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British Columbia Utilities Commission
Sixth Floor, 900 Howe Street
Vancouver, BC V6Z 2N3

Attention Erica M. Hamilton
Commission Secretary

Dear Sirs/Mesdames:

Re: FortisBC Energy Inc. - Application For a Certificate of Public Convenience and Necessity for the Lower Mainland Intermediate Pressure System Upgrade Projects

In accordance with the Regulatory Timetable set for this proceeding, we enclose for filing the electronic version of the Final Submission of FortisBC Energy Inc.

Fourteen hard copies of the enclosed will follow by courier.

Yours truly,

FASKEN MARTINEAU DuMOULIN LLP

[original signed by Tariq Ahmed]

Tariq Ahmed

TA/vde
Enclosure

BRITISH COLUMBIA UTILITIES COMMISSION

IN THE MATTER OF THE UTILITIES COMMISSION ACT
R.S.B.C. 1996, CHAPTER 473

and

AN APPLICATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY FOR THE LOWER MAINLAND INTERMEDIATE PRESSURE SYSTEM UPGRADE PROJECTS

FINAL SUBMISSION OF FORTISBC ENERGY INC.

July 17, 2015

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PART ONE: INTRODUCTION

1. FortisBC Energy Inc. (FEI or the Company) applies to the British Columbia Utilities Commission (the Commission) for a Certificate of Public Convenience and Necessity (CPCN) pursuant to sections 45 and 46 of the *Utilities Commission Act* (the Act) to construct and operate two Intermediate Pressure (IP) pipeline segments in the Lower Mainland of British Columbia that will replace the existing pipeline segments. In particular, FEI seeks approval under sections 45 and 46 of the Act to:

(a) Construct and operate a new Nominal Pipe Size (NPS) 30 IP pipeline operating at 2070 kPa between Coquitlam Gate Station and East 2nd & Woodland Station to upgrade and replace an existing NPS 20 IP pipeline operating at 1200 kPa (Coquitlam Gate IP Project); and

(b) Construct and operate a new NPS 30 IP pipeline operating at 1200 kPa between Fraser Gate Station and a point approximately 280 metres west of Fraser Gate Station to upgrade and replace an existing NPS 30 IP pipeline operating at 1200 kPa (Fraser Gate IP Project).

2. These two replacements are collectively referred to as the “Projects”, and individually referred to as the “Project” as the context requires. The estimated capital cost for the Projects in as spent dollars, including Allowance for Funds Used During Construction (AFUDC) and including abandonment/demolition costs, is $251.815 million, consisting of $242.825 million for the Coquitlam Gate IP Project and $8.990 million for the Fraser Gate IP Project.[1]

3. The Coquitlam Gate IP pipeline and the Fraser Gate IP pipeline are both a critical part of the gas supply to Metro Vancouver. The Metro IP system, of which both the Coquitlam Gate IP pipeline and the Fraser Gate IP pipeline are part, is an inter-connected system that supports more than 210,000 customers in the Metro Vancouver communities of Vancouver,

[1] Exhibit B-1-6, Application Evidentiary Update, p. 25.

Burnaby, Coquitlam, Port Moody, Port Coquitlam, West Vancouver and the District and City of North Vancouver.

4. The Coquitlam Gate IP Project is required to address integrity related risk, which is manifested in the increasing frequency of gas leaks resulting from non-preventable active corrosion. The Fraser Gate IP Project is necessary to address seismic concerns with respect to a portion of the pipeline located near Fraser Gate Station.

5. The need to replace the existing Coquitlam Gate IP pipeline for integrity reasons has created an opportunity for FEI to evaluate and mitigate two other identified system risks in a cost-effective manner:

(a) Operational Flexibility: Over time and with growth in demand on the system, there has been an erosion of the operational flexibility required to facilitate planned work; and

(b) System Resilience: The Fraser Gate IP pipeline and the Coquitlam Gate IP pipeline are identified as single point of failure pipelines at the present time; if either pipeline fails, there is no alternate supply capacity sufficient to provide year round system resiliency to mitigate potential consequences that could occur as a result of unplanned outages.

6. The replacement of the Coquitlam Gate IP pipeline has provided an appropriately timed and unique, one-time opportunity to restore operational flexibility and provide resiliency to the Metro IP system through an increase in pipeline capacity in the Coquitlam Gate IP pipeline.

7. FEI is also seeking Commission approval under sections 59 to 61 of the Act for deferral treatment of costs for preparing this Application and of project development costs and for amortization of both types of costs over a three-year period.

8. FEI submits that the Projects are in the public interest and a CPCN should be granted, as evidenced in the Application and the Evidentiary Update, further explained in

various responses to the IRs, and summarized in the following submissions. The submissions below generally follow the framework of the Application, first addressing the Projects' justifications followed by a discussion of the alternatives evaluated, project design, construction and cost. The submissions then address issues relating to cost treatment, and environmental, archaeological and socio-economic assessments. Finally, FEI discusses its engagement and consultation with the public and First Nations.

PART TWO: COQUITLAM GATE IP PROJECT JUSTIFICATION

9. The Coquitlam Gate IP Project involves the installation of approximately 20 kilometres of NPS 30 pipeline operating at 2070 kPa extending from Coquitlam Gate Station at Mariner Way & Como Lake Avenue in Coquitlam to East 2nd & Woodland Drive in Vancouver. FEI makes two points in this section:

- First, the existing NPS 20 pipeline operating at 1200 kPa must be replaced. It is nearing the end of its expected service life, as evidenced by the increasing frequency of gas leaks resulting from non-preventable active corrosion.
- Second, the Project as proposed will also provide operational flexibility and system resilience.

A. A Safety and Regulatory Concern

10. The Coquitlam Gate IP pipeline requires replacement. As described in the Application, it has been assessed as being near the end of its service life due to an unacceptable frequency of gas leaks resulting from non-preventable active corrosion. Engineering assessments have concluded that leak prevention cannot be effectively managed by maintenance activities and therefore the existing pipeline must be replaced.[2]

[2] Exhibit B-1, Application, pp. 28-29.

(a) Leak History

11. The Coquitlam Gate IP pipeline, constructed in 1958, has experienced a number of leaks. Since 1987 the Coquitlam Gate IP pipeline has experienced 15 instances of leaks due to corrosion, seven of which occurred in 2013. A further leak occurred in 2014.[3]

12. To date, FEI has had sufficient maintenance flexibility to address past failures without unplanned outages to firm customers due to the failure severity, time of year, and location of failure. However, in some cases, curtailment of interruptible customers has been used to facilitate repairs while, in other instances, FEI mobile LNG tanker/vapourizer facilities were used to provide service to firm customers.[4]

(b) Leak Assessment

13. Leaks on this pipeline will continue and are expected to occur with increasing frequency over time. The Pipeline Quantitative Reliability Assessment Report completed by Dynamic Risk Assessment Systems (DRAS) concludes that leaks are predicted to escalate to a rate of 3.7 times the 2013 rate by 2033. [5] All recorded leaks have occurred under the field-applied coating located at construction girth welds.[6] The thick field-applied coating is disbonding from the pipe surface in such a way that "cathodic protection (CP) shielding" is occurring. While FEI is confident that the CP system is operating as per design,[7] due to the shielding of the CP current, the CP cannot effectively mitigate corrosion growth and prevent leaks on the Coquitlam Gate IP pipeline.[8] Furthermore, corrosion cannot be effectively managed or prevented by increasing CP levels in the pipeline, since shielding prevents CP currents from reaching the surface of the pipe under disbonded coating.[9]

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[3] Exhibit B-1, Application, p. 17; Exhibit B-4, BCUC IR 1.1.1, 1.1.1.5.

[4] Exhibit B-4, BCUC IR 1.1.1.2.

[5] Exhibit B-1-1, Application Appendix A-1.

[6] Exhibit B-1, Application, p. 17; Exhibit B-4, BCUC IR 1.1.1.

[7] Exhibit B-4, BCUC IR 1.2.2.

[8] Exhibit B-1, Application, p. 17; Exhibit B-4, BCUC IR 1.2.2.

[9] Exhibit B-4, BCUC IR 1.2.3.

14. FEI evaluated several above ground techniques to locate areas of coating disbondment that were leading to corrosion damage. They were ineffective. For this reason, FEI is unable to determine where coating disbondment has occurred and where corrosion which may lead to failure is likely to exist.[10] In-line inspection, including tethered in-line inspection, is not a viable option due to low operating pressures and the expected presence of inside diameter restrictions.[11]

15. Corrosion rate can be influenced by a number of factors including soil type, coating type and condition, ground water presence and rate of movement, temperature, presence of microbiological organisms, and other possible contributors such as aeration of the soil that could result from excavation activity of nearby utility operators. Due to site-specific influences, each leak site would be expected to have an independent corrosion rate. Review of the available data has not identified any factors other than the passage of time that would have contributed to the higher number of leaks on the Coquitlam IP pipeline in 2013.[12]

16. Based on FEI's past excavations and leak history, and the nature of the failure mechanism, corrosion is occurring at girth welds along the entire length of the existing Coquitlam Gate IP pipeline. FEI has excavated and inspected a total of 38 girth welds along the length of the existing NPS 20 Coquitlam Gate IP pipeline, including the 15 leak locations. Of these 38 inspected girth welds, 74% have been found with field-applied girth weld coating disbondment.[13] As such, given sufficient time, it is expected that future leaks will be distributed along the entire pipeline length.[14]

(c) Safety Risk and Management

17. Replacement of this pipeline is the appropriate solution to prevent future leaks. The safety risk associated with operation of this pipeline, which includes an increasing leak

[10] Exhibit B-1, Application, p. 17.

[11] Exhibit B-4, BCUC IR 1.2.3; Exhibit B-11, BCUC IR 2.2.2; Exhibit B-14, CEC IR 2.8.1.1.

[12] Exhibit B-4, BCUC IR 1.1.1.5.

[13] Exhibit B-4, BCUC IR 1.1.19.3, 1.2.2.

[14] Exhibit B-4, BCUC IR 1.1.1.7, 1.2.2; Exhibit B-6 CEC IR 1.70.3.

occurrence and risk of gas migration and accumulations in public areas is currently being managed through mitigation measures such as odourization, leak detection (more frequent leak surveys), and leak response. However, leaks cannot be prevented through maintenance activities on this pipeline and therefore the pipeline has been assessed as nearing the end of its service life.[15]

18. Primarily in response to observed leak frequencies, FEI increased leak survey frequency of the Coquitlam Gate IP pipeline to quarterly in March 2013 in order to locate leaks at the pinhole stage and to prevent growth of any corrosion features and to mitigate the safety risk associated with gas migration. The Company further increased the leak survey frequency to weekly starting in August 2013.[16] Weekly leak survey of the Coquitlam Gate IP pipeline was later mandated by the BC Oil and Gas Commission (OGC) in accordance with OGC Order 2013-25.[17]

19. It is not practicable or cost-effective to modify the environment surrounding the pipeline in an attempt to influence corrosion rate. The corrosion rate under disbonded coating appears to correlate to the presence of ground water,[18] and ground water existence and migration are not considered controllable factors along the length of the Coquitlam Gate IP pipeline.[19]

20. As FEI is conducting regular leak surveys, it can be reasonably expected that leaks will be detected at an early stage. This minimizes, but does not eliminate, the potential for gas migration and accumulation that could result in material safety concerns.[20]

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[15] Exhibit B-1, Application, p. 18.

[16] Exhibit B-4, BCUC IR 1.1.1.6.

[17] Exhibit B-1-1, Application Appendix A-2.

[18] Exhibit B-4, BCUC IR 1.1.1.7.2.

[19] Exhibit B-4, BCUC IR 1.1.1.7.3.

[20] Exhibit B-4, BCUC IR 1.1.1.3.

Replacement and OGC Oversight

21. There are no mitigation activities, other than replacement of the pipeline, which will prevent future leaks.[21] Although the pipeline is considered suitable for continued service with the present interim mitigation activities until the pipeline can be replaced, replacement is congruent with the requirements of the *Oil and Gas Activities Act* (the OGAA) and the Canadian Standards Association (CSA) Z662 standard.[22] On that basis, FEI has developed a plan to address the ongoing non-preventable active corrosion by replacing the pipeline and has notified the OGC of that intended course of action.[23]

22. The replacement plan considers FEI's obligations as a permit holder under the OGAA to prevent spillage. On October 30, 2013, after the seventh reported leak that year, the OGC issued Order 2013-25[24] requiring FEI to, among other things, complete and submit an engineering assessment to the OGC. FEI's engineering assessment[25] identified pipe replacement as an integral part of FEI's plan to maintain compliance with the OGAA. The OGC has advised FEI that it would not accept leak survey, leak detection and repair as a means to prevent spillage; increased leak survey frequency is expected to reduce the consequence associated with a spillage but not prevent future leaks.[26] It is clear that as the leakage cannot be prevented or sufficiently mitigated; the pipeline must be replaced.

B. An Operational Flexibility and System Resiliency Opportunity

23. The need to replace the existing pipeline for integrity reasons has provided an opportunity for FEI to evaluate and mitigate system constraints in a cost effective manner. The replacement of the Coquitlam Gate IP pipeline provides a unique, one-time opportunity to

[21] Exhibit B-4, BCUC IR 1.2.2; Exhibit B-6, CEC IR 1.9.2, 1.10.3, 1.14.2.
[22] Exhibit B-5, BCOAPO IR 1.1.1.
[23] Exhibit B-4, BCUC IR 1.2.2.
[24] Exhibit B-1-1, Application Appendix A-2.
[25] Exhibit B-1-1, Application Appendix A-3.
[26] Exhibit B-11, BCUC IR 2.1.1.

prudently restore operational flexibility and provide resiliency to the Metro IP system through an increase in pipeline capacity in the Coquitlam Gate IP pipeline.[27]

(a) Limited Capacity to Provide Operational Flexibility

24. An operational window to interrupt the supply from Fraser Gate Station to facilitate planned work does not currently exist. In the past, all segments on the Coquitlam IP and Fraser Gate IP pipelines had maintenance windows where work could be carried out without the need for bypass piping. Over time, due to load growth, this maintenance flexibility has been eroded such that the pipeline segments immediately downstream of Fraser Gate Station require bypass piping to be installed at all times of the year, and pipeline segments downstream of Coquitlam Gate Station will require bypass piping to be installed in winter conditions. Based on estimates of historical outage windows, there has not been a Fraser Gate outage window since 2003 and the Coquitlam Gate outage window is currently from mid-March to late-October.[28] Over time, the operational flexibility and maintenance windows will continue to erode, making routine maintenance more complicated and costly to perform, with increasing impact on the public and customers.[29]

25. FEI plans scheduled maintenance requiring isolation of a segment of pipe to minimize service disruption or the need for installation of bypass piping. Where maintenance flexibility exists, the valves upstream and downstream of the section requiring isolation are closed and the repairs are made to the depressurized segment of pipeline. Where maintenance flexibility does not exist there are a limited number of options available including service disruptions, providing alternative supply to customers, or installing bypass piping around the isolated section.[30] Though dependent upon complexity, a typical NPS 20 bypass would cost approximately $0.6 million and an NPS 30 bypass approximately $0.8 million per occurrence.[31]

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[27] Exhibit B-1, Application, p. 29.

[28] Exhibit B-4, BCUC IR 1.3.3.1.

[29] Exhibit B-1, Application, pp. 21-22.

[30] Exhibit B-4, BCUC IR 1.3.4.

[31] Exhibit B-5, BCOAPO IR 1.3.7; Exhibit B-4, BCUC IR 1.3.5.

26. With the replacement NPS 30 Coquitlam Gate IP pipeline in service, it will be possible to isolate the Fraser Gate IP pipeline and replace the seismically vulnerable segment of pipe (i.e., the Fraser Gate IP Project) with the proposed upgraded pipe without the use of bypass piping. This is because the increased capacity of the NPS 30 Coquitlam Gate IP pipeline will be capable of supplying the Metro IP system without any supply required from Fraser Gate Station. Therefore, this will avoid the requirement for two temporary bypasses at both ends of the vulnerable section of the pipeline during construction of the Fraser Gate IP Project resulting in a savings of approximately $1.4 million.[32]

27. A quantitative risk assessment study[33] indicates that the operational risk reflective of select portions of today's Metro IP system is estimated to be $3.054 million/year. It concludes that the operational risk reduction associated with a potential Coquitlam Gate IP pipeline upgrade and a Cape Horn to Coquitlam TP loop installation to be approximately $2.456 million/year which is the difference between the $3.054 million/year risk associated with today's system and the remaining risk of $598 thousand/year following completion of the Projects.[34]

28. The replacement of the existing Coquitlam Gate IP pipeline with an enhanced capacity pipeline will provide FEI the ability to create an extended operational window to facilitate planned maintenance.

(b) Limited Capacity to Provide Resiliency

29. The need to replace the existing NPS 20 Coquitlam Gate IP pipeline due to integrity concerns also presented FEI with a unique, one-time opportunity to address a lack of system resiliency within the Metro IP system. The Metro IP system serves a greater number of customers than any other IP system in the province and currently delivers natural gas to more than 210,000 customers – almost one quarter of FEI's entire customer base. As an incremental

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[32] Exhibit B-4, BCUC IR 1.3.6; Exhibit B-6, CEC IR 1.22.1.3; Exhibit B-11, BCUC IR 2.20.1.

[33] Exhibit B-1-1, Application Appendix A-10, p. 17.

[34] Exhibit B-1, Application, p. 25.

benefit of the Project, improving the resiliency and operational flexibility of this system, given the need to replace the existing Coquitlam Gate IP pipeline, will provide additional security of supply to large numbers of customers in a cost effective manner.

30. The supply of natural gas is vital in meeting the energy needs of the province on a continuous basis. Over time, the increasing number of customers and increasing demand has also reduced the overall resiliency of the natural gas delivery system. The erosion of system resiliency has increased the risk associated with possible unplanned system outages.

31. Resiliency provides the ability to isolate a section of pipeline on an emergency basis without impacting supply to customers. Like operational flexibility, system resiliency is achieved by having pipeline loops or multiple sources of supply within a system.[35]

32. Unlike operational flexibility, where temporary bypass piping can be used to prevent downstream supply shortfalls during planned maintenance, emergency repairs must be conducted by shutting in a section of pipeline using the inline valves as quickly as possible to minimize the potential impact of escaping gas. Where insufficient supply downstream of the isolated segment exists, customers will be interrupted.[36] Examples of events that could result in emergency shut downs include: third party damage (punctures), corrosion leaks, equipment failure and geotechnical, hydrotechnical or seismic failures.[37]

33. Opportunities to provide full resiliency such as can be achieved with the proposed Coquitlam Gate IP Project do not generally exist. The uniqueness of the current opportunity to improve resiliency of the Metro IP System stems from the need to replace the entire length of the Coquitlam Gate IP pipeline. If FEI were to attempt to address resiliency alone by looping or replacing portions of the existing system with larger pipe, phased over time, the improvements to resiliency would be marginal until the last phases of looping or replacement covered the majority of the distance between Coquitlam Gate and East 2nd &

[35] Exhibit B-1, Application, p. 22.

[36] Exhibit B-1, Application, p. 22.

[37] Exhibit B-1, Application, p. 22.

Woodland Stations. Leaving even a few kilometres of NPS 20 pipe in the IP system provides a substantial bottleneck to achieving full resiliency and improved operational flexibility. Additionally, the increase in operating pressure, a consideration available because of the need for the complete pipeline replacement, allows a NPS 30 to deliver full resiliency. In a phased approach to achieving resiliency, a segment by segment pressure upgrade would be difficult to implement and again would be marginally effective until the phasing extended the length of the pipeline.[38]

34. The current Metro IP system has the capacity to meet the forecasted peak hour demand throughout the 20 year planning horizon when all components of the system are operational. However, in the event supply is interrupted from either Fraser Gate or Coquitlam Gate Station, under peak demand, the system is capacity constrained and a rapid pressure collapse along the system would occur impacting as many as 171,000 of the currently connected customers.[39]

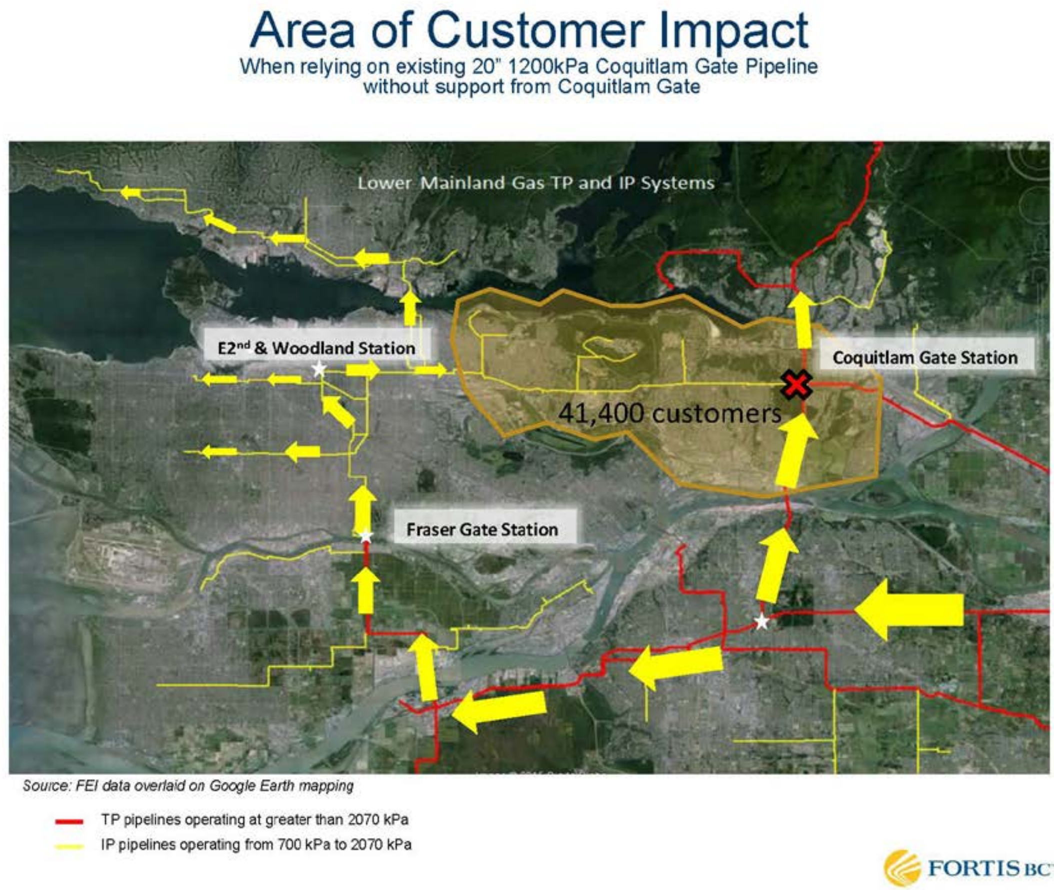
35. If a major failure occurs on the Coquitlam Gate IP pipeline or the transmission pressure (TP) pipelines serving Coquitlam Gate Station during design conditions, it is possible that up to 41,000 customers served by that pipeline system could be impacted, and potentially experience a prolonged period of gas service outage.[40] The approximate area that would be affected by such an outage is shown in the figure below.[41]

[38] Exhibit B-4, BCUC IR 1.4.1.2.

[39] Exhibit B-4, BCUC IR 1.4.1.2.

[40] Exhibit B-1, Application, p. 29.

[41] Exhibit B-2, Workshop Materials, p. 20.



36. If a major failure occurs on the Fraser Gate IP pipeline or the TP pipelines serving the Fraser Gate Station during design conditions, due to the current lack of capacity to supply the Fraser Gate load from the Coquitlam Gate IP pipeline, it is possible that up to 171,000 customers served by that pipeline system could be impacted, and potentially experience a prolonged period of gas service outage.[42] The approximate area that would be affected by such an outage is shown in the figure below.[43]

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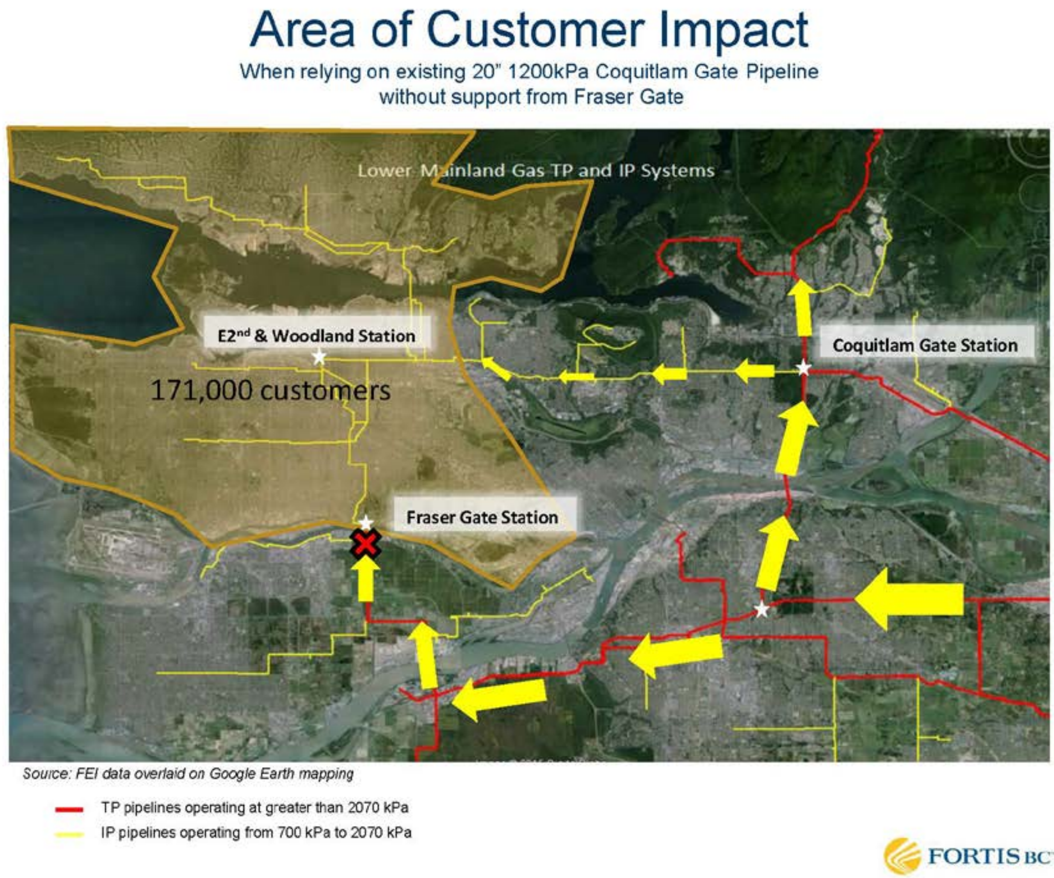
[42] Exhibit B-1, Application, p. 29.

[43] Exhibit B-2, Workshop Materials, p. 19.



37. An economic impact study shows that a gas supply interruption as a result of an unplanned failure of the Fraser Gate IP pipeline could be in the order of three weeks and the economic impact to the general public, customers and the Company could be in excess of $320 million.[44] The economic impact to the general public, customers and the Company as a result of a failure of the Coquitlam Gate IP pipeline could be in the range of $64 million[45] and the gas supply interruption could be in excess of five days.[46]

38. System resiliency is an important consideration. Recent disruptions at energy delivery utilities around North America have driven increased industry and government

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[44] Exhibit B-1-1, Application Appendix A-5, p. 5, Table ES-2a "Reference Case "As Is" Economic Consequences", line item IP-Segment 1.

[45] Exhibit B-1-1, Application Appendix A-5, p. 5, Table ES-2b "Reference Case "Residual" Economic Consequences".

[46] Exhibit B-1, Application, p. 25.

awareness of the essential nature of critical energy delivery infrastructure. For example, the consideration for increased resiliency in infrastructure planning is recognized in the Government of Canada's National Strategy for Critical Infrastructure[47] which states:

> "The National Strategy supports the principle that critical infrastructure roles and activities should be carried out in a responsible manner at all levels of society in Canada. Responsibilities for critical infrastructure in Canada are shared by federal, provincial and territorial governments, local authorities and critical infrastructure owners and operators – who bear the primary responsibility for protecting their assets and services."

39. System resiliency has been considered by the Commission in the context of other recent FEI projects. For example, system resiliency was a factor in the Fraser River Crossing Upgrade Project decision granting approval of a CPCN to replace both the NPS 20 and NPS 24 South Fraser River crossings in 2012.[48] It was also a consideration in the recent Huntingdon Station Bypass decision granting approval of a CPCN to construct a bypass pipeline around FEI's Huntingdon Flow and Pressure Control Station.[49] In that decision the Commission found that:

> "[…] given the risks and potential severe consequences of large-scale service disruption to 600,000 customers and economic loss resulting from failure of Huntingdon Station, a risk mitigation project is in the public interest."

40. In summary, the Coquitlam Gate IP pipeline has been assessed as being near the end of its service life due to an unacceptable projected frequency of gas leaks resulting from non-preventable active corrosion. Engineering assessments have concluded that leak prevention cannot be effectively managed by maintenance activities and therefore the existing pipeline must be replaced. The need for replacement brings with it an opportunity to significantly improve the resiliency, operational flexibility, and overall reliability of the natural gas supply to a significant portion of the population of the Metro Vancouver region. Under the existing conditions, a failure of either the Coquitlam Gate IP or Fraser Gate IP pipeline could

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[47] Exhibit B-1-1, Application Appendix A-7-1.

[48] *In the Matter of an Application by Terasen Gas Inc. for a Certificate of Public Convenience and Necessity for the Fraser River Crossing Upgrade Project Decision,* Order No. C-2-09, March 12, 2009.

[49] *In the Matter of an Application by FortisBC Energy Inc. for a Certificate of Public Convenience and Necessity for the Huntingdon Station Bypass Project Decision*, Order No. C-6-14, April 4, 2014.

have an adverse economic effect and result in significant harm to the public and to public confidence in the energy infrastructure. The Projects will result in a more reliable and resilient system that will significantly reduce the probability and consequences of such an event. The construction of the Projects will create a resilient infrastructure in the Metro Vancouver area, with is in the best interest of customers and the public, and is consistent with the intent of the Government of Canada National Strategy for Critical Infrastructure.

PART THREE: COQUITLAM GATE IP PROJECT ALTERNATIVES

41. FEI utilized an appropriate process to evaluate alternatives, consistent with the Commission's CPCN guidelines. This process evaluated a number of alternatives to meet the Coquitlam Gate IP Project objectives. An NPS 30 pipeline operating at 2070 kPa (described as in the Application as Alternative 6), is the best alternative to address the existing issues with the Coquitlam Gate IP pipeline. In addition to being constructible and eliminating the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline, it also the only alternative that provides operational flexibility and full resiliency to the end of the planning period. A financial analysis also demonstrated that it is the most appropriate alternative.

A. Objectives

42. As described above, the Coquitlam Gate IP pipeline has reliability, safety, and regulatory risks resulting from non-preventable pipeline corrosion and an unacceptable projected frequency of gas leaks that must be addressed. The capacity of the pipeline is not sufficient to backfeed the Fraser Gate IP pipeline to provide operational flexibility or resiliency to the Metro IP system and a rare opportunity exists to change this and significantly improve system integrity. Thus, the objectives of the Coquitlam Gate IP Project are to:

(a) Eliminate the elevated reliability, safety and regulatory risk (including under the OGAA) posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency (Pipeline Risk);

(b) Provide sufficient operational flexibility to permit planned maintenance and repair of the Fraser Gate IP pipeline (Operational Flexibility);

(c) Provide full system resilience in conjunction with the Cape Horn to Coquitlam TP pipeline reinforcement, to fully supply the Coquitlam Gate IP pipeline and the Fraser Gate IP pipeline from either Fraser Gate Station or Coquitlam Gate Station on any day of the year and therefore reduce the potential consequences of a failure upstream, at, or downstream of either gate station (System Resiliency); and

(d) Address constructability, operational and safety factors, such as routing constraints, proximity to adjacent utilities and appropriate construction techniques, limiting interruption of flow of gas during construction and commissioning and allowing sufficient space to work around existing piping and components (Constructability).[50]

B. Alternatives

43. As part of its assessment of the Coquitlam Gate IP Project, FEI evaluated several alternatives. Pages 30 to 46 of the Application provide a detailed description of each alternative and set out the alternatives analysis in detail. They can be summarized as follows:

(a) Alternative 1 - Do nothing (Status quo of continuing ongoing integrity and leak management, and an infeasible solution);

(b) Alternative 2 - Rehabilitate the existing NPS 20 Coquitlam Gate IP operating at 1200 kPa in place (an infeasible solution);

(c) Alternative 3 - Replace (in-kind) the existing NPS 20 Coquitlam Gate IP operating at 1200 kPa with a NPS 20 pipeline operating at 1200 kPa (an inappropriate solution);

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[50] Exhibit B-1, Application, p. 30.

(d) Alternative 4 - Replace the existing NPS 20 Coquitlam Gate IP operating at 1200 kPa with a NPS 24 pipeline operating at 2070 kPa (a partial solution);

(e) Alternative 5 - Replace the existing NPS 20 Coquitlam Gate IP operating at 1200 kPa with a NPS 36 pipeline operating at 1200 kPa (a partial solution);

(f) Alternative 6 - Replace the existing NPS 20 Coquitlam Gate IP operating at 1200 kPa with a NPS 30 pipeline operating at 2070 kPa (preferred alternative and a full solution); and

(g) Alternative 7 - Replace the existing NPS 20 Coquitlam Gate IP operating at 1200 kPa with a NPS 42 pipeline operating at 1200 kPa (an infeasible solution).

44. Alternative 1 involves operating and maintaining the underground asset in its current form without rehabilitating, upgrading or replacing the pipe. Ongoing increased integrity and leak management would not address the current pipeline concerns, and would only mitigate some of the risk associated with leaks on the Coquitlam Gate IP pipeline until a more permanent solution could be implemented.

45. Alternatives 2 through 7 were evaluated because they provided a range of industry standard pipeline diameters which could potentially deliver the necessary capacity to meet the objectives and requirements. This determination was based on the criteria that the pipeline design will use the Company's current standard for IP pipeline operating pressures.

C. Outcome of the Alternatives Analysis

46. The outcome of the analysis was that only one alternative, replacement with a NPS 30 pipeline operating at 2070 kPa (Alternative 6), was found to meet all the Coquitlam Gate IP Project objectives. The analysis is summarized in the following table and explained below.[51]

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[51] Exhibit B-1-4, Application Errata, p. 41.

Coquitlam Gate IP Project Non-Financial Comparison

Alternatives		Objectives/Requirements				Overall Assessment
		Reduce Pipeline Risk	Provide Sufficient Operational Flexibility	Provide Full System Resiliency	Constructible	
1	Do Nothing	Does not meet Objective	Does not meet Objective	Does not meet Objective	Not Applicable	Not Feasible
2	Rehabilitate Existing NPS 20	Partially meets Objective	Does not meet Objective	Does not meet Objective	Meets Objective	Not Feasible
3	Replace Existing NPS 20 in kind	Meets Objective	Does not meet Objective[1]	Does not meet Objective	Meets Objective	Not Feasible
4	Replace with NPS 24 at 2070 kPa	Meets Objective	Meets Objective	Does not meet Objective[3]	Meets Objective	Feasible
5	Replace with NPS 36 at 1200 kPa	Meets Objective	Meets Objective	Does not meet Objective[4]	Meets Objective	Feasible
6	Replace with NPS 30 at 2070 kPa	Meets Objective	Meets Objective[2]	Meets Objective[2]	Meets Objective	Feasible
7	Replace with NPS 42 at 1200 kPa	Meets Objective	Meets Objective	Meets Objective	Does not meet Objective	Not Feasible

(green)	Meets objective/feasible
(amber)	Partially meets objective
(red)	Does not meet objective/not feasible

Notes:

(1) Requires a bypass any time maintenance or repair is required.

(2) Meets objective 365 days of the year.

(3) Under this alternative, a failure upstream, at, or downstream of the Fraser Gate Station during mid-winter conditions will impact up to 171,000 customers that could result in an economic impact in excess of $320 million.

(4) Under this alternative, a failure upstream, at, or downstream of the Fraser Gate Station during mid-winter conditions will impact up to 47,500 customers that could result in significant economic impact.

(a) Alternative 1 - Do Nothing (Status Quo of Continuing Ongoing Integrity and Leak Management and an Infeasible Solution)

47. The "do nothing" alternative does not address the reliability, safety, or regulatory concerns associated with the unacceptable projected frequency of gas leaks. As the

alternative does not meet any of the objectives of the Project or the OGC requirements, this is not a feasible alternative.[52]

(b) Alternative 2 - Rehabilitate the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa (Infeasible Solution)

48. Rehabilitation it is not a feasible alternative. While constructible at significant expense, this alternative does not provide operational flexibility or system resiliency, or fully address pipeline risk.

49. Rehabilitation of the existing pipeline would involve proactively excavating each girth weld location along the pipeline, inspecting for corrosion and repairing where necessary. A significant number of excavations would be required as there are approximately 1,700 girth welds along the pipeline. There are no technical methods to identify girth weld locations from above ground, and consequently multiple digs may be required to locate each weld. Furthermore, some sections of the pipeline have increased depth of cover resulting in welds which are unusually deep making them extremely difficult to access. [53]

50. Once a girth weld was exposed, an assessment would be conducted and necessary repairs would occur. Subsequent to the repair, the pipeline girth weld, together with the adjacent pipe body, would be tested, inspected and recoated, the trench backfilled and the street or landscape refurbished as necessary.[54]

51. Within the alternatives comparison table above, Alternative 2 was identified as partially meeting the objective of reducing pipeline risk. The "partial" qualification was due to there being no technical methods to identify girth weld locations from above ground. Unless the entire length of the pipeline was excavated, it would be possible that some welds could be missed for inspection. It is possible that coating repairs on the pipe body during the original construction may have behaved the same or similarly to field applied joint coatings. Without

[52] Exhibit B-1, Application, pp. 32-33.

[53] Exhibit B-1, Application, p. 17 and 33; Exhibit B-6, CEC IR 1.20.1.

[54] Exhibit B-1, Application, p. 33.

inspecting the entire pipeline, some future leak uncertainty associated with the pipe body would remain.[55]

52. The OGC's comments to FEI are consistent with FEI's assessment that each weld would have to be inspected and that the condition of the rest of the pipeline would have to be considered:[56]

> "Assuming the rehabilitation work is to dig up and inspect EVERY weld, this option would be considered by the OGC. FortisBC Energy Inc. (FEI) would also have to demonstrate that the rest of the pipeline is fit for service and continue the increased frequency leak survey on uninspected sections of the pipeline, until all the welds have been inspected and repaired where necessary. This approach is based on no increased leak frequency or size of leak being detected."
>
> (Emphasis in original.)

53. FEI expects that the work to rehabilitate the entire 20 kilometre length of the existing Coquitlam Gate IP pipeline could possibly be completed over a three to four year timeframe.[57]

54. This alternative does not fully mitigate potential future pipeline corrosion leaks because only the pipeline at each weld location would have been exposed for inspection, evaluation and repair. The estimated cost of this alternative, with minimal potential benefits compared to the other long term strategy solutions, is in the range of $154 million.[58] While constructible, it does not provide operational flexibility or system resiliency, or fully address pipeline risk and therefore it is not a feasible alternative.[59]

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[55] Exhibit B-11, BCUC IR 2.1.2.

[56] Exhibit B-11, BCUC IR 2.1.3.

[57] Exhibit B-6, CEC IR 1.27.1.

[58] Exhibit B-4, BCUC IR 1.19.5.

[59] Exhibit B-1, Application, p. 34.

(c) Alternative 3 - Replace (in-kind) the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a New NPS 20 Pipeline Operating at 1200 kPa (Inappropriate Solution)

55. Alternative 3 is constructible and meets the objective of eliminating the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency. However, replacing the existing NPS 20 in kind does not restore any of the operational flexibility or the system resiliency that has been eroded over time as a result of customer and demand growth.[60] Therefore, this alternative is not appropriate or viable.

(d) Alternative 4 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 24 Pipeline Operating at 2070 kPa (Partial Solution)

56. Alternative 4 is constructible and meets the objectives of eliminating the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency. This alternative also provides some operational flexibility and system resiliency for a portion of the year. However, under this alternative, a failure upstream, at, or downstream of the Fraser Gate Station during colder winter day conditions, will result in outages to customers.

57. With this alternative, at the end of the 20 year planning period, under peak hour demand, and in the absence of Fraser Gate supply, approximately 192,500 customers with a gas demand of more than 566,000 standard m3/hour would lose delivery pressure sufficient to operate their gas appliances.[61] At the end of the 20-year planning period the NPS 24 pipeline operating at 2070 kPa could provide support to the full Metro IP system for only 353 days in a normal year. Sufficient backfeed could not be provided for 12 days of a normal year to provide full resiliency because of the limited capacity of the NPS 24 IP pipeline.[62]

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[60] Exhibit B-1, Application, p. 34; Exhibit B-1-4, Application Errata, p. 41.

[61] Exhibit B-4, BCUC IR 1.9.1.

[62] Exhibit B-4, BCUC IR 1.9.1, 1.9.1.1; Exhibit B-11, BCUC IR 2.6.1.

58. As it does not provide resiliency, this alternative would restrict work requiring isolation of the supply at either gate station to the period between mid-March to mid-November where it is the most improbable that one of the 12 colder days of the year would occur. This would provide an operational window sufficient for work that is planned in advance to be completed within this window.[63]

59. Work in colder months outside of this operational window (i.e., between mid-November and mid-March) would require that the gate stations remain in service and that bypass piping be installed around the isolated section to provide necessary support to the downstream system should the expected 12 colder days of the winter occur during the course of work.[64]

60. The cost to FEI per occurrence would be the cost of installing and then removing the bypass piping. Costs would vary depending on the location of the work (impacting the bypass pipe size required) and the total length and routing needed to span the work area.[65] An estimate of total cost that may be incurred over a given number of years related to the cost of additional work needed due to this lack of full resiliency cannot be fully determined because the total number of occurrences is unpredictable.[66] Work that would have to be performed outside of the identified operational window would be unplanned and of very urgent nature and would drive up either bypass installation costs or costs associated with possible widespread customer outages.[67]

61. The NPS 24 (2070 kPa) alternative is not comparable to the preferred NPS 30 (2070 kPa) alternative. With or without the Cape Horn to Coquitlam TP loop under peak hour demand, the NPS 24 pipeline alternative, similar to the other alternatives that do not meet the

[63] Exhibit B-11, BCUC IR 2.3.2.

[64] Exhibit B-11, BCUC IR 2.3.2.

[65] Exhibit B-5, BCOAPO IR 1.3.7; Exhibit B-4, BCUC IR 1.3.5.

[66] Exhibit B-11, BCUC IR 2.3.2.

[67] Exhibit B-11, BCUC IR 2.3.2.

full resiliency objective, would suffer a collapse in downstream pressure as the gas flows away from Coquitlam Gate Station. This would cause a higher number of customer outages.[68]

62. Since this alternative provides some operational flexibility and resiliency it was given additional consideration.

(e) Alternative 5 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 36 Pipeline Operating at 1200 kPa (Partial Solution)

63. Alternative 5, similar to Alternative 4, is constructible and meets the objectives of eliminating the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency. This alternative also provides operational flexibility for a portion of the year. Alternative 5 provides an additional degree of system resiliency above Alternative 4, in that a failure upstream, at, or downstream of Fraser Gate Station would only result in outage and resulting economic impact for up to 47,500 of the 171,000 customers served by this pipeline.[69]

64. The 47,500 customers in this scenario are potentially at risk in the event that a failure interrupts supply at Fraser Gate Station and the Metro IP system is fed entirely from Coquitlam Gate Station. The larger NPS 36 pipeline operating at 1200 kPa in this alternative could provide pressures sufficient for most areas of the Metro IP system except for the stations nearer Fraser Gate serving south Burnaby and the stations feeding the Point Grey area of Vancouver as these stations would be near the tail end of the system.[70]

65. Since this alternative provides more operational flexibility and resiliency (compared to Alternative 4), and better meets the Coquitlam Gate IP Project objectives and requirements, it was given additional consideration.

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[68] Exhibit B-4, BCUC IR 1.9.2.

[69] Exhibit B-1, Application, pp. 36-37.

[70] Exhibit B-6, CEC IR 1.31.1 and 1.31.3.

(f) Alternative 6 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 30 Pipeline Operating at 2070 kPa (Preferred Alternative and Full Solution)

66. The non-financial analysis showed that of the alternatives assessed, only Alternative 6 provided a solution that met all of the stated objectives. Replacement with the NPS 30 2070 kPa IP alternative is constructible and eliminates the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline as a result of the known corrosion mechanism and resulting unacceptable projected leak frequency. It also provides the necessary operational flexibility to facilitate planned outages and resiliency to mitigate the risks and consequences associated with unplanned outages.[71]

67. The proposed NPS 30 (2070 kPa) pipeline provides full resiliency to the end of the planning period and would allow work that may require isolation of supply at either the Coquitlam or the Fraser Gate station to be accommodated at any time of year. Work performed on the Metro IP system would not incur any additional costs for bypass piping around the work area and emergency situations requiring isolation would not incur significant customer outages and associated costs.[72]

68. FEI currently expects the Cape Horn to Coquitlam TP loop to go into service by Q4 2017 based on the Company's assessment of resources required for design, construction and other necessary activities to place the project in service.[73] However, even without the Cape Horn to Coquitlam TP loop, FEI expects that with a normal year forecast there would be about 361 days a year that the Metro IP system could support an outage of supply from Fraser Gate Station the first year of operation with Alternative 6.[74] At the end of the 20 year planning period, without the Cape Horn to Coquitlam TP loop, with a normal year forecast FEI expects there would be about 359 days that the Metro IP system could support such an outage.[75]

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[71] Exhibit B-1, Application, p. 39.
[72] Exhibit B-11, BCUC IR 2.3.2, 2.4.2, 2.4.4.
[73] Exhibit B-4, BCUC IR 1.8.3.
[74] Exhibit B-4, BCUC IR 1.8.1.
[75] Exhibit B-4, BCUC IR 1.8.1.1.

69. The proposed NPS 30 pipeline would also provide more resiliency than the NPS 24 pipeline even in the absence of the Cape Horn to Coquitlam TP loop. Under peak hour demand at the end of the 20 year planning period, the NPS 30 pipeline would require shutdown of up to 57,200 customers.[76] Under the same peak hour conditions, with or without the Cape Horn to Coquitlam TP loop, the NPS 24 pipeline the Metro IP system would have up to 192,500 customer outages.[77]

70. This demonstrates that the NPS 24 (2070 kPa) alternative is not comparable to the proposed NPS 30 (2070 kPa) alternative. With or without the Cape Horn to Coquitlam TP loop under peak hour demand, the NPS 24 pipeline alternative, similar to the other alternatives that do not meet the full resiliency requirement, would suffer a collapse in downstream pressure as the gas flows away from Coquitlam Gate Station. This would cause a higher number of customer outages.[78]

71. While NPS 30 pipe is only six inches or 25% larger in diameter than NPS 24 pipe, it has almost a 60% greater cross-sectional area – and consequently a much higher flow capacity. The gas velocity in the NPS 24 or smaller pipelines is therefore much higher than the NPS 30 pipeline under peak hour flow and this contributes to an even higher rate of pressure drop as the gas moves along the pipeline. An additional challenge for the pipeline is that almost 90% of the gas leaving Coquitlam Gate Station heading west has to travel more than 15 km – or three-quarters of the length of the pipeline – before reaching the major laterals and district stations in the vicinity of East 2nd Avenue & Boundary Road and west to distribute the gas to Vancouver and the North Shore communities. This combination of sustained higher velocities over long distance exceeds the ability of the NPS 24 and smaller pipelines to offer the full resiliency provided by the proposed NPS 30 IP pipeline.[79]

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[76] Exhibit B-4, BCUC IR 1.8.2.1, 1.9.2.

[77] Exhibit B-4, BCUC IR 1.9.1, 1.9.2.

[78] Exhibit B-4, BCUC IR 1.9.2.

[79] Exhibit B-4, BCUC IR 1.9.2.

72. The robustness of Alternative 6 is demonstrated by the fact that it would still offer FEI sufficient operational flexibility and resiliency in the event of the addition of 10% higher peak day demand forecast over the 20-year forecast period when even a 10% lower peak day forecast for Alternatives 4 and 5 will note provide resiliency at the anticipated in-service date.[80]

73. Alternative 6 is the only alternative that met all of the Project objectives, and its benefits are clear, justifying its selection as the preferred alternative.

(g) Alternative 7 - Replace the Existing Coquitlam Gate IP Pipeline Operating at 1200 kPa with a NPS 42 Pipeline Operating at 1200 kPa (Infeasible Alternative)

74. A constructability analysis completed as part of the pipeline routing process identified prohibitive construction constraints associated with the installation of NPS 42 pipeline along the more densely developed sections of the route. Consequently, FEI concluded that this alternative was not feasible.[81]

(h) Other Alternatives Canvassed during the IR Process

75. A number of disadvantageous or infeasible alternatives were examined in the IR process.

Higher Operating Pressures

76. An IP system operating at pressure above 2070 kPa (300 psig) would not be feasible in the Lower Mainland area. The Coastal Transmission System (CTS) is supplied at Huntingdon Gate where the contract minimum supply pressure from Spectra Energy is 3440 kPa (500 psig). As a result, the CTS must be designed to deliver the peak demand requirements at the minimum supply pressure of 3440 kPa. Operating an IP system at 3100 kPa (450 psig) supplied by the CTS would provide insufficient pressure differential from the contract minimum

[80] Exhibit B-11, BCUC IR 2.4.2, 2.4.4.

[81] Exhibit B-1, Application, p. 31.

supply pressure at Huntingdon Gate to maintain adequate working pressure through the CTS to the Coquitlam TP/IP Gate station.[82]

77. Furthermore, operating an IP system above 2070 kPa would require heating of the gas at all offtake points to counteract the cooling effect associated with pressure reduction. Heating of gas in this manner is only applied at the Coquitlam Gate and Fraser Gate Stations where there is sufficient space to accommodate the heating equipment. The offtake points along the Coquitlam Gate IP and Fraser Gate IP pipelines supply district stations (small underground vaults) containing pressure control equipment that is designed to operate without gas heating. Therefore, the maximum inlet pressure must be restricted to mitigate the risk of freezing. Inlet pressures above 2070 kPa would increase the risk of equipment malfunction due to freeze-up.[83]

NPS 30 Pipeline operating at 1200 kPa

78. A NPS 30 pipeline operating at 1200 kPa would not provide full system resiliency either on the proposed in service date or at the end of the 20 year planning period. A NPS 30 pipeline operating at 1200 kPa pipeline would provide operational flexibility for only a portion of the year.[84] This window would provide opportunities to carry out planned work, but would, for example, not permit the tie in of the Fraser Gate IP Pipeline in November 2019 as proposed without requiring bypass piping installed to maintain supply from Fraser Gate Station.[85]

LNG Regasification

79. It would not be feasible to provide additional system resiliency to any of the alternatives that do not provide full resiliency on its own through the acquisition of moveable LNG regasification plants.[86] While FEI has used a moveable LNG regasification facility for scheduled work to avoid small distribution pressure outages, the practical delivery volumes are

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[82] Exhibit B-4, BCUC IR 1.9.3.

[83] Exhibit B-4, BCUC IR 1.9.3.

[84] Exhibit B-4, BCUC IR 1.10.1.1; Exhibit B-11, BCUC IR 2.7.1.

[85] Exhibit B-4, BCUC IR 1.10.1.2.

[86] Exhibit B-6, CEC IR 1.32.1.

far below those that would be required to support moderate or larger area outages in winter conditions.[87]

D. Load Determination Methodology

80. The alternatives considered the criteria that, at a minimum, the pipeline design capacity had to meet forecasted design degree day load (i.e., peak demand) for the 20 year planning period.[88]

81. The load determination methodology is a two-step process and is consistent with the practice used to assess distribution projects submitted as part of previous FEI regulatory filings. The first step involves updating the current network hydraulic model with current peak hour demand for each customer. The second step involves determining future loads and then applying those loads to a network model of the IP system to represent a future year within the 20 year planning period.[89]

82. To determine loads for models for each year of the 20 year planning period, the current station loads for each station are extracted into a 20 year station load table from the current hydraulic model of the Metro distribution system. The annual load growth for each station is determined by proportionally distributing the annual incremental load growth of the system to each station. The load growth being determined as the sum of the products of the account additions for each rate class times the peak hour use per customer (UPC) for each rate class. With the load applied to the model, the modelling software can determine the expected flow and pressure at any point in the system and determine the impacts of changes to piping or station configurations. Models of the Metro IP system built from current assessments of peak hour demand were used to determine the effectiveness of various Coquitlam Gate IP pipeline alternatives.[90]

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[87] Exhibit B-6, CEC IR 1.32.1.1, 1.32.1.4.

[88] Exhibit B-1, Application, p. 31.

[89] Exhibit B-4, BCUC IR 1.5.1 1.

[90] Exhibit B-4, BCUC IR 1.5.1.

83. Although FEI has seen a reduction in the annual UPC in some customer classes, the impact on peak hour demand has not followed the same declining trend. At present, given the variability in the trending of the peak hour UPC and considering that the determination of peak hour UPC is an annual process while peak hour load forecasts are adjusted regularly to reflect the most current information on peak hour demand, FEI considers it reasonable that the peak hour UPC remains constant over the planning period.[91]

E. Financial Considerations

84. While Alternative 6 is the only alternative that meets all of the Project objectives and requirements, a financial analysis was completed for those alternatives that met a significant portion of the Project objectives in the non-financial technical analysis. The financial analysis also demonstrated the virtue of Alternative 6.

85. The capital cost estimate for the Alternative 6 NPS 30 pipeline was developed to an AACE Class 3 level of project definition.[92] In response to a Commission IR, the AACE Class 4 estimate for Alternative 4 (NPS 24 at 2070 kPa) was updated to an AACE Class 3 estimate.[93] The Alternative 4 AACE Class 3 basis of estimate reflects the conditions prevailing at the time the Alternative 6 AACE Class 3 estimate was developed. Both AACE Class 3 cost estimates can be compared appropriately as each was developed to the same level of project definition and using the same bases of estimate.[94]

86. The estimated construction productivity for the NPS 30 and NPS 24 Project Alternatives is the same as there is only a six inch difference in the pipeline diameters. This means that for both pipeline sizes the trench would be formed using a standard 42 inch wide excavator bucket. Because the trench excavation progress will be the limiting factor in determining the construction productivity, and the trench size to be excavated for both the NPS 30 and NPS 24 pipeline sizes will be the same, the construction productivity will be the same.

[91] Exhibit B-11, BCUC IR 2.9.2.

[92] Exhibit B-1-4, Application Errata, p. 43.

[93] Exhibit B-11, BCUC IR 2.15.1.

[94] Exhibit B-17, Panel IR 1.2.1, 1.3.1.

Handling and lowering the pipe into the prepared trench would be performed using the same capacity range of cranes, crane trucks and pipe laying equipment for both the NPS 24 and NPS 30 pipeline sizes. There would be some productivity savings (and therefore cost savings) in terms of welding for the NPS 24 compared to the NPS 30 pipe size, but it is not significant enough to impact overall productivity. Further, the cost savings from reduced welding would be partially offset by the greater civil cost for Alternative 4 (NPS 24) as there is a higher amount of sand backfill required due to the trench being essentially the same size for both the NPS 24 and NPS 30 pipe sizes, but the NPS 24 pipe will occupy less volume of the trench.[95]

87. The table below shows the financial comparison of Alternatives 4, 5 and 6.[96]

Updated Coquitlam Gate IP Project Financial Comparison

	Alternative 4 Install NPS 24 pipeline at 2070 kPa (BCUC IR 2.15.1)	Alternative 5 Install NPS 36 pipeline at 1200 kPa (Evidentiary Update Table 2-2)	Alternative 6 Install NPS 30 pipeline at 2070 kPa (BCUC IR 2.15.1)
AACE Estimate Accuracy	***Class 3***	***Class 4***	***Class 3***
Total Direct Capital Cost excl. AFUDC & includes Abandonment / Demolition (2014 $millions)	191.952	205.836	199.053
Total Direct Capital Cost excl. AFUDC (As-spent $millions)	222.261	238.747	230.474
AFUDC (as spent $millions)	11.896	12.177	12.351
Total As-spent includes Abandonment / Demolition & AFUDC ($millions)	234.157	250.924	242.825
Annual incremental gross O&M (2014 $millions)	0.055	0.020	0.055
Levelized Rate Impact – 60 Yr. ($ / GJ)	0.096	0.103	0.100
PV Incremental Cost of Service – 60 Yr. ($millions)	284.207	306.928	297.183

88. Alternative 6 (NPS 30 at 2070 kPa) and Alternative 5 (NPS 36 at 1200 kPa) have somewhat similar capital cost estimates at $230.474 million and $238.747 million respectively

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[95] Exhibit B-17, Panel IR 1.1.1.

[96] Exhibit B-1-6, Application Evidentiary Update, p.16 as revised by Exhibit B-11, BCUC IR 2.15.1.

(excluding AFUDC). However, Alternative 5 has a higher cost and does not offer the system resilience of Alternative 6.[97]

89. A calculation of the present value of operational risk was conducted on Alternatives 4 and 6 to determine the differential between the two alternatives in terms of a 60 year levelized cost when the impact of operational risk reduction was taken into account. The present value of the operational risk was added to the present value of the cost of service to provide an overall present value comparison, which is summarized in the table below. Operational risk is a measure of loss-of-service impact, and is defined as the sum of the quantitative risk value of each pipeline section per year of operation, based on failure frequency per year and financial cost per event associated with the loss-of-service. The calculation of the annual risk reduction of $2.456 million associated with the proposed Alternative 6 is included in Appendix A-10 of the Application. The calculation of the annual risk reduction associated with Alternative 4 is $0.352 million.[98]

90. Table 2-3 from the Evidentiary Update is provided below with revisions to Alternative 4 results from using Project costs based on a Class 3 AACE Estimate of Accuracy.[99]

[97] Exhibit B-1-6, Application Evidentiary Update, p.16.
[98] Exhibit B-4, BCUC IR 1.22.7; Exhibit B-11, BCUC 2.16.1.
[99] Exhibit B-11, BCUC IR 2.15.2.

Evidentiary Update Revised Table 2-3: Updated Coquitlam Gate IP Project Financial and Operational Risk Comparison

		Alternative 4 Install NPS 24 Pipeline at 2070 kPa	Alternative 6 Install NPS 30 Pipeline at 2070 kPa
1	Potential Operational Risk Reduction Per Appendix A-10 (2014 $millions/year)	2.456	2.456
2	Operational Risk Reduction (Coquitlam Gate IP Pipeline and Cape horn to Coquitlam TP complete) (2014 $millions/year)	0.352	2.456
3	Operational Risk Reduction (%)	14.34%	100.0 %
4	Remaining Operational Risk (2014 $millions/year)(line 1-Line2)*	2.104	0
5	PV Remaining Operational Risk – 60 Yr ($millions)	33.307	0
6	PV Incremental Cost of Service – 60 Yr ($millions)	284.207	297.183
7	PV Remaining Operational Risk + PV Incremental Cost of Service – 60 Yr ($millions)	317.514	297.183

** Based on potential operational risk in line 1*

91. As shown in the table above, the difference in operational risk reduction for Alternative 6 (NPS 30) compared to Alternative 4 (NPS 24) is 85.66 percent (100% - 14.34%).

92. The financial incremental benefit of the NPS 30 (2070 kPa) pipeline over the NPS 24 (2070 kPa) pipeline is the avoidance of any costs associated with bypass installation and costs associated with customer outages.[100] As previously described, even in the event of a 10% lower peak day demand forecast over the 20-year forecast period, Alternative 4 would still not offer FEI sufficient operational flexibility and resiliency.[101]

93. As shown in line 5 of the table above, the benefit of the PV operational risk differential for a 60 year period utilizing the Company's 6.14 percent weighted average cost of capital (WACC) for Alternative 6 (NPS 30) compared to Alternative 4 (NPS 24), was calculated to be $33.307 million.

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[100] Exhibit B-11, BCUC IR 2.3.2.

[101] Exhibit B-11, BCUC IR 2.4.2, 2.4.3.

94. As shown in line 7 of the table above, where the 60 year PV Incremental Cost of Service and PV Operational Risk are added, Alternative 6 (NPS 30) is $20.331 million less than Alternative 4 (NPS 24).

95. An analysis of the PV of the 60 year cost of service shows that Alternative 4 (NPS 30) is $12.976 million less than Alternative 6 (NPS 24) and that, as shown in the prior table, the differential in terms of a 60 year Levelized Rate Impact between the two is $0.004 per GJ. Based on an average annual consumption of 95 GJ per residential customer, this would result in an annual cost difference between the two alternatives of $0.38 per customer (($0.100 - $0.096) x 95 GJ = $0.38).

96. In summary, when taking into account the reduction in operational risk provided by Alternative 6 compared to Alternative 4, and that the differential in terms of a 60 year Levelized Rate Impact between the two is only $0.004 per GJ and that Alternative 6 is the only alternative which meets all of the stated objectives that FEI has identified, Alternative 6 is a well justified preferred alternative.

F. Conclusion regarding Coquitlam Gate IP Pipeline Alternatives

97. Alternative 6, an NPS 30 pipeline operating at 2070 kPa, is the best alternative to address the existing issues with the Coquitlam Gate IP pipeline. In addition to being constructible and eliminating the elevated reliability, safety and regulatory risk posed by the existing Coquitlam Gate IP pipeline, it also provides operational flexibility and full resiliency to the end of the planning period. A financial analysis also shows that it is the most appropriate alternative. Accordingly, FEI submits that Commission should approve Alternative 6, the specific attributes of which are described further in the Application, the Evidentiary Update and below.

PART FOUR: COQUITLAM GATE IP PROJECT DESIGN, CONSTRUCTION, COST AND SCHEDULE

98. The NPS 30 pipeline operating at 2070 kPa will be designed, constructed and operated in accordance with appropriate standards and methods, and include suitable

components. FEI has selected a constructible and economic route option for the Coquitlam Gate IP Project that minimizes potential impacts. The Project cost has been forecast and evaluated, and a Project schedule that is coordinated with the Fraser Gate IP Project has been prepared.

A. Proposed Project

99. The Coquitlam Gate IP Project scope for Alternative 6 includes the design, routing, construction and commissioning of a new NPS 30 IP pipeline and associated facilities. The main Project components include:[102]

(a) NPS 30 IP pipeline that will operate at a Maximum Operating Pressure (MOP) of 2070 kPa;

(b) Pipeline design in accordance with CSA Z662 Section 12 for 'Gas Distribution Systems' to operate at hoop stresses of less than 30 percent of the specified minimum yield strength of the line pipe;

(c) Upgrades to the Coquitlam Gate Station to facilitate the larger IP pipeline flow capacity and operating pressure;

(d) Upgrades to East 2nd & Woodland Station to interface the NPS 30 IP pipeline with the existing Fraser Gate IP network; and

(e) Interface with the existing IP network at a number of supply offtakes en-route from Coquitlam through Burnaby to the terminus at East 2nd & Woodland in Vancouver.

100. The design, construction and operation of FEI natural gas pipelines and stations are conducted in accordance with OGC regulations and CSA Standard Z662.[103]

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[102] Exhibit B-1, Application, pp. 47-48.
[103] Exhibit B-1, Application, p. 48.

101. Densification of urban areas has been considered in the pipeline design and routing. The pipeline will operate at a low stress level with a corresponding high factor of safety suitable for urban locations. Also, the pipeline route is located mostly within road allowance which will mitigate risk of future impact to adjacent development and densification. Furthermore, during the routing process, FEI engaged with the municipalities along the route corridor to present the proposed alignment and inform the routing process with respect to long term municipal development plans which could impact route selection.[104]

102. East 2nd & Woodland Station, in addition to facilitating gas flow from the proposed NPS 30 Coquitlam Gate IP pipeline to the Fraser Gate IP pipeline (forward flow regime), will also include facilities to provide automatic reverse flow capabilities (reverse flow regime) to flow gas from the Fraser Gate IP pipeline to the Coquitlam Gate IP pipeline. This bi-directional flow capability will ensure the NPS 30 Coquitlam Gate IP pipeline is fully integrated into the overall Coquitlam Gate IP system and the Fraser Gate IP system and provides flexibility in achieving full resiliency of the Metro IP system. Thus, if gas from Fraser Gate Station, or the Fraser Gate IP pipeline, is disrupted, the system can be shut in and gas will flow from the Coquitlam Gate IP pipeline through East 2nd & Woodland Station into the Fraser Gate IP pipeline to supply all customers.[105]

103. Also, if the gas flow from Coquitlam Gate Station, or through the Coquitlam Gate IP pipeline, is disrupted, there exists the capability for gas to flow in the opposite direction from Fraser Gate IP pipeline network back through the East 2nd & Woodland Station along the Coquitlam Gate IP pipeline to supply all customers.[106]

104. The various components of the Project are described in detail in section 3.3 of the Application. FEI provides submissions below on those components that were examined in more detail in the IR process.

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[104] Exhibit B-1, Application, pp. 48-53; Exhibit B-4, BCUC IR 1.12.2.

[105] Exhibit B-1, Application, pp. 52-53.

[106] Exhibit B-1, Application, p. 53.

(a) In-Line Inspection

105. Due to the longevity of steel pipelines, it is appropriate to design the Coquitlam Gate IP pipeline with future in-line inspection (ILI) capability. This will enable the cost effective and targeted mitigation of specific pipeline hazards (i.e. corrosion) over the service life of the new asset.[107]

106. Although FEI has not run ILI tools in pipelines operating at these relatively low operating pressures (2070 kPa) in the past, there are now commercially available free-swimming and robotic ILI technologies capable of inspecting the proposed NPS 30 Coquitlam Gate IP pipeline. These are recent industry developments.[108]

107. ILI is a proven industry tool for proactive identification of sections of pipe that may require maintenance or replacement over time. Because the minimum acceptable bend radius for ILI is equal to or less than the minimum pipeline induction bend radius required for directional change, FEI considers the incremental cost to include ILI capability, in terms of pipeline bend requirements, to be immaterial.[109] As full bore type block valves are required irrespective of pipeline ILI capabilities, there would be no opportunity to save costs through the use of reduced port block valves if the pipeline did not include ILI.[110]

108. Accordingly, the only anticipated incremental costs for ILI capability are for the ILI launcher at Coquitlam Gate Station and ILI receiver at the East 2nd & Woodland Station including materials (pipe, fittings, valves and actuators), construction, fabrication, pipe supports, inspection and testing, which are approximately $1.9 million (2014$).[111]

109. Over the lifespan of the new Coquitlam Gate IP pipeline, FEI expects ILI technology will maximize asset life by proactively identifying possible mitigation requirements and allow a longer-term planning horizon than otherwise possible. Due to the nature and

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[107] Exhibit B-1, Application, p. 58.
[108] Exhibit B-4, BCUC IR 1.14.1.
[109] Exhibit B-4, BCUC IR 1.14.2.
[110] Exhibit B-4, BCUC IR 1.14.3.
[111] Exhibit B-4, BCUC IR 1.14.4.

quality of the data that can be collected, ILI enables more targeted mitigation planning and response than other currently available methods (e.g., above-ground cathodic protection and coating surveys, followed by excavations along the length of the pipeline). This in turn enables asset planning and risk mitigation decisions with minimal community disruption and optimal life-cycle cost.[112] Accordingly, the inclusion of ILI capability for the Coquitlam Gate IP Project is appropriate.

(b) Coating

110. The proposed new pipeline will be constructed with industry standard Fusion Bonded Epoxy (FBE) factory applied pipe coating and field applied liquid epoxy at girth weld locations. The selection of coating was based on FEI's internal standard, and is currently the only approved plant-applied coating for line pipe of NPS 24 and greater.[113] The pipeline will not include girth welds with similar field applied coating as to that which is exhibiting corrosion and leaks on the existing pipeline.[114] Modern day pipeline coatings, such as FBE or liquid epoxy, are subject to strict application procedures as well as a greater level of inspection and quality control than when the existing pipeline was constructed. In addition, these coatings are designed to be compatible with cathodic protection in the case of coating disbondment, damage or degradation. This coating system is considered "non-shielding" in the case of failure or loss of adhesion and therefore cathodic protection will continue to protect the pipe from corrosion.[115]

111. FEI has successfully utilized FBE coating on most large diameter pipeline projects over the last 15 years. These projects include the Southern Crossing Pipeline and the Fraser River South Arm NPS 20 and NPS 24 crossing upgrade. FBE pipeline coatings are industry standard for large diameter pipelines, and have a successful performance history.[116]

[112] Exhibit B-14, CEC IR 2.8.1.2.
[113] Exhibit B-4, BCUC IR 1.11.4.
[114] Exhibit B-6, CEC 1.38.1, 1.40.4.
[115] Exhibit B-6, CEC IR 1.3.1.2.
[116] Exhibit B-6, CEC IR 1.40.2.

(c) Cathodic Protection

112. Cathodic protection is generally regarded as a secondary defense against external corrosion, used in conjunction with coatings. It is also a requirement of the CSA Z662 standard. Corrosion control of the Coquitlam Gate IP pipeline will be achieved via the protective external coating described previously and an impressed current cathodic protection system.[117] The CP system for the existing NPS 20 Coquitlam Gate IP pipeline is in satisfactory condition and has sufficient capacity to provide cathodic protection to the new NPS 30 pipeline. [118]

(d) Abandonment

113. The existing NPS 20 Coquitlam Gate IP pipeline will be abandoned in place once the new pipeline is in service in accordance with CSA Z662 and the Company's internal standards.[119]

114. FEI selected abandonment of the NPS 20 Coquitlam Gate IP pipeline as the least impact end-of-life solution for the existing pipeline. When carrying out abandonment, FEI will identify, manage and mitigate the potential environmental, public or stakeholder legacy issues. FEI does not foresee any significant adverse effects as a result of abandoning the pipeline in place.[120] The existing NPS 20 pipeline will be cut into shorter segments which will then be cleaned and capped to minimize any potential sources of contamination. Since the NPS 20 Coquitlam Gate IP pipeline is used to transport sweet, dry, natural gas and is operated in a clean state, the risk of contaminants being left in the pipeline is minimal, and the potential for soil and/or groundwater contamination from the cleanliness of the pipeline will not be a factor for this Project.[121] It should be noted that gas flow in the existing NPS 20 pipeline must be maintained to supply customers while the NPS 30 pipeline is constructed and commissioned. Therefore, it is not possible to remove the existing NPS 20 IP pipeline prior to, or in conjunction

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[117] Exhibit B-1, Application, p. 59.

[118] Exhibit B-4, BCUC IR 1.11.5.

[119] Exhibit B-1, Application, pp. 63-64.

[120] Exhibit B-4, BCUC IR 1.11.7.1.

[121] Exhibit B-6, CEC IR 1.45.1; 1.45.4.

with, the construction and installation of the proposed NPS 30 IP pipeline.[122] FEI sees no reason to continue CP on the existing pipeline after abandonment.[123]

B. Routing

115. FEI made use of a routing selection process to minimize potential impacts on the community, stakeholders and environment while meeting safety requirements, and identifying a constructible and economic route.[124]

116. Section 3.3.4 of the Application and supporting Appendix A-17 filed with the Application and section 2.3.2 of the Evidentiary Update, including the Addendum to Appendix A-17, describe the pipeline route evaluation process and the original proposed route alignment for the NPS 30 Coquitlam Gate IP pipeline. An overview map of the route corridor (subdivided into seven Sections to facilitate the route evaluation process) is located in Exhibit B-1, Figure 3-7.

117. The routing selection process identified a route corridor between Coquitlam Gate Station and East 2nd & Woodland Station. The corridor was sectionalized into seven sections based on the locations of lateral offtakes from the existing NPS 20 Coquitlam Gate IP pipeline. Twenty four route options (ranging from two to five for each section) within the corridor were evaluated. This approach helped to identify feasible alternatives while ensuring routing efficiency in interfacing with the existing IP network was maintained.[125]

118. The route selection process adopted for the Project was based on a typical approach to routing a pipeline between fixed start and end points and any intermediate off take points. However, the process was tailored to meet the specific requirements and objectives of the urban location of the Coquitlam Gate IP pipeline.[126] FEI completed both a non-financial and financial (comparative cost) analysis of the route options identified in each

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[122] Exhibit B-4, BCUC IR 1.11.7.1.
[123] Exhibit B-6, CEC IR 1.45.7; Exhibit B-14, CEC IR 2.12.1.
[124] Exhibit B-1, Application, pp. 64-77.
[125] Exhibit B-1, Application, p. 77.
[126] Exhibit B-1, Application, p. 64.

section of the route corridor. The estimated cost for constructing each route option was one of four categories considered as part of the analysis.

119. The non-financial analysis compared the route options against multiple evaluation criteria defined in Exhibit B-1, Table 3-9. A weighting was applied to these criteria as explained in Exhibit B-1, section 3.3.4.5.2, and the options were scored and ranked. Comparatively, the financial analysis considered a single key criteria – cost. Therefore, because cost was the only financial evaluation criteria, it was not necessary to apply a weighting; instead, the route options were directly compared and ranked in terms of relative construction costs (i.e., least expensive ranked first, etc.).[127]

120. In effect, during the initial stages of the route selection process, the non-financial analysis identified a route alignment based on the highest ranked route option in each section and the financial analysis also identified a route alignment based on the highest ranked route option in each section.[128]

121. To select the preferred route alignment the non-financial and financial route rankings were compared and reconciled in each section to determine which route option best met the routing objectives detailed in Exhibit B-1, section 3.3.4.1. In all cases, with the exception of Section 2 (Poirier St. to Robinson St/ Coquitlam West), Section 3 (Robinson St. to Underhill Ave.), and Section 5 (Bainbridge Ave. to Springer Ave.), the highest ranked non-financial route option was also the least cost and was therefore selected as the preferred route.[129] (As described below, the preferred alignment for Section 5 was subsequently changed to the least cost option.)

122. In Sections 2, 3 and 5, the highest ranked non-financial option did not align with the highest ranked financial option (i.e. the route option selected on non-financial criteria was

[127] Exhibit B-4, BCUC IR 1.16.1.

[128] Exhibit B-4, BCUC IR 1.16.1.

[129] Exhibit B-4, BCUC IR 1.16.1.

not the least cost). To reconcile the differences, the relative cost margin between these route options was considered.[130]

123. The actual cost difference in each Section was approximately 1-3%, and the total difference between the selected preferred route and a route alignment comprising the least expensive (non-financial) route options was 5% of the total pipeline construction cost estimate. This difference, which is within the accuracy ranges of the AACE Class 3 and Class 5 estimates, was not sufficient to influence the preferred route selection, which best met the routing objectives detailed in the Application.[131] Cost estimates for the route Sections were filed confidentially with the Commission.[132]

124. The route selection process explicitly considered cost as separate but key criteria in determining the preferred route. It demonstrates that FEI selected a preferred route alignment that is optimized in terms of Community and Stakeholder, Environmental and Technical criteria but for a relatively small additional cost as the calculated incremental cost difference is well within the range of accuracy of even a Class 3 estimate. The clarity provided by this approach justifies FEI's decision to include cost in the route selection process in this fashion and as an un-weighted criterion in the financial analysis.[133] A sensitivity analysis performed in response to a Commission IR showed that the overall preferred routes selection was robust.[134]

125. As described in section 3.3.4.7 of the Application, during consultation in November 2014 the City of Burnaby indicated that traffic impacts along Lougheed Highway should not be considered as a major issue when assessing route feasibility. At that time the City of Burnaby stated that if a mutually agreeable route alignment could be determined along Lougheed Highway for Sections 5 and 6, the City would support the route. Since then, FEI completed further assessment of the potential traffic impacts from the proposed pipeline

[130] Exhibit B-4, BCUC IR 1.16.1.
[131] Exhibit B-4, BCUC IR 1.16.1.
[132] Actual cost estimates filed confidentially in Exhibit B-11-1, BCUC IR 2.13.1.
[133] Exhibit B-4, BCUC IR 1.16.1; Exhibit B-4, BCUC IR 1.16.4.
[134] Exhibit B-4, BCUC IR 1.16.7.

construction on Lougheed Highway[135] and worked with City of Burnaby staff to fully understand the potential impacts from construction.[136]

126. As a result of the analysis and the re-evaluation of the Lougheed Highway route options that took place after the filing of the Application, FEI determined that route options along Lougheed Highway for Section 5 and a portion of Section 6 of the route corridor were feasible. FEI updated its preferred route to follow Lougheed Highway for Section 5 and Section 6.[137] As described in the Evidentiary Update, both are the least expensive route option in their Section.[138]

127. The revised route resulted in a minor reduction in the Project cost and has mitigated concerns raised by the City of Burnaby and residents of a neighbourhood through which the original route option progressed.[139] Following deliberation by City Council, the City of Burnaby determined that the traffic disruptions from the Lougheed Highway alignment are acceptable. The City of Burnaby strongly encouraged both FEI and the Commission to pursue and support the revised alignment along Lougheed Highway between Bainbridge Avenue and Madison Avenue.[140]

128. The revised proposed route aligns closely with the existing NPS 20 Coquitlam Gate IP pipeline. The relative position of the selected route to the existing Coquitlam Gate IP pipeline is detailed in the table below.[141]

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[135] Exhibit B-1-8, Application Appendix A-18-5 Addendum.
[136] Exhibit B-1-6, Application Evidentiary Update, pp. 6-7, 34-36.
[137] Exhibit B-1-6, Application Evidentiary Update, p. 18.
[138] Exhibit B-1-6, Application Evidentiary Update, pp. 10-12.
[139] Exhibit B-1-6, Application Evidentiary Update, p. 18.
[140] Exhibit C5-2, March 6, 2015 letter from Burnaby submitting comments.
[141] Exhibit B-1-6, Application Evidentiary Update, pp. 9-10.

Coquitlam Gate IP Project New Proposed Pipeline Route Details

Section	Existing NPS 20 Coquitlam IP route	New Proposed NPS 30 Coquitlam IP route	Relative Position
1	Como Lake Avenue	Como Lake Avenue	Parallel in same road
2	Como Lake Avenue	Como Lake Avenue	Parallel in same road
3	Como Lake Avenue and Broadway	Como Lake Avenue and Broadway	Parallel in same road
4	Broadway	Broadway	Parallel in same road
5	Broadway	Lougheed Highway	Parallel (offset one street south)
6	Springer Avenue, Halifax Street, Brentlawn Drive, Lane adjacent to Brentwood Town Centre, Halifax Street, 2nd Avenue	Lougheed Highway, Madison Avenue, Douglas Road, Graveley Street	Parallel (within a few blocks)
7	East 2nd Avenue	East 1st Avenue	Parallel Street (offset one street north)

129. FEI is seeking approval of a CPCN to construct and operate the entire Coquitlam Gate IP Project based on a routing that the Commission determines is in the public interest. Should the Commission grant CPCN approval for the Project based on this route, FEI will proceed with detailed design (routing and engineering) to achieve a fully engineered and defined final pipeline route alignment.[142]

130. In the event that the Commission approved routing is no longer considered feasible and another route emerges as a feasible alternative after detailed design, FEI proposes to update the Commission about the alternative route, including any Project cost and schedule impacts and additional consultation that may be required. FEI expects that the requirement for further review would be based on the extent of the proposed route change. While a minor change may require little or no review, a significant change may require a more detailed Commission review.[143]

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[142] Exhibit B-11, BCUC IR 2.10.1.

[143] Exhibit B-11, BCUC IR 2.10.1.

C. Construction Methods

131. FEI expects that the Coquitlam Gate IP pipeline will be constructed by one pipeline construction contractor beginning in the summer season of 2018. The Project is expected to be completed with five separate construction crews due to congestion and proximity of obstacles impeding the work zones as a result of working in a built up urban area. Final cleanup will be completed as the construction progresses.[144]

132. The construction of the NPS 30 IP pipeline from Coquitlam Gate Station to East 2nd & Woodland Station will traverse areas including arterial traffic routes, residential streets, green areas and streams which will present different construction challenges and constraints and require specific construction techniques. Trenchless construction, as detailed in Exhibit B-1, section 3.3.3.5.1.5, will be used in areas where it is not possible to excavate a trench to install the NPS 30 Coquitlam Gate IP pipeline, or it is necessary to minimize the surface impact from pipeline construction by avoiding typical trenched pipeline installation.[145] FEI anticipates trenchless construction techniques will be required in three locations of the Coquitlam Gate IP pipeline.[146] The final determination of the most appropriate method will be site specific for each crossing location and may involve different trenchless techniques for different locations.[147]

133. The detailed engineering phase of the Project will commence after approval of the CPCN, and include a suite of site investigations and site surveys which will further inform the Project team in terms of sub-surface uncertainty and risk. At the trenchless locations in particular, deeper boreholes, down-hole testing, sampling and off-site lab testing and geophysical profiling will be utilized to build a complete picture of the sub-surface conditions. As the Project develops, the detailed design and routing and construction planning, including specifications, procedures and methodologies will be developed and tailored to mitigate identified risks associated with trenched and trenchless pipeline construction and installation

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[144] Exhibit B-1, Application, p. 81.

[145] Exhibit B-1, Application, pp. 82-84; Exhibit B-6, CEC IR 1.47.1.

[146] Exhibit B-6, CEC IR 1.47.2.

[147] Exhibit B-6, CEC IR 1.47.3; Exhibit B-12 BCUC Conf. IR 2.1.1, 2.1.4.

where feasible, based on the site investigations findings and analysis. Residual risk that cannot be mitigated through existing controls or a risk treatment plan will be mitigated through appropriate contingency allocation.[148]

134. A detailed mitigation plan to address the specific construction impacts at each location will be developed in conjunction with further route design to finalize an exact pipeline alignment. A key aspect of this effort will also involve identification and mitigation of impacts to institutional access, emergency response routes, emergency services mobilization and pedestrian and public transit. The development of Project plans to implement appropriate mitigation measures will involve ongoing consultation with affected municipalities, major stakeholders and local residents, transit operators, and businesses, and will minimize disruptions to the communities as much as possible. Examples of possible measures to reduce the impacts to accesses, pedestrian and public transit include tailored construction staging, construction scheduling and timing, temporary rerouting of bicycle lanes and bus routes including temporary relocation of bus stops, coupled with appropriate signage, messaging and early warning and notification.[149]

D. Project Cost

135. The total capital cost of the Coquitlam Gate IP Project is forecast to be $242.825 million in as spent dollars (including AFUDC of $12.351 million and abandonment/demolition costs of $4.169 million).[150] The estimate is based on AACE Class 3 specifications.[151]

136. FEI conducted a risk analysis, including a Monte Carlo analysis, of the Project and used the results of the analysis in determining the contingency.[152]

137. Project management best practices will be utilized throughout the lifecycle of the Project. The control budget will provide the baseline reference for subsequent project

[148] Exhibit B-4, BCUC IR 1.23.1.

[149] Exhibit B-5, BCOAPO IR 1.3.21.

[150] Exhibit B-1-6, Application Evidentiary Update, p. 13, filed confidentially in Appendix E-3-1.

[151] Exhibit B-1, Application, pp. 95-101; Exhibit B-13, BCOAPO IR 2.2.1, 2.2.2.

[152] Exhibit B-1, Application, pp. 100-101.

monitoring and control and assessment of financial performance during the Projects. Project controls will be put in place where processes and tools will be used to manage and mitigate potential cost issues and any risk events that may impact Project costs. These Project controls will provide the means to recognize variances from the cost management plans.[153]

E. Project Schedule and Coordination of the Projects

138. The Coquitlam Gate IP Project schedule is found in A-20-1 of the Evidentiary Update.

139. While each of the individual Projects is a stand-alone project that is justified on its own merits, and can be constructed independently of the other Project, it is logical that both Projects should be undertaken at the same time in terms of planning, permitting, stakeholder consultation and ultimately construction and commissioning, and FEI has identified cost savings benefits that can be achieved by coordinating the construction of the Projects. [154]

140. The proposed Coquitlam Gate IP and Fraser Gate IP Projects both involve the construction and installation of NPS 30 pipe to replace existing pipe along sections of the two primary pipelines supplying gas to the Metro IP system. The Coquitlam Gate IP Project is larger in scope; however, in general, both Projects share common attributes in terms of design, routing process, materials procurement and specialized construction and installation techniques due to their urban location. More specifically, with the replacement NPS 30 Coquitlam Gate IP pipeline in service, it will be possible to isolate the Fraser Gate IP pipeline and replace the seismically vulnerable segment of pipe with the proposed upgraded pipe without the use of bypass piping. This particular link will require the commissioning window for both pipelines to be synchronized, and any delay in commissioning the Coquitlam Gate IP pipeline would also likely delay the Fraser Gate IP pipeline commissioning. It is therefore logical

[153] Exhibit B-5, BCOAPO IR 1.5.2.

[154] Exhibit B-6, CEC IR 1.6.2, 1.65.1.

that both Projects should be undertaken at the same time in terms of planning, permitting, stakeholder consultation and ultimately construction and commissioning.[155]

141. The proposed Projects' scope and cost estimates are based on the assumption that the Coquitlam Gate IP pipeline is in-service prior to tie-in connections between the new replacement pipe and the existing network being completed on the Fraser Gate IP pipeline. If the tie-ins for the Fraser Gate IP pipeline are completed prior to the Coquitlam Gate IP pipeline being commissioned, additional costs for a bypass will be required to mitigate any risk to gas supply to the customers fed downstream from the Fraser Gate IP pipeline.[156]

142. While the Projects can be constructed separately, together the Projects will improve system integrity and safety, allow for full system resiliency and reduce the risk of gas supply disruption to up to approximately 171,000 customers residing in the Lower Mainland in the event of a failure. If only one of these Projects as applied for is approved, then FEI would not be able to fully achieve these objectives and requirements.[157]

143. FEI has requested Commission approval prior to the end of December 2015 so that detailed routing and design can begin in early 2016 to enable procurement of long lead materials in late 2016. This will allow the Company to meet a 2018 in-service date for the Coquitlam Gate IP and Fraser Gate IP Projects.[158]

144. In the event FEI receives Commission approval later than December 2015, the Projects' schedule would be re-evaluated. A CPCN approval beyond December 2015 could delay the planned 2018 in-service date by one year. This is due to the fact that the detailed engineering and design needs to be progressed sufficiently to facilitate procurement of the long lead material items that are required onsite at the start of construction. The construction window generally extends from the spring until the fall and generally does not extend into the

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[155] Exhibit B-6, CEC IR 1.3.2, 1.6.2, 1.65.1.

[156] Exhibit B-6, CEC IR 1.65.1.3.

[157] Exhibit B-6, CEC IR 1.6.2.1.

[158] Exhibit B-6, CEC IR 1.46.1.

winter because the operational risk is greater due to peak load demands on the system and because of increased construction costs associated with poor weather conditions.[159]

145. If Commission approval was granted earlier than December 2015, then Project components such as detailed engineering and routing, which will not commence prior to Commission approval, could commence earlier.[160]

PART FIVE: FRASER GATE IP PROJECT JUSTIFICATION

146. The Fraser Gate IP Project is required as the pipeline has been assessed as being vulnerable to failure in a less than 1:2475 year seismic-induced ground movement event. This vulnerability should be mitigated by the Fraser Gate IP Project.

147. The risk posed by the Fraser Gate IP pipeline is driven by the seismic concerns and by the consequence-of-failure factors including potential safety issues, possible complete shutdown of the pipeline for an extended repair period and the impact to service to customers in Vancouver, Burnaby, and the North Shore. The magnitude of potential safety issues, service interruption, and business and economic losses, warrants mitigation. The Fraser Gate IP Project will mitigate the potential safety risk and economic consequences associated with failure of the Fraser Gate IP pipeline in the vicinity of Fraser Gate Station due to a seismic induced earth movement event.

A. Pipeline Vulnerability to a 1:2475 Seismic Event

148. FEI's Integrity Management Program (IMP) provides a comprehensive and systematic approach to managing risks associated with hazards to the FEI pipeline system assets. One activity within the FEI IMP is Seismic Hazard Management. The objective of this activity is to maintain pressure integrity such that failure of identified assets will not pose a

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[159] Exhibit B-6, CEC IR 1.46.1.

[160] Exhibit B-6, CEC IR 1.46.1.

hazard to the public immediately following ground displacements during an earthquake with a 1:2475 return period.[161]

149. FEI undertakes periodic reviews of existing assets. Given an identified seismic vulnerability on a segment of the Fraser Gate IP pipeline (i.e., vulnerable to failure due to less than 1:2475 year seismic induced ground movement), FEI engaged a consultant in 2012 to produce a site specific summary report to capture the level of pipeline vulnerability and to recommend necessary follow-on study or mitigation measures for the Fraser Gate IP pipeline.[162] The study identified the section of pipeline from Fraser Gate Station along East Kent Avenue as being susceptible to a seismic event, assessed the level of pipeline vulnerability and recommended mitigation measures for the Fraser Gate IP pipeline.[163]

150. The governing technical code for the subject pipeline, CSA Z662, requires that anticipated seismic loading be part of the design criteria for any oil or gas pipeline. In accordance with this code and consistent with industry practice, the FEI seismic design guideline DES-09-02[164] requires an assessment of potential seismic risks and that the pipeline design be sufficient to withstand anticipated seismic loadings for a seismic event with a return period of 1:2475 years (2.5 percent probability of exceedance over 50 years).[165] FEI's seismic criteria align with both the 2005 Building Code of Canada and the minimum criteria applied by other critical utility infrastructure operators in the Lower Mainland.[166]

151. The additional subsurface information collected in 2015 after the Application was filed, which is described further below, does not alter the estimates of the likelihood of a seismic event leading to a full bore rupture. The additional study does not revise the assessment of the vulnerability or riskiness of the Fraser Gate site. Due to the number of customers impacted by a failure of the Fraser Gate IP pipeline and the nearby residences, the

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[161] Exhibit B-1, Application, p. 102.

[162] Exhibit B-1, Application, p. 102; Exhibit B-6, CEC IR 1.52.2, 1.52.7.1.

[163] Exhibit B-1, Application, p. 104; Exhibit B-1-1-1 Application Appendix A-4.

[164] Exhibit B-1-1, Application Appendix A-28.

[165] Exhibit B-1, Application, pp. 102-103.

[166] Exhibit B-1, Application, p. 102.

Fraser Gate IP pipeline remains a priority for seismic upgrading.[167] The priority of the Fraser Gate IP Project is also unchanged if it were to be addressed independently of the Coquitlam Gate IP Project.[168]

(a) Consequences of Failure of the Fraser Gate IP Pipeline (Safety)

152. The safety concern associated with the identified seismic vulnerability of the Fraser Gate IP pipeline is influenced by factors such as the predicted pipeline failure mode and population density. A widely referenced methodology for estimating the threat within the immediate vicinity of a pipeline failure location is outlined in "A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines, Gas Research Institute (GRI), 2000". This model estimates a hazard area radius of 83 metres for this pipeline.[169]

153. The Fraser Gate IP pipeline is located in an urban area. A review of East Kent Avenue in the vicinity of the pipeline shows that there are residential dwellings along the north side of the roadway. A full-bore rupture of the pipeline resulting from a seismic event could therefore result in significant public safety issues.[170]

(b) Consequences of Failure of the Fraser Gate IP Pipeline (Economic)

154. In addition to the safety concern noted above, the potential consequence of large-scale service impacts to up to 171,000 customers and the economic loss resulting from failure of the Fraser Gate IP pipeline due to a seismic event is an additional driver for this Project.[171]

155. At the present time, the failure of the Fraser Gate IP pipeline due to a seismic event can lead to the complete shutdown of the pipeline. If the Fraser Gate IP pipeline is shutdown, customers downstream of Fraser Gate station could suffer a very rapid loss of

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[167] Exhibit B-14, CEC IR 2.13.1.

[168] Exhibit B-14, CEC IR 2.14.2.

[169] Exhibit B-1, Application, p. 103.

[170] Exhibit B-1, Application, p. 103.

[171] Exhibit B-1, Application, p. 103.

natural gas supply. As an example, it is estimated that should a complete outage of gas flow occur there is less than one hour of line pack during a peak winter day.[172]

156. An outage of the Fraser Gate IP pipeline due to a seismic event could result in loss of service to up to 171,000 customers for a prolonged period of time. As described above with respect to the Coquitlam Gate IP Project objectives, an economic impact study shows that a gas supply interruption as a result of an unplanned failure of the Fraser Gate IP pipeline could be in the order of three weeks and the economic impact to the general public, customers and the Company could be in excess of $320 million.[173]

B. Operational Flexibility and System Resiliency

157. As described earlier in the submission, the Fraser Gate IP pipeline and the Coquitlam Gate IP pipeline are identified as single point of failure pipelines because if either pipeline fails, there is no alternate supply or redundant pipeline to serve all of the customers currently served by the other pipeline segment.[174]

158. In summary, the Fraser Gate IP Project is required since the pipeline has been assessed as being vulnerable to failure in a less than 1:2475 year seismic-induced ground movement event. A pipeline constructed in accordance with FEI's seismic standard would mitigate the identified seismic vulnerability and potential consequences.

PART SIX: FRASER GATE IP PROJECT ALTERNATIVES

159. FEI utilized an appropriate process to evaluate alternatives, consistent with the Commission's CPCN guidelines. This process evaluated two alternatives, and selected the upgrade of a portion of the pipeline near Fraser Gate Station as the only alternative that would provide the required seismic resistance.

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172 Exhibit B-1, Application, pp. 103-104.

173 Exhibit B-1, Application, p. 104; Exhibit B-1-1, Application Appendix A-5, p. 5, Table ES-2a "Reference Case "As Is" Economic Consequences", line item IP-Segment 1.

174 Exhibit B-1, Application, p. 104.

A. Alternatives

160. FEI considered two alternatives, and selected the upgrade of approximately 280 metres of NPS 30 pipeline operating at 1200 kPa and extending from Fraser Gate Station at the 2700 block of East Kent Avenue to a point 30 metres east of where the existing NPS 30 pipeline turns north to cross beneath the CP Rail line. The following were the only available alternatives:

(a) Alternative 1 - Do nothing; and

(b) Alternative 2 – Existing pipeline abandonment, and upgraded replacement. Replace a segment of NPS 30 pipeline with a higher grade of steel and thicker pipe wall to mitigate the seismic risk. This is the only alternative that will provide the required seismic resistance.

161. The outcome of the analysis was that only one alternative, replacement, was found to meet all the Fraser Gate IP Project objectives. The analysis is summarized in the following table and explained below.[175]

Fraser Gate IP Project Non-Financial Comparison

Pipeline Solution		Objectives/Requirements				Overall Assessment
		Achieve Seismic Criteria [1]	Mitigate the Safety Risk [2]	Mitigate the Economic Risk[3]	Constructability, Operation and Safety[4]	
1	Do Nothing	Does not meet Objective	Does not meet Objective	Does not meet Objective	Not Applicable	Not Feasible
2	Pipeline Replacement	Meets Objective	Meets Objective	Meets Objective	Meets Objective	Feasible

Notes:

(1) Achieve FEI's seismic criteria of resistance to a 1:2475 year event.

(2) Mitigate the safety risk posed by the pipeline as a result of seismic issues.

(3) Mitigate the economic risk posed by the pipeline as a result of seismic issues.

(4) Addresses constructability, operational and safety factors, such as routing constraints, proximity to adjacent utilities and appropriate construction techniques, limiting interruption of flow of gas during construction and commissioning and allowing sufficient space to work around existing piping and components.

[175] Exhibit B-1, Application, pp. 108-109.

(a) Alternative 1: Do Nothing

162. This alternative is not feasible because it would prolong the risk associated with the pipeline's vulnerability to failure in a less than 1:2475 year seismic-induced ground movement event. As this alternative does not meet any of the objectives of the Project, it was rejected.[176]

(b) Alternative 2: Upgraded Replacement

163. Replacement is the only technically viable alternative that meets the Project objectives.[177] The pipe design, material selection, construction and testing will ensure the upgraded pipeline will meet the Company's seismic design objective to maintain pressure integrity and not pose a hazard to the public following ground displacements during a major earthquake.

(c) Other Alternatives Canvassed during the IR Process

164. A number of disadvantageous alternatives were examined in the IR process.

Vibro-Replacement

165. FEI did not consider an alternative involving ground improvement as it would have a significantly higher cost and larger construction footprint, and therefore result in more community/stakeholder, environmental, and engineering and technical impacts. Furthermore, the additional effort to excavate, inspect and potentially repair the existing NPS 30 IP pipeline (given the vintage of the pipeline) would offer no advantage over the NPS 30 IP pipeline replacement alternative.[178]

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[176] Exhibit B-1, Application, p. 107.

[177] Exhibit B-1, Application, p. 108.

[178] Exhibit B-4, BCUC IR 1.33.1.2.

Ground Improvement

166. FEI is not aware of any advantages associated with improving the seismic withstand ability of this section of pipeline by ground improvement. There are significant disadvantages associated with a potential ground improvement alternative, compared to the proposed replacement of the pipeline, which include:[179]

(a) higher environmental impact compared to pipe replacement;

(b) more complex project planning and execution risk (e.g., construction permitting, in-stream works etc.);

(c) significantly larger scope and longer on-site construction timeframe, resulting in prolonged disruption to businesses and residents of the community; and

(d) higher overall construction cost.[180]

B. Financial Considerations

167. The financial evaluation of the preferred alternative consists of the following components, and their impact on the levelized rates and incremental cost of service:

(a) Capital costs; and

(b) Present value of operating costs.

168. FEI evaluated the incremental cost of service, cash flow and rate impacts associated with Alternative 2 over a 60 year period. The 60 year time horizon was chosen to be consistent with the assumed useful life of the assets. The incremental cost of service estimates are based on FEI's currently approved capital structure, cost of capital and tax treatment. The following table provides a summary of the financial evaluation conducted.[181]

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[179] Exhibit B-11, BCUC IR 2.20.2.
[180] Exhibit B-11, BCUC IR 2.20.4.
[181] Exhibit B-1-6, Application Evidentiary Update, p. 24.

Summary of Financial Evaluation

	Reduced Scope Alternative 2 – Route Option 1 – East Kent Ave South
Estimate Accuracy	Class 3
Total Direct Capital Cost excl. AFUDC (2014 $millions)	7.378
Total Direct Capital Cost excl. AFUDC (As-spent ($millions)	8.572
AFUDC (as spent ($millions)	0.419
Total As-spent ($millions)	8.990
Annual Gross O&M (2014 $millions)	0.001
Levelized Rate Impact $ / GJ – 60 Yr.	0.004
PV Incremental Cost of Service – 60 Yr. ($millions)	10.764

C. Conclusion regarding Fraser Gate IP Pipeline Alternatives

169. Replacement is the only technically viable alternative that addresses the existing pipeline's vulnerability to failure due to a less than 1:2475 year seismic-induced ground movement event. Accordingly, FEI submits that Commission should approve replacement, the specific attributes of which are described further in the Application, the Evidentiary Update and below.

PART SEVEN: FRASER GATE IP PROJECT DESIGN, CONSTRUCTION, COST AND SCHEDULE

170. The NPS 30 replacement pipeline will be designed, constructed and operated in accordance with appropriate standards and methods, and include suitable components. FEI has selected a constructible and economic route option for the Fraser Gate IP Project that minimizes potential impacts. The Project cost has been forecast and evaluated and a Project schedule has been prepared.

A. Proposed Project

171. The Project scope will include the design, routing, construction and commissioning of approximately 280 metres of new NPS 30 pipeline. The Fraser Gate IP Project

will be developed in accordance with all applicable statutory codes and standards including FEIs internal standards.[182]

172. The original Fraser Gate IP Project scope involved the replacement of approximately 500 metres of NPS 30 pipeline. Additional subsurface information collected in March and April 2015, in conjunction with the seismic analysis, enabled a subsequent optimization of the extent of the pipeline that needs to be replaced to meet the seismic demand based on technical considerations. As a result of this new information, FEI updated the Project description, scope and capital cost estimate. The revised Fraser Gate IP Project scope as presented in the Evidentiary Update now involves the replacement of approximately 280 metres of NPS 30 pipeline operating at 1200 kPa.[183]

173. The various components of the Project are described in detail in section 4.3 of the Application, and are generally similar to the Coquitlam Gate IP Project. FEI provides submissions below regarding those components that were examined in more detail in the IR process.

(a) In-line Inspection

174. ILI capability is not a part of the Fraser Gate IP Project as the existing NPS 30 Fraser Gate IP pipeline was not designed to be in-line inspected. Currently, no ILI vendors are offering conventional free-swimming NPS 30 ILI tools to inspect gas pipelines operating at 1200 kPa. If in the future these tools were to become available, then any existing reduced diameter mainline valves, bore restricting fittings and tight radius elbows would have to be removed to allow tool passage. It is unlikely that full ILI data would be collected for the entire line due to tool speed excursions, and the risk of lodging the tool in the pipeline due to unknown inside diameter restrictions, requiring tool cutout, would be high.[184]

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[182] Exhibit B-1, Application, p. 112; Exhibit B-1-6, Application Evidentiary Update, p. 24.

[183] Exhibit B-1-6, Application Evidentiary Update, p. 19.

[184] Exhibit B-6, CEC IR 1.59.1.

(b) Cathodic Protection

175. As the Fraser Gate IP Project is simply replacing a section of the pipeline, FEI has not identified any factors that would limit the viability of the existing CP system to provide protection to the new Fraser Gate IP pipeline.[185]

(c) Abandonment

176. The NPS 20 Coquitlam Gate IP pipeline is significantly longer in length than the NPS 30 Fraser Gate IP Project; however, the same approach applies to the NPS 30 Fraser Gate IP pipeline in terms of selecting the appropriate abandonment strategy, which is based on various factors including site specific considerations.[186]

177. The Fraser Gate IP pipeline cannot be decommissioned, or removed, until the NPS 30 Coquitlam Gate IP replacement pipeline is installed and commissioned. Notwithstanding that the existing NPS 30 and proposed replacement NPS 30 Fraser Gate IP pipeline segments are located within the same roadway, it is not possible to construct the new pipe and remove the existing pipe concurrently. The position of the existing NPS 30 Fraser Gate IP pipeline, and the complexities of removing any deeper sections, would involve construction excavation which would completely restrict access along East Kent South for a period of time while the abandonment and removal construction progressed. The business served by East Kent South requires unrestricted daily access maintained, with only short traffic flow interruptions tolerated. Furthermore, the removal of the existing NPS 30 Fraser Gate IP pipeline would not be cost effective, primarily due to challenging sub-surface conditions, including a high water table. FEI has also selected abandonment of the NPS 30 Fraser Gate IP pipe section in place as the overall least impact end-of-life solution and in doing so will identify, manage and mitigate the potential environmental, public or stakeholder legacy issues, in a similar fashion as outlined for the NPS 20 Coquitlam Gate IP pipeline.[187]

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[185] Exhibit B-6, CEC IR 1.60.1.

[186] Exhibit B-6, CEC IR 1.61.1.

[187] Exhibit B-6, CEC IR 1.61.1.

B. Routing

178. The route selection process for the Fraser Gate IP project followed the same process as for the Coquitlam Gate IP Project, with the overall objective of the routing process being to select the route option that minimizes potential impacts on the community, stakeholders and environment while meeting safety requirements, and identifying a constructible and economic route.[188]

179. As described in Section 4.3.4 of the Application, based on the original Project scope FEI initially considered three route options which are illustrated in Figure 4-3 of the Application. Section 4.3.4.6 of the Application describes the selection of Route Option 1 as the original preferred route option.

180. After FEI's further study of soil conditions and seismic analysis, the length of pipe that required replacement was reduced, eliminating the need to install new pipeline under the CP Rail line, which would have required trenchless construction.[189]

181. Route Option 1, as originally considered, was reduced to approximately 280 metres as the new proposed Project scope significantly reduced the replacement pipeline length. Route Option 2 and Route Option 3, due to their configuration, could not be reduced in length accordingly. They would incur significant additional impacts and costs, due to their additional length and construction effort, when compared to the reduced Route Option 1. Therefore, they were no longer practical route options. As a result, the margin between the relative impact scoring increased significantly compared to that presented in section 4.3.4.7 of the Application and as a consequence Route Option 1 was confirmed as the preferred route in the Evidentiary Update.[190]

182. FEI is seeking CPCN approval to construct and operate the entire Fraser Gate IP Project based on a routing that the Commission determines is in the public interest, which FEI

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[188] Exhibit B-1, Application, pp. 117-119.
[189] Exhibit B-1-6, Application Evidentiary Update, pp. 20-21.
[190] Exhibit B-1-6, Application Evidentiary Update, p. 20.

submits is the preferred route (Route Option 1).[191] As with the Coquitlam Gate IP Project, If an approved pipeline route is no longer considered feasible during the detailed engineering stage and another route emerges, FEI believes that a limited review by the Commission of the newly proposed route and changes (if any) resulting from the reroute may be conducted based on the evidence provided by the Company. [192]

C. Project Cost

183. The total capital cost of the Fraser Gate IP Project, is forecast to be $8.990 million in as spent dollars (including AFUDC of $0.419 million) based on AACE Class 3 specifications.[193] The risk analysis and project management practices for the Fraser Gate IP Project as the same as described above for the Coquitlam Gate IP Project.

D. Project Schedule

184. The Fraser Gate IP Project schedule is found in A-20-2 of the Evidentiary Update. As described above, with respect to the Coquitlam Gate IP Project schedule, it is logical that both Projects should be undertaken at the same time.

185. The total capital cost of the Fraser Gate IP Project, is forecast to be $8.990 million in as spent dollars (including AFUDC of $0.419 million) based on AACE Class 3 specifications.[194] The risk analysis and project management practices for the Fraser Gate IP Project as the same as described above for the Coquitlam Gate IP Project.

PART EIGHT: COST TREATMENT OF COQUITLAM AND FRASER GATE PROJECTS AND REPORTING

186. FEI has prepared cost estimates and evaluated the rate impacts of the Projects and proposed a financial treatment that is appropriate. FEI anticipates providing some form of periodic reports to the Commission which will include reports of material cost variances.

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[191] Exhibit B-4, BCUC IR 1.36.1.

[192] Exhibit B-4, BCUC IR 1.36.2.

[193] Exhibit B-1-6, Application Evidentiary Update, p. 22 and filed confidentially in Appendix E-3-2.

[194] Exhibit B-1-6, Application Evidentiary Update, p. 22 and filed confidentially in Appendix E-3-2.

187. The estimated capital cost for the Projects in as spent dollars, including AFUDC and including abandonment/demolition costs, is $251.815 million, consisting of $242.825 million for the Coquitlam Gate IP Project and $8.990 million for the Fraser Gate IP Project.[195] Details of the Projects' capital costs can be found in Confidential Appendices to the Evidentiary Update.[196]

188. The impact to customer rates in 2019 (when the assets enter rate base) is approximately $0.124 per GJ and levelized over the 60 year analysis period is approximately $0.104 per GJ. For a typical FEI residential customer consuming an average 95 GJ per year, in 2019, this would equate to approximately $11.80 per year. The annual impact to customers from the Coquitlam Gate IP Project in 2019 would be approximately $11.40 per year and from the Fraser Gate IP Project would be approximately $0.40 per year.[197] Based on approved natural gas commodity and common delivery rates effective January 1, 2015, the approximate annual bill impact for small commercial customers is forecast to be approximately 1.4% and for large commercial sales customers to be approximately 1.6%.[198]

189. Consistent with FEI's treatment of CPCNs, the capital costs of the two Projects will be held in Work in Progress Attracting AFUDC until January 1 of the year following when they are in service. The Projects are planned to be in service in October, 2018. On January 1, 2019 the Projects' costs will be transferred to Gas Plant in Service accounts and included in the Company's Rate Base.[199]

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[195] Exhibit B-1-6, Application Evidentiary Update, p. 25.

[196] Details of the updated Coquitlam Gate IP Project capital costs can be found in Confidential Appendix E-1-1, Schedule 6, and in Confidential Appendix E-3-1. Updated Fraser Gate IP Project costs can be found in Confidential Appendix E-1-2, Schedule 6, and in Confidential Appendix E-3-2.

[197] Exhibit B-1-6, Application Evidentiary Update p. 25; Exhibit B-11, BCUC IR 2.21.1, 2.21.2.

[198] Exhibit B-14, CEC IR 2.18.1.

[199] Exhibit B-1, Application, p. 138; Exhibit B-5, BCOAPO IR 1.5.1.

190. The abandonment/demolition costs are forecast to be $3.536 million (2014 dollars) or in as-spent dollars to be $4.284 million (including a WACC return totalling $0.115 million).[200]

191. Charges for abandonment and demolition costs as well as the negative salvage provision are shown in Evidentiary Update Confidential Appendix E-1-1 Schedule 9[201] for the Coquitlam Gate IP Project and in Evidentiary Update Confidential Appendix E-1-2, Schedule 9[202] for the Fraser Gate IP Project (there are no abandonment or demolition costs for the Fraser Gate IP Project).

192. The pre-tax development costs are forecast to be $2.920 million (2014 dollars) or in as-spent dollars to be $3.144 million (including a WACC return totalling of $0.215 million). Of this amount, 93 percent is attributable to the Coquitlam Gate IP Project and 7 percent is attributable to the Fraser Gate IP Project.[203] The December 31, 2015 net-of-tax balance in the LMIPSU Development Costs deferral account is forecast to be $2.382 million.[204]

193. FEI does not expect any O&M savings resulting from the Coquitlam Gate IP Project. FEI is forecasting incremental O&M resulting from the Coquitlam Gate IP Project over a 60-year assessment period.[205] FEI acknowledges that under the terms of its Performance Based Ratemaking plan, the Commission could consider whether an adjustment to the formula O&M is required as a result of a CPCN. In this case, since the avoided leak repair costs would not be realized until at least 2018, and FEI has forecast additional O&M associated with this CPCN for which it has not proposed an increase to the base O&M, FEI has likewise not proposed a reduction of the Base O&M for the embedded avoided leak repair costs.[206]

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[200] Exhibit B-1-6, Application Evidentiary Update, p. 26; these costs are identified in Confidential Appendix E-3-1.

[201] Exhibit B-1-7, Application Evidentiary Update, Confidential Appendix E-1-1 Schedule 9.

[202] Exhibit B-1-7, Application Evidentiary Update, Confidential Appendix E-1-2 Schedule 9.

[203] Exhibit B-1-6, Application Evidentiary Update, pp. 26-27; Exhibit B-4, BCUC IR 1.52.1, 1.52.3.

[204] Exhibit B-1-6, Application Evidentiary Update, p. 27.

[205] Exhibit B-4, BCUC IR 1.24.1; Exhibit B-14, CEC IR 2.19.1.

[206] Exhibit B-11, BCUC IR 2.19.1.

194. Similarly, there are no O&M and capital savings that have been identified resulting from the Fraser Gate IP Project.[207] No adjustment to the PBR O&M Base is required as a result of this CPCN application.

195. Consistent with other CPCN projects of the Company, FEI anticipates providing some form of periodic reports to the Commission and also considers a requirement for reporting of significant delays or material cost variances to be appropriate. Such reporting requirements strike an appropriate balance between the Commission’s oversight of the execution of the Projects and the Company’s responsibility for the ongoing management of the Projects.[208]

PART NINE: ENVIRONMENTAL, ARCHAEOLOGICAL AND SOCIO-ECONOMIC ASSESSMENTS

196. The Projects are expected to have minimal environmental and archaeological impacts. Any impacts can be mitigated through the implementation of standard best management practices.[209] In addition, a socio-economic report indicates the Projects have the potential to result in a net positive impact to residents and businesses. Improving the long-term natural gas supply to the area also has positive economic benefits. Any short-term disruption effects of the Projects are expected to be temporary and generally minor should the recommended mitigation measures be implemented. No long term negative effects are expected to result.[210]

A. Environmental Assessment

197. The preliminary environmental assessment of the Projects[211] covered a wide assessment area but focused on a 200 metre wide study corridor along the existing Coquitlam Gate IP and Fraser Gate IP alignments (applied as 100 metres on either side of the existing

[207] Exhibit B-4, BCUC IR 1.40.1.

[208] Exhibit B-5, BCOAPO IR 1.5.5; Exhibit B-13, BCOAPO IR 2.2.5.

[209] Exhibit B-1, Application, p. 141, Exhibit B-1-6, Application Evidentiary Update, p. 26.

[210] Exhibit B-1, Application, p. 141, Exhibit B-1-6, Application Evidentiary Update, p. 32.

[211] Exhibit B-1, Application, p. 141; Exhibit B-1-1, Application Appendix B-1; Exhibit B-1-6, Application Evidentiary Update, p. 28; Exhibit B-1-8, Application Evidentiary Update Appendix B-1.

alignment). All of the preferred route options and the majority of the considered route options were found within, or in close proximity to, the 200 metre wide environmental assessment corridor. Therefore, based on the extent of the assessment area and high level information reviewed, the relative proximity of each route option to the study corridor, and the general similarity of the urban terrain along the route corridor, the environmental assessment considered sufficient information to identify potential environmental risks and facilitate the routing analysis for route options both within the study corridor, and for localized instances where a route option fell outside the study corridor.[212]

198. Based on these preliminary assessments, the environmental risk of the Projects is low and any potential environmental impacts from the Projects can be mitigated through standard environmental protection and mitigation measures.[213]

199. Environmental constraints and potential environmental impacts related to the Projects will be further documented during the detailed environmental assessment, which will include vegetation, fish and wildlife and their habitat, and surface/ground water resources. Detailed environmental specifications will be prepared as part of the Project tendering process to ensure that contractors are aware of the Projects' environmental requirements in addition to FEI's internal environmental standards.[214]

B. Archaeology

200. An Archaeological Overview Assessment (AOA)[215] of the Projects was obtained to assess the potential for archaeological and/or cultural heritage resources within the area of the Projects and to determine the requirements for an Archaeological Impact Assessment (AIA) prior to ground disturbing activities.[216] The AOA concluded that the majority of each Project is considered to have low archaeological potential due to the amount of previous disturbance by

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[212] Exhibit B-4, BCUC IR 1.46.1.

[213] Exhibit B-1, Application, p. 141; Exhibit B-1-6, Application Evidentiary Update, p. 30.

[214] Exhibit B-1, Application, p. 144; Exhibit B-1-6, Application Evidentiary Update, pp. 30-31.

[215] Exhibit B-1-1, Application Appendix B-2; Exhibit B-1-8, Application Evidentiary Update Appendix B-2 Addendum.

[216] Exhibit B-1, Application, p. 144; Exhibit B-1-6, Application Evidentiary Update, p. 31.

development activities. The areas surrounding fish-bearing streams have been provisionally assessed as having high archaeological potential and therefore an AIA has been recommended for these areas. A detailed AIA will be undertaken once Commission approval is received and prior to construction of the Projects.[217]

201. Detailed archaeological specifications will be prepared as part of the Projects' tendering process to ensure that contractors are aware of the Projects' archaeological requirements. An Environmental Management Plan, including protection of archaeological and cultural resources, will be developed by the successful contractors prior to commencement of the Projects.[218]

C. Socio-Economic Assessment

202. FEI also obtained a socio-economic impact assessment study (see Appendix B-3).[219] The socio-economic report indicates the Projects have the potential to result in a net positive impact to residents and businesses through the creation of additional employment and economic spinoffs for local business owners. Improving the long-term natural gas supply to the area also has positive economic benefits. Any short-term disruption effects of the Projects are expected to be temporary and generally minor should the recommended mitigation measures be implemented. No long term negative effects are expected to result.

D. Conclusion

203. FEI submits that any potential environmental, archaeological, or socio-economic impacts associated with the Projects are expected to be minimal and can be mitigated through the implementation of standard best management practices and mitigation measures.

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[217] Exhibit B-1, Application, p. 145; Exhibit B-1-6, Application Evidentiary Update, p.32; Exhibit B-4, BCUC IR 1.53.1, 1.53.2; Exhibit B-4, BCOAPO IR 1.6.1, 1.6.2.

[218] Exhibit B-1, Application, p. 144; Exhibit B-1-6, Application Evidentiary Update, p. 32.

[219] Exhibit B-1, Application, p. 146; Exhibit B-1-1, Application Appendix B-3; Exhibit B-1-6, Application Evidentiary Update, p. 32; Exhibit B-4, BCUC IR 1.47.1.

PART TEN: PUBLIC AND FIRST NATIONS CONSULTATION

204. Public and First Nations consultation activities carried out to date have been sufficient and appropriate for the Projects.

A. Public Consultation

205. FEI identified, engaged, and solicited feedback from the public and affected parties near the Projects and provided them with updated information on the proposed work plan. Consultation by FEI included initial mailings to 8,000 residents located near the proposed pipeline upgrades,[220] numerous newspaper advertisements and five public information sessions.[221] In addition, FEI attended a number of meetings with a particular neighbourhood that expressed concerns regarding routing.[222] FEI also mailed 14,000 invitations inviting residents and business along the initial proposed Coquitlam IP Project route and the new preferred route to an additional public information session.[223]

206. FEI consulted with a number of government representatives, including municipal and regional engineering departments with regard to decisions on routing, detailed work, and traffic plans.[224] FEI also consulted with business groups and community associations and other utilities and stakeholders.[225]

207. Engagement with business owners is underway and ongoing, with the purpose of learning the nature of their business and access requirements for both customers and pick-up/delivery of commercial goods. As FEI moves toward detailed design of the Projects, the impact to access and egress that businesses and commercial operations rely on will become more apparent; i.e., FEI will be able to communicate more information with respect to the exact location of the installation, how long the pipeline will take to construct near the business,

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[220] Exhibit B-4, BCUC IR 1.54.2; Exhibit B-4, BCUC IR 1.54.3.
[221] Exhibit B-1, Application, pp. 157-162.
[222] Exhibit B-1, Application, pp. 161-162; Exhibit B-4, BCUC IR 1.57.
[223] Exhibit B-11, BCUC IR 2.24.1.
[224] Exhibit B-1, Application, pp. 163-168; Exhibit B-4, BCUC IR 1.58.1.
[225] Exhibit B-1, Application, pp. 163-170; Exhibit B-11, BCUC IR 2.11.1.

and other construction impacts. An ongoing dialogue with businesses will be necessary to address specific concerns and mitigate these various disruptions where possible. This will also give businesses the opportunity to mitigate impacts on their own by scheduling the pick-up/delivery of commercial goods at times that will coordinate both with Project construction as well as their own business requirements.[226]

208. Also, FEI will work with some businesses to place temporary signage to highlight pedestrian access and temporary parking options. The Company will communicate with the pipeline contractor and work closely with both the contractor and affected businesses to ensure agreements and understandings related to business access are fulfilled. FEI Community Relations representatives will be available to business owners/operators throughout the entire construction period and afterwards. [227]

209. Public consultation does not end with CPCN approval. FEI is committed to continuing consultation with Project stakeholders and will continue to ensure that, as the Projects progress, they are kept informed and have ways to provide feedback. This will include a comprehensive Communications Plan to be developed prior to the start of construction.[228]

210. FEI submits that its public consultation activities to date have been sufficient, appropriate and meet the requirements of the CPCN Guidelines with respect to the Projects. In particular, consultation and communication with land owners, residents, and businesses directly affected by the Projects and with the municipalities of Coquitlam, Burnaby, and Vancouver has been both useful and productive, and has been incorporated into FEI's plans for the Projects.

B. First Nations Consultation

211. FEI has engaged First Nations by providing information regarding the Projects and by inviting questions and further involvement. FEI identified that the Projects were located

[226] Exhibit B-14, CEC IR 2.22.2.
[227] Exhibit B-14, CEC IR 2.22.2.
[228] Exhibit B-1, Application, p. 171.

within traditional territories of the Coast Salish Peoples, in particular, the Tsleil-Waututh First Nation, Squamish Nation, Kwikwetlem First Nation, Stó:lō, Musqueam Indian Band, Semiahmoo First Nation and Tsawwassen First Nation.[229]

212. Meetings were held and letters sent to these First Nations. These discussions and letters provided a general overview of the Projects, including the potential route, the rationale for the Projects, as well as requesting a response as to whether the First Nation would like to be further consulted. FEI will continue to consult with any First Nation whose claimed traditional territory overlaps with the Projects' potential routes to keep them informed of major Project developments, and to work together to address potential impacts of the Projects on the exercise of their asserted rights or title, and other concerns.[230]

213. The Projects do not cross First Nations reserve land. The Projects do cross the traditional territories of a number of First Nations, however the Projects' routes will follow in existing roads, right-of-ways, and pre-disturbed land.

214. The potential impact of the Projects on First Nations' rights and title will be limited. The potential of the Projects to impact First Nations interests is confined to impacts on archaeological sites (if any) from construction activities associated with the pipeline upgrades. As described above, FEI retained a consultant to conduct an AOA to assess the potential for archaeological and/or cultural heritage resources within the area of Projects.[231] The AOA concluded that for the Coquitlam Gate IP and Fraser Gate IP Projects:

(a) There are no recorded archaeological sites within 500 metres of the area of the Projects;

(b) Most of the area of the Projects was evaluated as having low archaeological potential therefore not requiring any further archaeological assessment; and

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[229] Exhibit B-1, Application, p. 173.

[230] Exhibit B-1, Application, p. 177.

[231] Exhibit B-1, Application, pp. 179-180; Exhibit B-1-1, Application Appendix B-2.

(c) Four areas along the Coquitlam IP pipeline segment, associated with unnamed, fish bearing watercourses, have a high archaeological potential, and therefore require an AIA.

215. First Nations with any potential interests in the general area of the Projects have been identified as noted above and have been provided with, and will be continued to be provided with, information on the Projects. No significant concerns have been raised. Any concerns will be addressed by the Company as necessary.

216. FEI has engaged First Nations by providing them with information regarding the Projects and by inviting their questions and further involvement. The Company believes that a First Nation will respond if it is interested in receiving more information, or participating in the review of the Projects. FEI will engage with those interested in knowing more about the Projects.[232] Additionally, FEI's continued consultation efforts will be in concert with the OGC's efforts as part of the OGC application process.

217. Accordingly, FEI submits that the level of First Nations engagement undertaken at this stage of the Projects is appropriate. It is FEI's intention and regular practice to continue liaising with First Nations as the Projects progress.

PART ELEVEN: CONCLUSION

218. The evidence indicates that Coquitlam Gate IP Project as proposed eliminates the identified non-preventable corrosion risks associated with the existing Coquitlam Gate IP pipeline and addresses other capacity related constraints on the Metro IP system, and that the Fraser Gate IP Project will mitigate the identified seismic vulnerability and associated consequences. The evidence further indicates the Projects are the most cost effective response to the demonstrated need. The Projects have limited environmental, archaeological impacts that can be mitigated. In addition, the Projects have the potential to result in a net positive

[232] Exhibit B-5 BCOAPO IR 1.7.1; Exhibit B-13, BCOAPO 2.1.5.

impact to residents and businesses. Significant consultation has taken place with the public and First Nations, and will continue as the Projects progress.

219. FEI submits that the Projects are in the public interest and approval should be granted as sought.

ALL OF WHICH IS RESPECTFULLY SUBMITTED.

Dated: July 17, 2015 ***[original signed by Tariq Ahmed]***

Tariq Ahmed
Counsel for FortisBC Energy Inc.