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Waste Management

STRATEGY FOR CVWMC LANDFILL GAS UTILIZATION

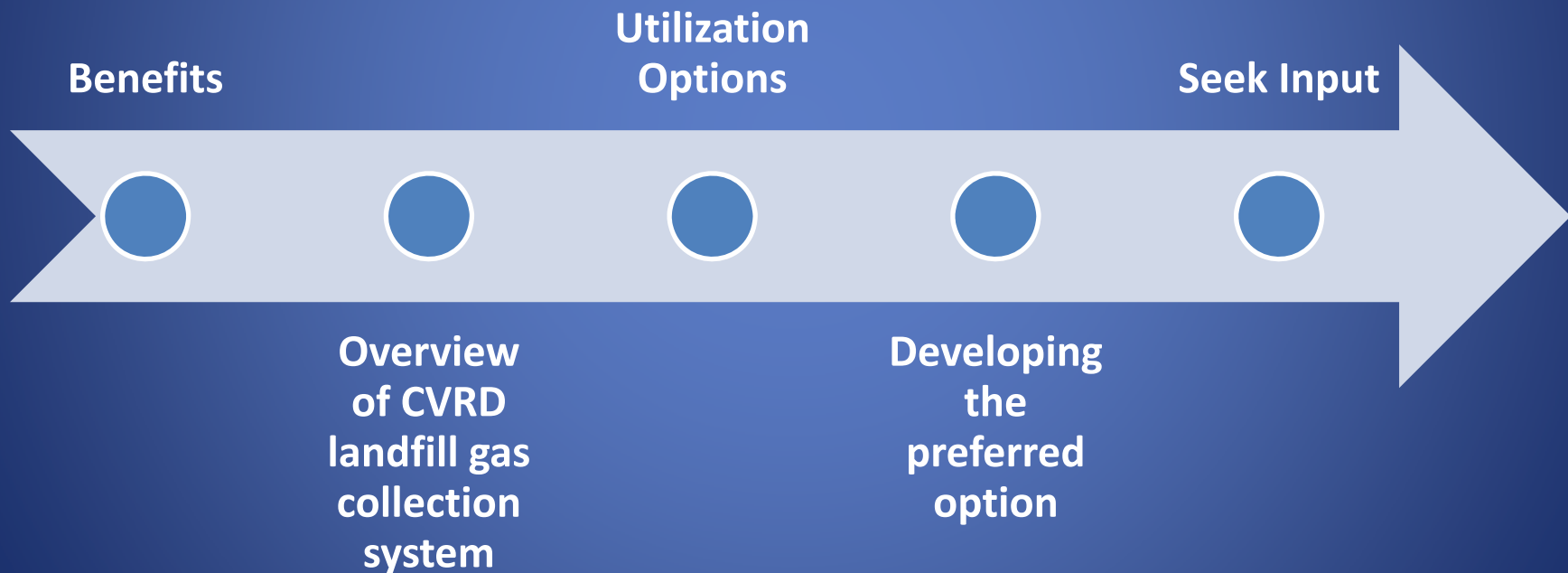
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June 19, 2014

ETHINK REDUCE REUSE RECYCLE

PURPOSE



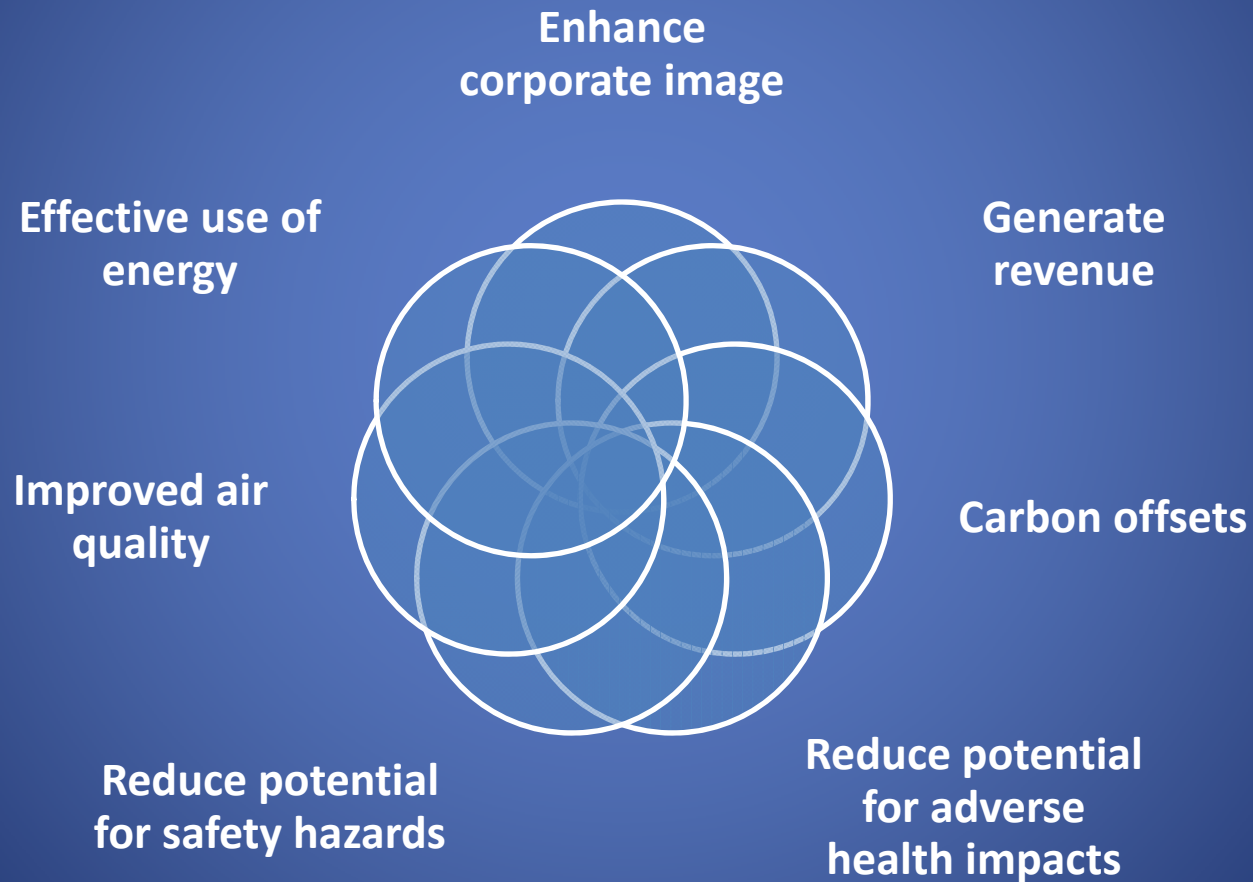
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BENEFITS



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LANDFILL GAS



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Generated due to anaerobic oxidation (oxygen –strived) of wastes

BC regulations require capture and utilization

LFG is a medium-grade fuel. Utilization is an environmentally benign use of energy

Meets “integrated resource recovery” (IRR) objective of the Solid Waste Management Plan (CS-SWMP)

BC REGULATIONS



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Landfills > 1,000 t/yr. of methane generation require capture and LFG Management Plan. CVRD has prepared and submitted the plan to the MoE

Minimum capture efficiency  75%

Design Guidelines: Landfill Gas Management Facilities, S7, Landfill Gas Management Regulation. CVRD has prepared detailed design in accordance with these guidelines

<http://www.env.gov.bc.ca/epd/mun-waste/waste-solid/landfills/pdf/Design-guidelines-final.pdf>

LFG generation assessment using BC MoE assessment spreadsheet

Carbon Offsets now dealt by the Climate Action Secretariat (previously by BC Carbon Pacific Trust)

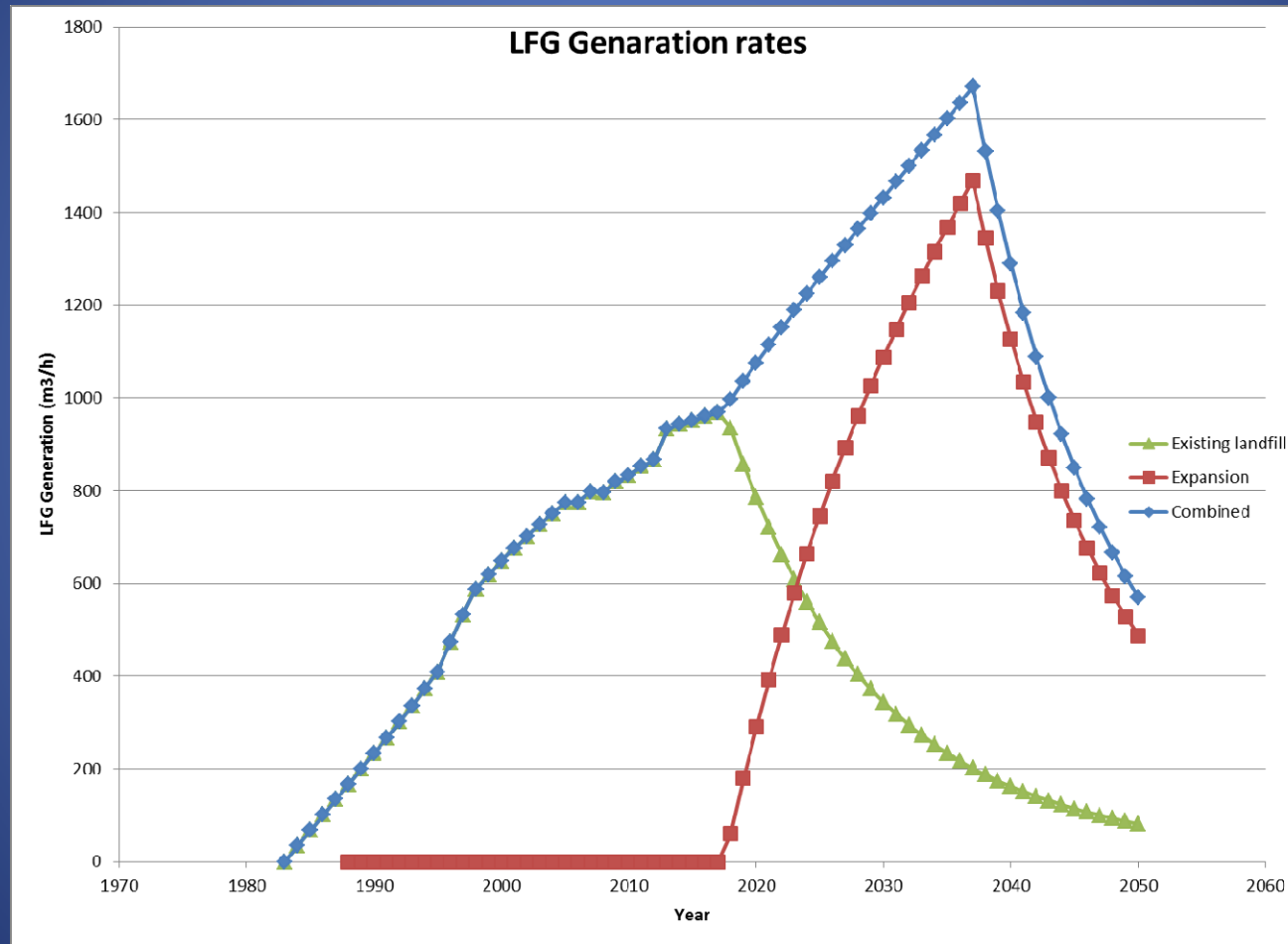
TYPICAL GAS QUALITY AND QUANTITY



Compound	Mol %
Methane (CH ₄)	60
Carbon dioxide (CO ₂)	37
Nitrogen (N ₂)	1.9
Oxygen (O ₂)	0.6
Other trace gases	1.1



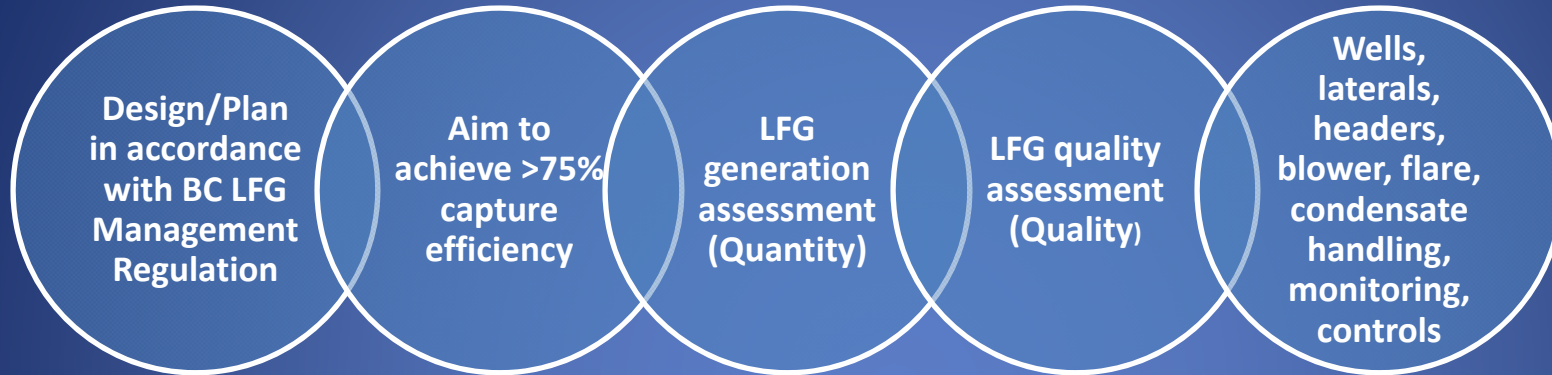
ESTIMATED LFG GENERATION RATE (BASED ON BC MoE MODEL)



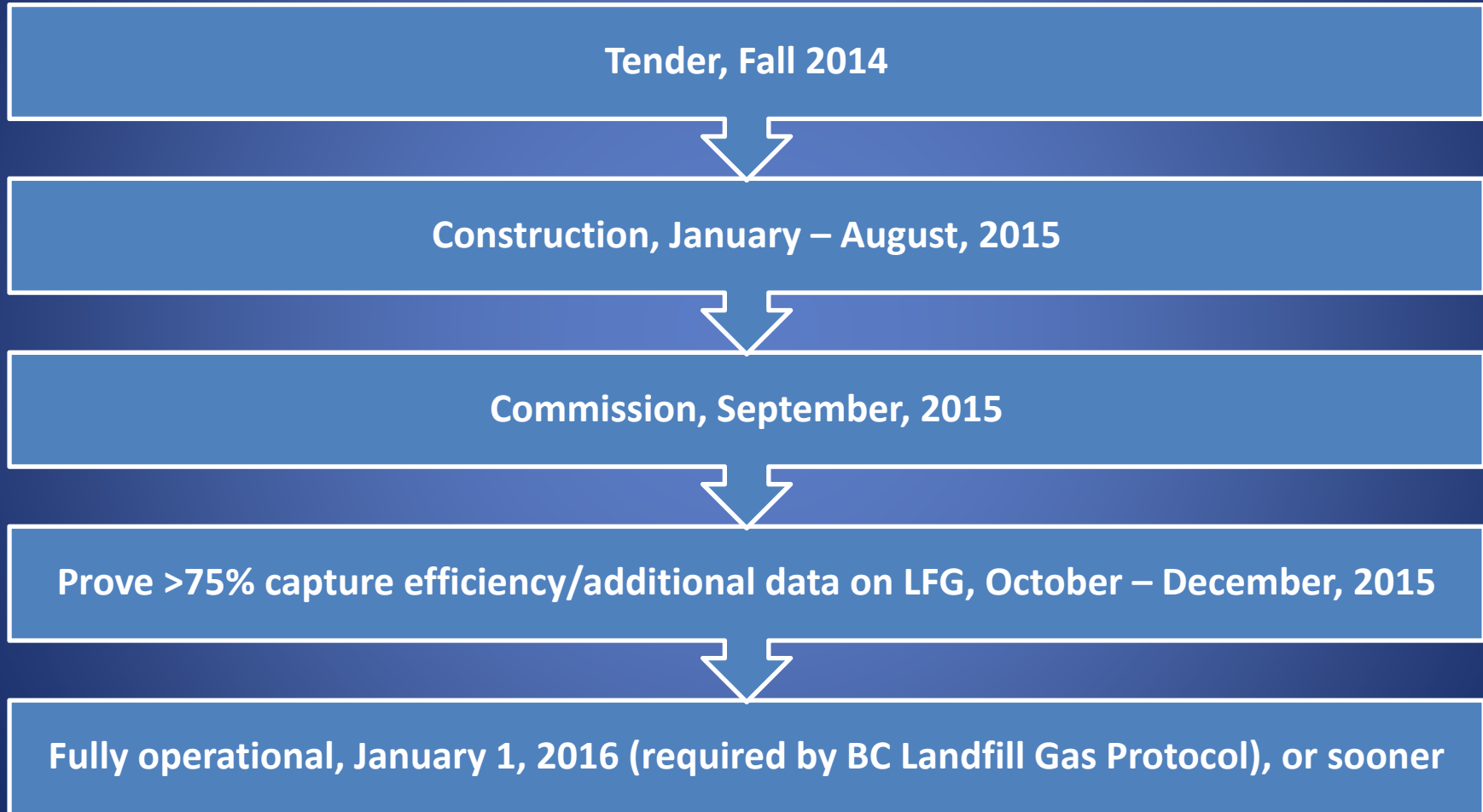
LANDFILL GAS COLLECTION SYSTEM



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PROPOSED SCHEDULE OF LFG COLLECTION SYSTEM



CVWMC LFG ALTERNATIVE END USE OPTIONS REVIEWED

POWER: Micro turbines, reciprocating engines

Heat: Greenhouse, boilers, furnaces, additional power (Organic Rankin Cycle).
No known end use of rejected heat

CHP: Combined Heat and Power

Vehicle Fleet: Convert to CNG (light duty vehicles or LNG (heavy duty vehicles). Not feasible for CVRD

Sell Gas: Clean up (CO_2 , H_2O , N_2 , H_2S) to P/L specifications and tie-in to BC Fortis P/L

→ Price of NG @ ~ \$14/GJ on the island makes Fortis BC P/L option economically attractive



PRELIMINARY COSTS

LFG UTILIZATION OPTIONS



Costs	Engines	MT
Capital technology	\$6,038,435	\$6,780,541
Capital treatment	\$1,650,000	\$1,650,000
Total Capital	\$7,688,435	\$8,430,541
Annual O/M, Technology	\$291,853	\$196,632
Annual O/M, Treatment	\$500,000	\$500,000
Total Annual O/M	\$791,853	\$696,632
Electricity Sold	\$1,945,684	\$1,638,602
Net annual return	\$1,153,831	\$941,970
Simple Payback (SPB), years	6.66	8.95

Sell Gas to Fortis	~ Costs
Capital (gas treatment)	\$2,550,000
Total Capital	\$2,550,000
Capital including 25% contingency	\$3,187,500
Annual O/M	\$845,000
Revenue from gas @ \$12/GJ	\$1,639,434
Net profit	\$794,434
Simple Payback (SPB), years	4.01

- Costs presented are for the future beneficial LFG utilization project (to be developed)
- Additionally, the CVRD will invest in the LFG collection system
- The LFG collection system is a legislated requirement

LANDFILL GAS CLEAN UP



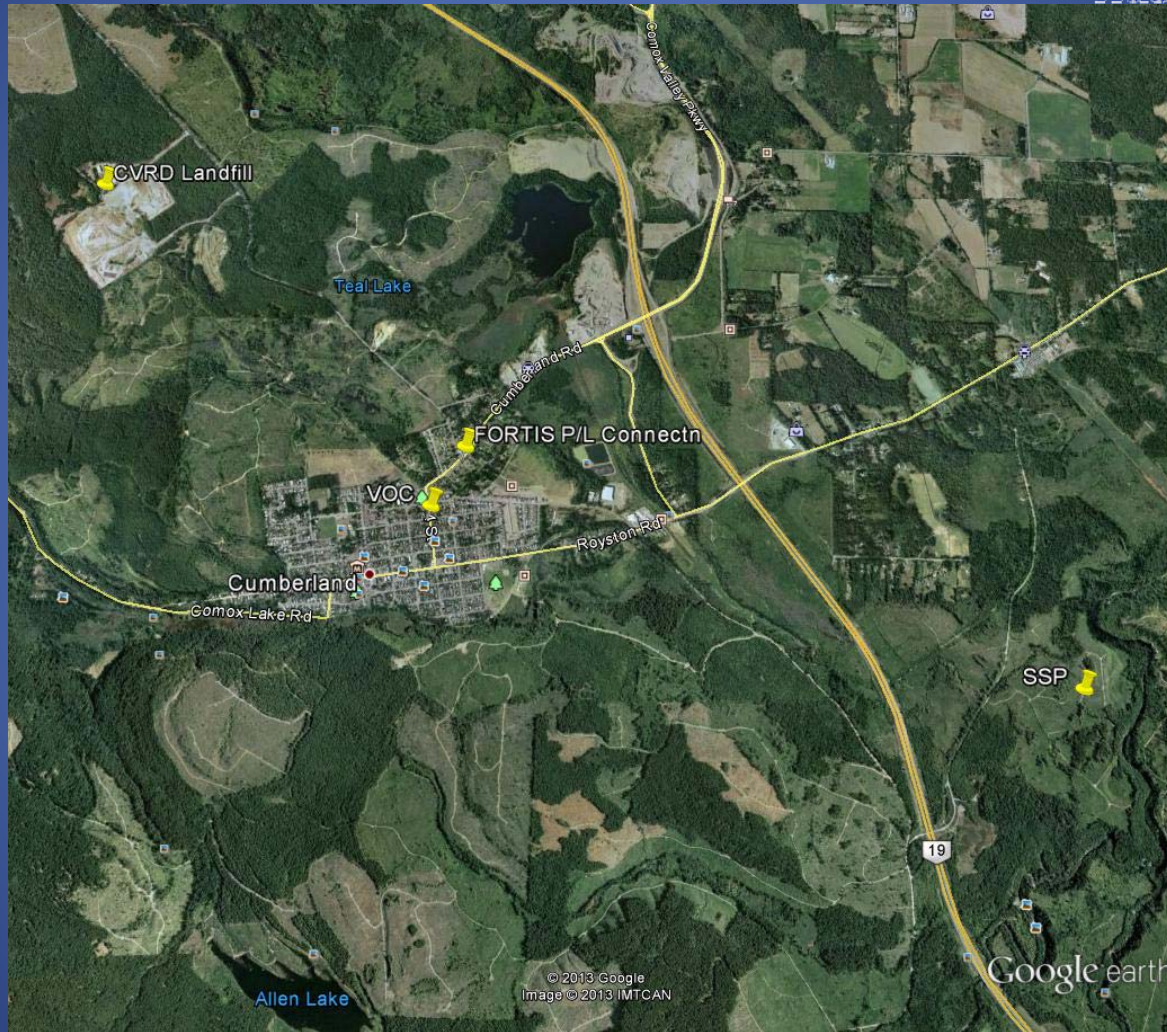
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LFG to be cleaned up
to Westcoast Energy
Pipeline (P/L)
specifications or specs
for other technology

Commission option



FORTIS PIPELINE AT BEVAN/CUMBERLAND ROAD



BUILDING PARTNERSHIP FORTIS PIPELINE OPTION



Initial discussions indicate synergies for business case/partnership

Submit Expression of Interest (EOI) in Fall, 2014

Business case – reliability of supply, quality of LFG (meet Waste-coast Energy P/L specs)

Technical feasibility, concept level design

Establish project economics: production cost < approved customer cost

Engage stakeholders - Seek Input

Sources for capital + external funding

Mitigation of any potential risks

MOU/Agreement –ownership, DBO, capital, GHG offsets

Regulatory approvals

Timeline for moving from concept to tie-in to the P/L

CARBON OFFSETS POTENTIAL



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CH₄ removal is the main contributor to carbon offsets/credits

~ 51,500 tonnes CO₂E/year (first estimate to be verified every year)

Carbon price: Approximately \$15/t - \$25/t (likely to rise)

Work with BC MoE Climate Action Secretariat

1 Unit of Carbon Offset = 1*CO₂ + 21*CH₄ + 310*N₂O (expressed as carbon dioxide equivalent emissions (CO₂E))

CO₂ = Carbon dioxide, CH₄ = Methane, N₂O = Nitrous oxide

CARBON OFFSETS BENEFITS



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~ 51,500 tonnes
CO₂E

Valued at ~ \$1.1
MM to \$1.8
MM annually

Equivalent to:

- Removing 10,800 passenger vehicles **or**
- 4,700 homes' energy use for 1 year



<http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>