BC Hydro
Power smart

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

July 30, 2024

[redacted]

[redacted]

Dear [redacted]:

RE: CEAP IR 43 - [redacted] - Interconnection Feasibility Study Report

Enclosed is the Interconnection Feasibility study report for the proposed [redacted] 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 $19.6 M.

Major Scope of Work Identified:

- Supply and install 138kV tap structure and three disconnect switches with associated structures
- Supply and install one dead-end structure as the demarcation point between BCH and customer
- Supply and install telecom towers, racks, passive reflectors, waveguides and antennas
- Install digital teleprotection circuits and connect to protective equipment.
- Supply and install protection relays and other required protection equipment
- Telecom and Protection work, as required

Exclusions:

- GST
- Right-of-Way
- Permits

Key Assumptions:

- Construction will be done by contractor
- Early Engineering and Procurement3 years of construction

Key Risks:

- Transmission routing may be different than assumed, including number of disconnect switches and structure types may change
- Additional right of way or acquisition of more property may be required
- No defined supply chain strategy, construction costs may increase depending on delivery method
- 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 2, 2030 (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,

[redacted]

Senior Manager, Transmission Interconnections

BC Hydro

Encl.: CEAP2024_IR_43_[redacted]FeS_Report_final.pdf

[redacted]

[redacted] (POI at 1L203)

Interconnection Feasibility Study

BC Hydro EGBC Permit to Practice No: 1002449

2024 CEAP IR # 43

Prepared for: [redacted]

[redacted]

[redacted]

Report Metadata

Header:	[redacted]POI at 1L203)
Subheader:	Interconnection Feasibility Study
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Revisions

Revision	Date	Description
0	2024 Jun	Initial release

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Executive Summary

[redacted] the interconnection customer (IC), requests to interconnect its [redacted] (2024 CEAP IR # 43) to the BC Hydro (BCH) system. [redacted] has twenty-eight (28) inverters [redacted], adding a total capacity of 104 MW. The proposed Point of Interconnection (POI) is on BC Hydro's 138 kV transmission line 1L203, approximately 16.5 km from Highland Substation (HLD). The IC's project will connect to the POI via a 1.5km, 138 kV interconnection line. The IC's proposed commercial operation date (COD) is October 1, 2028.

To interconnect the [redacted] and its facilities to the BCH Transmission System at the proposed POI, this Feasibility Study has identified the following conclusions and requirements:

1. The T-tap connection on the BCH's existing circuit 1L203 is acceptable for interconnecting the IC's generating project to the BCH system.
2. The connection of [redacted] does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal and single contingency conditions.
3. In addition to entrance protection and 1L203 line protection, the IC is required to install anti-islanding protection within their facility to disconnect the [redacted] from the grid when an inadvertent island with 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 [redacted] as submitted does not meet the reactive capability requirement at zero MW output level, which will need to be addressed.
5. At the POI, BCH will design and build the tap that will include a tap structure and up to three switch structures. Additional Right-of-Way (ROW) may be required to accommodate the tap.
6. BC Hydro will replace 1L203 line protections at Highland Substation (HLD) and Savona Substation (SVA). As part of the line protection replacements, 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.

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
ERIS	Energy Resource Interconnection Service
FeS	Feasibility Study
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
RAS	Remedial Action Scheme
TIR	BC Hydro “60 KV to 500 kV Technical Interconnection Requirements for Power Generators”
WECC	Western Electricity Coordinating Council
EDM	Edmonds Office
FVO	Fraser Valley Office
SIO	South Interior Office

1 Introduction

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

Table 1-1 Summary of Project Information

Project Name	[redacted]	
Name of Interconnection Customer (IC)	[redacted]	
Point of Interconnection (POI)	Line 1L203, 16.5 km from HLD	
IC's Proposed COD	1st October 2028	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection [1] (MW)	102 MW (Summer)	102 MW (Winter)
Number of Generator Units	28 x 3.71 MW	
Plant Fuel	Solar	

[redacted] the interconnection customer (IC), requests to interconnect its [redacted](2024 CEAP IR # 43) to the BC Hydro system. [redacted]has twenty-eight (28) inverters [redacted], adding a total installed capacity of 104 MW. The proposed Point of Interconnection (POI) is on BC Hydro's 138 kV transmission line 1L203, approximately 16.5 km from Highland Substation (HLD). The IC's project will connect to the POI via a 1.5 km, 138 kV interconnection line. The IC's proposed commercial operation date (COD) is Oct 1, 2028.

Figure 1-1 shows the Nicola-Highland region transmission system diagram. Nicola substation (NIC) is a major substation in this area with two existing 500/230 kV transformers (NIC T2 & T3) and two 230/138 kV transformers (NIC T5 & T6). NIC presently supplies three 138 kV transmission lines — 1L251 to the [redacted] Copper Mountain substation (CUM) and Similco substation (SCO), 1L243 to BC Hydro's Highland substation (HLD) and 1L244 to BC Hydro's Westbank substation (WBK).

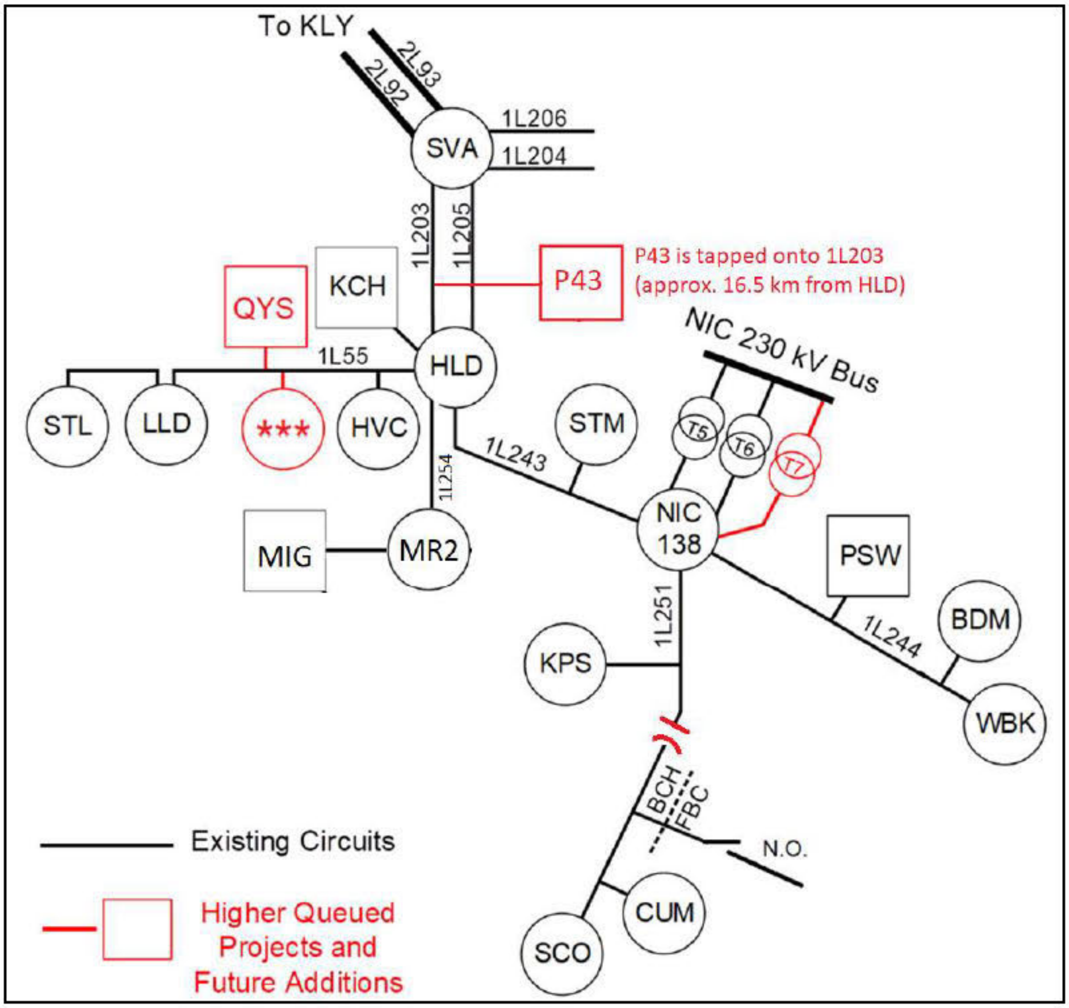

Figure 1-1: Nicola-Highland region 138/230 kV Transmission System Diagram

HLD is a 138/60 kV substation that mainly supplies the industrial customer of Highland Valley Copper. It also interconnects two power plants owned by independent power producers (IPP) in the region:

- Kwoiek Creek Generating Station (KCH) with a total capacity of 60 MW is connected to HLD via a 72.7 km, 138 kV transmission line 1L57.
- Merritt Green Energy Project Generating Station (MIG) with a total capacity of 40 MW is connected to Merritt 2 Substation (MR2) which is fed by 1L254 from HLD.

In addition to these existing IPPs, quA-ymn Solar farm (QYS) is a 15 MW IPP generating project under construction in the region. It will connect to to BC Hydro system via a tap on 1L55 at approximately 22.5 km from HLD.

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 proposed to be constructed. 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 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 is a Successful Participant of the CEAP.

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) The projected in-service date for 1L251 series capacitor project is not available. For the sole purpose of delivering this Feasibility Study, it is assumed the series capacitor will enter service in early 2028.

5 System Studies and Results

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.

Steady-state power flow studies have been conducted with the focus on the first year of operation which is typically a stressed condition for a generation interconnection project. The study condition takes into considerations of factors such as load conditions, seasonal variation in ambient temperatures, and generation patterns. The 28HW, 29HS, and 29LS cases are studied to capture any performance violations under different 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. For all the studied load conditions (28HW, 29HS, and 29LS), 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		
				1L203	1L203	1L205
		Cat.	Description	SVA-P43POI	HLD- P43POI	HLD-SVA
Winter Rating				191.2 MVA	191.2 MVA	149.6 MVA
28HW	Max	P0	System Normal	38%	18%	21%
	Max	P1	5L87	41%	15%	24%
	Max	P1	1L205	46%	14%	-
	Max	P1	1L243	39%	20%	23%
	Max	P2.1	1L203 Open at SVA	-	55%	49%
Summer Rating				172.8 MVA	172.8 MVA	118.6 MVA
29HS	Max	P0	System Normal	46%	17%	31%
	Max	P1	5L87	54%	9%	43%
	Max	P1	1L205	57%	14%	-
	Max	P1	1L243	45%	20%	32%
	Max	P2.1	1L203 Open at SVA	-	61%	70%
29LS	Max	P0	System Normal	48%	13%	35%
	Max	P1	5L87	62%	4%	53%
	Max	P1	1L205	62%	10%	-
	Max	P1	1L243	50%	14%	37%
	Max	P2.1	1L203 Open at SVA	-	61%	77%

5.1.2 Steady-State Voltage Analysis

For all the studied load conditions (28HW, 29HS, and 29LS), the voltage performance under system normal condition (Category P0) and single contingency (Categories P1 and P2) is acceptable.

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

Case	IC's Plant Output	Contingency		Bus Voltage (PU)		
		Cat.	Description	HLD 138	SVA 138	WKA 138
28HW	Max	P0	System Normal	1.01	1.02	1.01
	Max	P1	5L87	1.01	1.02	1.01
	Max	P1	1L205	1.01	1.02	1.01
	Max	P1	1L243	1.01	1.02	1.01
	Max	P2.1	1L203 Open at SVA	1.02	1.02	1.01
29HS	Max	P0	System Normal	1.01	1.02	1.01
	Max	P1	5L87	1.01	1.02	1.01
	Max	P1	1L205	1.01	1.02	1.01
	Max	P1	1L243	1.01	1.02	1.01
	Max	P2.1	1L203 Open at SVA	1.02	1.02	1.01
29LS	Max	P0	System Normal	1.01	1.02	1.01
	Max	P1	5L87	1.01	1.02	1.01
	Max	P1	1L205	1.02	1.02	1.01
	Max	P1	1L243	1.01	1.02	1.01
	Max	P2.1	1L203 Open at SVA	1.01	1.02	1.01

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 proposed generating project would be capable of to meet the BC Hydro's reactive capability requirement at the plant's maximum MW output, which is subjected to further verification in the next stage of interconnection study.

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, which will need to be addressed.

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

The POI of [redacted] is a tap connection on 138 kV 1L203 line. No station work is required.

5.4 Transmission Line Requirements

At the POI, BCH will design and build the tap that will include a tap structure and up to three switch structures. A 152 kV rated disconnect switch will be installed to isolate the IC's facilities from the BCH system. Two 152 kV rated disconnect switches will be installed to isolate the trunk circuit on both sides. Additional Right-of-Way (ROW) may be required to accommodate the tap.

5.5 Protection & Control Requirements

For successful integration of [redacted] (P43), the line protection relays at BC Hydro's Highland Substation (HLD) and Savona Substation (SVA) for 1L203 will be replaced. As part of the line protection replacement, telecommunication facilities will be required for each of the three substations.

The IC, [redacted] to provide the following for the interconnection of [redacted] (P43):

- 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) relays at the entrance of [redacted] (P43) to provide protection coverage for 1L203. BC Hydro P&C Planning will provide core settings for these relays to protect transmission line 1L203 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 line protection relays and PPIS equipment by BCH servers.

5.6 Telecommunications Requirements

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

Teleprotection Requirements for Telecom

- Provide WECC Level 3 64 kbps synchronous circuits between HLD and SVA, with C37.94 interfaces.
- Provide WECC Level 3 64 kbps synchronous circuits between HLD and [redacted] (P43), with C37.94 interfaces.
- Provide WECC Level 3 64 kbps synchronous circuits between SVA and [redacted] (P43), with C37.94 interfaces.

Telecontrol Requirements for Telecom

- [redacted] (P43) SCADA circuit off FVO & SIO.

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 [redacted] and its facilities to the BCH Transmission System at the POI, this Feasibility Study has identified the following conclusions and requirements:

1. The T-tap connection on the BCH's existing circuit 1L203 is acceptable for interconnecting the IC's generating project to the BCH system.
2. The connection of [redacted] does not cause any performance violation (i.e. thermal overload, voltage performance violation or voltage stability concern) under system normal and single contingency conditions.
3. In addition to entrance protection and 1L203 line protection, the IC is required to install anti-islanding protection within their facility to disconnect the [redacted] from the grid when an inadvertent island with 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 [redacted] as submitted does not meet the reactive capability requirement at zero MW output level, which will need to be addressed.
5. At the POI, BCH will design and build the tap that will include a tap structure and up to three switch structures. Additional Right-of-Way (ROW) may be required to accommodate the tap.
6. BC Hydro will replace 1L203 line protections at Highland Substation (HLD) and Savona Substation (SVA). As part of the line protection replacements, 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.

Appendix A

Plant Single Line Diagram Used for Power Flow Study

Figure A-1 shows [redacted] single line diagram used for power flow study.

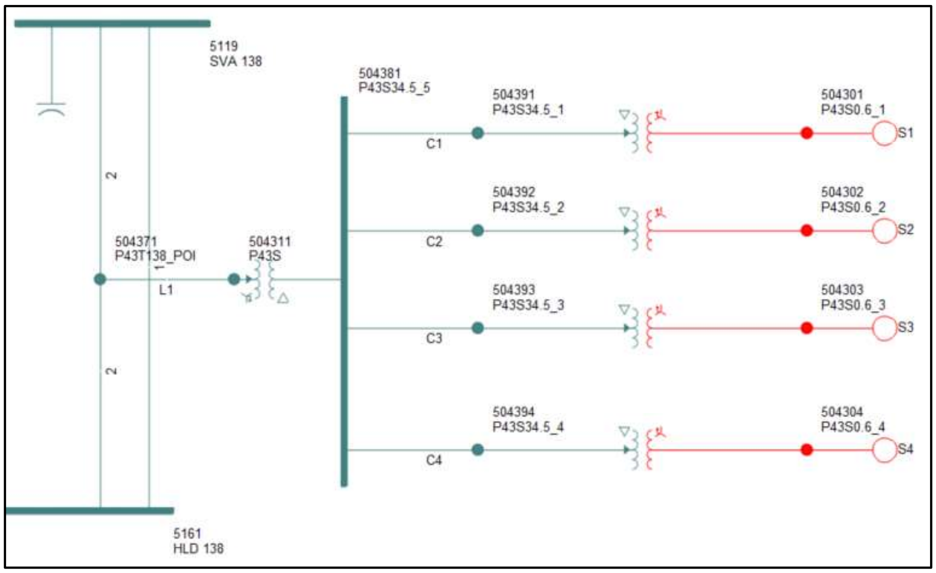

Figure A-1: [redacted] Single Line Diagram for Power Flow Study.

As seen in the diagram, [redacted] (POI at 1L203) has a main power transformer to connect four (4) feeders which connected with solar inverters.