Trans Mountain Pipeline ULC
Trans Mountain Expansion Project
NEB Hearing Order OH-001-2014
Responses to Information Request from Raincoast Conservation Foundation

Qualifications of Technical Report Authors

1.01 Identification and qualification of technical report authors

Reference:

i) National Energy Board, Intervenor Workshop, Part 1: Written Submissions, Trans Mountain Expansion Project, April 2014, online at http://www.neb-one.gc.ca/clfnsi/rthnb/pplctnsbfrthnb/trnsmntnxpnsn/trnsmntnxpnsnprsnttn/ntrvnrwrkshp-eng.pdf, at 11.
ii) References identified in Tables A and B below.

Preamble:

For the technical reports identified in Table A below, a corporate author is identified, but the individual authors of the report are not identified. Therefore, it is impossible for Interveners or the Board to assess the qualifications and expertise of the authors of the technical report.

Similarly, for the technical reports identified in Table B below, individual authors are identified but no information is provided on the qualifications of the authors of the report.

It is impossible for the Interveners and the Board to determine the relative weight to be assigned to expert reports and opinions when the qualifications of the authors are not set out in the technical reports.

In Reference (i), the Board has indicated that Interveners should set the context for their written submission by describing their expertise. Fairness would dictate that Trans Mountain also establish the expertise of their consultants.

Request:

a) For the technical reports identified in Table A below, please provide the names of the individual authors and curriculum vitae setting out the author(s)' qualifications.

Table A

Ref. No.	Report Title	Corporate Author
A3S1U8 through A3S1W4	Groundwater Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Waterline Resources Inc.
A3S1W6 through A3S1Z6	Fisheries (Alberta) Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants

Ref. No.	Report Title	Corporate Author
A3S2C1 through A3S2G5	Fisheries (British Columbia) Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Triton Environmental Consultants Ltd.
A3S2H5 through A3S2I5	Wetland Evaluation Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants
A3S2I7 through A3S2Q2	Vegetation Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants
A3S2Q3 through A3S2R4	Wildlife Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants
A3S2R5	Wildlife Modelling and Species Accounts Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants
A3S2R6	Marine Sediment and Water Quality, Westridge Marine Terminal, Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Stantec Consulting Ltd.
A3S2R7	Marine Resources, Westridge Marine Terminal, Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Stantec Consulting Ltd.
A3S2R8	Marine Birds, Westridge Marine Terminal, Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Stantec Consulting Ltd.
A3S4J5 pages 1-118	Marine Resources, Marine Transportation Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Stantec Consulting Ltd.
A3S4J6	Marine Birds, Marine Transportation Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Stantec Consulting Ltd.
A3S4K3	Traditional Marine Resource Use – Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	TERA Environmental Consultants
A3S4K4 A3S4K5 A3S4K6	Marine Commercial, Recreation and Tourism Use - Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	TERA Environmental Consultants
A3S4K7	Ecological Risk Assessment of Marine Tanker Spills, Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Stantec Consulting Ltd.
A3S4R1	Screening Level Human Health Risk Assessment of Marine Transportation, Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Intrinsik Environmental Sciences Inc.
A3S4R2	Qualitative Human Health Risk Assessment of Marine Transportation Spills, Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Intrinsik Environmental Sciences Inc.

Ref. No.	Report Title	Corporate Author
A3S4R8 pages 50-74	Projections of Vessel Movements Report	Seaport Consultants Canada Inc.
A3S4S0 through A3S4S7	TERMPOL 3.3 – Fishery Resources Survey, Trans Mountain Expansion Project	TERA Environmental Consultants Stantec Consulting Ltd.
A3S4T0	Trans Mountain Pipeline ULC, Trans Mountain Expansion Project Simulation Study, Analysis of Second Narrows Transits	Ausenco
A3S4X4, pages 39-40; A3S4X5 through A3S4Y2; A3S4Y3, pages 1-285	Application, Vol. 8A – Marine Transportation, Section 4.0, Environmental and Socio-Economic Assessment	Rowan Williams Davies and Irwin Inc. Stantec Consulting Ltd. TERA Environmental Consultants Intrinsik Environmental Services Inc. Vista Strategy Corp.
A3S5G2 A3S5G4 A3S5G5	A Study of Fate and Behavior of Diluted Bitumen Oils on Marine Waters	Witt Obrien's Polaris Applied Sciences Western Canada Marine Response Corporation
A3S5G7	A Comparison of the Properties of Diluted Bitumen Crudes with Other Oils	Polaris Applied Sciences Inc.
A3S5I9	Review of Trans Mountain Expansion Project Future Oil Spill Response Approach Plan Recommendations on Bases and Equipment	Western Canada Marine Response Corporation

b) For the technical reports identified in Table B below, please provide curriculum vitae setting out the qualifications of the named authors.

Table B

Ref. No.	Report Title	Corporate Author	Personal Author(s)
A3S1T3	Trans Mountain Pipeline ULC, Trans Mountain Expansion Project, Acid Rock Drainage and Metal Leaching Potential	BGC Engineering Inc.	Tracye Davies Alex Baumgard Rob Marsland
A3S1T4 A3S1T5 A3S1T6	Soils Technical Report for the Trans Mountain Expansion Project	Mentiga Pedology Consultants Ltd.	A.G. Twardy B. Cernipeski
A3S1T7 A3S1T8 A3S1T9	Terrestrial Noise and Vibration Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Project	RWDIAIR Inc.	Teresa Drew Craig Vatcher Aaron Haniff Gillian Redman Gerrit Atkinson Erica Stolp Matthew Johnston Nghi Nguyen Matthew Sawycky Dave Horrocks

Ref. No.	Report Title	Corporate Author	Personal Author(s)
A3S1U0 A3S1U1 A3S1U2 A3S1U3, pages 1-33 A3S1U4, pages 11-53, A3S1U5 A3S1U6 A3S1U7	Air Quality and Greenhouse Gas Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Project	RWDIAIR Inc.	David Chadder Craig Vatcher Christian Reuten Nancy Chan Julia Veerman Jyotsna Kashyap Golnoosh Bizhani Noam Bar-Nahoum
A3S1U3, pages 34-53 A3S1U4, pages 1-10	Community Multi-scale Air Quality (CMAQ) Modelling for the Trans Mountain Expansion Project	RWDIAIR Inc.	David Chadder Jeff Lundgren Martin Gauthier Saba Hajaaghassi Christian Reuten
A3S4J5 pages 119-173	Underwater Noise Modelling for Trans Mountain Expansion Project, Burrard Inlet, Gulf Islands and Juan de Fuca Strait	Jasco Applied Sciences	Zizheng Li Alexander MacGillivray
A3S4J7 A3S4J8 A3S4J9 A3S4K0	Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Final Report	RWDIAIR Inc.	David Chadder Craig Vatcher Nancy Chan Trudi Trask Alena Saprykina Michelle Seguin Julia Veerman
A3S4K1	Community Multi-scale Air Quality (CMAQ) Modelling for Trans Mountain Expansion Pipeline Project: Final Report	RWDIAIR Inc.	David Chadder Jeff Lundgren Martin Gauthier Saba Hajaghassi Christian Reuten
A3S4K2	Marine Noise (Atmospheric) – Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Final Report	RWDAIR Inc.	Teresa Drew Craig Vatcher Nghi Nguyen
A3S4R6	TERMPOL 3.1 – Introduction, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres
A3S4R7 A3S4R8 pages 1-49	TERMPOL 3.2 – Origin, Destination and Marine Traffic Volume Survey	Moffatt & Nichol	James Traber Ron Byres
A3S4R9	Traffic Statistics for 2012	Det Norske Veritas	Vincent Demay Ole Oystein Aspholm Nick Roper
A3S4S8	TERMPOL 3.6 – Special Underkeel Clearance Survey, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres
A3S4S9	TERMPOL 3.7 – Transit Time & Delay Survey, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres

Ref. No.	Report Title	Corporate Author	Personal Author(s)
A3S4T1	TERMPOL 3.8 – Casualty Data Survey, Trans Mountain Expansion Project	Det Norske Veritas (U.S.A.) Inc.	Vincent Demay Ole Oystein Aspholm Nick Roper
A3S4T2	TERMPOL 3.9 – Ship Specifications, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres
A3S4T3	TERMPOL 3.10 – Site Plans and Technical Data, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres
A3S4T4	Westridge Marine Terminal 2013 Interm[sic] Meteorological Report	EBA	Robert E Draho James Stronach
A3S4T5	Oceanographic Observations at Trans Mountain's Westridge Marine Terminal	EBA	Justin Rogers James Stronach
A3S4T6	TERMPOL 3.11 – Cargo Transfer and Transshipment Systems, Trans Mountain Expansion Project	L.J. Swann & Associates Moffatt & Nichol	Capitan John Swann James Traber Ron Byres
A3S4T7	TERMPOL 3.5 & 3.12 – Route Analysis & Anchorage Elements, Trans Mountain Expansion Project	L.J. Swann & Associates Moffatt & Nichol	Capitan John Swann James Traber Ron Byres
A3S4U0 through A3S4U4	Summary Report of Manoeuvring Assessment, Westridge Terminals Vancouver Expansion, Design Options 11 and 12	LANTEC Marine Inc.	Garland Hardy Bikramjit Kanjilal
A3S4U6 through A3S4U9	Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion	EBA	Albert Leung Travis Miguez James Stronach
A3S4V0	TERMPOL 3.13 – Berth Procedures and Provisions, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres
A3S5F4 A3S5F6 A3S5F8	TERMPOL 3.15 – General Risk Analysis and Intended Methods of Reducing Risks, Trans Mountain Expansion Project	Det Norske Veritas (U.S.A.) Inc.	Ole Aspholm Vincent Demay Tim Fowler Per Sollie Nick Roper
A3S5G0	An Evaluation of Local Escort and Rescue Tug Capabilities in Juan de Fuca Strait	Robert Allan Ltd.	Mike Phillips Robert G. Allan
A3S5G9 through A3S5I7	Modelling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project	EBA	Aurelien Hospital Travis Miguez James Stronach
A3S5I8	Methods for Estimating Shoreline Oil Retention	Coastal and Ocean Resources	John R. Harper
A3S5J0 through A3S5J5	Trans Mountain Expansion Project Oil Spill Response Simulation Study, Arachne Reef and Westridge Marine Terminal	EBA Western Canada Marine Response Corporation	Aurelien Hospital James Stronach M.W. McCarthy Mark Johncox

Ref. No.	Report Title	Corporate Author	Personal Author(s)
A3S5J7	TERMPOL 3.16 & 3.17 – Port Information and Terminal Operations Manual, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres
A3S5J9	TERMPOL 3.18 – Contingency Planning	Moffatt & Nichol	James Traber Ron Byres
A3S5K1	TERMPOL 3.19 – Oil Handling Facilities Requirements	Moffatt & Nichol	James Traber Ron Byres

Response:

a) Resumes for the authors listed in Table A are attached to this response as follows.

Report Title	Corporate Author	Lead Authors	Attachment File Name
Groundwater Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Waterline Resources Inc.	Andrzej Slawinski Darren David David van Everdingen Steven Foley	• Raincoast IR. No. 1.01a-Slawinski-Resume • Raincoast IR. No. 1.01a-David-Resume • Raincoast IR. No. 1.01a-vanEverdingen-Resume • Raincoast IR. No. 1.01a-Foley-Resume
Fisheries (Alberta) Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants	Greg Eisler	• Raincoast IR. No. 1.01a-Eisler-Resume
Fisheries (British Columbia) Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Triton Environmental Consultants Ltd.	Ian Emerson	• Raincoast IR. No. 1.01a-Emerson-Resume
Wetland Evaluation Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants	Joanne Mauthner	• Raincoast IR. No. 1.01a-Mauthner-Resume
Vegetation Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants	Amy Griffiths	• Raincoast IR. No. 1.01a-Griffiths-Resume
Wildlife Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants	Lois Pittaway Jody Bremner	• Raincoast IR. No. 1.01a-Pittaway-Resume • Raincoast IR. No. 1.01a-Bremner-Resume
Wildlife Modelling and Species Accounts Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	TERA Environmental Consultants	Lois Pittaway Jody Bremner	• Raincoast IR. No. 1.01a-Pittaway-Resume • Raincoast IR. No. 1.01a-Bremner-Resume
Marine Sediment and Water Quality, Westridge Marine Terminal, Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Stantec Consulting Ltd.	Karen Munro	• Raincoast IR. No. 1.01a-Munro-Resume

Report Title	Corporate Author	Lead Authors	Attachment File Name
Marine Resources, Westridge Marine Terminal, Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Stantec Consulting Ltd.	Stefan Dick Andrea Ahrens	• Raincoast IR. No. 1.01a-Dick-Resume • Raincoast IR. No. 1.01a-Ahrens-Resume
Marine Birds, Westridge Marine Terminal, Technical Report for Trans Mountain Pipeline ULC, Trans Mountain Expansion Project	Stantec Consulting Ltd.	Billi Gowans Marcel Gahbauer	• Billi Gowans is no longer with the Project, however, her area of expertise is covered under Marcel Gahbauer • Raincoast IR. No. 1.01a-Gahbauer-Resume
Marine Resources, Marine Transportation Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Stantec Consulting Ltd.	Stefan Dick Andrea Ahrens	• Raincoast IR. No. 1.01a-Dick-Resume • Raincoast IR. No. 1.01a-Ahrens-Resume
Marine Birds, Marine Transportation Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Stantec Consulting Ltd.	Billi Gowans Marcel Gahbauer	• Billi Gowans is no longer with the Project, however, her area of expertise is covered under Marcel Gahbauer • Raincoast IR. No. 1.01a-Gahbauer-Resume
Traditional Marine Resource Use – Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	TERA Environmental Consultants	Wanda Lewis	• Raincoast IR. No. 1.01a-Lewis-Resume
Marine Commercial, Recreation and Tourism Use - Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	TERA Environmental Consultants	Susan Dowse Nina Barton	• Raincoast IR. No. 1.01a-Dowse-Resume • Raincoast IR. No. 1.01a-Barton-Resume
Ecological Risk Assessment of Marine Tanker Spills, Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Stantec Consulting Ltd.	John Henderson	• Raincoast IR. No. 1.01a-Henderson-Resume
Screening Level Human Health Risk Assessment of Marine Transportation, Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Intrinsik Environmental Sciences Inc.	Christine McFarland Donald Davies	• Raincoast IR. No. 1.01a-McFarland-Resume • Raincoast IR. No. 1.01a-Davies-Resume
Qualitative Human Health Risk Assessment of Marine Transportation Spills, Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project	Intrinsik Environmental Sciences Inc.	Christine McFarland Donald Davies	• Raincoast IR. No. 1.01a-McFarland-Resume • Raincoast IR. No. 1.01a-Davies-Resume

Report Title	Corporate Author	Lead Authors	Attachment File Name
Projections of Vessel Movements Report	Seaport Consultants Canada Inc.	Terence Smyth	• Raincoast IR. No. 1.01a-Smyth-Resume
TERMPOL 3.3 – Fishery Resources Survey, Trans Mountain Expansion Project	TERA Environmental Consultants Stantec Consulting Ltd.	Susan Dowse Nina Barton Stefan Dick	• Raincoast IR. No. 1.01a-Dowse-Resume • Raincoast IR. No. 1.01a-Barton-Resume • Raincoast IR. No. 1.01a-Dick-Resume
Trans Mountain Pipeline ULC, Trans Mountain Expansion Project Simulation Study, Analysis of Second Narrows Transits	Ausenco	Shaolin Tsui	• Raincoast IR. No. 1.01a-Tsui-Resume
Application, Vol. 8A – Marine Transportation, Section 4.0, Environmental and Socio-Economic Assessment	Rowan Williams Davies and Irwin Inc. Stantec Consulting Ltd. TERA Environmental Consultants Intrinsik Environmental Services Inc. Vista Strategy Corp.	David Chadder Craig Vatcher Nancy Chan Aaron Haniff Trudi Trask Alena Saprykina Michelle Seguin Julia Veerman Teresa Drew Nghi Nguyen Stefan Dick Karen Munro Billi Gowans Marcel Gahbauer Andrea Ahrens Christine McFarland Donald Davies Susan Dowse Nina Barton	• Raincoast IR. No. 1.01a-Chadder-Resume • Raincoast IR. No. 1.01a-Vatcher-Resume • Raincoast IR. No. 1.01a-Chan-Resume • Raincoast IR. No. 1.01a-Haniff-Resume • Raincoast IR. No. 1.01a-Trask-Resume • Raincoast IR. No. 1.01a-Saprykina-Resume • Raincoast IR. No. 1.01a-Seguin-Resume • Raincoast IR. No. 1.01a-Veerman-Resume • Raincoast IR. No. 1.01a-Drew-Resume • Raincoast IR. No. 1.01a-Nguyen-Resume • Raincoast IR. No. 1.01a-Dick-Resume • Raincoast IR. No. 1.01a-Munro-Resume • Billi Gowans is no longer with the Project, however, her area of expertise is covered under Marcel Gahbauer • Raincoast IR. No. 1.01a-Gahbauer-Resume • Raincoast IR. No. 1.01a-Ahrens-Resume • Raincoast IR. No. 1.01a-McFarland-Resume • Raincoast IR. No. 1.01a-Davies-Resume • Raincoast IR. No. 1.01a-Dowse-Resume • Raincoast IR. No. 1.01a-Barton-Resume

Report Title	Corporate Author	Lead Authors	Attachment File Name
A Study of Fate and Behavior of Diluted Bitumen Oils on Marine Waters	Witt Obrien's Polaris Applied Sciences Western Canada Marine Response Corporation	Elliott Taylor Gregory Challenger Andrew Graham Jose Rios Mark Johncox Jim Morris Pamela Chelgren-Koterba M.W. McCarthy	• Raincoast IR. No. 1.01a-Taylor-Resume • Raincoast IR. No. 1.01a-Challenger-Resume • Raincoast IR. No. 1.01a-Graham-Resume • Raincoast IR. No. 1.01a-Rios-Resume • Raincoast IR. No. 1.01a-Johncox-Resume • Raincoast IR. No. 1.01a-Morris-Resume • Raincoast IR. No. 1.01a-Chelgren-Koterba-Resume • Raincoast IR. No. 1.01a-McCarthy-Resume
A Comparison of the Properties of Diluted Bitumen Crudes with Other Oils	Polaris Applied Sciences Inc.	Elliott Taylor Gregory Challenger Andrew Graham Jose Rios	• Raincoast IR. No. 1.01a-Taylor-Resume • Raincoast IR. No. 1.01a-Challenger-Resume • Raincoast IR. No. 1.01a-Graham-Resume • Raincoast IR. No. 1.01a-Rios-Resume
Review of Trans Mountain Expansion Project Future Oil Spill Response Approach Plan Recommendations on Bases and Equipment	Western Canada Marine Response Corporation	Mark Johncox	• Raincoast IR. No. 1.01a-Johncox-Resume

b) Resumes for the authors listed in Table B are attached to this response as follows.

Report Title	Corporate Author	Personal Author(s)	Attachment Names
Trans Mountain Pipeline ULC, Trans Mountain Expansion Project, Acid Rock Drainage and Metal Leaching Potential	BGC Engineering Inc.	Tracye Davies Alex Baumgard Rob Marsland	• Raincoast IR. No. 1.01b-Davies-Resume • Raincoast IR. No. 1.01b-Baumgard-Resume • Raincoast IR. No. 1.01b-Marsland-Resume
Soils Technical Report for the Trans Mountain Expansion Project	Mentiga Pedology Consultants Ltd.	A.G. Twardy B. Cernipeski	• Raincoast IR. No. 1.01b-Twardy-Resume • Raincoast IR. No. 1.01b-Chernipeski-Resume

Report Title	Corporate Author	Personal Author(s)	Attachment Names
Terrestrial Noise and Vibration Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Project	RWDI AIR Inc.	Teresa Drew Craig Vatcher Aaron Haniff Gillian Redman Gerrit Atkinson Erica Stolp Matthew Johnston Nghi Nguyen Matthew Sawycky Dave Horrocks	• Raincoast IR. No. 1.01b-Drew-Resume • Raincoast IR. No. 1.01b-Vatcher-Resume • Raincoast IR. No. 1.01b-Haniff-Resume • Raincoast IR. No. 1.01b-Redman-Resume • Raincoast IR. No. 1.01b-Atkinson-Resume • Raincoast IR. No. 1.01b-Stolp-Resume • Raincoast IR. No. 1.01b-Johnson-Resume • Raincoast IR. No. 1.01b-Nguyen-Resume • Raincoast IR. No. 1.01b-Sawycky-Resume • Raincoast IR. No. 1.01b-Horrocks-Resume
Air Quality and Greenhouse Gas Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Project	RWDI AIR Inc.	David Chadder Craig Vatcher Christian Reuten Nancy Chan Julia Veerman Jyotsna Kashyap Golnoosh Bizhani Noam Bar-Nahoum	• Raincoast IR. No. 1.01b-Chadder-Resume • Raincoast IR. No. 1.01b-Vatcher-Resume • Raincoast IR. No. 1.01b-Reuten-Resume • Raincoast IR. No. 1.01b-Chan-Resume • Raincoast IR. No. 1.01b-Veerman-Resume • Raincoast IR. No. 1.01b-Kashyap-Resume • Raincoast IR. No. 1.01b-Bizhani-Resume • Raincoast IR. No. 1.01b-Bar-Nahoum-Resume
Community Multi-scale Air Quality (CMAQ) Modelling for the Trans Mountain Expansion Project	RWDI AIR Inc.	David Chadder Jeff Lundgren Martin Gauthier Saba Hajaaghassi Christian Reuten	• Raincoast IR. No. 1.01b-Chadder-Resume • Raincoast IR. No. 1.01b-Lundgren-Resume • Raincoast IR. No. 1.01b-Gauthier-Resume • Saba Hajaaghassi is no longer with the Project, however, her area of expertise is covered under Jeff Lundgren and Martin Gauthier. • Raincoast IR. No. 1.01b-Reuten-Resume
Underwater Noise Modelling for Trans Mountain Expansion	Jasco Applied Sciences	Zizheng Li Alexander	• Raincoast IR. No. 1.01b-Li-Resume

Report Title	Corporate Author	Personal Author(s)	Attachment Names
Project, Burrard Inlet, Gulf Islands and Juan de Fuca Strait		MacGillivray	• Raincoast IR. No. 1.01b-MacGillivray-Resume
Marine Air Quality and Greenhouse Gas Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Final Report	RWDI AIR Inc.	David Chadder Craig Vatcher Nancy Chan Trudi Trask Alena Saprykina Michelle Seguin Julia Veerman	• Raincoast IR. No. 1.01b-Chadder-Resume • Raincoast IR. No. 1.01b-Vatcher-Resume • Raincoast IR. No. 1.01b-Chan-Resume • Raincoast IR. No. 1.01b-Trask-Resume • Raincoast IR. No. 1.01b-Saprykina-Resume • Raincoast IR. No. 1.01b-Seguin-Resume • Raincoast IR. No. 1.01b-Veerman-Resume
Community Multi-scale Air Quality (CMAQ) Modelling for Trans Mountain Expansion Pipeline Project: Final Report	RWDI AIR Inc.	David Chadder Jeff Lundgren Martin Gauthier Saba Hajaaghassi Christian Reuten	• Raincoast IR. No. 1.01b-Chadder-Resume • Raincoast IR. No. 1.01b-Lundgren-Resume • Raincoast IR. No. 1.01b-Gauthier-Resume • Saba Hajaaghassi is no longer with the Project, however, her area of expertise is covered under Jeff Lundgren and Martin Gauthier. • Raincoast IR. No. 1.01b-Reuten-Resume
Marine Noise (Atmospheric) – Marine Transportation Technical Report for Trans Mountain Pipeline ULC Trans Mountain Expansion Project, Final Report	RWDI AIR Inc.	Teresa Drew Craig Vatcher Nghi Nguyen	• Raincoast IR. No. 1.01b-Drew-Resume • Raincoast IR. No. 1.01b-Vatcher-Resume • Raincoast IR. No. 1.01b-Nguyen-Resume
TERMPOL 3.1 – Introduction, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.2 – Origin, Destination and Marine Traffic Volume Survey	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
Traffic Statistics for 2012	Det Norske Veritas	Vincent Demay Ole Oystein Aspholm Nick Roper	• Raincoast IR. No. 1.01b-Demay-Resume • Raincoast IR. No. 1.01b-Aspholm-Resume • Raincoast IR. No. 1.01b-Roper-Resume

Report Title	Corporate Author	Personal Author(s)	Attachment Names
TERMPOL 3.6 – Special Underkeel Clearance Survey, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.7 – Transit Time & Delay Survey, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.8 – Casualty Data Survey, Trans Mountain Expansion Project	Det Norske Veritas (U.S.A.) Inc.	Vincent Demay Ole Oystein Aspholm Nick Roper	• Raincoast IR. No. 1.01b-Demay-Resume • Raincoast IR. No. 1.01b-Aspholm-Resume • Raincoast IR. No. 1.01b-Roper-Resume
TERMPOL 3.9 – Ship Specifications, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.10 – Site Plans and Technical Data, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
Westridge Marine Terminal 2013 Interm[sic] Meteorological Report	EBA	Robert E Draho James Stronach	• Raincoast IR. No. 1.01b-Draho-Resume • Raincoast IR. No. 1.01b-Stronach-Resume
Oceanographic Observations at Trans Mountain's Westridge Marine Terminal	EBA	Justin Rogers James Stronach	• Raincoast IR. No. 1.01b-Rogers-Resume • Raincoast IR. No. 1.01b-Stronach-Resume
TERMPOL 3.11 – Cargo Transfer and Transshipment Systems, Trans Mountain Expansion Project	L.J. Swann & Associates Moffatt & Nichol	Capitan John Swann James Traber Ron Byres	• Raincoast IR. No. 1.01b-Swann-Resume • Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.5 & 3.12 – Route Analysis & Anchorage Elements, Trans Mountain Expansion Project	L.J. Swann & Associates Moffatt & Nichol	Capitan John Swann James Traber Ron Byres	• Raincoast IR. No. 1.01b-Swann-Resume • Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
Summary Report of Manoeuvring Assessment, Westridge Terminals Vancouver Expansion, Design Options 11 and 12	LANTEC Marine Inc.	Garland Hardy Bikramjit Kanjilal	• Raincoast IR. No. 1.01b-Hardy-Resume • Raincoast IR. No. 1.01b-Kanjilal-Resume
Meteorological and Oceanographic Data Relevant to the Proposed Westridge Terminal Shipping Expansion	EBA	Albert Leung Travis Miguez James Stronach	• Raincoast IR. No. 1.01b-Leung-Resume • Raincoast IR. No. 1.01b-Miguez-Resume • Raincoast IR. No. 1.01b-Stronach-Resume

Report Title	Corporate Author	Personal Author(s)	Attachment Names
TERMPOL 3.13 – Berth Procedures and Provisions, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.15 – General Risk Analysis and Intended Methods of Reducing Risks, Trans Mountain Expansion Project	Det Norske Veritas (U.S.A.) Inc.	Ole Aspholm Vincent Demay Tim Fowler Per Sollie Nick Roper	• Raincoast IR. No. 1.01b-Aspholm-Resume • Raincoast IR. No. 1.01b-Demay-Resume • Raincoast IR. No. 1.01b-Fowler-Resume • Raincoast IR. No. 1.01b-Sollie-Resume • Raincoast IR. No. 1.01b-Roper-Resume
An Evaluation of Local Escort and Rescue Tug Capabilities in Juan de Fuca Strait	Robert Allan Ltd.	Mike Phillips Robert G. Allan	• Raincoast IR. No. 1.01b-Phillips-Resume • Raincoast IR. No. 1.01b-Allan-Resume
Modelling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project	EBA	Aurelien Hospital Travis Miguez James Stronach	• Raincoast IR. No. 1.01b-Hospital-Resume • Raincoast IR. No. 1.01b-Miguez-Resume • Raincoast IR. No. 1.01b-Stronach-Resume
Methods for Estimating Shoreline Oil Retention	Coastal and Ocean Resources	John R. Harper	• Raincoast IR. No. 1.01b-Harper-Resume
Trans Mountain Expansion Project Oil Spill Response Simulation Study, Arachne Reef and Westridge Marine Terminal	EBA Western Canada Marine Response Corporation	Aurelien Hospital James Stronach M.W. McCarthy Mark Johncox	• Raincoast IR. No. 1.01b-Hospital-Resume • Raincoast IR. No. 1.01b-Stronach-Resume • Raincoast IR. No. 1.01b-McCarthy-Resume • Raincoast IR. No. 1.01b-Johncox-Resume
TERMPOL 3.16 & 3.17 – Port Information and Terminal Operations Manual, Trans Mountain Expansion Project	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.18 – Contingency Planning	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume
TERMPOL 3.19 – Oil Handling Facilities Requirements	Moffatt & Nichol	James Traber Ron Byres	• Raincoast IR. No. 1.01b-Traber-Resume • Raincoast IR. No. 1.01b-Byres-Resume

Marine Environmental Impacts

1.02 Marine environmental impacts: assessment of alternative shipping routes

Reference:

i) A3S4X4, Application Volume 8A – Marine Transportation, Section 2.2.2, PDF page 21 of 40.
ii) National Energy Board, "Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increased Marine Shipping Activities, Trans Mountain Expansion Project", (10 September 2013), PDF page 1 of 3.
iii) Canadian Environmental Assessment Act, 2012, SC 2012, c 10, s 52, at s 19(1) (a), (g).

Preamble:

Reference (i) states, "Alternatives related to the tanker shipping lanes and traffic patterns were not considered as the shipping lanes established in the Salish Sea region have proven effective at safely managing the existing volumes of marine traffic in this region." The basis for this statement is not provided.

Reference (ii) requires that the proponent provide information on the potential environmental and socio-economic effects of marine shipping activities, including the potential effects of accidents or malfunctions that may occur.

Section 19(1)(a) of CEAA, 2012 (Reference (iii)) requires that the environmental assessment of the Project must take into account the cumulative environmental effects likely to result from the Project in combination with other physical activities.

Section 19(1)(g) of CEAA, 2012 (Reference (iii)) requires that the environmental assessment of the Project must take into account alternative means of carrying out the Project.

Request:

a) Please provide evidence that existing shipping lanes and traffic patterns can cope safely with the anticipated higher levels of shipping traffic arising from the proposed Project, as well as expansion of Port Metro Vancouver and other projects.

b) Please provide an analysis of the relative safety of alternate shipping lanes and traffic patterns in the Salish Sea given Project-related marine traffic and other anticipated increased marine traffic.

Response:

a) Please refer to Volume 8C TR8C-12 Termpol 3.15 for this information.

b) Project tankers will utilise existing shipping lanes that are the IMO recognised passage for all ocean going ships travelling between Vancouver and the Pacific Ocean. Therefore analysing alternate shipping lanes is not relevant to the project and is not contemplated.

1.03 Marine environmental impacts: atmospheric sound emissions

Reference:

A3S4X8, Application Volume 8A – Marine Transportation, Section 4.2.5.3, Table 4.2.5.1, PDF pages 10, 11 of 23.

Preamble:

Reference (i) states, "Current marine traffic levels in the Marine RSA are high, with a small contribution from marine vessels associated with existing Trans Mountain operations."

Table 4.2.5.1 (Reference (i)) as presented is unclear. The column header reads, "Octave Spectrum (dB)", but the numbers in the following rows (31.5, 63, 125 etc.) are in Hz, not dB. These are the centre frequencies (in Hz) for standard octave bands. The values under each row (e.g., 127.8,115.2 etc) are in dB. Those are meant to be received levels at some range.

The accompanying text for Table 4.2.5.1 (Reference (i)) reads, "The estimated sound emission levels from the tugs and tankers for use in calculation of sound levels at distance calculations are listed in Table 4.2.5.1."

Request:

a) Did Trans Mountain also consider anthropogenic noise from small boats, which are already named as a threat to recovery of southern resident killer whales at existing traffic levels, or was only noise from tankers without other vessel traffic considered?

b) Please provide details as to which anthropogenic noise sources are included in the assessment, and the references for these sources, should they exist.

c) Please clarify the units of measurement in Table 4.2.5.1 (Reference (i)).

d) What was the distance at which the received level was modeled (Reference (i))?

Response:

a) The atmospheric sound level assessment focussed on changes in shipping related to the Trans Mountain Expansion Project only and did not account for other anthropogenic noise sources, as listed in Table 4.2.5.1 of Volume 8A - Marine Transportation of the Application for ship traffic. The assessment looked at relative changes in sound levels from sources directly utilized by the Project.

   Ambient underwater noise levels were estimated for the modelling study based on a review of available published ambient measurements for the area. Results of this review show that marine traffic is the dominant source of underwater noise in the Marine Regional Study Area, and primary noise sources identified include (in no particular order): bulk carriers, container ships, cruise ships, barges, tugs, tankers, coast guard vessels, ferries, fishing vessels, whale watching boats, recreational boats, sea planes, and wind and wave noise. Further details of the modelling study are provided in

Appendix A of Technical Report 8B-1 in Volume 8B, Marine Resources - Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013) of the Application. The assessment of cumulative effects acknowledged that smaller, faster vessels such as recreational fishing boats and pleasure craft will also contribute to underwater noise, and noise from all vessels may act additively to increase overall underwater ambient sound levels in the marine environment. However, the assessment focuses on potential exposure to underwater noise stemming from Project-related marine vessel traffic.

b) No other sources than those referenced in the response to Raincoast IR No. 1.03a were included in the atmospheric sound level assessment of marine transportation for the Project. As detailed in Sections 4.0 and 5.0 of Technical Report 8C-4 of Volume 8C, Marine Noise (Atmospheric) – Marine Transportation Technical Report, the assessment is a comparative analysis of changes in Trans Mountain related sources only.

Ambient underwater noise levels were estimated for the acoustic modelling study based on a review of available published ambient measurements for the area. Details are provided in Appendix A of Technical Report TR 8B-1 of Volume 8B, Marine Resources - Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013) of the Application.

c) The units that are used in Table 4.2.5.1 of Volume 8A, Marine Transportation of the Application are decibels (dB) which are defined in Appendix A of Technical Report 8B-4 of Volume 8B, Marine Noise (Atmospheric) Technical Report (RWDI December 2013) as:

> "A unit of measure of sound pressure that compresses a large range of numbers into a more meaningful scale. Hearing tests indicate that the lowest audible pressure is approximately 2 x 10^{-5} Pa (0 dB), while the sensation of pain is approximately 2 x 10^{2} Pa (140 dB). Generally, an increase of 10 dB is perceived as twice as loud."

Table 4.2.5.1 include both A-weighted sound values (dBA) as well as un-weighted values (dB). The A-weightings (expressed as dBA) are assigned to reflect the response of the human ear to different frequencies of sound. The human ear is more sensitive to higher frequency sound than lower-frequency sound; this is reflected in the A-weighting scale.

d) The sound levels provided in Table 4.2.5.1 of Volume 8A of the Application, are Sound Power Levels and not Sound Pressure Levels. Sound Power Levels do not have distances associated with them, while Sound Pressure Levels require a distance in order to be a useful metric or piece of information. Appendix A of Technical Report 8B-4 of Volume 8B, Marine Noise (Atmospheric) Technical Report (RWDI December 2013) provides details on these definitions.

1.04 Marine environmental impacts: Marine RSA boundaries

Reference:

i) A3S4K7, Application Vol. 8B – Technical Report, Ecological Risk Assessment of Marine Transportation Spills, PDF pages 27, 28 of 116.
ii) A3S4K8, Application Vol. 8B – Technical Report, Ecological Risk Assessment of Marine Transportation Spills, PDF pages 1, 2, 5, 6 of 9.

Preamble:

Trans Mountain identified the Marine RSA as being "the area of ecological relevance where environmental effects could potentially result from accidents and malfunctions. This area is effectively established by the limits of the domain for the stochastic oil spill modeling" (Reference (i)). Trans Mountain did not include northern parts of the Strait of Georgia, Puget Sound and open Pacific Ocean waters westward of the 12 nautical mile limit of Canada's territorial sea (Reference (i)). However, a large number of hypothetical oil spill scenarios demonstrate that the probability of oil presence and the probability for the shore to be oiled is greater than 0% in areas outside the Marine RSA (i.e. Figures D.1-2, D.1-3, D. 2-2, D.2-3, Reference (ii).

Request:

a) Please provide the number of hypothetical oil spill scenarios that resulted in the probabilities of oil presence and shore oiling being greater than 0% outside of the Marine RSA.

b) Please provide the number of hypothetical oil spill scenarios that resulted in the probabilities of oil presence and shore oiling being 0% outside of the Marine RSA.

c) Given that multiple hypothetical oil spill scenarios resulted in probabilities of oil presence and shore oiling being greater than 0% outside the Marine RSA, please provide additional justification for the existing Marine RSA boundaries.

Response:

a) Please refer to the response to NEB IR No. 1.67, which explains that some amount of oil may eventually cross virtually any practical boundary that might be used to define the RSA. The drawings referenced above provide probability contours for the presence or absence of crude oil on the water surface as a result of the stochastic analysis of hypothetical spill scenarios. These probability contours provide the response to the question. While this is a useful representation in the stochastic analysis for the probability of oil presence, it does not represent the quantity or thickness of crude oil present. Crude oil thickness will generally be greater in the areas closer to the hypothetical spill location (where the probability of oiling is also greater), and lesser in areas with a low probability of oiling. As a result, the contours provide a conservative representation of oil presence, but should not be used to infer the quantity of oil present.

Most of the crude oil associated with the hypothetical crude oil spills would remain within the RSA, unless the hypothetical spill location was close to the RSA boundary.

b) Please refer to the response to Raincoast IR No. 1.04a.

c) Please refer to the response to Raincoast IR No. 1.04a.

1.05 Marine environmental impacts: intertidal and subtidal habitat near the Westridge Marine Terminal

Reference:

A3S1R0 Application Volume 5A – Environmental and Socio-Economic Assessment - Biophysical

i) PDF page 46 of 260
ii) PDF page 47 of 260

Preamble:

Reference (i) states that 5,470 m^2 of intertidal habitat will be lost in the vicinity of the Westridge Marine Terminal due to construction of additional berths, but that this loss will be offset by the creation of 3,770 m^2 of rip rap (rubble) intertidal habitat. It is not clear from the reference what the original 5,470 m^2 of intertidal habitat lost during construction consisted of. Intertidal habitats of different substrate types and grain sizes may support very different intertidal communities, and infilling of rip rap will only serve as an appropriate offset for some types of intertidal habitat.

Reference (ii) states that 17,100 m^2 of soft sediment subtidal habitat will be lost as a consequence of Westridge Marine Terminal expansion, but that this will also be offset by the construction of 5,550 m^2 of subtidal rip rap habitat. Soft sediment habitat and rip rap will likely support vastly different faunal and algal communities

Request:

a) Please provide details on the type of intertidal habitat lost during terminal expansion and how the communities supported by this habitat compare to those supported by rip rap.

b) Please justify why creation of rocky subtidal (rip rap) habitat is expected to provide a reasonable offset for the destruction of soft-sediment habitat.

Response:

a) As stated in Section 7.6.9.3 of Volume 5A, approximately 68% of the shoreline within the Westridge Marine Terminal water lot has been replaced with fill material. Intertidal habitats that will be affected by construction of the Westridge Marine Terminal are almost entirely composed of rip-rap, with a small area of mixed cobble/sand/shell to the immediate west of the existing small vessel dock. Biotic communities supported by the existing rip-rap intertidal habitat are expected to be very similar to those supported by the post-construction rip-rap habitat. For details on the intertidal species assemblage found at the Westridge Marine Terminal, please refer to Section 5.2 of Volume 5C, Biophysical Technical Report 5C-13, Marine Resources – Westridge Marine Terminal Technical Report (Stantec Consulting Ltd. December 2013).

b) Nearly all subtidal habitats in Burrard Inlet are composed of soft sediment (see Figure 4.2 in Technical Report 5C-13 in Volume 5C, Marine Resources – Westridge Marine Terminal Technical Report [Stantec December 2013]). While these habitats do support important commercial, recreational and Aboriginal (CRA) fish species, they are not in limited supply. Complex rocky habitat, on the other hand, is virtually absent from most of Burrard Inlet, and is considered to be a limiting habitat type. Rock reefs provide important habitat for a variety of CRA species that do not generally inhabit soft substrates, such as rockfish (*Sebastes* spp.), lingcod (*Ophiodon elongatus*), and red rock crab (*Cancer productus*), among others. Rock reefs also provide attachment surfaces for a diverse assemblage of algal and invertebrate species that cannot persist on soft substrates. Therefore, construction of a rock reef in Burrard Inlet would be expected to increase species diversity and primary productivity relative to baseline conditions. Establishing a rock reef within the Eastern Burrard Inlet Rockfish Conservation Area (RCA) would also increase the availability of suitable rockfish habitat, providing important benefits to this vulnerable group of reef-dwelling species. Additional information on marine fish habitat offsetting will be provided in the Preliminary Marine Fish Habitat Offsetting Plan. Please refer to the response to NEB IR No. 1.51.

1.06 Marine environmental impacts: impact of Project-related vessel wake on structure-forming intertidal organisms

Reference:

i) A3S4Y3 Application Volume 8A – Marine Transportation, Section 4.3.6.4.2, PDF page 55 of 294.

Preamble:

Reference (i) notes that wake caused by Project-related vessels could lead to the dislodgement of structure-forming intertidal organisms (algae and sessile invertebrates) along the shoreline. Such reductions in the cover of structure-forming organisms may lead to indirect effects on intertidal biodiversity through destruction of habitat. Reference (i) states that no measures are necessary to mitigate these impacts of vessel wake, but provide no estimates of what the impact of wake on structure-forming intertidal organisms would be.

Request:

a) Please provide a quantitative assessment of the impact of vessel wake on structure-forming intertidal organisms (e.g., in terms of percent cover lost due to Project-related vessel activity).

b) Please provide justification for the recommendation that no mitigation measures be taken to limit the effects of vessel wake.

Response:

a) Potential effects of wake waves produced by Project-related vessels on intertidal habitat are assessed in Section 4.3.6.6.1 of Volume 8A. Structure-forming intertidal organisms are a component of intertidal habitat, and are therefore assessed under the intertidal habitat indicator. The assessment concludes that the height of wake waves reaching shoreline habitats will be well within the range of natural wave conditions; therefore, disturbance to intertidal habitat, including structure-forming organisms, is expected to be immediately reversible and of negligible magnitude.

b) The assessment of potential effects of wake waves produced by Project-related vessels concludes that residual effects on marine fish and fish habitat will be of negligible magnitude and not significant (see Section 4.3.6.6 of Volume 8A). For this reason, additional mitigation measures are not required.

1.07 Marine environmental impacts: effects of increased vessel wake frequency on the intertidal community

Reference:

i) A3S4Y3, Application Volume 8A – Marine Transportation, Section 4.4.4.3.1, PDF page 239 of 294.
ii) A3S4X4, Application Volume 8A – Marine Transportation, Table 4.1.1.1, PDF page 40 0f 40.

Preamble:

Reference (i) notes that wake heights from Project-related vessel traffic "are predicted to be within the range of natural wave conditions" and are therefore unlikely to negatively affect biophysical characteristics of intertidal habitat along the marine transport route.

Reference (ii) notes that, as a result of the Project, vessel traffic leaving the Westridge Marine Terminal and transiting through the Salish Sea will increase from 5 to 34 vessels per month.

The focus on wake height in Reference (i) does not take into consideration the 580% increase in the frequency of Project-related vessel traffic along the marine transport route (Reference (ii)) and the concomitant increase in exposure of intertidal habitats to vessel wake. This increase in wake frequency will increase the occurrence of periods of high turbidity (particle suspension) – which may interfere with filter feeding organisms such as barnacles and mussels – and will increase the frequency of both displacement of settling invertebrate larvae and physical disturbance to fish and invertebrates using shoreline habitats.

Request:

a) Please provide an assessment of the cumulative effects of increased Project-related vessel wake frequency on the biophysical characteristics of intertidal habitat.

Response:

a) The potential cumulative effect of disturbance to intertidal habitat due to wake waves produced by Project-related vessels and other marine traffic (existing and future) in the Marine regional study area (RSA) is assessed in Section 4.4.4 of Volume 8A.

1.08 Marine environmental impacts: recovery of oiled shoreline habitat

Reference:

i) A3S5Q3, Volume 8A – Marine Transportation, Section 5.6.2.1.1, PDF page 15 of 29.
ii) Harwell, M.A. and Gentile, J.H. 2006. Ecological significance of residual exposures and effects from the Exxon Valdez oil spill. Integrated Environmental Assessment and Management 2, 204 - 246.
iii) Peterson, C.H., Rice, S.D., Short, J.W., Esler, D., Bodkin, J.L., Ballachey, B.E. & Irons, D.B. 2003. Long-term ecosystem response to the Exxon Valdez oil spill. Science, 302, 2082-2086.

Preamble:

Reference (i) states that "recovery of oiled shoreline habitat within 2 to 5 years following a large oil spill is a reasonable expectation…". This statement is based on Reference (ii), which reviewed the recovery of shoreline habitat in Prince William Sound, Alaska following the Exxon Valdez Oil Spill (EVOS). However the conclusions of Reference (ii) are highly controversial, and in direct contradiction of several other studies, notably those reviewed in Reference (iii), which found substantial residual effects of oil on shoreline habitats lasting at least a decade following EVOS. These residual effects include changes in community structure following initial die-offs of the habitat-providing alga Fucus gardneri, and chronic exposure of sediment-affiliated species (bivalves and the mammals and birds that feed on them) to oil-related toxins.

Request:

a) Please provide a detailed justification or revision of the predicted 2 to 5 year recovery time for oiled shoreline habitat that takes into consideration not only the persistence of oil along the shoreline, but also the community- level and indirect effects of initial oiling and persistent toxicity considered in Reference (iii).

Response:

a) The requested information can be found in Sections 3.4 and 3.5 of Attachment 1 to the response to NEB IR No. 1.62d (NEB IR No. 1.62d – Attachment 1, Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills [Stantec Consulting Ltd. 2014]).

1.09 Marine environmental impacts: persistence of oil in shoreline habitats

Reference:

i) A3S4Y9, Application Volume 8A – Marine Transportation, Section 5.6.2.5.1, PDF page 18 of 28.
ii) Hayes, M.O. and Mitchell, J. 1999. Factors determining the long-term persistence of Exxon Valdez oil in gravel beaches. Marine Pollution Bulletin, 38, 92-101.

Preamble:

Reference (i) states that shoreline habitats consisting of low exposure cobble/boulder veneer over sand (a common shoreline type along the marine transportation route) are "readily restored if oiled, and would recover in a relatively short period of time."

Reference (ii) notes that the shoreline type described above (cobble/boulder veneer over sand) is known to sequester oil for extended periods of time (i.e., at least 8 years following EVOS).

Request:

a) Please provide justification for the conclusion that shoreline habitats consisting of low exposure cobble/boulder veneer over sand will recover quickly, despite evidence that this shoreline type sequesters oil for extended periods following a large oil spill.

Response:

a) The Prince William Sound beach sites described by Hayes and Michel (1999) in Reference (ii) above comprise deeper layers of high porosity gravels than the majority of beach sites within the RSA. In addition, Hayes and Michel (1999) note that the six sites they studied were uplifted between 0.6 and 3.5 m during the earthquake of 1964 and had not yet achieved an erosional/depositional equilibrium. The potential for crude oil to penetrate and persist on beaches within the RSA was evaluated based on a report prepared by Coastal and Ocean Resources (2013) which takes the thickness of gravel layers and depth to the impermeable layer into account.

Reference:

Coastal and Ocean Resources. 2013. Methods for estimating shoreline oil retention. Prepared for EBA Engineering, Vancouver, BC, by John R. Harper, Coastal & Ocean Resources, Victoria, BC. May, 2013.

1.10 Marine environmental impacts: chronic small discharges of oil

Reference:

i) A3S4Y3, Application Volume 8A – Marine Transportation, Section 4.3.2, PDF pages 17, 18, 19 of 294.
ii) A3S4Y3, Volume 8A – Marine Transportation, Section 4.3.13, PDF pages 196, 197 of 294.
iii) MacDuffee, M., Rosenberger, A. R., Dixon, R., Price, M. H. H., Paquet, P. C. 2013. Embroiled, Volume 1: Salmon, tankers and the Enbridge Northern Gateway Proposal. Raincoast Conservation Foundation. Sidney, British Columbia. Vers 01-13, pp. 107.
iv) Serra-Sogas, N., O'Hara, P. D., Canessa, R., Keller, P., Pelot, R. 2008. Visualization of spatial patterns and temporal trends for aerial surveillance of illegal oil discharges in western Canadian marine waters. Marine Pollution Bulletin. 56(5): 825-833.

Preamble:

References (i) and (ii) cross reference each other with respect to release of low volumes of hydrocarbons through bilge water and routine operations, but neither addresses the ecological impacts of the cumulative effects of these small releases. Studies from Exxon Valdez revealed clearly that spilled hydrocarbons are lethal to pink salmon and Pacific herring eggs at much lower concentrations than previously thought.

Request:

a) Given the evidence in Reference (iii) that the cumulative effects of oil releases can have significant ecological effects, please provide referenced justification for why the cumulative ecological effects of small discharges of oil likely to occur with Project-related marine traffic was not included in the submission?

b) Given the evidence in Reference (iv) and elsewhere, please provide additional information on chronic small discharges of oil as an existing habitat disturbance in the Marine and Terminal RSAs.

c) Please provide additional information regarding the potential effects of Project-related vessel chronic oils spills (e.g. routine discharge of <15 mg/L or accidental/malfunction-related discharge of >15 mg/L oil into marine environments) to Pacific herring and associated habitats.

Response:

a) The release of contaminated bilge water (oil concentration > 15 mg/L) is an illegal activity under the *Canada Shipping Act* Vessel Pollution and Dangerous Chemicals Regulations and MARPOL (International Convention for the Prevention of Pollution from Ships). Such releases could come from vessels of any size, including small pleasure vessels, fishing vessels, and large cargo vessels (not restricted to oil tankers). Compliance monitoring and enforcement of this legislation is the responsibility of Transport Canada. Cumulative ecological effects of small discharges of oil (< 15 mg/L hydrocarbon) were not considered as a residual effect because effective compliance monitoring and enforcement of existing legislation (which is designed to protect the marine environment) should prevent cumulative effects.

The ecological effects of large oil spills are discussed at length in Reference (iii) but no conclusive data is provided on the cumulative effects of small spills. Research on the effects of small oil discharges is limited by the fact that such spills are often unplanned, unreported and have limited spatial and temporal range. Research by Serra-Sogas et al. (2008) concluded that the occurrence of chronic oil spills had declined in British Columbia's marine Exclusive Economic Zone over the ten year study period. While an average of 0.42 spills per hour of oil spill aerial monitoring patrol was recorded before 1997, this figure had declined to 0.05 spills per hour of patrol by 2007 (Serra-Sogas et al. 2008). As noted by Serra-Sogas et al. (2008), a new oil spill surveillance aircraft was scheduled for operation in British Columbia in 2008. This aircraft (introduced in January 2008) allowed for greater spatial coverage of surveys, improved spill observation and the ability to operate in a wider range of weather conditions. The decline in oil spill observations indicates that chronic oil spills are becoming increasingly rare in British Columbia waters and the improved monitoring will act as a deterrent to non-compliant vessel operators.

Reference:

Serra-Sogas, N., P.D. O'Hara, R. Canessa, P. Keller and R. Pelot. 2008. Visualization of spatial patterns and temporal trends for aerial surveillance of illegal oil discharges in western Canadian marine waters. Marine Pollution Bulletin 56(5): 825-833.

b) The amount of hydrocarbon released from the Exxon Valdez (Reference iii) is orders of magnitude greater than would be associated with a release of oily bilge water. Existing marine water and sediment quality in the Marine regional study area (RSA) for the Westridge Marine Terminal (Burrard Inlet east of the First Narrows) are described in Section 7.6.8 of Volume 5A. The baseline hydrocarbon levels in sediment in the Marine RSA for the Westridge Marine Terminal (reflected in concentrations of polycyclic aromatic hydrocarbons) reflect numerous sources, including stormwater runoff, spills on land that are transported to the sea, and vessel traffic. Various monitoring programs have collected in-situ water quality data (temperature, dissolved oxygen, salinity, turbidity, pH) in the Marine RSA for marine transportation and the results indicate good water quality. Sediment surveys in the southern Strait of Georgia and Juan de Fuca Strait for the Washington State Department of Ecology indicated good sediment quality, with contaminant concentrations below state and national regulatory guidelines in most samples and below detection limits in two thirds of samples (Washington State Department of Ecology 2013).

Chronic oil spills are, by their nature, small volume and generally unplanned and undocumented. Therefore, it is not possible to provide a comprehensive description of chronic oil spill conditions in the Marine RSA for either the Westridge Marine Terminal or for the marine transportation component of the Project. The only discharge from vessels that is allowed under the Vessel Pollution and Dangerous Chemicals Regulations of the

Canada Shipping Act, 2001 is that of bilge water treated to have less than 15 mg/L hydrocarbon. It is the responsibility of Transport Canada to ensure legislation governing oil spills is enforced to minimize the frequency of their occurrence.

Research by Serra-Sogas et al. (2008) concluded that the occurrence of chronic oil spills had declined in British Columbia's marine Exclusive Economic Zone over a ten year study period. While an average of 0.42 spills per hour of oil spill aerial monitoring patrol was recorded before 1997, this figure had declined to 0.05 spills per hour of patrol by 2007 (Serra-Sogas et al. 2008). As noted by Serra-Sogas et al. (2008), a new oil spill surveillance aircraft was scheduled for operation in British Columbia in 2008. This aircraft (introduced in January 2008) allowed for greater spatial coverage of surveys, improved spill observation and the ability to operate in a wider range of weather conditions. The decline in oil spill observations indicates that chronic oil spills are becoming increasingly rare in British Columbia waters and the improved monitoring will act as a deterrent to non-compliant vessel operators.

References:

Serra-Sogas, N., P.D. O'Hara, R. Canessa, P. Keller and R. Pelot. 2008. Visualization of spatial patterns and temporal trends for aerial surveillance of illegal oil discharges in western Canadian marine waters. Marine Pollution Bulletin 56(5): 825-833.

Washington State Department of Ecology. 2013. Long-Term Marine Sediment Monitoring Data Summaries, Findings, Publications.

c) The release of contaminated bilge water (i.e., of greater than 15 mg/L hydrocarbon) is an illegal activity under the *Canada Shipping Act* Vessel Pollution and Dangerous Chemicals Regulations and MARPOL (International Convention for the Prevention of Pollution from Ships). Trans Mountain will use reputable vessel operators who have an excellent track record of compliance with all shipping regulations. Please see Section 5.6 of Volume 8A for the assessment of potential effects of an accidental tanker spill on marine fish, including Pacific herring.

1.11 Marine environmental impacts: chronic small discharges of oil

Reference:

i) A3S4X6, Application Vol. 8A – Marine Transportation, Section 4.2.2.1, PDF pages 10-11 of 11.
ii) U.S. Environmental Protection Agency. 2013. Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels (VGP): Authorization to discharge under the National Pollution Discharge Elimination System, Section 2.2.9. Controllable Pitch Propeller and Thruster Hydraulic Fluid and Other Oil-to-Sea Interfaces. p 47, Available at http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm

Preamble:

Reference (i) states: "Shipping activities have the potential to affect water quality through release of ballast or bilge water….. Bilge water must be treated to remove oils and grease prior to discharge. Therefore, any releases of oily water would be due to an accident or malfunction (Section 4.3.13) **and not routine operations**. Reports of marine oil spills and sheens are addressed through the Regional Marine Information Centre, which coordinates a response through various agencies, including the CCG. Given that spills and sheens can originate from land or sea (commercial or recreational marine vessels), it can be challenging to identify a source." (Emphasis added)

The operation of freighters and tankers with oil lubricated external propellers and parts is a known chronic source of oil pollution that adversely affects marine life, particularly marine birds.

In December 2013, the U.S. Environmental Protection Agency (EPA) eliminated the allowance of petroleum lubricants in all oil-to-sea interfaces in ships calling in US waters and mandated the use of 'Environmentally Acceptable Lubricants' ("EALs") (Reference (ii)). Approved lubricants include those made from vegetable oils, bio-synthetic esters, polyalkykene glycols and sea water (Reference (ii)).

While welcomed, it is likely the EPA's criteria to qualify vegetable-based oils as EALs are too lenient to eliminate chronic oiling mortality of marine birds, and vegetable oils too, must be eliminated as lubricants in oil-to sea interfaces.

Request:

a) Please provide an assessment of the risks to marine birds (and other wildlife) from chronic oiling from oil-to sea lubricated parts (eg. propellers) in tankers entering the Marine RSA.

b) Please provide an assessment of the risks to shoreline habitats from chronic oiling from oil-to sea lubricated parts (eg. propellers) in tankers entering the Terminal RSA.

Response:

a) According to International Maritime Organization's (IMO's) MARPOL (International Convention for the Prevention of Pollution from Ships) (IMO 2013) and the Vessel

Pollution and Dangerous Chemicals Regulations (annexed to the *Canada Shipping Act*, 2001), no oil above 15 mg/L shall be released into the marine environment.

The basic premise behind this regulation and concentration level is that releases <15 mg/L hydrocarbon do not produce a sufficiently thick layer of oil and sheen to affect seabirds. It follows that as long as operators of vessels and marine terminals follow these regulations, that no adverse effects on marine birds are anticipated. Releases above this limit are assumed to be the result of accidents or malfunctions.

The effect of oil on marine birds is difficult to predict, as it is strongly dependent on location, timing, weather, the type of oil, and the bird species in the area. As a general rule, however, heavier fuel oils are more detrimental to birds than light fuel oils because the latter are more volatile, disperse faster and create less disruption to feathers, which is the main cause for bird mortality.

The oils under the new US Environmental Protection Agency (EPA) regulation (Reference [ii] in the preamble) fall under this light fuel/lubricant category and, if released into the marine environment above legal limits, are therefore anticipated to have less effect on marine birds than heavy fuel oil.

Regardless of the oil, however, a single release of oil (e.g., from bilges), as was assessed in Section 4.3.13 of Volume 8A, is likely to have small and not significant effects from a population standpoint. If such releases were chronic, effects to marine birds may be larger, but again less so for these new lubricants than previously documented in the literature for heavier types of oil pollution.

Given the enforcement of oil pollution regulations by Transport Canada and the commitments already made by Trans Mountain regarding this issue, accidental discharges of hydrocarbons above the 15 mg/L limit are not anticipated.

Reference:

International Maritime Organization. 2013. Port State Control.

b) The United States Environmental Protection Agency (US EPA) regulations described in the preamble (Reference (ii)) (National Pollutant Discharge Elimination System (NPDES) Vessel General Permit (VGP) for Discharges Incidental to Normal Operation of Vessels) define an environmentally acceptable lubricant (EAL) as “a lubricant that is biodegradable, exhibits low toxicity to aquatic organisms and has a low potential for bioaccumulation”. Under US federal law, EALs may not be discharged in quantities that may be harmful to the marine environment (40 CFR Part 110, Discharge of Oil). Similarly, in Canada, discharge of oil in concentrations greater than 15 mg/L is illegal under the *Vessel Pollution and Dangerous Chemicals Regulations* of the *Canada Shipping Act, 2001*. Given these restrictions, the permitted discharge of low concentrations of EALs from oil to sea interfaces is not expected to result in adverse effects to shoreline habitats within the Marine Regional Study Area (RSA) for the Westridge Marine Terminal.

Fish – Pacific Herring

1.12 Pacific herring: underwater noise

Reference:

i) A3S4Y3, Application Volume 8A – Marine Transportation, Section 4.3.6.4.1, PDF pages 54, 55 of 294.

ii) Kuznetsov, Y. A., Bocharov, L. N., Akulin, V. N., Kuznetsov, M. Y. 2012. Marine Bioacoustics and the Regulation of Fisheries. In The Effects of Noise on Aquatic Life. Springer New York. pp 575-577.

Preamble:

Reference (i) states, "Underwater noise from vessel traffic could; however, potentially trigger behavioural responses by marine fish. Consequently, this potential effect was considered for inclusion in the assessment."

Reference (i) goes on to state, "For the reasons discussed above and according to the judgment of the assessment team, behavioural disturbance to marine fish and invertebrates due to underwater noise from vessel traffic was not considered further in this assessment."

Pacific herring have been demonstrated to react to approaching vessels of differing underwater acoustic transmissions (Reference (ii)) but no fish species are identified by Trans Mountain as being potentially negatively affected by underwater noise.

Request:

a) Without empirical data (and given studies from elsewhere suggesting that noise affects other fish species), how did Trans Mountain reach the conclusion that it was acceptable to ignore effects of underwater noise on fish? Please provide supporting references.

b) Given the scientific evidence that noise can affect fish, why did Trans Mountain not conduct additional research to quantify responses of Canadian Pacific fishes to ship noise? Please provide supporting references.

c) Please include at least one marine fish as an indicator species representing the potential effects of auditory injury or sensory disturbance due to underwater noise.

Response:

a) The potential effect of behavioural disturbance to marine fish and invertebrates due to underwater noise from Project-related vessels was considered for inclusion in the assessment of marine fish and fish habitat. However, for the reasons presented in Section 4.3.6.4.1 of Volume 8A, it was determined that a detailed assessment of this potential effect was not required. Supporting references are provided in Section 4.3.6.4.1 of Volume 8A.

b) Please refer to the response to Raincoast IR No. 1.12a.

c) Please refer to the response to Raincoast IR No. 1.12a.

1.13 Pacific herring: indicator species and habitat

Reference:

i) A3S4X8, Application Vol. 8A – Marine Transportation, PDF page 17 of 23.
ii) A3S4J5, Application Vol. 8B, Technical Report, Marine Resources, PDF pages 22, 23, 69 of 173.
iii) A3S4X9, Application Vol. 8A – Marine Transportation, PDF pages 1-33 of 33.
iv) McKechnie, I., Lepofsky, D., Moss, M. L., Butler, V. L., Orchard, T. J., Coupland, G., Foster, F., Caldwell, M., Lertzman, K. 2014. Archaeological data provide alternative hypotheses on Pacific herring (Clupea pallasii) distribution, abundance, and variability. Proceedings of the National Academy of Sciences. 111(9): E807-E816.
v) Stick, K. C. and Lindquist, A. 2009. 2008 Washington State herring stock status report. Washington Department of Fish and Wildlife, Fish Program, Fish Management Division. pp 111.
vi) Fisheries and Oceans Canada. 2012. Pacific Herring Important Areas. MAPSTER. Available: http://pacgis01.dfompo.gc.ca/Mapster30/#/SilverMapster. Acquired by Raincoast Conservation Foundation: April 2014.

Preamble:

Pacific herring was selected by Trans Mountain to be an indicator species representing the “potential effects from Project-related increased marine vessel traffic on marine fish and fish habitat” (Reference (i)). One of the criteria used to select indicator species includes that the species has “an established baseline information in biology, population abundance and distribution” (Reference (ii)). For Pacific herring, the stated rationale for selection as an indicator species does not include an established baseline of information (Reference (ii)).

In the description of the species, Trans Mountain states that Pacific herring reached a “historical high in 2003” (Reference (iii)) but makes no reference to the temporal length or quality of the historical baseline employed to make this evaluation. Recently, an archaeological study of ancient human settlements along the Pacific coast of North America (Reference (iv)) suggested that Pacific herring were far more abundant in the past than at present and in particular, were considered superabundant in midden sites located around the perimeter of the Salish Sea. Further, combined evidence derived from oral historical knowledge, early historical observations and archaeological study suggests that Pacific herring were already significantly impacted by industrial fishing prior to the development of the historical baseline used to assess current herring population benchmarks (Reference (iv)) that were initiated in BC in the mid 1900s.

Trans Mountain also includes maps of “Pacific herring spawning habitat and DFO Important Areas for Pacific herring in the Marine RSA” (Figures 4.3 and 4.2-20, References (ii) and (iii)). In this map, with the exception of a very small spawning area located on the US-side of Point Roberts/Boundary Bay, the spawning areas mapped are all located in Canadian waters. Pacific herring spawn in numerous areas along US shorelines within the Marine RSA (e.g. Cherry Point, San Juan Islands and Portage Bay (Reference (v)). These spawning areas were not included by Trans Mountain in Figures 4.3 and 4.2-20 (References (ii) and (iii)).

In the same map (Figure 4.3 and Figure 4.2-20, References (ii) and (iii)), Trans Mountain relies exclusively on the DFO-identified Important Areas for Pacific herring to delineate the marine areas important for Pacific herring. These “DFO Important Areas for Pacific herring” were generated by four DFO employees or former employees drawing “polygons on paper maps to denote Important Areas for herring” which were then digitized for subsequent use in GIS applications (Reference (vi)). This identification of “Important Areas for Pacific herring” is exclusively restricted to Canadian waters and no important areas for Pacific herring were identified by Trans Mountain for US waters in the Marine RSA (References (ii) and (iii)).

Request:

a) Please include a description of the “historical low” (a population collapse) and its suspected drivers (overfishing) that occurred in the 1960s to complement Trans Mountain’s description of the Strait of Georgia Pacific herring population “historical high”.

b) Please provide additional information regarding Strait of Georgia herring populations derived from additional sources (e.g. oral historical knowledge, early historical observations, marine sediment analyses and archaeological studies) to complement the relatively short-term Fisheries and Oceans Canada baseline information that Trans Mountain relies upon in their application.

c) Please include US Pacific herring spawning areas and holding site information in the Application including written text and figures (Figures 4.3 and 4.2-20, References (ii) and (iii)).

d) Please confirm that no information similar to “DFO Important Areas for Pacific herring” identified in Figure 4.2-20 (Reference (iii)) is available for areas important to Pacific herring in US waters. If so, please correct Figures 4.3 and 4.2-20 (References (ii) and (iii)) to reflect that no information is available in US waters to identify Important Areas for Pacific herring in the Marine RSA.

e) Please confirm that the “DFO Important Areas for Pacific herring”, which were generated by four experts drawing on paper before being digitized, represent the best-available information for Pacific herring important areas in Canadian waters of the Marine RSA.

f) Please confirm whether an established baseline of information exists for Pacific herring in the Marine RSA with particular reference to Pacific herring distribution.

g) Do the “DFO Important Areas for Pacific herring” referenced by Trans Mountain include areas important to the small populations of non- migratory Pacific herring described by Trans Mountain (References (ii) and (iii))?

h) Please describe in more detail and indicate the annual migratory route used by the majority of Strait of Georgia Pacific herring on the Pacific herring map (Figures 4.3 and 4.2-20, References (ii) and (iii)).

Response:

a) The requested information is not required for assessing potential effects of the increase in Project-related marine vessel traffic on the Pacific herring indicator. Project effects are assessed against existing (baseline) conditions, which are defined as the current state of the environment prior to the commencement of Project operations (refer to Section 3.4 of Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report [Stantec Consulting Ltd. December 2013]). Existing conditions for Pacific herring are described in Section 4.3.2 of Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013), and Sections 4.2.6.5.2 and 4.2.6.7.2 of Volume 8A. The assessment of potential effects of the increase in Project-related marine vessel traffic on Pacific herring concludes that effects will be of negligible magnitude and not significant (refer to Section 4.3.6.6.2 of Volume 8A).

b) The requested information is not required for assessing potential effects of the increase in Project-related marine vessel traffic on the Pacific herring indicator. Project effects are assessed against existing (baseline) conditions, which are defined as the current state of the environment prior to the commencement of Project operations (refer to Section 3.4 of Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report [Stantec Consulting Ltd. December 2013]). Existing conditions for Pacific herring are described in Section 4.3.2 of Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013), and Section 4.2.6.5.2 of Volume 8A. The assessment of potential effects of the increase in Project-related marine vessel traffic on Pacific herring concludes that effects will be of negligible magnitude and not significant (refer to Section 4.3.6.6.2 of Volume 8A).

c) Pacific herring spawning areas in the United States (US) portion of the Marine regional study area (RSA) are described in Section 4.2.6.7.2 of Volume 8A. Pacific herring spawning areas and holding areas in the US portion of the Marine RSA are shown on Raincoast IR No. 1.13c – Attachment 1 (Figure S1, Pacific herring spawning areas, holding areas, and DFO Important Areas for Pacific herring in the Marine RSA). This information was obtained from the 2008 Washington State Herring Stock Status Report (Stick and Lindquist 2009).

Reference:

Stick, K.C. and A. Lindquist. 2009. 2008 Washington State Herring Stock Status Report. Stock Status Report No. FPA 09-05. Washington Department of Fish and Wildlife. 111 pp.

d) Trans Mountain is not aware of any information similar to Fisheries and Oceans Canada's (DFO's) Important Areas for Pacific herring in the United States (US) portion of the Marine regional study area (RSA). Figure 4.3 (Reference [ii]) and Figure 4.2-20 (Reference [iii]) do not imply that this information is available for the US portion of the Marine RSA.

e) The Fisheries and Oceans Canada (DFO) Important Areas (IAs) for Pacific herring within the Marine regional study area (RSA) were identified by Thomas Therriault, Douglas Hay, Jacob Schweigert and Bruce McCarter. These individuals are scientific experts in the field of Pacific herring biology and ecology; therefore, the DFO IAs for Pacific herring are considered best-available information.

f) Baseline information for Pacific herring in the Marine regional study area (RSA), including distribution of spawning areas, is provided in Section 4.3.2 of Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013), and Sections 4.2.6.5.2 and 4.2.6.7.2 of Volume 8A.

g) The Fisheries and Oceans Canada (DFO) Important Areas (IAs) for Pacific herring within the Marine regional study area (RSA) may include habitats important to non-migratory populations of Pacific herring. However, Therriault *et al.* (2009) report that these resident populations are found in Puget Sound and inlets on the eastern side of the Salish Sea, which for the most part are outside of the Marine RSA.

Reference:

Therriault, T.W., D.E. Hay and J.F. Schweigert. 2009. Biological overview and trends in pelagic forage fish abundance in the Salish Sea (Strait of Georgia, British Columbia). Marine Ornithology 37: 3-8.

h) Migratory routes used by Strait of Georgia Pacific herring are described in Section 4.3.2 of Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013), and Section 4.2.6.5.2 of Volume 8A. While the majority of Strait of Georgia Pacific herring are known to migrate through the Juan de Fuca Strait to offshore feeding grounds on the West Coast of Vancouver Island, the precise migratory paths are not known. Given the widespread distribution of Pacific herring in coastal waters, it is assumed that Pacific herring migrate through all marine habitats within the Marine regional study area (RSA).

1.14 Pacific herring: measurement endpoints

Reference:

i) A3S4J5, Application Vol. 8B, Technical Report, Marine Resources, PDF pages 24, 96 of 173.

Preamble:

Trans Mountain states "measurement endpoints facilitate quantitative or qualitative measurement of potential residual and cumulative effects, and provide a means to determine the level or amount of change to an indicator" (Reference (i)).

Pacific herring and salmon are selected as indicators of potential injury and mortality to marine fish due to vessel wake and Trans Mountain states that "the key issue for marine fish and fish habitat is the potential for wake waves generated by Project-related tankers and tugs to disturb intertidal habitats and potentially injure or kill" marine fish, including Pacific herring and Pacific salmon. The only other marine transport-related potential environmental effects identified as potentially affecting marine resources are (1) disturbance to marine fish habitat due to vessel wake and (2) auditory injury or sensory disturbance to marine mammals due to underwater noise (Reference (i)). Intertidal habitats are selected as an indicator species for vessel wake effects and three marine mammals are selected as indicator species for underwater noise effects (Reference (i)).

Request:

a) Please identify which marine mammal species represents the forage fish Pacific herring as an indicator species for auditory injury or sensory disturbance due to underwater noise (Reference (i)).

b) In addition to predicted wave height, length of shoreline affected and length of shore types affected by vessel wake (Reference (i)), please rate the potential severity of disturbance to marine fish habitat (intertidal indicator species) by shore type and length of shoreline type affected.

c) Please provide additional information on which marine fish species the indicator species Pacific herring and Pacific salmon are considered to represent, respectively.

Response:

a) No marine mammal indicator represents Pacific herring.

b) The assessment of potential effects of wake waves produced by Project-related vessels considered all 14 shore zone types found within the Marine regional study area (RSA). The assessment concluded that disturbance to intertidal habitat due to vessel wake would be of negligible magnitude and not significant (refer to Section 4.3.6.6.1 of Volume 8A). This conclusion is applicable to all shore zone types.

c) The rationale for selection of marine fish and fish habitat indicators for the marine transportation component of the Project is provided in Section 3.2 of Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013). Pacific salmon and Pacific herring were selected as indicators, in part, because their life history and habitat requirements (e.g., use of shoreline habitats for rearing, migrating and/or spawning) make them potentially susceptible to the effects of vessel wake. For the assessment of potential effects of the increase in Project-related vessel traffic, Pacific salmon and Pacific herring are not intended to represent effects on a wide range of marine fish species. Rather, as species that fill important ecological niches, they are intended to be representative of the broader health of the marine ecosystem.

1.15 Pacific herring: Quantitative Ecological Risk Assessment

Reference:

i) A3S4K7, Application Vol. 8B – Technical Report, Ecological Risk Assessment of Marine Transportation Spills, PDF pages 18, 34, 56, 57, 65, 66, 67, 70 of 116.
ii) A3S4Q4, Application Vol. 8B – Technical Report, Ecological Risk Assessment of Marine Transportation Spills, PDF Page 1 (Figure C.3) of 3.
iii) A3S4J5, Application Vol. 8B, Technical Report, Marine Resources, PDF page 69 of 173.
iv) A3S4X9, Application Vol. 8A – Marine Transportation, PDF pages 1, 2 and 3 of 33.

Preamble:

Trans Mountain states that "a Detailed Quantitative Ecological Risk Assessment (DQERA) for a CWC spill and a smaller spill for one selected spill location will be filed as a supplemental study in early 2014" (Reference (i)).

For the Preliminary Quantitative Ecological Risk Assessment (PQERA), Biological Sensitivity Factors (BSF) for marine fish and habitats were based, in part, on the assumption that species sensitivity (the "synthetic sensitive species") is the same regardless of the specific habitat being considered and thus the "sensitivity of the community becomes a function of the degree of exposure of the particular habitat to dissolved hydrocarbons" (Reference (i)).

The marine fish BSF classification relies heavily on bathymetry, particularly for BSF values 1 (>30 m depth), 2 (10- 30 m depth) and 3 (<10 m) (Reference (i)). The highest BSF (value of 4) includes a selection of defined areas for fish (Pacific herring spawning areas, Dungeness crab important habitat, rockfish conservation areas, eulachon Critical Habitat, salmon streams and other areas important to salmon (Reference (i)). No other "fish" species or important areas were included in the description of BSF 4 communities, some of which have been described (e.g. DFO Important Areas for Pacific herring; Reference (ii)). Further, in Figure C.3 (Reference (ii)), much of the open waters of the Marine RSA are described as BSF 1, even though those areas contain waters classified as BSF 1, 2 and 3. Trans Mountain deems each BSF classification as "exclusive with no overlap in area", with exception to BSF 4, which can overlap with areas with other BSF values (Reference (i)). For areas with overlapping BSF values, no description of BSF ranking priority is provided.

Trans Mountain lists "Herring Spawning and Holding Areas (US)" GIS data from the Washington Department of Fish and Wildlife as a data source for biological resource evaluation in the PQERA (Reference (i)). This same US herring spawn area information was not used in the Pacific herring species description and maps of herring spawning areas or other areas identified as important to herring located elsewhere in the document (i.e. Figure 4.3 and Figure 4.2-20, References (iii) and (iv)). In addition, the "DFO Important Areas for Pacific herring" that were identified and used for mapping elsewhere in Trans Mountain's document (References (iii) and (iv)) were excluded from the PQERA analysis (Reference (i)).

Unlike the marine bird section of the PQERA, which provided estimates of the number of marine bird colonies oiled under the various modeled oil spill scenarios (i.e. Table 6.9 and 6.10, Reference (i)), the marine fish and habitat section only describes the area and percent area according to BSF that are exposed to oil under the various oil spill scenarios (Reference (i)). Trans Mountain does not provide a summary of effects for Pacific herring spawning areas, rockfish conservation areas or any other areas important included in the high sensitivity ranking BSF 4 (Reference (i)).

Request:

a) Please provide the date when the Detailed Quantitative Ecological Risk Assessment (DQERA) will be filed on the public registry.

b) Please provide supporting scientific evidence that the sensitivity of marine fish and associated habitat is a function of the degree of exposure of the particular habitat to dissolved hydrocarbons.

c) Other than the five marine fish and fish habitat data sources listed in Table 4.4. (Reference (i)), please list any additional GIS data sources used in Figure C.3 (Reference (ii)).

d) Please include "Herring Spawning and Holding Areas (US)" in the description of Pacific herring and associated maps (e.g. text and Figures 4.3 and 4.2-20, References (iii) and (iv)).

e) Please provide a detailed justification for the exclusion of the "DFO Important Herring Areas" from the PQERA and associated map (References (i) and (ii)).

f) Please provide a list of the fish and invertebrate species within the Marine RSA that are without any delineated habitat in classification BSF 4 (References (i) and (ii)).

g) Please provide tables which summarize the area and percent of Pacific herring spawning areas (US and Canada), DFO Important Herring Areas (Canada) and holding areas (US) within the Marine RSA that will be exposed to oil under the various oil spill scenarios in the PQERA as opposed to the current oil spill scenario tables that only list the area and percent area of fish habitat oiled (i.e. Table 6.5, Reference (i)).

h) Please provide a detailed explanation as to why much of the open waters of the Marine RSA are described as BSF 1 (References (i) and (ii)), even though those areas contain habitat classified as BSF 1, 2 and 3. Is Trans Mountain using the presence of the lowest ranking BSF as representative for the entire water column BSF?

Response:

a) The Detailed Qualitative Ecological Risk Assessment was submitted on May 14, 2014 to support the Application for the Project. Refer to NEB IR No. 1.62d – Attachment 1.

b) Refer to Reference (i) above, pages 55-56 of 116. In a toxicological context, exposure is a precursor of effects. In the absence of exposure, a toxicological response will not be induced. The referenced pages explain how marine habitat was classified in order to focus on the likelihood of exposure, such that deep water habitat (<30 m deep) was assigned the lowest overall sensitivity, and shallow habitat was assigned a higher sensitivity. Areas of particular management concern as outlined in Table 5.4 (page 56 or reference (i)) were given additional consideration regardless of water depth.

c) Please refer to the response to FER IR No. 1.01.02.

d) Please refer to the response to Raincoast IR No. 1.13c.

e) Reference (i) addresses the potential environmental effects of crude oil spills on fish and fish habitat, without regard to species. The conceptual framework underlying this approach included a sensitive effect on reproduction (*i.e.,* the blue sac disease endpoint) as well as effects on whole fish (*i.e.,* the narcosis endpoint based on a "sensitive species" approach). This approach provides a conservative assessment of the potential for harm to fish populations (including but not limited to herring).

f) Table 5.4 of reference (i) provides the basis for the development of biological sensitivity factors for different types of marine habitat.

g) The approach that has been taken (*i.e.,* development of biological sensitivity factors representing a hypothetical sensitive species) is intended to provide a conservative assessment of the likelihood of adverse environmental effects occurring to any life stage or species of fish.

h) Tables 6.5, 6.6, 7.5, 7.6, 8.5, and 8.6 in reference (i) provide summary information as to the area of fish habitat affected by crude oil under the stochastic oil spill scenarios. Biological sensitivity factors 1, 2 and 3 are mutually exclusive (non-overlapping). Biological sensitivity factor 4 is evaluated independently of the other three sensitivity factors, as explained in Section 6.3 of reference (i).

1.16 Pacific herring: Pacific herring and other marine fish habitat recovery from oil spills

Reference:

i) A3S4K7, Application Vol. 8B – Technical Report, Ecological Risk Assessment of Marine Transportation Spills, PDF page 96, 97, 98, 103, 104 of 116.
ii) EVOSTC. 2010. Exxon Valdez oil spill restoration plan: 2010 update injured resources and services. Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.

Preamble:

Trans Mountain relies on just four EVOS-focused scientific sources to evaluate the potential for marine fish and marine fish habitat to recover from an oil spill in the Marine RSA (Reference (i)). Trans Mountain also states that the "effects of the EVOS on marine fish populations … were either not significant to begin with, or recovery occurred within one or two years at most" (Reference (i)).

Relying on Reference (ii) to assign injury to marine fish and marine fish habitat following the EVOS in Prince William Sound, Trans Mountain lists two marine fish as "recovered", sediments as "recovering", rockfish and subtidal communities as "very likely recovered" and Pacific herring as "not recovered" (emphasis ours; Reference (i)). In terms of Pacific herring, Trans Mountain uses just three scientific sources to assert that, despite an abundance of studies suggesting that Pacific herring were negatively impacted by EVOS, there are "no remaining ecologically significant effects" on Pacific herring following the spill (Reference (i)). Trans Mountain does not provide a timeframe for their assertion that there are "no remaining ecologically significant effects" on Pacific herring (Reference (i)).

Following Trans Mountain's four-source literature review on EVOS- related effects on marine fish and marine fish habitat and their own PQERA, Trans Mountain states that: "due to the generally low potential for the spill scenarios to cause wide-spread mortality of fish, recovery of the marine fish community would be expected to be rapid. Even under a worst-case outcome event where localized fish kills might be observed, it is expected that natural processes would compensate for the lost biological productivity within one to two years. By comparison, effects of the EVOS on marine fish populations, were either not significant to begin with, or recovery occurred within one or two years at most" (Reference (i)).

Request:

a) In terms of marine fish and marine fish habitat recovery from a large oil spill, please justify Trans Mountain's reliance on only four EVOS-focused scientific sources given the wealth of scientific literature available on marine fish and marine fish habitat exposed to oil in cold-water environments.

b) Please elaborate on how the lack of quantitative baselines for marine fish and habitat in pre-EVOS Prince William Sound complicated scientific investigations that sought to detect and measure the specific effects of the EVOS on marine fish, marine fish habitat and other marine species.

c) Please state, given the weight of evidence derived from numerous scientific studies relating to the effects of EVOS on Pacific herring, whether EVOS significantly impacted Prince William Sound Pacific herring in the two year post-spill period and afterwards.

d) Please clarify Trans Mountain's statement that there are "no remaining ecologically significant effects" on Pacific herring following the EVOS (Reference (i)). In particular, answer and provide supporting evidence for:
   i) whether the EVOS ever had ecologically significant effects on Pacific herring; and
   ii) the approximate year(s) when those ecologically significant effects became "insignificant".

e) Please provide additional supporting scientific evidence for Trans Mountain's statement that the "effects of the EVOS on marine fish populations … were either not significant to begin with, or recovery occurred within one or two years at most" (Reference (i)).

f) Please reconcile Trans Mountain's statement that the "effects of the EVOS on marine fish populations … were either not significant to begin with, or recovery occurred within one or two years at most" (Reference (i)) with the findings of the Reference (ii).

g) Please reconcile Trans Mountain's expectation in the event of a large oil spill in the Marine RSA that "recovery of the marine fish community", including Pacific herring, would be rapid and any lost productivity would be "compensated for by natural processes within one to two years" (Reference (i)) with the Reference (ii) conclusion that Pacific herring in Prince William Sound have not recovered.

h) Other than evidence from the EVOS, is there any evidence from cold- water oil spills to suggest that the marine fish community or marine fish habitat was impacted for any period greater than two years? Please describe this evidence.

i) Please list and describe in additional detail the "natural processes" that would compensate for any lost productivity for marine fish and marine fish habitat caused by a large oil spill in the Marine RSA (Reference (i)).

j) Please define the term "productivity" as Trans Mountain uses it in the response to the above question (g).

k) Please define the term "recovery", as it is applied for marine fish and marine fish habitat recovery following an oil spill (Reference (i)).

Response:

a) Section 9.0 of reference (i) provides the requested justification.

b) Additional discussion of this issue can be found in reference (ii) above (EVOSTC 2010), pages 1 to 7. As defined by EVOSTC, the recovery goal for injured ecosystem resources and services was "a return to conditions that would have existed had the spill not occurred". Without suitable baseline information, this definition of recovery is problematic.

c) Pearson *et al.* (2013) provide a recent review of the Pacific herring story following the EVOS. The biomass of Pacific herring in Prince William Sound was high and increasing throughout the 1980's. Although the spill occurred at a time when herring eggs were being laid, and estimates of their exposure are conflicting, such exposure did not produce effects at the population level. The biomass of herring remained high from 1989 through to the summer of 1992, but the expected high biomass of Pacific herring did not materialize in the spring of 1993 (four years after the spill). Between the spring of 1992 and the spring of 1993, it appears that there was high mortality of all year classes, not attributable to the EVOS. Pearson *et al.* (2013) reviewed multiple hypotheses regarding the cause of the decline of Pacific herring in Prince William Sound, as well as hypotheses regarding the lack of subsequent recovery.

Reference:

Pearson, W.H., R.A. Elston, K. Humphrey and R.B. Deriso. 2013. Pacific Herring. Chapter 13 in: Oil in the Environment: Legacies and lessons of the Exxon Valdez oil spill. J.A. Wiens, Ed. Cambridge University Press. 458 pp.

d) This topic is well covered by Harwell and Gentile (2006) and Pearson *et al.* (2013). It is reasonable to conclude that some herring eggs were exposed to harmful concentrations of hydrocarbons in the water during the spring of 1982 as a result of the EVOS. The degree to which such exposure would have caused population-level effects on Pacific herring, in the context of natural variability in egg deposition and survival, is debatable and is reviewed by Harwell and Gentile (2006) and Pearson *et al.* (2013). It is stated (Pearson *et al.* (2013)) that both Trustee and EXXON-funded studies agreed that any effects on herring eggs were limited to 1989.

References:

Harwell, M.A. and J.H. Gentile. 2006. Ecological significance of residual exposures and effects from the Exxon Valdez oil spill. Integrated Environmental Assessment and Management 2: 204-246.

Pearson, W.H., R.A. Elston, K. Humphrey and R.B. Deriso. 2013. Pacific Herring. Chapter 13 in: Oil in the Environment: Legacies and lessons of the Exxon Valdez oil spill. J.A. Wiens, Ed. Cambridge University Press. 458 pp.

e) Please refer to the response to Raincoast IR No. 1.16d.

f) Please refer to the response to Raincoast IR No. 1.16d.

g) The basis for this statement is explained in the three preceding paragraphs in Section 11.2 (pages 103-104 of 116) in reference (i), as well as in the supporting technical analysis of Sections 5, 6, 7 and 8 of that document. Also refer to the responses to Raincoast IR No. 1.16c and 1.16d above.

h) Harm to marine fish populations seems to be the exception, rather than the rule, following marine oil spills. This is a subject area that was addressed in evidence submitted as part of the Enbridge Northern Gateway Project Hearings (Reply Evidence: Recovery of the Biophysical and Human Environments from Oil Spills. Enbridge Northern Gateway Project. July, 2012.)

Reference:

Joint Review Panel. July 2012. Reply Evidence of Northern Gateway: Recovery of the Biophysical and Human Environments from Oil Spills. Enbridge Northern Gateway Project.

i) Natural processes leading to recovery of marine fish populations would include natural recruitment, as well as potentially immigration from other stocks or populations.

j) In fishery science, production is the total elaboration of new biomass for the species under consideration, generally with reference to spatial and temporal units (*e.g.,* tonnes of herring produced per year for a given stock). One can also differentiate between gross production (tissue elaborated regardless of whether that biomass lives through the period under consideration) and net production (the difference between gross production and losses due to metabolism and death). In ecology, and in the context of this question, gross production is the measure of interest, since biomass that does not live through the period under consideration may be consumed by organisms belonging to other trophic levels.

k) There are many different definitions of recovery in the context of environmental effects, but the common element is generally a return to some desirable system state following a disturbance.

The context for the concept of recovery for Marine Fish and Supporting Habitat is provided in Section 11.2 of the Ecological Risk Assessment of Marine Transportation Spills of Application of Volume 8B7 (pages 103-104 of 116 of reference (i)).

Fish – Pacific Salmon

1.17 Pacific salmon: migration routes

Reference:

i) A3S4X9, Application Vol. 8A – Marine Transportation, Section 4.2.6.5.3, PDF page 6 of 33.

Preamble:

Figure 4.2-21 in Reference (i) shows important salmon areas and migration routes for Pacific Salmon. Notably, migration routes are not shown at the mouth of the Fraser River and the southern Strait of Georgia (other than those in the Gulf Islands). In addition, no migration routes are shown in the Strait of Juan de Fuca or in the RSA that leads to Puget Sound.

Request:

a) Clarify why the migration routes shown on the map do not include known migration routes to the Fraser River and Puget Sound area.

b) Provide information addressing whether the migration routes are those of adult salmon entering their respective spawning streams/areas or those of smolts leaving their spawning streams.

Response:

a) Please refer to the response to Tsartlip FN IR No. 1.1.14.

b) The salmon migration routes shown in Figure 4.2-21 of Volume 8A are assumed to represent routes used by both juvenile and adult salmon; however, the metadata associated with these routes does not include life stage. Please refer to the response to Tsartlip FN IR No. 1.1.14.

1.18 Pacific salmon: habitat in US waters

Reference:

i) A3S4X9, Application Vol. 8A – Marine Transportation, Section 4.2.6.5.3, PDF page 6 of 33.

Preamble:

As a result of the US Magnuson-Stevens Fishery Conservation and Management Act, essential fish habitat for Pacific Salmon is: "In the estuarine and marine areas, salmon EFH extends from the near-shore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington, Oregon, and California north of Point Conception."

As DFO Important Salmon Areas are shown in Figure 4.2-21, it would be prudent to include essential fish habitat in the US, to reflect the importance of near-shore waters to salmon in the US waters of the marine RSA.

Request:

a) Please amend Figure 4.2-21 to reflect the essential fish habitat in US waters.

Response:

a) It is acknowledged that essential fish habitat (EFH) for Pacific salmon in United States waters includes all estuarine and marine areas within the Marine regional study area (RSA). For the assessment of potential effects of the increase in Project-related marine vessel traffic on Pacific salmon (refer to Section 4.3.6.6.3 in Volume 8A), it was conservatively assumed that salmon migrate through all estuarine and marine habitats within the Marine RSA. Therefore, amending Figure 4.2-21 in Volume 8A is not considered necessary.

1.19 Pacific salmon: Puget Sound

Reference:

i) A3S4X9, Application Vol. 8A, Volume 8A – Marine Transportation, Section 4.2.6.5.3, PDF page 5 of 33.

Preamble:

Reference (i) lists a number of Canadian salmon stocks of conservation concern or Species of Conservation Concern as designated by COSEWIC, including coho, sockeye and chinook stocks. However, there is no mention of threatened salmon in Puget Sound, including Hood Canal summer-run ecologically significant unit (ESU) chum salmon or Puget Sound ESU Chinook salmon. These stocks migrate through the RSA, and portions of the Puget Sound Chinook ESU (where critical habitat has been defined) lie within the marine RSA.

Request:

a) Please identify the threatened salmon stocks in the US waters.

Response:

a) Salmon populations of conservation concern in United States waters within or near the Marine regional study area (RSA) are shown in Table 1.19A-1, below.

TABLE 1.19A-1

SALMON POPULATIONS OF CONSERVATION CONCERN IN UNITED STATES WATERS WITHIN OR NEAR THE MARINE RSA

Species	Population	Location	Status[1]
Chum salmon (*Oncorhynchus keta*)	Hood Canal summer-run ESU[2]	All naturally spawned summer-run populations originating from Hood Canal and its tributaries, Olympic Peninsula rivers between Hood Canal and Dungeness Bay, as well as 4 artificial propagation programs.	Threatened
Chinook salmon (*Oncorhynchus tshawytscha*)	Puget Sound ESU[2]	All naturally spawned populations originating from rivers flowing into Puget Sound from the Elwha River, eastward including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia, as well as 26 artificial propagation programs.	Threatened

Sources: National Oceanic and Atmospheric Administration 2014a,b (refer to Raincoast IR No. 1.19a – Attachment 1 and 2)
Notes: [1] Listing under the United States Endangered Species Act
[2] ESU – Evolutionarily Significant Unit

References:

National Oceanic and Atmospheric Administration. 2014a. NOAA Fisheries, West Coast Region, Chum, Hood Canal Summer-run Chum. Website: http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/chum/hood_canal_summer_run/hood_canal_summer_run_chum.html. Accessed: May 2014. (refer to Raincoast IR No. 1.19a – Attachment 1).

National Oceanic and Atmospheric Administration. 2014b. NOAA Fisheries, West Coast Region, Chinook, Puget Sound Chinook. Website: http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/chinook/puget_sound/puget_sound_chinook.html. Accessed: May 2014. (refer to Raincoast IR No. 1.19a – Attachment 2).

Marine Mammals

1.20 Marine mammals: consultation with the Department of Fisheries and Oceans

Reference:

i) National Energy Board, Filing Manual, Release 2014-1, Section 3.4.2, page 3-6 and Table 3.1, page 3-15.
ii) A3S4X4, Application Vol. 8A – Marine Transportation, Section 3.1.1, Table 3.1.1, PDF page 23 of 40.
iii) A3S4Y3, Application Vol. 8A – Marine Transportation, Section 4.3.7.1, PDF page 69 of 294.

Preamble:

Reference (i) states that a project proponent must ensure that appropriate government authorities are included in the consultation process. Reference (i) indicates that consultation with the Department of Fisheries and Oceans ("DFO") may be needed where the project could affect wildlife species at risk or their critical habitat.

In Reference (ii), Trans Mountain identifies federal Government of Canada agencies as stakeholders for consultation with respect to marine shipping lanes.

In Reference (iii), Trans Mountain states that a meeting was held with DFO in Kamloops on September 25, 2013 to present a high level overview of the Marine ESA approach.

Request:

a) Please identify all representatives of Trans Mountain, Trans Mountain's consultants and DFO that attended the September 25, 2013 meeting in Kamloops.

b) Please provide a copy of the agenda and any notes arising out of the September 25, 2013 meeting in Kamloops.

c) Please identify any other meetings between Trans Mountain and/or Trans Mountain's consultants and DFO, the dates and locations of such meetings, the list of attendees, the agenda and notes arising out of such meetings that occurred during the preparation of the Project Application.

d) Specifically, please identify any meetings between Trans Mountain and/or Trans Mountain's consultants and DFO with respect to acoustic impacts on marine mammals. For any such meetings, please provide the date and location of such meetings, the list of attendees, the agenda and any notes arising out of such meetings.

Response:

a) Attendees of the September 25, 2013 meeting in Kamloops, BC included representatives from Fisheries and Oceans Canada (DFO), Trans Mountain, GeoMarine Environmental Consultants Ltd. and Stantec Consulting Ltd.

b) A summary of the agenda and issues discussed from the September 25, 2013 meeting with Fisheries and Oceans Canada (DFO) in Kamloops, BC is documented in the table below. Trans Mountain does not intend to file the original notes from these meetings.

Agency Name	Date of Consultation Activity	Reason for Engagement	Issues/Concerns	Commitments/Follow-up Actions/Comments
Fisheries and Oceans Canada (DFO)	September 25, 2013	Project introduction. Marine resources indicators. Key issues/effects for marine resources. Approach to habitat compensation / offsetting. Outline methods and approach to fish and fish habitat investigations along the Project length. Brief review of regulatory changes.	No concerns with indicator selection or effects being considered were raised. No concerns with the general methodology. Need to ensure that compensation/offset projects have high probability of success.	Agreed to develop habitat compensation / offsetting plans during the permitting phase of the Project for the pipeline and facilities assessment. Engage DFO at the time of developing Fish Habitat Compensation/Offset. Ensure First Nation involvement in development and implementation.

c) In-person meetings with Fisheries and Oceans Canada (DFO) for the Trans Mountain Expansion Project in addition to the September 25, 2013 meeting in Kamloops, BC are documented in the table below. Trans Mountain does not intend to file the original notes from these meetings. In addition to meetings, Trans Mountain communicated with DFO regarding the Project through emails, letters and phone calls.

Agency Name	Date of Consultation Activity	Location	Attendees	Issues Discussed
Fisheries and Oceans Canada (DFO)	May 15, 2012	Ottawa, ON	• DFO - Senior MPR Analysts, Major Project Reviews • Trans Mountain • Cornerstone Planning • TERA Environmental Consultants • Comsult Inc.	• Community Capacity Building - First Nation • Engagement Process – Aboriginal • Engagement Process – Regulatory • Engagement Process – Stakeholder • Marine - Air Emissions/Greenhouse Gas • Marine – Dredging • Marine - Tanker safety • Regulatory – National Energy Board (NEB) process • Routing - Existing Pipelines • Terrestrial - Parks and Protected Areas • Routing - Expropriation/Devaluation • Marine - Tanker traffic • Marine - Tanker details (size, number etc) • Safety - Pipeline Integrity • Routing - Water Crossings

Agency Name	Date of Consultation Activity	Location	Attendees	Issues Discussed
DFO	July 19, 2012	Vancouver, BC	• DFO - Manager, Environmental Assessment and Major Projects • Trans Mountain • Comsult Inc.	• Project overview • Biophysical field studies update • Preliminary routing objectives • DFO assessment and working with NEB • Fisheries Act permitting process and changing legislation • TERMPOL
DFO	September 14, 2012	Vancouver, BC	• DFO – Team Leader, EA and Major Projects • DFO – EA Analyst, EA and Major Projects • Trans Mountain • TERA Environmental Consultants • GeoMarine Environmental Consultants Ltd. • Stantec Consulting Ltd.	• Project introduction. • Intertidal, subtidal, and riparian habitat survey methodology. • Overview of assessment methodology for marine resources. • Marine Local Study Area (LSA)/Marine Regional Study Area (RSA) boundaries. • Outline methods and approach to fish and fish habitat investigations along the Project length. Brief review of regulatory changes.
DFO	November 29, 2012	Eagle Creek, BC	• DFO – Habitat Biologist, Habitat Management • TERA Environmental Consultants	• Terrestrial - Mammals • Terrestrial - Water bodies • Workshop hosted by the Eagle Creek Storm Water Management
DFO	January 22, 2013	Vancouver, BC	• DFO – Marine and Civil Infrastructure • DFO – Superintendent, Waterways Development • DFO – Officer-in-Charge, Marine Communications and Traffic Services Vancouver • Trans Mountain • Cornerstone Planning • Lizette Parsons Bell & Associates • Salmo Consulting Inc. • TERA Environmental Consultants • Tetra Tech (Pre-Aquisition EBA Engineering)	• Project team members hosted a Hazard Identification Study to discuss the risks of the Westridge Marine Terminal Expansion. • Marine - Dock Site
DFO	May 22, 2013	Kamloops, BC	• DFO – Restoration Biologist, Resource Restoration Unit • DFO – Fisheries Protection Program Biologist • Trans Mountain	• Review plans for the Swift Creek restoration project in Valemount BC • Community Capacity Building - First Nation • Community Capacity Building – Métis • Socio-Economic Terrestrial - Employment/Training - First Nations • Terrestrial-Water Quality/Quantity • Terrestrial-Riparian Areas • Terrestrial - Freshwater Fish

Agency Name	Date of Consultation Activity	Location	Attendees	Issues Discussed
DFO	May 24, 2013	Vancouver, BC	• DFO – Fisheries Protection Program Biologist • DFO – Senior Fisheries Protection Biologist • DFO – Team Leader, Fisheries Protection Program • TERA Environmental Consultants • Salmo Consulting Inc. • Stantec Consulting Ltd. • Trans Mountain • Tetra Tech (Pre-Acquisition EBA Engineering)	• Pipeline and Marine Risk Assessment (Quantitative and Ecological) • Corporate Policy - Oil Sands • Marine - Ecological Risk Assessment • Marine - Spills - Safety

d) Acoustic impact on marine mammals was discussed with Fisheries and Oceans Canada (DFO) on September 25, 2013 in Kamloops, BC. Please refer to the response to Raincoast IR No. 1.20a for the list of attendees at this meeting. Please refer to the response to Raincoast IR No. 1.20b for the agenda and notes from this meeting.

The objectives of this meeting were to: present an overview of the Project; present the marine resources indicators selected for the environmental assessment; discuss the key issues and effects that would be considered; and discuss the approach to habitat compensation and offsetting for the Project. The indicators selected (including marine mammal indicators) were discussed, as well as potential marine effects such as underwater noise effects to marine mammals, and the spatial boundaries of the assessment. DFO did not raise any concerns with the marine resources indicators and indicated that the effects being considered were appropriate for the scope of the Project.

Prior to this meeting, a summary of the proposed methods for the underwater noise modeling work for the Trans Mountain Expansion Project was shared with DFO on March 14, 2013 by email. No feedback on the modeling approach from DFO was received at that time.

1.21 Marine mammals: field data collection

Reference:

i) A3S4X8, Application Volume 8A – Marine Transportation, Section 4.2.6.2, PDF page 15 of 23.
ii) A3S4X9, Application, Volume 8A – Marine Transportation, Section 4.2.7.6.1, PDF page 18 of 33.
iii) A3S4J5, Application Volume 8B – Marine Resources, Marine Transportation Technical Report, Section 4.3.4, PDF pages 77, 78, 79 of 173.
iv) BC Cetaceans Sighting Network. Wild whales: how sightings are used. Available at: http://wildwhales.org/sightings-network/how-sightings-are- used/.

Preamble:

Reference (i) states, "Information on marine resources within the Marine RSA is readily available in published literature and is deemed to be sufficient to assess potential effects of the increased Project-related marine vessel traffic on marine fish and fish habitat. Therefore, Project-specific field studies for this aspect of data gathering were not considered warranted."

Reference (ii) states "…(note that sightings presented on this map do not differentiate between potential killer whale populations). Data obtained from the BC Cetacean Sightings Network were collected opportunistically with limited knowledge of the temporal or spatial distribution of observer effort. As a result, absence of sightings at any location does not demonstrate absence of cetaceans."

Further, Section 4.3.4 (Reference iii), which relates to Steller sea lions, relies heavily on opportunistic data derived from Reference (iv). The BC Cetaceans Sighting data cannot be used to distinguish between places that animals do not use and places where people have not looked and carries a strong disclaimer: "However, the way sightings network data is collected, creates a puzzle that limits the usefulness of the data. We know where areas of high sightings concentrations are, but we don't know whether high concentrations of sightings in these areas are due to more observers or to higher concentrations of cetaceans and sea turtles" (reference iv).

Request:

a) Please provide details supporting the assertion in Reference (i) that field studies were not warranted.

b) Given the known inadequacy of opportunistic data identified in References (ii) and (iv) and the lack of abundance estimates for most marine mammal species in the area, how does Trans Mountain justify its decision that new field studies were not required?

c) Please describe how a quantitative assessment of the impacts on exposed populations of marine mammals and other taxa can be conducted in the absence of quantitative population abundance estimates.

Response:

a) As discussed in Section 4.3.6.4 of Volume 8A, potential effects of the increase in Project-related marine vessel traffic on marine fish and fish habitat are expected to be limited to the effects of vessel wake on shoreline habitats and biota. The information needed to assess this effect pathway for the selected marine fish and fish habitat indicators is readily available in the scientific literature (refer to the baseline information presented in Volume 8B, Biophysical Technical Report 8B-1, Marine Resources – Marine Transportation Technical Report [Stantec Consulting Ltd. December 2013]. Where site-specific information was not available, conservative assumptions were made to ensure the assessment did not underestimate potential effects. For example, spatially-explicit data on the distribution of juvenile Pacific salmon in nearshore marine habitats is not available for all areas of the Marine regional study area (RSA). Therefore, it was conservatively assumed that juvenile Pacific salmon (all five species) migrate along shoreline habitats throughout the entire Marine RSA, where they could interact with wake waves produced by Project-related vessels. With the information available in published literature, and the application of conservative assumptions, marine fish and fish habitat field surveys for the marine transportation component of the Project were not considered warranted.

b) Abundance estimates for all marine mammal species specific to the study area are not considered necessary to conduct an assessment of potential project effects. It is acknowledged that there are gaps in scientific understanding of population-level consequences of underwater noise related to vessel traffic; however, perfect knowledge of densities and distributions of marine mammals in the Marine Regional Study Area (RSA) would not improve the understanding of this effect pathway. A good understanding of many marine mammal populations is however available in the literature and conservative assumptions were used in conducting the assessment. For example, the southern resident killer whale population is censused annually based on photo-identification of uniquely-identifiable individuals, and as of July 1, 2013, there were 82 individuals in the southern resident population (i.e., J Pod = 26, K Pod = 19 and L Pod = 37) (recently updated to 80 individuals as of December 2013 as noted in Raincoast IR No. 1.21b – Attachment 1).

The assessment assumed that the entire population of southern resident killer whales could be present in the Marine RSA (and thus potentially 100% of the animals could be exposed to Project-related underwater noise) at any given time. Furthermore, population status of marine mammal species under the *Species at Risk Act* was given strong consideration in determining significance of residual effects, and assigned statuses (which generally factor in population sizes and trends of listed species) were explicitly considered. In summary, existing population estimates, particularly with respect to cetacean species at risk, are considered sufficient to support the conclusions reached in the environment assessment.

Reference:

Center for Whale Research. 2014. Southern Resident Killer Whales. Population Abundance as of December 2013. Website: http://www.whaleresearch.com/#!orcas/cto2. Accessed: May 2014.

c) Acoustic modelling conducted for the Project would be considered a quantitative aspect of the assessment, although measurement endpoints (used to characterize and evaluate the magnitude of Project-related effects) were qualitative in nature, as explained in Section 4.3.7.1 and Table 4.3.7.1 of Volume 8A of the Application. As noted in the response to Raincoast IR No. 1.21b above, existing population estimates, particularly with respect to cetacean species at risk, are considered sufficient to support the conclusions reached in the environment assessment.

1.22 Marine mammals: acoustic disturbance

Reference:

i) A3S4Y3, Application Volume 8A – Marine Transportation, Section 4.3.7.5.1, PDF page 88 of 294.
ii) Williams, R., Erbe, C., Ashe, E., Beerman, A., Smith, J. 2014. Severity of killer whale behavioral responses to ship noise: a dose response study. Marine Pollution Bulletin. Severity of killer whale behavioral responses to ship noise: a dose-response study. 79(1-2): 254-60.
iii) Williams, R., Krkošek, M., Ashe, E., Branch, T.A., Clark, S., et al. 2011. Competing Conservation Objectives for Predators and Prey: Estimating Killer Whale Prey Requirements for Chinook Salmon. PLoS ONE. 6(11): e26738.
iv) Erbe, C., MacGillivray, A., Williams, R. 2012. Mapping cumulative noise from shipping to inform marine spatial planning. JASA Express Letters. 132(5): 1-6.
v) Williams, R., Clark, C. W., Ponirakis, D. Ashe, E. 2014. Acoustic quality of critical habitats for three threatened whale populations. Animal Conservation. 17: 174–185.
vi) Erbe, C., Williams, R., Sandilands, D., Ashe, E. 2014. Identifying Modeled Ship Noise Hotspots for Marine Mammals of Canada's Pacific Region. PLoS ONE. 9(3).

Preamble:

Reference (i) states, "It is not possible to quantify how much time an individual or population of marine mammals may be exposed to noise resulting specifically from increased Project-related marine vessels, as both the vessels and marine mammals are in a near constant state of motion, and at any one time, their occurrence may or may not overlap."

Although whales and ships move, it is common in spatially explicit risk assessments to estimate the average overlap of marine mammals and noise. Previous studies have shown that resident killer whales follow a stereotypical dose-response relationship to passage of large ships at received levels of 120-130dB (Reference (ii)). Trans Mountain's assessment ignores the increased number of times that whales will be exposed to such disturbance, which is likely to come at the cost of feeding activity. That is problematic for a population like southern resident killer whales that are already prey-limited (Reference (iii)).

Previous studies (Reference (iv)) have predicted and demonstrated empirically (Reference (v)) that Haro Strait and Georgia Strait are among the noisiest sites in BC. When overlaying that noise surface with average density of marine mammals (Reference (vi)), Haro Strait emerged as an acoustically degraded habitat. Ship noise causes a 62-97% loss of communication space for vocal killer whales under median and noisy conditions, respectively. The Project can only increase behavioural responses and acoustic masking.

Request:

a) Please provide a referenced rationale for the basis on which Trans Mountain concludes that increasing the risk of behavioural responses and acoustic masking is negligible?

b) Given that Project-related impacts include increases in large vessel traffic, please provide details of the extent to which the Trans Mountain's findings and conclusions would change if Trans Mountain assessed how killer whales respond to large ships (Reference (ii)), rather than small boats.

Response:

a) Trans Mountain is unable to find this wording in reference (i) above and no such conclusion is made.

b) Given that the Application concluded that "effects on southern resident killer whales were determined to be significant" (Section 4.3.7.6.1 of Volume 8A of the Application), additional information published in 2014 assessing killer whale behavioural responses to large vessel traffic would not alter the conservative conclusions presented in the Application. Conclusions were based on behavioural response thresholds in use by the United States National Oceanic and Atmospheric Administration, which do not distinguish between source levels (i.e., small versus large vessels), and on acoustic modelling, which predicted sound levels based on surrogate large vessels.

1.23 Marine mammals: acoustic disturbance

Reference:

i) A3S4Y3, Volume 8A – Marine Transportation, Section 4.3.7.6.1, PDF page 94 of 294.
ii) Tougaard, J., Carstensen, J., Teilmann, J., Skov, H. Rasmussen, P. 2009 Pile driving zone of responsiveness extends beyond 20 km for harbor porpoises (Phocoena phocoena (L.). Journal of the Acoustical Society of America. 126(1): 11-14.

Preamble:

Reference (i) states, "While species such as harbour porpoises may be somewhat more sensitive than southern resident killer whales to high frequency sounds and may show more pronounced responses to disturbance, acoustic modelling of harbour porpoises suggest that the extent of sensory disturbance is expected to be generally comparable across all toothed whale species found within the Marine RSA."

Some research (Reference (ii)) suggests that harbour porpoise are particularly sensitive to noise, showing responses to pile driving noise at ranges beyond 20 km (when received levels are below 160 dB and the high frequency energy will have attenuated). The literature would suggest that porpoise are far more vulnerable to ship noise than this assessment would suggest.

Request:

a) Please provide a detailed referenced rationale for the basis on which Trans Mountain concludes that vulnerability of harbour porpoise (and other small cetaceans) to ship noise is adequately captured by killer whales.

b) Please provide a detailed referenced rationale for the basis on which Trans Mountain did not conduct field studies to measure responses of BC marine mammals to ship noise, rather than relying entirely on published literature.

Response:

a) Trans Mountain agrees that harbour porpoise may be particularly sensitive to noise, particularly with respect to construction activities such as pile driving (see Section 7.6.11.6 of Volume 5A of the Application). Rationale for the selection of killer whales as the odontocete (*i.e.,* toothed whale) indicator was provided in Section 4.3.7.1 of Volume 8A. In the initial selection of a marine mammal indicator representative of odontocetes, both the harbour porpoise and the southern resident killer whale were considered. The southern resident killer whale was ultimately selected because its designated critical habitat overlaps almost entirely with the Marine RSA; it is considered to be of greater conservation concern (*i.e.,* it is listed as Endangered under *SARA* in contrast to the harbour porpoise which is listed as Special Concern); and the current acoustic thresholds used for assessing behavioural disturbance do not distinguish between different species of toothed whale (see Section 4.3.7.4.3 of Volume 8A). In consideration of potential differences, the harbour porpoise was included as an additional indicator in the acoustic modelling study so that results could be assessed for comparability with killer whales (see for example Tables 4.3.7.5 and 4.3.7.6 of Volume 8A, which show values for the harbour porpoise indicator alongside killer whales). Audiogram-weighted levels calculated for harbour porpoises were found to be appropriately represented by the killer whale indicator. Therefore, the southern resident killer whale is considered to be an appropriate indicator for assessing effects of underwater noise on other toothed whales, including porpoises and dolphins. Acoustic modeling results specific to harbour porpoises are available in Appendix A Technical Report 8B-1, Volume 8B, Marine Resources - Marine Transportation Technical Report (Stantec Consulting Ltd. December 2013).

b) Scientific studies of this nature are considered beyond the scope of the Application. While there are gaps in scientific understanding of population-level consequences of underwater noise related to vessel traffic, conservative assumptions were used to conduct the environmental assessment and the available literature is considered sufficient to support the conclusions reached.

1.24 Marine mammals: mitigation measures for acoustic disturbance

Reference:

i) A3S4Y3, Application Vol. 8A – Marine Transportation, Section 4.3.7.1, PDF page 85 of 294.

Preamble:

In Reference (i), Trans Mountain states that it has little direct control over the operating practices of tankers or tugs as Project-related marine vessels are owned and operated by a third party. Therefore, Trans Mountain states that it has prepared no direct mitigation measures for effects associated with increased Project-related marine transportation.

Trans Mountain relies on a project being developed by the Port of Metro Vancouver to address issues of underwater noise in the Strait of Georgia and surrounding waters.

Request:

a) In Trans Mountain's opinion, which party or government agency is responsible for the environmental assessment of the acoustic disturbance impacts on marine mammals caused by the Project?

b) In Trans Mountain's opinion, which party or government agency is responsible for identifying technically and economically feasible mitigation measures for the impacts of acoustic disturbance on marine mammals caused by the Project?

c) In Trans Mountain's opinion, which party or government agency is responsible for ensuring that the mitigation measures identified for acoustic disturbance of marine mammals caused by the Project are consistent with the recovery strategy for southern resident killer whales?

d) For the parties or government agencies identified in the responses to questions a-c, have those parties or government agencies confirmed to Trans Mountain that they will accept the responsibilities identified in questions a-c?

Response:

a) Trans Mountain Pipeline ULC (Trans Mountain) applied to the National Energy Board (NEB) for a certificate of public convenience and necessity and related approvals for the Trans Mountain Expansion Project (Project). The Project is a designated project under the Canadian Environmental Assessment Act, 2012 and the Board is the Responsible Authority. Trans Mountain has conducted an assessment of the potential environmental and socio-economic effects of the Project and filed the assessment with the NEB as part of the Facilities Application. The NEB is conducting an environmental assessment under the Canadian Environmental Assessment Act, 2012, which will be included in the NEB's report to the Minister of Natural Resources. For more information, see the NEB`s 2 April 2014 Factors and Scope of the Factors for the Environmental Assessment pursuant to the Canadian Environmental Assessment Act, 2012.

b) Please refer to the response to Raincoast IR No. 1.24a.

c) Please refer to the response to Raincoast IR No. 1.24a.

d) Please refer to the response to Raincoast IR No. 1.24a.

1.25 Marine mammals: impacts of an oil spill

Reference:

i) A3S4Y7, Application Volume 8A – Marine Transportation, Section 5.6.2.2.5, PDF page 18 of 19.
ii) Matkin, C. O., Saulitis, E. L., Ellis, G. M., Olesiuk, P., Rice, S. D. 2008. Ongoing population-level impacts on killer whales *Orcinus orca* following the 'Exxon Valdez' oil spill in Prince William Sound, Alaska. Marine Ecology Progress Series. 356: 269–281.
iii) Williams, R., Gero, S., Bejder, L., Calambokidis, J., Kraus, S. D., Lusseau, D., Read, A. J., Robbins, J. 2011. Underestimating the damage: interpreting cetacean carcass recoveries in the context of the Deepwater Horizon/BP incident. Conservation Letters. 4(3): 228-233.
iv) Williams, R., Lusseau, D., Hammond, P. S. 2009. The role of social aggregations and protected areas in killer whale conservation: the mixed blessing of critical habitat. Biological Conservation. 142(4): 709-719.
v) Schwacke, L. H., Smith, C. R., Townsend, F. I., Wells, R. S., Hart, L. B., Balmer, B. C., Collier, T. K., De Guise, S., Fry, M. M., Guilette, L. J., Lamb, S. V., Lane, S. M., McFee, W. E., Place, N. J., Tumlin, M. C., Ylitalo, G. M., Zolman, E. S., Rowles, T. K. 2013. Health of Common Bottlenose Dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, Following the Deepwater Horizon Oil Spill. Environmental Science and Technology. 48(1): 93–103.

Preamble:

Reference (i) notes, "Therefore, there is a relatively high probability of exposure for whales should an oil spill occur at this location. Some level of negative effect would be expected for animals exposed to oil, but the effects would not likely be lethal, except in the case of weaker animals such as calves or older and diseased animals, or animals that were exposed to heavy surface oiling and inhalation of vapours from fresh oil, as could occur in the immediate vicinity of the spill location."

This statement runs counter to the observed effects of oiling on killer whales after Exxon Valdez (Reference (ii)). Except in the unusual case of killer whale populations that are completely censused, effects of oiling on other cetaceans is always underestimated due to low carcass recovery rate (Reference (iii)).

By relating effects to the proportion of area or shoreline that would be oiled, Trans Mountain ignores the more likely scenario that animals are clustered in high-density areas (Reference (iv)). The reliance on opportunistic data (i.e. assuming uniform distribution throughout the range) underestimates risk if a spill occurs in a high-density area, and reiterates the point that field surveys would have been preferable to using existing reports.

Request:

a) Please provide scientific evidence supporting Trans Mountain's statements in Reference (i) and reconcile these conclusions with the observed effects of oiling on killer whales after the EVOS (Reference (ii)).

b) Please provide scientific evidence supporting Trans Mountain's statement that cetaceans are more robust to oiling than previously thought.

c) Please provide information with regard to the considerations Trans Mountain gave to the lagged effects of oiling on marine mammals, which can cause death years following an oil spill (Reference (v)).

d) Please provide details of the potential overall significance of impacts when also considering lagged effects.

Response:

a) Statements in reference (i) are not in conflict with the findings and conclusions of reference (ii). Killer whales show little or no tendency to avoid oil spills. During the EVOS members of the transient AT1 population and the Resident AB pod were seen surfacing in oil slicks immediately following the spill in 1989. As reported by the Exxon Valdez Oil Spill Trustees Council (EVOSTC 2010) and Matkin *et al.* (2008), both groups experienced mortality in the months following oil exposure. Deaths were potentially due to the inhalation of petroleum vapours, or from feeding on oiled seals or contaminated fish (EVOSTC 2010). Mortality continued in the following year because mothers died leaving orphaned calves that subsequently died (EVOSTC 2010). The mortality rate for the AB pod was reported to be 19% in 1989 and 21% in 1990, compared to an expected natural mortality rate of about 2.5% (EVOSTC 2010, Matkin *et al.* 2008). However, the AB pod was in conflict with the commercial longline fishery of Prince William Sound prior to the EVOS. Matkin *et al.* (1999) documented bullet wounds on 10 whales in the pod, 5 of which subsequently died. Between 1985 and 1986, 6 whales were lost from AB pod. The mortality rate in the AB pod was therefore higher than normal even before the oil spill. Matkin *et al.* (1999) described the social structure of the matriarchal pods, noting that the loss of an important matriarch can affect a pod for some years thereafter. Thus, the loss of key matriarchs from the 1986 shootings, and from the 1989 EVOS event, may have resulted in a continuing of AB pod decline (Harwell and Gentile 2006). Harwell and Gentile (2006) concluded that the population reduction of the AB pod in the immediate aftermath of the EVOS was ecologically significant, and was most likely caused by exposure to crude oil, which exacerbated ongoing effects on that pod as a result of recent conflict with fishermen. However, not all resident or transient killer whale in Prince William Sound and the Gulf of Alaska were affected in the way that the AB pod was, indicating that not all of the whales had the same, or critical exposure. Harwell and Gentile (2006) report that the larger Prince William Sound population of killer whale pods, both resident and transient, shows no signs of short- or long-term effects from EVOS; to the contrary, the resident populations continue the general trend of a gradual increase seen in the rest of the Gulf of Alaska.

References:

Exxon Valdez Oil Spill Trustee Council (EVOSTC). 2010. Exxon Valdez Oil Spill Restoration Plan: 2010 update injured resources and services. May 14, 2010.

Harwell, M.A. and J.H. Gentile. 2006. Ecological significance of residual exposures and effects from the Exxon Valdez oil spill. Integrated Environmental Assessment and Management 2: 204-246.

Matkin, C.O., G.M. Ellis, E.L. Saulitis, L. Barret-Lennard and D. Matkin. 1999. Killer whales of southern Alaska. North Gulf Oceanic Society, Homer, AK.

b) We are unable to find this wording in reference (i) above.

c) Please refer to the response to Raincoast IR No. 1.25a.

d) An accident that caused a serious adverse environmental effect (e.g., death or serious injury) to a member of the southern resident killer whale population would be significant in the context of the Canadian Environmental Assessment Act, 2012, due to the listing of this population as “Endangered” under the Species at Risk Act. However, the significance of such an effect also needs to be considered in the context of the cumulative probability of a credible worst case accident occurring, and that the environmental effects of such an accident would overlap with the distribution of the members of this population at that time, with sufficient exposure to cause the effect.

1.26 Marine mammals: Humpback whales

Reference:

i) A3S4X9, Application Volume 8A – Marine Transportation, Section 4.2.7.6.2, PDF pages 21, 22 of 33.
ii) Williams, R., Thomas, L. 2007. Distribution and abundance of marine mammals in the coastal waters of British Columbia, Canada. Journal of Cetacean Research and Management. 9(1):1-15.
iii) Williams, R., O'Hara, P. 2010. Modelling ship strike risk to fin, humpback and killer whales in British Columbia, Canada. Journal of Cetacean Research and Management. 11(1): 1-8.
iv) The Splash Program (www.cascadiaresearch.org).

Preamble:

Trans Mountain relies exclusively on BC Cetaceans Sightings Network information for humpbacks in the Marine RSA, which are opportunistically collected sightings which are not corrected for effort (Reference (i)). The last systematic survey for marine mammals in BC's coastal waters covered the Strait of Georgia in 2004 (Reference (ii)). At that time, humpback whales were not seen in Strait of Georgia. A decade later, humpback whale sightings are now far more common in Haro Strait and the Strait of Juan de Fuca. As a result, previous ship strike risk models based on data from 2004 (e.g., Reference (iii)) underestimate ship strike risk to humpback whales in this region. That survey did not cover the west coast of Vancouver Island. Therefore no quantitative information is available to assess ship strike risk to humpback whales in that region.

Reference (iv), The SPLASH Program, suggested two populations of humpback whales in BC: a north coast stock and a southwest Vancouver Island (SWVI) stock. The Project would increase ship strike risk to the putative SWVI stock, which is estimated to be very small and unable to cope with even modest levels of anthropogenic mortality.

Request:

a) Given the lack of current humpback whale data for the west coast of Vancouver Island, please provided a detailed justification, including scientific evidence, outlining why Trans Mountain decided that new fieldwork was not necessary.

b) Please provide additional supporting evidence for the exclusion of the SWVI stock from the risk assessment and provide a justification for not conducting field work for the SWVI stock.

Response:

a) As explained in response to Raincoast IR No. 1.21b, abundance estimates for all marine mammal species specific to the study area are not considered necessary to conduct an assessment of potential Project effects. The Application recognized that areas of higher relative risk occur where shipping traffic overlaps with higher density areas for marine mammals, and that in the Marine RSA; this is most likely to be the western-most region, which overlaps with critical habitat for humpback whales (Section 4.3.13.5.4 of Volume 8A). Based on identification of this area as critical habitat in DFO's Humpback Whale Recovery Strategy (Fisheries and Oceans Canada 2013), humpback whales are expected to be present here in higher densities (relative to other areas of the Marine RSA) primarily in the summer and fall. Additional fieldwork is therefore not expected to alter the conclusions presented in the Application.

Reference:

Fisheries and Oceans Canada. 2013. Recovery Strategy for the North Pacific Humpback Whale (*Megaptera novaeangliae*) in Canada. Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. x + 67 pp.

b) There is currently no formally recognized southwest Vancouver Island (SWVI) stock of humpback whales. In 2012, there was a request to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to consider whether humpback whales common to SWVI might be a separate designatable unit (DU); however, the Marine Mammals Specialist Subcommittee ultimately decided that there was currently no clear evidence in support of dividing the North Pacific humpback whale population into more than one DU (COSEWIC 2013).

Reference:

COSEWIC. 2013. Letter from Marty L. Leonard, Chair, COSEWIC to The Honourable Leona Aglukkaq, Minister of the Environment - Rationale for maintaining a single designatable unit for the North Pacific population of Humpback Whale. Dated Dec 17, 2013. 3 pp.

1.27 Marine mammals: "minimum number alive"

Reference:

i) A3S4Y3, Application Volume 8A – Marine Transportation, Section 4.3.7.6.2, PDF pages 95, 96 of 294.
ii) Hilborn, R., Redfield, J. A., Krebs, C. J. 1976. On the reliability of enumeration for mark and recapture census of voles. Canadian Journal of Zoology 54: 1019-1024.
iii) Efford, M. 1992. Comment—Revised estimates of the bias in the "minimum number alive" estimator. Canadian Journal of Zoology. 70: 628–631.

Preamble:

As Trans Mountain notes in Reference (i), there is no audiogram for humpback whales. The report notes the inadequacies of this information, but fails to fill any of the data gaps.

In one instance, Trans Mountain estimates the "risk" associated with the Project in terms of the proportion of BC's humpback whale population that could be exposed to Project-related noise (or worse, oil spills). But this estimate of risk relies on a DFO estimate of the "minimum number alive". That estimator was proposed in 1976 (Reference (ii)), and has not been in common use since 1992, when it was shown to give a very biased estimate of population size (Reference (iii)). It is insufficient to note the limitations of using existing data when field data could fix those limitations.

Request:

a) Please provide a referenced rationale for why Trans Mountain did not conduct studies to gauge the sensitivity of BC humpback whales to ship noise (e.g., estimating a source level for vocalizing humpback whales in BC; assessing whether humpback whales demonstrate a Lombard effect to compensate for increased background noise; behavioural dose-response studies).

b) Please provide a referenced rationale for the lack of field surveys to estimate how many of these marine mammal species would be exposed to various noise levels or oil spills.

Response:

a) Scientific studies of this nature are considered beyond the scope of the Application. The reason no direct measurements of humpback whales (or any other baleen whale) hearing have been taken (as noted as a knowledge gap in the Application) is due to logistical difficulties in obtaining such a metric (*i.e.,* there are no humpback whales in captivity, which is the source of other directly measured marine mammal audiograms in existence today [Southall *et al.* 2007]). The sensitivity of baleen whales such as humpback whales cannot be easily inferred from the acoustic environment (Southall *et al.* 2007).

Reference:

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. 2007. Special Issue: Marine mammal noise exposure criteria. Aquatic Mammals 33(4):411-509.

b) Field surveys are not expected to alter the conclusions presented in the Application based on a conservative assessment of pathways of effects. Please refer to the responses to Raincoast IR No. 1.21b and 1.26a. The use of the "minimum number alive" estimator, as referenced in the preamble, was adopted by Fisheries and Oceans Canada in developing their Canadian Science Advisory Secretariat Science Response (Fisheries and Oceans Canada 2010).

Reference:

Fisheries and Oceans Canada. 2010. Advice Relevant to the Identification of Critical Habitats for North Pacific Humpback Whales (*Megaptera novaeangliae*). Canadian Science Advisory Secretariat Science Response 2009/016. 14 pp.

1.28 Marine mammals: humpback whale as an indicator species for fin whales.

Reference:

i) A3S4Y3, Application Volume 8A – Marine Transportation, Section 4.3.7.1, PDF pages 67, 68, 69 of 294.
ii) Williams, R., Clark, C. W., Ponirakis, D. and Ashe, E. 2014. Acoustic quality of critical habitats for three threatened whale populations. Animal Conservation. 17: 174–185.
iii) Williams, R., O'Hara, P. 2010. Modelling ship strike risk to fin, humpback and killer whales in British Columbia, Canada. Journal of Cetacean Research and Management. 11(1): 1-8.

Preamble:

Reference (i) suggests fin whale sensitivity is assumed to be captured by humpback whales. However, fin and humpback whales are likely to differ in terms of:

a. their conservation status (i.e., current abundance relative to pre-whaling abundance);
b. their sensitivity to ocean noise (i.e., humpback whale feeding calls are far more likely to be masked than those of fin whales (Reference (ii));
c. fin whales are far more commonly killed by ships than humpback whales and the ability of BC's fin whale population to withstand ship strike mortality is far lower than that of humpback whales (Reference (iii)).

Request:

a) Given their difference in conservation status, sensitivity to ocean noise and strike mortality, why does Trans Mountain believe that humpback whales serve as an appropriate proxy species for fin whales? Please provide detailed supporting references.

b) Please provide a detailed, referenced assessment of the instances in which humpback whales do not serve as an indicator for fin whale sensitivity to Project-related activities and potential accidents.

Response:

a) Trans Mountain agrees with the listing of differences between fin whales and humpback whales itemized in the preamble. Rationale for the selection of humpback whales as the baleen whale indicator is provided in Section 4.3.7.1 and 4.3.7.6.2 of Volume 8A. Despite the acknowledged differences, the following similarities apply for purposes of assessment: *Species at Risk Act* status for both species was the same at the time of writing; both species belong to the same functional hearing group (*i.e.,* low-frequency specialists); the current acoustic thresholds used for assessing behavioural disturbance do not distinguish between different species of baleen whale (see Section 4.3.7.4.3 of Volume 8A); humpback whales are more abundant in the Marine RSA and thus have a greater likelihood for interaction; and the Marine RSA overlaps critical habitat for humpback whales but not fin whales. Fin whales were recognized in the Application as being the most commonly struck whale species globally and at potentially higher risk of vessel strikes (relative to humpback whales) although there are more records of humpback whale strike events in BC than fin whales (see Section 4.3.13.3.1 of Volume 8A). Furthermore, the assessment of physical injury or mortality of a marine mammal due to a vessel strike (see Section 4.3.13 of Volume 8A) considered baleen whales in general (including both fin and humpback whales).

b) Rationale for selection of the humpback whale indicator in the assessment of residual effects is provided in the response to Raincoast IR No. 1.28a above. The assessment of physical injury or mortality of a marine mammal due to a vessel strike (see Section 4.3.13 of Volume 8A) considered baleen whales in general (including both fin and humpback whales).

Marine Birds

1.29 Marine birds: field data collection

Reference:

i) A3S4Y0, Application Volume 8A – Marine Transportation, Section 4.2.8.3, PDF page 1 of 34.

Preamble:

Reference (i) states, "The abundant literature and data resources currently available for marine ecological information within the Marine RSA is deemed sufficient for the assessment of potential effects of the increased Project-related marine traffic on indicator species. Studies to pursue the collection of additional marine bird biological field data were considered unnecessary."

However, quantitative at-sea marine bird distribution and abundance information, which is required for the assessment of the consequences of oil spills on marine birds, is lacking.

Request:

a) Given the general lack of quantitative information regarding at-sea distribution and abundance of marine birds in the Marine RSA, please provide a referenced justification for why Trans Mountain decided that additional fieldwork was not necessary.

b) Please provide an indication of the levels of uncertainty in associated risk assessments in the absence of these quantitative data.

Response:

a) The marine bird assessment took the conservative assumption that marine birds are present throughout the Marine local study area (LSA) and Marine regional study area (RSA), and focused on the ecology and anticipated behavioural responses of indicator species in relation to Project-related activities, based on scientific literature.

b) There is a degree of uncertainty about the distribution and abundance of birds at sea in the Marine local study area (LSA) and Marine regional study area (RSA), whereas nesting colonies and other coastal populations are reasonably well documented. However, the risk assessment primarily considered the potential effects of oil spills, which are well understood in principle; therefore, there is little uncertainty in the assessment provided.

1.30 Marine birds: shorebird sensitivity to oiling

Reference:

i) A3S4Y8, Application Volume 8A – Marine Transportation, Section 5.6.2.3.4, PDF page 11 of 19.

Preamble:

Reference (i) states, "Shorebirds generally have low sensitivity to oiling when compared to other guilds, and it is unlikely that lightly oiled individuals would die as a result of low or moderate exposure." No supporting citation is provided.

Request:

a) Please provide a detailed referenced evidence base for the conclusion that shorebirds can tolerate low to moderate exposure to oil.

b) Please define the term "lightly oiled" as used in Reference (i).

Response:

a) The approach to developing biological sensitivity factors for avian guilds is based upon that of the U.S. Natural Resource Damage Assessment (NRDA) process. Several factors act in concert to determine the sensitivity of birds to oil exposure. These include consideration of the probability that they will encounter spilled oil in their habitat (greater for seabirds and diving birds than for shorebirds or birds that spend little time on the water surface), as well as other factors that arise from exposure (probability and quantity of oil ingestion from preening or with food, and particularly the potential for loss of buoyancy and thermal insulation as a result of external oil exposure).

The U.S. Department of the Interior developed the Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME). Technical documentation supporting this model (French *et al.* 1997) provides the basis for classifying the sensitivity of various wildlife groups to oil exposure. Table 4.5 of French *et al.* (1997) identifies several behavioural guilds of bird species, and provides a probability of oiling and death (Pw) given an encounter with surface oil. These include:

- Dabbling waterfowl (Pw = 0.99)
- Surface seabirds (Pw = 0.99)
- Nearshore aerial divers (Pw = 0.35)
- Wading birds and Shorebirds (Pw = 0.35)
- Aerial Seabirds (Pw = 0.05)
- Hawks (Pw = 0.01).

More recently, these values were presented by French McCay (2004) as the basis for the biological effects evaluation for birds in the SIMAP model. Similar schemes have also been applied in the Aleutian Islands and Cook Inlet Risk Assessments conducted under the purview of the U.S. National Fish and Wildlife Foundation, Coastguard and

Alaska Department of Environmental Conservation (*e.g.,* ERM 2011). The biological sensitivity classes identified provide the basis for the Biological Sensitivity Classes as explained in Table 5.5 of Technical Report 8B7, Volume 8B, Ecological Risk Assessment of Marine Transportation Spills (Stantec Consulting Ltd. 2013).

References:

Environmental Resources Management (ERM). 2011. Consequence Analysis Report. Aleutian Islands Risk Assessment. Phase A – Preliminary Risk Assessment, Aleutian Islands, Alaska. Tasks 3 and 4. Report prepared for the National Fish and Wildlife Foundation, United States Coastguard, and Alaska Department of Environmental Conservation. Project No. 0105563. July, 2011. Available at: http://www.aleutiansriskassessment.com/documents.htm. Accessed: October 2013.

French, D.P., M. Reed, K. Jayko and others. 1997. The CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME). Technical Documentation, Volume I – Part 1 Model Description. Prepared by Applied Science Associates Inc., A.T. Kearney Inc. and Hagler Bailly consulting Inc. for Office of Environmental Policy and Compliance, U.S. Department of the Interior, Washington, DC. April 1996, Revision 1 October 1997.

French-McCay, D.P. 2004. Oil spill impact modeling: development and validation. Environmental Toxicology and Chemistry 23: 2441-2456.

b) Information presented in the response to part (a) above identifies the probability of oiling and death for various behavioural guilds of birds upon encountering oil. Avian guilds such as alcid seabirds which spend much of their time on the water surface, and which dive for food, have a high probability of extensive or whole-body oiling in the event of encountering an oil slick. This oil exposure causes their pelage to lose buoyancy and thermal insulation properties, resulting in the death of the exposed individuals. In contrast, other guilds of birds living around water (such as shorebirds) have a lower probability of exposure because stranded oil tends to be patchy in its distribution, and the birds are less likely to become immersed in the oil. Oiling of the pelage for these individuals is likely to be both lighter, and more patchy than for alcids. As a result the probability of death as a consequence is lower.

Oil Spill Risk Assessment

1.31 Oil spill risk assessment: probability of an oil spill

Reference:

i) A3S4Y4, Application Volume 8A – Marine Transportation, Section 5.2.5, Table 5.2.4, PDF page 1 of 7.
ii) A3S4Y3, Application Volume 8A – Marine Transportation, Section 5.2.1.6, PDF pages 290, 291 of 294.

Preamble:

Reference (i) states that the risk of an accidental cargo oil spill of any size from a Project-related tanker given existing navigation safety measures is 1 in 46 years.

Reference (ii) states "With respect to tankers in the US waters of the Salish Sea region, DNV noted that the annual number of incidents ranged from eight in 2006 to three in 2007/2008. Most of these incidents occurred in the vicinity of terminals at Cherry Point and Anacortes, Washington. DNV indicated since the data reported covers only five years and the number of vessels is relatively low in the US waters of the Salish Sea, the validity of frequency estimates is low.

It is difficult to reconcile the occurrence of three to eight tanker incidents per year given the relatively low numbers of tankers in the US Salish Sea with Trans Mountain's estimate of a probability of 1 in 46 years for a spill of any size from Project related traffic.

Request:

a) Please provide a detailed referenced rationale for the basis on which Trans Mountain reconciles empirical evidence of several incidents per year in the US Salish Sea with a model prediction of one spill of any size in 46 years from Project related traffic.

Response:

a) As noted in Volume 8C TR8C-12 Termpol 3.15, if the Project goes ahead then, if no additional risk reducing measures are implemented, the frequency will be 1 in every 46 years. If all the risk reducing measures discussed in this report are implemented the frequency will be 1 in every 237 years. Trans Mountain has proposed inclusion of all additional risk reducing measures and recommended the same to the NEB and Termpol. Therefore the oil spill frequency of any size will be 1 In every 237 years.

As noted in Volume 8C TR8C-6, Termpol 3.8, Section 6.5, which discusses tanker incidents in the US portion of the Salish Sea it is noted that "There was one allision in 2006, but no collision or grounding incidents in the five year time period. This gives an annual frequency of 0.2 for allision...it gives an indication of what impact a high level of navigational risk controls can have on the level of navigational safety in the area, because of the low or non-existing number of allision, collision and grounding. These accident types are the ones directly related to the effectiveness of the navigational risk controls implemented in the area." Oil spill from a tanker is prevented by preventing the occurrence of allision, collision and grounding, which is evident from the data.

1.32 Oil spill risk assessment: oil spill modeling

Reference:

i) A3S5G9, Application Volume 8C - Technical Report, Modeling the Fate and Behavior of Marine Spills for the Trans Mountain Expansion Project, PDF pages 18-35.
ii) Baschek, B., Farmer, D. M., and Garrett, C.. 2006. Tidal fronts and their role in air-sea gas exchange. Journal of Marine Research. 64(4): 483-515.
iii) Farmer, D., Pawlowicz, R. and Jiang, R. 2001. Tilting separation flows: a mechanism for intense vertical mixing in the coastal ocean. Dynamics of Atmospheres and Oceans, 36(1): 43–58.

Preamble:

Reference (i) uses 3D hydrodynamic circulation models with an embedded oil spill model (SPILLCALC) to create marine oil spill scenarios. Models incorporate vertical and horizontal forces driven by tides, currents and wind to determine probabilities for the distribution and movement of oil. The resulting scenarios and descriptors from the Turn Point spill scenario show that spilled oil travels primarily on the water's surface until it is either recovered with skimmers or strands on shorelines.

Oceanographic research in Haro Strait has identified the presence of energetic tidal fronts that create strong down-welling currents that can carry light particles (such as air bubbles) to depths up to 160 metres with vertical velocities of up to 0.75 m/s (References (ii) and (iii)). These fronts weaken stratification and aerate water masses passing through the sea.

The presence of these fronts in Haro Strait, Boundary Pass, Turn Point and elsewhere along the tanker route have substantial implications for the fate and transport of spilled oil products, oil spill response methods and marine organisms that may be exposed to submerged, water soluble oil components.

Request:

a) Please explain how Trans Mountain will incorporate the presence of these hydrodynamic fronts in its spill scenarios for Georgia and Haro Straits.

b) Please explain how Trans Mountain's spill response methods will provide for the recovery of oil that is submerged by adduction processes.

c) Please provide an assessment of the toxicity risks to finfish and other aquatic organisms from submerged, water-soluble oil fractions such as benzene.

Response:

a) Please refer to the responses to Farmer D IR No. 1.2b, and 1.2c2 to 1.2c6.

b) Please refer to the response to Farmer D IR No. 1.2c3.

c) This assessment is provided in the Detailed Quantitative Ecological Risk Assessment for Loading Accidents and Marine Spills, submitted to the NEB on May 14, 2014, as the response to NEB IR No. 1.62d (NEB IR No. 1.62d – Attachment 1).

1.33 Oil spill risk assessment: oil spill modeling scenarios

Reference:

i) A3S5G9, Application Vol. 8C, Modelling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project, Section 7.0, PDF page 42 of 72.
ii) A3S4Z4 through A3S5H5, Application Vol. 8C, Appendix D, Parts 1-56, Modelling the Fate and Behaviour of Marine Oil Spills for the Trans Mountain Expansion Project.

Preamble:

As a result of the stochastic oil spill simulations introduced in Reference (i), various statistical products are presented throughout the Figures in Reference (ii). These include probability of oil presence, probability for shore to be oiled, time to first contact for shoreline segments, and P50 and P90 after various lengths of time post spill, at numerous sites.

We would like to be able to complete our own quantitative risk assessment, and in an effort to ensure that the same data are being used, shapefiles including the statistical products listed above for the various marine spill locations would be beneficial.

Request:

a) Please provide access to the shapefiles used to produce the maps for all locations and spill scenarios, and in particular, the spill scenario shapefiles at Arachne Reef.

Response:

a) Relevant and credible spill scenario results in the form of stochastic modeling results in commonly used format have been provided with the application. Trans Mountain believes that its Application contains appropriate and credible information to allow informed decision making in accordance with the National Energy Board's Letter, "Filing Requirements Related to the Potential Environmental and Socio-Economic Effects of Increase Marine Shipping Activities, Trans Mountain Expansion Project" dated 10 September, 2013. Therefore, the information requested will not be provided.

1.34 Oil spill risk assessment: fate and behaviour of diluted bitumen

Reference:

i) A3S5J0, Application Volume 8C – Trans Mountain Expansion Project Oil Spill Response Simulation Study Arachne Reef and Westridge Marine Terminal, Sections 2.5 and 3.0, PDF pages 14-17 of 42.
ii) A3S5G9, Application Volume 8C - Technical Report, Modeling the Fate and Behavior of Marine Oil Spills for the Trans Mountain Expansion Project, Table 8.3.4, PDF page 50 of 72.
iii) A3S5G9, Application Volume 8C - Technical Report, Modeling the Fate and Behavior of Marine Oil Spills for the Trans Mountain Expansion Project, Sections 5.2.7.3 and 5.2.7.6, PDF pages 34-35 of 72.
iv) Michel, J. 2010. Submerged Oil. In Oil Spill Science and Technology, Ed. M. Fingas, Elsevier Inc., Oxford, UK, pp. 959-981.
v) A3S5G9, Application Volume 8C - Technical Report, Modeling the Fate and Behavior of Marine Oil Spills for the Trans Mountain Expansion Project, Sections 5.2.7.4, PDF pages 34-35 of 72.
vi) A3S5G9, Application Volume 8C - Technical Report, Modeling the Fate and Behavior of Marine Oil Spills for the Trans Mountain Expansion Project, Table 5.2.1, PDF pages 31-32 of 72.

Preamble:

Spill response methods and technology proposed by WCMRC and Trans Mountain are predicated on the assumption that diluted bitumen and similar products will float (Reference (i)). Modeling initiated by Trans Mountain has simulations suggesting roughly 20% of oil evaporates and 70% reaches shorelines (Reference (ii)). Two factors have been identified that would influence the floating or sinking of diluted bitumen - the density of seawater and the presence of sediment (Reference (iii)).

Sediment has been an important factor in most spills where oil has sunk (Reference (iv)). At temperatures between 0 and 15°C, the density of weathered diluted bitumen may exceed that of estuarine or brackish waters. It is possible that factors such as cold rainfall in estuarine waters carrying sediment will make weathered dilbit far more prone to sinking.

Request:

a) Please identify the suspended sediment concentrations at which diluted bitumen is likely to sink?

b) Please identify the suspended sediment concentrations likely to be found throughout the Burrard Inlet, Georgia Strait and the Salish Sea.

c) Please provide the Test Simulation described for March 2002 in Reference (v).

d) Please provide the Effective Density of oil components described in Reference (vi) at 10° C vs. 25° C

Response:

a) Two factors are necessary for diluted bitumen to interact with suspended sediments and sink: a high level of energy, characterized by the energy dissipation rate, and a significant concentration of suspended sediment. These two parameters cannot be dissociated; hence the suspended sediment concentration has to be quantified at the same time as energy dissipation rate. The modelling studies found that at no time in the shipping route was there both sufficient energy and sufficient sediment concentration to form oil-mineral aggregate, using equations for the rate of formation found in the published literature, as described in the Volume 8C TR8C-12 S9-Modeling the fate and behaviour of marine spills for the Trans Mountain Expansion Project.

b) Please refer to the response to NEB IR No. 1.62a.

c) The reference to the simulation described for March 2002 is about jet fuel spill modelling in the Fraser River and the Strait of Georgia. It was part of the Vancouver Airport Fuel Facility Corporation (VAFFC) Application for the development of a loading facility on the Fraser River to convey jet fuel directly to the airport. This application received the Environmental Assessment Certificate in December 2013. The results of the March 2002 simulation can be found in the VAFFC Application submitted to the BC Environmental Assessment Office early 2009.

d) Please refer to the response to NEB IR No. 1.60b for information on the dependence of oil density on temperature. For information on the overall product density and its evolution with time, please refer to the Gainford Study presented in the Application: Volume 8C TR8C-12 S7 - A study of fate and behaviour of diluted bitumen oils on marine waters.

1.35 Oil spill risk assessment: impacts of an oil spill

Reference:

i) A3S4Y4, Application Volume 8A – Marine Transportation, Section 5.2.5, Table 5.2.4, PDF page 1 of 7.
ii) Burger, A. E. 1993. Estimating the mortality of seabirds following oil spills: effects of spill volume. Marine Pollution Bulletin. 26(3): 140-143.
iii) Szaro R. C. 1977. Effects of Petroleum on Birds, Reprinted from transactions of the 42nd American Wildlife Natural Resources Conference. Published by the Wildlife Management Institute, Washington, D.C.
iv) Heintz, R. A., Short, J. W., Rice, S. D. 1999. Sensitivity of fish embryos to weathered crude oil: Part II. Increased mortality of pink salmon (Oncorhynchus gorbuscha) embryos incubating downstream from weathered Exxon Valdez crude oil. Environmental Toxicology and Chemistry. 18: 494–503.

Preamble:

The implication of Reference (i) is that the volume of oil spilled is a good predictor of ecological impacts of a spill. There is very weak evidence for a relationship between spill volume and number of birds killed (Reference (ii)). Small spills seem to be downplayed entirely in the Application, despite very small volumes of oil having reproductive consequences for seabirds (Reference (iii)) and salmon (Reference (iv)).

The oil spill fate models in Section 5, Volume 8A, would be more accurate if they were combined with spatially explicit estimates of marine mammals and birds that would be exposed to oil.

Request:

a) Please provide spatially explicit estimates, supported by population estimates, of the numbers of marine mammals and birds that would be exposed to oil in each spill scenario.

Response:

a) The stochastic spill scenarios are developed for credible worst case and smaller spill volumes at multiple locations within Burrard Inlet, the Strait of Georgia, and Juan de Fuca Strait. As stochastic simulations, they are initiated typically every 3 or 6 hours over the course of a calendar year. Although detailed weather, tide and current data are available or can be simulated to support this oil spill fate and transport modeling effort, the biological data for multiple receptor species is not available at a similar level of detail to satisfy this request.

Markets

1.36 Petroleum exports to North Korea

Reference:

i) A3S0R0, Application, Vol. 2, Project Overview, Economics and General Information, Section 3.2.1, PDF page 8 of 43.
ii) A3S0R1, Trans Mountain Expansion Project, Direct Written Evidence of Steven J. Kelly, PDF pages 37-39, 55-56.
iii) Nanto, D.K. and Manyin, M.E. 2010. China-North Korea Relations. U.S. Congressional Research Service, pp. 16-17. Available at: https://www.fas.org/sgp/crs/row/R41043.pdf.

Preamble:

Reference (i) indicates that 13 companies have entered into binding transportation service agreements for the Project.

The economic benefits of the Project, as asserted by Trans Mountain, rely heavily on higher netback prices on deliveries to Asian markets, including China (Reference (ii)).

China is a major source of North Korean imports of petroleum products (Reference (iii)).

Request:

a) Please identify any companies that have entered into transportation service agreements for the Project that are Chinese state-owned or state- controlled companies or are companies in which Chinese state-owned or state-controlled entities have an interest.

b) Please confirm whether or not any companies identified in response to question (a), or any entities related to or supplied by such companies, exported crude oil or petroleum products from China to North Korea during the period 2010 to 2013.

c) Can Trans Mountain assure the Board that no crude oil or petroleum products transported by the Project, and no petroleum products derived from those substances, will be exported by Chinese state-controlled entities to North Korea?

Response:

a) Trans Mountain is not in a position to confirm the ownership of its shippers. 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.

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 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.