Lower Mainland Natural Gas Intermediate Pressure System Upgrade Projects

BCUC Workshop – CPCN Overview

February 3, 2015

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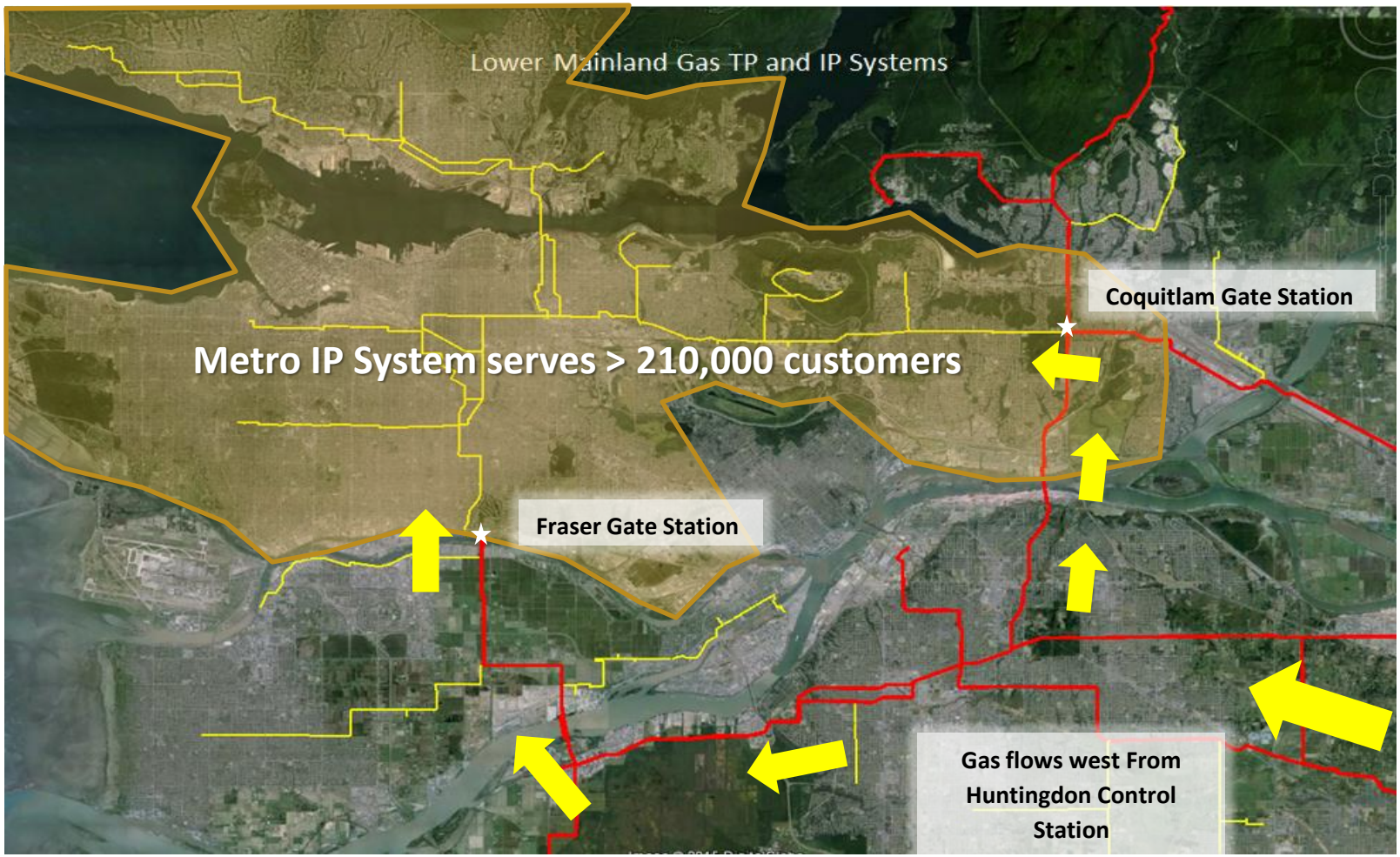
System Overview
Lower Mainland IP and TP



Source: FEI data overlaid on Google Earth mapping

- TP pipelines operating at greater than 2070 kPa
- IP pipelines operating from 700 kPa to 2070 kPa

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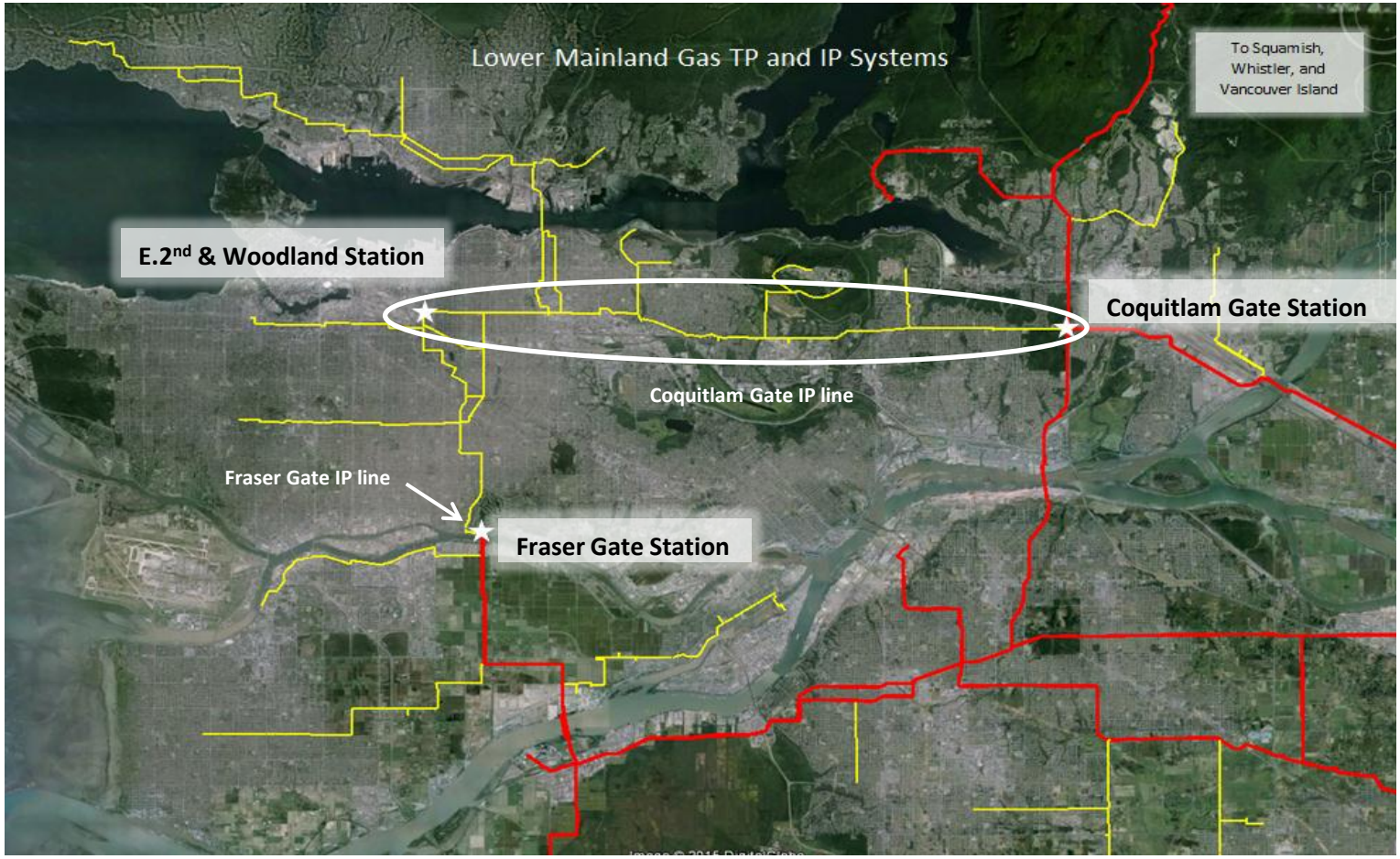
Lower Mainland IP System Upgrade Projects



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- TP pipelines operating at greater than 2070 kPa
- IP pipelines operating from 700 kPa to 2070 kPa

Approvals Sought

FEI is applying to the BCUC for a CPCN to construct and operate a new:

- NPS 30 2070 kPa IP pipeline between Coquitlam Gate Station and East 2nd & Woodland Station;
- NPS 30 1200 kPa IP pipeline between Fraser Gate Station and East Kent Avenue & Elliott Street; and

FEI is also seeking approval of:

- Deferral treatment for application costs and development costs

Agenda - CPCN Overview

1. Coquitlam Gate IP
2. Fraser Gate IP
3. Project Cost Estimates and Rate Impacts
4. Environmental, Archaeological and Socio-Economic Considerations
5. Public Consultation and First Nations Engagement
6. Summary

Coquitlam Gate IP

Melanie Kilpatrick

Coquitlam Gate IP

- Project justification
- Alternatives and recommended solution
- Project description, construction and routing

Justification #1 – Integrity

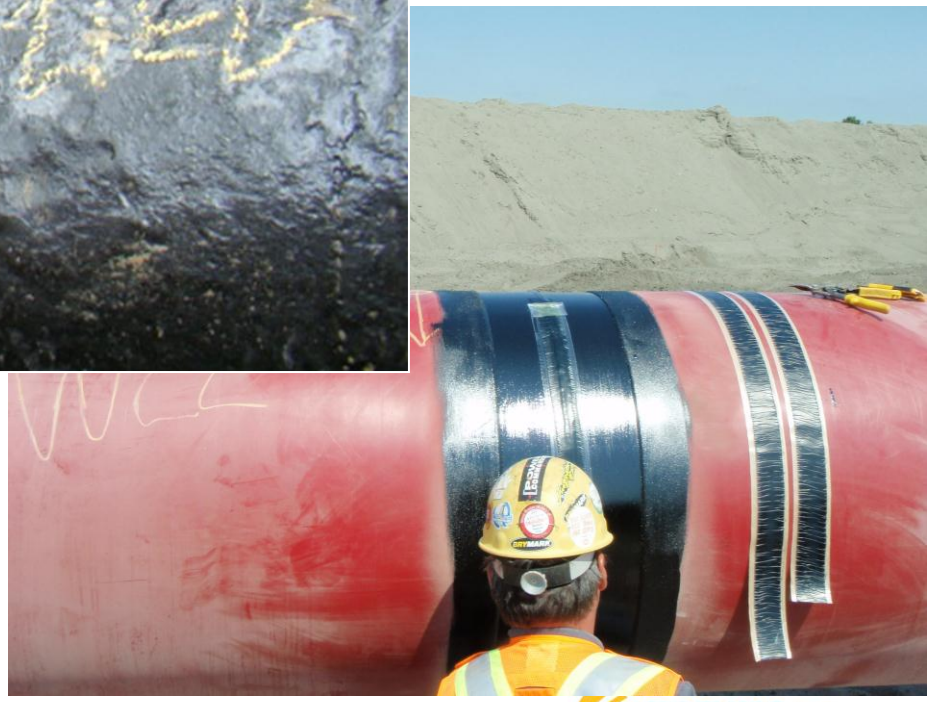
- Increasing leak frequency at girth welds
  - not observed on other pipelines of similar vintage
- Available preventive methods are ineffective
  - cathodic protection (CP) shielding
- Pipeline is approaching the end of its service life

Girth Weld

A circumferential weld at a joint connecting two pipes

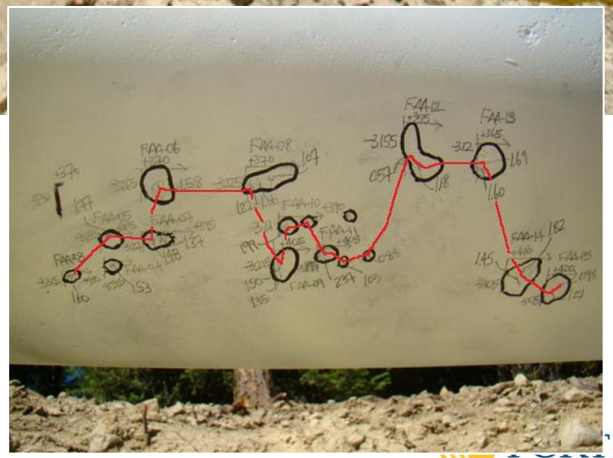
Coating – Factory-Applied vs Field-Applied

Photo from 2012 excavation of Coquitlam Gate IP



Field-applied girth weld coating during modern pipeline construction

Cathodic Protection Shielding



Rocks against a pipeline can “shield” or block the cathodic protection current from reaching the pipe metal surface.

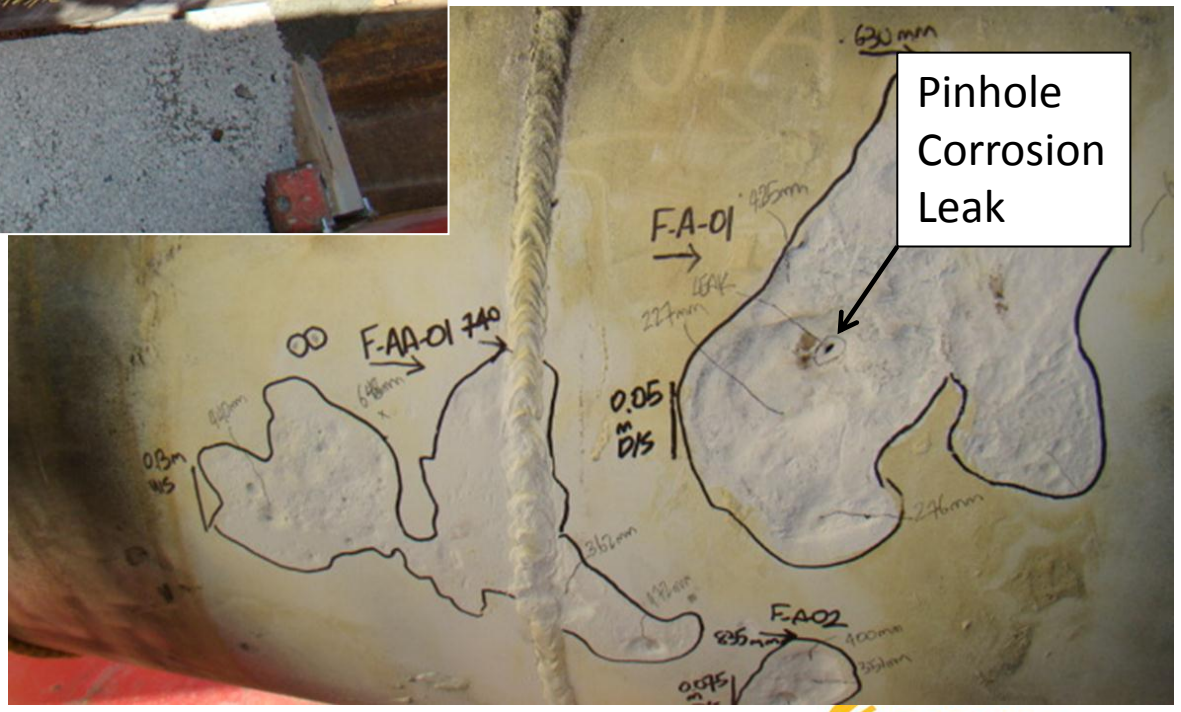
Coquitlam Gate IP Leak Mechanism

Field-applied coating has disbonded from the pipeline

Coquitlam Gate IP Leak Mechanism

2012 Coquitlam IP Leak

Factory-applied coating beyond girth weld area is bonded to the pipe. No corrosion is occurring in these regions.



Corrosion is occurring at regions of disbonded field-applied coating

Ensuring OGC Compliance

- Order was issued in 2013 by the BC OGC
- Pipeline safety is being managed until replacement can be completed
- Pipe replacement is considered the only reasonable long-term solution

Justification #2 – Reliable Service

- Driven by reliability (operational flexibility/resiliency), not load growth
- The existing Metro IP system has the capacity to support core growth over the next 20 years
- However meeting that demand currently requires that both Coquitlam and Fraser feeds remain operational
- Coquitlam Gate IP pipeline is the bottleneck

Opportunity to Address the Bottleneck

Operational Flexibility - facilitates planned work with reduced impact (i.e. expense/public impact of by-pass)

System Resiliency - mitigates potential consequences that could occur as a result of unplanned outages

Operational Flexibility

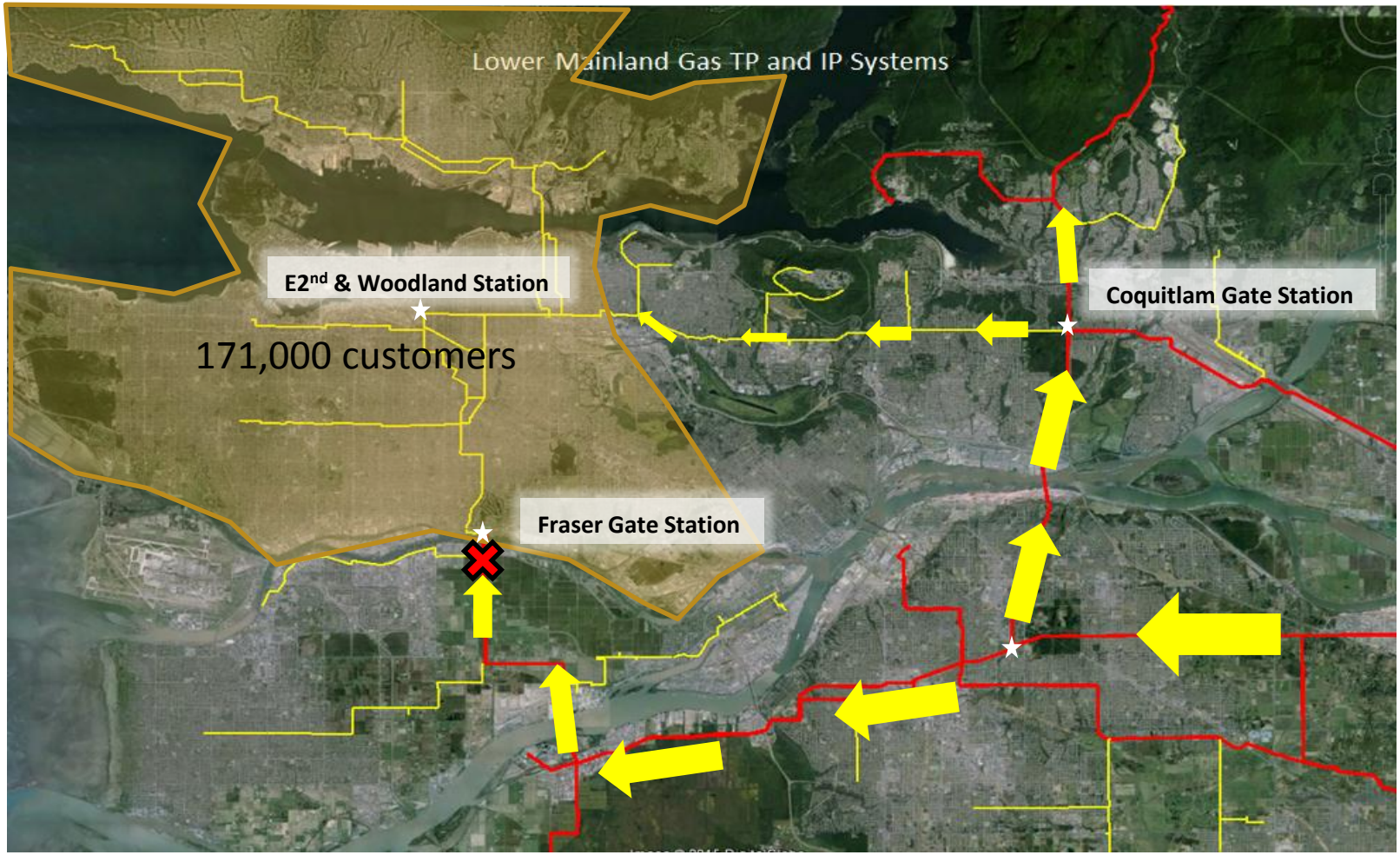
- Facilitates planned maintenance and repairs
  - Without the need for bypass piping
  - System demand growth has eroded FEI's ability to perform planned work
- Can be improved by increasing supply
  - Larger diameter pipeline or loops
  - Adding new supply sources
- Replacement with an **enhanced capacity pipeline** will create an extended operational window to facilitate planned maintenance

System Resiliency

- Single point of failure pipelines
  - If either pipeline fails, there is no alternate supply to serve all of the customers currently served by the other pipeline segment
  - Where insufficient supply downstream of the isolated segment exists, customers will be interrupted
- Provides the ability to isolate a section of pipeline on an emergency basis without impacting supply to customers
- Replacement with an **enhanced capacity pipeline** will provide increased system resilience

Area of Customer Impact

When relying on existing 20” 1200kPa Coquitlam Gate Pipeline
without support from Fraser Gate

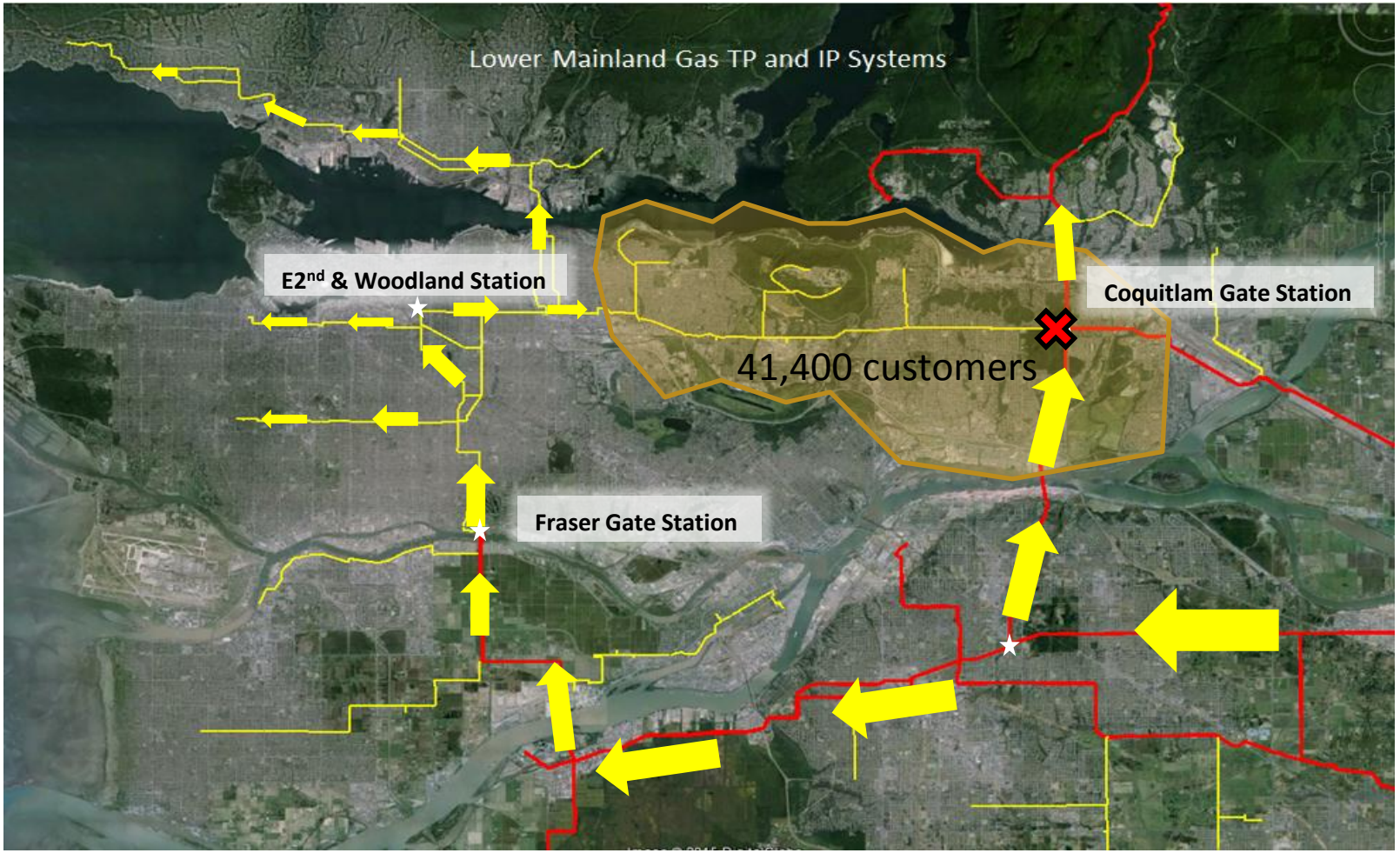


Source: FEI data overlaid on Google Earth mapping

- TP pipelines operating at greater than 2070 kPa
- IP pipelines operating from 700 kPa to 2070 kPa

Area of Customer Impact

When relying on existing 20” 1200kPa Coquitlam Gate Pipeline
without support from Coquitlam Gate



Source: FEI data overlaid on Google Earth mapping

- TP pipelines operating at greater than 2070 kPa
- IP pipelines operating from 700 kPa to 2070 kPa

Value of System Resiliency

Gas supply interruption of the Metro IP system would result in significant impact to public, customers and the company

Fraser Gate IP unplanned outage potential impacts

- Up to 171,000 customers
- Up to 3 weeks
- $320 MM economic loss

Coquitlam Gate IP unplanned outage potential impacts

- Up to 41,400 customers
- In excess of 5 days
- $64 MM economic loss

Operational Risk:

approx. $2.5 million risk/year

60 year PV equivalent to $39 million

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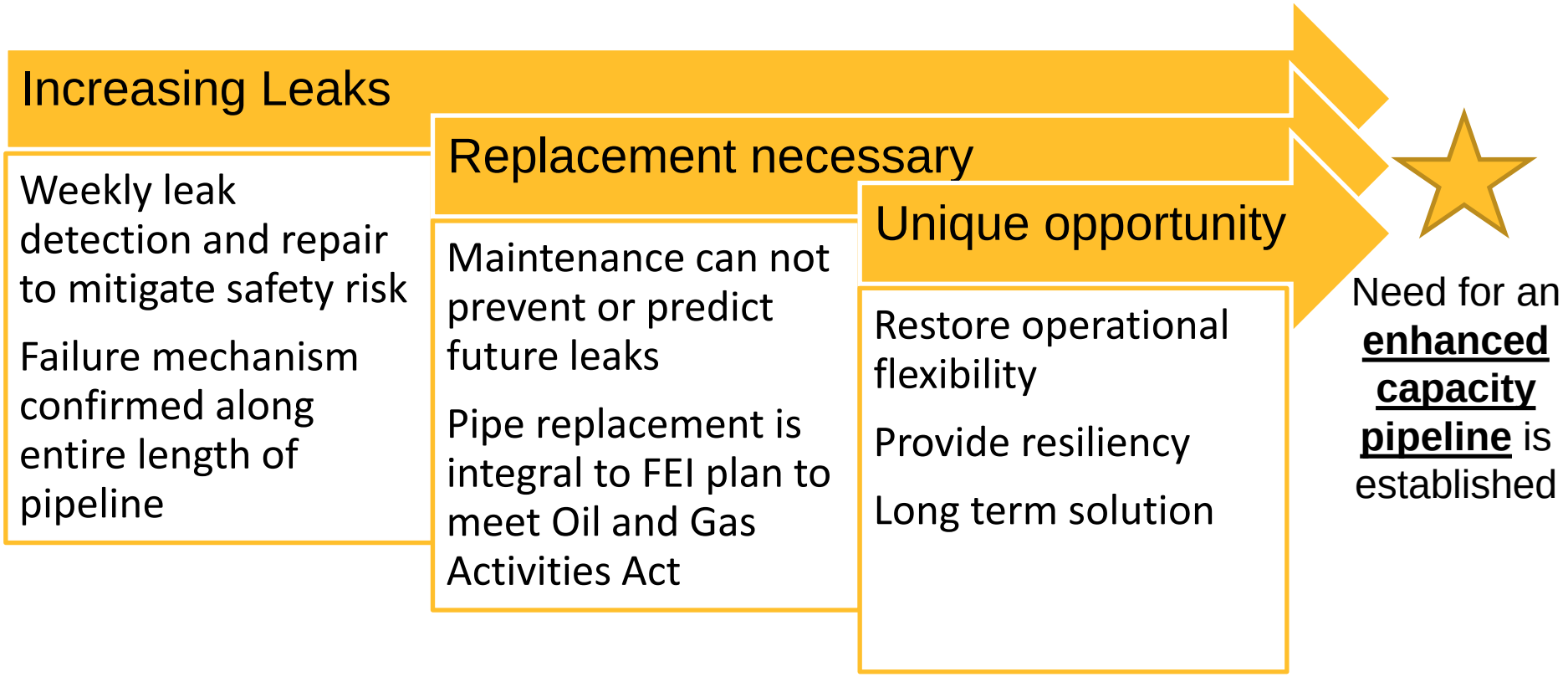
Coquitlam Gate IP – Justification Conclusion



Alternatives Evaluation

John Quinn

Coquitlam Gate IP – Pipeline Replacement Solution

Alternatives Evaluation Process:

STEP 1: Define Evaluation Criteria

STEP 2: Identify Alternative Solutions

STEP 3: Non Financial Comparison

STEP 4: Financial Comparison

STEP 5: Financial and Operational Risk Evaluation

STEP 6: Selection of a Preferred Alternative

Alternatives Evaluation Criteria

Objectives and Requirements:

1. Eliminate Elevated Pipeline Risk
2. Restore Operational Flexibility
3. Enhance System Resiliency
4. Constructability

Alternatives 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	Does not meet Objective	Meets Objective	Not Feasible
4	Replace with NPS 24 at 2070 kPa	Meets Objective	Meets Objective	Does not meet Objective	Meets Objective	Feasible
5	Replace with NPS 36 at 1200 kPa	Meets Objective	Meets Objective	Does not meet Objective	Meets Objective	Feasible
6	Replace with NPS 30 at 2070 kPa	Meets Objective	Meets Objective	Meets Objective	Meets Objective	Feasible
7	Replace with NPS 42 at 1200 kPa	Meets Objective	Meets Objective	Meets Objective	Does not meet Objective	Not Feasible

	Meets objective/feasible
	Partially meets objective
	Does not meet objective/not feasible

Source: Exhibit B-1, Table 3-1 (pg: 41)

Alternatives Financial Comparison

	Alternative 4 Install NPS 24 pipeline at 2070 kPa	Alternative 5 Install NPS 36 pipeline at 1200 kPa	Alternative 6 Install NPS 30 pipeline at 2070 kPa
AACE Estimate Accuracy	***Class 4***	***Class 4***	***Class 3***
Total As-spent includes Abandonment / Demolition & AFUDC ($millions)	213.535	250.487	245.557
PV Incremental Cost of Service – 60 Yr. ($millions))	259.659	306.480	300.513
Levelized Rate Impact – 60 Yr. ($ / GJ)	0.087	0.103	0.101

Source: Exhibit B-1, 4 Table 3-2 (pg: 43)

Financial and Operational Risk Evaluation

		Alternative 4 Install NPS 24 pipeline at 2070 kPa	Alternative 6 Install NSP 30 pipeline at 2070 kPa
1	Operational Risk Reduction (%)	0	100
2	Remaining Operational Risk (2014$millions / year)	2.456	0
3	PV Remaining Operational Risk: 60 Yr ($millions)	38.880	0
4	PV Incremental Cost of Service: 60 Yr ($millions)	259.659	300.513
5	PV Remaining Operational Risk + PV Incremental Cost of Service –60Yr ($millions)	**298.539**	**300.513**

Source: Exhibit B-1, Table 3-3 (pg: 44)

Preferred Alternative

Alternative 6 (NPS 30 at 2070 kPa) is the preferred alternative and it will satisfy all the objectives and requirements outlined:

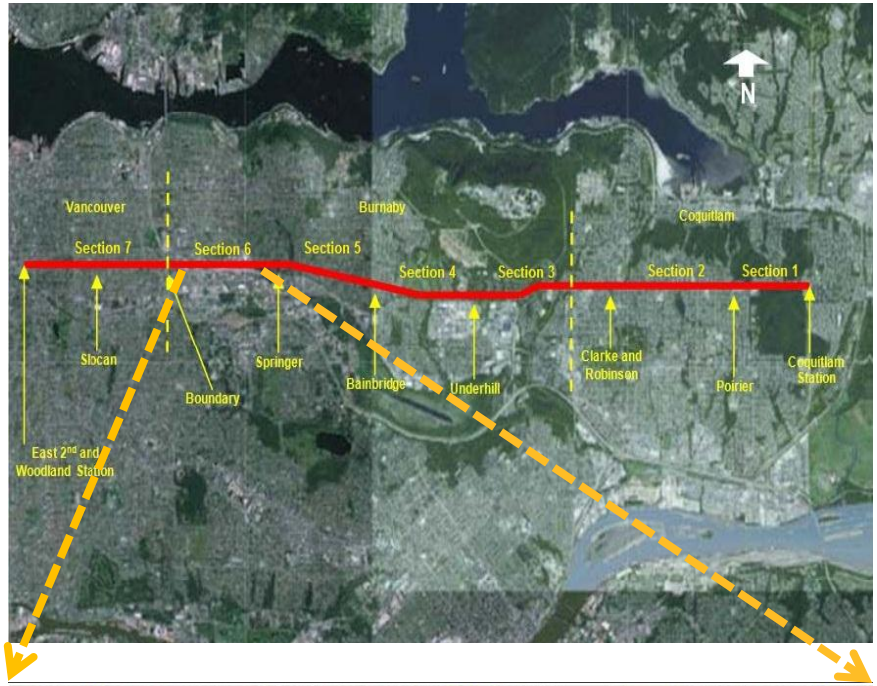
1. ✓ Eliminates the elevated reliability, safety and OGC risk posed by the existing Coquitlam Gate IP pipeline
2. ✓ Provides the necessary operational flexibility to facilitate planned outages
3. ✓ Provides the necessary resiliency to mitigate the risks and consequences associated with unplanned outages
4. ✓ Is constructible
5. ✓ Is cost effective

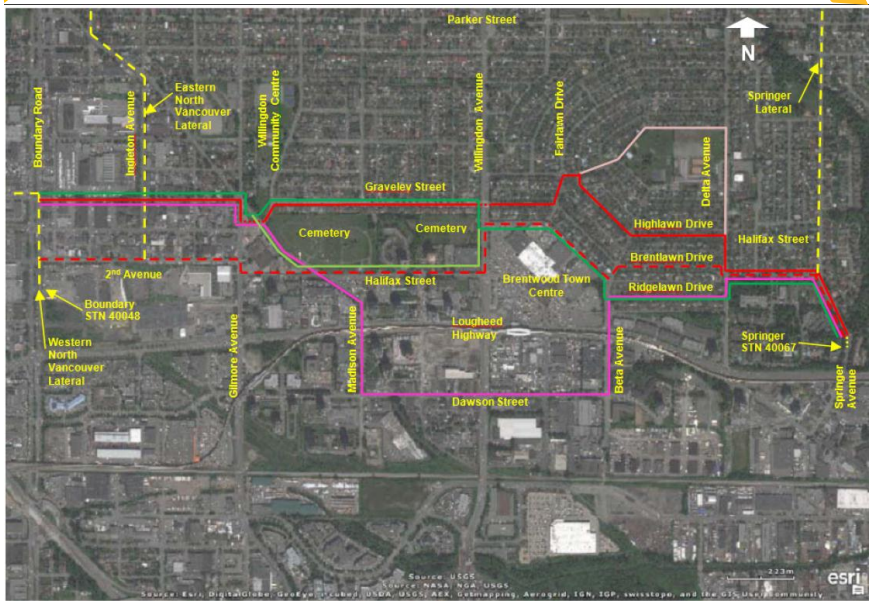
- In summary, when taking into account the reduction in operational risk provided by Option 6 compared to Option 4, and that Alternative 6 is the only cost effective alternative which meets all of the objectives and requirements, FEI has selected Alternative 6 as the preferred alternative.

Coquitlam Gate IP - Project Description

- 20 km NPS 30 pipeline with Maximum Operating Pressure (MOP) of 2070 kPa distribution gas line
- Design in accordance with Canadian Standards Association standard Z662
- The proposed pipeline will include a number of mainline block valves
- Station upgrades required
- Interface required at existing system offtakes
- Existing NPS 20 pipeline will be disconnected and left in place

Route Selection Process





- Integrated multi-stage routing process
- Initial route assessment corridor established
- Corridor sectionalized for analysis
- Total of 24 route options identified
- Route options compared and evaluated and a preferred option selected
- Final route will be subject to detailed engineering

Route Evaluation Criteria

Route Evaluation Criteria Categories:

1. Community and Stakeholder
2. Environmental
3. Technical
4. Cost

Route Option Evaluation

- The route options were evaluated against the criteria, ranked and a preferred option selected
- Each route option was also ranked according to capital cost
- The result is an economic pipeline route which does not compromise safety or the environment while minimizing the overall pipeline footprint and local impact on the communities that the pipeline passes through.
- Refer to Appendix A-17 in the Application for full details

Score	Impact Evaluation
5	Very low (negligible) impact, best choice
4	Low impact, better choice
3	Moderate impact, good choice
2	High negative impact, poor choice
1	Very high negative, (unacceptable) impact, unviable choice

Source: Exhibit B-1, Table 3-10 (pg: 76)

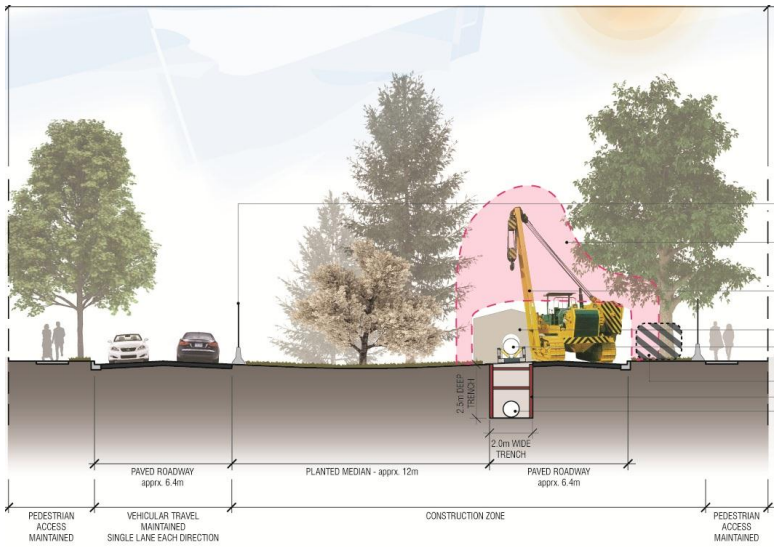
Proposed Pipeline Route

Section	Existing NPS 20 Coquitlam IP route	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	Broadway	Parallel in same road
6	Springer Avenue, Halifax Street, Brentlawn Drive, Lane adjacent to Brentwood Town Centre, Halifax Street, 2nd Avenue	Springer Avenue, Halifax Street, Highlawn Drive, Brentlawn Drive, Graveley Street	Parallel Street (offset one to two streets north)
7	East 2nd Avenue	East 1st Avenue	Parallel Street (offset one street north)

- The initial 70 percent of the proposed route follows the existing Coquitlam Gate IP pipeline alignment within the same roadway
- The remainder of the proposed route is offset one to two blocks north of the existing Coquitlam Gate IP pipeline alignment
- Further evaluation of Lougheed Highway route options is currently underway for Sections 5 & 6 in Burnaby

Source: Exhibit B-1, Table 3-11 (pg: 77)

Construction and Commissioning



PIPE LAYING PHASE

TYPICAL 4-LANE ARTERIAL STREET (WITH PLANTED MEDIAN)

- Pipeline
  - Trenched
  - Trenchless
- Stations
  - Coquitlam
  - District
  - East 2nd & Woodland
- Commissioning
  - Tie-In
  - Introduce Gas

Project Schedule

Activity	Date
Concept Development	Completed
CPCN Preparation	July 2013 – Dec. 2014
CPCN Filing	Dec. 2014
CPCN Approval	Q3 2015
Start Detailed Engineering, material specification and contract development	Oct. 2015
Materials Tendering and Orders Placed	Aug. 2016
Award Contractor	June 2017
Submit OGC Application	Sept. 2017
OGC Pipeline Approval	Jan. 2018
Materials Delivery	Mar. 2018
Construction Start	April 2018
In Service	Nov. 2018
Restoration	June 2019

Source: Exhibit B-1, Table 3-12 (pg: 90)

- Conceptual engineering has been completed
- Detailed engineering will commence after CPCN approval
- Construction is proposed to be undertaken, in 2018.

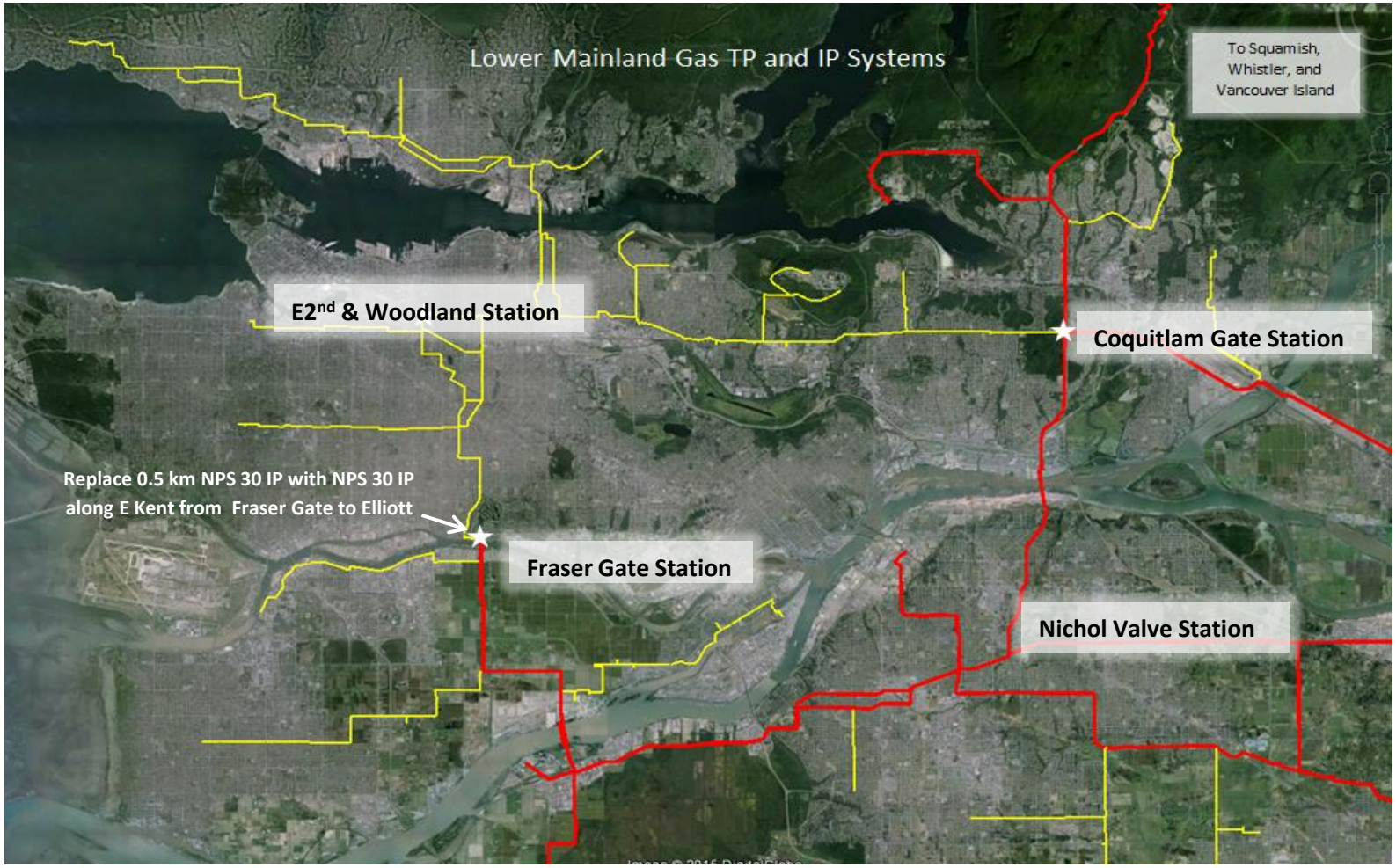
Capital Cost Estimate Methodology

- AACE Class 3 Estimate (+30% to -20% accuracy)
- WorleyParsons assisted FEI with the pipeline and facilities estimates
- Deterministic preparation methodology
- FEI developed owners cost estimates
- Quantitative risk assessment using Monte Carlo method to determine estimate contingency

Fraser Gate IP

John Quinn

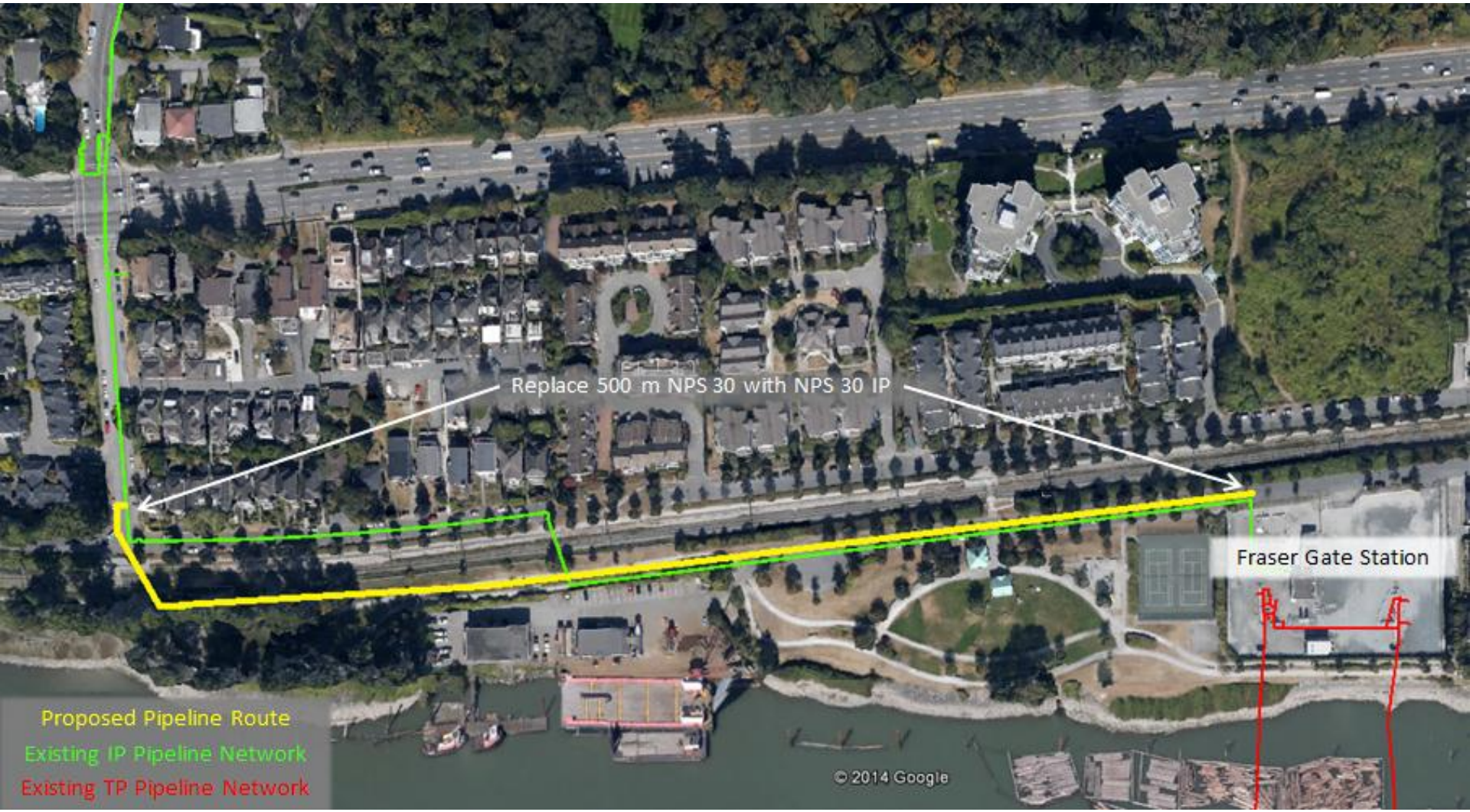
Fraser Gate IP Overview



Source: FEI data overlaid on Google Earth mapping

- TP pipelines operating at greater than 2070 kPa
- IP pipelines operating from 700 kPa to 2070 kPa

Fraser Gate IP Pipeline Replacement

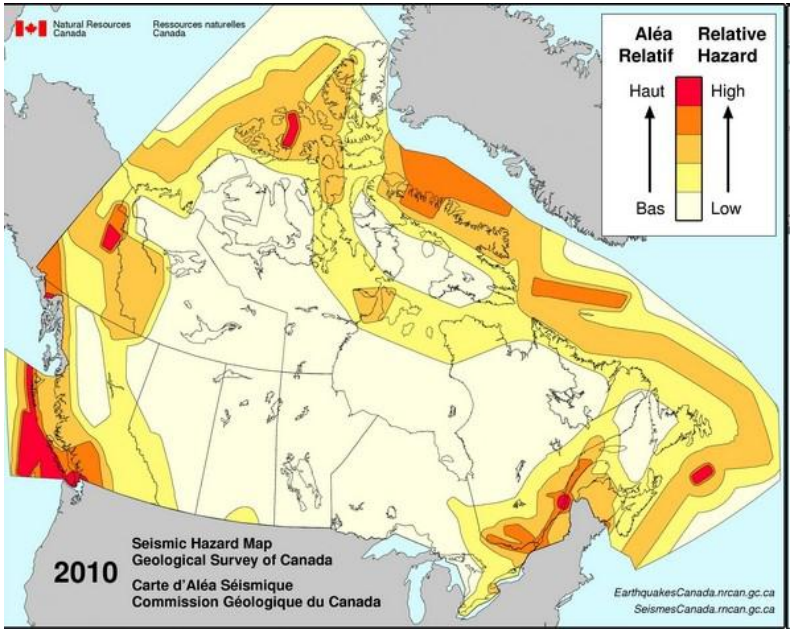


Fraser Gate IP - Justification

Pipeline Vulnerable to a 1:2475 Seismic Event

Consequences of a seismic event resulting in failure:

- Potential for significant public safety impact
- Loss of gas supply to approximately 171,000 customers
- Customer supply impact in the order of three weeks
- Economic impact of gas supply loss to the general public, customers and the Company could be in excess of $320 million



Fraser Gate IP - Pipeline Upgrade Solution

Alternatives Evaluation Process:

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STEP 5: Selection of a Preferred Alternative

Alternative Evaluation Criteria

Objectives and Requirements:

- Achieve FEI's seismic criteria
- Mitigate the safety risk
- Mitigate the economic risk
- Constructability

Alternatives & Non-Financial Comparison

Pipeline Solution		Objectives/Requirements				Overall Assessment
		Achieve Seismic Criteria	Mitigate the Safety Risk	Mitigate the Economic Risk	Constructability, Operation and Safety	
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

	Meets objective/feasible
	Partially meets objective
	Does not meet objective/not feasible

Source: Exhibit B-1, Table 4-1 (pg: 109)

Alternative Financial Evaluation

	Alternative 2 – Route Option 1 – East Kent Ave South
Estimate Accuracy	Class 3
Total As-spent ($millions)	18.107
PV Incremental Cost of Service – 60 Yr. ($millions)	21.654
Levelized Rate Impact $ / GJ – 60 Yr.	0.007

Source: Exhibit B-1: Table 4-2 (pg: 110)

Preferred Alternative

A pipeline replacement will satisfy all the objectives and requirements outlined; this alternative will:

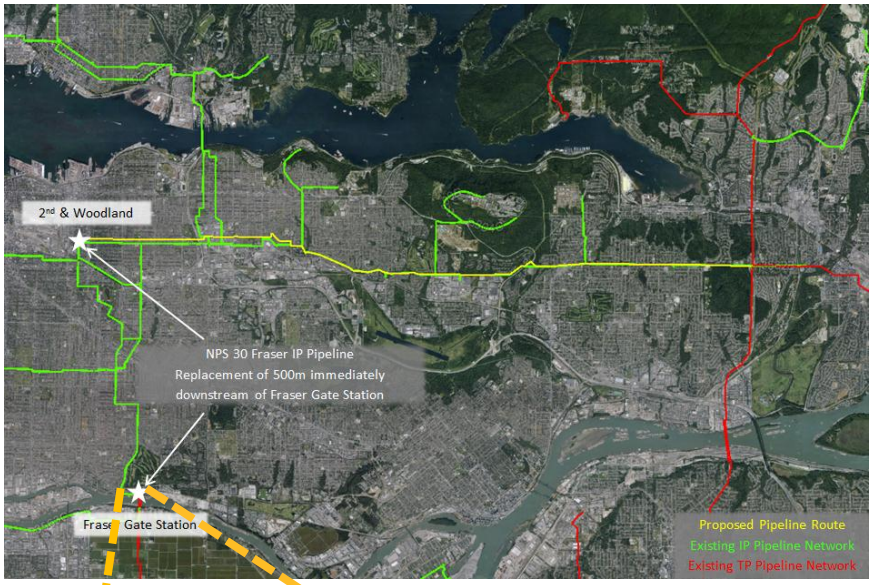
1. ✓ Remove from service the section of pipeline that is vulnerable to a 1:2475 year seismic induced earth movement
2. ✓ Reduce the probability of pipeline failure and therefore safety risk
3. ✓ Reduce the loss of gas supply and economic risk; and
4. ✓ Is constructible

- In summary, this alternative will replace the vulnerable section of line with one capable of withstanding a 1:2475 year seismic event

Project Components

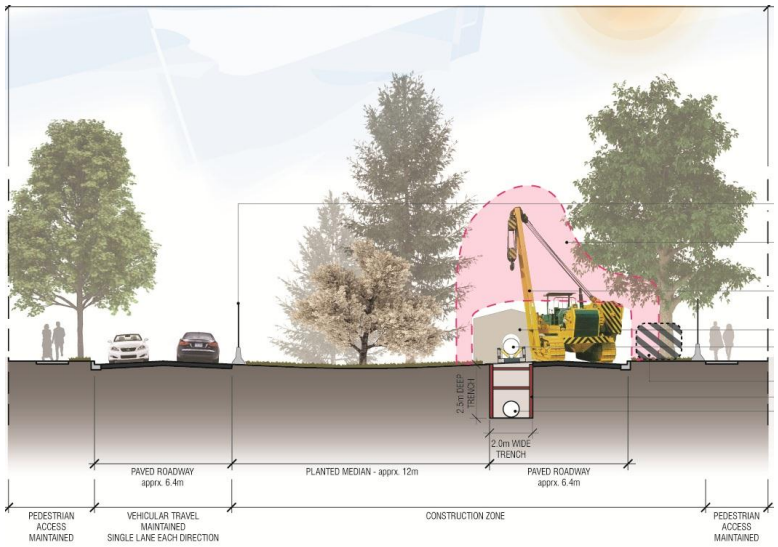
- Approximately 0.5 km NPS 30 IP pipeline with Maximum Operating Pressure (MOP) of 1200 kPa
- Design in accordance with Canadian Standards Association standard Z662
- Pipeline replacement seismic design will follow the FEI Seismic Design Guideline (DES-09-02)
- Existing NPS 30 pipeline will be left in place
- No station modifications required

Route Selection Process



- Integrated multi-stage routing process similar to the Coquitlam Gate IP pipeline
- Three route options analyzed
- The selected route option parallels the existing Fraser Gate IP pipeline in East Kent Avenue South

Construction, Installation and Commissioning



PIPE LAYING PHASE

TYPICAL 4-LANE ARTERIAL STREET (WITH PLANTED MEDIAN)

- Coquitlam Gate IP and Fraser Gate IP will be constructed concurrently
- Pipeline
  - Trenched
  - Trenchless
- Commissioning
  - Tie-In
  - Introduce Gas

Project Schedule

Activity	Date
Concept Development	Completed
CPCN Preparation	July 2013 – Dec. 2014
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Start Detailed Engineering, material specification and contract development	Oct. 2015
Materials Tendering and Orders Placed	Aug. 2016
Award Contractor	June 2017
Submit OGC Application	Sept. 2017
OGC Pipeline Approval	Jan. 2018
Materials Delivery	Mar. 2018
Construction Start	April 2018
In Service	Nov. 2018
Restoration	June 2019

Source: Exhibit B-1, Table 4-5 (pg: 131)

- Conceptual engineering completed
- Detailed engineering will commence after CPCN approval
- Construction of the Coquitlam Gate IP and Fraser Gate IP pipelines is proposed to be undertaken in 2018.

Risk Assessment, Cost Estimate and Contingency Methodology

- Project risk assessment similar to Coquitlam Gate IP project
- Estimate preparation and quantitative cost risk analysis methodology similar to the Coquitlam Gate IP project

Coquitlam Gate IP and Fraser Gate IP Project Estimates and Rate Impacts

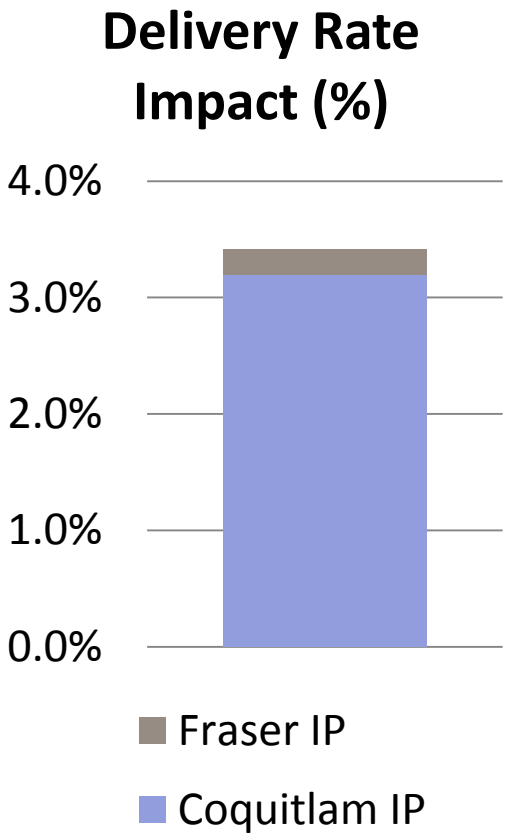
Melanie Kilpatrick

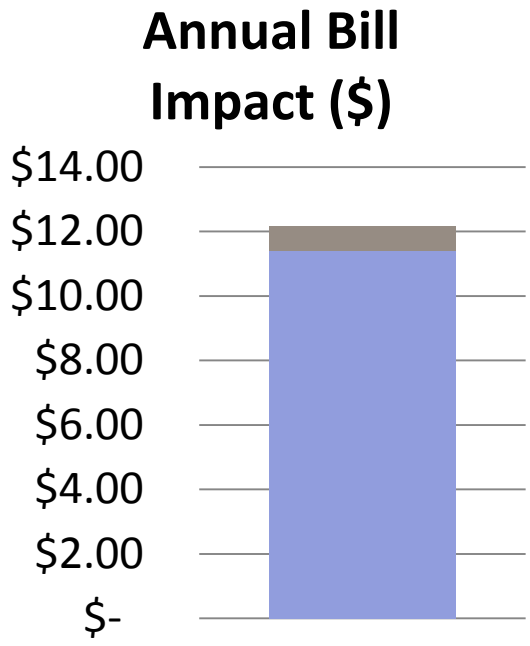
Project Estimates - As Spent ($Millions)

Coquitlam Gate IP Project Capital Cost		$241.268
Fraser Gate IP Project Capital Cost		$ 18.107
Development Deferral		$ 2.004
Application Deferral		$ 1.047
Negative Salvage Deferral		$ 4.289
	Total	**$266.715**

Note: Includes AFUDC

Estimated 2019 Impacts





- Average Cost of Service Impact - $0.130 / GJ.
- Typical residential customer consuming 95GJ per year , estimated to equate to approximately $12 per year (an increase of 3.39% on delivery rate or 1.3% on annual bill).

Coquitlam Gate IP and Fraser Gate IP Environmental, Archaeological and Socio-Economic Considerations

Melanie Kilpatrick

Environmental and Archaeological Considerations – to date

Environmental and archaeological sensitivities:

- Streams
- Contaminated sites
- Natural areas
- Archaeological sites

Sensitivities will be managed and mitigated through:

- Management plans
- Construction methodology
- Environmental monitoring programs

Environmental and Archaeological Considerations – next steps

During the detailed engineering phase:

- An environmental consultant will be hired to manage environmental risk, apply for required permits and write environmental management plans
- An archaeological consultant will undertake field investigations and write archaeological management plans

Environmental and archaeological conditions will be included in the tender documentation

Socio Economic Considerations

- Construction will generate disturbances to:
  - Business activity
  - Traffic
  - Access
  - Loss of on-street parking
- Impacts can be mitigated
- Economic benefits
  - new jobs, demand for contractors and vendors, and use of hospitality services

Coquitlam Gate IP and Fraser Gate IP Public Consultation and Engagement

Melanie Kilpatrick

Public Consultation & Engagement

Who we consulted:

- Municipal and regional governments
  - Staff and elected officials
- Provincial and federal governments
  - MLAs, MPs, staff from relevant ministries and offices
- Community associations
- Organizations representing business and commerce
  - Queries about opportunities for vendors, trades
- Residents and businesses along the corridor

Public Consultation & Engagement

How we did it:

- More than 100 meetings with stakeholders
  - Engaging communities, neighbourhood associations, business organizations and elected representatives
- Reaching out to public
  - 6000 letters mailed to residents within 200 metres of proposed route
  - Four public sessions in Coquitlam, Burnaby and Vancouver
    - Advertised in community and daily newspapers
- Informing FortisBC customers
  - Bill insert to 950,000 customers, info via electronic newsletter

Public Consultation: What we heard

Questions raised:

- Traffic disruption
- Route alignment
- Impact to tree canopy and the environment
- Public consultation process
- Property values, safety
  - Highlawn Drive, W. Burnaby

City of Burnaby

- Requested a re-examination of Lougheed Highway

First Nations Consultation & Engagement

The project does not cross reserve lands, but does cross certain traditional territories. The potential impact of the Projects on First Nations' rights and title will be limited.

We engaged the following First Nations:

Stó:lō	Kwikwetlem First Nation	Musqueam Indian Band	Tsleil-Waututh Nation	Squamish Nation	Tsawwassen First Nation	Semiahmoo First Nation

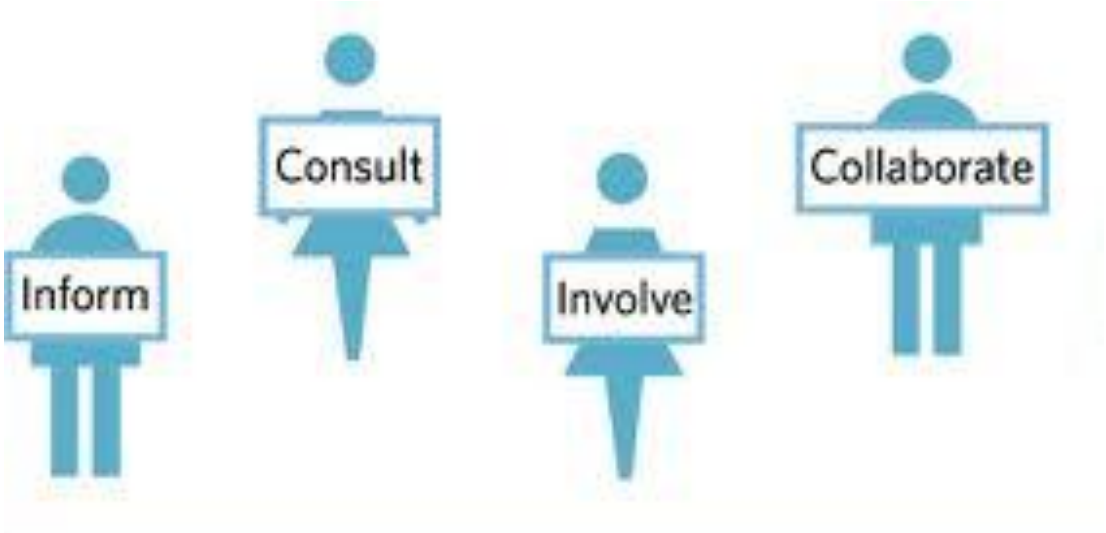
Response:

- Meeting requested and held with Tsleil-Waututh Nation
- More detailed mapping requested by Squamish Nation
- Meeting held with Kwikwetlem First Nation

No objections were expressed

Consultation Moving Forward

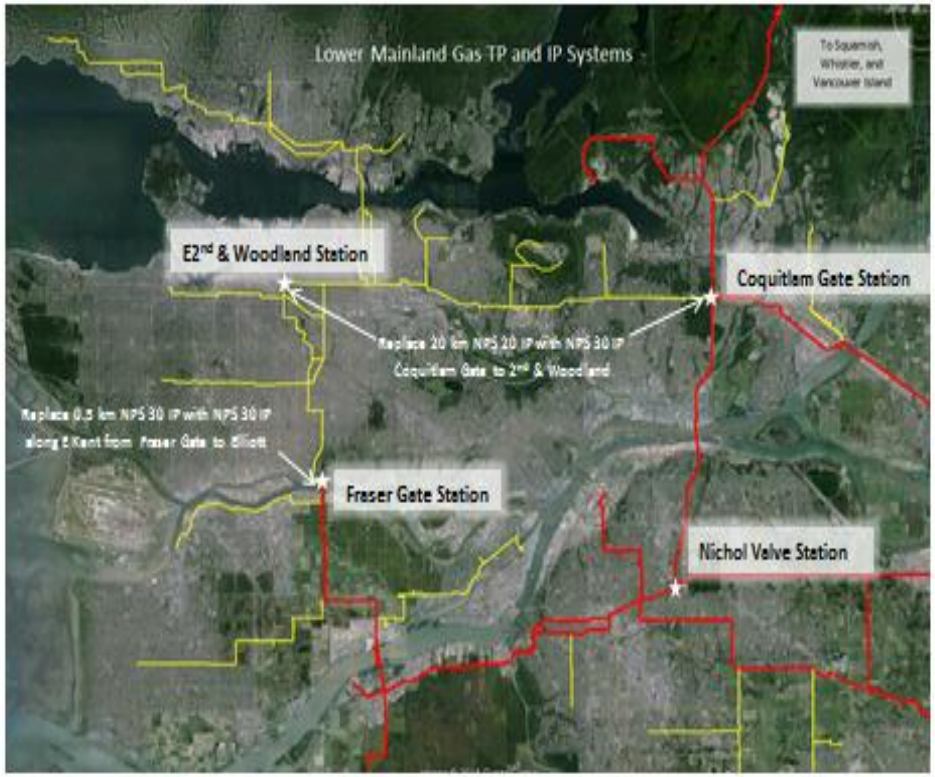
Consultation and engagement will be ongoing:



- Project modifications
- Environmental and archaeological management plans
- Communication plan
- Traffic management plan

Application Summary

The Proposed Projects address all the objectives and requirements outlined:



Source: FEI data overlaid on Google Earth mapping

TP pipelines operating at greater than 2070 kPa

IP pipelines operating from 700 kPa to 2070 kPa

Eliminates elevated corrosion and seismic risk

Restores operational flexibility

Provides system resiliency

- Eliminate both the Fraser Gate IP and Coquitlam Gate IP as single points-of-failure pipelines
- Minimize potential for a loss of service due to a pipeline failure

Proposed solutions are constructible

Cost effective

Lower Mainland Natural Gas Intermediate Pressure System Upgrade Projects

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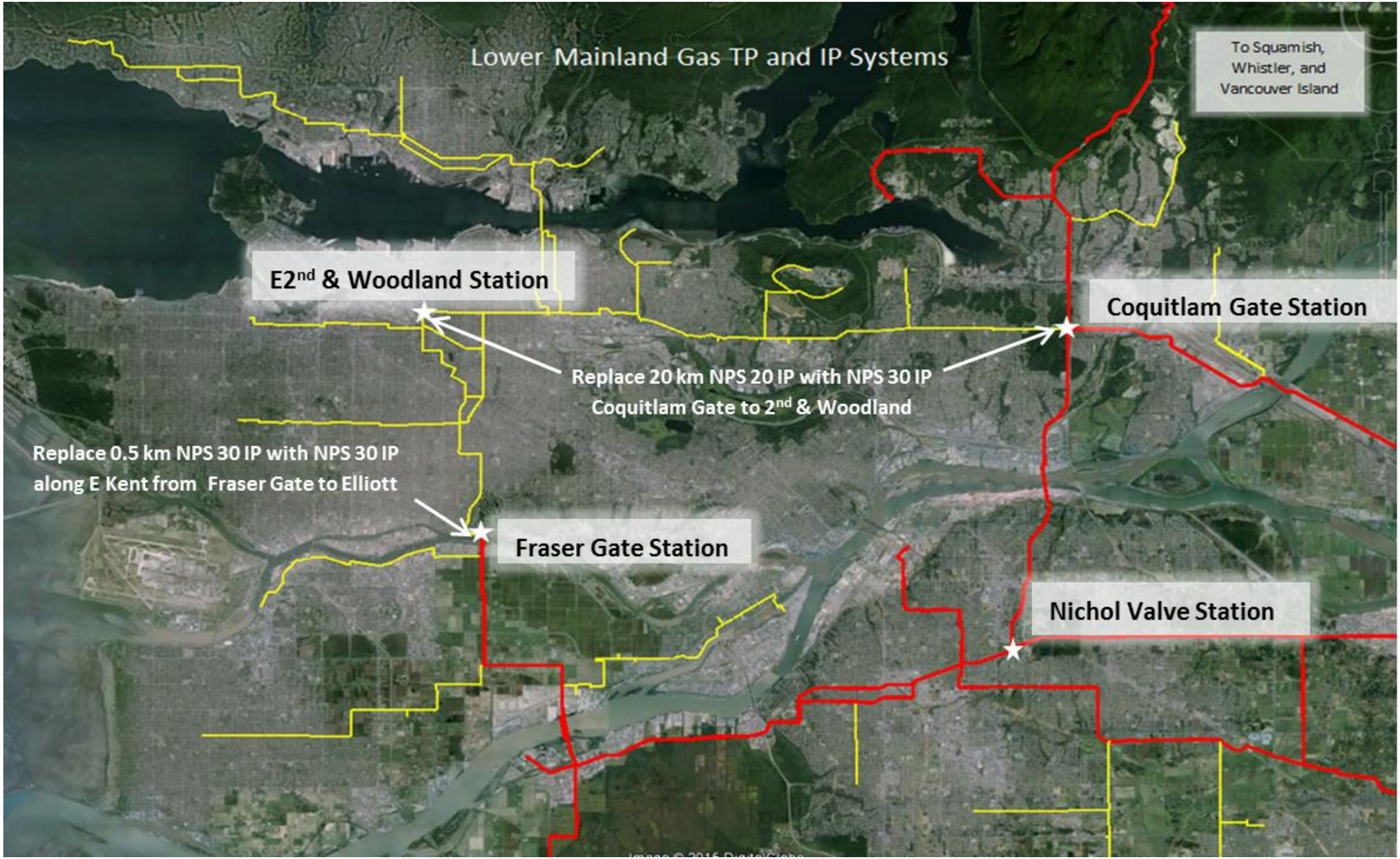
WORKSHOP GLOSSARY OF TERMS

Acronym or Term	Definition
AACE	Association for the Advancement of Cost Engineering also known as AACE International.
AFUDC	Acronym for Allowance for Funds Used During Construction, which allows for the cost of borrowing funds until a project is placed into service to be included in rates; the requirement for AFUDC forms a separate line item of the overall project cost.
Anode	In corrosion protection, a formed metal - usually zinc, aluminum, or magnesium - buried near and connected to a structure of lesser galvanic potential such that the metal corrodes in favor of the structure.
BCUC	British Columbia Utilities Commission, or Commission - The BCUC is the provincial body regulating utilities in British Columbia.
Block Valve	Main line valve designed to close in or shut down gas flow.
Burner Tip	A generic term that refers to the ultimate point of consumption for natural gas.
By-Pass	An auxiliary piping arrangement, generally to carry gas around specific equipment or an integral section of a piping system. A by-pass is usually installed to permit passage through the line while adjustments or repairs are made on the section which is by-passed.
Capital Cost	Expenditures to acquire or improve assets with a service life of greater than one year.
Cathodic Protection or CP	A technique to prevent the corrosion of a metal surface by making that surface the cathode of an electrochemical cell. Generally considered a secondary defense corrosion management tool that relies on the existence of an external pipe coating as the primary defense.
Commission	see British Columbia Utilities Commission, BCUC
Core, core customers, Core market	Residential, commercial and small industrial customers that have gas delivered to their home or business (bundle sales). FortisBC purchases natural gas and delivers it to the customer in a bundled sales rate. Core Market customer typically use a significant portion of their gas requirements for heating applications, resulting in weather sensitive demand.
CPCN	Certificate of Public Convenience and Necessity – A certificate obtained from the British Columbia Utilities Commission under Section 45 of the *Utilities Commission Act* for the construction and/or operation of a public utility plant or system, or an extension of either, that is required, or will be required, for public convenience and necessity.

Acronym or Term	Definition
Coquitlam IP or Coquitlam Gate IP	Coquitlam Gate IP (NPS 20 now and proposed NPS 30) Pipeline: Coquitlam Gate Station to 2nd & Woodland Station. In some Appendices completed by third parties and in some public information documents completed early in the planning phase, the Coquitlam IP Project was referred to as the Metro IP Project
Corrosion	Destruction of a metal by chemical or electrochemical reaction with its environment.
CSA	Canadian Standards Association
CTS	Coastal Transmission System – transmission pressure pipeline system starting from the Huntingdon Station in Abbottsford running through the Lower Mainland. The CTS is the sole source of supply to the lower Mainland, serving Mission/Abbotsford and communities west, including the Metro the Vancouver distribution system as well as the Vancouver Island gas pipeline system.
Deferred Cost	Cost that incurred but that will be expensed in the future.
Design day, or design hour demand	The maximum expected amount of gas in any one day or hour required by customers on the utility system. Since core customers' demand is primarily weather dependent, design-day or design-hour demand is forecasted based upon a statistical approach called Extreme Value Analysis, which provides an estimate of the coldest day weather event expected with a 1-in-20-year return period. For transportation customers, the design-day is equivalent to the firm contract demand.
DP	Distribution pressure (700 – 70 kPag)
EPC	Engineering, procurement and construction
FEI	FortisBC Energy Inc.
Fraser IP or Fraser Gate IP	Fraser Gate IP (NPS 30) Pipeline: Fraser Gate Station to 2nd & Woodlands.
Girth Weld	A circumferential weld at a joint connecting two pipes.
GJ – Gigajoule	A measure of energy of natural gas – one billion joules. One joule of energy is equivalent to the heat needed to raise the temperature of one gram (g) of water by one degree Celsius (°C) at a standard pressure (101.325 kPa) and standard temperature (15°C).
HDD	Horizontal directional drilling – a trenchless construction method for the installation of underground piping.
Huntingdon/Sumas	Gas Flow regulating station on either side of the British Columbia/ US border through which much of the regional gas supply is traded.
ILI	In-line inspection – A widely accepted industry practice to monitor pipeline asset health.

Acronym or Term	Definition
IMP	Integrity Management Program
IP	Intermediate pressure (3,100 – 701 kPag)
kPa	Kilopascal - a metric measurement unit of pressure. Gauge pressure is often given in units with a 'g' appended, e.g. 'kPag'.
Line Pack	The difference in gas volume in a pipeline between maximum pressure and the minimum pressured required for constant supply. A pipeline is said to be "packed" when withdrawal from it is at a minimum and when, therefore, for a constant supply of gas, the discharge pressure is a maximum. A pipeline is "unpacked" when withdrawals are at maximum and pressure is at minimum for a constant supply of gas to the line.
Load	The total amount of gas demanded by all customers at a given point in time.
Looping	The twinning of sections of gas transmission pipeline to improve flow characteristics within the service area.
LTRP	Long Term Resource Plan – A plan that identifies resource requirement and acquisition strategies to meet expected natural gas demand and reliability requirements at the lowest reasonable cost to customers over a 20 year planning horizon.
LTSP	Long Term Sustainment Plan - An asset management process/planning approach that assists in creating and supporting long term asset replacement plans and capital expenditures.
Metro IP	Intermediate Pressure pipeline system between Coquitlam Gate Station and Fraser Gate Station serving Metro Vancouver.
MOP	Maximum operating pressure.
NPS	Nominal pipe size expressed in inches
OD	Outside diameter
OGC	British Columbia Oil and Gas Commission
Psig	Pounds per square inch gauge - A measurement of pressure
Purging	The act of replacing the atmosphere within a container by an inert substance in such a manner as to prevent the formation of explosive mixtures.
Resilience	Ability to rebound quickly in case of equipment failure. Robustness and recovery characteristics of utility infrastructure and operations, which avoid or minimize interruptions of service during an extraordinary and hazardous event. A resilient system has the capacity to avoid or minimize interruptions of service during planned activities and/or equipment failure.

Acronym or Term	Definition
ROW	Right-of-way.
SCADA	System Control and Data Acquisition – The SCADA system provides centralized control of selected remote equipment, while also typically gathering and recording data attributes such as operating pressure and temperature for the purposes of system monitoring and analysis.
Shut in / Shut down	The act of shutting off gas supply to a gas pipeline or customer service line such that there is no gas flow into the line. Shut in /Shut down ensures the gas supply system will be positively isolated from customer service lines when it is re-pressurized. This is a public safety measure to prevent re-pressurization of private systems whose condition will not have been verified until assessed by a qualified person during a relight campaign.
Stations	Coquitlam Gate Station—Coquitlam Cape Horn Station—Cape Horn Delta Valve Station--Delta East 2nd and Woodland District Station—2nd and Woodland Ferguson Station—Ferguson Fraser Gate Station—Fraser Marine and Elliott District Station –marine and Elliott Nichol Valve Station—Nichol Port Mann Station—Port Mann Roebuck Valve Station—Roebuck Tilbury valve Station—Tilbury Tilbury LNG Plant—Tilbury LNG
Stopple Fitting	Fitting welded on a pipeline used for temporary shut off of the gas flow in order to execute repair or replacement of the downstream pipeline section.
TP	Transmission pressure (14,890 – 3,101 kPag)
UCA or Act	Utilities Commission Act



Source: FEI data overlaid on Google Earth mapping

TP pipelines operating at greater than 2070 kPa

IP pipelines operating from 700 kPa to 2070 kPa