BC Hydro
Power smart

6911 Southpoint Drive (B03)
Burnaby, BC
V3N 4X8

July 30, 2024

[redacted]

RE: CEAP IR 68 - Neskonlith 3 Project - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed Neskonlith 3 Project submitted under Attachment M-2: Transmission Service and Interconnection Service Procedures for Competitive Electricity Acquisition Process (CEAP) of the Open Access Transmission Tariff (OATT). This letter provides a non-binding good faith estimate of the cost and time to construct the facilities required to interconnect your project to BC Hydro's Transmission System, being the Network Upgrades, based on the findings of the Interconnection Feasibility study.

Open Access Transmission Tariff

The OATT defines Network Upgrades as additions, modifications, and upgrades to BC Hydro's Transmission System required at or beyond the Point of Interconnection to accommodate the interconnection of the Generating Facility to the BC Hydro's Transmission System. Pursuant to the OATT, BC Hydro will design, procure, construct, install, and own the Network Upgrades. While BC Hydro will pay the costs for the Network Upgrades, the Interconnection Customer provides security for such costs.

Cost Estimate

Based on the Interconnection Feasibility study, the non-binding good faith estimated cost (typical accuracy range of +150%/-50%) for Network Upgrades required to interconnect your project is $94.4M.

Major Scope of Work Identified:

- Acquire adequate property for a new substation close to the existing transmission line 1L209
- Construct a new outdoor 138kV, 3- circuit breaker ring bus switching substation
- Supply and install protection relays and other required protection equipment
- Supply and install microwave towers, waveguides, antennas, and other required telecommunications equipment

Exclusions:

- GST
- Right-of-way
- Permits

Key Assumptions:

- Construction by contractor
- 3 years of construction
- No expansion of existing stations or control buildings to accommodate new equipment
- Early Engineering and Procurement
- No piles will be required for construction
- No contaminated soil will be encountered during construction

Key Risks:

- Additional right of way or acquisition of more property may be required
- Existing microwave towers may need to be upgraded at various sites to accommodate new equipment leading to increased costs
- Transmission routing may be different than assumed, including number of disconnect switches and structure types may change
- No defined supply chain strategy, construction costs may increase depending on delivery method
- Cost of construction may increase based on geotechnical condition of the actual project site
- Project schedule may be longer than expected, leading to increased costs

Costs may be affected by market conditions and escalation. Please note that the Revenue Metering requirements and associated costs required to interconnect your project have not been determined at this stage and, therefore, not included in the above estimate. Revenue Metering costs that are attributable to the Interconnection Customer are to be paid in cash. For more details on Revenue Metering requirements and responsibilities, please refer to:

https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/distribution/standards/ds-rmr-complex-revenue-metering.pdf.

Schedule

Based on the Interconnection Feasibility study, the non-binding good faith estimated in-service date for your project's Network Upgrades is Quarter 3 2031 (calendar year). To achieve this timeline, we may need to expedite certain activities, including engineering design and procurement of long-lead equipment.

Timely actions required from you to minimize risks to the schedule:

- Submission of additional technical data required for the System Impact Study and Facilities Study
- Submission of any required information or document such as demonstration of Site Control
- Execution of Combined Study Agreement and Standard Generator Interconnection Agreement
- Financial commitments and securities

Please note that changes to your interconnection request, delays in data submission, or financial commitments may also impact the target in-service date.

Next Steps

In September 2024, we will issue a final invoice for the Feasibility Study costs. This invoice will reflect the total amount due, taking into account the $15,000 Feasibility Study deposit you have already paid and any remaining amount on the non-refundable $15,000 Interconnection request deposit that we did not spend in reviewing and validating your interconnection request.

If you have any questions, please contact the BC Hydro CEAP Team at ceap2024@bchydro.com.

Sincerely,

Senior Manager, Transmission Interconnections

BC Hydro

Encl.: CEAP2024_IR_68_Neskonlith 3_FeS_Report_final.pdf

[redacted]

Neskonlith-3 Wind Project

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 68

Prepared for: [redacted]

[redacted]

[redacted]

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Revision	Date	Description
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Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its Neskonlith-3 Wind Project (2024 CEAP IR # 68) to the BC Hydro (BCH) system. Neskonlith-3 Wind Project has fourteen (14) [redacted] type-4 wind turbine generators with total installed capacity of 49 MW. The proposed Point of Interconnection (POI) is on BC Hydro's 138 kV line 1L209, approximately 14 km southwest of Chase Substation (CHS). The IC's project will connect to the POI via a 2.3 km, 138 kV interconnection line. The IC's proposed commercial operation date (COD) is January 1, 2029.

To interconnect the Neskonlith-3 Wind Project and its facilities to the BCH Transmission System at the proposed POI, this Feasibility Study has identified the following conclusions and requirements:

1. A new 138 kV switching station (referred to as "P68T") on 1L209 is required at the proposed POI for interconnecting the IC's generating project to the BCH system. With the new switching station P68T, 1L209 will be segregated into three new lines, temporarily referred to as: 1L209_A (SAM - P68T), 1L209_B (P68T- VVW) and 1L209_C (P68T-P68). The temporary line designations will be replaced by permanent designations at a later stage of interconnection study.

2. The connection of Neskonlith-3 Wind Project does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal conditions.

3. In addition to entrance protection and 1L209_C line protection, the IC is required to install anti-islanding protection within their facility to disconnect the IC's wind farm from the grid when an inadvertent island with the local loads forms.

4. According to BC Hydro's TIR, the IC's project must have sufficient reactive power capability over full MW operating range including at the zero MW output level. The reactive power capability of Neskonlith-3 wind farm as submitted is slightly lower than what is required at the plant's maximum MW output, which is subjected to further verification in the next stage of interconnection study. Additionally, Neskonlith-3 wind farm does not meet the reactive capability requirement at zero MW output level.

5. BC Hydro will provide line protections for 1L209_A, 1L209_B, and 1L209_C (BC Hydro end only). As part of the line protection replacements/additions for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes. The IC shall provide required relays, telecom facility and associated equipment at its facilities to accommodate the new protection schemes which include IC's entrance protection and new line protection for 1L209_C.

The above conclusions are made based on the IC's input data and study assumptions listed in Section 4, which represent the best available information on May 22, 2024.

A non-binding good faith estimated cost and time to construct the Network Upgrades required to interconnect the proposed project will be provided in a separate letter to the IC.

Contents

Appendices

Acronyms

The following are acronyms used in this report.

BCH	BC Hydro
CEAP	Competitive Electricity Acquisition Process
COD	Commercial Operation Date
DTT	Direct Transfer Trip
EDM	Edmonds Office
ERIS	Energy Resource Interconnection Service
FeS	Feasibility Study
FVO	Fraser Valley Office
IBR	Inverter-Based Resources
IC	Interconnection Customer
MPO	Maximum Power Output
NERC	North American Electric Reliability Corporation
NRIS	Network Resource Interconnection Service
OATT	Open Access Transmission Tariff
POI	Point of Interconnection
SIO	South Interior Office
TIR	BC Hydro “60 KV to 500 kV Technical Interconnection Requirements for Power Generators”
WECC	Western Electricity Coordinating Council
WTG	Wind Turbine Generator

1 Introduction

Table 1-1 below summarizes the project reviewed in this Feasibility Study.

Table 1-1 Summary of Project Information

Project Name	Neskonlith-3 Wind Project	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	on 1L209, 14 km southwest of CHS	
IC's Proposed COD	January 1, 2029	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection [1] (MW)	47.6 MW (Summer)	47.6 MW (Winter)
Number of Generator Units	14 x 3.5 MW WTGs	
Plant Fuel	Wind	
Note 1: The maximum achievable power injection at the POI is approx. 47.6 MW after accounting for MW losses and service load which is lower than the IC proposed 49 MW.		

[redacted] the interconnection customer (IC), requests to interconnect its Neskonlith-3 Wind Project (2024 CEAP IR # 68) to the BC Hydro (BCH) system. Neskonlith-3 Wind Project has fourteen (14) [redacted] type-4 wind turbine generators with total installed capacity of 49 MW. The proposed Point of Interconnection (POI) is on BC Hydro's 138 kV line 1L209, approximately 14 km southwest of Chase Substation (CHS). The IC's project will connect to the POI via a 2.3 km, 138 kV interconnection line. The IC's proposed commercial operation date (COD) is January 1, 2029.

Figure 1-1 shows the Salmon Arm - Ashton Creek regional transmission system diagram. Ashton Creek substation (ACK) is a major substation in this area with a strong connection to the 500 kV backbone system. ACK presently supplies three 230 kV transmission lines — 2L240 to SAM substation, and 2L255 and 2L256 to Vernon Terminal substation (VNT).

SAM is a 230/138/60 kV substation that mainly supplies the local load of the area. At SAM, there is an autotransformer (SAM T4) that transfers power from 230 kV to 138 kV; SAM T4 is already heavily loaded under N-1 condition for the heavy summer scenarios. In addition, SAM also supplies the local 69 kV transmission system through a 138/69 kV transformer (SAM T6).

SAM also connects to two 230/138 kV substations via two long distance 138 kV lines that supply the tapped load along the path:

- SAM to Valleyview (VVW) via 1L209 with Sorrento Substation (STO), Chase Substation (CHS), and Lafarge Cement No.2 Substation (LF2) tapped on the path.
- SAM to VNT via 1L218 with Enderby Substation (END), Armstrong Substation (ARM), Armstrong Wood Waste Co-Gen (RVG), and Armstrong Division Substation (RVS) tapped on the path.

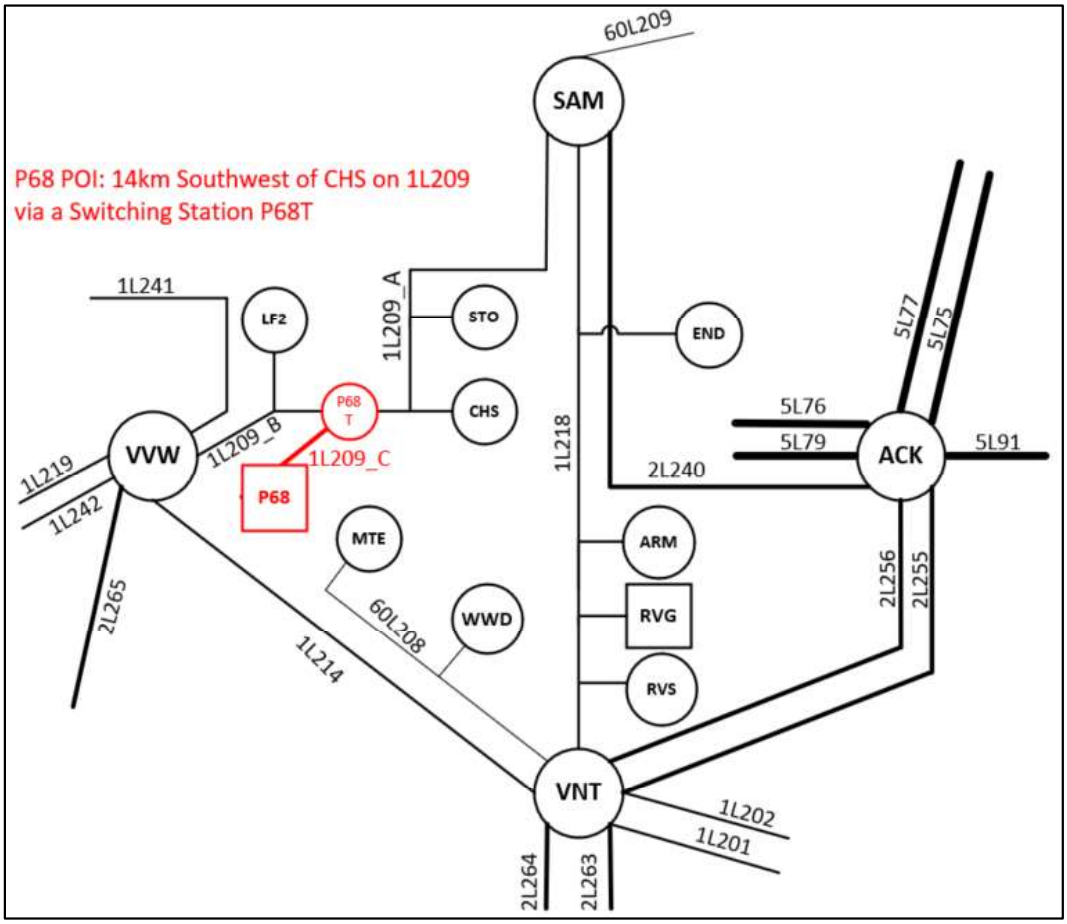

Figure 1-1: Salmon Arm - Ashton Creek region and POI of Project Neskonlith-3 – 1L209 - 49MW (P68)

There are several high-queued load interconnections and their associated network upgrades in the study region. The relevant network upgrades being planned in the study region are as follows.

- Nicola Substation Transformation Capacity Reinforcement: this project will add a new 230 kV/138 kV transformer at NIC (i.e. NIC T7) to mitigate the possible transformer overload associated with the industrial load increase in Highland region.
- 1L243 reconductoring: this line rating upgrade is required to accommodate an industrial load increase in Highland region.
- 1L251 series capacitor project: Line 1L251 will be series compensated to accommodate an industrial load increase on 1L251.

2 Purpose and Scopes of Study

This Feasibility Study is a preliminary evaluation of the system impact of interconnecting the proposed project to the BC Hydro system based on power flow and short circuit analysis in accordance with BCH's Open Access Transmission Tariff (OATT). A non-binding good faith estimated cost of required Network Upgrades and estimated time to construct will be provided.

Per OATT, the feasibility study is performed individually for each of the participating projects in the CEAP process and focuses specifically on the BC Hydro regional transmission system where the proposed generating project is connected. An assessment of the incremental effect on the 500kV bulk transmission system is beyond this study scope.

This is a "limited scope" study which is restricted to power flow studies of Categories P0, P1, and P2 planning events as defined in TPL-001-4 , Table 1 and short circuit analysis. The study does not address other technical aspects such as transient stability and switching transients and impact of multiple contingencies. These subjects would be addressed in subsequent System Impact Study if the project proceeds further.

In case impact to the adjacent external systems to BC Hydro is observed, such impact would be addressed in subsequent detailed and coordinated studies with the relevant adjacent entities if the proposed interconnection proceeds further.

3 Standard and Criteria

The Feasibility Study is performed in compliance with the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) reliability standards, and the BCH interconnection requirements in the TIR, and upon the ratings of the existing BCH transmission facilities described in Operating Orders, specifically:

- NERC standards: TPL-001-4 and FAC-002-3 relevant to the scope of this Feasibility Study.
- WECC criteria TPL-001-WECC-CRT-4 Transmission System Planning Performance, July 1, 2023.
- BC Hydro's 60 kV to 500 kV Technical Interconnection Requirements for Power Generators.
- BC Hydro Operating Order 5T-10, Ratings for All Transmission Circuits 60 kV or Higher, April 16, 2024.
- BC Hydro Operating Order 5T-14, Ratings for All Transmission and Distribution Transformer, November 8, 2022.
- BC Hydro System Operating Order 7T-22 System Voltage Control, September 19, 2023.

4 Assumptions and Conditions

This Feasibility Study is performed based on the IC's submitted data and information available to BC Hydro on May 22, 2024 for the study purpose. Appendix A shows the plant single line diagram for the IC's project used in the study model. Certain assumptions were, as set out below, made to the extent required.

The power flow study cases used in this Feasibility Study are established based upon the BC Hydro's base resource plan and load forecasts available at the time of performing the study, which includes existing and future generations, transmission facilities, and loads in addition to the subject interconnection project in this study. Applicable seasonal conditions and the appropriate study years for the study planning horizon are also incorporated.

Additional assumptions are listed as follows.

1) The regional generation are dispatched to the patterns that stress the transmission system in the study area. In these patterns, the regional generations are typically set to their Maximum Power Outputs (MPO) unless otherwise specified.

2) West Kelowna Transmission Project (WKTP) is not included in the Feasibility Study model, as the project scope is undetermined at the time of performing this study.

3) For the purpose of performing this study, Nicola Substation Transformation Capacity Reinforcement project (i.e. addition of NIC T7) and 1L243 reconductoring is assumed completed by the time the IC's generating project enters service.

4) 1L243 after reconductoring is assumed to have a conductor rating of 1145 A (summer) and 1388 A (winter).

5 System Studies and Results

Based upon the IC's submitted information and the area system conditions, a new switching station (referred to as "P68T") at the proposed POI on 1L209 is required to interconnect the IC's generating project to the BCH system. There are multiple terminals and multiple sources on the existing line 1L209. The addition of the new switching station would help to maintain reliability and adequate protection performance to serve the existing customers and the new addition.

5.1 Power Flow Study Results

Power flow studies were performed to evaluate whether the IC's generating project would cause any unacceptable system performance (e.g. equipment overloads, steady-state voltage violation and voltage instability) and to determine the reinforcement requirement based on steady state performance analysis.

The study focuses on the 2029 light summer (29LS) system load conditions which are typically stressed conditions for a generation interconnection project, taking into considerations of factors such as load conditions, seasons and generation patterns. The 2029 heavy summer (29HS) and 2028 heavy winter (28HW) cases are also checked at a high level to capture any possibility of performance violations under high load conditions.

5.1.1 Branch Loading Analysis

Table 5-1 shows a summary of branch loading analysis under system normal and single contingencies (Categories P1 and P2) for various load conditions. There is no branch overload identified under system normal and single contingency conditions.

Table 5-1: Summary of Branch Loading Analysis Results

Case	IC's Plant Output	Contingency		Branch Loading		
				SAM T4	1L209_A	1L209_B
		Cat.	Description		CHS-P68T	P68T-LF2
Winter Rating				178 MVA	160.9 MVA	160.9 MVA
28HW	Max	P0	System Normal	66%	10%	23%
	Max	P1	2L255	78%	11%	22%
	Max	P2	1L218 VNT Open	68%	12%	22%
	Max	P2	1L209 SAM Open	54%	30%	6%
	Max	P2	1L209 VVW Open	55%	29%	1%
Summer Rating						
29HS	Max	P0	System Normal	77%	10%	38%
	Max	P1	2L255	92%	12%	36%
	Max	P2	1L218 VNT Open	81%	13%	37%
	Max	P2	1L209 SAM Open	63%	36%	15%
	Max	P2	1L209 VVW Open	64%	39%	1%
29LS	Max	P0	System Normal	43%	5%	48%
	Max	P1	2L255	50%	4%	47%
	Max	P2	1L218 VNT Open	44%	5%	48%
	Max	P2	1L209 SAM Open	32%	17%	27%
	Max	P2	1L209 VVW Open	23%	41%	1%

5.1.2 Steady-State Voltage Analysis

With the connection of the IC's project, the voltage performance under system normal condition and single contingencies is acceptable for all the three load conditions (28HW, 29HS, and 29LS). Table 5-2 shows a summery of steady-state voltage performance under various system conditions and contingencies.

Table 5-2: Summary of Steady-State Voltage Study Results

Case	IC's Plant Output	Contingency		Bus Voltage (PU)			
		Cat.	Description	P68T 138	SAM 138	VVW 138	VNT 138
28HW	Max	P0	System Normal	1.01	1.02	1.02	1.02
	Max	P1	2L255	1.01	1.02	1.02	1.02
	Max	P2	1L218 VNT Open	1.01	1.01	1.02	1.03
	Max	P2	1L209 SAM Open	1.01	1.03	1.02	1.03
	Max	P2	1L209 VVW Open	1.01	1.02	1.02	1.02
29HS	Max	P0	System Normal	1.01	1.02	1.02	1.03
	Max	P1	2L255	1.01	1.02	1.02	1.02
	Max	P2	1L218 VNT Open	1.01	1.02	1.02	1.03
29LS	Max	P0	System Normal	1.01	1.03	1.02	1.03
	Max	P1	2L255	1.01	1.03	1.02	1.03
	Max	P2	1L218 VNT Open	1.01	1.02	1.02	1.03

5.1.3 Reactive Power Capability Evaluation

The BC Hydro TIR requires IBR power plant to have the dynamic reactive power capability at a minimum of +/- 33% of its MPO at the high voltage side of the IC's switchyard over the full MW operating range.

Based on the PSS/E power flow data submitted by the IC, the study finds that the reactive capability of the proposed generating project is slightly lower than what is required to meet the BC Hydro's TIR. Extra reactive power device may be needed in this generation project; further verification will be performed in the next phase of the project using dynamic simulation studies.

Furthermore, the BCH TIR requires the IC's project to provide sufficient reactive power capability over full MW operating range including at zero MW output level. The proposed wind farm does not meet this requirement at near zero MW output.

5.1.4 Anti-Islanding Requirements

The IC is required to install anti-islanding protection within its facility to disconnect the IC's wind farm from the grid when an inadvertent island with the local load forms.

5.2 Fault Analysis

The short circuit analysis in the FeS is based upon the latest BC Hydro system model, which includes the generating facility information and associated impedance data provided by the IC. A more detailed study will be performed at the system impact study stage if needed.

5.3 Stations Requirements

A new outdoor 138 kV, 3-circuit breaker ring bus switching substation (refer to as "P68T") will be built at POI, close to the existing 138 kV transmission line 1L209. The existing transmission line 1L209 will be cut and looped in to, and 138 kV line of Neskonlith-3 Wind will be terminated at the new substation.

The scope of work at the new switching station P68T is as follows.

- Acquire adequate property for a new substation close to the existing transmission line 1L209.

- Construct a new outdoor 138 kV, three-circuit breaker ring bus switching substation. Refer to the one-line sketch in Appendix B for details.
  Note:
  - The designations of the new station, the new line connecting to the customer and the two new lines derived from 1L209 will be assigned in later stage.
  - The Installation location of the metering kits will be decided in later stage.

5.4 Protection & Control Requirements

BC Hydro will provide line protections for 1L209_A (SAM - P68T), 1L209_B (P68T-VVW) and 1L209_C (P68T-P68, BC Hydro end only). As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes.

The IC is to provide the following for the interconnection of Neskonlith-3 wind project :

- Entrance protection that complies with the latest version of the “60 kV to 500 kV BC Hydro Technical Interconnection Requirements for Power Generators.”
- Provide two SEL-411L-1 relays (firmware and options specified by BC Hydro) at the entrance of P68 to provide protection coverage for 1L209_C. BC Hydro P&C Planning will provide core protection settings for these relays to protect transmission line 1L209_C during a transmission line fault. Non-core protection such as local breaker failure, auto-reclosing, backup protection for station elements will not be provided by BC Hydro P&C Planning.
- The IC is responsible for NERC PRC-related tasks, settings to compliance standards within their facilities.
- The IC is responsible for providing a communications link for remote interrogation of the PPIS equipment by BCH servers.
- Provide anti-islanding protection as stated in Section 5.1.

5.5 Telecommunications Requirements

BC Hydro performed a high-level feasibility assessment of a telecom solution to meet the following requirements.

Teleprotection Requirements for Telecom

- WECC Level 3 PY & SY, SAM – P68T, with C37.94 interfaces.
- WECC Level 3 PY & SY, P68T – VVW, with C37.94 interfaces.
- WECC Level 3 PY & SY, P68T – P68, with C37.94 interfaces.

Telecontrol Requirements for Telecom

- One P68 SCADA circuit off FVO & SIO.
- One P68T SCADA circuit off FVO & SIO.
- One P68T REMACC circuit off EDM.

Other Requirements for Telecom

- None identified.

Certain assumptions were made for determining a potential telecom solution. Details of the telecom solution (e.g. assumptions made, alternatives investigated and work required for BCH and the IC) would be provided at the next study stage.

6 Cost Estimate and Schedule

The non-binding good faith estimated cost and time to construct the Network Upgrades required to interconnect the proposed project will be provided in a separate letter to the IC.

7 Conclusions

To interconnect the Neskonlith-3 Wind Project and its facilities to the BCH Transmission System at the POI, this Feasibility Study has identified the following conclusions and requirements:

1. A new 138 kV switching station (referred to as "P68T") on 1L209 is required at the proposed POI for interconnecting the IC's generating project to the BCH system. With the new switching station P68T, 1L209 will be segregated into three new lines, temporarily referred to as: 1L209_A (SAM - P68T), 1L209_B (P68T- VVW) and 1L209_C (P68T-P68). The temporary line designations will be replaced by permanent designations at a later stage of interconnection study.

2. The connection of Neskonlith-3 Wind Project does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal conditions.

3. In addition to entrance and 1L209_C line protection, the IC is required to install anti-islanding protection within their facility to disconnect the IC's wind farm from the grid when an inadvertent island with the local loads forms.

4. According to BC Hydro's TIR, the IC's project must have sufficient reactive power capability over full MW operating range including at the zero MW output level. The reactive power capability of Neskonlith-3 wind farm as submitted is slightly lower than what is required at the plant's maximum MW output, which is subjected to further verification in the next stage of interconnection study. Additionally, Neskonlith-3 wind farm does not meet the reactive capability requirement at zero MW output level.

5. BC Hydro will provide line protections for 1L209_A, 1L209_B, and 1L209_C (BC Hydro end only). As part of the line protection replacements/additions for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes. The IC shall provide required relays, telecom facility and associated equipment at its facilities to accommodate the new protection schemes which include IC's entrance protection and new line protection for 1L209_C.

Appendix A
Plant Single Line Diagram Used for Power Flow Study

Figure A-1 shows Neskonlith-3 Wind Project single line diagram used for power flow study.

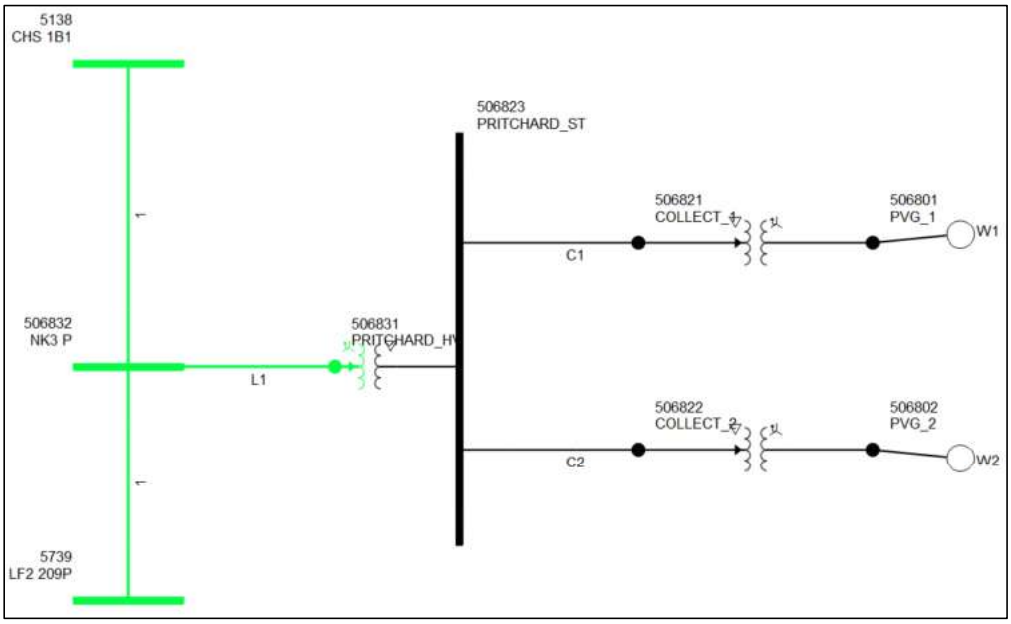

Figure A-1: Neskonlith-3 Wind Project Single Line Diagram for Power Flow Study.

As seen in the diagram, Neskonlith-3 Wind Project has one main power transformers and two (2) feeders connecting fourteen (14) wind turbines to the collector station.

Appendix B
One-Line Sketch for New Switching Station

Figure B-1 shows the Stations Planning One-Line Sketch for the New Switching Station P68T.

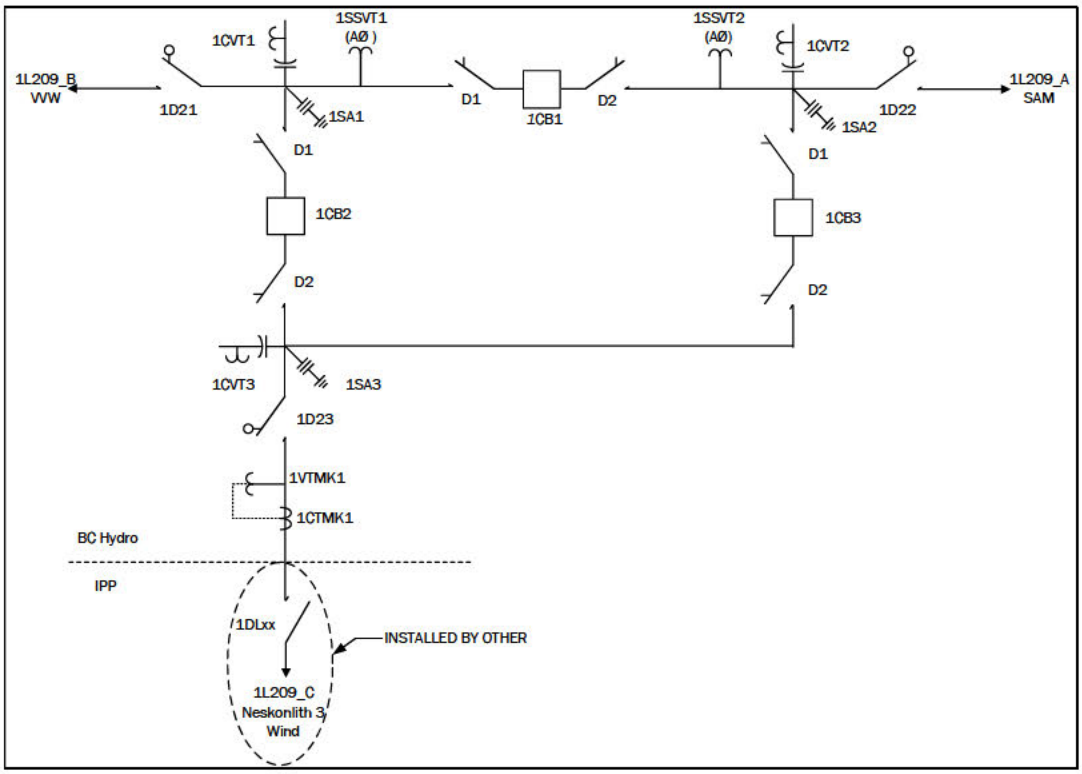

Figure B-1: Stations Planning One-Line Sketch for the New Switching Station P68T.