Trans Mountain) Application for the Trans Mountain Expansion Project (Project). April 16, 2014.

f) As outlined in Section 1.3, Volume 3A, Trans Mountain conducted an open, extensive and thorough public consultation process, commonly known as stakeholder engagement. The program was designed to take into account the unique and varying needs of the communities along the Project corridor, and to be responsive and adaptive to the feedback received through the various stages of the engagement program. In addition, the feedback received has been incorporated into the program and has influenced the design of subsequent phases of stakeholder engagement.

Details of stakeholder engagement conducted for TMEP over the period of August to December 2013 are provided in the Consultation Update No. 1 & Errata (Trans Mountain, March 2014). Consultation Update No. 2 will be provided to the NEB in Q3 2014.

Initial meetings were sought with each local government within Metro Vancouver during Phase 1 of the Trans Mountain Expansion Project stakeholder engagement program. This included meetings with the following communities within Metro Vancouver along Trans Mountain's existing pipeline corridor:

- Township of Langley
- City of Surrey
- City of Coquitlam
- City of Burnaby

Feedback received during interactions with municipalities has been used to design the engagement program for each community according to its specific needs. Subsequent meetings occurred in Metro Vancouver municipalities to discuss topics of common interest, seek input and answer questions/respond to concerns. In subsequent phases, Trans Mountain also met with Metro Vancouver staff (initial meeting November 2012). To date, more than 40 meetings have occurred with municipalities within Metro Vancouver on a variety of topics; most included discussions about routing. In addition to meetings, discussions transpired via phone and email.

Trans Mountain also provided opportunities for local governments to participate in engagement activities including:

- Eight Community Interest (routing) workshops to gather feedback from those representing community interests to proposed study corridors and optimized study corridor(s)
- One Environmental and Socio-economic Assessment (ESA) workshop to share information about Trans Mountain's ESA approach and gather input from local experts
- Nine Open Houses - public events supported by advertising (traditional, online, social media, letter to adjacent property owners)
- One regional Emergency Management Stakeholder Workshop – an initial workshop to share information about Trans Mountain's emergency management plans and seek input
- Online opportunities to provide feedback including discussions forums that supported the ESA workshops

Trans Mountain also engages with local governments informally at conferences such as the Lower Mainland Local Government Association and the Union of BC Municipalities where topics of mutual interest and concern are discussed, such as the proposed expansion Project. Trans Mountain will continue to engage with local governments; this

includes continuing to share updated project information and addressing concerns about the proposed Trans Mountain Expansion Project as they arise.

Volume 3A, Section 1.5.5 and 1.5.6 of the Application describes the scope of Ongoing Engagement during the Regulatory Process, through to In Service and Ongoing Operational Consultation, Post Construction Throughout Operational Life.

Summary of New Commitments:

- Trans Mountain will provide an update on routing in portions of the Metro Vancouver area in Technical Update No. 1, to be submitted to the NEB in Q3 2014. The update will include additional information and a map of the proposed and alternative corridors being considered.
- Provide an update on routing in the Brunette Overpass to Gagliardi Way area in Technical Update No. 1, to be submitted to the NEB in Q3 2014.

1.5.03 Pipeline Design and Construction – Alternative Means of Carrying out the Project

Reference:

i) Volume 4A Project Design and Execution – Engineering Design and Appendices A-D

ii) Volume 4B Project Design and Execution – Construction

iii) Information provided to Metro Vancouver: 2014-04-02 Trans Mountain Expansion Project – Preliminary Corridor Map with WS and LWS Infrastructure V1.pdf and Application by Trans Mountain For Approval Of The Trans Mountain Expansion Project Volume 4A Appendix E Maps

iv) Analysis of identified Sensitive Ecosystem Inventory and new alternate route PDF (Attachment)

Preamble:

At a meeting between Trans Mountain staff and Metro Vancouver staff (2014-03-12), the alternate routing was shown in a Power Point presentation. Subsequently, MV staff were provided with shapefiles (Reference iii). This data was overlaid with Sensitive Ecosystem Inventory data from Metro Vancouver. From mid-Langley to Westridge Terminal, only 1.03 km of the route is twinned with the existing Pipeline. 36.5% (12.25 km) of the newly planned corridor (33.53 km) intersects with Sensitive Ecosystem lands. None of this area had Environmental and Socio-Economic Assessment completed or published. There are no Environmental Protection Plans published for this area.

At the meeting with Trans Mountain staff and Metro Vancouver staff (2014-03-12), the Project Manager (Greg Toth) and Routing Specialist (Roger Tonge) explained that in parks and environmentally sensitive areas of the TMX Anchor Route, the construction right-of-way could be considerably smaller than the Study Corridor on the maps that were shown.

This request examines the potential to reduce the footprint requirement for right-of-ways in Metro Vancouver Parks and Sensitive Ecosystems.

Request:

Please provide:

a) Rationale in the Environmental and Socio-Economic Assessment (ESA) as to why less than 1 km of the pipeline is being twinned between mid Langley and Burnaby. When this project was proposed, it was communicated as a twinning of the existing pipeline. With such a small portion of portion of the pipeline being twinned in the populated area of Metro Vancouver, this would be viewed by many as a completely different pipeline.

b) Information from Trans Mountain as to why this should not be considered a new pipeline. What is the justification for calling this twinned If only 1.03 km is twinned in the section between Westridge and mid-Langley? Would it be more appropriate to refer to this

section as a new route rather than a twinned route. Please confirm whether an ESA would be prepared for this section of the routing where no ESA work has been provided.

c) Please provide more detailed information about the rationale for this new section of pipeline through populated Surrey, Coquitlam, and Burnaby in particular. Please provide detailed information as to why the existing corridor could not be used for every km along this section. Metro Vancouver staff were advised it was problematic in some instances. Please provide details of why these problems along the existing pipeline could not be overcome and why these problems are perceived as less than routing through Sensitive Ecosystems and through protected areas such as parks and greenways.

d) Rationalization for the current width of the Study Corridor, particularly in Metro Vancouver Parks and in the Brunette Regional Greenway Corridor.

- Specifically, please elaborate on whether the construction right-of-way at Surrey Bend Regional Park, Colony Farm Regional Park, and Brunette Fraser Regional Greenway could be reduced to 18m or preferably less.
- Will "cut and cover" construction be proposed for the pipeline through Surrey Bend Regional Park, the Brunette River Greenway and other wetlands identified in the Sensitive Ecosystem Inventory of the Lower Mainland? Is trenchless technology method a viable alternative for construction, as it has been in Southern US in estuaries and wetlands? If so, which methods would be recommended and why?
- What is the timing and planning for consultation with Metro Vancouver staff and for consultation with other municipalities regarding route alignment? When will this consultation occur?

Response:

a) The corridor selection process that Trans Mountain adopted for this Project is described in Section 4.2 of Volume 2 and in Section 2.8 of Volume 4A of the Application. As mentioned in Section 4.2.2 of Volume 2, a hierarchy of routing criteria was established, commencing with installing the Line 2 segments on or adjacent to the existing TMPL easement wherever feasible. Over the entire 992.6 km Project length from Edmonton to Burnaby, that criterion was met on 715.0 km (72%). As mentioned in Section 4.2.3, urbanization in Metro Vancouver has sufficiently encroached on the existing TMPL right-of-way in the past 60 years to make contiguous looping not feasible, in which case the second criterion applies, which is to install Line 2 segments adjacent to easements or rights-of-way of other linear facilities. In Metro Vancouver, that would include CN Rail, South Fraser Perimeter Road, CP Rail and several city streets. The result is a looping (or "twinning") of the Trans Mountain pipeline system between Edmonton and Burnaby. In Metro Vancouver, the Trans Mountain pipeline system will include the existing TMPL easement and a new TMEP easement which is generally parallel and adjacent to other linear facilities. Also refer to the response to Metro Vancouver IR No. 1.1.5.03c.

b) Please refer to the response to Metro Vancouver IR No. 1.5.03a.

With respect to the last part of the Information Request, Trans Mountain filed an Environmental and Socio-Economic Assessment (ESA) with the Application to the NEB in December 2013 (refer to Volumes 5 and 6 of the Application). The scope of the ESA included the proposed pipeline corridor as well as the associated facilities including pump stations and pipeline terminals. Trans Mountain has continued to conduct engineering and environmental studies and consult with government representatives, landowners, Aboriginal communities, and other interested stakeholders regarding the Project. These efforts have resulted in the proposed pipeline corridor being revised in several locations. Refer to the response to NEB IR No. 1.40a for information regarding environmental baseline studies to be conducted on the revised proposed pipeline corridor.

c) Since announcing TMEP, Trans Mountain has been clear that it will maximize use of its existing right-of-way (or other utility corridors), where feasible. This is generally feasible in rural areas and 72 per cent of the proposed corridor is along the existing right-of-way, with a further 17 per cent along other existing linear infrastructure. Where communities have grown up around the TMPL right-of-way with high density urbanization, it is not always feasible to go through residential neighborhoods. That is why Trans Mountain is proposing a corridor in high density urban areas that avoids as many individual landowners as feasible (refer to the response to Metro Vancouver IR No. 1.1.5.03a). Selecting a final corridor and route for the proposed expansion project is an iterative process and one that involves a combination of technical and environmental studies, public consultation and on-the-ground fieldwork.

Routing a pipeline is about providing the alignment and space to move hundreds of workers and associated equipment along the construction footprint efficiently and safely while minimizing impacts to the environment and the public. All factors in the stated routing criteria in Volume 2, Section 4.2 and Volume 4A, Section 2.8 are important, but are not presented in hierarchical order. Every community and circumstance is different, but, based on environmental and engineering studies and stakeholder feedback, all the input and information gathered is considered in the context of corridor selection.

In order to minimize impacts to people and the environment, Trans Mountain is following up on technical and environmental assessments and stakeholder feedback in order to refine the proposed study corridor. A final right-of-way will be determined only after regulatory approval and during the Detailed Engineering and Design Phase. The Application before the NEB is for a Certificate of Public Convenience and Necessity for the entire Trans Mountain Expansion Project, it is not for a detailed pipeline route. Should a Certificate be issued for the Project, Trans Mountain would then file its Plan, Profile, and Book of Reference that sets out the detailed pipeline route through every property encountered by the construction footprint, as well as provide notice to landowners on the proposed detailed route in the area. Before approving the detailed route, the NEB is required to hear and consider objections raised by landowners on the detailed route or those whose lands would be adversely affected.

In urban areas, the amount of urban growth and commercial and infrastructure development means that options need to be examined in order to minimize impacts to people and the environment. Short stretches of dense residential development can be accommodated especially if lots are enlarged by the right-of-way. Where roads have been built over the pipeline, the easement rights have been extinguished and no second line rights exist. Short lengths of in-street installation might be acceptable to communities but lengthy interruption of traffic in busy roads such as exist in the lower mainland are likely to require significant mitigating efforts during construction. These factors may result in routing away from the existing easement with a focus on following other existing linear infrastructure rights-of-way whenever possible.

Approaching Metro Vancouver from the east, residential development starts to encroach on both sides of the existing TMPL right-of-way for long distances commencing around Yorkson Creek. In addition the Port Kells area is heavily commercialized with building, utilities, developed storage and work yards and infrastructure required to work in the area. Industrial operations are crossed at other points in the pipeline route, but the development of industrial operations over a 3 km distance in Port Kells is unique in its density and extent. Attempts to install Line 2 on the existing right-of-way would lead to significant impacts to the operations of many companies based in this area. As such it is unfeasible to build a pipeline within the TMPL easement in this area.

The corridor selection process that Trans Mountain adopted for this Project is described in Section 4.2 of Volume 2 and in Section 2.8 of Volume 4A of the Application. Paralleling an existing linear infrastructure and easement is the next best routing solution and the rail corridor is the best example. In order for a new easement to get to this corridor while impacting as few new landowners as practical it was decided to back up prior to Walnut Grove and deviate to the North and turn West to parallel the CN rail right-of-way. Regarding Surrey, also please refer to the response to Surrey Teachers IR No. 1.1a. After crossing the Fraser River, the urban density increases to a greater extent and long stretches (>500 m) across dense urban subdivisions such as are found in the lower mainland are likely to be unacceptable to the communities involved. Therefore, it was considered unfeasible to construct in the residential areas of Coquitlam. Again the rail corridor was assessed as the best alternative in this area. In order to follow the rail corridor to the extent practical and then reach the Burnaby Terminal, another abandoned rail corridor and pipeline easement were assessed to be practical for new construction. Further north, the corridor follows streets, boulevards and industrial lands that were assessed to be feasible in order to reach the Trans Mountain terminal.

Trans Mountain is working hard to find the best solutions for everyone while ensuring the pipeline can be built safely and efficiently. The corridors selected in the lower mainland are heavily developed transportation and utility corridors with plans for new development of roads, pipelines, water lines and sewer lines. Trans Mountain believes that construction parallel to these existing corridors will create less impact than through dense residential areas or in roadways that are heavily trafficked. Through the use of construction techniques and proper mitigation and restoration, the impact to the areas adjacent to the existing transportation infrastructure will be minimal. It is worth noting

that a cooperative effort from all parties will lead to the best solution. Also refer to the response to City Surrey IR No. 1.7a.

d) An attempt has been made in the selection of the width of the proposed pipeline corridor to accommodate adjustments that may arise during the detailed engineering and design phase of the project by ensuring that the coverage of the environmental studies is fully comprehensive. The width of the construction footprint and the construction techniques to be employed will be determined during the detailed design and engineering phase of the project, but addressing the specific questions raised;

- The construction right of way can be reduced to 18 m for areas where the pipe is laid at normal depth in competent soils. Where streams or other underground utilities are crossed requiring an increase of depth, it may not be possible to keep to 18 m.
- "Cut and cover" construction, most likely using a static welding station, will be employed through Surrey Bend Regional Park. Construction through the Brunette River Greenway will employ a mix of cut and cover and trenchless methods.
- Trenchless technologies are limited to approximately 2 km and require adequate working space for prefabrication and pressure testing of the section to be installed, as is being discussed at Colony farm.

Trans Mountain Pipeline ULC (Trans Mountain) Stakeholder Engagement Program is ongoing. Trans Mountain is committed to an open, extensive and thorough public consultation process as outlined in the Application Volume 3A, section 1.3. The program was designed to take into account the unique and varying needs of the communities along the Project corridor, and to be responsive and adaptive to the feedback received through the various stages of the engagement program. Feedback received has been incorporated into the program and has influenced the design of subsequent phases of stakeholder engagement.

Trans Mountain has engaged with local governments along the pipeline and marine corridor since the project was announced in the Spring of 2012. Trans Mountain understands that Metro Vancouver has specific interests related to the proposed project and welcomes the opportunity to continue to engage with Metro Vancouver at your earliest convenience, including continuing to share updated project information and gathering feedback on construction effects and mitigation measures; as well as continuing to work collaboratively to address concerns as they arise. Refer to the Application, Volume 3A, section 1.5.5 for more information.

Project staff would be pleased to meet with Metro Vancouver to discuss these matters at your earliest convenience.

1.5.04 Seismic Concerns in the Metro Vancouver Region

Reference:

i) Volume 7 – Appendix A1 Risk and Threat Assessment, Page 25; Volume 8: Spills
ii) NEB Website, Screen Shot capture of Interactive Map from Trans Mountain Pipeline website on 2014-04-30 (Attachment)
iii) Information provided to Metro Vancouver: 2014-04-02 Trans Mountain Expansion Project – Preliminary Corridor Map with WS and LWS Infrastructure V1.pdf and Application by Trans Mountain For Approval Of The Trans Mountain Expansion Project Volume 4A Appendix E Maps
iv) Clague, John J.(2002) The Earthquake Threat in Southwestern British Columbia: A Geologic Perspective. (Attachment)

Preamble:

The Southern Coast of British Columbia, including the Westridge Terminal and section of the TMX ULI pipeline from Hope to Burnaby are located in a seismically active part of British Columbia. More than ten moderate to large (magnitude 6 – 7) earthquakes have occurred in southwestern British Columbia and northwestern Washington in the last 130 years (Clague). There is a significant risk that a larger earthquake of magnitude 8 – 9 will strike the Pacific Northwest. According to Simon Fraser University scientist, Dr. John Clague, Vancouver is at great risk from an earthquake this size because of tsunamis, landslides and liquefaction. The infrastructure including pipelines is partly what puts Vancouver at serious risk because of the resulting fires and spills. In Volume 7 and 8, much of the assessment is based on the operation of the smaller current pipeline, and on Trans Mountain's history in the pipeline industry, most of which is based in areas that are not as seismically unstable. This cannot adequately inform the assessment of seismic risks of the south coast of British Columbia.

Request:

Please provide:

a) An up-to-date summary of the earthquake risks for a seismic event of between 6 and 9 on the Richter scale located on the Pacific west coast and including Metro Vancouver. This should detail the risks to the supplementary tanks locations, (both construction and operations), the operations of the new pipeline, and the construction and operations of the Westridge Terminal and the new reef that is proposed at Westridge.

b) Detail on the risks from seismic events to the pipeline, how the assessments of the pipeline post-event would occur, and what would be the spill response planned for such a disaster. Further information on leakage detection in the event of an earthquake, and how the damage could be mitigated, and handled quickly.

c) Assessment for seismic risk along the alternate routing of the pipeline from Hope to Burnaby. Include landslide potential, areas subject to liquefaction, and potential impacts of tsunami damage (which could result in smaller slides).

d) Further information on response to a seismic event including: disaster planning, fire hazards, fire response, fire suppression during a seismic event, and seismic conditions, in particular at Westridge Marine Terminal, the Tank Farms, and along the populated pipeline route through the Lower Mainland of BC.

Response:

a) Volume 4A of the Project Application describes preliminary engineering studies completed in advance of the Application and outlines proposed investigations for the project, including site-specific geological and seismic hazard assessments. Volume 7 describes risk assessments planned to support detailed design.

As part of the Seismic Assessment Desktop Study (A55987, Application Volume 4A, s. 5.0, Appendix J - Seismic Assessment Desktop Study Report) both shallow intra-plate and the 9.0 magnitude subduction zone earthquakes were considered in the assessment. Impacts of such earthquakes in general could include soil liquefaction, lateral spreading, or the initiation of seismically induced landslides, as described in the report, depending the ground susceptibility at the site. As soil and bedrock conditions vary along the Project the ground susceptibility also varies, and hence the specific impact from earthquakes of varying magnitudes and distances also varies. Accordingly, it is not possible to provide an up-to-date summary of the earthquake risks for the general case of "a seismic event of between 6 and 9 on the Richter scale located on the Pacific west coast and including Metro Vancouver" until site-specific assessments are completed.

The findings from the Seismic Assessment Desktop Study will be used to design, prioritize and implement detailed site-specific geotechnical investigations focusing on assessing seismic hazards to then be used to inform the detailed design of the pipeline and facilities. These site-specific geotechnical investigations will be implemented in different phases, with the first phase expected to start in summer 2014, and will include drilling boreholes and other geotechnical measurements to collect subsurface ground information at various locations identified in the preliminary study. In addition, a study of the potential activity of faults crossing the proposed route in the Lower Mainland and Fraser Valley has been commissioned by Trans Mountain, and is currently being undertaken by Drs. John Clague and Doug Stead of the Department of Earth Sciences at Simon Fraser University.

b) Volume 7 of the Project Application describes how risk assessments will be integrated into project design. Details will be developed as part of the ongoing and iterative, site-specific geotechnical design of pipeline segments and facilities through 2014 and 2015.

In the event of an earthquake, the Trans Mountain Control Centre Operator (CCO) would receive notification from either a SCADA alarm triggered by a seismic switch (there are three located on Trans Mountain's pipeline system at the Burnaby Terminal, Sumas Station, and Laurel Station in Washington State), or from other sources such as the USGS website. Upon notification, the CCO would immediately determine if any assets

are located within the Potential Damage Radius using reports of the earthquake magnitude and location and the Geographic Information System (GIS). The Potential Damage Radius is a chart that has been created by Trans Mountain's geotechnical consultant using datasets of historic liquefaction, lateral spreading, landsliding and rockfalls as a result of seismic events worldwide for various levels of seismic activity. The chart provides a first indication of whether potentially damaging wave propagations or ground displacements are likely at the facility locations based solely on the size of earthquake and distance from the epicentre (typically the only information available within minutes of an event occurring) and conservatively assuming a shallow event. If any assets are located within the Potential Damage Radius, an immediate shutdown of all facilities and pipelines within that radius would occur. A plan would then be put into place to inspect each facility and pipeline within the impacted area, including a thorough damage and hazard assessment. Modern buried steel pipelines with welded joints are less susceptible to damage from seismic wave propagation than other pipeline types (including pre-1950s steel, cast iron, or concrete segmented lines). Permanent ground displacements along the pipeline alignment would be the main indicator of possible pipeline damage.

The pipeline would not be restarted until all inspections confirmed that no permanent ground displacements had occurred on the pipeline route and no other damage was observed within facilities. In the event that ground displacements are observed on the pipeline route, additional inspections and any necessary repairs would be carried out to confirm the integrity of the piping before returning it to service. Any required repairs to ensure facilities equipment was fit for service would be completed before allowing the facilities to be restarted. Trans Mountain would notify the Transportation Safety Board of Canada any time the pipeline was shut down for safety reasons. Restart of the pipeline would not be permitted until a process was completed to authorize the pipeline restart following a safety shutdown.

While the risk assessment and detailed engineering design will focus on measures to prevent a failure, in the event of a leak or rupture on the system Kinder Morgan would implement its Emergency Management program as documented in Volume 7, Section 4.0. A review of historical seismic events have demonstrated that pipelines can be adequately designed and constructed to withstand seismic events.

c) Please refer to the response to Metro Vancouver IR No. 1.1.5.04a. Geohazard assessment will be iterative and ongoing throughout detailed design as additional site specific information on individual geohazard sites are investigated. A preliminary geohazard assessment is currently being completed and will be provided as part of the risk assessment on Line 2 referred to in NEB IR No. 1.81a, and will include alternate routing of the pipeline from Hope to Burnaby as indicated in the response to NEB IR No. 1.40a. Earthquake-related hazards included in this assessment include ground-motion amplification, surface faulting, seismically triggered liquefaction and related lateral spreading, and seismically triggered landsliding.

d) Trans Mountain will design and construct the pipeline in accordance with the BC Building Code (BCBC) and National Building Code of Canada (NBCC) requirements for an earthquake with a 1:2475 annual probability of exceedance, as well as proven materials and design in accordance with CSA Z662, Oil and Gas Pipeline Systems.

Section 2.9.3, Volume 4A of the Facilities Application briefly describes the principles to be used in the seismic design of the new pipelines and facilities (including pump stations and terminals) proposed as part of the Project. Please see Volume 7, Section 4 for a description of Kinder Morgan Canada's (KMC) Emergency Management Program. The emergency response plans are comprehensive in their application regarding hazards and potential emergency situations on the Trans Mountain System which includes checklists for earthquake response.

Damage to the integrity of Trans Mountain's facilities or operations would be responded to quickly to protect the public and the environment. Please refer to the response to Amy C IR No. 1.5d for the assessment of earthquake damage to the Trans Mountain Pipeline and Facilities.

1.5.05 Species at Risk:

Reference:

i) Volume 5A – ESA Biophysical
ii) NEB Website, 2014-04-30 Interactive Map. Screen shot from Application by Trans Mountain For Approval Of The Trans Mountain Expansion Project website 2014-04-30 (attachment)
iii) Metro Vancouver Species at Risk List 2012 (attachment)
iv) Species at Risk Act, October 2003 Government of Canada (page 7) (attachment)

Preamble:

Volume 5 ESA (Reference i) did not include the alternate routing for the Pipeline (Reference ii), therefore no information has been presented in an Environmental and Socio-Economic Assessment about Species at Risk in some of the habitat the new pipeline is proposed to impact. There are 167 SARA listed species in Metro Vancouver (reference iii). On non-federal lands, the *Species at Risk Act* (Reference iv) requires effective protection of listed species and their critical habitat (i.e., the habitat the species needs to survive and recover, as identified in a final recovery strategy or action plan). The *Species at Risk Act* provides the provincial government, local governments, landowners and land managers with the first opportunity to protect critical habitat. Not all of the 167 species are involved, but there are a significant number that were not mentioned specifically in the Trans Mountain application that are present or recorded in the area of the proposed alternate pipeline routing. Recovery strategies, prepared under the *Species at Risk Act* are available for some of these species, which lay out clear action plans for the species. These have not been studied or referred to in the Environmental Protection Plan or in Volume 5A.

Request:

Please provide:

a.1) [Trans Mountain has designated this Information Request as “Metro Vancouver IR No. 1.1.5.5a.1 ” as it was the second usage of 1.1.5.5a in this Information Request list.]

The status of Trans Mountain’s consultation with Environment Canada and BC Ministry of Forests, Lands and Natural Resource Operations regarding the Project’s interaction with and appropriate mitigation for the SARA listed species that could be affected along the alternate routing.

b.1) [Trans Mountain has designated this Information Request as “Metro Vancouver IR No. 1.1.5.5b.1 ” as it was the second usage of 1.1.5.5b in this Information Request list.]

The status of Trans Mountain’s consultation with other agencies involved in ecological protection for the species at risk along the alternate routing.

c.1) [Trans Mountain has designated this Information Request as "Metro Vancouver IR No. 1.1.5.5c.1 " as it was the second usage of 1.1.5.5c in this Information Request list.]

An Environmental and Socio-Economic Assessment on the proposed alternate routing.

Please provide:

Species at Risk Freshwater Aquatic Species:

a.2) [Trans Mountain has designated this Information Request as "Metro Vancouver IR No. 1.1.5.5a.2 " as it was the second usage of 1.1.5.5a in this Information Request list.]

Specific information on how the Recovery Plan for white and green sturgeon will be accommodated on the Fraser River and its tributaries in the Metro Vancouver region.

b.2) [Trans Mountain has designated this Information Request as "Metro Vancouver IR No. 1.1.5.5b.2 " as it was the second usage of 1.1.5.5b in this Information Request list.]

Specific information on how the Recovery Plan for Nooksack dace will be mitigated by Trans Mountain during the proposed routing along Brunette River Greenway.

c.2) [Trans Mountain has designated this Information Request as "Metro Vancouver IR No. 1.1.5.5c.2 " as it was the second usage of 1.1.5.5c in this Information Request list.]

In relation to a.2) and b.2), please include:

- Potential habitat usage by the individual species at proposed pipeline crossing sites and in the fish and fish habitat;
- Identification of any critical fish habitat for the listed SARA species;
- Records of consultation with relevant government agencies, stakeholders and Aboriginal groups;
- Potential project related mortality of fish, fry, eggs, and/or embryos at watercourse crossings;
- Additional mitigation to be undertaken with respect to the Recovery Plans; and
- In case of a spill, the compensation for loss or disturbance of critical habitat for SARA listed species.

Response:

a.1) The preamble reference of 167 *SARA* listed species in Metro Vancouver (reference iii) incorrectly identifies 167 *SARA* listed species, since this list includes all provincially designated species as well as extirpated species.

On the Metro Vancouver Species at Risk List 2012 (reference iii), there are currently five wildlife species with Federal Recovery Strategies (short-tailed albatross and pink-footed shearwater are covered under a single Recovery Strategy). These are listed below. Please note that two of the Recovery Strategies were released after the Project application was filed (marbled murrelet and Oregon spotted frog).

- *Recovery Strategy for the Short-tailed Albatross (*Phoebastria albatrus*) and Pink-footed Shearwater (*Puffinus creatopus*) in Canada* (2008).
- *Recovery Strategy for the Northern Spotted Owl (*Strix occidentalis caurina*) in British Columbia* (Chutter *et al.* 2004) (note this provincial Recovery Strategy was adopted as the federal Recovery Strategy in 2006).
- Proposed *Recovery Strategy for the Marbled Murrelet (*Brachyramphus marmoratus*) in Canada* (Environment Canada 2014a) (note: posted on the Species at Risk Public Registry website in January 2014 after submission of the Application).
- Proposed *Recovery Strategy for the Oregon Spotted Frog (*Rana pretiosa*) in Canada* (Environment Canada 2014b) (note: posted on the Species at Risk Public Registry website in May 2014 after submission of the Application).

Consultation with Environment Canada and BC MFLNRO is ongoing, and discussions related to *SARA* listed species and mitigation will continue through 2014 as the construction footprint is defined through Detailed Engineering Design.

References:

Chutter, M.J., I. Blackburn, D. Bonin, J. Buchanon, B. Costanzo, D. Cunnington, A., Harestad, T. Hayes, D. Heppner, L. Kiss, J. Surgenor, W. Wall, L. Waterhouse and L. Williams. 2004. Recovery Strategy for the Northern Spotted Owl (*Strix occidentalis caurina*) in British Columbia. BC Ministry of Environment. Victoria, BC. 74 pp.

Environment Canada. 2008. Recovery Strategy for the Short-tailed Albatross (*Phoebastria albatrus*) and the Pink-footed Shearwater (*Puffinus creatopus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Ottawa, ON. 46 pp.

Environment Canada. 2014a. Recovery Strategy for the Marbled Murrelet (*Brachyramphus marmoratus*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Ottawa, ON. 44 pp.

Environment Canada. 2014b. Recovery Strategy for the Oregon Spotted Frog (*Rana pretiosa*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Ottawa, ON. 21 pp.

b.1) Trans Mountain has engaged and will continue to consult with the appropriate federal and provincial regulatory agencies, as well as municipal governments and other stakeholders regarding routing and facility siting (including route alternatives), and Project interaction with species at risk.

Trans Mountain is committed to respectful, transparent and collaborative interactions with communities. From early planning stages of the Project, stakeholder engagement and communication activities have sought to proactively identify and involve stakeholders to the greatest extent possible in the Project. Trans Mountain's extensive consultation efforts to ensure that stakeholders are aware and have had an opportunity

to express interests or concerns related to the Project are described in Volume 3A, Part 2 of Consultation Update No. 1 as well as the response to NEB IR No. 1.12a.

c.1) Please refer to the response to City Burnaby IR No. 1.01.01a.

a.2) Please refer to the response to NEB IR No. 1.52b for mitigation and protection measures for green sturgeon and to the response to NEB IR No. 1.53i for general mitigation and protection measures for white sturgeon (Lower Fraser River population) (stock group SG1) in the lower Fraser River and its tributaries.

In line with the Recovery Strategies prepared by Fisheries and Oceans Canada (DFO 2014) for White Sturgeon, measures will be taken to avoid serious harm to fish and fish habitat. Recommendations were made for the most suitable construction methods and associated mitigation measures for a broad range of species, including white sturgeon, green sturgeon and species that were not selected as indicator species for the purposes of the Project's effects assessment. Effects on the population of white and green sturgeon is expected to be no different than for other fish species at each of the crossings described in Section 7.2.7 of Volume 5A. Overall, the implementation of environmental mitigation measures and best management practices provided are expected to eliminate or reduce potential Project-related effects to fish and fish habitat, and protect fish species, including those that are federally and provincially-listed for conservation consideration, while maintaining the overall health and productivity of the aquatic ecosystem.

Reference:

Fisheries and Oceans Canada . 2014. Recovery Strategy for the White Sturgeon (*Acipenser transmontanus*) in Canada. Species at Risk Act Recovery Strategy Series. 266 pp.

b.2) Please refer to the response to NEB IR No. 1.52d for mitigation and protection measures for nooksack dace, as well as the responses to Hackett A IR No. 1.3m to 1.3p for general mitigation measures for crossings of tributaries to the Brunette River.

In line with the Recovery Strategies prepared by Fisheries and Oceans Canada (DFO 2008) for nooksack dace, measures will be taken to avoid serious harm to fish and fish habitat. Recommendations were made for the most suitable construction methods and associated mitigation measures for a broad range of species, including nooksack dace and species that were not selected as indicator species for the purposes of the Project's effects assessment. Effects on the population of nooksack dace is expected to be no different than for other fish species at each of the crossings listed in the responses to Hackett R IR No. 1.3m to 1.3p and as described in Section 7.2.7 of Volume 5A. Overall, the implementation of environmental mitigation measures and best management practices provided are expected to eliminate or reduce potential Project-related effects to fish and fish habitat, and protect fish species, including those that are federally and provincially-listed for conservation consideration, while maintaining the overall health and productivity of the aquatic ecosystem.

Reference:

Fisheries and Oceans Canada. 2008. Recovery Strategy for the Nooksack Dace (*Rhynichthys cataractae*) in Canada. Species at Risk Act Recovery Strategy Series. 55 pp.

c.2) Refer to Section 4.4 of the Technical Report 5C-7 provided in Volume 5C, Fisheries (British Columbia) Technical Report (Triton Environmental Consultants Ltd. December 2013) for habitat descriptions and known distributions of green and white sturgeon and nooksack dace in relation to the Project area. Refer to the responses to NEB IR No. 1.52b, 1.52d and 1.53i for other relative species-specific discussions and general mitigation measures for green sturgeon, nooksack dace and white sturgeon (Lower Fraser River population).

In the case of a potential spill response scenario (refer to Volume 7 - Risk Assessment and Management of Pipeline and Facility Spills), compensation for any unforeseen environmental effects including the loss or disturbance to potential critical habitat will be determined on a case-by-case basis in discussions involving the NEB, Fisheries and Oceans Canada and applicable provincial regulators.

1.5.06 Invasive Species

Reference:

i) Website of the Invasive Species Council of Metro Vancouver: http://www.iscmv.ca/ (attachment)
ii) Volume 5A ESA – Biophysical and Socio-Economic
iii) Volume 6A Environmental Compliance

Preamble:

There are a number of invasive species that are managed in the Metro Vancouver region, and a regional Invasive Species Council has been formed [ref (i)]. Construction and restoration of lands post-construction have risks of introducing invasive species. Transportation and pipeline corridors are often viewed as harbingers of invasive plants. Equipment used in construction compacts the soil, and often carries invasive species with on the equipment when transported from one site to the next to provide the services, as can the contractors and employees. Post-construction activity often consists of restoration, bringing in replacement soil and replanting, all of which carry the risk of invasive species being introduced. Invasive plants can lead to monocultures in sensitive ecosystems. Most of these plants have very low habitat value (food and/or shelter) for our native species of insects, birds and animals so these native species are displaced from their natural habitat. Some of these native species are species at risk, and because their numbers are low, the introduction of invasive species is particularly serious for these species.

Request:

Please provide:

a) Detailed assessment to identify all of the potential invasive species that exist currently in the new alternate routing and the threats incurred by choosing the new alternate routing.

b) Detailed plans for protection against the introduction of invasive species in a new Environmental Protection Plan for the alternate routing of the new pipeline. Within this, please include:

- Details of training for all contractors and staff on construction sites regarding invasive species
- Trans Mountain's commitments and plans for monitoring and handling any invasive species that are introduced during the construction phase, and the ongoing monitoring and adaptive management that may be required post-construction.

Response:

a) In 2013, vegetation surveys were focused on the proposed pipeline corridor in areas of native vegetation where access was available. Surveys in native areas are also planned for 2014 and will encompass alternative pipeline corridors that are being considered. During these surveys only high level weed information is collected since weed

distribution and density is expected to change annually from the time of survey to the time of construction. For this reason a pre-construction weed survey will be conducted along the confirmed Project footprint prior to construction which will ensure current and accurate site-specific mitigation for invasive species is applied. Management strategies and recommended mitigation measures to control the introduction and spread of weeds and other invasive plants are provided in the Weed and Vegetation Management Plan for the Project (Section 14.0, Appendix C of Volume 6B).

b) The Weed and Vegetation Management Plan provided in Section 14.0 of Appendix C of the Pipeline Environmental Protection Plan (Volume 6B) provides mitigation measures that protect against the introduction of invasive species. Details regarding training of Project personnel are provided in the Environmental Education Program in Section 6.0 of Volume 6A whereas post-construction environmental monitoring of vegetation establishment and weed management on the construction right-of-way is discussed in Section 9.6 of Volume 6A.

1.5.07 Cumulative Impacts

Reference:

i) Volume 5A: ESA – Biophysical, Section 8.0: Cumulative Effects Assessment

Preamble:

Gradual accumulative degradation of the Metro Vancouver region and Salish Sea environment due to collective anthropogenic impacts is a major environmental concern and must be avoided.

Request:

1) Please confirm approach to ongoing work to monitor and respond to cumulative marine effects. Specifically, provide information on the following:
   a) Development and funding of an Expert Advisory Panel with local marine experience in environmental monitoring, sampling and measurement to examine the potential for cumulative effects of increased activity (shipping and near shore development) in Burrard Inlet and the Salish Sea.
   b) Expert Advisory Panel designed approach to monitor effects and provide oversight once a cumulative effects monitoring program is established.

Response:

1) Mitigation and monitoring measures that will help minimize the Project's contribution to cumulative effects in the Salish Sea are described in Sections 8.11, 8.12, 8.13, and 8.14 of Volume 5A and Sections 4.4.4, 4.4.5, and 4.4.6 of Volume 8A.

   The Marine Mammal Protection Programme framework provided in the response to NEB IR No. 1.56 notes that cumulative effects management is most effective when all parties contributing to cumulative effects also contribute to solutions. For shipping, this includes resource managers, regulatory authorities, the maritime community, Aboriginal communities, and municipalities. If development and funding of an Expert Advisory Panel for cumulative effects monitoring is to proceed, it will require support and participation from all these groups.

   Trans Mountain is committed to investing in community benefits initiatives in municipalities and regions affected by the Project. Trans Mountain intends to contribute to community benefits in communities where it operates and has initiated discussions with local governments and organizations to explore community benefit opportunities related to its priority areas of environment; safety, emergency preparedness and response; and community growth and well-being. Trans Mountain will consider the Expert Advisory Panel as a community benefits initiative and seek feedback from other groups and communities on its perceived value and priority relative to other social, cultural, and environmental proposals.

1.5.08 Cumulative Impacts

Reference:

i) Volume 5A: ESA – Biophysical, Section 8.0: Cumulative Effects Assessment

Preamble:

Cumulative effects are significant in complex urban environments with diverse and continuous pressures on social, economic and environmental elements. This project should not negatively contribute to the cumulative impacts of development on the Metro Vancouver region.

Request:

a) Page 8-1 of the project submission says, "*a cumulative effects assessment differs from conventional project-specific environmental effects assessments by considering larger geographic study areas, longer time frames and unrelated projects or activities (Antoniuk 2002)*." Also noted on Page 8-2, "*The temporal boundaries used in the cumulative effects assessment include past development (up to the construction of the Project)*, …" It is well known that cumulative effects assessments should also take into consideration approved or planned activities in the project area. Please provide further details on the cumulative effects assessment:
   i) With regard to other projects that have been scoped in to the cumulative effects assessment to which the direct effects of this project could contribute incrementally, please provide a listing of all projects not yet built, but approved or already in a formal regulatory process at the municipal level (and thus likely to occur) within Metro Vancouver that were part of the cumulative effects assessment.
   ii) The geographic scope of the assessment regarding direct effects. Specifically provide the allowable distance between the site of disturbance and the proposed mitigation measures.
   iii) The temporal scope of the assessment regarding direct effects. Provide the timeframe and 'representative requirements' for mitigation measures to meet or exceed the provision of ecological services.
   iv) Confirm any commitment to ensure no net loss of publicly owned and accessible land (e.g. Regional Park or Greenway).

Response:

a) i) A listing of all projects not yet built, but approved or already in a formal regulatory process at the municipal level within Metro Vancouver considered in the cumulative effects assessment are provided in Appendix 8.1, Table 8A.1-6 of Volume 5A and are also described in Section 8.1.4.2 of Volume 5A.

   ii) The geographic scope of the assessment regarding direct effects (*i.e.*, Project-specific effects) is defined by local and regional study areas for each element or indicator in Section 7.0 of volumes 5A and 5B. Mitigation measures developed for Project construction and operation have been developed in consideration of

the extent to which Project-related activities may have a potential residual effect on the biophysical or socio-economic environment.

iii) The temporal scope of the effects and cumulative effects assessments are defined in Sections 7.1.3 and 8.1.2, respectively, of Volumes 5A and 5B. The effectiveness of mitigation and success of restoration measures implemented for the Project will be confirmed during post-construction environmental monitoring. Trans Mountain will conduct the Post-Construction Environmental Monitoring Program during a period up to the first five complete growing seasons (or during years one, three and five) following commissioning of the Project or as per National Energy Board certificate conditions. Additional information regarding the purpose and scope of the Post-Construction Environmental Monitoring Program is provided in Section 9.0 of Volume 6A.

iv) Restoration of natural areas and features following construction will be implemented on publicly owned and accessible land, such as regional parks and other green spaces to ensure continued access and use. The effectiveness of mitigation and success of restoration measures will be confirmed during post-construction environmental monitoring.

1.5.09 Cumulative Impacts

Reference:

i) Volume 5A: ESA – Biophysical, Section 8.0: Cumulative Effects Assessment

Preamble:

Cumulative effects are significant in complex urban environments with diverse and continuous pressures on social, economic and environmental elements. This project should not negatively contribute to the cumulative impacts of development on the Metro Vancouver region.

Request:

a) Cumulative effects are a shared responsibility of all levels of government. As written on page 8-1 [reference (i)], a cumulative effects assessment, "*may also assist municipal, provincial and federal authorities by identifying requirements for additional planning, monitoring or mitigation that are beyond the direct control of the proponent and need to be implemented or led by others*." Please provide further details on the implications to regional and municipal governments with regard to the project. Specifically identify:
   i) Planning, monitoring or mitigation requirements at the Municipal, Regional or Provincial level that will be triggered by the project.
   ii) Ways that municipal and regional land use goals (e.g., contained in Official Community Plans and Regional Growth Strategies), data from ecological research, and descriptions of other projects and activities in the study area were used in the cumulative effects assessment.

b) Identify conflicts with existing plans, strategies or major infrastructure activities of Metro Vancouver, including for example the planning processes that are currently underway with Port Metro Vancouver.

Response:

a) i) Permit requirements for Project construction are summarized in Section 1.5 of Volume 2. During the detailed design and engineering phase, Trans Mountain will work directly with affected municipal, regional and provincial authorities to ensure information and agreements required for specific development authorizations and any specifically identified planning, monitoring or mitigation requirements are in place. The need for additional mitigation measures beyond the control of the proponent was considered for each cumulative effects assessment indicator in Section 8.0 of Volume 5A and no additional mitigation beyond Project-specific measures were recommended.

   ii) Municipal and regional land use goals and objectives were considered in the assessment of Project-specific and cumulative effects as guidance on desired outcomes for specific elements and indicators. This informed conclusions on the magnitude of residual effects (see Section 7.0 of Volumes 5A and 5B). In this way, land use goals and objectives informed the cumulative effects assessment

and conclusions regarding the significance of the Project's contribution to cumulative effects.

Data from ecological research obtained through scientific sources, outcomes of previous pipeline projects and the Project-specific field program were utilized for certain elements and indicators, where applicable, to inform the methodology and assessment of the Project's contribution to cumulative environmental effects and current combined risk to specific indicators. Refer to the various elements and indicators assessed in Section 8.0 of Volume 5A for specific details.

Descriptions of other reasonably foreseeable projects and activities helped to inform the cumulative effects assessment by allowing assessors to identify ways that these reasonably foreseeable developments could interact in time and space with existing activities and the Project. Projects and activities specifically considered in the cumulative effects assessment for pipeline and facilities are noted in Section 8.1.4 of Volumes 5A and 5B and under each element subsection.

b) The overall effects of the Project on each element were evaluated relative to applicable objectives or goals of management plans as identified in Section 7.0 of Volumes 5A and 5B for the facilities and pipeline components.

No specific conflicts were identified, but Trans Mountain will work directly with Metro Vancouver and within Port Metro Vancouver during the detailed design and engineering phase to identify and, if required, plan or mitigate against any potential conflicts with other infrastructure or planning activities.

1.5.10 Cumulative Impacts

Reference:

i) Volume 5A: ESA – Biophysical, Section 8.0: Cumulative Effects Assessment

Preamble:

Cumulative effects are significant in complex urban environments with diverse and continuous pressures on social, economic and environmental elements. This project should not negatively contribute to the cumulative impacts of development on the Metro Vancouver region.

Request:

a) Please provide mitigation and compensation plans, determining appropriate activities and locations for addressing non-fish impacts could be evaluated a number of different ways, including area, biodiversity values, or ecosystem services provision. Please confirm the framework that will be used to balance quantitatively and qualitatively assessed impacts with their associated mitigation or compensation measures.

b) Please provide an evaluation of the impact of the project activities, describing how the conclusions were affected by uncertainty and if the precautionary principal was applied.

Response:

a) Mitigation or compensation measures proposed to address each Project-related effect are described for each biophysical element and indicator in Section 7.0 of Volume 5A. Mitigation or compensation measures proposed to address the Project's contribution to cumulative effects are described for each biophysical element and indicator in Section 8.0 of Volume 5A. These mitigation or compensation measures are proposed to avoid or reduce the spatial extent, magnitude and/or duration of potential effects.

b) Section 8.0 of Volume 5A provides the cumulative effects assessment for elements and indicators where Project-related residual effects could interact with other reasonably foreseeable activities. Table 7.1-2 in Volume 5A summarizes the significance criteria applied for the cumulative effects assessment, including a criterion for confidence. To ensure that the rationale for assessment conclusions is transparent to the National Energy Board and other readers, the level of confidence was reported for each assessment conclusion to reflect the relative degree of uncertainty using low, moderate, and high categories. An assessment with very high uncertainty or where the precautionary principle needed to be applied would be rated as low confidence.

1.5.11 Marine

[Trans Mountain has designated this Information Request as "Metro Vancouver IR No. 1.5.11" as it was the second usage of 1.5.10 in this Information Request list.]

Reference:

i) Volume 5A: ESA – Biophysical, Section 6.0: Environmental Setting for Facilities

Preamble:

The new facilities and twinning of the pipeline are designed to accommodate a roughly four fold increase in tankers in Burrard Inlet, each carrying approximately 575,000 barrels of oil. This activity represents a significant increase to existing marine traffic and fossil fuel transportation in the region.

Request:

a) Current and planned facilities in Burrard Inlet will be designed to accommodate outgoing tankers and incoming diluted bitumen. Please clarify the upper limit of what both the end point facilities and twinned pipelines can accommodate, in terms of tankers per week and amount of diluted bitumen respectively.

b) Provide information on the terms or conditions placed on the operations of the Trans Mountain facilities from Port Metro Vancouver, in terms of amount of allowable traffic per day, week or year.

Response:

a) As described in the application, the designed capacity of the expanded pipeline system shall be 890,000 barrels per day. The dock facility at Westridge is being designed to handle 630,000 barrels per day. Please refer to Vol 8A Table 2.2.1 for information on the number of anticipated tankers.

b) Similar to other vessels, tankers may arrive and depart Port Metro Vancouver provided they follow and meet all relevant requirements of PMV's Harbour Operations Manual. The conditions dictating the number of vessels that will call Westridge has been described in Termpol 3.7, Section 3.1.1 which is included in Volume 8C.

1.6 Air Quality, Greenhouse Gases and Human Health

1.6.01 Calculation Method for 24-hour PM2.5 and PM10 Concentrations for Comparison to Metro Vancouver Ambient Air Quality Objectives

Reference:

i) 2011 Lower Fraser Valley Air Quality Monitoring Report http://public.metrovancouver.org/about/publications/Publications/AmbientAirQuality2011.pdf, PDF page 20 of 107 (attachment)
ii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Table 1.3, PDF page 35 of 567
iii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 350 of 567
iv) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 354 of 567
v) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 333 of 567
vi) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF pages 1 to 567

Preamble:

Reference (i) states that Metro Vancouver's 24-hour $PM_{2.5}$ objective is applied as a rolling average and that several of Metro Vancouver's objectives are intended to be compared with rolling averages. For example, Metro Vancouver's 24-hour PM_{10} objective should be compared to a rolling average.

Reference (ii) does not indicate that Metro Vancouver objectives for 24-hour $PM_{2.5}$ and PM_{10} are based on rolling averages.

References (iii) and (iv) clearly indicate that 8-hour rolling averages of predicted ozone concentrations were computed for comparison with the Canada-wide standard for ozone.

A search of the word "rolling" in reference (v) has only three results: references (iii), (iv) and (v), all of which relate to predicted ozone. Nowhere is a rolling average mentioned in the context of predicted 24-hour $PM_{2.5}$ or PM_{10}.

Request:

a) Please clarify whether rolling or daily averages of predicted concentrations were compared to Metro Vancouver's objectives for 24-hour $PM_{2.5}$ and PM_{10}.

b) If daily averages of predicted concentrations were compared to Metro Vancouver's objectives for 24-hour $PM_{2.5}$ and PM_{10}, please provide revised results based on 24-hour rolling averages for the Base Case, Application Case and Cumulative Case. Please also discuss how the revised results affect the assessment of significance of the increase in ambient concentrations of criteria air contaminants.

Response:

a) Rolling averages were used to determine background concentrations. For the Base Case, Application Case and Cumulative Case, daily averages were modeled and compared to the Metro Vancouver ambient objective with the rolling 24-h background concentration.

b) As noted in the response to Metro Vancouver IR No. 1.16.01a, rolling 24-h averages were used to calculate the ambient background but not the CALPUFF predicted concentrations. Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014. Trans Mountain will provide rolling 24-h $PM_{2.5}$ and PM_{10} concentrations for the Base Case, Application Case and Cumulative Case at that time.

Summary of New Commitments:

- Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014 with rolling 24-h $PM_{2.5}$ and PM_{10} concentrations for the Base Case, Application Case and Cumulative Case.

1.6.02 Predicted Exceedances of Metro Vancouver Objectives for 24-hour PM2.5 and PM10 for the Combined Base Case – Westridge Marine Terminal

Reference:

i) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 212 of 567

ii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 77 of 567

iii) United States Environmental Protection Agency AP-42 Compilation of Air Pollutant Emission Factors, Chapter 13.5 Industrial Flares (http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s05.pdf) PDF page 4 of 5 (attachment)

iv) Burnaby Terminals Information Session Materials – September 25, 2013, http://talk.transmountain.com/document/show/458 PDF page 21 of 46 (attachment)

Preamble:

Reference (i) states that exceedances of Metro Vancouver's objectives for 24-hour PM_{10} and $PM_{2.5}$ were predicted to occur for the Base or Existing Case. It is also stated that the largest contributor to predicted $PM_{2.5}$ concentrations is the existing VCU at Westridge Marine Terminal.

Reference ii) states that emissions of soot from the VCU were estimated following the methodology in Chapter 13.5 of AP-42 (US EPA 1991) and that due to the high energy content of the marine loading vapours and a relatively high branched hydrocarbon content, soot formation in the VCU was assumed to be representative of an average smoking flare.

Reference (iii) provides emission factors for 4 types of flares: 0 micrograms per litre (µg/L) for non-smoking flares; 40 µg/L for lightly smoking flares; 177 µg/L for average smoking flares; and 274 µg/L for heavily smoking flares.

Reference (iv) states that in December 2010, an emission monitoring program was completed on the burner tower of the vapour control unit at Westridge. The purpose of the study was to determine the effectiveness of the burner and ensure all regulatory objectives were met.

Reference (iv) states that in 2011, an ambient air modelling study was completed to determine maximum ground-level concentrations of air contaminants and the dispersion of emissions from the burner tower.

Request:

Please provide:

a) Plots of frequency of exceedance of the Metro Vancouver 24-hour $PM_{2.5}$ and PM_{10} objectives for the Burnaby and Westridge Marine Terminals Combined Base Case.

b) The numbers of residences, schools, universities, daycares, and senior care facilities where exceedances of the Metro Vancouver 24-hour $PM_{2.5}$ or PM_{10} objectives are predicted for the Burnaby and Westridge Marine Terminals Combined Base Case.

c) Additional justification for the assumption that the US EPA AP-42 emission factor for an average smoking flare is most representative of emissions from the existing VCU at Westridge Marine Terminal. For example, are there stack test results, manufacturer specifications or observational evidence to support this assumption?

d) Results of the 2011 ambient air modelling study of emissions from the burner tower.

e) Results of the December 2010 emission monitoring program completed on the burner tower of the VCU at Westridge Marine Terminal.

f) Comparison of the December 2010 emission monitoring program results to the US EPA AP-42 emission factors for soot from industrial flares.

g) Revised dispersion modelling of $PM_{2.5}$ and PM_{10} for the Burnaby and Westridge Marine Terminals Combined Base Case if the results of the December 2010 emission monitoring program prove to be more representative of soot emissions from the existing VCU at Westridge Marine Terminal.

Response:

a) Figures 1 and 2 (provided as Metro Vancouver IR No.1.1.6.02a – Attachment 1 and Attachment 2, respectively) show plots of frequency of exceedance of the Metro Vancouver 24-hour particulate matter $(PM)_{2.5}$ and PM_{10} objectives for the Burnaby and Westridge Marine Terminals Combined Base Case. Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014.

b) The Metro Vancouver 24-hour $PM_{2.5}$ objective was predicted to be exceeded at three residences, one elementary school and one university for the Burnaby and Westridge Marine Terminals Combined Base Case. Note that this refers to the list of discrete receptors modelled for Technical Report 5D-7 in Volume 5D, Screening Level Human Health Risk Assessment of Pipelines and Facilities Technical Report (Intrinsik Environmental Sciences Inc. December 2013) and does not consider every residence in the Regional Study Area. Exceedances of the Metro Vancouver 24-hour PM_{10} objective were not predicted at any discrete receptors. Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014.

c) The use of the United States Environmental Protection Agency AP-42 emission factor for an average smoking flare was selected based on professional judgement of the vapour composition and properties. There are no manufacturer specifications or observation data regarding soot formation in the vapour combustion unit.

d) The existing vapour control unit at Westridge Marine Terminal will be replaced with new pollution control equipment as part of the Trans Mountain Pipeline Expansion Project and this information request is not relevant to one of more of the issues identified in the National Energy Board's List of Issues for the Trans Mountain Expansion Project. However, in recognition of the interests of Metro Vancouver, Trans Mountain commits to meet with Metro Vancouver to review the results of the 2011 ambient air modelling study of emissions.

e) The existing vapour control unit at Westridge Marine Terminal will be replaced with new pollution control equipment as part of the Trans Mountain Pipeline Expansion Project and this information request is not relevant to one of more of the issues identified in the National Energy Board's List of Issues for the Trans Mountain Expansion Project. However, in recognition of the interests of Metro Vancouver, Trans Mountain commits to meet with Metro Vancouver to review the results of the December 2010 emission monitoring program completed on the burner tower of the VCU at Westridge Marine Terminal.

f) The December 2010 emission monitoring program did not measure soot formation in the vapour combustion unit, and therefore, a comparison to the United States Environmental Protection Agency AP-42 emission factors for soot cannot be made.

g) As indicated in the response to Metro Vancouver IR No. 1.1.6.02f, the December 2010 emission monitoring program did not measure soot formation in the vapour combustion unit (VCU). The US Environmental Protection Agency AP-42 emission factors therefore remain the most representative source of estimating soot emissions from the VCU and no revised dispersion modelling will be conducted in this regard. Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014.

Summary of New Commitments:

- Trans Mountain will update dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014.

1.6.03 Predicted Exceedances of Metro Vancouver Objectives for 24-hour PM2.5 and PM10 for the Combined Application Case – Westridge Marine Terminal

Reference:

i) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 230 of 567
ii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Table 5.16, PDF page 226 of 567
iii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 76 of 567
iv) Burnaby Terminals Information Session Materials – September 25, 2013, http://talk.transmountain.com/document/show/458 PDF page 19 of 46 (attachment)
v) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 259 of 567
vi) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, Table 7.6.4-1, PDF page 509 of 1106
vii) Health and Air Quality 2002 – Phase 1 Methods for Estimating and Applying Relationships Between Air Pollution and Health Effects. RWDI West Inc. May 2003. p. iii. (attachment)

Preamble:

Reference (i) states that exceedances of Metro Vancouver's objectives for 24-hour PM_{10} and $PM_{2.5}$ were predicted to occur for the Application Case. It is also stated that the largest contributor to predicted $PM_{2.5}$ concentrations is the existing VCU at Westridge Marine Terminal.

Reference (ii) indicates that the largest source of PM emissions at the Westridge Marine Terminal is the vapour combustion unit.

Reference (iii) states that the proposed Project design for the new berths includes a new VCU.

Reference (iv) states that the existing VCU will be decommissioned after the new berths enter service and that a new VCU is planned.

Reference (v) refers to a Table 7.5.4-3 for recommended mitigation measures for primary emissions of criteria air contaminants for the Westridge Marine Terminal.

Reference (vi) scope includes mitigation measures of operation of the Westridge Marine Terminal; however, the mitigation measures listed under Primary emissions of criteria air contaminants relate to construction only.

Reference (vii) states that "*Since population-level (as compared with individual or panel-level) thresholds for adverse effects have not been shown to exist in the cases of particulate pollution and ozone, <u>current air quality objectives should not be interpreted as bright lines between 'safe' and 'unsafe' levels</u>*." and "*It needs to be recognized that any improvement in air quality for PM and ozone would result in fewer negative health impacts*."

Request:

Please provide:

a) Plots of frequency of exceedance of the Metro Vancouver 24-hour $PM_{2.5}$ and PM_{10} objectives for the Burnaby and Westridge Marine Terminals Combined Application Case.

b) The numbers of residences, schools, universities, daycares, and senior care facilities where exceedances of the Metro Vancouver 24-hour $PM_{2.5}$ or PM_{10} objectives are predicted for the Burnaby and Westridge Marine Terminals Combined Application Case.

c) Confirmation that the existing VCU will be removed and that a new VCU will be installed.

d) An assessment of alternative technologies to the proposed VCU that will have lower soot emissions and therefore do not result in predicted exceedances of the Metro Vancouver objectives for 24-hour $PM_{2.5}$ and PM_{10}.

e) Table 7.5.4-3 referred to in Reference (v).

f) Mitigation measures for primary emissions of criteria air contaminants from the Westridge Marine Terminal during operation.

g) A commitment to conduct stack testing and dispersion modelling of emissions of criteria air contaminants from the new VCU (or alternative technology) once it has been commissioned using methods acceptable to Metro Vancouver.

h) A list of contingency mitigation measures should the dispersion modelling based on stack test results of the newly commissioned VCU (or alternative technology) indicate the potential for exceedances of Metro Vancouver's ambient objectives.

i) A proposed ambient air quality monitoring program for $PM_{2.5}$ and PM_{10}.

Response:

a) Figures 1 and 2 (provided as Metro Vancouver IR No. 1.1.6.03a – Attachment 1 and 2, respectively) provide the contours showing the predicted exceedances of the Metro Vancouver 24-hour $PM_{2.5}$ and PM_{10} objectives for the Burnaby and Westridge Marine Terminals Combined Application Case. Trans Mountain is currently updating dispersion modelling in support of engineering design and the results will be filed with the NEB as Technical Update No. 1 in Q3 2014.

b) Exceedances of the Metro Vancouver 24-hour $PM_{2.5}$ objective for the Burnaby and Westridge Marine Terminals Combined Application Case were predicted at the same discrete receptors as for the Base Case. Please refer to the response to Metro Vancouver IR No. 1.1.6.02b. As per the Base Case, no exceedances of the Metro Vancouver 24-hour PM_{10} objective were predicted to occur at any of the discrete receptors. Trans Mountain is currently updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014.

c) The current design is to remove the existing vapour combustion unit (VCU) and replace it with a new VCU to be used only when all three berths are utilized simultaneously, or for backup purposes during vapour recovery unit (VRU) downtime. However, detailed engineering design is currently underway and the technologies used for vapour recovery at Westridge Marine Terminal may change as the design process progresses.

d) Alternative technologies are being considered as part of the engineering design currently underway. Trans Mountain is updating dispersion modeling and the results will be filed with the NEB as Technical Update No. 1 in Q3 2014.

e) Modified Table 7.5.4-3 is presented below as requested. Trans Mountain is currently updating dispersion modelling in support of engineering design and the results will be filed with the NEB as Technical Update No. 1 in Q3 2014.

TABLE 7.5.4-3

DISPERSION MODELLING RESULTS FOR AMBIENT VOC CONCENTRATIONS FOR EMISSIONS FROM TANK OPERATION AND COMPARISON WITH APPLICABLE REGULATORY STANDARDS (EXPRESSED AS NET CHANGE FROM EXISTING CONDITIONS) (in µg/m^3)

Terminal	Pollutant	Averaging Period	Project	Objective[1]
Edmonton	Benzene	1-hour	0.25	30
		Annual	0.01	3
	Ethylbenzene	1-hour	0.02	2,000
	Toluene	1-hour	0.23	1,880
		24-hour	0.16	400
	Xylenes	1-hour	0.098	2,300
		24-hour	0.061	700
Sumas	Benzene	1-hour	0.09	N/A[2]
		Annual	-4.1E-07	N/A
	Ethylbenzene	1-hour	0.01	N/A
	Toluene	1-hour	0.07	N/A
		24-hour	0.02	N/A
	Xylenes	1-hour	0.02	N/A
		24-hour	0.01	N/A
Burnaby	Benzene	1-hour	1.69	N/A
		Annual	0.02	N/A
	Ethylbenzene	1-hour	0.50	N/A
	Toluene	1-hour	7.10	N/A
		24-hour	1.42	N/A
	Xylenes	1-hour	2.42	N/A
		24-hour	0.48	N/A

Notes: 1 Alberta Ambient Air Quality Objectives (AESRD 2013b).
2 N/A: not available.

f) There are no current mitigation designs for primary emissions of criteria air contaminants (CACs) from the Westridge Marine Terminal during operation. The sources of CAC emissions at Westridge Marine Terminal are marine vessels and the vapour combustion unit (VCU). Trans Mountain is not responsible for vessel operations but all marine vessels will need to meet regulatory standards established by the International Maritime Organization as part of the North American Emission Control Area. Trans Mountain is committed to meeting Metro Vancouver ambient air quality objectives, and to this end, is engaging in additional dispersion modelling to inform engineering design of vapour

abatement technologies including the VCU. Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014.

g) As a federally regulated entity under the *National Energy Board Act*, if Trans Mountain Pipeline ULC (Trans Mountain) is granted a Certificate of Public Convenience and Necessity, it will proceed to apply for all permits that are required by law. Trans Mountain will engage with Metro Vancouver regarding this information request when engineering plans are further advanced.

h) Please refer to the response to Metro Vancouver IR No. 1.1.6.03g. Contingency mitigation measures will be developed as necessary.

i) A new ambient monitoring station will be installed at the Westridge Marine Terminal in 2015. This new unit will meet the nine requirements of NEB Draft Condition No. 21 – Air Emissions Management Plan for the Westridge Marine Terminal of the NEB's *Letter – Draft Conditions and Regulatory Oversight* (NEB 2014). This Condition requires methods and schedule for ambient monitoring of contaminants of potential concern in air including particulate matter, carbon monoxide, nitrogen dioxide, sulphur dioxide, hydrogen sulphide and volatile organic compounds.

Reference:

National Energy Board. 2014. Draft Conditions and Regulatory Oversight. Hearing Order OH-001-2014. Trans Mountain Pipeline ULC (Trans Mountain) Application for the Trans Mountain Expansion Project (Project). April 16, 2014.

Summary of New Commitments:

- Trans Mountain will update dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No. 1 in Q3 2014.
- Trans Mountain is conducting updated dispersion modelling in support of engineering design and the results will be filed with the NEB as Technical Update No. 1 in Q3 2014.
- Trans Mountain will engage with Metro Vancouver regarding their request for stack testing and dispersion modelling when engineering plans are further advanced.
- Trans Mountain will update dispersion modeling and the results will be filed with the NEB as Technical Update No. 1 in Q3 2014.
- Trans Mountain will install a new ambient monitoring station at the Westridge Marine Terminal in 2015 to meet the requirements of draft NEB Condition No. 21 which requires the methods and schedule for ambient monitoring of contaminants of potential concern in air including particulate matter, carbon monoxide, nitrogen dioxide, sulphur dioxide, hydrogen sulphide and volatile organic compounds.

1.6.04 Assessment of Significance of Potential Residual Effects on Air Quality due to Emissions from the Westridge Marine Terminal

Reference:

i) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, Table 7.6.4-2, PDF page 511 of 1106

ii) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, Table 7.6.4-2, PDF page 510 of 1106

iii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 232 of 567

iv) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 230 of 567

v) Guidelines for Air Quality Dispersion Modelling in British Columbia, BC Ministry of Environment, March 2008

(http://www.bcairquality.ca/reports/pdfs/air_disp_model_08.pdf), page 94 of 152 (attachment)

vi) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, PDF page 102 of 1106

vii) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, Table 7.1-2, PDF page 101 of 1106

Preamble:

Reference (i) compares dispersion modelling results for ambient CAC and VOC concentrations for emissions from Westridge Marine Terminal ("Project at Westridge Marine Terminal") to Metro Vancouver ambient air quality objectives. These results are expressed as the net change from existing conditions.

Reference (ii) directs the reader to the Air Emissions and Greenhouse Gas Technical Report (Volume 5C) for more detailed information related to Table 7.6.4-2 (Reference i).

Reference (iii) presents the same "Project at Westridge Marine Terminal" results as Reference (i) as well as the Base Case (With Background) and the Application Case (With Background).

Reference (iv) explains how the "Project at Westridge Marine Terminal" results presented in Reference (iii) were calculated: as the difference in the maximum concentrations between the Application Case and the Base Case. Also noted is that all Application and Base Case results include ambient background. What is not noted is that the Project results do not include background. Since the Project results are calculated by subtracting Base Case (With Background) from Application Case (With Background), the background values are cancelled out.

Reference (v) states that although it is useful to know the predicted incremental impact due to a source, it is the cumulative air quality that is of importance. The cumulative air quality is given

by: Cumulative = Background + Predicted increment (contribution from modelled emission). It is Metro Vancouver policy to compare cumulative predicted air quality to ambient air quality objectives. Furthermore, Metro Vancouver objectives are not considered to be "pollute up to" limits.

Reference (vi) defines residual effects as "*the environmental effects that are present after mitigation measures are applied*." It does not define them as the environmental effects that are present after existing effects are subtracted. Therefore, the residual effects assessment should be based on the results of the Application Case (With Background) presented in Reference (iii) and not the incremental "Project at Westridge Marine Terminal" results presented in Reference (ii).

Reference (vii) defines low, medium and high magnitude of residual environmental effect in terms of environmental and/or regulatory standards. For example, medium magnitude is defined as "*Residual effects are detectable and may approach, but are still within the environmental and/or regulatory standards*". Reference (i) indicates that the regulatory standards used for the assessment of residual effects on air quality are Metro Vancouver's ambient air quality objectives. As discussed above, the correct metric to compare to Metro Vancouver's objectives is the cumulative predicted air quality, which for this assessment would be the Application Case (With Background) results.

Request:

a) Please confirm that the emissions used to model the Application Case were estimated assuming operation of the proposed Project-related mitigation measures, such as the vapour recovery units (VRUs) and the vapour combustion units (VCU).

b) Please re-evaluate the magnitude and significance of potential residual effects on air quality due to emissions from Westridge Marine Terminal based on the Application Case (With Background) model results.

Response:

a) Emissions used to model the Application Case assumed operation of proposed Project-related mitigation measures (i.e., tank vapour activation units [TVAUs], vapour recovery units [VRUs] and vapour combustion unit [VCU]).

b) An environmental effect is defined in the NEB *Filing Manual* (NEB 2014) as any change that a Project may cause to a bio-physical or socio-economic element. Existing operations and background concentrations from other sources are not part of the Project. Therefore, the potential residual effects of the Project on air quality are properly evaluated based on the change in predicted ambient air quality concentrations and a re-evaluation will not be conducted. Trans Mountain commits to meeting with Metro Vancouver to discuss the methodology and model results.

Reference:

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, AB.

1.6.05 Emissions of Volatile Organic Compounds (VOCs) from Westridge Marine Terminal

Reference:

i) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Table 4.33, PDF page 201 of 567
ii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Table 5.16, PDF page 226 of 567
iii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 225 of 567
iv) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Appendix C, Table 4.2, PDF page 345 of 567
v) National Pollutant Release Inventory Online Data Search – Facility and Substance Information for Chevron Canada Limited Burnaby Refinery (2012) – Substance Reports (Criteria Air Contaminants) (http://ec.gc.ca/inrp-npri/donnees-data/index.cfm?do=facility_substance_summary&lang=en&opt_npri_id=0000002776&opt_report_year=2012#cac) (attachment)
vi) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, Table 7.6.4-4, PDF page 512 of 1106
vii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 76 of 567

Preamble:

Reference (i) indicates that existing annual VOC emission rate from the Westridge Marine Terminal is 34.7 tonnes per year (t/y).

Reference (ii) indicates that the annual VOC emission rate from the Westridge Marine Terminal is projected to increase to 840 t/y as a result of the Project. Thus, VOC emissions from Westridge Marine Terminal are expected to increase by 805.3 t/y, which is a 2300% increase.

Reference (iii) states that fugitive emissions from berthed ships and controlled fugitive emissions from the VRU account for most VOC emissions at Westridge Marine Terminal.

Reference (iv) indicates that when VOC emissions from TMEP marine vessels in transit or at anchor are included, the incremental annual VOC emissions due to the Project are 1,518 t/y.

Reference (v) indicates that in 2012 the Chevron Canada Limited Burnaby Refinery emitted 116 t in 2012. Thus, the projected increase in VOC emissions in the Lower Fraser Valley due to the Project at Westridge Marine Terminal is equivalent to adding 13 new refineries the size of the Chevron Burnaby Refinery to the airshed. As a group, VOCs are of concern due to their pivotal role in the secondary formation of ground level ozone. The Lower Fraser Valley (LFV) continues to experience occasional episodes of exceedance of Metro Vancouver's ambient air quality objective and the Canada-wide standard for ozone, and increasing annual average concentrations. Recent evidence indicates that the western portion of the LFV is VOC limited, meaning that an increase in VOC will likely lead to an increase in ozone. Individual VOCs are also of concern due to their potential health effects (e.g., benzene, toluene and xylene).

Reference (vi) indicates that the magnitude of effect of the increase in VOC emissions is low and not significant. This seems at odds with the fact that the increase in VOC emissions is equivalent to adding 13 new refineries to the airshed.

Reference (vii) indicates that the collection efficiency for the proposed vapour recovery and vapour combustion units is only 90%. It also states that the new VCU will only be used for peak periods and back-up or standby use when three tankers are berthed.

Request:

a) Justify why the new VCU will be used only during peak periods or as a back-up given the 2300% increase in VOC emissions at Westridge Marine Terminal due to the Project.

b) Provide evidence that the proposed VRU and VCU system with collection efficiency of 90% represent best available control technology.

c) Given the large projected increase in VOC emissions due to the Project, consider assessing the significance of the increase in VOC emissions based on more than just the predicted increase in ambient concentrations of four individual VOCs.

Response:

a) Current design for vapour abatement of ship loading activities at Westridge Marine Terminal (WMT) proposes two new vapour recovery units (VRUs) and one new vapour combustion unit (VCU). During normal operation and when one or two berths are utilized, the two VRUs are expected to be sufficient to capture and recycle the fugitive vapours associated with ship loading activities. The VCU is therefore proposed to be used only during peak periods when all three berths are utilized, or as back-up during VRU downtime. This opinion is based on emissions estimation and dispersion modelling as noted in the Application.

With respect to the increase in Project-related VOC emissions at WMT, as noted in Table 5.16 of the Air Quality and Greenhouse Gas Technical Report 5C-4 of Volume 5C (RWDI December 2013), 566 tonnes per year and 266 tonnes per year were listed for the VRUs and fugitive emissions from tanker loading, respectively. It was also indicated in the Application that the control technologies being proposed were based on very preliminary engineering estimates and an update would be issued in 2014 as the facility design evolved. Table 1.1.6.05A-1 (reprinted from Table 3.19 of the Technical Report 5C-4 of Volume 5C) indicates the original control efficiencies for the VRUs and VCU at WMT as summarised in the 2013 NEB filing. Table 1.1.6.05A-2 indicates control efficiencies for the VRUs and VCU at WMT as developed in process specifications by Trans Mountain in 2014 for equipment manufacturers. The process specifications indicate both higher collection and destruction (VCU), or capture and recovery (VRU) efficiencies relative to the original VOC calculations in the Application. As a result of the commitment by Trans Mountain to the process specifications for the VRUs and VCU at WMT, the annual VOC emissions will be much lower than the originally reported values in the 2013 NEB filing.

TABLE 1.1.6.05A-1

CONTROL EFFICIENCIES ASSOCIATED WITH VAPOR ABATEMENT TECHNOLOGIES AT WESTRIDGE MARINE TERMINAL IN 2013 APPLICATION

Control Technology	Compound	Collection Efficiency	Destruction or Capture/Recycle Efficiency	Total Reduction Efficiency
VCU	TOC	90%	98%	98%
	TRS		70%	63%
VRU	TOC	90%	75%	68%
	TRS		80%[a]	72%

Note: (a) VRU technology does not recover methane and ethane.

TABLE 1.1.6.05A-2

CONTROL EFFICIENCIES ASSOCIATED WITH VAPOR ABATEMENT TECHNOLOGIES AT WESTRIDGE MARINE TERMINAL BASED ON 2014 PROCESS SPECIFICATIONS

Control Technology	Compound	Collection Efficiency	Destruction or Capture/Recycle Efficiency	Total Reduction Efficiency
VCU	Hazardous Air Pollutants (HAPs)	100%	98%	98%
	Other VOCs		98%	98%
VRU	Hazardous Air Pollutants (HAPs incl. H_2S)	100%	98%	98%
	Other VOCs		95%[a]	95%

Note: (a) VRU technology does not recover methane and ethane.

b) Please refer to the response to FVRD IR No. 1.02a. The collection efficiency of 90% was used as a conservative initial value for modelling. Trans Mountain's intent is to achieve a collection efficiency of 100%, directing all vapours expelled during loading to the vapour recovery units (VRUs) or vapour combustion unit (VCU) for recovery or destruction of hazardous air pollutants (HAP) and other VOCs (with target recovery and destruction rates of 95% to 98%).

c) The significance of volatile organic compounds (VOC) emissions due to the Project was assessed based on the predicted increase in ambient concentrations of VOCs as ambient concentrations represent the most direct link to potential health and environmental effects; VOC emissions do not translate directly to potential health and environmental effects.

1.6.06 Evaluation of Magnitude of Effect and Significance of an Increase in Ambient Concentrations of VOCs due to Emissions from Westridge Marine Terminal

Reference:

i) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 34 of 567
ii) Environment Canada Toxic Substances List – Schedule 1 (http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=0DA2924D-1&wsdoc=4ABEFFC8-5BEC-B57A-F4BF-11069545E434) (attachment)
iii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 232 of 567
iv) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, Table 7.1-2, PDF page 101 of 1106
v) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, Table 7.6.4-4, PDF page 512 of 1106

Preamble:

Reference (i) presents Alberta ambient air quality objectives for the VOCs benzene, ethylbenzene, toluene and xylene. Of particular note is that the 1-hour objective for benzene is 30 µg/m^3.

Reference (ii) indicates benzene is a toxic substance.

Reference (iii) compares predicted concentrations for the Burnaby and Westridge Marine Terminals to Metro Vancouver objectives. Of particular note is that the one-hour benzene concentration for the Application Case (With Background) is 41.6 µg/m^3 and for the Project at Westridge Terminal is 34.3 µg/m^3. Both of these concentrations are greater than the Alberta ambient air quality objective for one-hour benzene. Benzene is a known carcinogen. Metro Vancouver evaluates predicted ambient concentrations of contaminants for which it does not have objectives by comparison to criteria established in other jurisdictions, such as Alberta, Ontario or Texas. Typically, air quality objectives adopted by Metro Vancouver are at least as stringent as any other jurisdiction in Canada.

Reference (iv) defines low, medium and high magnitude of residual environmental effect in terms of environmental and/or regulatory standards. For example, low magnitude is defined as “Residual effects are detectable but well within the environmental and/or regulatory standards”. The definitions of magnitude do not specify the jurisdiction of the environmental and/or regulatory standards.

Reference (v) indicates that increase in ambient concentrations of VOCs has been rated low magnitude and not significant. No discussion of this evaluation is provided in the text.

Request:

a) Reassess magnitude and significance of an increase in ambient concentrations of VOCs due to emissions from Westridge Marine Terminal using objectives from other jurisdictions, such as Alberta.

b) Please provide written justification for the revised assessment.

Response:

a) Updated dispersion modeling will be filed with the NEB as Technical Update No. 1 in Q3 2014.

b) Please refer to the response to Metro Vancouver IR No.1.1.6.06a. Written justification for the revised assessment will be provided in the Technical Update No. 1 in Q3 2014.

Summary of New Commitments:

- Trans Mountain will update dispersion modeling and the results will be filed with the NEB as Technical Update No. 1 in Q3 2014.
- Trans Mountain will provide a written justification for the revised assessment as part of Technical Update No. 1 in Q3 2014.

1.6.07 Ozone

Reference:

i) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Appendix C, Table 4.2, PDF page 345 of 567
ii) National Pollutant Release Inventory Online Data Search – Facility and Substance Information for Chevron Canada Limited Burnaby Refinery (2012) – Substance Reports (Criteria Air Contaminants) (http://ec.gc.ca/inrp-npri/donnees-data/index.cfm?do=facility_substance_summary&lang=en&opt_npri_id=0000002776&opt_report_year=2012#cac (attachment)
iii) Health and Air Quality 2002 – Phase 1 Methods for Estimating and Applying Relationships Between Air Pollution and Health Effects. RWDI West Inc. May 2003. p. iii. (attachment)
iv) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Appendix C, PDF page 336 of 567
v) Steyn D.G., B. Ainslie, C. Reuten, P.L. Jackson. 2013. A retrospective analysis of ozone formation in the Lower Fraser Valley, British Columbia, Canada. Part I: Dynamical Model Evaluation. Atmosphere-Ocean, 51, 153-169. (attachment)
vi) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Appendix C, PDF page 339 of 567
vii) Volume 5A, ESA - Biophysical, Section 7.0: Environmental Effects Assessment, PDF page 514 of 1106
viii) Guidelines for Air Quality Dispersion Modelling in British Columbia, BC Ministry of Environment, March 2008 (http://www.bcairquality.ca/reports/pdfs/air_disp_model_08.pdf), PDF page 59 of 152 (attachment)

Preamble:

Reference (i) indicates that when VOC emissions from TMEP marine vessels in transit or at anchor are included, the incremental annual VOC emissions due to the Project are 1,518 t/y. VOC emissions are of concern due to their pivotal role in the secondary formation of ground level ozone. The Lower Fraser Valley (LFV) continues to experience occasional episodes of exceedance of Metro Vancouver's ambient air quality objective and the Canada-wide standard for ozone, and increasing annual average concentrations. Recent evidence indicates that the western portion of the LFV, where the Westridge Marine and Burnaby Terminals are located, is VOC limited, meaning that an increase in VOC will likely lead to an increase in ozone.

Reference (ii) indicates that in 2012 the Chevron Canada Limited Burnaby Refinery emitted 116 t in 2012. Thus, the projected increase in VOC emissions in the LFV due to the Project is equivalent to adding 13 new refineries the size the Chevron Burnaby Refinery to the airshed.

Reference (iii) states that "*Since population-level (as compared with individual or panel-level) thresholds for adverse effects have not been shown to exist in the cases of particulate pollution and ozone, current air quality objectives should not be interpreted as bright lines between 'safe' and 'unsafe' levels*."

Reference (iv) states that the system used to model secondary formation of ozone is thoroughly documented in the peer-reviewed literature (Steyn et al. 2013; Ainslie et al. 2013).

Reference (v) states that four ozone episodes were investigated to capture the observed changes in ozone reduction and the different meteorological types that occur during LFV ozone events.

Reference (vi) states that the model period used to assess secondary formation of ozone was June 24 to July 3, 2006, which is only one of the four episodes investigated by Steyn et al., 2013 to explore the full range of meso-scale meteorological variability seen in the Lower Fraser Valley airshed.

Reference (vii) assesses the significance of emissions from the Project on formation of secondary particulate matter and ozone based on the results of modelling for one 10-day period, which is representative of only one of several meteorological types that result in elevated ozone concentrations. Predicting a small change in peak ozone for a short period does not prove that a larger change would not occur under different meteorological conditions.

Reference (viii) discusses the length of record of meteorological data used for air quality modelling:

> *"Predicting the air quality impacts of a yet-to-be-built emission source raises a fundamental question: what will the atmosphere be like in the future? Although this cannot be answered with absolute certainty, it is possible to get a good idea of the future conditions, given measurements taken over a number of years in the past.*
>
> *The measurement period required to obtain a stable distribution of conditions depends on the variable being measured. Landsberg and Jacobs (1951) indicate that greater than 10 years may be required to achieve stability in the frequency distributions of some meteorological variables. Burton et al. (1983) indicate that five years of data collection would be a minimum period to obtain a representative long-term average. Unfortunately, in many situations there are no site-specific data of five years' duration available.*
>
> *For Level 2 or Level 3 assessments, the following is recommended:*
>
> - *Minimum period of data is one year with up to five years preferred*
> - *One year of data is acceptable if meteorological data is produced from a [meso-scale meteorological] model"*

Trans Mountain has used a meso-scale meteorological model, the Weather Research and Forecasting (WRF) model to produce meteorological data used in the CMAQ air quality modelling system. While the main subject of Reference (viii) is regulatory dispersion modelling using screening or refined models and not advanced models such as CMAQ, the general philosophy of the above quote holds true for models such as CMAQ: they make use of historical meteorological data to predict the future. Given the computational resources required by a modelling system such as CMAQ, it is not realistic to require that a full year of data be modelled. However, drawing conclusions on the potential effect of a large increase in VOC emissions on ozone, an air contaminant for which there is no known safe level, based on only 10 days of

modelling is also not sufficient. A reasonable compromise would be to model at least the same four episodes investigated in Reference (v).

Request:

a) Revise the assessment of the potential effect of VOC emissions from the Project on the secondary formation of ozone based on CMAQ model results for more periods that encompass the full range of meso-scale meteorological variability seen in the Lower Fraser Valley airshed (e.g., the four episodes investigated in Reference v: Steyn et al. (2013)).

Response:

a) Trans Mountain met with senior scientists from Environment Canada on November 21, 2012 to review two draft work plans (marine and terrestrial) that were developed by RWDI in response to NEB *Filing Manual* (NEB 2014) requirements for assessments of air emissions and greenhouse gas emissions. Suggestions were provided by Environment Canada to improve upon the plans and these were incorporated into the final version of the work plan. Environment Canada and other regulatory agencies, such as Metro Vancouver and Fraser Valley Regional District, that RWDI met with also made recommendations for additional effort with new studies to strengthen the final submissions to the NEB and reduce the number of Information Requests (IRs). These included regional air shed modeling using the Community Multi-Scale Air Quality (CMAQ) model to estimate the formation of photochemical pollutants such as ozone, particulate matter ($PM_{2.5}$) and visibility. Trans Mountain agreed to the additional studies requested by Environment Canada and others, and the results were incorporated into the Application which was filed with the NEB in December 2013.

It should be noted that RWDI prepared a detailed model plan which outlined the proposed meteorological and air quality information that RWDI was proposing to rely upon to complete the air quality assessments (terrestrial and marine) (refer to Appendix A of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report [RWDI December 2013]). It was agreed in the meeting with Environment Canada on November 21, 2012 that, as Metro Vancouver and the British Columbia Ministry of the Environment (BC MOE) would be approving and signing the detailed model plan, Environment Canada did not want to be involved in that task.

With respect to this IR, the request is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC MOE. As such, no additional analysis of the information provided or modeling will be completed in response to this request.

Reference:

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, AB.

1.6.08 Burning of Brush during Construction

Reference:

i) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 62 of 567
ii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, PDF page 253 of 567
iii) Greater Vancouver Regional District Air Quality Management Bylaw No. 1082, 2008, PDF page 1 of 14
http://www.metrovancouver.org/boards/bylaws/Bylaws/RD_Bylaw_1082.pdf (attachment)
iv) Greater Vancouver Regional District Air Quality Management Bylaw No. 1082, 2008, PDF page 4 of 14
http://www.metrovancouver.org/boards/bylaws/Bylaws/RD_Bylaw_1082.pdf (attachment)

Preamble:

In the context of emissions from construction activities, Reference (i) states that burning of brush will result in CAC and VOC emissions but these emissions will be sporadic and are not estimated.

Reference (ii) indicates that a key recommendation for smoke during construction is to comply with local government bylaws, the the *Forest and Prairie Protection Act* (Alberta Reg. 310/72) and *BC Open Burning Smoke Control Regulation* and the *Forest Fire Prevention and Suppression Regulation* when burning slash.

Reference (ii) indicates that a mitigation measure for smoke during construction is to avoid burning slash in the Lower Mainland where air quality is an issue. Mulch in place or ship/haul slash to an approved disposal location.

Reference (iii) establishes the authority of the Greater Vancouver Regional District (GVRD) to prohibit, regulate and otherwise control and prevent the discharge of air contaminants.

Reference (iv) Sections 5 to 10 sets out the main prohibitions and exemptions for the discharge of air contaminants within the GVRD. One of the exemptions is if the discharge is conducted strictly in accordance with the terms and conditions of a valid and subsisting permit, approval or order. This is likely the most applicable exemption for burning of slash associated with the Project.

Request:

a) For clarity, please explicitly list the GVRD Air Quality Management Bylaw 1082, 2008 in the key recommendation set out in Reference (ii) and in Section 7.0 of the EPP.

b) Please clarify whether any burning of slash will occur within the boundaries of Metro Vancouver.

c) If any slash burning is planned within the boundaries of Metro Vancouver, please confirm that Trans Mountain will apply for a permit under Section 7 of GVRD Air Quality Management Bylaw 1082, 2008.

Response:

a) Trans Mountain will list the GVRD Air Quality Management Bylaw 1082, 2008 in the version of the Environmental Protection Plans that are prepared and submitted in advance of the construction phase of the Project.

b) As stated in Section 8.1 of the Pipeline Environmental Protection Plan (Volume 6B), Trans Mountain will avoid burning of slash and woody debris in the Lower Mainland Region, which includes Metro Vancouver.

c) As a federally regulated entity under the *National Energy Board Act*, if Trans Mountain Pipeline ULC (Trans Mountain) is granted a Certificate of Public Convenience and Necessity, it will proceed to apply for all permits that are required by law. Trans Mountain will work with Metro Vancouver to understand the applicability of its bylaws and standards to the construction and operation of the Project.

Summary of New Commitments:

- Update the tables of permits, approvals and authorizations provided in the three project-related Environmental Protection Plans to include the GVRD Air Quality Management Bylaw 1082, 2008.

1.6.09 Total Reduced Sulphur

Reference:

i) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Table 1.3, PDF page 35 of 567
ii) 2011 Lower Fraser Valley Air Quality Monitoring Report http://public.metrovancouver.org/about/publications/Publications/AmbientAirQuality2011.pdf, Table 1, PDF page 21 of 107 (attachment)
iii) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Figure 4.49, PDF page 173 of 567
iv) Volume 5C, Biophysical Technical Reports, Air Quality and Greenhouse Gas Technical Report, Table 3.30, PDF page 106 of 567
v) 2011 Lower Fraser Valley Air Quality Monitoring Report http://public.metrovancouver.org/about/publications/Publications/AmbientAirQuality2011.pdf, Figure 68, PDF page 90 of 107 (attachment)

Preamble:

Reference (i) tabulates BC objectives for total reduced sulphur (TRS) but not the Metro Vancouver objectives.

Reference (ii) provides Metro Vancouver's ambient air quality objectives for one-hour TRS.

Reference (iii) illustrates observed TRS concentrations in 2011 along the pipeline corridor. It indicates that 1-hour TRS concentrations were 0 $\mu g/m^3$ at North Burnaby Capitol Hill, Burnaby North, and Burnaby Kensington Park; 3 $\mu g/m^3$ at Port Moody; and 2 $\mu g/m^3$ at Burmount.

Reference (iv) indicates a background H2S concentration of 0.0 $\mu g/m^3$ for Burnaby and Westridge Marine Terminals Regional Study Area based on TRS monitoring data from Burnaby Kensington Park.

Reference (v) illustrates observed TRS concentrations in 2011 in Metro Vancouver. It indicates that maximum observed 1-hour average TRS concentrations were 1.3, 1.8, 4.6, 21.0 and 1.7 $\mu g/m^3$ at Burnaby Capitol Hill, Burnaby North, Burnaby Kensington Park, Port Moody and Burnaby-Burmount, respectively.

Request:

a) Please confirm Trans Mountain will revise Table 1.3 of Reference (i) to include the Metro Vancouver objectives.

b) Please explain why the 2011 TRS observations provided in Reference (iii) are so different from the values published by Metro Vancouver in Reference (iv).

c) If the reason for the difference is that the monitoring data used were not obtained directly from Metro Vancouver, please confirm Trans Mountain will obtain QA/QC'd data from Metro Vancouver for all contaminants and revise the background values listed in Reference (iv).

d) Please provide revised dispersion model results and assessment of significance for all air contaminants that required a revision to the background value.

e) Please provide an assessment of TRS emissions at Burnaby and Westridge Marine Terminals using the Metro Vancouver objectives provided in Reference (ii).

Response:

a) The Metro Vancouver total reduced sulphur (TRS) objectives will be included in Technical Update No. 1 as part of updated dispersion modelling to be filed with the NEB in Q3 2014.

b) It is assumed the question is asking to compare the data in Reference (iv) with (v). The data presented in the Metro Vancouver 2011 Lower Fraser Valley Air Quality Monitoring Report are average values; whereas, the data in the Figure 4.49 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) are the 99th percentile 1-hour, 99th percentile 24-hour concentrations and 50th percentile annual concentrations. Please refer to the response to Metro Vancouver IR No. 1.1.6.21b for additional discussion on the potential differences.

c) Please refer to the responses to Metro Vancouver IR No. 1.1.6.09a and 1.1.6.09b.

d) Please note the background values of air contaminants do not require revision and therefore, no revised dispersion modeling or assessment of significance is necessary.

e) The maximum predicted concentrations predicted in the Marine Air Quality Regional Study Area for the Westridge Marine Terminal and Burnaby Terminal, and reported in Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) were compared to the British Columbia Ministry of Environment (BC MOE) total reduced sulpur (TRS) objectives. The BC MOE 1-hour TRS objective is the same as the Metro Vancouver desirable TRS objective. No exceedances above the BC MOE objectives were identified at either terminal when doing this comparison. As the predicted concentrations will not exceed the BC MOE TRS objectives, there is no need to compare to the Metro Vancouver objectives.

Summary of New Commitments:

- As part of Technical Update No. 1 in Q3 2014, Trans Mountain will provide Metro Vancouver total reduced sulphur (TRS) objectives.

1.6.10 CALMET – Land Use

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page D-33.

ii) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

In Figure D.20 of Reference (i) the Burrard Inlet water mass appears to be shown to have an incorrect land-use. In the figure, Burrard Inlet appears to be assigned an urban and residential land-use instead of a water land-use.

Request:

a) Please clarify if an error has been made in the CALMET modelling (References (i) and (ii)) whereby the Inlet has been modelled as land.

b) If so, please confirm what, if any, impact this will have on CALPUFF model results.

Response:

a) Please refer to the response to GoC EC IR No. 1.103a.

b) An updated air quality assessment using CALPUFF for the Westridge Marine Terminal and Burnaby Terminal will be filed as Technical Update No. 1 with the NEB in Q3 2014.

Summary of New Commitments:

- Trans Mountain will provide an updated air quality assessment using CALPUFF for the Westridge Marine Terminal and Burnaby Terminal as part of Technical Update No. 1 with the NEB in Q3 2014.

1.6.11 CALMET – GEO.DAT

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.
ii) Guidelines for Air Quality Dispersion Modelling in British Columbia, British Columbia Ministry of Environment, Victoria, British Columbia, March 2008, Page 86. (attachment)
iii) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

It is recommended in Reference (ii) that terrain and land-use are plotted along with the locations of meteorological stations using in the modelling. Reference (i) does not contain a plot that contains all three of these types of information on the same plot.

Request:

a) Please provide a plot of terrain, land-use and the locations of the meteorological stations directly from the GEO.DAT input file used in Reference (i) and (iii).

Response:

a) The information requested is provided in Figures 1.1.6.11A-1 to 1.1.6.11A-5 below.

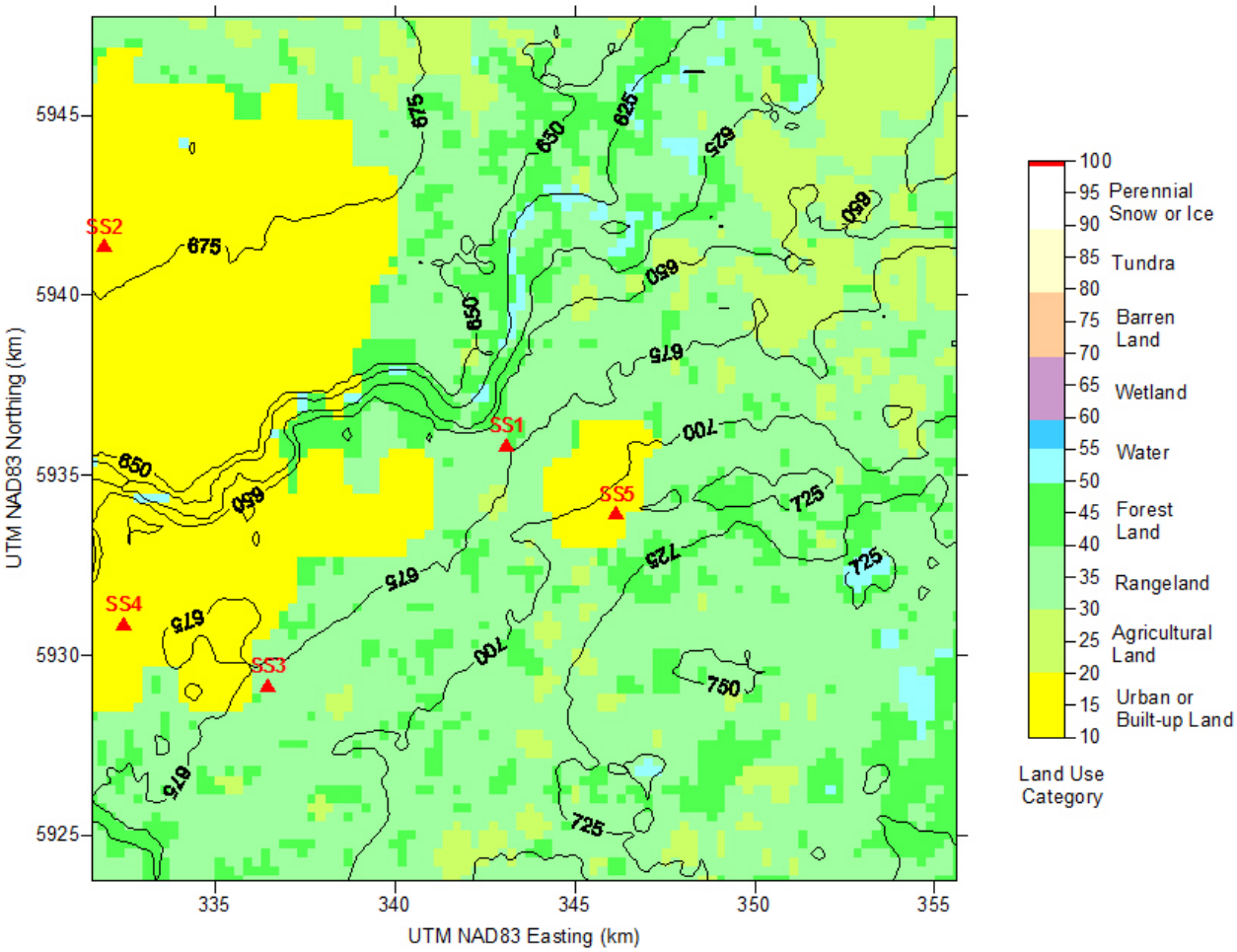


Figure 1.1.6.11A-1 Terrain, Land Use and Surface Stations for the Edmonton Terminal Air Quality Regional Study Area

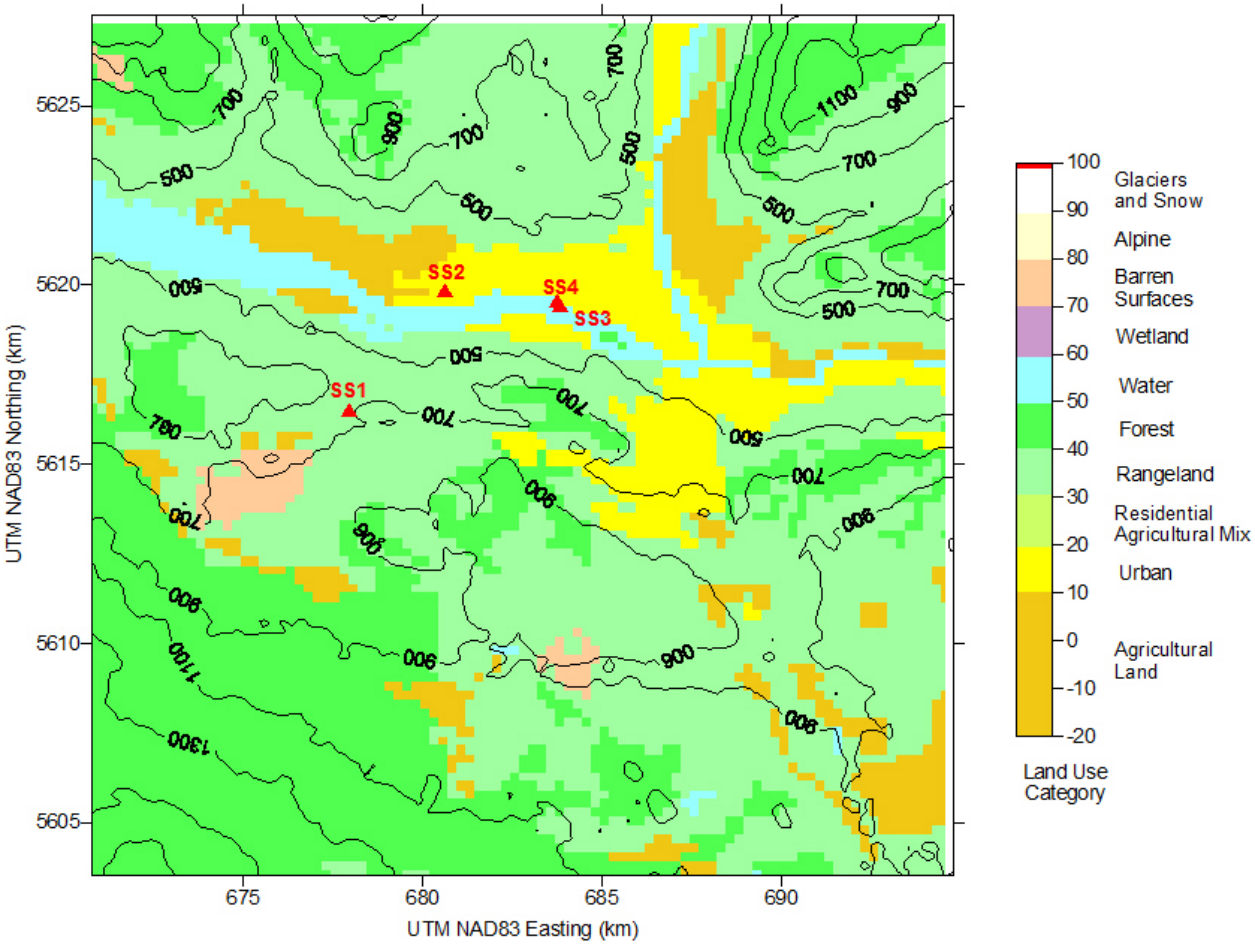


Figure 1.1.6.11A-2 Terrain, Land Use and Surface Stations for the Kamloops Terminal Air Quality Regional Study Area

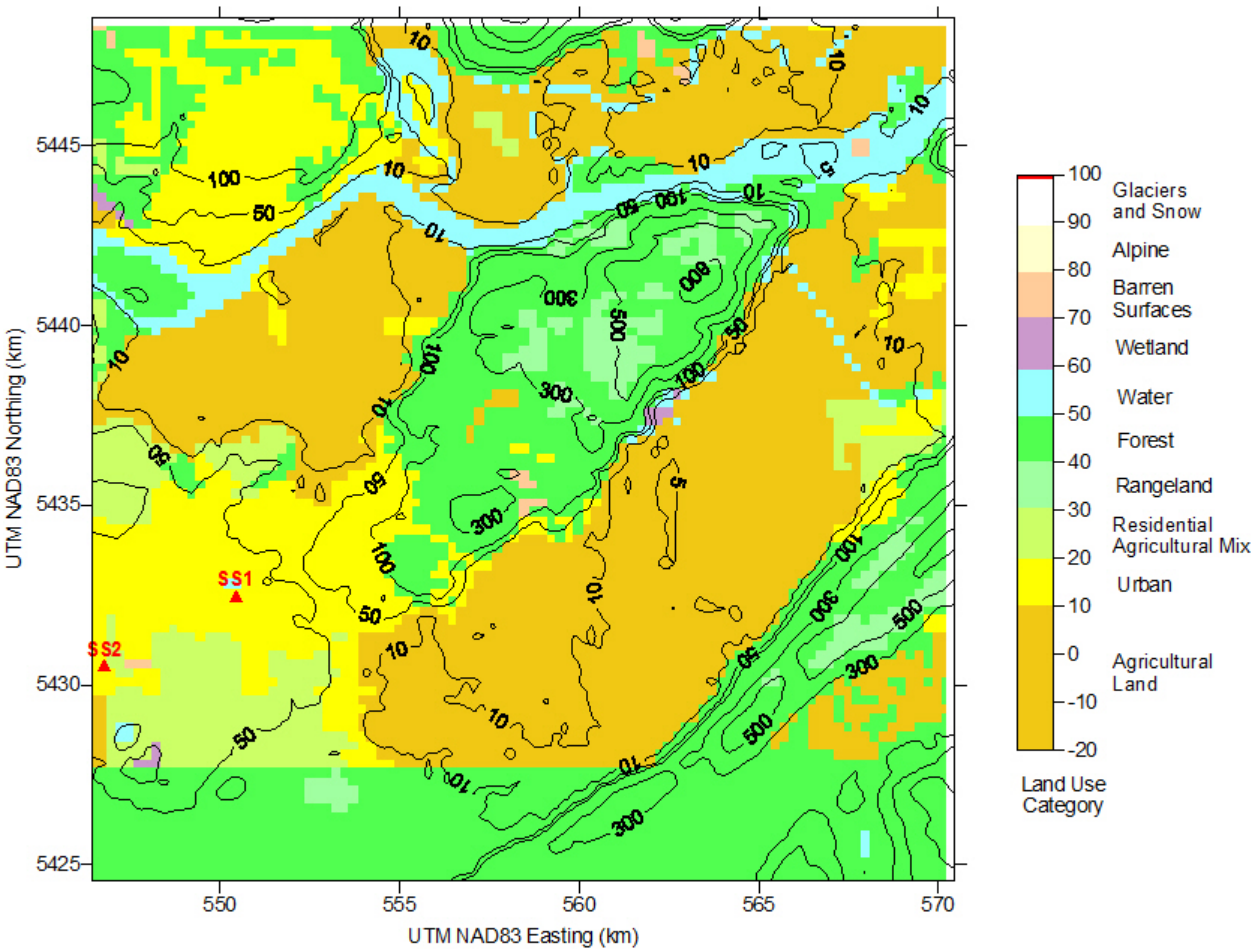


Figure 1.1.6.11A-3 Terrain, Land Use and Surface Stations for the Sumas Terminal Air Quality Regional Study Area

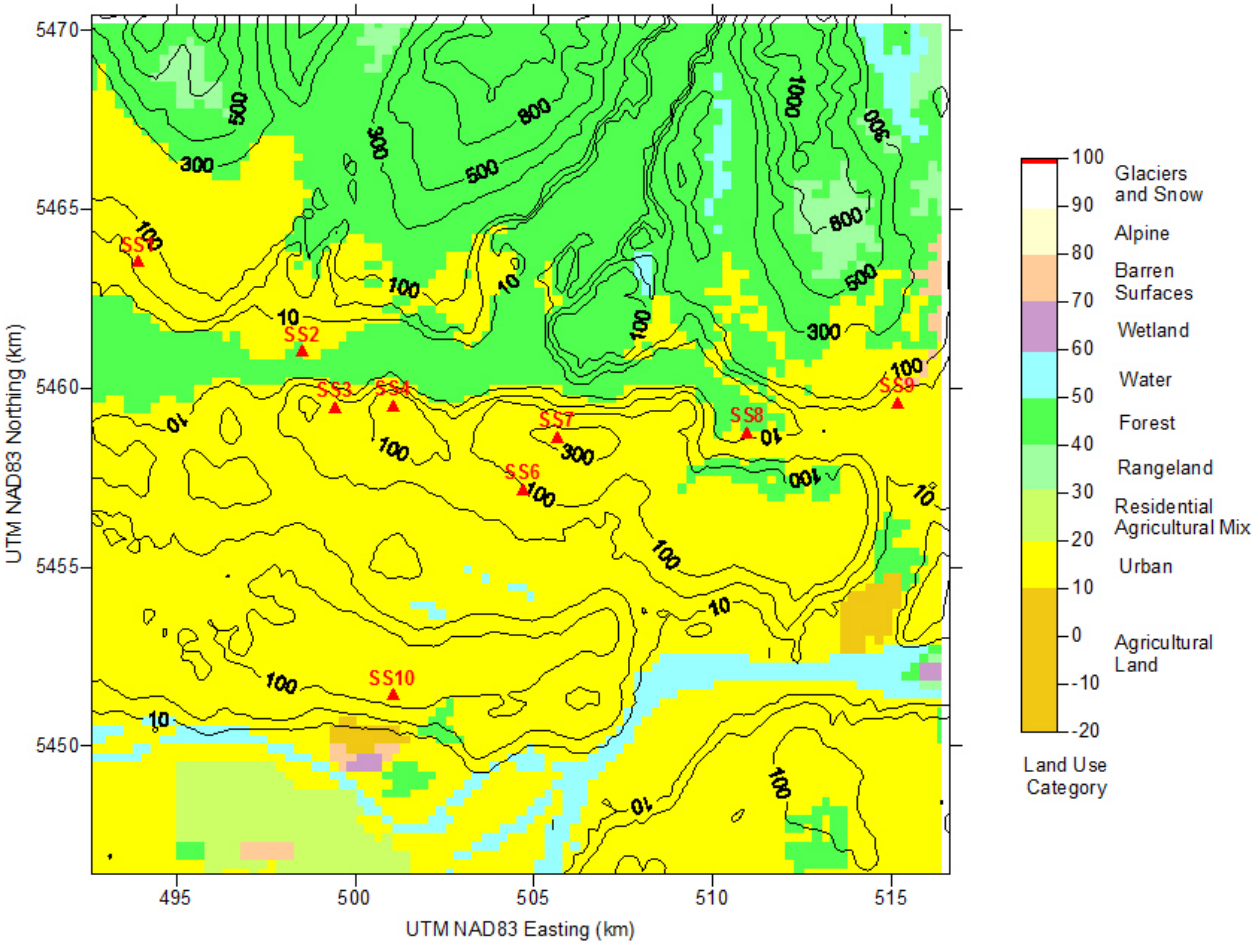


Figure 1.1.6.11A-4 Terrain, Land Use and Surface Stations for the Burnaby and Westridge Marine Terminals Air Quality Regional Study Area

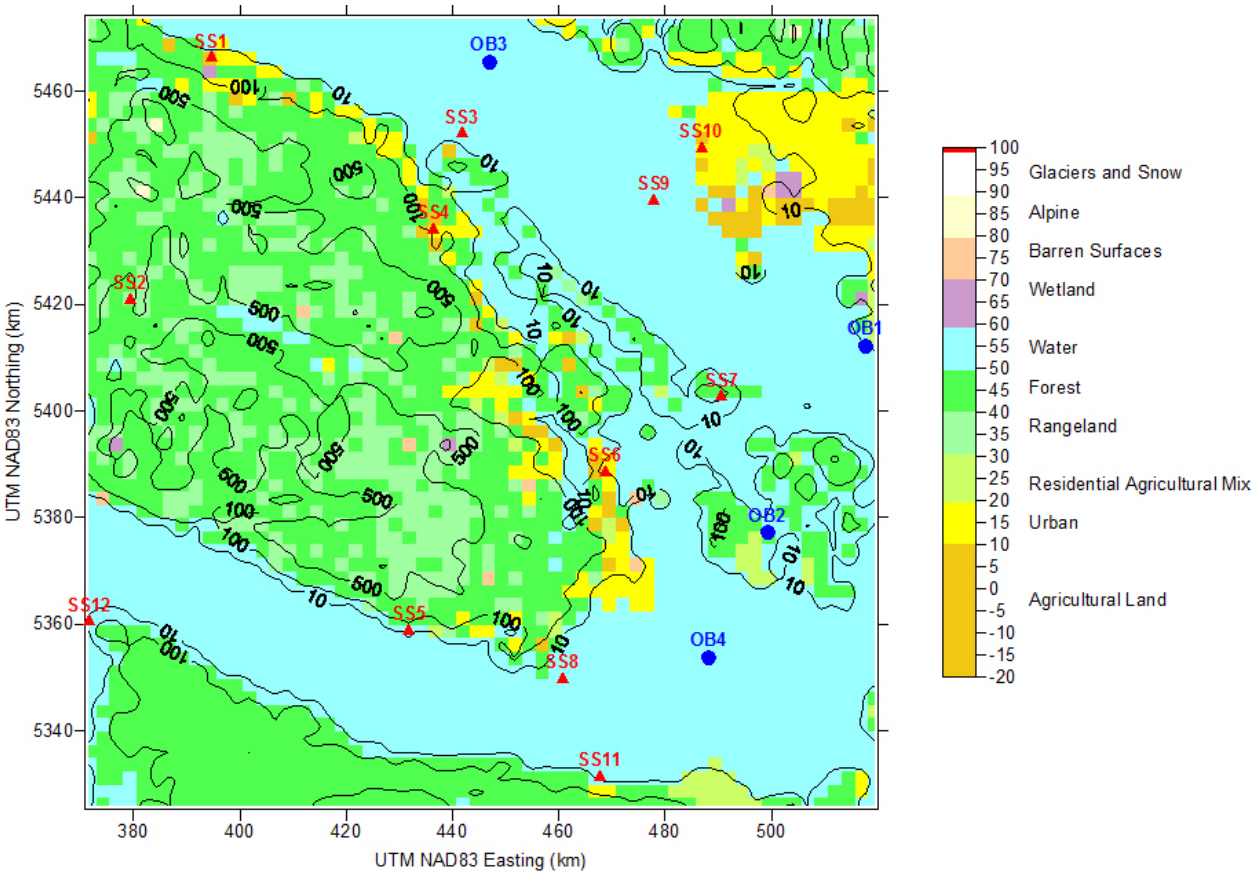


Figure 1.1.6.11A-5 Terrain, Land Use, Surface Stations and Overwater Buoys for the Marine Air Quality Regional Study Area

1.6.12 CALMET - WRF Output

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.
ii) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

Reference (i) and (ii) indicate that Weather Research and Forecasting (WRF) prognostic model output was used as an input in the CALMET meteorological modelling for the Sumas, Burnaby/Westridge and Marine assessments.

Request:

a) Please clarify if WRF output was used in all CALMET modelling.

b) Please identify the organization which created the WRF output used.

c) Please provide the methodology used to execute the WRF model along with key model options and settings used.

Response:

a) Weather Research and Forecasting (WRF) output was used in all CALMET modeling.

b) RWDI AIR Inc. conducted the Weather Research and Forecasting (WRF) modeling and created the output.

c) The Weather Research and Forecasting (WRF) model was run in a nested 12 km, 4 km and 1 km configuration with the inner most 1 km domain covering a 244 km x 180 km area over the Lower Fraser Valley, the Salish Sea, Southern Vancouver Island and Northwestern Washington state. The model was run using 35 vertical layers, with approximately 20 in the lowest 2,000 m above ground level. Boundary and initial conditions were set using North American Regional Reanalysis (NARR) meteorological fields from National Centers for Environmental Protection (NCEP). Geophysical data for the model domains were derived from the United States Geological Survey (USGS) database supplied with the WRF model codes. The WRF model options were set in accordance with US Environmental Protection Agency recommendations for air quality simulations including one-way nesting, use of the Pleim-Xu and ACM2 surface and boundary layer physics modules, and analysis nudging in the parent domain.

1.6.13 CALPUFF - Flagpole Receptor Height

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.
ii) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.
iii) Guidelines for Air Quality Dispersion Modelling in British Columbia, British Columbia Ministry of Environment, Victoria, British Columbia, March 2008, Page 86. (attachment)

Preamble:

The CALPUFF model allows the user to select the receptor height, called flagpole receptors (Reference (iii)). Elevated flagpole receptors can be used to represent elevated locations such as apartment buildings or high-rise buildings.

There are multiple high-rise buildings within the Burnaby Regional Study Area at locations that are near modelled emission sources and/or at locations where pollutants are predicted to be elevated. These locations include:

1) Burnaby North 49°17'18.80"N, 123° 1'19.08"W

2) Simon Fraser University 49°16'49.41"N, 122°55'39.89"W

3) Simon Fraser University 49°16'47.93"N, 122°54'24.04"W

4) Phillips Ave and Halifax St in Burnaby 49°16'5.41"N, 122°56'56.15"W

Request:

a) Please clarify what flagpole height was used in the Sumas and Burnaby models (Reference (i)).

b) Please clarify what flagpole height was used in the marine study area (Reference (ii)).

c) Were elevated receptors used to characterize the predicted ambient air quality concentrations at any high-rise building locations?

d) Would the use of elevated receptors in CALPUFF result in higher predicted concentrations at locations (1), (2), (3), and (4) as defined above?

Response:

a) All receptors in the CALPUFF modelling were set at ground level with a flagpole height of zero.

b) All receptors in the CALPUFF modelling were set at ground level with a flagpole height of zero.

c) Elevated receptors at specific high-rise buildings were not considered.

d) There is potential for predicted concentrations at elevated receptors to be slightly higher than for ground-level receptors at the same location. However, the difference is expected to be small and inconsequential for the assessment of Project effects on air quality given the limitations and uncertainties associated with the dispersion modelling.

1.6.14 CALPUFF - Terminal Fence-line

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

ii) Guidelines for Air Quality Dispersion Modelling in British Columbia, British Columbia Ministry of Environment, Victoria, British Columbia, March 2008. (attachment)

Preamble:

It is recognized that the CALPUFF receptor spacing used in the Burnaby modelling was based on Reference (ii) as outlined on page 66 and 67 of Reference (i). Figure 3.11 on page 65 of Reference (i) shows the locations of receptors used in the CALPUFF modelling. However, due to the small scale of the figure it is not possible to decipher where the Burnaby and Westridge Terminal fence-line, surrounding residents and finely spaced receptors are located.

Request:

a) Please provide a large scale figure that clearly shows the Burnaby Terminal fence line, receptors and residents within 0.5 km of the terminal fence-line.

b) Please provide a large scale figure that clearly shows the Westridge Terminal fence line, receptors and residents within 0.5 km of the terminal fence-line.

Response:

a) The requested figure is presented as Figure 1.6.14.1 (in Metro Vancouver IR No. 1.1.6.14a – Attachment 1). The air quality receptors are drawn over an aerial image of Burnaby Terminal. Residences are shown on the aerial image. A 500 m buffer around the Burnaby Terminal fence line is also included on the image for reference.

b) The requested information is presented in Figure 1.6.14.2 (in Metro Vancouver IR No. 1.1.6.14b – Attachment 1). The air quality receptors are drawn over an aerial image of Westridge Marine Terminal. Residences are shown in the aerial image. A 500 m buffer around the Westridge Marine Terminal fence line is also included on the image for reference.

1.6.15 CALPUFF - Downwash

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P69.

Preamble:

Reference (i) indicates that downwash was incorporated using the Building Profile Input Program Plume Rise Model Enhancement (BPIP PRIME) algorithm.

Request:

a) Please provide a table outlining the dimensions of all buildings and structures considered in the BPIP PRIME algorithm for the Burnaby/Westridge modelling.

b) Please provide a figure showing the locations of all buildings and structures considered in the BPIP PRIME algorithm for the Burnaby/Westridge modelling.

Response:

a) Please refer to the response to GoC EC IR No. 1.104. All building and structure information are included in the appended Building Profile Input Program (BPIP) input files.

b) Please refer to the response to GoC EC IR No. 1.104. A Google Earth file is included with the response.

1.6.16 CALPUFF – Exhaust from Berthed Ships

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 69.
ii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 175.
iii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 200.

Preamble:

Reference (i) indicates that combustion emissions from marine vessels hotelling at berth at the Westridge Marine Terminal were modelled as point sources. However, in Table 4.34 of Reference (ii) and Table 5.18 of Reference (iii) a value of zero has used as the maximum hourly emission rate for CACs for these sources.

Request:

a) Please explain how these sources were included in the modelling if values of zero where assigned as the emission rate.

Response:

a) Some of the values presented in Tables 4.34 and 5.18 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) had issues with rounding. The updated values are provided as Table 1.6.16A-1 and Table 1.6.16A-2.

TABLE 1.6.16A-1

UPDATED EXISTING CASE EMISSIONS

Emission Source	Maximum Hourly Emissions (g/s)						
	TSP	PM_{10}	$PM_{2.5}$	CO	NO_x	SO_2	VOC
Storage Tanks Holding Jet Fuel	0	0	0	0	0	0	4.6
Exhaust from Berthed Ships	0.08	0.07	0.07	0.37	0.09	0.15	0.09
Vapour Combustion Unit	32.7	32.7	32.7	23.1	4.2	0.2	1.1
Fugitive Ship Emissions from Loading	0	0	0	0	0	0	6.0
Total Emissions at KMC Operations	**32.8**	**32.8**	**32.8**	**23.4**	**4.3**	**0.3**	**11.7**

Note: TSP = total suspended particulate; PM = particulate matter; CO = carbon monoxide; NO_x = oxides of nitrogen; SO_2 = sulphur dioxide; VOC = volatile organic compound

TABLE 1.6.16A-2

UPDATED PROJECT CASE EMISSIONS

Emission Source	Maximum Hourly Emissions (g/s)						
	TSP	**PM_{10}**	**$PM_{2.5}$**	**CO**	**NO_x**	**SO_2**	**VOC**
Storage Tanks Holding Jet Fuel	0	0	0	0	0	0	4.6
Exhaust from Berthed Ships	0.23	0.22	0.20	1.10	0.28	0.44	0.28
Storage Tanks Holding Light Crude	0	0	0	0	0	0	0.04
Vapour Combustion Unit	32.7	32.7	32.7	23.1	4.2	0.2	1.7
Vapour Recovery Unit	0	0	0	0	0	0	41.8
Fugitive Ship Emissions from Loading	0	0	0	0	0	0	27.9
Total Emissions at KMC Operations	**32.9**	**32.9**	**32.9**	**24.2**	**4.5**	**0.6**	**76.2**

Note: TSP = total suspended particulate; PM = particulate matter; CO = carbon monoxide; NO_x = oxides of nitrogen; SO_2 = sulphur dioxide; VOC = volatile organic compound

1.6.17 CALPUFF – Annual Averages

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

Preamble:

Reference (i) indicates that scaling factors were applied for estimation of annual averages.

Request:

a) Please provide the scaling factors that were used in Reference (i).

b) Please more information on how these factors were derived and provide justification for their use.

Response:

a) Tables 1.6.17A-1 to 1.6.17A-5 present the scaling factors used to estimate the annual concentrations for existing conditions (i.e. Base Case) for the Burnaby, Westridge, Sumas, Kamloops and Edmonton Terminals.

Tables 1.6.17A-6 to 1.6.17A-9 present the scaling factors used for existing conditions and the Project (i.e. Application Case) for the Burnaby, Westridge, Sumas and Edmonton Terminals. Kamloops Terminal is unchanged from the Base Case.

Scaling factors are provided for sulphur dioxide (SO_2), nitrogen oxides (NO_X), total particulate matter (TPM), particulate matter smaller than 10 µm (PM_{10}), particulate matter smaller than 2.5 µm ($PM_{2.5}$), carbon monoxide (CO), and volatile organic compounds (VOC).

TABLE 1.6.17A-1

ANNUAL SCALING FACTORS FOR BURNABY TERMINAL IN THE BASE CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
B_tanks_CL	Heavy Crude Tanks	1	1	1	1	1	1	0.2
B_tanks_G85	Refined Product Tanks	1	1	1	1	1	1	0.5
B_tanks_PCSR	Light Crude Tanks	1	1	1	1	1	1	0.1

TABLE 1.6.17A-2

ANNUAL SCALING FACTORS FOR WESTRIDGE MARINE TERMINAL IN THE BASE CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
M_aux	Berthed Ship Auxiliary Engine	0.2	0.2	0.2	0.2	0.2	0.2	0.2
M_boil	Berthed Ship Boiler	0.16	0.16	0.16	0.16	0.16	0.16	0.16
M_fug_CL	Heavy Crude Fugitives at Berth	0	0	0	0	0	0	0.1
M_fug_JF	Jet Fuel Fugitives at Berth	0	0	0	0	0	0	0.01
M_fug_PCSR	Light Crude Fugitives at Berth	0	0	0	0	0	0	0.04
VCU_CL	VCU with Heavy Crude	0.13	0.13	0.13	0.13	0.13	0.13	0.1
VCU_JF	VCU with Jet Fuel	0.01	0.01	0.01	0.01	0.01	0.01	0.01
VCU_PCSR	VCU with Light Crude	0.05	0.05	0.05	0.05	0.05	0.05	0.04
WR_tanks	Jet Fuel Tanks	0	0	0	0	0	0	0.01

TABLE 1.6.17A-3

ANNUAL SCALING FACTORS FOR SUMAS TERMINAL IN THE BASE CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
S_tanks_CL	Heavy Crude Tanks	1	1	1	1	1	1	0.4
S_tanks_PCSR	Light Crude Tanks	1	1	1	1	1	1	0.4

TABLE 1.6.17A-4

ANNUAL SCALING FACTORS FOR KAMLOOPS TERMINAL IN THE BASE CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
K_heater	Heaters	1	1	1	1	1	1	1
K_tanks	Light Crude Tanks	1	1	1	1	1	1	0.2

TABLE 1.6.17A-5

ANNUAL SCALING FACTORS FOR EDMONTON TERMINAL IN THE BASE CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
E_tanks_CL	Heavy Crude Tanks	1	1	1	1	1	1	0.4
E_tanks_G85	Refined Product Tanks	1	1	1	1	1	1	0.3
E_tanks_PCSR	Light Crude Tanks	1	1	1	1	1	1	0.3

TABLE 1.6.17A-6

ANNUAL SCALING FACTORS FOR BURNABY TERMINAL IN THE APPLICATION CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
b_tanks_cl_p	Heavy Crude Tanks	1	1	1	1	1	1	0.1888
b_tanks_g85_p	Refined Product Tanks	1	1	1	1	1	1	0.4704
b_tanks_pcsr_p	Light Crude Tanks	1	1	1	1	1	1	0.2072

TABLE 1.6.17A-7

ANNUAL SCALING FACTORS FOR WESTRIDGE MARINE TERMINAL IN THE APPLICATION CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
m_aux_p	Berthed Ship Auxiliary Engine	0.389	0.389	0.389	0.389	0.389	0.389	0.389
m_boil_p	Berthed Ship Boiler	0.375	0.375	0.375	0.375	0.375	0.375	0.375
m_fug_cl	Heavy Crude Fugitives at Berth	0	0	0	0	0	0	0.25
m_fug_jf	Jet Fuel Fugitives at Berth	0	0	0	0	0	0	0.003
m_fug_pcsr	Light Crude Fugitives at Berth	0	0	0	0	0	0	0.047
WR_tanks	Jet Fuel Tanks	0	0	0	0	0	0	0.01
wr_tanks_pcsr_p	Light Crude Tanks	0	0	0	0	0	0	0.643
wr_vcu_cl_p	VCU with Heavy Crude	0.034	0.034	0.034	0.034	0.034	0.034	0.034
wr_vcu_jf_p	VCU with Jet Fuel	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
wr_vcu_pcsr_p	VCU with Light Crude	0.006	0.006	0.006	0.006	0.006	0.006	0.006
wr_vru_cl_p	VRU with Heavy Crude	0	0	0	0	0	0	0.362
wr_vru_jf_p	VRU with Jet Fuel	0	0	0	0	0	0	0.004
wr_vru_pcsr_p	VRU with Light Crude	0	0	0	0	0	0	0.067

TABLE 1.6.17A-8

ANNUAL SCALING FACTORS FOR SUMAS TERMINAL IN THE APPLICATION CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
s_tanks_cl_p	Heavy Crude Tanks	1	1	1	1	1	1	0.09
s_tanks_pcsr_p	Light Crude Tanks	1	1	1	1	1	1	0.416

TABLE 1.6.17A-9

ANNUAL SCALING FACTORS FOR EDMONTON TERMINAL IN THE APPLICATION CASE

Source ID	Emission Source	Annual Scaling Factors						
		SO_2	NOx	TPM	PM_{10}	PM_{25}	CO	VOC
e_tanks_cl_p	Heavy Crude Tanks	1	1	1	1	1	1	0.3624
e_tanks_g85_p	Refined Product Tanks	1	1	1	1	1	1	0.2784
e_tanks_pcsr_p	Light Crude Tanks	1	1	1	1	1	1	0.3024

b) Annual scaling factors were calculated as annual expected emissions divided by maximum hourly emissions used for the modelling. This is the common practice for estimating concentrations for long-term averages. It better reflects actual operations, rather than assuming that the maximum hourly emission rate will be continuous year-round.

1.6.18 Background Values

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.
ii) 2011 Lower Fraser Valley Air Quality Monitoring Report, Metro Vancouver, April 2013. (attachment)

Preamble:

Metro Vancouver operates ten air quality stations located within the Burnaby Regional Study Area (RSA) and six air quality stations within the Burnaby Local Study Area (LSA) as indicated in Reference (ii). These ambient air quality stations have been established to monitor air quality within various neighbourhoods throughout the region as it has been recognized that there is considerable spatial variability of air quality throughout the Burnaby RSA.

In Reference (i) only one of these stations (Burnaby-Kensington Park) has been used to establish background values of PM10, PM2.5, CO, NOx, SO2, and H2S. These background values, using only one station, have been applied to the entire Burnaby RSA.

It has been demonstrated that higher levels of these pollutants have been measured at stations within the RSA. These stations include Burnaby-Capitol Hill, Burnaby North and North Vancouver-Second Narrows (Reference (ii)). These are also locations were Reference (i) indicates maximum predicted concentrations will occur. It would be more appropriate to use representative ambient air quality data from these areas rather than excluding them from the background concentration calculation.

Request:

a) Please provide tabulated and plotted results using a background value that is established using data from multiple air quality stations within the Burnaby RSA.

Response:

a) Trans Mountain met with senior scientists from Environment Canada on November 21, 2012 to review two draft work plans (marine and terrestrial) that were developed by RWDI in response to NEB *Filing Manual* (NEB 2014) requirements for assessments of air emissions and greenhouse gas emissions. Suggestions were provided by Environment Canada to improve upon the plans and these were incorporated into the final version of the work plan. Environment Canada and other regulatory agencies, such as Metro Vancouver and Fraser Valley regional District, that RWDI met with also made recommendations for additional effort with new studies to strengthen the final submissions to the NEB and reduce the number of Information Requests (IRs). These included regional air shed modeling using the Community Multi-Scale Air Quality (CMAQ) model to estimate the formation of photochemical pollutants such as ozone, particulate matter ($PM_{2.5}$) and visibility. Trans Mountain agreed to the additional studies

requested by Environment Canada and others, and the results were incorporated into the Application which was filed with the NEB in December 2013.

It should be noted that RWDI prepared a detailed model plan which outlined the proposed meteorological and air quality information that RWDI was proposing to rely upon to complete the air quality assessments (terrestrial and marine) (refer to Appendix A of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report [RWDI December 2013]). It was agreed in the meeting with Environment Canada on November 21, 2012 that, as Metro Vancouver and the British Columbia Ministry of the Environment (BC MOE) would be approving and signing the detailed model plan, Environment Canada did not want to be involved in that task.

With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC MOE. As such, no additional analysis of the information provided or modeling will be completed in response to this request.

Reference:

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, AB.

1.6.19 Ambient Air Quality – Total Suspended Particulate

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 79.

Preamble:

Background concentrations have been presented in Reference (i).

Request:

a) Please provide more information on how the TSP values in Table 3.30 were established.

b) Please provide more information on the data source of the TSP data.

c) Please provide more information on where were the TSP measurements made and what time period of data was used in the values provided in Table 3.30.

Response:

a) Total suspended particulate (TSP) is not measured by Metro Vancouver ambient air quality monitoring stations, instead, background PM_{10} that was measured at Metro Vancouver stations was used as a surrogate. The surrogate is multiplied by a scaling factor of 1.8 (Lall *et al.* 2004) to represent the background TSP reported in Table 3.30 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013).

Reference:

Lall, R., M. Kendall, K. Ito and G. Thurston. 2004. Estimation of historical annual $PM_{2.5}$ exposures for health effects assessment. Atmospheric Environment 38: 5217-5226.

b) Please note the scaling factor of 1.8 was derived from the work of Lall *et al.* (2004). The authors studied over 100 Metropolitan Statistical Areas in the United States and ratios of $PM_{2.5}/PM_{10}$ of 0.54 and $PM_{2.5}$/total suspended particulate (TSP) of 0.30 were determined. It follows that a TSP/PM_{10} ratio would be equivalent to 1.8.

Reference:

Lall, R., M. Kendall, K. Ito, and G. Thurston. 2004. Estimation of historical annual $PM_{2.5}$ exposures for health effects assessment. Atmospheric Environment 38: 5217-5226.

c) The TSP results were derived from other particulate measurements using the method described in the responses to Metro Vancouver IR No. 1.1.6.19a and 1.1.6.19b.

1.6.20 Background Values – Volatile Organic Compounds

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 78.

ii) 2011 Lower Fraser Valley Air Quality Monitoring Report, Metro Vancouver, April 2013, Page 9. (attachment)

Preamble:

Reference (i) states that the only VOC monitoring in the Burnaby Regional Study Area (RSA) is at the Burnaby-Burmount air quality station. There are in fact four monitoring sites that measure VOCs in the RSA [Reference (ii)]. Routine VOC monitoring was conducted at the Port Moody, Burnaby South, Burnaby-Burmount and Burnaby North stations during the year 2011. Measurements of Benzene were 2.4 times greater at the North Burnaby station compared with the Burnaby-Burmount station. The Port Moody station also measured levels of Benzene that were greater than the Burnaby-Burmount station.

The Reference (i) should be revised to indicate that there are four monitoring sites of BTEX within the Burnaby RSA.

Further, the Reference (i) should be revised to include discussion of the fact that both North Burnaby and Port Moody stations in 2011 have measured higher levels of Benzene compared with the Burnaby-Burmount station.

Request:

a) Please calculate a Benzene background value using all of the data within the Burnaby RSA and add this to the predicted results. Please present this information in tables and figures.

Response:

a) No additional analysis is required. The ambient air quality monitoring station selected to represent background is representative, conservative and suitable for the assessment.

1.6.21 Background Values – Total Reduced Sulphur

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 77 to 79.
ii) 2011 Lower Fraser Valley Air Quality Monitoring Report, Metro Vancouver, April 2013, Page 9. (attachment)

Preamble:

Reference (i) indicates that background H2S concentrations were established using total reduced sulphur (TRS) monitoring data collected from the Burnaby Kensington Park monitoring station for the Burnaby and Westridge Terminal Regional Study Area (RSA). It is not clear which time periods were used to calculate the H2S values presented in Table 3.30. Values of H2S presented in Table 3.30 are different from values calculated by Metro Vancouver.

Using the TRS data available to Metro Vancouver for the years 2009 to 2011, the 98th percentile of hourly TRS for Kensington Park is 0.56 ug/m3 and 98th percentile of the 24-hour average is 0.42 ug/m3.

Reference (i) presents values of 0.0 for the 98th percentile of hourly TRS for Kensington Park and 0.2 ug/m3 for the 98th percentile of the 24-hour average.

Other stations within the RSA that are representative of Burrard Inlet such as Port Moody have higher values of TRS. The 98th percentile of hourly TRS for Port Moody is 2.8 ug/m3 and 98th percentile of the 24-hour average is 2.01 ug/m3.

Request:

a) Please provide more information on the methodology used for the calculation of the 1-hour and 24-hour H2S values presented in Table 3.30.

b) Please provide more information on why there is a discrepancy between the H2S values presented in Table 3.30 and the values calculated by Metro Vancouver presented in the Preamble above.

c) Please calculate a background value using all TRS data available within the Burnaby RSA and add this to the predicted results. Please present this information in tables and figures.

Response:

a) 1-hour total reduced sulphur (TRS) values were downloaded from the British Columbia Ministry of Environment (BC MOE) Envista website in April 2013 (BC MOE 2013). Since no information is available to estimate hydrogen sulphide (H_2S) based on TRS monitoring data, it was conservatively assumed that all TRS was H_2S for the purpose of defining background concentrations. Conversion from ppb to µg/m³ was completed using the ideal gas law, molecular weight of H_2S and the temperature measured at the station

at that time. Hours with no TRS measurements were removed from the data set. The 98th percentile was taken for the remaining measurements. These measurements include those that are below detection limit which is represented by 0 in the downloaded data base.

Reference:

British Columbia Ministry of Environment. 2013. Envista: Station Report.

b) For clarification three years of data is equivalent to 26,280 hours. Total reduced sulfur (TRS) concentrations were reported for 25,672 hours (approximately 98% complete). The 98th percentile was taken from the 25,672 hours of available records.

As reported by Metro Vancouver (2013), average levels are near and/or below detection limit. Below detection limit values are usually represented by 0 in the downloaded sheet; however, they represent valid measurements and should be included when determining the recorded percentile.

Of the downloaded data from British Columbia Ministry of Environment (2013), 25,450 hours record 0 concentration for TRS (i.e., below detection limit) and represents over 99% of the measurements, thus the 98th percentile would be equivalent to 0.

It was noted in the early stage of analysis that the data downloaded from the website was not read in as a number but as text. Calculations in a spreadsheet program may not include these text numbers. It is assumed that Metro Vancouver experienced similar problems and/or either did not include 0 values when determining 98th percentile. No detailed information on their calculation was given to speculate further.

A similar calculation was used to determine concentration for the 24-hour rolling average.

Reference:

British Columbia Ministry of Environment. 2013. Envista: Station Report.

c) Please note, the ambient air quality monitoring station selected to represent background is representative and conservative. No additional analysis is required.

1.6.22 Background Values – Annual Averages

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.
ii) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

The annual background values that have been established for Reference (i) presented in Table 3.30 are based on the median value of data rather than the annual average or mean value. The use of median values results in lower background values compared with the use of annual averages.

In Reference (i) the annual results for the base case (i.e., existing case) for the Burnaby Regional Study Area (RSA) are presented as the sum of the predicted annual average and the median background value (shown in Table 4.43 as Base Case with background). For some pollutants, including SO2 and NO2, the predicted values for "Base Case with background" are lower than what was measured in 2011 by the ambient air quality monitoring stations throughout the Burnaby RSA. This suggests that the annual impact of the project for these pollutants have been under-estimated.

The annual SO2 "Base Case with background" presented in Table 4.43 is 2.8 ug/m3 while in 2011 Port Moody measured an annual average of 3.1 ug/m3, Burnaby- Kensington Park 3.1 ug/m3, North Burnaby 7.6 ug/m3, Burnaby-Capitol Hill 4.5 ug/m3 and North Vancouver-Second Narrows 5.2 ug/m3.

The annual NO2 "Base Case with background" presented in Table 4.43 is 21.4 ug/m3 while in 2011 Port Moody measured an annual average of 24 ug/m3, Burnaby-South 25 ug/m3 and North Vancouver-Second Narrows 25 ug/m3.

The monitoring station at Burnaby-Kensington Park measured annual NO2 averages of 21.0 ug/m3 in 2011, 22 ug/m3 in 2010 and 26.3 ug/m3 in 2009.

Request:

a) Please provide the "Base Case with background" using background value established by calculating the annual mean with monitoring data from all monitoring stations within the Burnaby RSA.

Response:

a) Please note, the ambient air quality monitoring station selected to represent background is representative and conservative. No additional analysis is required.

1.6.23 Results – Frequency of Exceedances

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

Preamble:

Reference (i) shows that both the Base Case and Application Case will result in exceedances of PM2.5, PM10, NO2 and benzene, however there is limited discussion on how often these exceedances are predicted to occur. No plots have been provided in Reference (i) that show the frequency of exceedances of objectives.

Request:

a) For all pollutants and metrics that are predicted to exceed ambient air quality objectives within the Burnaby Regional Study Area please provide isopleth plots that show the frequency of exceedance of each.

Response:

a) Please refer to the responses to Metro Vancouver IR No.1.1.6.02a and 1.1.6.03a for the frequency of exceedance figures for PM_{10} and $PM_{2.5}$, respectively. The frequency of exceedance figures for nitrogen dioxide (NO_2) are provided in Figures 1 and 2 (refer to Metro Vancouver IR No. 1.1.6.23a – Attachment 1 and Metro Vancouver IR No. 1.1.6.23a – Attachment 2).

1.6.24 Results – Clarity of Plots

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Figures 4.52 to 5.16.

Preamble:

Many of the Burnaby plots provided in Reference (i) show the entire Regional Study Area (RSA) yet only show isopleths in small areas contained in the center of each plot which are difficult to see. The way the plots are presented it is difficult to determine the areas that will be impacted. For example, Figure 4.62 shows two areas where NO2 is predicted to exceed the 1-hour objective yet it not possible to determine the extent of these impacts to residents as one cannot visually see where the shore line is and/or where residents are located on the map. The scale of the plot is too small to determine the effects of the project and who will be impacted.

The location of residents are not shown on the plots provided in Reference (i) and it is not possible to determine the number of residents that will be impacted by elevated levels of predicted pollutants as a result of the project.

Request:

a) Please provide larger scale plots for the Burnaby Local Study Area that clearly show the areas that are predicted to exceed the ambient air quality objectives along with resident locations and sensitive receptors such as hospitals, schools, daycares, senior centres, etc.

Response:

a) The requested figures will not be supplied at this time. Additional dispersion modelling for marine transportation effects has been completed and will be filed as a supplemental marine air quality and greenhouse gas report with the NEB on June 16, 2014. Updated dispersion modelling in support of informing engineering design for the tank terminals is in progress and the results will be filed with the NEB as Technical Update No. 1 in Q3 2014.

Summary of New Commitments:

- Trans Mountain will file updated dispersion modelling in support of informing engineering design for the tank terminals with the NEB as Technical Update No. 1 in Q3 2014.

1.6.25 Results – Impact to Residents

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

Preamble:

Reference (i) shows that both the existing case and future case will result in exceedances of PM2.5, PM10, NO2 and benzene and impact large populated areas.

There is no discussion in Reference (i) as to how large an area has been predicted to exceed the ambient air quality objectives and/or how many residents will impacted by these exceedances.

Request:

a) Please provide information on how many residents are contained in the Burnaby Regional Study Area in areas where exceedances are predicted.

Response:

a) The locations and number of sensitive receptors will be provided in the quantitative Human Health Risk Assessment for Westridge Marine Terminal which will be filed with the NEB on June 16, 2014.

1.6.26 Results – Sensitive Receptors

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

Preamble:

Reference (i) presents results that indicate that several pollutants including PM10, PM2.5, NO2 and Benzene are predicted to exceed ambient air quality objectives for both the existing and project case in areas where there are residents. Despite this there is no discussion and/or results presented for sensitive receptors such as hospitals, schools, daycares, senior centres, etc.

Request:

a) Please provide more information that shows all sensitive receptors (e.g., hospitals, schools, daycares, senior centers, etc) within the Burnaby and Westridge Regional Study Area on a map.

b) Please provide the predicted maximum 1-hour, 8-hour, and 24-hour and annual averages for each sensitive receptor where exceedances of the ambient air quality objectives are predicted.

c) Please provide the frequency of exceedance of the 1-hour, 8-hour, 24-hour and annual ambient air quality objectives for each sensitive receptor where exceedances of the ambient air quality objectives are predicted.

Response:

a) The requested information is provided within the detailed Human Health Risk Assessment for Westridge Marine Terminal being filed with the NEB on June 16, 2014.

b) The requested information is provided within the detailed Human Health Risk Assessment for Westridge Marine Terminal being filed with the NEB on June 16, 2014.

c) The requested information is provided within the detailed Human Health Risk Assessment for Westridge Marine Terminal being filed with the NEB on June 16, 2014.

1.6.27 Results - BTEX

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 184.
ii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 205.

Preamble:

In Reference (ii) Benzene has been predicted to have a 1-hour maximum of 41.6 ug/m3 for the Application Case with background. The predicted value of 41.6 ug/m3 exceeds the 1-hour Benzene Alberta Ambient Air Quality Objective of 30 ug/m3. Similarly in Reference (ii) Benzene is shown to exceed the 1-hour Benzene Alberta Ambient Air Quality Objective for the Project at Westridge Terminal without background. However, despite this there is no discussion of these exceedances nor a frequency of exceedance provided.

Request:

a) Please include the Alberta Ambient Air Quality Objectives for BTEX in Reference (i) and (ii).

b) Please provide a comparison of BTEX results to Alberta Ambient Air Quality Objectives which includes a discussion and frequency of exceedance.

Response:

a) Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No.1 in Q3 2014.

b) Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No.1 in Q3 2014.

Summary of New Commitments:

- Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB as part of Technical Update No.1 in Q3 2014.

1.6.28 Results - 1,3-Butadiene

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

Preamble:

Reference (i) includes results for Benzene, Elthylbenzene, Toluene, and Xylenes, however does not include 1,3-Butadiene.

Request:

a) Please provide the rationale why 1,3-Butadiene was not considered in this assessment.

Response:

a) 1,3-Butadiene was not detected in the bulk liquid laboratory analysis or during the flux chamber sampling on the Cold Lake Winter Blend so emissions were neither estimated nor modelled.

1.6.29 CALPUFF – Berthed ships

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 199.

Preamble:

Reference (i) states that "*the maximum hourly scenario considered for the Westridge Marine Terminal is considers three ships berthed at the same time, which is assumed to occur less than 5% of the time*".

Request:

a) Please clarify how berthed ships were modelled for the maximum hourly scenario.

b) Were three berthed ships modelled as point sources emitting for every hour of the year (i.e., 8760 hours) or just 5% of the time (i.e., 438 hours)?

Response:

a) An Aframax tanker was modelled as point sources at each of the three berth locations in the maximum hourly scenario of the Application Case. Please see Section 3.4.3.2 of Technical Report 8B-3 in Volume 8B, Marine Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) for the methodology on modelling berthed ships.

b) The maximum operating scenario used for modelling of maximum hourly ambient concentrations considers three ships at berth at any given time, and therefore, the CALPUFF modelling includes berth emissions for every hour of the model period (i.e. 8,760 hours). As discussed in Section 3.4.3.3 of Technical Report 8B-3 of Volume 8B, Marine Air Quality and Greenhouse Gas Marine Technical Report (RWDI December 2013), the CALSUM post-processing software was used to apply scaling factors in order to estimate annual average concentrations which considers the annual emissions expected from 34 tankers and two crude barges per month. Based on this number of marine vessels, the three berth utilization is expected to occur only 5% of the time.

1.6.30 Cumulative Effects – Other Foreseeable Projects within Regional Study Area

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P219 to 222.

ii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

iii) Coal System Improvement Projects Public Engagement Summary Report, Neptune Terminals, September 2012. http://www.portmetrovancouver.com/docs/default-source/projects-project-review/neptune-terminals_coal-system-improvement-project-engagement-summary-report_january-2013.pdf?sfvrsn=0 (attachment)

iv) Vancouver Terminal Grain Storage Project, Community Engagement, October 1 – 19, 2012, Project Overview, Richardson. http://www.richardson.ca/uploads/ck/files/Richardson%20-%20Vancouver%20TerminalGrain%20Storage%20Project%20-%20Proj.pdf (attachment)

Preamble:

There are several facilities located near (within 10 km) the Westridge Marine Terminal that are proposing to expand and are not captured within any existing ambient air quality monitoring data. These facilities include expansion of Neptune Terminals (Reference (iii)) and Richardson Grain Terminals (Reference (iv)).

Request:

a) How have the expansion of these Neptune and Richardson Terminals (Reference (ii) and (iii)) been considered in Cumulative Effects Assessment of Reference (ii)?

b) What effect will the expansion of these terminals have on TSP, PM10, PM2.5, SO2 and NO2 model results presented in Reference (ii)?

Response:

a) The cumulative effects assessment for air emissions is discussed in Section 8.4 of Volume 5A. All reasonably foreseeable developments in Tables 8A.1-1 to 8A.1-6 in Appendix 8A, including the expansion at Neptune and Richardson Terminals, were considered.

b) Emissions data associated with the expansion of Neptune and Richardson Terminals were not publicly available at the time that the TMEP Application was being prepared, and therefore, these reasonably foreseeable developments could not be included in the dispersion modelling to determine their combined effect on total suspended particulate (TSP), particulate matter (PM) PM10, PM2.5, sulphur dioxide (SO_2) and nitrogen dioxide (NO_2). A qualitative approach was therefore used to evaluate the significance of the Project's contribution to cumulative effects on air quality. It is expected that these reasonably foreseeable developments will be required to meet Metro Vancouver ambient air quality objectives by incorporating best management practices and mitigation

measures. With the benefit of air dispersion over the approximately 8 km separation distance, it is expected that the Project's contribution to a cumulative increase in ambient air concentrations will be within normal variability of existing conditions.

1.6.31 Cumulative Effects – Other Terminals

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

Preamble:

It is understood that the Trans Mountain pipeline is used by many oil and gas companies that may include Chevron, Esso, Shell, and Petro Canada. It is also understood that an increased pipeline capacity will provide easier access to resources for these companies which may led to increased emissions from their facilities.

Request:

a) If the Project is built, how will the capacity of other oil and gas companies that use the pipeline change?

b) What is the process to assess the potential air quality effects of other companies that use the pipeline if their access to resources is increased?

c) How will the cumulative effects of other companies be assessed as a result of the increased pipeline capacity (i.e., the Project)?

Response:

a) This Information Request is not relevant to one or more of the issues identified in the National Energy Board's List of Issues for the Trans Mountain Expansion Project.

b) The Information Request is not relevant to one or more of the issues identified in the National Energy Board's List of Issues for the Trans Mountain Expansion Project.

c) The cumulative effects assessment is limited to reasonably foreseeable developments that are expected to proceed (i.e. the project proponent has publicly disclosed its intention to seek the necessary approvals to proceed). If purchasers of crude from the Trans Mountain pipeline have announced their plans for expansion and there is a spatial and temporal overlap with the Project, the contribution of these reasonably foreseeable developments are included in the cumulative effects assessment in Section 8.4 of Volume 5A. If they have not announced their plans for expansion, they are outside the scope of the Environmental and Socio-economic Assessment.

In addition, the downstream use of products is not relevant to one or more of the issues identified in the National Energy Board's (NEB) List of Issues for the Trans Mountain Expansion Project. Appendix I of Hearing Order OH-001-2014 (NEB 2014) indicates that "The National Energy Board does not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of the oil transported by the pipeline."

Reference:

National Energy Board. 2014. Trans Mountain Pipeline ULC Trans Mountain Expansion Project. File Number OF-Fac-Oil-T260-2013-03-02, Hearing Order OH-001-2014. 2 April 2014.

1.6.32 Post-Construction Monitoring

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P231.
ii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P205.
iii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P229.
iv) 2011 Lower Fraser Valley Air Quality Monitoring Report, Metro Vancouver, April 2013, P76. (attachment)
v) 2011 Lower Fraser Valley Air Quality Monitoring Report, Metro Vancouver, April 2013, P9. (attachment)

Preamble:

Additional Post-Construction Environmental Monitoring has not been proposed in Reference (i) despite predicted exceedances of multiple pollutants in densely populated areas (Reference (ii)).

Despite Reference (ii) indicating that the Project at Westridge Terminal alone will be responsible for 1-hour Benzene levels of 34.3 ug/m3, a value that exceeds the Alberta Ambient Air Quality Objectives, Reference (i) states that Post-construction monitoring is not required.

Reference (iii) states that the Burnaby Terminal currently has continuous ambient stations that report H2S, SO2 and total VOC measurements and further states that Trans Mountain has access to this data in real-time. Collection of VOC samples are collected on a daily schedule by canister every sixth or twelfth day on a national schedule (Reference (iv)). Canisters are then sent to the federal laboratory in Ottawa for analysis. Based on the current VOC measurement technology in Burnaby, real-time measurements are not possible without employing new continuous monitoring technology.

Request:

a) Please provide the rationale for not proposing additional ambient air quality monitoring in Reference (i) and (iii) considering the following:

- NO2 is predicted to exceed at Capitol Hill, however the Capitol Hill monitoring station does not currently monitor nitrogen oxides (Reference (v)).
- PM10 and PM2.5 are predicted to be exceeded at Burnaby Mountain, however PM10 and PM2.5 are not currently monitored at the Burnaby Mountain monitoring station (Reference (v)).
- The maximum predicted 1-hour Benzene and 24-hour PM2.5 and PM10 concentration is located near the Westridge Marine Terminal adjacent to residents, however there is no ambient air quality monitoring station located there nor any other monitoring station that is able to capture this hot spot (Reference (v)).

b) Please explain how the existing monitoring conducted in Burnaby (i.e., a daily VOC sample analyzed for Benzene collected at Burnaby-Burmount) will be used post-construction to assess the 1-hour Benzene levels at Westridge Marine Terminal where residents are in close proximity.

c) Please explain why continuous measurement of VOCs, specifically Benzene, is not proposed despite Reference (ii) indicating that the Application Case alone will results in exceedances of the 1-hour Benzene Alberta Ambient Air Quality Objective of 30 ug/m3.

d) Please provide a Post-Construction Environmental Monitoring Program that addresses predicted exceedances 24-hour PM2.5, 24-hour PM10, 1-hour NO2 and 1-hour Benzene in locations that coincide with residents.

Response:

a) Predicted exceedances of nitrogen dioxide (NO_2), particulate matter $(PM)_{10}$ and $PM_{2.5}$ were associated with existing conditions and have no bearing on the Project. Maximum predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ due to the Project were predicted to be low and well below ambient air quality objectives. Therefore, additional ambient air quality monitoring for these contaminants were not deemed necessary.

An Automated Monitoring System (SAM[1]) unit is installed in the northwest corner of the Burnaby Terminal as shown in NEB IR No. 1.35a – Attachment 1. The SAM unit collects sulphur dioxide (SO_2), hydrogen sulphide (H_2S) and total volatile organic compounds (VOCs), wind speed and wind direction data based on 1-minute averages. Odours will be monitored indirectly, though the monitoring of the above contaminants. A new ambient monitoring station will be installed at the Westridge Marine Terminal in 2015. This new unit will meet the nine requirements of NEB Draft Condition No. 21 – Air Emissions Management Plan for the Westridge Marine Terminal of the NEB's *Letter – Draft Conditions and Regulatory Oversight* (NEB 2014). This Condition requires methods and schedule for ambient monitoring of contaminants of potential concern in air including PM, carbon monoxide, NO_2, SO_2, H_2S and VOCs.

There are no benzene air quality objectives applicable to the Westridge Marine Terminal from Metro Vancouver, BC or Canada with which to compare predicted benzene concentrations. Therefore, additional ambient air quality monitoring for benzene was not proposed. The Alberta Ambient Air Quality Objectives for benzene will be considered in a supplemental filing as per the response to Metro Vancouver IR No. 1.1.6.06a and the need for additional ambient air quality monitoring will be re-assessed at that time.

Reference:

National Energy Board. 2014. Draft Conditions and Regulatory Oversight. Hearing Order OH-001-2014. Trans Mountain Pipeline ULC (Trans Mountain) Application for the Trans Mountain Expansion Project (Project). April 16, 2014.

[1] Système Automatisé de Monitoring

b) Please note, a new ambient monitoring station will be installed at the Westridge Marine Terminal in 2015. This station will meet the requirements of NEB Draft Condition No. 21 of the NEB's *Letter – Draft Conditions and Regulatory Oversight* (NEB 2014) which requires methods and schedule for ambient monitoring of contaminants of potential concern in air including particulate matter, carbon monoxide, nitrogen dioxide, sulphur dioxide, hydrogen sulphide and volatile organic compounds. The NEB draft condition for the new station at the Westridge Marine Terminal requires that the rationale for siting the new station be submitted to the NEB and Trans Mountain will undertake dispersion modeling as an objective means to assist with the siting process.

Reference:

National Energy Board. 2014. Draft Conditions and Regulatory Oversight. Hearing Order OH-001-2014. Trans Mountain Pipeline ULC (Trans Mountain) Application for the Trans Mountain Expansion Project (Project). April 16, 2014.

c) Please refer to the responses to Metro Vancouver IR No.1.1.6.32a and 1.1.6.32b.

d) Please refer to the responses to Metro Vancouver IR No. 1.1.6.32a and 1.1.6.32b.

Summary of New Commitments:

- Trans Mountain is updating dispersion modelling in support of engineering design and the results will be filed with the NEB in Q3 2014. A new ambient monitoring station will be installed at the Westridge Marine Terminal in 2015 to meet the requirements of NEB Draft Condition No. 21 which requires methods and schedule for ambient monitoring of contaminants of potential concern in air including particulate matter, carbon monoxide, nitrogen dioxide, sulphur dioxide, hydrogen sulphide and volatile organic compounds.
- Trans Mountain will install a new ambient monitoring station at the Westridge Marine Terminal in 2015 to meet the requirements of NEB Draft Condition No. 21 which requires methods and schedule for ambient monitoring of contaminants of potential concern in air including particulate matter, carbon monoxide, nitrogen dioxide, sulphur dioxide, hydrogen sulphide and volatile organic compounds.

1.6.33 Existing Air Quality – SO2

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, Page 119.

ii) 2011 Lower Fraser Valley Air Quality Monitoring Report, Metro Vancouver, April 2013, P15. (attachment)

Preamble:

It is not clear why SO2 trends are not shown. The Burnaby Regional Study Area (RSA) contains the highest SO2 concentrations in the region in Reference (i). In 2011, annual averages measured were 7.6 ug/m3 at Burnaby North, 5.2 ug/m3 at North Vancouver-Second Narrows, 4.5 ug/m3 at Burnaby Capitol Hill and 3.1 ug/m3 at Burnaby- Kensington Park as presented in Reference (ii). This differs from the statement made in Reference (i) that "*the 50th percentile generally oscillate from 0 ug/m3 to 3 ug/m3 and do not provide any meaningful information*".

Request:

a) Please provide more information on the annual trends of SO2 in the Burnaby RSA.

Response:

a) Please note, the ambient air quality monitoring station selected to represent background is representative and conservative. No additional analysis is required.

1.6.34 Existing Air Quality – Tables and Figures

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P118 to P128.
ii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P150.

Preamble:

In Reference (i) it is not clear what is being presented in Figures 4.38, 4.39, 4.40, 4.41 and 4.42. It is not clear what the bars represent, which stations and time periods are presented.

Request:

a) Please clarify what the bars represent in Figures 4.38, 4.39, 4.40, 4.41 and 4.42. For example, are they maximums, minimums, percentiles, mean, median, etc?

b) Clarify why the word "area" is included for describing Hope, Chilliwack and Abbotsford in Figures 4.38, 4.39, 4.40, 4.41 and 4.42? Was some type of spatial averaging done for these "areas"? There is only one station in Hope and only one station in Chilliwack. In Abbotsford there was only one station with complete data (T33 – Abbotsford – Mill Lake) in 2011. Please be specific about which station data were used for these figures and the time periods included.

c) Why is a 1hour averaging period shown for Burnaby North and N. Van – Mahon Park shown in Table 4.9?

d) What data completeness criteria were used in the presentation of data shown in Section 4.1.1.6 and 4.1.1.7?

e) In Reference (ii) what do the bars represent in this Figure 4.51? The caption states that these are average observed values, however averaging 1 hour measurements should provide the same value as an annual average.

Response:

a) Each figure represents air quality conditions as the bar charts are showing concentration levels for all averaging periods for which there are ambient air quality criteria. The bars represent the 99th percentile 1-hour (blue bar), 99th percentile 24-hour (red bar), and 50th percentile 1-hour (green bar) concentrations (to represent the annual average). The 99th percentile is selected for short-term averaging periods to consider overall air quality excluding outliers and to avoid squeezing longer averaging periods close to zero, making plots visually difficult to compare.

b) The literature and desktop review was intended to examine conditions along the proposed pipeline corridor, particularly near pump stations. The name of the major town or city near the ambient air quality station is used in Figures 4.38 to 4.42 of Technical

Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) to assist the reader in identifying the approximate location of each station. No spatial averaging was done. All data were taken from the 2011 calendar year, unless otherwise specified in the figure footnotes. Table 1.1.6.34B-1 summarizes the stations used in each area:

TABLE 1.1.6.34B-1

AMBIENT MONITORING STATION USED TO APPROXIMATE AREA OF INTEREST

Area Identified in Figure	Ambient Monitoring Station Used
Hope	Hope Airport
Chilliwack	Chilliwack Airport
Abbotsford	Abbotsford Central (with the exception of Abbotsford Airport for Figure 4.39)

c) There is a labelling typo in this table; the data are correct as presented. All averaging periods in Table 4.9 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) should read “24-hour”, not “1-hour”. There were no exceedances of the 24-hour PM_{10} objective at either station.

d) Data over or equal to 80% complete were shown in Sections 4.1.1.6 and 4.1.1.7 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013).

e) The bars represent the 99th percentile 1-hour (blue bar), 99th percentile 24-hour (red bar), and 50th percentile 1-hour (green bar) concentrations of ozone measured at each station. The word “average” in the caption of Figure 4.51 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) should not be used.

1.6.35 Discrepancies in Ambient Air Quality Data

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P30-31.
ii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P33.
iii) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report, P137.
iv) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.

Preamble:

References (i) and (iii) contain incorrect station references, locations, addresses, pollutants monitored and periods of available data. In Abbotsford during the time period described in Reference (i) and (iii) there have been three separate air quality monitoring stations in Abbotsford described below:

- MV ID: T33, MV Name: Abbotsford – Mill Lake, NAPS ID: 101003. Measurements: CO, NO2, O3, PM10, and SO2 (1998-present) and PM2.5 (2010-present). Lat/Long: 49.0426 -122.3098
- MV ID: T34, MV Name: Abbotsford Airport, NAPS ID: 101004. Measurements: NO2 (2003-2010), O3 (2006-2010), SO2 (2006-2010), PM2.5 (2002-2010), BTEX (2007-2010) Lat/Long: 49.024 -122.343
- MV ID: T45, MV Name: Abbotsford Airport, NAPS ID: 101005. Measurements: CO, NO2, O3, PM10, SO2, and PM2.5 (2012-present). Lat/Long: 49.0215 -122.3265

Figure 3.7 of Reference (ii) shows the incorrect location of several air quality stations.

Request:

a) Please revise the station references, locations, addresses, pollutants monitored and periods of available data made in Reference (i) and (iii) and throughout Reference (iv).

b) Please confirm whether monitoring data was used for the applicable three Abbotsford monitoring stations during the time period described. If not, would this change the results presented in Reference (iv) and/or the background values used or presented in Reference (iv)?

c) Please correct the locations of the ambient air quality monitoring stations shown in Figure 3.7 of Reference (ii).

Response:

a) Abbotsford Airport Metro Vancouver (MV) station T34: criteria air contaminant (CAC) data were taken from MV station T34. The information for this station in Table 3.4 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report

(RWDI December 2013) is consistent with the BC Ministry of Environment Envista website. (The station was relocated and renumbered to be T45 in 2012, but this is after the period considered in the report.) The coordinates in Table 3.4 are consistent with those provided in the Preamble of this IR, however, the period of data for nitrogen dioxide (NO_2), ozone (O_3) and sulphur dioxide (SO_2) in the report table is incorrect, and should be the same as provided above; i.e. NO_2 (2003-2010), O_3 (2006-2010), and SO_2 (2006-2010).

Abbotsford Airport National Air Pollution Surveillance (NAPS) station 101004: The BTEX data considered in the report were from NAPS station 101004. The station information in Table 3.4 of Technical Report 5C-4 in Volume 5C is consistent with the data downloaded from the NAPS station.

Abbotsford Central MV station T33: Additional CAC data were considered from MV station T33. There was a typing error in Table 3.4 of Technical Report 5C-4 in Volume 5C. The table should say “T33” instead of “T45”. The data in the report table is consistent with the information provided for station T33 in the preamble of this IR.

b) The correct monitoring data was used in the assessment. The Application included monitoring data from the three applicable monitoring stations: the Abbotsford Airport MV (Metro Vancouver) and NAPS (National Air Pollution Surveillance) stations, and the Abbotsford Central MV station. Data from January 2002 to December 2011 were reviewed, where available.

Background concentrations for all criteria air contaminants (CACs), with the exception of particulate matter $(PM)_{2.5}$ were developed based on the Abbotsford Central data. Background nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and $PM_{2.5}$ concentrations were developed based on the Abbotsford Airport MV station data. Background BTEX concentrations were developed based on the Abbotsford Airport NAPS station data.

Consequently, there is no change in the background values for the Abbotsford area, presented in Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013).

c) The NAPS station in Figure 3.7 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) was originally shown at location Lat/Long: 49.0**23**5, -122.35306. It should have been presented at location Lat/Long: 49.0**32**5, -122.35306.

Please see the corrected Abbotsford ambient monitoring station locations shown on a map in the response to Living Oceans IR No. 1.20a.

1.6.36 Background - Marine

Reference:

i) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise, P57-58.
ii) 2011 Lower Fraser Valley Air Quality Monitoring Report, Metro Vancouver, April 2013. (attachment)

Preamble:

Reference (i) provides some explanation how background values were determined for three different areas: Burrard Inlet, Victoria Area and Regional Background. It is not clear where these areas are defined and/or which background values have been assigned to what areas. It is also not clear if data from Cheeka Peak or Kensington Park have been used to represent Vancouver, Richmond and/or North Vancouver.

Vancouver, Richmond and North Vancouver have measured some of the highest levels of nitrogen oxides and carbon monoxide in the region (Reference (ii)). Measurements of nitrogen oxides and carbon monoxide from Vancouver, Richmond and North Vancouver are much higher than measurements taken from Cheeka Peak or Kensington Park. It is not appropriate to use a background value calculated from either the Cheeka Peak or Kensington Park station to represent a background value for Vancouver, Richmond and North Vancouver.

Request:

a) Please provide a plot that clearly shows the areas where each background value has been applied in Reference (i), i.e., Burrard Inlet, Victoria Area and Regional Background.

b) Please calculate CAC background values for Vancouver using ambient data from the Vancouver-Downtown and Kitsilano stations and add them to the predicted results for Vancouver presented in tables and figures.

c) Please calculate CAC background values for Richmond using ambient data from the Richmond-Airport and Richmond South stations and add them to the predicted results for Richmond presented in tables and figures.

d) Please calculate CAC background values for North Vancouver (City and District) using ambient data from the North Vancouver –Second Narrows and North Vancouver-Mahon Park and add them to the predicted results for North Vancouver presented in tables and figures.

Response:

a) The information requested is provided on Figure 1.1.6.36a-1 (refer to Metro Vancouver IR No. 1.1.6.36a – Attachment 1).

b) All isopleth figures in Technical Report 8B-3 of Volume 8B, Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report (RWDI December 2013) do

not include ambient background, as noted in the figure titles. All maximum predicted concentrations over land shown in Table 4.9 and Table 5.3 of Technical Report 8B-3 of Volume 8B are located in the Burnaby area near the Westridge Marine Terminal where background concentrations from Kensington Park were appropriately applied. Ambient background concentrations will not be added to the over water receptors.

c) Please refer to the response to Metro Vancouver IR No. 1.1.6.36b.

d) Please refer to the response to Metro Vancouver IR No. 1.1.6.36b.

1.6.37 CALPUFF - Barges

Reference:

i) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

In Reference (i) barges were not included in the modelling nor are they represented in the background values.

Request:

a) Please provide the rationale for not including barges in the modelling.

Response:

a) The reasonable maximum operating scenario represented in the modelling of the short-term (i.e. one-hour to 24-hour) averaging periods consists of Aframax tankers only because Aframax tankers result in the highest combustion emissions, and the highest 24-hour average concentrations as a result of the longer berth times. Furthermore, the Project effects assessment is focussed on Aframax vessels as this represents the vessel category that will be increasing as a result of the Project.

The annual averaging period considers the full mix of Aframax tankers, Panamax tankers and crude barges expected to call at the Westridge Marine Terminal.

Only jet fuel barges were not included in the modelling. Jet fuel barges are not part of the Project but represent other vessels also calling at the Westridge Marine Terminal. Jet fuel barges travel along a different shipping route from Cherry Point, Washington, and are not expected to spatially overlap with the shipping routes of crude product outside of Burrard Inlet. Furthermore, emissions from jet fuel barges are expected to account for less than one percent of total emissions from crude vessels.

1.6.38 CALPUFF – Anchored Vessels

Reference:

i) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

In Reference (i) it is not clear if anchored vessels were included in the modelling and how they were modelled.

Request:

a) If anchored vessels were included in the modelling, please explain how they were included in the modelling.

b) If anchored vessels were not included in the modelling, please provide the justification for not including them.

Response:

a) Emissions from anchored marine vessels associated with Trans Mountain were included in the modelling. Similar to vessels at berth, combustion emissions while at anchorage were modelled as point sources, with source parameters as outlined in Table 3.13 of Technical Report 8B-3 of Volume 8B, Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report (RWDI December 2013). Fugitive emissions were modelled as area sources representing vessel cargo holds while at anchor, with a release height of 17 m and an initial sigma-z of 10 m. For both existing conditions and with Project (Application Case), the maximum operating scenario modelled included three vessels at anchorage, one at each of the anchorage locations indicated to be used by Trans Mountain.

b) Anchored vessels were included in the modelling for the Project. Please refer to the response to Metro Vancouver IR No.1.1.6.38a.

1.6.39 CALPUFF – Tug Boats

Reference:

i) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

In Reference (i) it is not clear if tug boats were included in the modelling and how they were modelled.

Request:

a) If tug boats were included in the modelling, please explain how they were included in the modelling.

b) If tug boats were not included in the modelling, please provide the justification for not including them.

Response:

a) Escort tugs were included in the modelling along with the accompanied tankers. As discussed in Section 3.4.3.2 of Technical Report 8B-3 of Volume 8B, Marine Air Quality and Greenhouse Gas Marine Technical Report (RWDI December 2013), marine vessels in transit along the shipping lanes were modelled as a series of adjacent area sources. Source parameters for combustion emissions were selected to represent a typical exhaust stack from an Aframax vessel, with a release height of 37 m and an initial sigma-z of 10 m. This includes combustion emissions from both tankers and escort tugs in transit.

An updated assessment of tug boats and other marine vessels will be filed with the NEB as a supplemental marine air quality and greenhouse gas report for marine transportation on June 16, 2014.

b) Tug boats were included in the modelling for the Project. Please refer to the response to Metro Vancouver IR No.1.1.6.39a.

Summary of New Commitments:

- Trans Mountain will file a supplemental marine air quality and greenhouse gas report for marine transportation with the NEB on June 16, 2014.

1.6.40 Results – 8-Hour, 24-Hour and Annual Averages

Reference:

i) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

In Reference (i) it is not clear how averaging periods greater than 1-hour were calculated.

Request:

a) Please provide more detail on how 8-hour, 24-hour and annual averages were calculated. Which scaling factors were used and why?

b) How were multiple ships, barges and tugs considered within an 8 hour, 24 hour or annual time period?

Response:

a) Tables 1.1.6.40A-1 and 1.1.6.40A-2 below show the CALSUM scaling factors used in the marine dispersion modelling for Existing Conditions and the Application Case, respectively.

Eight-hour and 24-hour scaling factors for combustion emissions at berth and emissions at anchorage were calculated based on the total time-in-mode. For example, anchorage duration was assumed to be 20 hours as shown in Table 3.7 of Technical Report 8B-3 of Volume 8B, Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report (RWDI December 2013). Therefore, the 24-hour scaling factor for emissions at anchorage was 20/24 = 0.833.

Eight-hour and 24-hour scaling factors for fugitive emissions at berth were calculated based on the expected vessel loading time. Existing conditions at the Westridge Marine Terminal allows product loading at 3 million litres per hour which translates to approximately 29 hours to fill an Aframax vessel (i.e., 24-hour scaling factor of 1.0). With the Project, the maximum product loading rate is expected to be approximately 4.6 million litres per hour (700 kbbl/d) while the average product loading rate is expected to be 4.2 million litres per hour (630 kbbl/d) which translates to approximately 21 hours to fill an Aframax vessel. Since modelling was conducted using the maximum product loading rate, the 24-hour scaling factor was calculated as (630/700) * (21/24) = 0.79.

Eight-hour and 24-hour scaling factors for emissions in transit were calculated based on the expected number of vessels within each averaging period. Existing conditions consists of five tankers, two crude barges and one jet fuel barge per month, which translates to one vessel every few days on average. With the Project, there will be 34 tankers, two crude barges and one jet fuel barge per month, which translates to one to two vessels per day on average. Emissions in transit were modelled based on one inbound and one outbound Aframax vessel travelling at any location along the shipping

routes at any time. Over 24-hours, this equates to 24 inbound and 24 outbound Aframax vessels at any location. Therefore, to consider only one Aframax vessel per day for Existing Conditions and only two Aframax vessels per day for the Application Case, the 24-hour scaling factors were calculated as 1/24 = 0.042 for Existing Conditions and as 2/24 = 0.083 for Application Case.

Annual scaling factors were calculated as annual expected emissions divided by maximum hourly emissions used for the modelling.

TABLE 1.1.6.40A-1

CALSUM SCALING FACTORS – EXISTING CONDITIONS

Source	CALSUM Scaling Factor			
	1-Hour	8-Hour	24-Hour	Annual
Emissions at berth - auxiliary engine	1.000	1.000	1.000	0.200
Emissions at berth - boiler	1.000	1.000	1.000	0.160
Emissions at berth - fugitive	1.000	1.000	1.000	0.146
Emissions at anchorage - auxiliary engine	1.000	1.000	0.833	0.044
Emissions at anchorage - boiler	1.000	1.000	0.833	0.074
Emissions at anchorage - fugitive	1.000	1.000	0.833	0.047
Emissions in transit - combustion	1.000	0.125	0.042	0.008
Emissions in transit - fugitive	1.000	0.125	0.042	0.005
Corbett	1.000	1.000	1.000	1.000

TABLE 1.1.6.40A-2

CALSUM SCALING FACTORS – APPLICATION CASE

Source	CALSUM Scaling Factor			
	1-Hour	8-Hour	24-Hour	Annual
Emissions at berth - auxiliary engine	1.000	1.000	1.000	0.389
Emissions at berth - boiler	1.000	1.000	1.000	0.375
Emissions at berth - fugitive	1.000	1.000	0.790	0.303
Emissions at anchorage - auxiliary engine	1.000	1.000	0.833	0.319
Emissions at anchorage - boiler	1.000	1.000	0.833	0.314
Emissions at anchorage - fugitive	1.000	1.000	0.833	0.470
Emissions in transit - combustion (segments 1 to 6)	1.000	0.250	0.083	0.047
Emissions in transit - combustion (segment 7)	1.000	0.250	0.083	0.057
Emissions in transit - fugitive (segments 1 to 6)	1.000	0.250	0.083	0.047
Emissions in transit - fugitive (segment 7)	1.000	0.250	0.083	0.053
Corbett	1.000	1.000	1.000	1.000

b) Please refer to the response to Metro Vancouver IR No. 1.1.6.40a.

1.6.41 CALPUFF – Transiting Ships

Reference:

i) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise, P49.

Preamble:

It is not clear how transiting ships were modelled as described in Reference (i). It is not clear if one or two ships were considered modelled in the sentence "*A realistic worst-case scenario based on existing marine vessel traffic was therefore developed based on one Aframax vessel travelling in and out along the shipping routes shown in Figure 3.1.*"

Request:

a) Please provide further information on how transiting ships were modelled and clarify if one ship or two ships were modelled at the same location during the same hour.

b) Please explain if it is possible for two opposing ships to pass through the first narrows and/or second narrows of Burrard Inlet during a one hour period.

c) Please clarify if two ships were modelled together as though they passed through the first narrows and/or second narrows of Burrard Inlet during the same hour.

Response:

a) As explained in the response to Metro Vancouver IR No. 1.1.6.40a, the maximum operating scenario was modelled as one inbound and one outbound Aframax vessel travelling at any location along the shipping lanes at any given time. In some segments of travel, the inbound and outbound shipping lanes are the same, and therefore, modelling would have included two vessels at the same location during the same hour. In other segments of travel, the inbound and outbound shipping routes were not co-located, and therefore, modelling would have included one vessel at the inbound location and one vessel at the outbound location during the same hour.

b) Port Metro Vancouver governs the passage of ships through the First Narrows and Second Narrows of Burrard Inlet. As stated in Section 1.4.3 of Volume 8A, only one vessel at a time is allowed in the Second Narrows Movement Restriction Area and First Narrows.

c) As explained in the response to Metro Vancouver IR No.1.1.6.41a, modelling consisted of one inbound and one outbound Aframax vessel at any location at any time. This would equate to two ships passing through the First Narrows and Second Narrows of the Burrard Inlet, in opposing directions, during the same hour.

1.6.42 CALPUFF – Emissions Sources

Reference:

i) Volume 5C, Biophysical Technical Reports, TR 5C-4 - Air Quality and Greenhouse Gas Technical Report.
ii) Volume 8B Marine Environmental and Social-Economic Technical Reports - Marine Resources, Birds, AQ and GHG, Noise.

Preamble:

Based on the information provided in Reference (i) and (ii), it is difficult to understand which emissions sources were included in the modelling, how they were modelled and what locations they were assigned in the modelling.

Request:

a) Please provide a figure showing all of the point, area, and volume sources modelled in Burrard Inlet in Reference (i) and (ii).

Response:

a) The information requested is presented on Figure 1.1.6.42 (see Metro Vancouver IR No. 1.1.6.42a - Attachment 1).

1.6.43 Current Visual Air Quality Descriptions for the Lower Fraser Valley

Reference:

Volume 5C, Air Quality and Greenhouse Gas Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project

i) PDF page 109 of 567
ii) PDF page 182 of 567
iii) PDF page 183 of 567
iv) PDF page 185 of 567
v) PDF page 186 of 567
vi) The Impact of Visual Air Quality on Tourism Revenues in Greater Vancouver and the Lower Fraser Valley, McNeill, R. and Roberge, A., July 2000 (attachment)
vii) Mountains that See, and that Need to Be Seen: Aboriginal Perspectives on Degraded Visibility Associated with Air Pollution in the BC Lower Mainland and Fraser Valley, Carlson, K. T., May 2009 (attachment).

Preamble:

The improvement of visual air quality has been defined as one of three goals in Metro Vancouver's 2011 Integrated Air Quality and Greenhouse Gas Management Plan. Visual air quality refers to the effect of air pollution, rather than the meteorological factors (e.g. fog, precipitation, low cloud), on the ability to see views.

Visual air quality is also being actively studied by the BC Visibility Coordinating Committee (BCVCC) in a pilot project centered on the Lower Fraser valley. This work has included assessments of the economic benefits [e.g. see Reference (vi)] as well as social and cultural effects of visual air quality impairment [e.g. see Reference (vii)]. Reference (i) provides the context in which visibility is being included in the assessment.

Reference (ii) provides a summary of historical visibility conditions based on observations from Abbotsford Airport.

Reference (iii) provides a summary of historical visibility conditions based on observations from Vancouver International Airport.

Reference (iv) categorizes the historical visibility observations from Abbotsford Airport.

Reference (v) categorizes the historical visibility observations from Vancouver International Airport.

Visibility measurements used at airports are designed to measure visibility primarily for navigational purposes (fog, thick smoke etc.) and have upper limits in the 15-24 km range, depending on the method, as stated on the Environment Canada climate archive website:

"*Due to different observation standards, the maximum visibility that can be recorded by manned stations is 15 statute miles, while the maximum for AWOS stations is 9 statute miles. A value*

of 15 (for manned stations) or 9 (for AWOS stations) may mean that the actual visibility value exceeded that amount"

The impacts of smog on the visibility of vistas are noticeable at visual ranges much greater than these upper ranges.

Request:

a) It is stated in Section 4.1.1 that "*visibility is often used as a gauge for air quality*". Please discuss the importance of visual air quality specifically for the Lower Fraser valley, with reference to Metro Vancouver and Fraser Valley Regional District goals for visual air quality as described in the respective agencies' management plans and the work of BC Visibility Coordinating Committee on the Lower Fraser valley pilot project. Particular attention should be given to the social, economic and health impacts of impaired visual air quality.

b) Please justify why visibility measurements from airports were considered satisfactory by the applicant for assessment of visual air quality conditions in the Lower Fraser valley.

c) Please explain why climate normals for 1981 – 2010 were not used.

d) Please explain why visual air quality specific data, based on measurements made by the visual air quality monitoring network, were not discussed.

e) Please provide a characterization of visibility for the Burnaby/Westridge, Sumas, Chilliwack and Hope areas using measured extinction data from Environment Canada's visibility monitoring network. Data is available as shown in the table below and can be provided upon request.

Site	Nephelometer	Aethalometer
Abbotsford Airport (T34)	May 2009 to Apr 2010	Apr 2009 to Apr 2010
Abbotsford Airport (T45)	Jun 2012 to Current	May 2012 to Current
Burnaby South (T18)	Jun 2011 to Current	Apr 2011 to Current
Vancouver International Airport (T31)	Aug 2010 to Current	Feb 2011 to Current
Chilliwack (T12)	Jun 2010 to Current	Jul 2010 to Current

f) Please explain how the effects of meteorological phenomena have been differentiated from visual air quality in using data from Abbotsford and Vancouver International airports.

g) Please describe the lines-of-sight represented by the visibility measurements from Abbotsford Airport and Vancouver International Airport and their relevance to visual air quality in the Lower Fraser Valley.

h) Please discuss the basis for which the distances categorizing visibility (<1 km, 1 – 9 km, and >9 km) were selected. Reference to work developing acceptability criteria for visual

air quality relevant to the Lower Fraser Valley and commentary on the effects of viewscape composition should be included.

Response:

a) Visibility is an important value for the Lower Fraser Valley. Since the formation of the BC Visibility Coordinating Committee in 2006, visibility has been brought to the forefront and the general population holds an interest in potential projects that may further degrade visibility in the region. In recognition of the importance of visual air quality for the Lower Fraser valley, photochemical modelling was conducted using the Community Multiscale Air Quality (CMAQ) modelling system to provide estimates of secondary ozone and particulate matter $(PM)_{2.5}$ formation and their effect on visibility.

A brief summary of the modelling results is presented in Section 5.3.2 of Technical Report 5C-4 of Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013). Technical details are provided in Appendix C of Technical Report 5C-4 of Volume 5C.

Trans Mountain met with senior scientists from Environment Canada on November 21, 2012 to review two draft work plans (marine and terrestrial) that were developed by RWDI in response to NEB *Filing Manual* (NEB 2014) requirements for assessments of air emissions and greenhouse gas emissions. Suggestions were provided by Environment Canada to improve upon the plans and these were incorporated into the final version of the work plan. Environment Canada, Metro Vancouver and other regulatory agencies that RWDI met with also made recommendations for additional effort with new studies to strengthen the final submissions to the NEB and reduce the number of Information Requests (IRs). These included regional air shed modelling using the CMAQ model to estimate the formation of photochemical pollutants such as ozone, $PM_{2.5}$, and visibility. Trans Mountain agreed to the additional studies requested by Environment Canada and others, and the results were incorporated into the Application, which was filed with the NEB in December 2013.

With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. As such, no additional analysis of the information provided or modelling will be completed in response to this request.

Reference:

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, AB.

b) Trans Mountain notes there are two possible interpretations of this request. The first interpretation is that the references cited by Metro Vancouver suggest that visual air quality conditions in the Lower Fraser Valley (LFV) are satisfactory. No professional opinion or assessment of visibility is provided or intended in the cited references above. The second interpretation of the request is that the measurements from the various

airport stations were satisfactory input to the assessment of visibility that was performed using the Community Multi-Scale Air Quality (CMAQ) modelling system. However, these visibility measurements were not incorporated into the modelling. A brief summary of the modelling results is presented in Section 5.3.2 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013). Details are provided in Appendix C of Technical Report 5C-4 in Volume 5C.

For consistency, all modelling used the same set of climate normals for all parameters. As noted, References (ii) and (iii) provide summaries of historical visibility conditions based on observations from Abbotsford Airport and Vancouver International Airport, respectively. The historical visibility measurements shown are monthly visibility observations which coincide with the monthly climate normals from 1971-2000. References (iv) and (v) categorize the historical visibility observations from Abbotsford Airport and Vancouver International Airport, respectively. These measurements were used to provide the context of existing visibility in the LFV.

As noted in the response to Metro Vancouver IR No. 1.1.6.43a, the regional air shed modelling using CMAQ to estimate secondary ozone and particulate matter $(PM)_{2.5}$ formation and their effect on visibility was part of the additional studies requested by Environment Canada and others. Following the discussions and agreement with Environment Canada and Metro Vancouver on the modelling scope, an approach using CMAQ modelling of an episode based on previous modelling conducted by the University of British Columbia for the Lower Fraser Valley was selected. This modelling system is thoroughly documented in the peer-reviewed literature. The modelling was updated to use more current releases of the model components, and to include existing, Project-related and Deltaport emissions as detailed in Appendix C of Technical Report 5C-4 in Volume 5C.

c) For consistency, all Community Multi-Scale Air Quality (CMAQ) modeling used the same set of climate normals. As discussed in the meeting with Environment Canada on November 21, 2012 (refer to the response to GoC EC IR No. 1.068d) consistency of model parameters between BC and Alberta was identified as an important aspect of the additional modeling. Existing climate conditions based on the 1981 to 2010 period were evaluated by RWDI on May 15, 2013 and preliminary climate normals for 1981-2010 became available later (July 2013).

d) Visual air quality readings from the Environment Canada monitoring network are publically available in qualitative form. For consistency, all meteorological parameters were selected for the same period and stations. Therefore, the climate normal stations were determined to be sufficient to characterize historical visibility. The quantitative assessment of both existing conditions and Project effects was completed using the Community Multiscale Air Quality (CMAQ) modelling.

e) For consistency, all meteorological parameters were selected for the same period and stations. With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry

of Environment. As such, no additional analysis of the information provided or modelling will be completed in response to this request.

f) Visibility measurements from airports were used for historical context. The data were not disaggregated for impacts from air quality vs. meteorology. The Community Multiscale Air Quality (CMAQ) modelling is driven by three-dimensional meteorological fields developed using the Weather Research and Forecasting model, as outlined in Appendix C of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013). As such, the effects of meteorological phenomena during the episode investigated were captured in the modelling effort.

g) Airport visibility measurements represented visibility range in any direction from the point of observation. They were provided as a historical context of the existing visual environment, both meteorological and photochemical, of the Lower Fraser Valley. The actual assessment of visibility was based on the change expressed in terms of deciview to light extinction from the baseline as determined through the Community Multiscale Air Quality (CMAQ) photochemical modelling. Airport measurements were not used to determine the baseline from which the change in deciview was determined.

h) The quantitative assessment of visibility changes due to Project emissions was conducted using deciview as the visibility metric. The deciview scale was created to describe the total light extinction capability of all haze species in the ambient air at a given time and location (within the corresponding grid cell only). The change in atmospheric concentration of the secondary pollutant species, whose individual extinction efficiencies contribute to deciview, was calculated using the Community Multi-Scale Air Quality (CMAQ) modelling system to characterize both baseline and Project-related conditions.

1.6.44 CMAQ Modelling of Visibility

Reference:

Volume 5C, Air Quality and Greenhouse Gas Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Appendix C.

i) PDF page 339 of 567
ii) PDF page 354 of 567
iii) PDF page 358 of 567
iv) The Impact of Visual Air Quality on Tourism Revenues in Greater Vancouver and the Lower Fraser Valley, McNeill, R. and Roberge, A., July 2000 (attachment)
v) Mountains that See, and that Need to Be Seen: Aboriginal Perspectives on Degraded Visibility Associated with Air Pollution in the BC Lower Mainland and Fraser Valley, Carlson, K. T., May 2009 (attachment).
vi) Visibility Perception in the Lower Fraser Valley, BC, Gallagher, J. and McKendry, I., 2011 (attachment)

Preamble:

Visual air quality is being actively studied by the inter-agency collaborative the BC Visibility Coordinating Committee (BCVCC) in a pilot project centred on the Lower Fraser valley. This work has included assessments of the economic benefits [e.g. see Reference (iv)] as well as social and cultural effects of visual air quality impairment [e.g. see Reference (v)]. Reference (i) provides the context in which visibility is being included in the assessment.

Reference (i) describes the conditions that were modelled to assess the effect of the proposed project on visibility.

Reference (ii) describes the $PM_{2.5}$ results from the CMAQ modelling.

Reference (iii) describes the visibility results from the CMAQ modelling.

Request:

a) Please explain how visual air quality will be adequately represented by the single period used in the CMAQ modelling.

b) Please provide the rationale for how this period was selected for assessing visual air quality and thus how the modelling is representative of the range of visual air quality conditions that can be experienced in the Lower Fraser valley, including periods representing the worst-case scenario.

c) Please discuss why impaired visual air quality is not expected to occur under any other conditions. For impaired visual air quality occurring under other meteorological regimes, please provide analysis of visual air quality impacts under these conditions.

d) Please clarify whether the peak 24-hour $PM_{2.5}$ concentration represents a daily average or a rolling 24-hour average.

e) Please explain why a visual range on 20 km is considered an acceptable desirable visual range. Impacts on visual air quality are known to occur even when the visual range is much greater than this.

f) Please provide a map showing distances from regional centres to key views such as Mount Baker, Mount Cheam, Golden Ears Provincial Park, Cypress Provincial Park, the North Shore mountains, the Lions, and from the North Shore mountains across the Lower Fraser valley.

g) Please compare the natural visual range for western Canada with the visual range arbitrarily chosen as desirable/acceptable in this application.

h) Please discuss the results in terms of visual air quality in terms of acceptability to residents in the Lower Fraser valley. See Reference (vi), and other work conducted by members of the BC Visibility Coordinating Committee and others.

Response:

a) The single episode used in the Community Multi-scale Air Quality (CMAQ) model provides an order of magnitude estimate of the direction and spatial extent of changes to visibility that might result during periods that are conducive to secondary pollutant formation.

Given the complexity of such model efforts the use of a single period is common practice for investigation of secondary photochemical phenomena. Such a practice has been previously used by other agencies within the Lower Fraser Valley to investigate regional secondary pollutant impacts from industrial activities (RWDI 2009). As well, the single episode approach was suggested and agreed to with Environment Canada in a scoping meeting with Trans Mountain dated November 21, 2012.

Reference:

RWDI AIR Inc. 2009. CMAQ Modelling of Possible Solid Waste Management Scenarios. Prepared for Metro Vancouver. Vancouver, BC.

b) The period was selected as the most recent photochemical episode that has been investigated in previous studies within the Lower Fraser Valley. This recent period allows closest comparison with existing emissions inventories used in the modelling and previous investigation provides a context within which to interpret results.

The episode represents a period of notably degraded regional air quality which was the rationale for selection of this period in the original study by Steyn *et al.* (2013). As such, it should be a reasonable estimate of typical 'worst case' conditions and the episode will provide an order of magnitude estimate of the direction and spatial extent of changes to visibility that might result during periods that are conducive to secondary pollutant formation.

Reference:

Steyn, D.G., B. Ainslie, C. Reuten and P.L. Jackson. 2013. A retrospective analysis of ozone formation in the Lower Fraser Valley, British Columbia, Canada. Part I: Dynamical Model Evaluation. Atmosphere-Ocean 51:153-169.

c) Please refer to the response to Metro Vancouver IR No. 1.1.6.44a.

d) The maximum 24-hour particulate matter $(PM)_{2.5}$ concentration represents a daily average.

e) The assessment of changes in visual air quality is based on deciview (dv). A perceptible change in visibility is based on the relative, not absolute, change in deciview. The 20 km/30 dv reference point was arbitrarily selected as a baseline by which to place relative deciview changes in a general context. The relationship between deciview and visual range is given in Figure 6.7 of Appendix C of Technical Report 5C-4 of Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013). As noted in the report, a perceptible change in visual range corresponds to approximately a 10% change in deciview. To interpret predicted changes in deciview relative to another baseline, please see Figure 6.7.

f) The air quality assessment completed for the Trans Mountain Expansion Project (Project) by Trans Mountain's consultants, RWDI AIR Inc., is sufficient to address emissions of air contaminants and greenhouse gases from the Project. The modeling results provided in the technical report are based on a number of conservative assumptions. Accordingly, the information requested is not required or necessary.

Trans Mountain's consultants RWDI AIR Inc. met with senior scientists from Metro Vancouver on November 20, 2012 to review two draft work plans (marine and terrestrial) that were developed by RWDI in response to NEB *Filing Manual* (NEB 2014) requirements for assessments of air emissions and greenhouse gas emissions. Suggestions were provided by Metro Vancouver to improve upon the plans and these were incorporated into the final version of the work plan. Metro Vancouver and other regulatory agencies, such as Environment Canada, that RWDI met with also made recommendations for additional effort with new studies to strengthen the final submissions to the NEB and reduce the number of Information Requests (IRs). These included regional air shed modeling using the Community Multi-Scale Air Quality (CMAQ) model to estimate the formation of photochemical pollutants such as ozone, particulate matter ($PM_{2.5}$) and visibility. Trans Mountain agreed to the additional studies requested by Metro Vancouver and others, and the results were incorporated into the Application which was filed with the NEB in December 2013.

It should be noted that RWDI prepared a detailed model plan which outlined the proposed meteorological and air quality information that RWDI was proposing to rely upon to complete the air quality assessments (terrestrial and marine) (see Appendix B of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report [RWDI December 2013]).

With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. As such, no additional analysis of the information provided or modeling will be completed in response to this request.

Reference:

National Energy Board. 2014. Filing Manual. Inclusive of Release 2014-01 (January 2014). Calgary, AB.

g) The Lower Fraser Valley is not an undisturbed natural setting. An undisturbed natural visual setting is not a representative background against which to assess the perceptibility of project induces changes. Using a public survey, Gallagher and McKendry (2011) established a median acceptable visual air quality rating corresponding to 21 deciview. The maximum predicted localized change of 2.6 deciview over water is approximately 15% of this value, and are therefore, in the range of perceptibility of 10-20% cited by Malm (1994). The maximum increase over land of 3.9 deciview would also be perceptible against the median acceptable visual air quality rating of 21 deciview. However, it is important to note that a deciview for a single grid cell, or even a group of grid cells, is not necessarily sufficient to reduce the visual range for any line of sight that transects that grid cell to the deciview value within that grid cell. Model predictions of deciview are calculated from the light extinction due to species that are present within the volume of the model grid cell. They represent the visual range that would occur if those extinctions persisted over a spatial scale equal to the visual range being suggested. The impact to any line of sight is then the integral of the extinctions along the line of sight.

For example, suppose the visual range in a 4 km grid cell was calculated to be equivalent to 10 km. Light transecting that grid cell will only be attenuated at a rate corresponding to a 10 km range while it is actually in that grid cell. Once it leaves, it will be attenuated at the rate given by the light extinction in the adjacent cell, and so on across the line of sight. When determining impacts one needs to take into account the integral of deciview across all grid cells along the given line of sight. A simple estimate of this would be the average deciview along the line of sight, and regional impacts can be estimated by looking at the spatially averaged change in deciview.

Viewed regionally over the scale of a typical line of sight, the spatially averaged maximum change in deciview for all cases on a regional scale is on the order of 1 and below. As such, the maximum predicted changes are likely imperceptible against the median acceptable range in the Lower Fraser Valley as estimated in Gallagher and McKendry (2011).

Reference:

Gallagher, J and I. McKendry. 2011. Visibility Perception in the Lower Fraser Valley, BC. Vancouver, BC.

Malm, W.C. 1999. Introduction to Visibility. CIRA, Colorado State University.

h) Please refer to the response to Metro Vancouver IR No. 1.1.6.44g.

1.6.45 Assessment of the Results from CMAQ Modelling of Visibility

Reference:

Volume 5C, Air Quality and Greenhouse Gas Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project.

i) PDF page 233 of 567

Preamble:

Reference (i) describes the results of the effects assessment for visual air quality.

Request:

a) Please explain why primary particulate matter has not been included in the discussion about the effects on visibility.

b) Please explain whether the calculated 24-hour average represents a daily or maximum rolling 24-hour average. If a daily average has been calculated, please provide the maximum increase in the rolling 24 hour average $PM_{2.5}$ concentration.

c) Please provide details about the number, duration and locations affected of occurrences of changes in light extinction greater than 1 deciview. Figures showing lines-of-sight should be included.

d) Please identify key scenic vistas for Lower Fraser valley residents and provide details of all impacts affecting these views.

e) Please provide analysis of the diurnal and seasonal variability in impacts on visual air quality.

Response:

a) Primary particulate matter and effects on visibility were included in the Community Multi-scale Air Quality (CMAQ) modelling and the discussion of results.

b) The 24-hour particulate matter (PM) concentration represents a daily average. Given the low magnitude of the predicted increases, a rolling average would not provide a meaningfully different result; therefore, this calculation is not needed.

c) With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. Please refer to the response to Metro Vancouver IR No. 1.1.6.44f.

d) With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. Please refer to the response to Metro Vancouver IR No. 1.1.6.44f.

e) With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. Please refer to the response to Metro Vancouver IR No. 1.1.6.44f.

1.6.46 Impacts of Effects on Visibility from Tank Operations

Reference:

Volume 5A, Environmental and Socio-Economic Assessment for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project.

i) PDF page 483 of 1106
ii) PDF page 485 of 1106
iii) PDF page 486 of 1106
iv) PDF page 488 of 1106

Preamble:

Reference (i) describes the potential effects and mitigation measures of tank installation and operations.

Reference (ii) presents the results of the photochemical modelling for marine traffic and operations at Lower Fraser valley locations.

Reference (iii) summarizes the significance evaluation of potential residual effects of air emissions associated with tank and terminal operations.

Reference (iv) provides a description of the significance evaluation.

Request:

a) Please discuss why volatile organic compounds have not been identified as a source of secondary particulate matter and included in the assessment (Section 7.5.4.1 and Table 7.5.4-1).

b) Please explain why the difference in visibility due to the project was provided rather than the calculated visibility for the current case and case with the emissions of the proposed project.

c) Please discuss the worsening in visibility of 3.9 deciviews due to this proposed project in terms of acceptability among residents for visual air quality in the Lower Fraser valley as described in the work of Pryor, Gallagher and McKendry, etc. The evaluation of significance should take this into account.

d) Please include the evaluation of impacts on visibility (Table 7.5.4-4) in the significance evaluation summary (Table 7.5.4-6) and the discussion section on the Air Emissions Indicator – Formation of Secondary Particulate Matter and Ozone.

Response:

a) As described in Appendix C of Technical Report 5C-4 of Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013), emissions of volatile organic compounds (VOCs) from biogenic and anthropogenic sources were calculated

and included in the Community Multi-scale Air Quality (CMAQ) modelling of secondary particulate matter (PM) and ozone.

b) The central issue is the change in existing conditions due to the Project which is best represented by the increment due to Project-related sources. In addition, the impact of a change in deciview is interpreted in terms of whether it represents a perceptible change from the existing conditions (Malm 1994); therefore, presenting the change in deciview is the most appropriate metric and that predicted change can then be interpreted across a broad spectrum of visual range, as shown in Figure 6.7 of Appendix C of Technical Report 5C-4 of Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013), beyond the specific conditions represented by the model period.

Reference:

Malm, W. C. 1999. Introduction to Visibility. CIRA, Colorado State University.

c) Please refer to the responses to Metro Vancouver IR No. 1.1.6.44g and 1.1.6.47b.

d) As noted in Table 3.1 of Technical Report 5C-4 of Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013), visibility was not identified by MV or agreed to as an air quality indicator for the land-based Project-related facilities nor in the TMEP terrestrial workshop held in Surrey (March 2013) which MV attended. Consequently, no evaluation of significance will be provided.

1.6.47 Impacts of Effects on Visibility from Westridge Marine Terminal Expansion and Operations

Reference:

Volume 5A, Environmental and Socio-Economic Assessment for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project.

i) PDF page 511 of 1106
ii) PDF page 512 of 1106
iii) PDF page 485 of 1106
iv) PDF page 513 of 1106

Preamble:

Reference (i) describes the net ambient concentrations for CAC and VOC associated with emissions from the Westridge Marine Terminal expansion.

Reference (ii) summarizes the significance evaluation and potential residual effects of operations at the Westridge Marine Terminal.

Reference (iii) presents the results of the photochemical modelling for marine traffic and operations at Lower Fraser Valley locations.

Reference (iv) describes the significance evaluation of reduced visibility due to the Westridge Marine Terminal expansion.

Request:

a) Please provide the total ambient concentration of $PM_{2.5}$ with and without the project emissions in Table 7.6.4-2.

b) Please explain why a low magnitude category has been assigned to reduced visibility. This appears to be inconsistent with category assigned in Table 7.5.4-4. In the text it is stated that $PM_{2.5}$ concentrations may approach Canadian Ambient Air Quality Standards and it is well known the impacts to visual air quality may occur at $PM_{2.5}$ concentrations well below current ambient air quality standards.

c) Please provide a reference to the location in the application of the analysis conducted to determine the level of economic impacts due to impaired visual air quality events occurring because of emissions from the proposed project.

Response:

a) Table 7.6.4-2 presents only the net change in particulate matter ($PM_{2.5}$) due to the Project, not total ambient concentration of $PM_{2.5}$ with and without the Project, and summarizes results for regulatory dispersion modelling using CALMET/CALPUFF. The CALPUFF model results are not applicable to Community Multi-scale Air Quality (CMAQ) photochemical study. For example, no annual average of $PM_{2.5}$ is possible from

an episodic study using the CMAQ model. Also, the CALPUFF dispersion model results capture local scale variations in concentration around the Westridge Marine Terminal that is occurring on spatial scales that would not be captured by the 4 km resolution of the CMAQ model. To present the CALPUFF and CMAQ results in the same table would be misleading as they represent different processes occurring over different physical and temporal scales.

b) Particulate matter (PM) and other species influence visibility by increasing the extinction of light and reducing the amount that is able to transit a given air mass. The resulting decrease in visibility to any line of sight is then the integral of the extinctions along that line of sight. As such, a localized increase in PM, or another species affecting visibility, is not necessarily sufficient to perceptibly reduce the visual range for any line of sight it affects. The increase must be manifested over the same spatial scales as the visual range which may be affected. For example, suppose visual range in a localized region of high PM was calculated to be equivalent to 10 km. Light transecting that region will only be attenuated at a rate corresponding to a 10 km range while it is actually in that area. Once it leaves, it will be attenuated at the rate given by the light extinction in the adjacent area, and so on across the line of sight. For actual perceived visibility to be reduced to 10 km, that concentration of PM would have to be present over a spatial scale of at least 10 km.

When determining visibility impacts, one needs to take into account the integral of extinction over all points along the given line of sight. A simple estimate of this would be the average extinction, along the line of sight, and regional impacts can be estimated by looking at the spatially averaged extinction. Although some areas show high PM values that approach Canadian Ambient Air Quality Standards, the spatial extent is limited when compared to the spatial scales that impact visibility. Thus, a rating of low magnitude is justified.

c) With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. Please refer to the response to Metro Vancouver IR No. 1.1.6.44f.

1.6.48 Impacts on Visibility from Marine Sources

Reference:

Volume 8B, Marine Environmental and Socio-Economic Technical Reports – Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion project.

i) PDF page 321 of 548
ii) PDF page 361 of 548
iii) PDF page 362 of 548
iv) PDF page 430 of 548
v) The Impact of Visual Air Quality on Tourism Revenues in Greater Vancouver and the Lower Fraser Valley, McNeill, R. and Roberge, A., July 2000 (attachment)
vi) Mountains that See, and that Need to Be Seen: Aboriginal Perspectives on Degraded Visibility Associated with Air Pollution in the BC Lower Mainland and Fraser Valley, Carlson, K. T., May 2009 (attachment).
vii) Visibility Perception in the Lower Fraser Valley, BC, Gallagher, J. and McKendry, I., 2011 (attachment)

Preamble:

Reference (i) describes the visibility measurements reported in the technical report.

Reference (ii) summarizes the climate normals visibility measurements.

Reference (iii) shows climate normals visibility data from Vancouver International Airport for the period 1971-2000.

Reference (iv) describes the model period used to assess impacts on visual air quality through CMAQ.

Visual air quality is being actively studied by the BC Visibility Coordinating Committee (BCVCC) in a pilot project centered on the Lower Fraser valley. This work has included assessments of the economic benefits [e.g. see Reference (v)] as well as social and cultural effects of visual air quality impairment [e.g. see Reference (vi)].

Request:

a) Please add the most recent climate normals data (1981-2010).

b) Please discuss the appropriateness of using airport visibility measurements to assess visual air quality impacts.

c) Please explain how the effects of meteorological phenomena have been differentiated from impacts of air quality on visibility in the assessment.

d) In survey work conducted for the BC Visibility Coordinating Committee, 38 deciviews (approx. 9 km visual range) would be considered very poor or unacceptable visual air

quality by most people [see Reference (vii)]. Please provide analysis of visibility data in the context of visual air quality impairment criteria informed by perception studies conducted in the Lower Fraser valley and the natural visual range for the region.

e) Please describe the seasonal and diurnal patterns of the visual air quality impacts of marine emissions associated with the project.

f) Please identify the frequency, duration and locations of occurrences of changes in light extinction of more than 1 deciview.

g) No commentary on specific viewscapes, e.g. from Horseshoe Bay to the Sunshine Coast, from Burnaby to the southern Gulf Islands, of Mount Baker from coastal and island locations, has been included. Please describe the lines-of-sight and viewscapes impacted by changes in visual air quality.

h) Please provide information about the applicability of the selected model period to visual air quality, in terms of the likelihood of this period being representative of the full range of visual air quality conditions that may occur in the region, and in particular, a worst-case scenario.

Response:

a) The most recent monthly hours of visibility for Vancouver and Victoria Airports (years 1980 to 2010) are provided in Tables 1.1.6.48A-1 and 1.16.48A-2.

TABLE 1.1.6.48A-1

MONTHLY HOURS OF VISIBILITY, VANCOUVER AIRPORT, 1980-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
< 1 km	29.6	9.2	2.9	0.2	0.2	0.1	0.1	0.2	2.6	16.4	11.8	24.1	97.3
1 to 9 km	99	52.3	33.9	21.6	14.6	12.6	10	11.1	30.1	83.7	71.1	90	529.9
> 9 km	615.4	615.2	707.2	698.2	729.2	707.3	734	732.8	687.3	643.9	637.1	629.9	8137.4

TABLE 1.1.6.48A-2

MONTHLY HOURS OF VISIBILITY, VICTORIA AIRPORT, 1980-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
< 1 km	19.6	7.8	4.3	1	0.9	0.8	0.8	0.8	5.6	20.1	16.5	16	94.1
1 to 9 km	112.2	72.6	42.6	21.9	15.1	12	8.7	13.8	35	86.9	95.8	110.2	626.8
> 9 km	612.2	596.7	697.2	697.1	728	707.2	734.5	729.3	679.4	637	607.8	617.8	8044.1

b) Please refer to the response to Metro Vancouver IR No. 1.1.6.43b.

c) Please refer to the response to Metro Vancouver IR No. 1.1.6.43f.

d) The 9 km visual range included in the climate normals was not used as criteria to evaluate changes in deciview presented in Appendix C of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013). For context of the modelling results in terms of perception studies, please refer to the response to Metro Vancouver IR No. 1.1.6.44g.

e) With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. Please refer to the response to Metro Vancouver IR No. 1.1.6.44f.

f) With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. Please refer to the response to Metro Vancouver IR No. 1.1.6.44f.

g) Discussions on line of sight and viewscapes were not explicitly studied in the visibility assessment; however, a discussion follows to speak to this matter. Model predictions of deciview are calculated from the light extinction due to species that are present within the volume of the model grid cell. They represent the visual range that would occur if those extinctions persisted over a spatial scale equal to the visual range being suggested. The impact to any line of sight is then the integral of the extinctions along the line of sight. As such, a deciview for single grid cell is not necessarily sufficient to reduce the visual range for any line of sight that transects that grid cell to the deciview value within that grid cell. For example, suppose visual range in a 4 km grid cell was calculated to be equivalent to 10 km. Light transecting that grid cell will only be attenuated at a rate corresponding to a 10 km range while it is actually in that grid cell. Once it leaves it will be attenuated at the rate given by the light extinction in the adjacent cell, and so on across the line of sight.

When determining impacts one needs to take into account the integral of deciview across all grid cells along the given line of sight. A simple estimate of this would be the average deciview along the line of sight, and regional impacts can be estimated by looking at the spatially averaged change in deciview. Although some locations show localized values that are higher, over the paths suggested above, Figures 6.8 to 6.10 of Appendix C of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) show that the spatially averaged change in deciview, and therefore, the spatially average impact to visibility over the visual ranges in question is typically less than 1.

h) Please refer to the response to Metro Vancouver IR No. 1.1.6.44b.

1.6.49 Air Quality – Photochemical Modelling

Reference:

Volume 5C, Biophysical Technical Report 5C4, Air Quality and Greenhouse Gas Technical Report

i) Appendix C, Section 3 Meteorological Modelling (WRF&MCIP)

Preamble:

Reference (i) describes the CMAQ modelling.

Request:

a) Please provide hourly MCIP relative humidity, CMAQ modeled NO2 and PM2.5 concentrations timeseries at selected Metro Vancouver monitoring stations and spatial plots in the late afternoon hours (when daytime visibility extinction is often the highest).

b) Changes in visibility are often only examined during daylight hours and only at those locations where relative humidity is below a certain threshold (e.g. 70%). Such a practice will produce smaller visibility degradation results than using output from all hours and all locations. Has any filtering of the data been done for RH here?

c) The CMAQ results show almost no change in ozone concentrations and very little changes to $PM_{2.5}$ concentrations, yet there are significant changes in visibility (up to 3.9 deciviews in Table 6.3 in Appendix B Section 8B). What is driving this almost 15 Mm^{-1} change in extinction? Is it a high relative humidity, large changes in NO_2, large increases in hourly sulphates, or perhaps elemental carbon?

Response:

a) With respect to this IR, it is outside the scope of work that was agreed to in the revised work plan or detailed model plan approved by Metro Vancouver and BC Ministry of Environment. Please refer to the response to Metro Vancouver IR No. 1.1.6.44f.

b) Please note it is not possible to run the Community Multi-scale Air Quality (CMAQ) model without using all of the hours in the meteorological inputs, nor is it computationally tenable to filter 3-dimensional time varying results for particular meteorological conditions during post-processing. No filtering of RH has been performed.

c) Results for extinction and deciview are reported to Community Multi-scale Air Quality (CMAQ) AEROVIS output files as the aggregate for all model species. It is not possible from standard model outputs to quantitatively determine the contribution from individual species. Qualitatively, changes closer to the emission sources will tend to be from emissions of photochemical pre-cursors or fast reactions. For example, formation of nitrogen dioxide (NO_2) from ozone (O_3) titration by nitrogen oxide (NO) emissions is a fast reaction that happens almost immediately. Changes farther away will tend to be from secondary products, such as ozone and aerosols that take longer react.

Figure 1.1.6.49C-1 below shows all locations for which any hour during the episode showed a change greater than 1 deciview (dv) (note that this could be a single hour in the 10 day episode, not the average for the episode) for the Future Case #2 (Deltaport 2030). The locations away from Project sources will be the result of secondary formation. The locations over the Strait of Georgia also correspond to areas that show decreases in peak O_3, suggesting that the change is indeed from pre-cursors, particularly NO_2 from O_3 titration. However, there may also be influence of recirculation of species that have undergone secondary reactions.

Figure 1.1.6.49C-1 Locations Where Visibility Changes Greater than 1 dv Occurred over any Hour for the Future Case #2

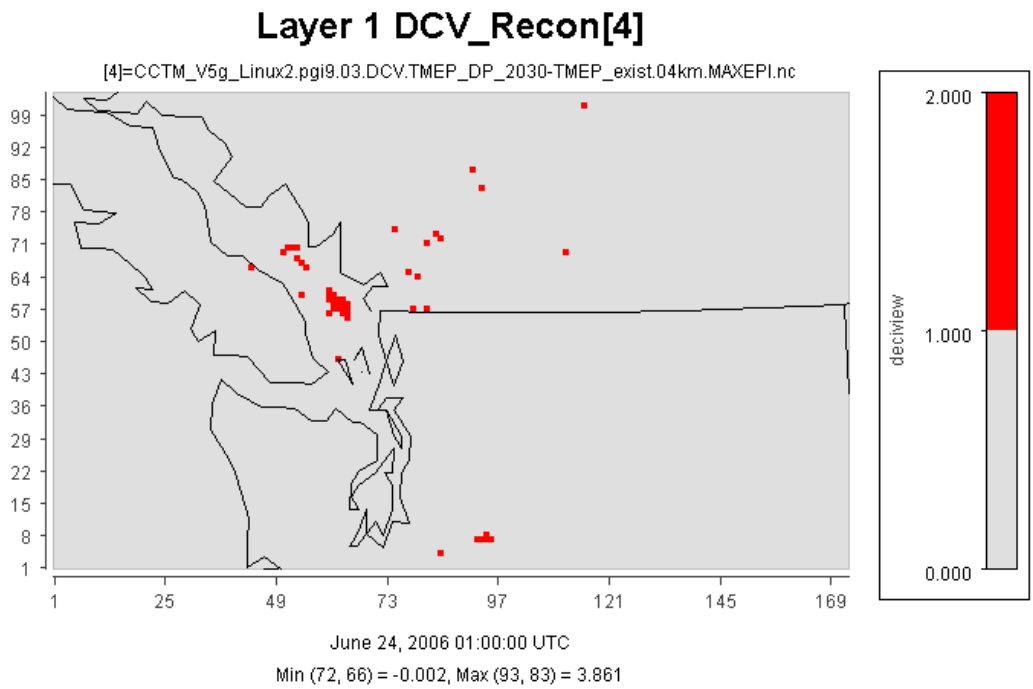
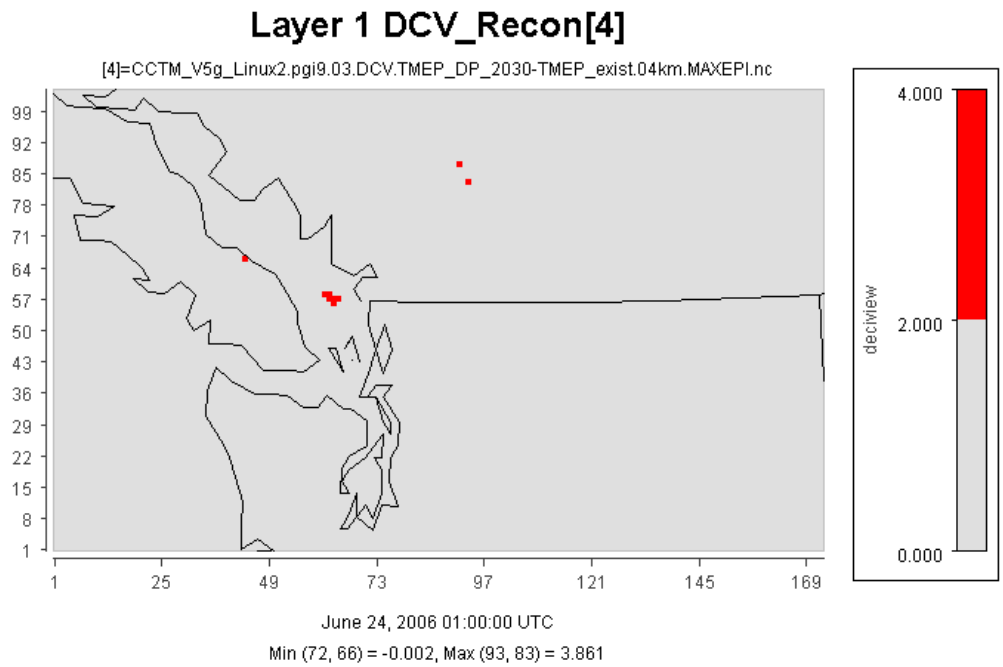


Figure 1.1.6.49C-2 below shows all locations for which any hour during the episode showed a change greater than 2 dv (again, note that this could be a single hour in the 10 day episode, not the average for the episode) for the Future Case #2 (Deltaport 2030). There are less than 10 grid cells showing a maximum hourly change greater than 2 dv with the majority of those in the areas of pre-cursor emissions, suggesting NO_2 increases are driving the change.

Figure 1.1.6.49C-2 Locations Where Visibility Changes Greater than 2 dv Occurred over any Hour for the Future Case #2



In summary, it appears that the areas where changes in visibility between 1 and 2 dv are occurring reflect local emission sources of nitrogen oxides (NO_x), a pre-cursor to photochemical activity and aerosol formation.

1.6.50 Human Health Risk Assessments: Detailed Quantitative Health Risk Assessments (HHRA)

Reference:

i) A3S1S9, Volume 5B, Environmental and Socio-Economic Assessment – Socio-Economic, PDF page 7-291
ii) A3S2L1, Volume 5D, TR 5D-7 Screening Level Human Health Risk Assessment of Pipeline and Facilities Technical Report, PDF pages i, ii, 1-1, 5-15, 6-1
iii) A3S4V6, Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, PDF Page 7-73, 7-185
iv) A3S4X2, Volume 7, TR 7-3 Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report, PDF pages i, 5-2, 6-1
v) A3S4Y3, Volume 8A, Marine Transportation - Effects Assessment and Spill Scenarios, PDF pages 8A–426
vi) A3S4Y9, Volume 8A, Marine Transportation - Effects Assessment and Spill Scenarios, PDF pages 8A–700
vii) A3S4R1, Volume 8B, TR 8B-8 Screening Level Human Health Risk Assessment of Marine Transportation Technical Report, PDF pages i, ii, 1-1, 6-1
viii) A3S4R2, Volume 8B, TR 8B-9 Qualitative Human Health Risk Assessment of Marine Transportation Spills – Marine Transportation Technical Report, PDF pages i, 1-2 to 1-3, 3-1, 5-1

Preamble:

Reference (i) includes statements referring to a "detailed quantitative HHRA":

- *Page 7-291: "A <u>detailed quantitative HHRA</u> will be conducted to expand on the findings and conclusions of the HHRA, with <u>a report discussing the detailed quantitative HHRA</u> to be submitted to the NEB in early 2014."*

Reference (ii) includes statements referring to a "detailed quantitative HHRA":

- Page i: "*A <u>detailed quantitative HHRA</u> will be conducted to expand on the findings and conclusions of the SLHHRA, with a report of the HHRA submitted to the National Energy Board (NEB) in early 2014*."
- Page ii: "*A <u>detailed quantitative HHRA</u> will be conducted to expand on the findings and conclusions of the SLHHRA, with a report discussing the detailed quantitative HHRA to be submitted to the NEB in early 2014*."
- Page 1-1: "*For any elevated health risks identified in the SLHHRA, a <u>detailed quantitative HHR</u>A will be conducted and submitted to the National Energy Board (NEB) in early 2014*."
- Page 5-15: "*The potential health effects of PM2.5 will be evaluated further in the <u>detailed quantitative HHRA</u>, which will expand on the findings and conclusions of the SLHHRA. The detailed quantitative HHRA will be submitted to the NEB in early 2014*."
- Page 6-1: "*A <u>detailed quantitative HHRA</u> will be conducted to expand on the findings and conclusions of the SLHHRA, with <u>a report discussing the detailed quantitative HHRA</u> to be submitted to the NEB in early 2014*."

In reference (ii), it is unclear whether any statements regarding a "detailed quantitative human health risk assessment" apply to both Tank Terminals and Westridge Marine Terminal.

Reference (iii) includes statements referring to a "more focused and detailed…HHRA" and "quantitative ERA and HHRA studies":

- *Page 7-73: "A more focused and detailed ERA and HHRA for the hypothetical Westridge Marine Terminal spill scenario described in Section 8.0 will be completed and submitted to the NEB in early 2014. These quantitative evaluations will verify conclusions provided in Sections 6.0, 7.0, and 8.0 and provide additional information to inform potential mitigation and emergency response actions."*
- Page 7-75: "*Trans Mountain will conduct air quality modeling for specific spill scenarios to predict ground-level hydrocarbon concentrations for the Westridge Marine Terminal spill scenario and support quantitative ERA and HHRA studies to be submitted in early 2014 to verify conclusions and inform potential mitigation and emergency response planning*."
- Page 7-185: "*A more focused and detailed HHRA to inform specific mitigation and ERPs will be completed and submitted to the NEB in early 2014*."

Reference (iv) includes statements referring to a "more focused and detailed human health risk assessment":

- Page i: "*A more focused and detailed human health risk assessment (HHRA) will be completed and submitted to the National Energy Board (NEB) in early 2014*."
- Page 5-2: "*Notwithstanding the above items, the QHHRA revealed that some potential exists for people's health to be affected under the CWC simulated spill scenario. This potential will be explored in a more focused and detailed HHRA. The results of this more detailed assessment will be used to inform emergency response and preparedness and other programs intended to protect public health and safety*."
- Page 6-1: "*A more focused and detailed HHRA will be completed and submitted to the NEB in early 2014*."

Reference (v) includes statements referring to a "comprehensive assessment" and "detailed quantitative HHRA":

- Page 8A-232: *"It does; however, indicate that further assessment is necessary in order to determine the actual extent of the human health risks. The increased detail and complexity of the comprehensive assessment that will be submitted in early 2014 will serve to reduce the uncertainty associated with the more simplistic HHRA, and provide for more realistic and reliable estimates of the potential human health risks."*
- Page 8A-426: *"A detailed quantitative HHRA will be conducted to expand on these findings with a report discussing the detailed HHRA to be submitted to the NEB in early 2014.*

Reference (vi) includes statements referring to a "more focused and detailed HHRA":

- Page 8A-700: "*A more focused and detailed HHRA to inform specific mitigation and emergency response plans will be completed and submitted to the NEB in early 2014*."

Reference (vii) includes statements referring to a "detailed quantitative HHRA":

- Page i: "*A detailed quantitative HHRA will be conducted to expand on the findings and conclusions of the SLHHRA, with a report of the HHRA submitted to the National Energy Board (NEB) in early 2014*."
- Page ii: "*Based on the weight of evidence, it is unlikely that people would experience health effects as a result of the potential increase in Project-related marine vessel traffic. A detailed quantitative HHRA will be conducted to expand on the findings and conclusions of the*

SLHHRA, with a report discussing the detailed quantitative HHRA to be submitted to the NEB in early 2014."

- Page 1-1: "*A detailed quantitative HHRA will be conducted to expand on the findings and conclusions of the SLHHRA, with a report discussing the detailed quantitative HHRA to be submitted to the National Energy Board (NEB) in early 2014.*"
- Page 6-1: "*Based on the weight of evidence, it is unlikely that people would experience health effects as a result of Project-related increases in marine transportation. A detailed quantitative HHRA will be conducted to expand on the findings and conclusions of the SLHHRA, with a report discussing the detailed quantitative HHRA to be submitted to the NEB in early 2014.*"

Reference (viii) includes statements referring to a "detail / detailed quantitative HHRA":

- Page i: "*A detail quantitative HHRA aimed at furthering understanding of the nature, extent and likelihood of occurrence of health effects among people in the area under the credible worst-case simulated oil spill scenario will be completed and submitted to the NEB in early 2014.*"
- Page 1-2 to 1-3: "*The principal objectives of the preliminary QHHRA were: … Help inform the detailed quantitative HHRA to be completed and submitted to the NEB during the early part of 2014.*"
- Page 3-1: "*Accordingly, rather than following a conventional paradigm with an emphasis on quantifying the potential risks involved, the QHHRA examined the prospect for people's health to be affected under the simulated oil spill scenarios from a qualitative perspective, with general discussion of the nature, extent and likelihood of occurrence of health effects as opposed to numerical risk estimates. This approach was consistent with the objective of using the findings from the QHHRA to inform the detailed quantitative HHRA to be completed and submitted to the NEB in early 2014, which will provide greater definition of the potential health risks involved.*"
- Page 5-1: "*Notwithstanding the conservatism involved, the QHHRA provides an indication of the types of health effects that people could experience under the simulated oil spill scenarios that were examined. The nature, extent and likelihood of occurrence of these health effects will be explored in a detailed quantitative HHRA to be completed and submitted to the NEB in early 2014.*"

None of the "detailed quantitative human health risk assessments" described in the references provided above are currently (as of April 25, 2014) available in the NEB online document repository for this project, despite the indications that these reports would be "*submitted to the NEB in early 2014*".

Based on statements in the reports referenced above, the results of the existing screening level human health risk assessments (references (ii) and (vii)) and qualitative human health risk assessments (references (iv) and (viii)) are clearly meant to be preliminary, and must be interpreted together with the "detailed quantitative human health risk assessments" alluded to in the reports. In the absence of these detailed assessments, a fulsome evaluation of the human health risk assessments provided in the 4 referenced reports is not possible.

Request:

Please provide:

a) A report discussing the "detailed quantitative human health risk assessment" for Pipeline and Facilities, as alluded to in references (i) and (ii);
   i) Please include detailed assessment for all Tank Terminals;

ii) Please include detailed assessment for Westridge Marine Terminal.

b) A report discussing the "more focused and detailed human health risk assessment" for Westridge Marine Terminal Spills, as alluded to in references (iii) and (iv);

c) A report discussing the "detailed quantitative human health risk assessment" for Marine Transportation, as alluded to in references (v) and (vii);

d) A report discussing the "detailed quantitative human health risk assessment" for Marine Transportation Spills, as alluded to in references (vi) and (viii);

Response:

a) Trans Mountain provided a screening level human health risk assessment (SLHHRA) aimed at identifying and understanding the potential health risks to people associated with short-term and long-term exposures to the chemicals that could be emitted from the additional tanks to be installed at the Edmonton, Sumas and Burnaby terminals and the Westridge Marine Terminal expansion. The SLHHRA was provided in Technical Report 5D-7 in Volume 5D, Screening Level Human Health Risk Assessment of Pipeline and Facilities (Intrinsik Environmental Sciences Inc. December 2013).

The results of the SLHHRA of the Edmonton, Sumas and Burnaby terminals revealed that the maximum predicted levels of chemical exposure associated with the three tank terminals remained below the health-based guidelines (or exposure limits) developed or recommended by regulatory or reputable scientific authorities for the protection of human health. Given the high level of conservatism incorporated in the SLHHRA, adverse health effects are not expected as a result of the additional tanks to be installed at the Edmonton, Sumas and Burnaby terminals.

The SLHHRA for the expansion of the Westridge Marine Terminal revealed some potential exceedances of the health-based guidelines, suggesting some prospect for adverse health effects. The implications of these exceedances must be balanced against the degree of conservatism incorporated into the assessment. Generally, this requires that the conservative assumptions used in the assessment be reviewed to determine to what extent the predicted health risks may have been overstated. In order to permit fuller understanding of the potential health risks, a detailed human health risk assessment (HHRA) will be completed for the Westridge Marine Terminal and filed with the National Energy Board in mid-2014. The HHRA will be based on a more refined and balanced set of assumptions having a higher likelihood of occurrence, rather than defaulting to the worst-case or near worst-case conditions described in the SLHHRA.

b) Trans Mountain is preparing a detailed human health risk assessment (HHRA) that builds on the information provided in Technical Report 7-3 in Volume 7, Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013). The detailed HHRA technical report on the potential human health effects associated with a set of simulated oil spill scenarios resulting from an incident while loading a tanker at berth at the Westridge Marine Terminal will be filed with the National Energy Board in mid-2014.

c) Trans Mountain provided a screening level human health risk assessment (SLHHRA) aimed at identifying and understanding the potential health risks to people associated with short-term and long-term exposures to the chemicals that could be emitted from the Project-related marine vessels. The SLHHRA was provided in Technical Report 8B-8 in

Volume 8B, Screening Level Human Health Risk Assessment of Marine Transportation Technical Report (Intrinsik Environmental Sciences Inc. December 2013).

The SLHHRA revealed some potential exceedances of the health-based guidelines, suggesting some prospect for adverse health effects. The implications of these exceedances must be balanced against the degree of conservatism incorporated into the assessment. Generally, this requires that the conservative assumptions used in the assessment be reviewed to determine to what extent the predicted health risks may have been overstated. In order to permit fuller understanding of the potential health risks, a detailed human health risk assessment (HHRA) will be completed for Project-related marine vessels and filed with the National Energy Board in mid-2014. The HHRA will be based on a more refined and balanced set of assumptions having a higher likelihood of occurrence, rather than defaulting to the worst-case or near worst-case conditions described in the SLHHRA.

d) Trans Mountain is preparing a detailed human health risk assessment (HHRA) that builds on the information provided in Technical Report 8B9 in Volume 8B, Qualitative Human Health Risk Assessment of Marine Transportation Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013). The detailed HHRA technical report evaluates the potential human health effects associated with a set of simulated oil spill scenarios resulting from the grounding of a laden tanker on Arachne Reef and will be filed with the National Energy Board in mid-2014.

1.6.51 Human Health Risk Assessments: Air Dispersion Modeling for Westridge Terminal Spills and Marine Spills

Reference:

i) A3S4X2, Volume 7, TR 7-3 Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report, PDF pages i, 3-2, 3-19, 3-24, 3-35, B-4

ii) A3S4R2, Volume 8B, TR 8B-9 Qualitative Human Health Risk Assessment of Marine Transportation Spills – Marine Transportation Technical Report, PDF pages i, 1-2, 2-1, 3-2, 3-3, 3-5, 5-1

iii) A3S5I3, Volume 8C, TR 8C-S10 Modeling the Fate And Behaviour Of Marine Oil Spills for the Trans Mountain Expansion Project Summary Report, PDF pages iv, 10, 27

iv) A3S4J7, Volume 8B, TR 8B-3 Marine Air Quality and Greenhouse Gas - Marine Transportation Technical Report, PDF

Preamble:

Reference (i) indicates that the primary human exposure pathway for chemicals of potential concern (COPC) from a spill at the Westridge Terminal would be inhalation. It further describes the use of "a dispersion model" to characterize inhalation exposures, but provides no further information on the model used, or the configuration of the model.

Reference (ii) indicates that the primary human exposure pathway for chemicals of potential concern (COPC) from a marine transportation spill at Arachne Reef in the Turn Point Special Operating Area would be inhalation. It does not provide any reference to a dispersion model, nor any discussion of how inhalation exposure estimates on which the QHHRA conclusions are based were derived.

Reference (iii) describes the details of the modelling of fate and behaviour of marine oil spills at a number of locations using the SPILLCALC model, including Arachne Reef / Turning Point, and Westridge Terminal. It also describes the use of the CALPUFF dispersion model to characterize dispersion of air contaminants away from the Westridge Terminal spill location.

Based on these references, it seems clear that the "dispersion model" referred to in reference (i) was CALPUFF, but the very limited discussion of modelling approach and model configuration in references (i) and (iii) make it impossible to determine exactly how CALPUFF was used, what duration of meteorological data was used, the spacing and spatial extent of the receptor grid used, and number and type of air contaminants modelled.

Also based in these references, it seems clear that no air dispersion modeling whatsoever was performed in support of the QHHRA described in reference (ii). This is particularly concerning, given the assertion in reference (ii) that that inhalation represents the primary human exposure pathway for COPCs for a marine spill. The absence of any exposure modelling, the conclusions presented in reference (ii) have no basis.

Both reference (i) and (ii) refer to "detailed quantitative human health risk assessments" that will be provided to NEB in early 2014, but no further information regarding the scope or approach for these assessments is provided.

Request:

Please provide:

a) A detailed report on the dispersion modelling conducted in support of reference (i), with sufficient detail for an expert familiar with the CALPUFF modelling system to assess the adequacy of the dispersion modelling approach and model configuration. The level of detail provided should be similar to the level of detail provided for the dispersion modelling report for marine traffic emissions (reference (iv)). This report will be important to support the conclusions of reference (i).

b) A detailed report on the approach used for consideration of inhalation exposure in reference (ii). If no exposure assessment was performed, this should be clearly documented.

c) Detailed reports on the dispersion modelling conduced in support of the "detailed quantitative human health risk assessments" for terminal and marine spills referenced in (i) and (ii), with sufficient detail for an expert familiar with the CALPUFF modelling system to assess the adequacy of the dispersion modelling approach and model configuration. The level of detail provided should be similar to the level of detail provided for the dispersion modelling report for marine traffic emissions (reference iv). These reports will be important to support the conclusions of the "detailed quantitative human health risk assessments".

Response:

a) Air dispersion modelling was completed for the selected Arachne Reef spill scenario and the Westridge Terminal spill scenario in early 2014. Technical details regarding the CALPUFF modelling were summarized in '*A3S5I3, Volume 8C, TR 8C-S10 Modeling the Fate And Behaviour Of Marine Oil Spills for the Trans Mountain Expansion Project Summary Report*'.

   Please refer to 'Addendum to Volume 8C, TR 8C-S10 Modeling the Fate And Behaviour Of Marine Oil Spills for the Trans Mountain Expansion Project Summary Report' for a more detailed description of the air dispersion modelling procedures for these two scenarios. This addendum will be filed June 14, 2014.

b) As discussed in the response to Metro Vancouver IR No. 1.6.50d, Trans Mountain is preparing a detailed human health risk assessment (HHRA) that builds on the information provided in qualitative assessment provided in Technical Report 8B-9 in Volume 8B, Qualitative Human Health Risk Assessment of Marine Transportation Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013). The detailed HHRA will be filed with the National Energy Board in mid-2014. This technical report will provide additional information with respect to the inhalation exposures to the chemicals of potential concern that people might experience during the early stages of an oil spill resulting from the hypothetical scenario involving grounding of a laden tanker on Arachne Reef.

c) Please refer to the response to Metro Vancouver IR No. 1.1.6.51a.

1.6.52 Human Health Risk Assessments: Marine Spills Assessment Locations

Reference:

i) A3S4R2, Volume 8B, TR 8B-9 Qualitative Human Health Risk Assessment of Marine Transportation Spills – Marine Transportation Technical Report, PDF pages 3-1, 3-2

Preamble:

Reference (i) provides a QHHRA for a single marine spill scenario occurring at the Arachne Reef in the Turn Point Special Operating Area. Justifications for the selection of this location are "greatest level of navigation complexity" and "very high environmental and socio-economic value". However, the potential for human exposure to oil and its components released in spill (via inhalation or any other relevant exposure pathway) would be considerably lower at this site than parts of the tanker route near large population centres (i.e. Burrard Inlet, Vancouver Harbour, English Bay, Race Rocks / Victoria coastline). As such, the results of the QHHRA are not relevant to significant portions of the tanker route.

Reference (i) refers to a "detailed quantitative human health risk assessment" for marine spills that will be provided to NEB in early 2014, but no further information regarding the scope or approach for these assessments is provided. It is unclear if this assessment will be conducted only for the Arachne Reef spill location, or for a number of locations along the tanker route. "Detailed human health risk assessment" conducted at only the Arachne Reef spill location may not be adequate to characterize potential human health risks to populations in the Greater Vancouver or Greater Victoria areas.

Request:

Please provide:

a) A "detailed quantitative human health risk assessment" for a number of locations along the tanker transportation route. At a minimum, locations should be chosen to characterize "high", "medium" and "low" human exposure scenarios to provide an indication of the potential range of human health impacts that can be expected from marine transportation spills.

Response:

a) Section 4.4 of the Technical Report 8B-7 in Volume 8B, Ecological Risk Assessment of Marine Transportation Spills Technical Report (Stantec Consulting Ltd. December 2013) discusses the selection of representative locations where hypothetical oil spill accidents could occur. These locations were established after joint review by the navigational risk assessment team, the oil spill modelling team, and the environmental and socio-economic risk assessment teams. Nine original locations were reduced to five in a prioritization process which included the experts listed in the previous sentence. The prioritization was based on overlap of socio-economic and environmental resources as well as assessment of navigational challenges, so that the final identification of hypothetical spill locations was risk-informed and took into consideration both spill

probability and potential consequences in terms of ecological, human and socio-economic sensitivities.

Selection of Arachne Reef for detailed 3D modelling and assessment was explained in the report as follows:

> *"Whereas several potential oil spill locations were modeled stochastically, the selection of a deterministic oil spill scenario focused on potential spills at Arachne Reef, in the Gulf Islands. This location is near the main shipping channel, and represents a location of greater than average navigational difficulty. It is also near the boundary between Canadian and U.S. territories, and this location provides proximity to sensitive shoreline and other ecologically sensitive areas associated with the Gulf/San Juan Islands. As indicated by the stochastic spill analysis, a spill at this location also has the potential to affect several distinct areas and habitats, including but not limited to Boundary Pass / Semiahmoo Bay, the Gulf/San Juan Islands, the Strait of Georgia, Juan de Fuca Strait and Puget Sound."*

Human health risk assessment results for the Arachne Reef location are representative of the types of health effects that might be experienced by people exposed to credible worst-case and smaller oil spills along the marine transportation route, and there is no need to conduct further analysis as requested. An updated Human Health Risk Assessment was filed with the NEB on June 16, 2014.

1.6.53 Human Health Risk Assessments: Exposure Pathways for Terminal and Marine Spills

Reference:

i) A3S4X2, Volume 7, TR 7-3 Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report, PDF pages i, 3-4, 3-5
ii) A3S4R2, Volume 8B, TR 8B-9 Qualitative Human Health Risk Assessment of Marine Transportation Spills – Marine Transportation Technical Report, PDF pages i, 3-2, 3-3
iii) A3S5J0, Volume 8C, TR 8C-S13 Oil Spill Response Simulation Study, Arachne Reef and Westridge Marine Terminal, PDF pages iii

Preamble:

References (i) and (ii) detailing the QHHRAs for Westridge Terminal Spills and Marine Transportation Spills both indicated that human health risks are expected to be dominated by acute inhalation exposures, and go so far as to state that "*No other relevant exposure pathways by which people in the area could be exposed to the hydrocarbons were identified*" (reference (i)) and "*no other obvious exposure opportunities were identified*" (reference (ii)).

In both references, it is indicated a portion of the spilled oil is not recovered. Reference (iii) indicates that 13% of the oil spilled at the Westridge Terminal would not be recovered (~21m^3), and 36% of the oil spilled at Arachne Reef would not be recovered (~5940m^3). The volatile portion of this unrecovered oil would presumably evaporate, leading to the inhalation exposures referenced in the QHHRAs. The remainder would disperse into the marine environment or be deposited on shorelines, in both cases creating the potential for human exposure via additional pathways (i.e. dermal contact, ingestion of contaminated seafood). The cursory assessments in references (i) and (ii) do not provide sufficient detail to credibly rule out these additional exposure pathways.

Both reference (i) and (ii) refer to "detailed quantitative human health risk assessments" that will be provided to NEB in early 2014, but no further information regarding the scope or approach for these assessments is provided.

Request:

Please provide:

a) "Detailed quantitative human health risk assessments" for both Westridge Terminal spills and Marine Transportation Spills. These reports should include assessment of exposure pathways other than acute inhalation, or detailed justification and sensitivity analysis justifying the exclusion of these pathways.

Response:

a) As discussed in the responses to Metro Vancouver IR No. 1.6.50c and 1.6.50d, Trans Mountain is preparing a detailed human health risk assessment (HHRA) that builds on the information provided in Technical Report 7-3 in Volume 7, Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013) and Technical Report 8B-9 in Volume 8B, Qualitative Human Health Risk Assessment of Marine Transportation Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013). The detailed HHRA of the potential human health effects associated with a series of simulated oil spill scenarios for an incident while loading a tanker at berth at the Westridge Marine

Terminal and the grounding of a laden tanker on Arachne Reef will be filed with the National Energy Board in mid-2014.

Consistent with the qualitative human health risk assessments (QHHRAs) provided in Technical Report 7-3 and Technical Report 8B-9, the detailed HHRA focuses on the potential health effects that could occur among people found in the area at the time of the spill from inhalation exposure to the hydrocarbon and other chemical vapours released from the surface of the spilled oil, with a specific focus on exposures that could be received on a short-term basis during the early stages of the incident. The choice of this exposure pathway is explained below:

- Opportunity exists for people located downwind of the oil spill to be exposed to chemical vapours released from the surface of the oil slick during the early stages of the incident because some time will elapse between the first reporting of a spill, the arrival of first responders and the implementation of the emergency response measures. Exposure to the vapours would be via inhalation on a short-term basis, with the likelihood and extent of exposure declining as responders arrive on scene and emergency response measures are implemented. It is expected that Trans Mountain, the Western Canada Marine Response Corporation (WCMRC), Coast Guard authorities and other response personnel will first arrive on scene within as little as one hour in the case of the Westridge Marine Terminal spill scenarios and within as little as six hours in the case of the marine transportation spill scenarios.

- Direct physical contact with the spilled oil was considered unlikely. The actions taken by first responders will include securing the area, restricting access, and containing the oil slick. Appropriate regulatory authorities will be immediately notified and the public will be advised to avoid the area. In the event that oiling of the shoreline occurs, beach and shoreline closures will be announced, if conditions warrant. These actions will limit opportunity for the general public to be exposed to the spilled oil through direct physical contact with the chemicals.

- In addition to the implementation of the emergency and spill response measures, if conditions warrant, local, provincial and/or federal authorities can implement controls or issue advisories to protect public health. Examples of such controls include closure of commercial and recreational fisheries, beach closures, forced evacuation of people off shore and/or on shore if public health and safety are potentially impacted, and the issuance of fish, shellfish or other seafood consumption advisories. In this regard, once a spill has occurred, the Fisheries and Oceans Canada (DFO) is notified. DFO along with other regulatory authorities such as Environment Canada and the Canadian Food Inspection Agency (CFIA) will assess the spill and, based on its location, size and the potential opportunities for people to be exposed to the oil through different exposure pathways, will determine the types of added control measures, if any, that may be necessary. These measures will further reduce the potential opportunities for exposure of people to the chemicals released during a spill not only via inhalation, but also through secondary pathways on both a short- and long-term basis.

- As part of the spill response measures, monitoring programs will be initiated to track both the movement of the oil slick itself as well as the presence of any spill related chemical residues in different environmental media, including the water column, air, soils and/or sediment, and extending to fish, shellfish and other possible foodstuffs if necessary to protect public health. The results of the monitoring program(s) will be used, in part, to guide decision making around the need for control measures such

as fisheries closures, beach closures and/or food advisories. These controls will remain in place until the results of the monitoring program(s) indicate that public health and safety is no longer potentially impacted. The implementation of the monitoring programs and introduction of such control measures will serve to reduce the opportunities for exposure of the public to the chemicals, especially any exposures that could be received through secondary pathways on a longer term basis.

- In addition, during the early stages of the oil spill incident, exposure of people might reasonably be expected to be self-limiting owing to the irritant properties of a number of the hydrocarbon components of the spilled oil as well as the odours that would be present. Both of these properties would provide warning of the presence of the chemicals such that individuals might reasonably be expected to take action to remove and/or distance themselves from the source, thereby limiting the amount and duration of any exposure that might be experienced.

1.6.54 Human Health Risk Assessments: Identification of Contaminants of Potential Concern based on Cold Lake Winter Blend (CLWB)

Reference:

i) A3S2L1, Volume 5D, TR 5D-7 Screening Level Human Health Risk Assessment of Pipeline and Facilities Technical Report, PDF pages 3-8, 3-12

i) A3S4X2, Volume 7, TR 7-3 Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report, PDF pages 3-5

iii) A3S4R1, Volume 8B, TR 8B-8 Screening Level Human Health Risk Assessment of Marine Transportation Technical Report, PDF pages 3-6

iv) A3S4R2, Volume 8B, TR 8B-9 Qualitative Human Health Risk Assessment of Marine Transportation Spills – Marine Transportation Technical Report, PDF pages 1-1

Preamble:

References (i), (ii), (iii) and (iv) all rely on the composition of Cold Lake Winter Blend (CLWB) diluted bitumen to develop lists of Contaminants of Potential Concern (COPC) for their respective risk assessments. This is justified in reference (i) and (ii) on the basis that CLWB represents the "crude oil likely to be stored in the largest volumes at the tank terminals" and "product most likely to be transported in the largest volumes". However, it is not the only product likely to be transported, and is not necessarily the product that would be spilled in the event of a terminal or marine spill. No other crude oil or diluted bitumen blends are analyzed or characterized in references (i), (ii), (iii) and (iv), so there is no way of assessing whether CLWB represents the "worst case" for fugitive emissions from tanks, fugitive emissions from oil spills, or dispersion and transport in the marine environment.

References (i), (ii), (iii) and (iv) refer to "detailed quantitative human health risk assessments" that will be provided to NEB in early 2014, but no further information regarding the scope or approach for these assessments is provided.

Request:

Please provide:

a) "Detailed quantitative human health risk assessments" for Tank Terminals and Westridge Terminal emissions, Westridge Terminal spills, Marine Emissions and Transportation Spills. These reports should include assessment contaminants of potential concern (COPC) that may arise from a variety of different product blends that are likely to be transported by the project, in order to characterize the potential range of risks and contextualize the risks associated with CLWB, the product that will be transported in the largest volumes.

Response:

a) As discussed in the previous response, Trans Mountain is preparing detailed human health risk assessments (HHRAs) that build on the information provided in:

- Technical Report 5D-7 in Volume 5D, Screening Level Human Health Risk Assessment of Pipeline and Facilities Technical Report (Intrinsik Environmental Sciences Inc. December 2013);
- Technical Report 7-3 in Volume 7, Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013);
- Technical Report 8B-8 in Volume 8B, Screening Level Human Health Risk Assessment of Marine Transportation Technical Report (Intrinsik Environmental Sciences Inc. December 2013); and
- Technical Report 8B-9 in Volume 8B, Qualitative Human Health Risk Assessment of Marine Transportation Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013).

The detailed HHRA technical reports were filed with the National Energy Board on June 16, 2014.

Consistent with the screening level and qualitative assessments provided in the Application, the detailed HHRA focuses on Cold Lake Winter Blend (CLWB) diluted bitumen (or dilbit) as the representative type of oil to be stored in the tank terminals and spilled. The rationale for the selection of CLWB is:

- Diluted bitumen is expected to comprise a large percentage of the oil transported by the new pipeline (refer to Section 5.1.1.1 in Volume 7).
- CLWB is currently transported by Trans Mountain, and it will continue to represent a large percentage of the total products transported by the new pipeline.
- The diluent in CLWB is liquid condensate that is rich in light-end hydrocarbons that are volatile or semi-volatile in nature. These hydrocarbon components could potentially be released as vapours from the surface of the stored oil or spilled oil, which would then disperse in a downwind direction, possibly reaching humans who could inhale them.
- A sample of CLWB was tested by an accredited third-party laboratory to provide information on its physical and chemical characteristics. A full list of trace elements and organic compounds analyzed in CLWB, including the concentration of individual chemical compounds, is provided in Table 6.2 of Technical Report 7-1 in Volume 7, Qualitative Ecological Risk Assessment of Pipeline Spills Technical Report. Copies of the original laboratory certificates are provided in Appendix A of the report.

- A study characterizing the emissions from the surface of the CLWB in terms of the types and amounts of chemicals present was conducted. The study is provided in Appendix I of Technical Report 8C-12 S7 in Volume 8C, A Study of Fate and Behaviour of Diluted Bitumen Oil on Marine Waters, Dilbit Experiments – Gainford Alberta.

Additional information on the physical and chemical characteristics of CLWB are provided in Appendix I of Technical Report 8C-12 S8 in Volume 8C, A Comparison of the Properties of Diluted Bitumen Crudes with other Oils (POLARIS Applied Sciences Inc. December 2013).

Based on the above, an assessment of potential human health effects associated with other products carried in the pipeline is not being considered.

1.6.55 Human Health Risk Assessments: Pipeline Spills

Reference:

i) A3S4V6, Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, PDF Pages 7-73, 7–89, 7-125, 7-138, 7-156
ii) A3S4X2, Volume 7, TR 7-3 Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report, PDF pages i, 5-2, 6-1
iii) A3S4J7, Volume 8B, TR 8B-3 Marine Air Quality and Greenhouse Gas - Marine Transportation Technical Report, PDF

Preamble:

The potential for human health risks associated with pipeline spills is acknowledged in reference (i), but no human health risk assessment whatsoever has been performed for any of the 4 over-land spill scenarios. Both of the potential spill locations in BC's Lower Mainland (Fraser River near Hope; Fraser River and Delta near Port Mann Bridge) have the potential to impact proximate populations, agricultural lands, ground-water, and human food fisheries.

Due to its proximity to large concentrations of population, the full-bore spill into the Fraser River and Delta near Port Mann Bridge is of particular concern. It was assumed to result in the uncontrolled release of 1,250 m3 of diluted bitumen into the river. The volume is two orders of magnitude larger than the uncontrolled spill volume of 32 m3 assumed for Westridge Terminal Spill Scenario, on which a qualitative human health risk assessment was performed (reference (ii)), and on which a detailed quantitative Human Health Risk Assessment will be delivered in "early 2014". Given that the proximate populations along the Fraser River near the spill area and downstream are of similar size to those surrounding Burrard Inlet, and the uncontrolled spill volume is 40 times larger, it is reasonable to expect that the human health impacts of the hypothetical Fraser River Spill could be larger than the human health impacts of the hypothetical Westridge Terminal spill.

Request:

Please provide:

a) Detailed quantitative human health risk assessments for all of the pipeline spill scenarios detailed in reference (i). Due to the potential for contamination of soil, groundwater, and the ecosystem of at least one river with a major fishery, these assessments should address exposure pathways beyond acute inhalation pathways.

b) A detailed report on the dispersion modeling conduced in support of the "detailed quantitative human health risk assessments" for over-land pipeline spills requested above, with sufficient detail for an expert familiar with the chosen dispersion modeling system to assess the adequacy of the dispersion modeling approach and model configuration. The level of detail provided should be similar to the level of detail provided for the dispersion modeling report for marine traffic emissions (reference (iii)). These reports will be important to support the conclusions related to air emissions exposure in the "detailed quantitative human health risk assessment".

Response:

a) Please refer to the response to FVRD IR No. 1.24a.

b) A human health risk assessment (HHRA) conducted to evaluate the potential health effects that might be experienced by people under a set of simulated pipeline oil spill scenarios was provided in the response to Surrey Teachers IR No. 1.5a. Two different sized spills were assessed: one representing the volume of oil that potentially could be spilled under credible worst-case (CWC) conditions, and the second involving the spillage of a smaller amount of oil. For the purposes of the assessment, the volume of oil spilled under the CWC spill scenario was assumed to be 1,558 m^3. For the smaller release scenario, it was assumed that the volume of oil spilled was 1,012 m^3. Reliance was placed on the results of spill modelling simulations and air dispersion modelling performed by RWDI Air Inc. (RWDI) for each of the simulated pipeline oil spill scenarios. Highlights of the modelling conducted by RWDI are presented in Section 4.2 of the HHRA; full details can be found in Appendix B of the report.

1.6.56 Human Health Risk Assessments: Combustion of Spilled Oil

Reference:

i) A3S4V6, Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, PDF Pages 7-46, 7-47

ii) A3S4W7, Volume 7, Risk Assessment and Management of Pipeline and Facility Spills, Appendix F, PDF pages F-6 to F-18

iii) A3S4X2, Volume 7, TR 7-3 Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report, PDF pages i, 3-2, 3-19, 3-24, 3-35, B-4

iv) A3S4R2, Volume 8B, TR 8B-9 Qualitative Human Health Risk Assessment of Marine Transportation Spills – Marine Transportation Technical Report, PDF pages i, 1-2, 2-1, 3-2, 3-3, 3-5, 5-1

Preamble:

References (iii) and (iv) indicate that the primary human health risk of both Westridge Terminal and Marine Transportation Spills is acute inhalation of exposure of hydrocarbon vapors that evaporate from spilled oil. However, in these health risk assessments there is no consideration of the possibility of the accidental or planned combustion of spilled oil that may occur. References (i) and (ii) indicate that "in-situ burning" of oil represents one of the potential spill response tactics for both pipeline and marine spills. Reference (ii) states clearly that "*Trans Mountain proposes the use of in-situ burning as one means to respond to oil spills*." Emissions from the combustion of spilled oil may pose health risks significantly greater than those posed by volatile hydrocarbon vapors.

References (i) and (ii) refer to "detailed quantitative human health risk assessments" that will be provided to NEB in early 2014, but no further information regarding the scope or approach for these assessments is provided. No human health risk assessment for pipeline spills has been performed.

Request:

Please provide:

a) "Detailed quantitative human health risk assessments" for Westridge Terminal spills, and Marine Transportation Spills. These reports should include assessment of the potential for burning spills, and assessment of the resultant human health impacts.

b) Detailed quantitative human health risk assessments for all of the pipeline spill scenarios detailed in reference (i). This report should include assessment of the potential for burning spills, and assessment of the resultant human health impacts.

c) A detailed report on the dispersion modeling conducted in support of the "detailed quantitative human health risk assessments" requested above, with sufficient detail for an expert familiar with the chosen dispersion modeling system to assess the adequacy

of the dispersion modeling approach and model configuration. The level of detail provided should be similar to the level of detail provided for the dispersion modeling report for marine traffic emissions (reference (iii)). These reports will be important to support the conclusions related to air emissions exposure in the "detailed quantitative human health risk assessment"

Response:

a) Trans Mountain is preparing a detailed human health risk assessment (HHRA) that builds on the information provided in Technical Report 7-3 in Volume 7, Qualitative Human Health Risk Assessment of Westridge Marine Terminal Spills Technical Report (Intrinsik Environmental Sciences Inc. December 2013) and Technical Report 8B-9, Volume 8B, Qualitative Human Health Risk Assessment of Marine Transportation Spills (Intrinsik Environmental Sciences Inc. December 2013). The detailed HHRA technical report will be filed with the National Energy Board on June 16, 2014. Consistent with the qualitative human health risk assessments (QHHRAs), the detailed HHRA focuses on determining the nature and extent of the potential health effects that could occur among people from short-term inhalation exposure to the chemical vapours released from the surface of the oil slick during the early stages of the oil spill before the arrival of first responders and the implementation of emergency and spill response measures.

Although in-situ burning (ISB) is generally considered to be a proven alternative oil spill response tactic, it can only be carried out after a special application to the Canadian Coast Guard through the Unified Command. As described in Section 5.5.1.4 of Volume 8A, ISB is not one of the methods pre-approved by Transport Canada for oil spill response tactic. It would thus only be considered on a case-by-case basis through consultation with federal and local authorities and experts. For example, it is unlikely that ISB would be used as a response tactic in the case of mobile oil near or at shore due to: (i) the difficulties associated with maintaining ignition; (ii) smoke-related issues; and (iii) the challenges associated with the clean-up of any near or at shore residues. Near shore response with booms, skimmers, pumps and sorbents is therefore viewed as a more practical, fast and effective response tactic. On this basis, ISB was not considered a viable scenario in the detailed HHRA.

Trans Mountain commissioned a risk assessment of the Westridge Marine Terminal expansion, which was filed as Attachment 5 in response to NEB IR No. 1.98a (NEB IR No. 1.98a – Attachment 5). The risk assessment identified the possible accidents or upset events (including fire related to a spill inside the containment boom) along with the associated consequences during ship loading at the Westridge Marine Terminal. The risk assessment evaluated the potential impact on the nearby areas of a number of "worst-case" scenarios (i.e., hazards) and the probabilities of their occurrence. Enhancements to the emergency response plan will be informed based on the findings of the worse-case scenario. The assessment was conducted without consideration of mitigation measures, such as the effective implementation of Trans Mountain's emergency response plan. According to the findings of the risk assessment, the overall risks posed to the public in the evaluated oil fire cases are deemed to be within the

acceptable level of risk criteria as set out by the Major Industrial Accidents Council of Canada.

b) A human health risk assessment (HHRA) aimed at identifying and understanding the potential health effects that might be experienced by people under a set of simulated pipeline oil spill scenarios was completed and attached to Surrey Teachers IR No. 1.5a (Surrey Teachers IR No. 1.5a – Attachment 1).

The probability of a pipeline oil spill is a low likelihood event, and the probability of spilled oil igniting is lesser still. In order for spilled oil to ignite, the vapour concentration on the oil surface has to be within flammability limits and a source of ignition has to be present. For reasons described in the response to Metro Vancouver 1.1.6.56a, in situ burning of spilled oil is not considered to be an emergency response option for urban areas.

c) Air dispersion modelling was conducted in the Application to understand the behaviour of evaporated hydrocarbons in the air coming from a marine spill in the Salish Sea or from a loading spill at Westridge Terminal. For a more detailed description of the air dispersion modelling procedures, please refer to '*Addendum to Volume 8C, TR 8C-S10 Modeling the Fate And Behaviour Of Marine Oil Spills for the Trans Mountain Expansion Project Summary Report*'. This addendum will be filed mid-2014.

1.6.57 Community Health Technical Report: Health Data Aggregation

Reference:

i) A3S2L9, Volume 5D, TR 5D- Community Health Technical Report, PDF page 4-1

Preamble:

Most of the background community social economic and health data in the Community Health Technical Report are presented at the Health Service Delivery Area (HSDA) level of aggregation for British Columbia. This level of aggregation is not sufficiently granular to be informative. The geographic area covered by one HSDA can include several communities. For example Fraser North HSDA includes Burnaby, New Westminster, Belcarra, Anmore, Port Moody, Coquitlam, Port Coquitlam, Pitt Meadows and Maple Ridge. HSDA level information is not very useful for describing the socio-economic and health characteristics of the population living in close proximity to the proposed pipeline route and for assessing the impact(s) from both the construction and operating phases of the project - especially in urban areas where significant variations can exist between neighborhoods even a short distance apart. There are finer aggregates available from the Ministry of Health, for example at the Local Health Area level (LHA), although even the LHA level is often not sufficiently granular.

Request:

Please provide:

a) A description of the population characteristics of residents and neighborhoods where the proposed line is to be located and compare these characteristics to the larger community. For example data should be aggregated for neighborhoods along the pipeline route using census dissemination area units and then use the HSDA, LHA or local municipality data as comparators. This will mean acquiring custom tabulations by special requests to agencies such as Statistics Canada, BC Ministry of Health, and Vital Statistics Agency.

Response:

a) For data on demographics, immigration/migration, and socio-economic data, please refer to Sections 4.0, 6.0, 10.1 and 10.2 in Technical Report 5D-2 in Volume 5D, Socio-economic Technical Report (Vista Strategy Corp. and TERA Environmental Consultants December 2013).

For information on the level of population health data being reported, please refer to the response to City of Vancouver IR No. 1.03.05a.

1.6.58 Community Health Technical Report: Demographic Information and Health Indicator Selection Criteria

Reference:

i) A3S2L9, Volume 5D, TR 5D- Community Health Technical Report, PDF section 4 (pages 4-1 – 4-44)

Preamble:

The Health profiles presented in Section 4 of reference (i) include data on "Overall Well-being", Mortality, Morbidity, and "Personal Health Behaviours". These data are difficult to interpret without further supporting demographic information. Health profiles for communities typically include a number of critical demographic variables:

- demographic breakdown (age, gender), trends over time, size of population
- immigration/migration
- socioeconomic status, employment rates, employment by industry

Request:

Please provide:

a) Demographic information as outlined above for each health aggregation area.

b) Detailed criteria and rationale supporting the selection of the health indicators in reference (i).

Response:

a) For data on demographics, immigration/migration, and socio-economic data, please refer to Sections 4.0, 6.0, 10.1 and 10.2 in Technical Report 5D-2 in Volume 5D, Socio-economic Technical Report (Vista Strategy Corp. and TERA Environmental Consultants December 2013).

b) The health indicators used for the Community Health Technical Report include: socio-economic health effects, infectious diseases, environmental health, public safety, health care service provision, and Aboriginal health. Rationale for indicator selection is provided in Section 7.2.8, Table 7.2.8-1 of Volume 5B as well as in Table 3.2-1 of Technical Report 5D-8 in Volume 5D, Community Health Technical Report (Habitat Health Impact Consulting Corp. December 2013).

In terms of the health data that is included in Reference (i), these data were collected to meet the primary purposes of the referenced section as described in Section 3.4 Existing Conditions, of Technical Report 5D-8 in Volume 5D. This text is copied below.

- to identify health vulnerabilities, challenges and opportunities in the potentially affected population in order to ensure that the Project does not exacerbate problems, and where possible, leverages the opportunity to improve health;

- to identify the current status of health conditions such that predictions can be made about the extent of change;
- to identify potentially vulnerable subsets of the population; and
- to create a reference point for measuring or gauging future change in health status.

1.6.59 Community Health Technical Report: Mitigation

Reference:

i) A3S2L9, Volume 5D, TR 5D- Community Health Technical Report, PDF Section 5 (pages 5-1 – 5-20)

Preamble:

Many of the contributing factors to the noted health issues (mental health, addiction and STI) that are highlighted in reference (i) are not addressed in the mitigation strategies. For instance, providing workers with sufficient recreational facilities, encouraging family relationships, working proactively with mental health and addiction services to set up services are suggested in the literature but are not included as mitigation measures. It is also important to note that the description of mental health and addiction services in the Lower Fraser Valley portion of the project area does not provide a clear picture of the true capacity of these services.

Request:

Please provide:

a) Details on how Trans Mountain will contribute to service provision for mental health and addiction. Current infrastructure for dealing with these health issues in many of the project communities is taxed and over capacity.

b) Details on Trans Mountain's health promotion activities and screening strategy for STI mitigation.

Response:

a) The Socio-economic Management Plan located in Appendix C of the Pipeline Environmental Protection Plan (Volume 6B) lists the following strategy to help mitigate any effects to health care service provision:

- Communicate with local health authorities, emergency medical service authorities, social service authorities on the timing of the Project, duration of stay in the local community, expected number of people coming into the area and onsite health care plans (Section 8.4.9).

In addition, please refer to the responses to NEB IR No. 1.16a, and 1.17a to 1.17d which discuss the development of a Community Readiness Engagement Program and a Worker Code of Conduct, respectively. Both speak to engagement with health and social services and reducing the burden on these services.

b) Section 8.4.5 of Volume 6B suggests the following strategy to promote health within the workplace: *Provide opportunities at Project accommodations for employees to connect electronically and/or by phone with family and friends*. This measure aims to ensure that transient employees maintain social ties while being away from home.

Alongside this measure, Trans Mountain will undertake the following activities that may have a positive effect on STI prevention and treatment:

- Trans Mountain will actively include consultation with health authorities and social service agencies as part of the Community Readiness Engagement Program (refer to the response to NEB IR No. 1.16) and use this information to inform the final Worker Code of Conduct policy.
- In order to identify additional measures that are appropriate regarding STI transmission, Trans Mountain will consult with organizations within and outside government agencies that are active in STI prevention and treatment.

Summary of New Commitments:

- Trans Mountain will actively include consultation with health authorities and social service agencies as part of the Community Readiness Engagement Program (refer to the response to NEB IR No. 1.16) and use this information to inform the final Worker Code of Conduct policy.
- Trans Mountain will consult with organizations on STI transmission mitigation within and outside of government agencies that are active in STI prevention and treatment.

1.6.60 Community Health Technical Report: Monitoring and Communication

Reference:

i) A3S1S7, Volume 5B, Environmental and Socio-Economic Assessment – Socio-Economic, PDF Section 7

ii) A3S2L9, Volume 5D, TR 5D- Community Health Technical Report, PDF page iii, Section 5 (pages 5-1 – 5-20)

Preamble:

A large number of mitigation measures have been proposed in reference (i). There is an absence of information on how the implementation and effectiveness of these proposed measures will be systematically monitored and results made available to the public, during both the construction and operation phases of the project. Further, there is a lack of information regarding the ways in which the proponent will respond where the mitigation strategies are not successful.

Further, though a communication plan for traffic safety are proposed in reference (i), there is no other details related to a communication plan that covers other health risks associated with the project. As reference (i) correctly notes, "…*people's perception of exposure to contamination can itself have adverse effects on health*" as "*perception of contamination can cause stress and anxiety*". Hence, it is important to communicate all identified health risks to the general public in plain language terms, showing evidence for the magnitude of predicted effects, and acknowledging the uncertainties and limitations of the assessment.

Request:

Please provide:

a) Details on how mitigation measures (reference (ii)) and residual effects (reference (i)) will be systematically monitored, evaluated, and publically reported, as well as measures that will be taken if mitigation strategies are not successful.
   i) Reference (ii) makes reference to a five year post construction monitoring program for the TMX Anchor Loop Project in Jasper National Park and Mount Robson Provincial Park. Please provide any and all reports or other documentations from this monitoring program, since information from this monitoring program appears to be used as evidence for assessing potential community health impacts from the current proposal.

b) A detailed communication plan that addresses potential public concerns and provides complaint response for all phases of the project including emergency management.

Response:

a) As described in the response to NEB IR No. 1.17d.6, Trans Mountain will develop and implement an issues tracking process to monitor and respond to Project-related socio-economic issues and opportunities that emerge during construction and reclamation. As suggested in NEB Draft Condition 11 as outlined in the NEB's Letter – Draft Conditions

and Regulatory Oversight (April 16, 2014) (NEB 2014), this will be called a Socio-Economic Effects Monitoring Program. As part of its ongoing consultation program, Trans Mountain will consult with key stakeholders (e.g., governments, local/regional service providers, Aboriginal communities, municipalities) regarding the socio-economic effects monitoring framework, indicators to be monitored, methods of reporting, and the level of local/regional interest in participating in socio-economic effects monitoring. The monitoring framework and process will then be finalized and shared publically. While the precise socio-economic effects monitoring framework and indicators are still to be determined, the Socio-Economic Effects Monitoring Program will include monitoring indicators related to worker/community interaction and worker conduct, which will assist Trans Mountain in assessing the success of its policies that relate to worker conduct.

i) The TMX-Anchor Loop Project As-Built Report as well as the subsequent post-construction monitoring reports from 2009 to 2012 used in reference (ii) have all been submitted to the NEB and are publicly available. It should be noted that the Parks Canada Agency provided a list of management objectives and desired end results that the project aimed to achieve, of which human health risks was not included, given the setting and focus of the Project in 2005-06.

Reference:

National Energy Board. 2014. Draft Conditions and Regulatory Oversight. Hearing Order OH-001-2014. Trans Mountain Pipeline ULC (Trans Mountain) Application for the Trans Mountain Expansion Project (Project). April 16, 2014.

b) Subject to the outcome of the NEB regulatory process, and prior to construction, Trans Mountain will undertake a communications and notification program to ensure local businesses and members of the public are made aware of potential construction impacts including lane restrictions, road closures and alternate access plans. The Communication and Notification Program will include advertisements, public general notices, area specific information handouts, and local signage as described in the Volume 6B, Section 1.2.3 Emergency Response Plans. Also refer to the response to NEB IR No. 1.15a.

More details regarding the plan for engagement and communications activities conducted prior to and during construction will be provided in Consultation Update No. 2 which will be submitted to the NEB in Q3 2014.

1.6.61 Human Health Risk Assessments: Ozone and Secondary Particulate

Reference:

i) A3S1U0, Volume 5C, Air Quality and Greenhouse Gas Technical Report, PDF pages 15, 59

ii) A3S1U1, Volume 5C, Air Quality and Greenhouse Gas Technical Report, PDF pages 187, 206, 230, 232

iii) A3S1U3, Volume 5C, Air Quality and Greenhouse Gas Technical Report, PDF Appendix C

iv) A3S2L1, Volume 5D, TR 5D-7 Screening Level Human Health Risk Assessment of Pipeline and Facilities Technical Report, PDF pages 3-32 to 3-36

v) A3S4J7, Volume 8B, TR 8B-3 Marine Air Quality and Greenhouse Gas - Marine Transportation Technical Report, PDF pages 27, 28, 29, 45, 82, 88, 92

vi) A3S4K1, Volume 8B, TR 8B-3 Marine Air Quality and Greenhouse Gas - Marine Transportation Technical Report, PDF Appendix B

vii) A3S4R1, Volume 8B, TR 8B-8 Screening Level Human Health Risk Assessment of Marine Transportation Technical Report, PDF pages 3-9

Preamble:

Air quality modelling for Tank Terminals, Westridge Marine Terminal (References (i), (ii), (iii)), and Marine Transportation (References (v), (vi)) included modelling of the formation of ozone and secondary particulate matter using the CMAQ modelling system. The results of these modelling efforts indicated that potential residual effects could include “increase in ambient ground-level concentrations of ozone” (Reference (ii), page 230), “increase in ambient concentrations of secondary ozone and particulate matter” (Reference (ii), page 232), and “increase in ambient ground-level concentrations of secondary PM. / Increase in ambient ground-level concentrations of ozone.” (Reference (v), page 92).

Despite the above-referenced potential for the project to contribute to increased ozone and secondary particulate levels, the contaminants of potential concern (COPC) for both the screening level risk assessments of Pipeline and Facilities (Reference (iv)) and Marine Transportation (Reference (vii)) do not include ozone or secondary particulate matter. As such, the risk assessments completed to date do not include any quantification of the potential risk associated with these pollutants.

Both reference (iv) and (vii) refer to “detailed quantitative human health risk assessments” that will be provided to NEB in early 2014, but no further information regarding the scope or approach for these assessments is provided.

Request:

Please provide:

a) A report discussing the "detailed quantitative human health risk assessment" for Pipeline and Facilities, as alluded to in reference (iv)
   i) Please include detailed assessment for all Tank Terminals, including assessment of the potential health impacts of ozone formation due to Tank Terminal emissions;
   ii) Please include detailed assessment for Westridge Marine Terminal, including assessment of the potential health impacts of ozone and secondary particulate formation due to Westridge Marine Terminal emissions;

b) A report discussing the "detailed quantitative human health risk assessment" for Marine Transportation, as alluded to in reference (vii). Please include assessment of the potential health impacts of ozone and secondary particulate formation due to Marine Transportation emissions.

Response:

a) i) Secondary ozone formation is a chemical process that typically takes several hours and requires the input of NO_x and volatile organic compound (VOC) emissions over large areas on the order of hundreds to thousands of square kilometres. Such conditions are typically only found in large population centres where vehicle emissions are the main driver, and maximum ozone concentrations are found downwind of the population centres. Depending on the characteristics of the air shed and NO_x and VOC emissions, a few large single industrial point sources might enhance secondary ozone formation in burdened air sheds. The area around and downwind of the Kamloops terminal is currently not known to be a burdened air shed. NO_x and VOC emissions from terminal operations at both Edmonton and Kamloops terminals are too small and spatially confined to substantially contribute to ozone formation in these regions. Ozone formation was not assessed for these terminals. Therefore, ozone was not assessed in the screening level human health risk assessment (SLHHRA) at the Edmonton and Kamloops terminals provided in Technical Report 5D-7 in Volume 5D, Screening Level Human Health Risk Assessment of Pipeline and Facilities Technical Report (Intrinsik Environmental Sciences Inc. December 2013). Emissions from Westridge Marine, Burnaby, and Sumas terminals were included in the photochemical modelling of ozone formation in the Lower Fraser Valley air shed. This approach is consistent with guidance received from Environment Canada in the November 21, 2012 scoping meeting.

   ii) The assessment of $PM_{2.5}$ in the SLHHRA of the Westridge Marine Terminal provided in Technical Report 5D-7 in Volume 5D included both primary particulates emitted directly to the atmosphere, and secondary particulates formed in the atmosphere through chemical and physical transformations.

Ozone was not assessed in the SLHHRA of the Westridge Marine Terminal expansion, but was included as part of the air quality assessment in Section 5.3.2 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI Air Inc. December 2013). In addition to the CALMET/CALPUFF dispersion modelling, photochemical modelling was completed using the Community Multi-scale Air Quality modelling system to provide estimates of secondary ozone formation in the Lower Fraser Valley. Based on the air dispersion and photochemical modelling, the maximum predicted increase in 8-hour ozone concentrations as a result of the Westridge Marine Terminal expansion is 0.3 parts per billion (ppb), which represents approximately 0.5% of the Canadian Ambient Air Quality Standards for ozone (62 ppb based on 2020 compliance) (CCME 2012). Section 5.3.2 of Technical Report 5C-4 states that, *"Project application emissions have a relatively minor effect on secondary pollutant formation…in the Lower Fraser Valley."*

As described in Section 4.1.4.1 of Technical Report 5C-4 in Volume 5C, observed ozone concentrations in Metro Vancouver were below the Metro Vancouver 1-hour air quality objective and the 8-hour Canadian Ambient Air Quality Standard in 2011.

Ozone concentrations related to the Project will depend on precursor emissions (NOx and VOCs). The management of ozone in relation to potential human health effects will be focused on monitoring, in accordance with current Provincial and Federal guidance, and, in the case of the Project, on precursor emissions management.

In its Integrated Science Assessment (ISA) document for ozone, the United States Environmental Protection Agency (US EPA 2013) concludes that, based on a weight of evidence, there is no clear health effects threshold for ozone. The US EPA acknowledges that there is some uncertainty in the lower end of the dose-response evaluations for ozone due to data limitations. Based on this "no threshold of effect" concept, any increase in regional ozone concentrations could result in adverse health effects. An emissions management plan for the precursor compounds will help mitigate potential ozone-related health risks in the area. Mitigation of air emissions was described in Section 9 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI Air Inc. December 2013). An updated human health risk assessment will be filed with the NEB on June 16, 2014.

References:

Canadian Council of Ministers of the Environment. 2012. Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone.

United States Environmental Protection Agency. 2013. EPA Integrated Science Assessment for Ozone and Related Photochemical Oxidants.

b) The assessment of $PM_{2.5}$ in the screening level human health risk assessment (SLHHRA) of marine transportation provided in Technical Report 8B-8 in Volume 8B (Screening Level Human Health Risk Assessment of Marine Transportation Technical Report [Intrinsik Environmental Sciences Inc. December 2013]) included both primary particulates emitted directly to the atmosphere, and secondary particulates formed in the atmosphere through chemical and physical transformations. As such, the SLHHRA accounted for secondary particulate formation.

Ozone was not assessed in the SLHHRA of marine transportation, but was included as part of the air quality assessment in Section 5.2.2 of Technical Report 8B-3 in Volume 8B, Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report (RWDI Air Inc. December 2013). In addition to the CALMET/CALPUFF dispersion modelling, photochemical modelling was completed using the Community Multi-scale Air Quality modelling system to provide estimates of secondary ozone formation in the Lower Fraser Valley. Based on the air dispersion and photochemical modelling, the maximum predicted increase in 8-hour ozone concentrations as a result of the Project-related increase in marine vessel traffic is 0.2 parts per billion (ppb), which is approximately 0.3% of the Canadian Ambient Air Quality Standards for ozone (62 ppb based on 2020 compliance) (CCME 2012). Section 5.3.2 of the Technical Report 8B-3 states "*The Project emissions have a relatively minor effect on secondary pollutant formation … in the Lower Fraser Valley.*"

As described in Section 4.1.4.1 of Technical Report 5C-4 in Volume 5C, observed ozone concentrations in Metro Vancouver were below the Metro Vancouver 1-hour air quality objective and the 8-hour Canadian Ambient Air Quality Standard in 2011.

Ozone concentrations related to the Project will depend on precursor emissions (NOx and VOCs). The management of ozone in relation to potential human health effects will be focused on monitoring, in accordance with current Provincial and Federal guidance, and, in the case of the Project, on precursor emissions management.

In its Integrated Science Assessment (ISA) document for ozone, the United States Environmental Protection Agency (US EPA 2013) concludes that, based on a weight of evidence, there is no clear health effects threshold for ozone. The US EPA acknowledges that there is some uncertainty in the lower end of the dose-response evaluations for ozone due to data limitations. Based on this "no threshold of effect" concept, any increase in regional ozone concentrations could result in adverse health effects. An emissions management plan for the precursor compounds will help mitigate potential ozone-related health risks in the area. Mitigation of air emissions was described in Section 7 of Technical Report 8B-3 in Volume 8B, Air Quality and Greenhouse Gas - Marine Transportation Technical Report (RWDI Air Inc. December 2013).

References:

Canadian Council of Ministers of the Environment. 2012. Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone.

United States Environmental Protection Agency. 2013. EPA Integrated Science Assessment for Ozone and Related Photochemical Oxidants.

1.6.62 Assumptions used for NO_x to NO_2 Conversion

Reference:

i) Volume 5C Air Quality and Greenhouse Gas Technical Report, page 72
ii) Volume 8B, Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report, page 54
iii) Volume 8B, Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report, Table 5.3 on page 85

Preamble:

References (i) and (ii) state that 90% of the NOx emissions would be in the form of NO, and 10% would be in the form of NO2. It was also stated that the NO2 concentrations were estimated using the ambient ratio method based on the ambient monitoring data.

It is shown in Table 5.3 in Reference (iii) that the NO2/NOx ratio of 0.1 was used in estimating 1-hour NO2 concentrations for the Application Case.

Request:

a) Please clarify which of the methods stated in References (i) and (ii) were used in predicting maximum 1-hour, 24-hour and annual NO2 concentrations.

b) Please confirm/clarify if the most conservative method of estimating NO2, as stated in the Guidelines for Air Quality Dispersion Modelling in British Columbia by BC MOE (i.e. "worst-case" for NOx to NO2 conversion), was taken into account in any of the scenarios when predicting the NO2 concentrations.

Response:

a) In order to use the RIVAD/ISORROPIA chemical reaction scheme, individual emissions of nitrogen oxide (NO) and nitrogen dioxide (NO_2) are required. For this assessment, it was assumed that 90% of the nitrogen oxides (NO_X) emissions would be in the form of NO, and 10% would be in the form of NO_2. In light of over-predictions of NO_2 in the higher concentration range seen in previous studies, and to more accurately account for the conversion of total atmospheric NO_X, predicted NO and NO_2 concentrations were combined using the POSUTIL post-processing software. Background NO_X concentrations were then added to the total NO_X results. Last, all NO_2 concentrations were estimated using the ambient ratio method outlined in the *Guidelines for Dispersion Modelling in British Columbia* (BC Ministry of Environment 2008). Please refer to Section 3.4.4.2 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) for a discussion of the full methodology.

Reference:

British Columbia Ministry of Environment. 2008. Guidelines for Air Quality Dispersion Modelling in British Columbia. Victoria, BC. 152 pp.

b) The "worst-case" for nitrogen oxides (NO_X) to nitrogen dioxide (NO_2) conversion (100% conversion of NO_X into NO_2) was not taken into account for any of the modelled scenarios to assess compliance as it would be overly conservative. According to the Guidelines for Air Quality Dispersion Modelling in British Columbia (BC Ministry of Environment 2008), the first and most conservative method of estimating NO_2 is to assume 100% conversion of NO_X into NO_2. If a more accurate estimate is desired, the ambient ratio method or the ozone limiting method may be used. The ambient ratio method is recommended in areas where representative NO_X and NO_2 ambient monitoring data are available. For this assessment, NO_2 concentrations were estimated using the ambient ratio method.

Reference:

British Columbia Ministry of Environment. 2008. Guidelines for Air Quality Dispersion Modelling in British Columbia. Victoria, BC. 152 pp.

1.6.63 Contribution of Various Project Sources to Ambient Air Quality Levels and Comparison to Air Quality Standards/Objectives/Guidelines

Reference:

i) Volume 5C Air Quality and Greenhouse Gas Technical Report, pages 200-212
ii) Volume 8B, Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report, Table 5.3 on page 85
iii) US Environmental Protection Agency - National Ambient Air Quality Standards - http://www.epa.gov/air/criteria.html (attachment)
iv) WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide - Global update 2005 http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf?ua=1 (attachment)

Preamble:

One of the purposes of CALPUFF modelling exercise is to determine the contribution of each source group such as the tank farm, marine terminal or marine vessels to the ambient concentration of various air pollutants. References (i) and (ii) provide data on contribution of the project to ambient concentrations in an aggregated form. It is important to give an indication about the per cent contribution of each source associated with the project to the predicted ambient concentrations.

The existing Canadian Ambient Air Quality Objectives for SO_2 and NO_2 were adopted decades ago. In 2012, the Canadian Council of Ministers of the Environment (CCME) initiated the development of Canadian Ambient Air Quality Standards (CAAQS) for SO_2 and NO_2. Health Canada and Environment Canada have been working closely with the provinces to review the health effects and the environmental status of SO_2 and NO_2 and preparing reports to support the new standards. Therefore, the existing National Ambient Air Quality Objectives for these pollutants may not be stringent enough to protect the health of Canadians. There are standards and guidelines for SO_2 and NO_2 that have been adopted more recently by the US EPA (Reference (iii)) and World Health Organization (WHO) (Reference (iv)) that the predicted concentrations can be compared against.

Request:

a) Please provide information that shows the per cent contribution of Burnaby Tank Farm, Westridge Terminal and Marine Vessels/Tankers to maximum 24-hour and annual $PM_{2.5}$, PM_{10} concentrations in the study area.

b) Please provide information that shows the per cent contribution of Burnaby Tank Farm, Westridge Terminal and Marine Vessels/Tankers to maximum 1-hour and annual NO_2 concentrations in the study area.

c) Please provide information that shows the per cent contribution of Burnaby Tank Farm, Westridge Terminal and Marine Vessels/Tankers to maximum 1-hour, 24-hour and annual SO_2 concentrations in the study area.

d) Please compare 1-hour SO_2 concentrations for the Base Case and the Application Case to the most recent USEPA national ambient air quality standards for SO_2.

e) Please compare 24 hour SO_2 concentrations for the Base Case and the Application Case to the WHO Guidelines for SO_2.

Response:

a) No criteria air contaminant (CAC) emissions were modelled at the Burnaby Terminal as there are no substantive sources. Therefore, the contribution of Burnaby Terminal to maximum 24-hour and annual $PM_{2.5}$ and PM_{10} concentrations in the Air Quality Regional Study Area is zero. Table 1.1.6.63A-1 shows the contributions from the Westridge Marine Terminal and marine transportation to the maximum concentrations.

TABLE 1.1.6.63A-1

PROJECT-RELATED CONTRIBUTION FROM WESTRIDGE MARINE TERMINAL AND MARINE TRANSPORTATION TO PREDICTED CONCENTRATIONS (in µg/m³)

Criteria Air Contaminant	Averaging Period	Total Contribution from Project	Project at Westridge	Project Marine Transportation	Contribution due to Westridge (%)	Contribution due to Marine Transportation (%)
PM_{10}	24-hour	16.03	15.97	0.06	99.6	0.4
	Annual	0.09	-0.06	0.09	None	100
$PM_{2.5}$	24-hour	16.02	15.97	0.06	99.7	0.3
	Annual	0.08	-0.06	0.08	None	100
NO_2	1-hour	89.88	89.88	-4.12E-05	100	None
	Annual	8.06	0.65	7.41	8.1	91.9
SO_2	1-hour	20.18	20.18	-4.00E-04	100	None
	24-hour	5.15	5.08	0.07	98.7	1.3
	Annual	0.29	0.24	0.04	85.5	14.5

Notes: All concentrations are presented without ambient background.
Particulate matter = PM; NO_2 = nitrogen dioxide; SO_2 = sulphur dioxide

b) Please refer to the response to Metro Vancouver IR No. 1.1.6.63a.

c) Please refer to the response to Metro Vancouver IR No. 1.1.6.63a.

d) Table 1.1.6.63D-1 provides the combined results for the Burnaby Terminal, Westridge Marine Terminal, and marine transportation. Since there are no substantive criteria air contaminant (CAC) emissions from the Burnaby Terminal, the contribution of Burnaby Terminal to the sulphur dioxide (SO_2) concentrations is zero. Modelled 1-hour SO_2 concentrations are presented for existing conditions (i.e., Base Case) and proposed operations including the Project (i.e., Application Case). Maximum predicted and 99th percentile concentrations are both shown. The 1-hour SO_2 concentrations are compared to the most recent United States Environmental Protection Agency (US EPA) National Ambient Air Quality Standard (NAAQS) for SO_2. The predicted concentrations with ambient background are well below the US EPA standard.

TABLE 1.1.6.63D-1

COMBINED MODELLED CONCENTRATIONS FROM WESTRIDGE MARINE TERMINAL AND MARINE TRANSPORTATION (in µg/m³)

Criteria Air Contaminant	Averaging Period	Base Case (With Background)	Application Case (With Background)	US EPA National Ambient Air Quality Standard
SO_2 (Maximum)	1-hour	73.2	73.2	196
SO_2 (99th Percentile)	Maximum Daily 1-hour	68.7	68.8	

Notes: 1. The US EPA standard is the 99th percentile of the 1-hour daily maximum concentrations averaged over three years while the modelling is for one year;
2. Ambient background = 26.3 µg/m³

e) Table 1.1.6.63E-1 provides the combined results for the Burnaby Terminal, Westridge Marine Terminal, and marine transportation. Since there are no substantial criteria air contaminant (CAC) emissions from the Burnaby Terminal, the contribution from Burnaby Terminal to the sulphur dioxide (SO_2) concentrations is zero. Maximum predicted 24-hour SO_2 concentrations are presented for existing conditions (i.e., Base Case) and proposed operations including the Project (i.e., Application Case). The 24-hour SO_2 concentrations are compared to the World Health Organization (WHO) Guideline for SO_2. It should be noted that ambient background (i.e., 17.4 µg/m³) contributes 86% and 76% of the maximum predicted 24-hour concentrations for the Base and Application Cases, respectively.

TABLE 1.1.6.63E-1

COMBINED MODELLED CONCENTRATIONS FROM WESTRIDGE MARINE TERMINAL AND MARINE TRANSPORTATION (in µg/m³)

Criteria Air Contaminant	Averaging Period	Base Case (With Background)	Application Case (With Background)	WHO Guideline
SO_2	24-hour	20.2	22.9	20

Note: Ambient background = 17.4 µg/m³

1.6.64 Greenhouse Gases – Contextual Information

Reference:

i) Volume 2 Project Overview, Economics and General Information, pages 2-4 and 2-42
ii) Volume 5C Air Quality and Greenhouse Gas Technical Report, pages 18, 212, 224

Preamble:

Most governments have established greenhouse gas reduction targets and developed action plans to meet those targets. Major new projects may add to the existing levels of greenhouse gases and impact the jurisdiction's ability to meet its target. The Application includes estimates of potential greenhouse gas emissions related to some components of the project. However, it doesn't give an indication how these estimates compare to GHG emissions from Canada, Provinces of B.C. and Alberta, and other Local/Regional Governments within the project area.

Request:

a) Please provide some contextual information about global climate change, as well as goals, targets and actions on climate change Government of Canada, Provinces of B.C. and Alberta, and other Local/Regional Governments within the project area. Please put into context the estimated GHG emissions associated with the project and the GHG emissions associated with upstream/downstream activities related to the expanded capacity (i.e. capacity increase of 590,000 bbl/d).

Response:

a) Global climate change and the effect of greenhouse gases (GHG) on it have been extensively investigated by research agencies, governments and policy makers. For a review of these studies, refer to Intergovernmental Panel on Climate Change (IPCC) report (2013).

Assessment of GHG emissions associated with upstream/downstream activities is outside of the scope of the National Energy Board (NEB) Hearing Order (NEB 2014). Appendix I of Hearing Order OH-001-2014 indicates that "The National Energy Board does not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of the oil transported by the pipeline."

There are a number of existing and planned federal, provincial, and local reduction targets, policies, and requirements related to GHG emissions that are summarized in Table 1.1.6.64a-1 (below). Examples are:

- Canada's proposed economy-wide emissions target of 17% below year 2005 levels by year 2020, as proposed at COP15 as part of the Copenhagen Accord;
- Alberta's strategy to reduce business-as-usual GHG emissions by 50 Mt by year 2020 and by 200 Mt by year 2050; and
- British Columbia's targets to reduce its GHG emissions by 18% by year 2016, 33% by year 2020, and 80% by year 2050, compared to year 2007 levels.

Canada's proposed emission target was presented as part of the COP15 meetings, but has not been ratified or finalized. Environment Canada's Greenhouse Gas Emissions Reporting Program requires industrial facilities that emit more than 50,000 tonnes of carbon dioxide equivalent (CO_{2e}) annually to report direct facility annual emissions (Queen's Printer for Canada 2013). The reporting program does not set absolute or facility specific GHG emission limits. Temporary construction emissions are exempt. No facilities associated with this Project will meet the reporting threshold. Environment Canada's National Inventory Report (2013) estimates total GHG emissions from Canada to be 702 Mt in year 2011. Operational emissions from Trans Mountain's proposed Project will increase total (indirect and direct) GHG emissions in Canada by 0.15% (see Table 7.2.5-9 of Volume 5A).

Alberta's 2008 Climate Change Strategy (Government of Alberta 2008) outlines actions to reduce GHG emissions by 50 Mt of CO_{2e} by year 2020 over the business-as-usual case. The strategy is supported by Alberta Environment and Sustainable Development's (AESRD) Specified Gas Reporting Regulation (AESRD 2014) and Specified Gas Emitters Regulation (Province of Alberta 2013). The Specified Gas Reporting Regulation (AESRD 2014) requires facilities emitting more than 50,000 tonnes of CO_{2e} annually to report to the provincial registry. New facilities emitting more than 100,000 tonnes of CO_{2e} annually must reduce their emission intensity by 10% over the first eight years of operations. Facilities that cannot achieve the reduction must purchase offsets or provide payments to a provincial fund. Temporary construction emissions are exempt. No facilities associated with this Project are expected to meet either threshold. Operational emissions from the Project will increase GHG emissions in Alberta by 0.46% (see Table 7.2.5-9 of Volume 5A).

British Columbia's Greenhouse Gas Reduction Targets Act legislates emission targets including a reduction in GHG emissions by 33% by year 2020, compared to year 2007 levels. All emissions from all sectors and activities will be included in the target. Specific emission limits and goals have not been set for individual facilities through this legislation.

British Columbia has a series of legislation to progress toward the emission reduction targets. The legislation that will apply to this Project includes:

- *Greenhouse Gas Reduction Targets Act* (Queen's Printer 2014c);
- The *Greenhouse Gas Reduction (Cap and Trade) Act* (Queen's Printer 2014a) including the Reporting Regulation (Province of British Columbia 2010), (Proposed) Offset Regulation (BC Ministry of Environment [MOE] 2014a) and (Proposed) Emissions Trading regulation (BC MOE 2014b);
- The *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* (Queen's Printer 2014b);
- The *Carbon Tax Act* (Queen's Printer 2008); and,
- *Local Government (Green Communities) Statutes Amendment Act* (Province of British Columbia 2008).

British Columbia's *Greenhouse Gas Reduction (Cap and Trade) Act* (Queen's Printer 2014a) includes the establishment of a Reporting Regulation (Province of British Columbia 2010). The Reporting Regulation requires annual reporting and verification of GHG emissions for facilities with direct emissions above the thresholds. Facilities with direct annual emissions above 10,000 tonnes of CO_{2e} must report their emission totals, and facilities with direct annual emissions above 25,000 tonnes of CO_{2e} must have their emissions verified by a third party. Construction emissions are exempt. None of the facilities associated with the Project are expected to exceed the reporting or verification thresholds. Operational emissions from the Project will decrease GHG emissions in British Columbia by 0.05% (see Table 7.2.5-9 of Volume 5A).

Under the *Greenhouse Gas Reduction (Cap and Trade) Act*, British Columbia has proposed an Emission Trading Regulation (BC MOE 2014b), which is not yet enacted. The proposed regulation could set emission allowance limits for facilities. Facilities which cannot meet these limits may be required to purchase offsets or allowances. Initial indications are that the regulation would apply to facilities emitting more than 25,000 tonnes of CO_{2e} annually. The regulation is not expected to apply to construction emissions. Operational emissions at all facilities associated with the Project are expected to be below this threshold.

British Columbia's *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* (Queen's Printer 2014b) applies to the sale of fuels in the province, and mandates that the total fuel sold within British Columbia contains specified minimum amounts of renewable and low carbon fuel content. All fuels bought in British Columbia for construction and operational equipment will be subject to these regulations. All new construction and operational vehicles bought in British Columbia will be subject to these regulations.

British Columbia's *Carbon Tax Act* (Queen's Printer 2008) sets a tax rate based on the carbon intensity of the fuel used ($30 per tonne of CO_{2e}). The *Carbon Tax Act* applies to the sale and consumption of all fuels in the province. The carbon tax will provide an economic incentive for Project-related vehicles and equipment to operate more efficiently and reduce fuel consumption and emissions.

British Columbia's *Local Government (Green Communities) Statutes Amendment Act* (Province of British Columbia 2008) requires local governments to include GHG emission targets, policies, and actions in their Official Community Plans and Regional Growth Strategies. Some local and regional governments in British Columbia have set community GHG emission targets consistent with the British Columbia targets. For example, Metro Vancouver's Regional Growth Strategy (Metro Vancouver 2011) includes a target to reduce regional GHG emissions by 33% by year 2020 (from year 2007). Many local governments in British Columbia and Alberta have plans, bylaws, or strategies, which include goals of reducing GHG emissions, but have not set specific numerical targets. The total direct GHG emissions from Project operations in British Columbia are expected to decrease due to the planned change of the operating status for the vapour combustion unit to stand-by mode; however, the decreases will not occur

in all local government regions. Direct GHG emissions from vapour flaring are expected to decrease, supporting the GHG emission goals of Metro Vancouver. The Project is expected to result in negligible increases of fugitive and space heating operational GHG emissions in many other local municipalities in British Columbia and Alberta. Construction equipment and land clearing will result in increased GHG emissions over the construction phase along the proposed pipeline corridor. These emissions are not expected to impact the long-term goals of local governments since the emissions will only occur during construction.

Because the Project is federally regulated, it is not yet clear to which extent provincial and local targets, policies, and requirements may apply to the Project. Even assuming that the Project is subject to all of these requirements, construction emissions are exempt from Environment Canada's Greenhouse Gas Emissions Reporting Program, Alberta's Specified Gas Reporting Regulation, Alberta's Specified Gas Emitters Regulation and British Columbia's Reporting Regulation under the *Greenhouse Gas Reduction (Cap and Trade) Act*. Further, none of the facilities associated with the Project are expected to exceed the reporting or compliance thresholds for any of these regulations.

TABLE 1.1.6.64A-1

FEDERAL, PROVINCIAL AND LOCAL GOVERNMENT GHG REGULATIONS, POLICIES AND TARGETS

Regulation, Policy, Target or Requirement	Existing/Planned?	Required Reduction, Offset, and/or Payment?	(Facility) Requirements	Applicability to Project	How Do Emissions Compare to Jurisdictional Reduction Target?
Federal					
Environment Canada's Greenhouse Gas Emissions Reporting Program (Queen's Printer for Canada 2013)	Existing requirement (under *Canadian Environmental Protection Act* regulation)	No absolute GHG limits set. For comparison, Environment Canada's National Inventory Report estimates total GHG emissions from Canada to be 702 Mt in 2011. Alberta: 242.0 Mt, British Columbia: 59.1 Mt.	Report emissions (if over threshold).	Construction emissions are exempt because they are not direct emissions from the operation of the facility. Facilities directly emitting more than 50,000 tonnes of CO_{2e} annually must report. No facilities associated with the Project should meet this threshold.	No target for comparison.
Canada's National Target under the Copenhagen Accord	Proposed target (from COP 15)	Canada has submitted an economy-wide emissions target of 17% below 2005 levels by 2020. There are no specific targets for industry.	None.	All emissions from all sectors and activities will be included in the National total.	Project operation will increase GHG emissions in Canada by 0.15%.
Provincial - Alberta					
Alberta's 2008 Climate Change Strategy (Government of Alberta 2008)	Existing target	Reduce GHG emissions by 50 Mt by 2020 (from business-as-usual scenario). Reduce business-as-usual GHG emissions by 200 Mt by 2050.	Specific regulations for industry.	All emissions from all sectors and activities will be included in the Alberta total.	Project will increase GHG emissions in Alberta by 0.46%.
Alberta Environment and Sustainable Development's *Specified Gas Reporting Regulation* (AESRD 2014)	Existing regulation	No absolute GHG limit.	Facilities emitting more than 50,000 tonnes of CO_{2e} annually must report.	No facilities associated with the Project should meet this threshold. Construction emissions are exempt because they are not direct emissions from the operation of the facility.	No target specific to this legislation.

TABLE 1.1.6.64A-1

FEDERAL, PROVINCIAL AND LOCAL GOVERNMENT GHG REGULATIONS, POLICIES AND TARGETS (continued)

Regulation, Policy, Target or Requirement	Exiting/Planned?	Required Reduction, Offset, and/or Payment?	(Facility) Requirements	Applicability to Project	How Do Emissions Compare to Jurisdictional Reduction Target?
Provincial – Alberta (continued)					
Alberta Environment and Sustainable Development's *Specified Gas Emitters Regulation* (Province of Alberta 2013)	Existing regulation	GHG Emission Intensity limit for large emitters. Reductions, offsets or compliance payments required.	New facilities emitting more than 100,000 tonnes of CO_{2e} annually must reduce emission intensity by 10% (2% per year over 8 years, starting in the fourth year of operations).	No facilities associated with the Project should meet this threshold. Construction emissions are exempt because they are not direct emissions from the operation of the facility.	Project facilities in Alberta will not meet threshold.
Provincial – British Columbia					
British Columbia's *Greenhouse Gas Reduction Targets Act,* November 2007 (Queen's Printer, 2014c)	Existing regulation	Reduce GHG emissions by - 18% by 2016 - 33% by 2020 - 80% by 2050 (from 2007 levels). Legislation including: • *Emissions Offsets Regulation* • *Carbon Neutral Government Regulation.*	Not specifically addressed in this legislation.	All emissions from all sectors and activities will be included in the British Columbia total.	British Columbia emissions decreased 4.5% from 2007 to 2010 (Live Smart BC 2012). Project will decrease GHG emissions in British Columbia by 0.05%.
British Columbia's *Greenhouse Gas Reduction (Cap and Trade) Act* (Queen's Printer 2014a)	Existing regulation	Legislation including: • *Reporting Regulation* • *(Proposed) Offsets Regulation* • *(Proposed) Emissions Trading Regulation.*	Sets a requirement for facilities to report GHG emissions, specific thresholds and requirements are in the *Reporting Regulation.*	No facilities associated with the Project should meet threshold as described in the *Reporting Regulation.*	No specific target for this legislation supports the *Greenhouse Gas Reduction Targets Act*.

TABLE 1.1.6.64A-1

FEDERAL, PROVINCIAL AND LOCAL GOVERNMENT GHG REGULATIONS, POLICIES AND TARGETS (continued)

Regulation, Policy, Target or Requirement	Existing/Planned?	Required Reduction, Offset, and/or Payment?	(Facility) Requirements	Applicability to Project	How Do Emissions Compare to Jurisdictional Reduction Target?
Provincial – British Columbia (continued)					
British Columbia's *Reporting Regulation* under the *Greenhouse Gas Reduction (Cap and Trade) Act* (Province of British Columbia 2010)	Existing regulation	No required reduction. Required reporting and verification.	Facilities with direct emissions above 10,000 tonnes of CO_{2e} annually must report.	No facilities associated with the Project should meet this threshold. Construction emissions are exempt because they are not direct emissions from the operation of the facility.	No specific target for this legislation supports the *Greenhouse Gas Reduction Targets Act*. Project will decrease GHG emissions in British Columbia by 0.05%.
British Columbia's *Offsets Regulation* under the *Greenhouse Gas Reduction (Cap and Trade) Act* (BC MOE 2014a)	Proposed regulation	Allows the establishment of emission offsets (Emission Reduction Units).	Offset projects can obtain emission offsets (Emission Reduction Units).	Does not apply to this Project.	No specific target for this legislation supports the *Greenhouse Gas Reduction Targets Act*.
British Columbia's *Emission Trading Regulation* under the *Greenhouse Gas Reduction (Cap and Trade) Act* (BC MOE 2014b)	Proposed regulation	Emission allowance limits for facilities. If limits are not meet, facilities may be required to purchase offsets or allowances.	Facilities emitting more than 25,000 tonnes CO_{2e} annually will have emission allowance limits, emissions beyond these limits will have to be reduced or offset (through purchase of allowances or credits).	Proposed operation at all Project facilities will be below this threshold. Does not apply to construction emissions.	Specific targets (allowances) will be assigned to individual facilities once regulation is enacted. No specific target for this legislation at this time, supports the *Greenhouse Gas Reduction Targets Act*.

TABLE 1.1.6.64A-1

FEDERAL, PROVINCIAL AND LOCAL GOVERNMENT GHG REGULATIONS, POLICIES AND TARGETS (continued)

Regulation, Policy, Target or Requirement	Existing/Planned?	Required Reduction, Offset, and/or Payment?	(Facility) Requirements	Applicability to Project	How Do Emissions Compare to Jurisdictional Reduction Target?
Provincial – British Columbia (continued)					
British Columbia's *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements)Act* (Queen's Printer 2014b)	Existing regulation	Fuel sold will reflect requirements.	No specific requirements for facilities. Fuels purchased may have renewable or low carbon content.	All fuels bought in British Columbia for equipment and vehicles may have renewable or low carbon content.	No specific target for this legislation supports the *Greenhouse Gas Reduction Targets Act*.
British Columbia's *Carbon Tax Act* (Queen's Printer 2008)	Existing regulation	Fuel sold includes an extra tax. Fee applied to purchase of fuel ($30 per tonne of CO_{2e}).	No specific requirements for facilities. Tax paid on purchase of fuels.	All fuels bought in British Columbia for equipment and vehicles will pay this tax.	No specific target for this legislation supports the *Greenhouse Gas Reduction Targets Act*.
British Columbia's Local Government (Green Communities) *Statutes Amendment Act* (Province of BC 2008)	Existing regulation	Local governments are required to include GHG emission targets, policies and actions in their Official Community Plans and Regional Growth Strategies.	No specific requirements for facilities.	Emissions from large sectors and activities will be included in the Local Government totals – Industrial facilities will not be included.	GHG emissions during Project construction will increase local emissions over the construction period. These emissions will not be included in local government GHG inventories.
Metro Vancouver 2040 – Shaping our Future (Metro Vancouver 2011)	Existing plan	Reduce regional GHG emissions by 15% by 2015 and 33% by 2020 (from 2007).	No specific requirements for facilities.	Some operations will occur in this jurisdiction.	Project will decrease GHG emissions in British Columbia by 0.05%.

TABLE 1.1.6.64A-1

FEDERAL, PROVINCIAL AND LOCAL GOVERNMENT GHG REGULATIONS, POLICIES AND TARGETS (continued)

Regulation, Policy, Target or Requirement	Existing/Planned?	Required Reduction, Offset, and/or Payment?	(Facility) Requirements	Applicability to Project	How Do Emissions Compare to Jurisdictional Reduction Target?
Local					
Municipalities and local governments in British Columbia and Alberta	Several plans in existence.	Most plans include a goal to reduce GHG emissions. Some plans include a numerical target. Some plans include a goal to become carbon neutral.	No specific requirements for facilities. Facility emissions will not be included in local government inventories.	GHG emissions during Project construction will increase local emissions and be contrary to local reduction goals. These emissions will occur only over the construction phase and will be distributed along the entire pipeline corridor.	Total direct GHG emissions from operations are expected to decrease. Direct GHG emissions from pipeline (129 tonnes of CO_{2e}) and pump station (32 tonnes of CO_{2e}) operation are expected to increase. Direct GHG emissions from vapour flaring are expected to decrease substantially. A small increase (32 tonnes of CO_{2e}) of direct GHG emissions is estimated from Project tank operation (see Table 7.2.5-4 of Volume 5A). Direct GHG emissions from vapour flaring are expected to decrease by 44,740 tonnes of CO_{2e} (see Table 7.2.5-5 of Volume 5A).

References:

Alberta Environment and Sustainable Resource Development. 2014. Specified Gas Reporting Standard Version 8. Edmonton, AB.

British Columbia Ministry of Environment. 2014a. Greenhouse Gas Reduction (Cap and Trade) Act – Consultation for a Proposed Offset Regulation. Victoria, BC.

British Columbia Ministry of Environment. 2014b. Greenhouse Gas Reduction (Cap and Trade) Act – Consultation for a Proposed Emissions Trading Regulation. Victoria, BC.

Intergovernmental Panel on Climate Change. 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press. Cambridge, United Kingdom and New York, NY, USA.

Environment Canada. 2013. National Inventory Report – Greenhouse Gas Sources and Sinks in Canada: 1990-2011. Gatineau, QC. 539 pp.

Government of Alberta. 2008. Alberta's 2008 Climate Change Strategy. Responsibility/ Leadership / Action. Edmonton, AB. 32 pp.

Live Smart BC. 2012. Making Progress on B.C.'s Climate Action Plan. Victoria, BC. 58 pp.

Metro Vancouver. 2011. Burnaby, BC Metro Vancouver 2040 – Shaping our Future. 73 pp.

National Energy Board. 2014. Trans Mountain Pipeline ULC Trans Mountain Expansion Project. File Number OF-Fac-Oil-T260-2013-03-02, Hearing Order OH-001-2014. 2 April 2014.

Province of Alberta. 2013. Specified Gas Emitters Regulation 139/2007 with amendments up to and including Alberta Regulation 89/2013. Edmonton, AB.

Province of British Columbia. 2008. Bill 27- 2008 *Local Government (Green Communities) Statutes Amendment Act*, 2008. May 22, 2008. Victoria, BC.

Province of British Columbia. 2010. *Greenhouse Gas Reduction (Cap and Trade) Act* Reporting Regulation Reg. 272/2009 [includes amendments up to B.C. Reg 376/2010, December 20, 2010]. Victoria, BC.

Queen's Printer. 2008. *Carbon Tax Act* [SBC 2008] Chapter 40. Victoria, BC.

Queen's Printer. 2014a. *Greenhouse Gas Reduction (Cap and Trade) Act* [SBC 2008] Chapter 32. Victoria, BC.

Queen's Printer. 2014b. *Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act* [SBC 2008] Chapter 16. Victoria, BC.

Queen's Printer. 2014c. *Greenhouse Gas Reduction Targets Act* [SBC 2007] Chapter 42. Victoria, BC.

Queen's Printer for Canada. 2013. Canada Gazette Part I Volume 147, No. 44. Ottawa, ON.

1.6.65 Greenhouse Gas Emissions and Associated Climate Impacts

Reference:

i) Volume 5C: Air Quality and Greenhouse Gas Technical Report for the Trans Mountain Pipeline ULC: Trans Mountain Expansion Project: pages 219 and 224

ii) Volume 5A: Volume 5A: ESA – Biophysical Environmental Effects Assessment Section 5 (p. 5-95) Section 7 (pages 7-101)

iii) Volume 2: Chapter 3: Economic Impacts Associated With the Operation of the Trans Mountain Expansion

Preamble:

Over 50 years of emissions, the estimated global temperature increase from the project is 2.6 x 10^{-5}°C and 3.0 x 10^{-5} for the cumulative effect of the project. However, the methodology for calculating the climate change impact on environmental parameters in reference (i) is not explained. It is unclear how the estimated temperature increases are used to calculate the change in environmental parameters per degree of warming.

Furthermore, the magnitude of the impact of the GHG emissions from the construction and operation of pipeline is determined to be negligible. However, the induced emissions facilitated by increased capacity of the pipeline are not included in the estimated GHG emissions or in calculating the effect on the climate. For congruency and comparison with the direct, indirect, and induced economic benefits outlined in Reference (iii), a calculation of the induced GHG emissions from the project is required.

Request:

Please provide:

a) A detailed explanation of the method used to project global temperature increase due to project GHG emissions.

b) A detailed explanation of the method used to project the influence of global temperature increase on the environmental parameters outlined.

c) A rationale for the exclusion of global sea level rise from environmental parameters reported.

d) A detailed explanation of the assumptions and limitations of the methods used to calculate the impact of the project on the global climate and the associated changes in environmental parameters.

e) An estimated calculation of the rise in global temperature and associated impact on environmental parameters from the induced GHG emissions resulting from the increase transport capacity of the expanded pipeline. Sources of induced GHG emissions should include but are not limited to:
   i) GHG emissions associated with increased extraction and processing of petroleum products that will be transported through the expanded pipeline.
   ii) GHG emissions associated with burning of fossil fuels which would become available to the market as a result of the expanded pipeline.

iii) GHG emissions associated with the manufacture of pipeline and facilities materials and transport of those material to the pipeline and facility construction location.

iv) GHG emissions associated with induced economic activity outlined in Volume 2: Chapter 3: Economic Impacts Associated With the Operation of the Trans Mountain Expansion (Reference (iii)).

v) GHG emissions associated with the reinvestment of higher netbacks to Canadian Oil Producers outlined in Volume 2: Chapter 3: Economic Impacts Associated With the Operation of the Trans Mountain Expansion (Reference (iii)).

f) An analysis of the local, Provincial, and National socio-economic and environmental impacts resulting from changes in the environmental parameters due to GHG emissions from the project including the induced GHG emissions.

Response:

a) As outlined in Section 3.4.3.1 of the Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013), the National Research Council (2011) estimates an average global temperature increase of 0.47°C due to 1,000,000 Mt CO_2e emissions. Based on this estimate, total emissions from Trans Mountain operations were scaled to obtain the expected global temperature increase as a result of Project-related activities.

Reference:

National Research Council. 2011. Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia. The National Academies Press. Washington, DC.

b) As outlined in Section 3.4.3.1 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013), the National Research Council (2011) points out that changes in the climate system and physical environment (e.g., precipitation changes and decreases in crop yields) are proportional to cumulative greenhouse gas (GHG) emissions and global temperature increase. The low and high estimated changes in some of the environmental parameters per 1°C of global temperature increase were provided by the National Research Council. Based on this estimate, total emissions from the 50-year life of the Project were scaled to obtain the expected global temperature increase and the change in the outlined environmental parameters as a result of Trans Mountain activities.

Reference:

National Research Council. 2011. Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia. The National Academies Press. Washington, DC.

c) A relationship between cumulative carbon emissions and global sea level rise was not provided in National Research Council (2011). The information provided by the National Research Council was collected from the scientific literature based on output from earth system models which incorporate the carbon cycle into climate models. While global climate models simulate the response of the climate system to prescribed atmospheric

greenhouse gas (GHG) concentrations, Earth system models simulate the response of the climate system to prescribed GHG emissions. Since part of the carbon dioxide (CO_2) emissions is embedded in the carbon cycle, earth system models estimate atmospheric GHG concentrations as a result of GHG emissions. Earth system models suggests that changes in global temperature and other parameters listed in National Research Council (2011) are directly proportional to cumulative global GHG emissions (*i.e.,* independent of the time frame over which the emissions occurred). In particular, if GHG emissions stopped immediately, global temperatures would stabilize within a few years and remain constant for centuries. This, however, does not apply to global sea level rise. Because of the inertia in the response of the large inland ice sheets on Antarctica and Greenland, their melting would continue for much longer and continue to increase global sea level. Therefore, a simple linear relationship between Project GHG emissions and global sea level rise does not exist.

Reference:

National Research Council. 2011. Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia. The National Academies Press. Washington, DC.

d) The values in Tables 6.9 and 8.2 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013) were directly calculated from Project GHG emission estimates and National Research Council (2011). No further assumptions or limitations apply. Key methods and assumptions in National Research Council (2011) are summarized here. More details are provided in the literature cited therein.

Earth system models incorporate the carbon cycle into climate models. This adds computational effort to the models. Furthermore, the focus is less on an accurate representation of daily weather variations and representative statistics but on longer-term responses of the earth's system to carbon emissions; this includes, for example, the uptake of carbon over time scales of decades to centuries by forests and centuries to millennia by the oceans. Therefore, earth system models are run over centuries to millennia. To relieve the computational burden, earth system models are run at a coarser spatial resolution than global climate models, and processes that are computationally expensive may be parameterized rather than explicitly modelled. These simplifications might lead to less reliable regional information but are unlikely to introduce substantial errors into global averages.

It is also possible that some processes involving the carbon cycle are not well understood. Some of the associated uncertainties are captured by the uncertainty ranges in Tables 6.9 and 8.2 in Technical Report 5C-4 of Volume 5C. However, only a small number of earth system models and scenario runs are available. Therefore, the full range of possible realizations of the carbon cycle and other processes in the earth system models might not have been well explored and the uncertainty ranges might be an underestimate. However, even if the true ranges are twice as broad, they still provide an order-of-magnitude estimate.

In summary, best estimates and overall uncertainty ranges in Tables 6.9 and 8.2 in Technical Report 5C-4 of Volume 5C are currently the best available information and likely provide a reliable order-of-magnitude estimate of Project effects on overall climate change.

Reference:

National Research Council. 2011. Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia. The National Academies Press. Washington, DC.

e) The information request is not relevant to one or more of the issues identified in the National Energy Board's (NEB) List of Issues for the Trans Mountain Expansion Project. Assessment of upstream and downstream induced emissions is outside of the scope of the NEB Hearing Order (NEB 2014). Appendix I of Hearing Order OH-001-2014 indicates that "The National Energy Board does not intend to consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of the oil transported by the pipeline."

Reference:

National Energy Board. 2014. Trans Mountain Pipeline ULC Trans Mountain Expansion Project. File Number OF-Fac-Oil-T260-2013-03-02, Hearing Order OH-001-2014. 2 April 2014.

f) Climate change and greenhouse gas (GHG) management are global issues being dealt with by way of a variety of regulatory interventions. The obligation of a project-specific proponent is to ensure that emissions from its project are accounted for and ways to reduce those emissions are considered within the context of this evolving regulatory framework.

As explained in the following paragraphs, the requested analysis is not possible on the basis of currently available knowledge and understanding. Note that an assessment of upstream and downstream induced emissions is outside of the scope of the NEB Hearing Order (2014). Total direct and indirect GHG emissions from Project construction and 50 years of operation were included in the estimated Project effects on overall climate change in Tables 6.9 and 8.2 of Technical Report 5C-4 in Volume 5C, Air Quality and Greenhouse Gas Technical Report (RWDI December 2013). Global average changes associated with these emissions were derived from National Research Council (2011). This request is for an analysis of environmental and associated socio-economic impacts at smaller spatial scales (local, provincial, and national).

First, it is noted that impacts vary by regions smaller than Canada (for example, Pacific Northwest and Prairies), and therefore, regional impacts need to be aggregated to the national scale. The values in Tables 6.9 and 8.2 of Technical Report 5C-4 in Volume 5C were estimated by scaling global environmental changes (as predicted by earth system models) with the Project's contribution to global GHG emissions. Earth system models do not have sufficient spatial resolution and representation of daily weather variations to provide reliable predictions of environmental impacts at regional scales.

On the other hand, global circulation models that have sufficient resolution to provide information at regional scales do not include the carbon cycle and, therefore, cannot predict changes in environmental parameters from GHG emissions. The response of atmospheric GHG concentrations to global emissions has large uncertainties and depends on the emissions path. Therefore, predictions from earth system models based on GHG emissions cannot be compared with predictions from global circulation models based on atmospheric GHG concentrations. Finally, regional predictions of changes in multi-variable environmental parameters like droughts and wildfires are still unreliable even with the best available global circulation models (refer to the response to GoC EC IR No. 1.013). Substantial progress in numerical modelling and available computational hardware will be necessary to integrate the carbon cycle into global circulation models of sufficiently high spatial resolution to provide the requested analysis.

Without an understanding of the environmental impacts at regional scales, the socio-economic impacts cannot be assessed. At global scales, analyses of socio-economic impacts of climate change (Stern 2007) have been challenged, for example for their choice of discount rates of costs and benefits over the long periods (many decades) that are typically considered in climate science. Similar problems apply to national and smaller scales. Therefore, it remains an even greater challenge to perform analyses of socio-economic than environmental impacts at regional scales.

References:

National Energy Board. 2014. Trans Mountain Pipeline ULC Trans Mountain Expansion Project. File Number OF-Fac-Oil-T260-2013-01, Hearing Order OH-001-2014. 2 April 2014.

National Research Council. 2011. Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia. The National Academies Press. Washington, DC.

Stern, N. 2007. The Economics of Climate Change. Cambridge University Press.

1.7 Socio-Economics

1.7.01 The Economic Feasibility of the Proposed Project.

Reference:

i) Volume 2, Project Overview, Economics and General Information, PDF page 2-44
ii) Volume 2, Project Overview, Economics and General Information, Appendix C Direct Evidence of John J. Reed of Concentric Energy Advisors, Inc. to the National Energy Board

Preamble:

The evidence presented by John J. Reed of Concentric Energy Advisors, Inc to the National Energy Board includes a definition of economic feasibility:

"*The term "economic feasibility," as I have used it, addresses the justification and need for a project within an industry context and centers on the Board's criterion that a project be used and useful. Economic feasibility is dependent on whether adequate commodity supply exists, and whether there is market demand for a project, and examines the level of shipper support for a project.*" (Volume 2, Appendix C, page 7)

The definition of economic feasibility seems to exclude costs and benefits that occur outside of the industry context.

Request:

a) Why doesn't the definition of economic feasibility include justification of the project in the context of Canada and all the stakeholders within it as opposed to just the industry context?

b) How is the definition of economic feasibility different from the definition of financial feasibility?

Response:

a) As outlined in the Direct Evidence of Mr. Reed the criteria to use when considering economic feasibility has been discussed by the National Energy Board (NEB) in several past decisions. In addition, Section A.3 of the NEB's Filing Manual states that filing information related to economic viability should demonstrate that the applied-for facilities will be used, will be useful and that fixed charges will be paid and that sufficient funds will be available for abandonment requirements. Those criteria relate to the need for the project within the industry. The economic benefits related to the Trans Mountain Pipeline as discussed in the Conference Board of Canada report provide justification for the Project in the context of Canada and all of the stakeholders.

b) As stated by Mr. Reed on page 6 of his Direct Evidence:

> *"In my usage of these terms, "financial feasibility" refers to commercial matters and focuses on the Board's criteria regarding the ability of a project to be financed and whether a project's fixed charges are likely to be paid. Commercial*

matters include factors such as the fairness and efficiency of the tolling principles proposed and the contractual commitments that have been signed. The term "economic feasibility," as I have used it, addresses the justification and need for a project within an industry context and centers on the Board's criterion that a project be used and useful. Economic feasibility is dependent on whether adequate commodity supply exists, and whether there is market demand for a project, and examines the level of shipper support for a project."

1.7.02 Alternative project routes and marine terminal locations

Reference:

i) Volume 2, Project Overview, Economics and General Information, PDF page 17 of 43

Preamble:

In Reference (i) above Trans Mountain states that it did not consider fundamentally different alternatives, such as pipeline concepts to different destinations. Specifically, Trans Mountain states that the RH-001-2012 proceeding demonstrated the need and benefits of expanding the existing Trans Mountain Pipeline and, for these reasons, no effort was made to consider the economic feasibility or environmental effects of these or other conceptual alternatives.

Request:

a) Please list the costs and benefits that were considered in determining that there were no alternatives such as pipeline concepts to different destinations.

Response:

a) Please refer to the response to City of Burnaby IR No. 1.01.01a.

1.7.03 Benefits of Project

Reference:

i) Volume 2, Project Overview, Economics and General Information, Section 3.4: Benefits PDF
ii) Volume 2 Project Overview, Economics and General Information, pages 2-4 and 2-42

Preamble:

Reference (i) above refers to:

"*The construction and operation of the Project will provide substantial economic and fiscal benefits to Canada and its regions. There will be significant benefits to the parties directly involved, to all Western Canadian oil producers, and to all Canadians and their governments*."

In economics, there is a range of goods and services that provide value to humans. The total economic value of a good or service is not necessarily captured by the price of that good or service. In fact, many goods and services do not have a market price because they are not traded in a marketplace while nevertheless being of high value.

Reference (ii) states that the operations phase will boost the Canadian GDP by at least $13.3 billion over the first 20 years. It is also stated that oil producers' revenues are forecast to rise $45.4 billion over the first 20 years of the pipeline's operation having access to new markets through the project.

Request:

a) Please provide a list of the nonfiscal benefits accruing to Canadians that were considered in the application.

b) Please provide a list of the economic benefits that are not fiscal benefits that were considered in the application.

c) Please provide a list of methods/studies used to establish the value of nonmarket benefits generated by the project for Canadians.

d) Please indicate what portion of the benefits stated in Reference (ii) is directly related to the construction and operation of the project, and what portion is due to having access to new markets through the project (i.e. downstream and/or upstream of the project).

Response:

a) The term nonfiscal is not defined in the information request. The term fiscal as used in the application refers to revenue to government; therefore, it is assumed that the term nonfiscal is meant to include benefits to parties other than governments. The Conference Board of Canada report on economic benefits, presented in Volume 2, Appendix B of the Application, provides estimates of the employment, Gross Domestic Product (GDP), and fiscal impacts associated with both the development and operation phases of the Project. The Direct Evidence of Steven Kelly of IHS Global Canada, presented in Volume 2, Appendix A of the Application, also discusses the benefits of the Project and quantifies these benefits in the form of higher netbacks (prices) for oil

producers. A summary of estimated economic effects of Project development and operations in Canada, including gross output, Gross Domestic Product (GDP), provincial and federal tax revenue, labour income and employment effects is presented in the Application under Section 3.4 of Volume 2 and also presented in Tables 7.2.7-4, 7.2.7-5 and 7.2.7-6 of Volume 5B. Section 7.2.7 of Volume 5B also discusses regional and local economic benefits anticipated in relation to the Project, including potential effects related to regional employment, municipal economies, contracting and procurement, and training and capacity development.

b) For a discussion of non-fiscal benefits please refer to the response to Metro Vancouver IR No. 1.1.7.03a. These and other non-fiscal benefits anticipated within Metro Vancouver include:

- Community Investment - The Kinder Morgan Foundation has donated almost $2M in grants to youth organizations which support education and art programs benefitting youth in grades K-12 in many communities where Kinder Morgan operates, as is described in Table 1.7.2, Section 1.7.2 and Table 1.7.4, Section 1.7.4, Volume 3A of the Application. This includes more than $350,000 in community investments in Burnaby since 2007.

- Community Benefits - Trans Mountain is committed to investing in community benefits initiatives in municipalities and regions crossed by the Trans Mountain Expansion Project (the Project). Trans Mountain intends to contribute to community benefits in communities where it operates and has initiated discussions with local governments and organizations to explore community benefit opportunities related to its priority areas of environment; safety, emergency preparedness and response; ecological off-sets, community investment and education.

- Capital Investment - The Project is a $5.5B capital investment, as outlined in Section 3.2.2, Volume 2. This includes capital costs of approximately $450M for the construction of the Westridge Tank Terminal and approximately $300M for the construction of the Westridge Marine Terminal, to which many of the construction related benefits will accrue to the Metro Vancouver region.

- Employment and Workforce Spending - The Metro Vancouver region will have the largest workforce requirements, with construction activities anticipated during the full construction period. The required workforce in the Metro Vancouver region will average about 655 workers and will peak about 1,200 workers in October 2016. It is estimated that approximately 30 per cent would be local hires, as described in Table 7.2.7-7, Section 7.2.7, Volume 5B. It is estimated that these workers would spend more than $100M locally during construction on goods and services such as accommodations and meals, as is described in Table 7.2.7-13, Section 7.2.7, Volume 3A.

- Ongoing Operations - A significant number of additional tradespeople, terminal operations personnel and other technical and supervisory staff, relative to current levels, will be directly employed to operate and maintain the expanded Trans

Mountain system, as noted in Section 4.1, Volume 4C. It is anticipated that 40 to 45 operations and maintenance personnel will be required at field locations in BC, including Burnaby. The additional field operations and maintenance staff, as well as Control Centre Operators will be recruited in advance of the start-up of the expanded system, to allow for appropriate training to take place.

c) Trans Mountain did not complete a study to quantify nonmarket benefits (and costs) generated by the Trans Mountain Expansion Project (the Project). The level of detail provided in the Application regarding potential adverse effects, benefits and opportunities associated with the Project meets the requirements of the National Energy Board (NEB) Filing Manual (NEB 2014) and allows for an issues-focused assessment of potential effects suitable to assist in federal-level regulatory decision-making. It also allows for a the determination of appropriate mitigation and management measures by Trans Mountain to avoid or reduce adverse effects and enhance the local, regional, Aboriginal and Canadian benefits associated with the Project.

d) The economic impacts associated with the project (using the minimum scenario for operations, which does not include any non-firm volume) include the following:

	Development	**20 years of operations**
Person-years of employment	58,037	50,273
GDP (Millions of 2012$)	4,852	13,323

GDP and employment impacts associated with higher netbacks were not calculated, but the fiscal impacts were. In the base case, the fiscal impacts break down in the following way:

	Development	**20 years of operations**	**Higher netbacks**
Fiscal impact (millions of 2012$)	1,214	2,549	14,720

Thus, the higher netbacks account for about 80% of the increase in government revenues that are attributable to the Expansion Project.

1.7.04 Costs of Project

Reference:

i) Volume 2, Project Overview, Economics and General Information, Section 3.4: Benefits PDF

Preamble:

There appears to be no accounting of nonmarket costs in the application.

Request:

a) Please provide a list of the nonmarket costs borne by Canadians that were considered in the application.

b) Please provide a list of methods/studies used to establish the value of nonmarket costs generated by the project for Canadians.

Response:

a) Please refer to the response to Metro Vancouver IR No. 1.1.7.03c.

b) Please refer to the response to Metro Vancouver IR No. 1.1.7.03c.

1.7.05 Social Costs/Damage Costs

Reference:

i) SOR/2013-24 February 22, 2013 - CANADIAN ENVIRONMENTAL PROTECTION ACT, 1999, Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations (2013), Regulatory Impact Analysis Statement, Section 7. Benefits and Costs, http://gazette.gc.ca/rp-pr/p2/2013/2013-03-13/html/sor-dors24-eng.html (attachment)

ii) Federal Register – The Daily Journal of the United States Government - Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order No. 12866, https://www.federalregister.gov/articles/2014/01/27/2014-01605/technical-support-document-technical-update-of-the-social-cost-of-carbon-for-regulatory-impact (attachment)

Preamble:

Most of the benefits (including the upstream and downstream of the project) were quantified and presented in the application. However, it does not appear that any of the social costs associated with the project were quantified or included in the application. There is social cost of carbon that most of the large energy companies, Environment Canada (Reference (i)) and the U.S. Government (Reference (ii)) consider in assessing the social cost of a new project or an amendment to an existing project.

There is also damage costs developed for air pollutants such as PM_{10}, $PM_{2.5}$, diesel PM, SO_2, NO_x, VOCs and various air toxics that are harmful for human health. These damage costs are often used to determine the societal costs per tonne of pollutant released to the atmosphere.

Request:

a) Please provide:
   i) a detailed list of social cost items included in the socio-economic analysis; what type of social-costs were considered but not included, and what criteria was used in excluding those social-cost items from further consideration.
   ii) details of the quantification methodology for all social-cost items considered in the socio-economic analysis.

b) Please quantify the social cost of carbon for the project to give an indication of the societal costs compared to the economic benefits of the project.

c) Please quantify the damage cost associated with the air pollutants to give an indication of the societal costs compared to the economic benefits of the project.

Response:

a) Please refer to the responses to Metro Vancouver IR No. 1.1.7.03c and Allan R IR No. 1.01x.

b) Trans Mountain disagrees that most of the upstream and downstream benefits of the project were identified. For example, a portion of the higher netbacks to producers estimated in the IHS report may be reinvested in the Western Canada Sedimentary

Basin, but such benefits were not been included in the Conference Board economic benefits report because they are not relevant to the List of Issues identified by the National Energy Board for the Project.

Please refer to the responses to Metro Vancouver IR No. 1.1.7.03c and Allan R IR No. 1.01x.

c) Please refer to the responses to Metro Vancouver IR No. 1.1.7.03c and Allan R IR No. 1.01x.

1.7.06 Discount Rate

Reference:

i) Volume 2, Project Overview, Economics and General Information, Section 3.4: Benefits PDF

Preamble:

In benefit cost analysis and financial analysis, the feasibility of a project depends on the net present value of the benefits and costs. The net present value in turn is affected by the discount rate.

Request:

a) Please provide the discount rates used in the benefit cost analysis in the application and provide the rationale for using those rates.

b) Please provide the discount rates used in the financial analysis in the application and provide the rationale for using those rates.

Response:

a) Trans Mountain has not completed a benefit cost analysis, nor is it required by the NEB to assess the Project. The economic benefits outlined in the Application do not represent an investment analysis for the Project, either from an owner's or shipper's perspective. A present value analysis was not required nor is it appropriate to address the issue examined in the IHS and Conference Board reports, i.e. the benefits resulting from the development of additional pipeline infrastructure. Therefore, discount rates were not required and are not relevant to the Application. Please also refer to the responses to Metro Vancouver IR No. 1.1.7.03c, and Allan R IR No. 1.01x, 1.08y and 1.08z.

b) Please refer to the response to Metro Vancouver IR No. 1.1.7.06a.