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July 23, 2021

Mr. Patrick Wruck
Commission Secretary and Manager
Regulatory Support
British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC V6Z 2N3

Dear Mr. Wruck:

**RE: British Columbia Utilities Commission (BCUC or Commission)**
**British Columbia Hydro and Power Authority (BC Hydro)**
**Bridge River Projects**

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BC Hydro is filing the attached application to the BCUC, pursuant to sections 45 and 46 of the *Utilities Commission Act*, for Certificates of Public Convenience and Necessity (**CPCN**) for the Bridge River 1 Units 1 to 4 Generator Replacement Project and the Bridge River Transmission Project.

BC Hydro is providing the Application as follows:

- Application;
- Application – Chapters 5 and 11 (Confidential Version);
- A Appendices;
- Appendices A-6-2 to A-6-5, A-6-8 (Confidential Version);
- B Appendices;
- Appendices B-2, B-3, B-5 to B-10, B-11, B-13 (Confidential Version);
- C Appendices; and
- Appendices C-1, C-3, C-4, C-9 (Confidential Version).

BC Hydro requests that certain information in the following chapters and appendices be held confidential in accordance with Part IV of the BCUC's Rules of Practice and Procedure.

- Chapter 5 – BR1 Project Description and Impacts;
- Chapter 11 – BRT Project Indigenous Nations Consultation & Public Engagement;

- Appendix A-6-2 to Appendix A-6-5 – Settlement Agreements;
- Appendix A-6-8 - Example of Consultation Material;
- Appendix B-2 – Bridge River System Studies;
- Appendix B-3 – Facility Asset Plans;
- Appendix B-5 – BR1 Alternative Assessment Financial Model;
- Appendix B-6 – BR1 Summary of Power Benefits Study;
- Appendix B-7 – BR1 Preliminary Design Report;
- Appendix B-8 – BR1 Project Procurement Decision;
- Appendix B-9 – BR1 Preliminary Cost Estimate;
- Appendix B-10 – BR1 Project Expenditure Breakdown by Year;
- Appendix B-11 - BR1 Rate Impact Models
- Appendix B-13 – BR1 Environmental Impact Statement;
- Appendix C-1 – Transmission Studies;
- Appendix C-3 – Bridge River Transmission Project Alternative Assessment Financial Model;
- Appendix C-4 – Bridge River Transmission Project Conceptual Design Report; and
- Appendix C-9 – Bridge River BRT Project Stakeholder Engagement Materials

In these chapters and appendices, BC Hydro has redacted commercially sensitive information related to BC Hydro’s cost estimates and past settlements which could prejudice BC Hydro’s position in future negotiations.

For the purpose of this proceeding and on appropriate undertakings, as contemplated by the BCUC’s Rules of Practice and Procedure, BC Hydro can make this information available to registered interveners. BC Hydro reserves the right to object to a request for access to confidential information on a case-by-case basis.

Communications on the Application should be directed to:

| | |
|---|---|
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Yours sincerely,

Chris Sandve
Chief Regulatory Officer

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Enclosure

# Summary Table of Contents

## BC Hydro Bridge River Projects

### Chapter 1. Executive Summary

1.1 Introduction ........ 1-1
1.2 BR1 Project Highlights ........ 1-5
  1.2.1 Description of the Bridge River Generation System and Bridge River Facility ........ 1-5
  1.2.2 BR1 Project is Needed to Address the Deteriorating Condition of Units 1 to 4 at the Bridge River 1 Generating Station ........ 1-6
  1.2.3 Preferred Alternative to Replace Unit 1 to 4 Generators Maximizes Reliability and Minimizes Environmental Impact, Cost and Cost Risk and Safety Risk ........ 1-7
  1.2.4 BR1 Project Description, Schedule and Impacts ........ 1-8
  1.2.5 BR1 Project Indigenous Nations Consultation and Stakeholder Engagement ........ 1-11
  1.2.6 BR1 Project Risks ........ 1-12
1.3 BRT Project Highlights ........ 1-13
  1.3.1 Description of the Bridge River Transmission System ........ 1-13
  1.3.2 BRT Project is Needed to Address System Constraints and Asset Health Issues ........ 1-15
  1.3.3 Leading Alternative is to Increase the Maximum Capacity of the 2L90 Circuit ........ 1-16
  1.3.4 BRT Project Description, Schedule and Impacts ........ 1-17
  1.3.5 BRT Project Indigenous Nations Consultation and Stakeholder Engagement ........ 1-19
  1.3.6 BRT Project Risks ........ 1-20
1.4 BC Hydro’s Capability to Undertake the Project ........ 1-21
  1.4.1 Nature of the Business ........ 1-21
  1.4.2 Financial Capacity of Applicant ........ 1-21
  1.4.3 Technical Capacity of Applicant ........ 1-21
  1.4.4 Project Structure and Governance ........ 1-22
1.5 Orders Sought and Proposed Regulatory Process ........ 1-23
  1.5.1 Orders Sought ........ 1-23
  1.5.2 Proposed Regulatory Review Process ........ 1-23
  1.5.3 Proposed Project Reporting ........ 1-26

1.6 Application Structure and Concordance with BCUC Guidelines and Government Policy ........ 1-27
    1.6.1 Chapters and Appendices ........ 1-27
    1.6.2 BR1 Project – CPCN Guidelines Concordance Table ........ 1-31
    1.6.3 BRT Project – CPCN Guidelines Concordance Table ........ 1-37
    1.6.4 BR1 Project and BRT Project – First Nations Information Filing Concordance Table ........ 1-43
    1.6.5 Government of B.C. Energy Objectives and Policy Considerations ........ 1-49
        1.6.5.1 British Columbia's Energy Objectives ........ 1-49
        1.6.5.2 Most Recent Approved Integrated Resource Plan ........ 1-50
        1.6.5.3 Section 19 of the Clean Energy Act ........ 1-51

## Chapter 2. Generation and Transmission System

2.1 Introduction ........ 2-1
2.2 Bridge River Generation System Overview ........ 2-2
    2.2.1 Description of the Bridge River Generation System ........ 2-2
    2.2.2 Bridge River Generating Units Are the Primary Mechanism for BC Hydro to Manage Water Flows ........ 2-4
2.3 Long-Term Plan to Maintain the Bridge River Generation System at the Lowest Cost ........ 2-8
    2.3.1 Primary Risks with Bridge River Generation System Are Aging Assets, Seismic and Flow Management ........ 2-9
        2.3.1.1 La Joie Facility ........ 2-12
        2.3.1.2 Bridge River Facility ........ 2-13
        2.3.1.3 Seton Facility ........ 2-17
    2.3.2 2014 System Study Confirmed Bridge River Generation System Was Lowest Cost Option ........ 2-19
    2.3.3 BR1 Project is the Next Step in Replacing Aging Downstream Generation Equipment ........ 2-23
2.4 Bridge River Transmission System Overview ........ 2-24
    2.4.1 Description of the Bridge River Transmission System ........ 2-24
        2.4.1.1 Regional Path 2 and Path 3 ........ 2-26
        2.4.1.2 Regional Path 1 ........ 2-26
        2.4.1.3 In Recent Years, More IPP Facilities Have Connected to the Bridge River Transmission System ........ 2-27
2.5 Long Term Plan to Maintain and Operate the Bridge River Transmission System ........ 2-28

2.5.1 Maintaining Transmission Lines in the Bridge River Transmission System ........ 2-29
2.5.2 Asset Strategy and Asset Condition of the Substation Assets ........ 2-30
2.6 Bridge River System is Economic when Planned Investments and Operating Costs are Considered ........ 2-32
2.6.1 Bridge River Generating Station 1 is Economic on a Stand-Alone Basis ........ 2-36

## Bridge River 1 Units 1 to 4 Generator Replacement Project

### Chapter 3. Project Justification

3.1 Introduction ........ 3-1
3.2 Overview of the Bridge River Facility and the Bridge River 1 Generating Station ........ 3-2
3.2.1 Description of the Bridge River Facility ........ 3-2
3.2.2 Bridge River Facility Asset Plan Prioritizes Investments in Reliable Generation and Water Flow Management ........ 3-5
3.2.3 Bridge River 1 Generating Equipment Has Largely Exceeded Its Industry Life Expectancy ........ 3-7
3.3 The BR1 Project is Needed to Improve the Reliability of Bridge River 1 Generating Units 1 to 4 ........ 3-11
3.3.1 BC Hydro Undertakes Equipment Health Assessments to Evaluate Asset Condition ........ 3-12
3.3.2 Unit 1 to 4 Generators Are in Unsatisfactory Condition ........ 3-14
3.3.3 Unit 1 to 4 Governors are in Poor Condition ........ 3-16
3.3.4 Unit 1 to 4 Exciters Are Approaching End of Life ........ 3-18
3.3.5 Unit 1 to 4 Control Systems are Obsolete ........ 3-18
3.4 The BR1 Project Is Needed to Improve Capacity and Reliability of Water Flow Management ........ 3-19
3.4.1 BC Hydro Must Manage Water Flows Within WUP Order and Agreement Commitments ........ 3-20
3.4.2 Bridge River Generating Units Are the Primary Mechanism for BC Hydro to Manage Water Flows ........ 3-21
3.4.3 De-Rating of Unit 4 and Reduction in Downton Reservoir Elevation Challenges BC Hydro’s Ability to Divert Water to Seton Lake ........ 3-23
3.4.4 BC Hydro is Currently Challenged to Manage Flows Within Targets and Has Received a Variance to the WUP Order ........ 3-24
3.4.5 Risk of Failures and Further Deratings Threatens Ability to Manage Water Flows ........ 3-26

## Chapter 4. Alternatives Analysis

4.1 Introduction ........ 4-1
4.2 BC Hydro Considered and Dismissed Alternatives That Were Determined to Not Be Feasible ........ 4-1
  4.2.1 Alternatives to Extend the Life of Some Existing Generating Equipment Are Not Feasible ........ 4-2
  4.2.2 Alternative to Defer Investment Is Not Feasible ........ 4-3
4.3 BC Hydro Identified Three Feasible Project Alternatives ........ 4-3
4.4 BC Hydro Undertook a Structured Approach to Evaluate the Alternatives ........ 4-4
4.5 Alternative Analysis Determined That the Replace Alternative is the Preferred Alternative ........ 4-5
  4.5.1 Objective 1 - Maximizing Unit Reliability ........ 4-7
  4.5.2 Objective 2 - Minimizing Environmental Impacts ........ 4-7
  4.5.3 Objective 3 - Improving Relations with the St’át’imc Nation ........ 4-9
  4.5.4 Objective 4 - Minimizing Net Present Value of Cost and Cost Risk ........ 4-10
    4.5.4.1 Minimizing Net Present Value of Cost ........ 4-10
    4.5.4.2 Minimizing Cost Risk ........ 4-11
    4.5.4.3 Net Present Value Results ........ 4-12
  4.5.5 Objective 5 - Minimizing Safety Risks ........ 4-13

## Chapter 5. Project Description and Impacts

5.1 Introduction ........ 5-1
5.2 Project Scope, Requirements, and Activities ........ 5-1
  5.2.1 BR1 Project Will Replace Unit 1 to 4 Generators, Governors, Exciters and Control Systems ........ 5-2
  5.2.2 Technical and Safety Requirements ........ 5-4
    5.2.2.1 Equipment Design and Performance Requirements ........ 5-4
    5.2.2.2 Safety by Design ........ 5-6
  5.2.3 BR1 Project Activities ........ 5-7
    5.2.3.1 Design Activities ........ 5-8
    5.2.3.2 Procurement Activities ........ 5-9
    5.2.3.3 Outage Planning and Delivery Activities ........ 5-9
    5.2.3.4 Construction Activities ........ 5-10
    5.2.3.5 Commissioning, Testing, and Completion Activities ........ 5-10
5.3 Procurement Approach ........ 5-11

5.3.1 Public Procurement Process for Generators ..... 5-11
5.3.2 Blanket Contract Orders for the Governors, Exciters, Control Systems and Fire Protection System ..... 5-12
5.4 Project Cost ..... 5-13
5.4.1 Direct Construction Costs ..... 5-15
5.4.2 Indirect Construction Costs ..... 5-16
5.4.3 Project Contingency ..... 5-16
5.4.4 Escalation, Capital Overhead and Interest During Construction ..... 5-17
5.4.5 Project Reserve ..... 5-18
5.5 Rate Impact Analysis ..... 5-19
5.6 Project Schedule ..... 5-20
5.6.1 Project Major Milestones ..... 5-20
5.6.2 Scheduling Constraints and Considerations ..... 5-21
5.7 Project Permits, Approval, and Authorization ..... 5-22
5.7.1 Environmental Assessments ..... 5-22
5.7.2 Water Licences and Water Use Plan Order ..... 5-23
5.7.3 Municipal and Provincial Requirements ..... 5-24
5.8 Project Impacts and Mitigation ..... 5-24
5.8.1 Identification of Environmental and Socio-Economic Impacts ..... 5-24
5.8.2 Environmental Impacts ..... 5-25
5.8.2.1 Valued Components Identified and Assessed ..... 5-25
5.8.2.2 Managing Water Flows During Planned Outages ..... 5-27
5.8.2.3 Managing Water Flows If More than One Unit Is Unavailable ..... 5-30
5.8.2.4 Identified Impacts and Mitigation to Fish and Fish Habitat ..... 5-30
5.8.2.5 Additional Environmental Monitoring Programs ..... 5-31
5.8.3 Socio-Economic Impact ..... 5-32
5.8.3.1 Valued Components Identified ..... 5-32
5.8.3.2 Valued Components Assessed ..... 5-33
5.8.4 Impact on Transmission System ..... 5-37
5.8.5 Public Works Impact ..... 5-37

## Chapter 6. Indigenous Nations Consultation and Public Engagement

6.1 Introduction ..... 6-1
6.2 Indigenous Nations Consultation and Engagement ..... 6-1

6.2.1 Introduction ........ 6-1
6.2.2 Identification of Indigenous Nations ........ 6-4
6.2.2.1 St'át'imc Nation ........ 6-5
6.2.2.2 Tŝilhqot'in Nation ........ 6-8
6.2.3 Duty to Consult ........ 6-9
6.2.3.1 The Duty to Consult and the Role of Negotiated Agreements ........ 6-9
6.2.3.2 St’át’imc Nation ........ 6-9
6.2.3.3 Tŝilhqot'in Nation ........ 6-13
6.2.4 Consultation and Engagement ........ 6-14
6.2.4.1 St’át’imc Nation ........ 6-14
6.2.4.2 Tŝilhqot'in National Government ........ 6-22
6.2.5 Adequacy of Consultation and Accommodation ........ 6-23
6.3 Public Engagement ........ 6-24
6.3.1 Introduction ........ 6-24
6.3.2 Local Community Setting ........ 6-25
6.3.3 Stakeholder Engagement Approach ........ 6-26
6.3.4 Engagement Activities to Date ........ 6-27
6.3.5 Public Support and Issues Identified ........ 6-28
6.3.6 Plan for Ongoing Public Engagement Activities ........ 6-29

## Chapter 7. Risks and Risk Management

7.1 Introduction ........ 7-1
7.2 BR1 Project Risks Were Identified and Analyzed Considering Past Experience and Established Risk Matrix ........ 7-2
7.2.1 BC Hydro Incorporated Experience from 10 Similar Major Projects ........ 7-2
7.2.2 Consequences, Probabilities and Severities Have Been Assigned to Each Identified Risk ........ 7-3
7.3 Definition Phase Risks and Treatment Plans ........ 7-5
7.3.1 BC Hydro is Implementing Measures to Mitigate the Risk of this Regulatory Proceeding Impacting the BR1 Project Schedule ........ 7-5
7.3.2 BC Hydro is Implementing Measures to Mitigate Bid Price Uncertainty from a Changing Generator Supply Market ........ 7-6
7.3.3 BC Hydro is Implementing Measures to Mitigate the Risk of BR1 Project Resources Contracting or Transmitting COVID-19 ........ 7-7
7.4 Implementation Phase Risks and Treatment Plans ........ 7-9

7.4.1 BC Hydro will be Implementing Measures to Mitigate the Risk of Delays Impacting the Required Duration of Planned Outages ........ 7-10
7.4.2 BC Hydro will be Implementing Measures to Mitigate the Risk of Fire in the Work Area during the Construction Stage ..... 7-11
7.4.3 BC Hydro will be Implementing Measures to Mitigate the Risk of Safety Incidents in a Constrained Work Area ........ 7-12
7.4.4 BC Hydro will be Implementing Measures to Mitigate the Risk of Delays due to Multiple Interdependent Activities ........ 7-14
7.4.5 BC Hydro is Implementing Measures to Mitigate Additional Cost Risk ........ 7-15
7.4.6 BC Hydro will be Implementing Measures to Mitigate the Risk of Limited Workforce Accommodation Availability ........ 7-16
7.4.7 BC Hydro will be Implementing Measures to Mitigate the Risk of Delay due to Space Constraints ........ 7-17
7.4.8 BC Hydro will be Implementing Measures to Mitigate the Risk of Impacts on Local Communities ........ 7-18
7.4.9 BC Hydro will be Implementing Measures to Mitigate the Risk of a Supplier Unable to Deliver on Contractual Obligations ........ 7-19
7.4.10 BC Hydro will be Implementing Measures to Mitigate the Risk of a Seismic Event Causing Significant Damage to the Bridge River 1 Generating Station During Construction ........ 7-19
7.5 Retained Operational Risks and Risk Management Plans ........ 7-20
7.5.1 Bridge River 1 Generating Station Foundation Stability ........ 7-21
7.5.2 Bridge River 1 Generating Station Powerhouse Seismic Performance ........ 7-22
7.5.3 Bridge River 1 Generating Station Penstocks Seismic Withstand ........ 7-22
7.5.4 Santa Clause Mountain Slope Failure ........ 7-23

## Bridge River Transmission Project

## Chapter 8. Project Justification

8.1 Introduction ........ 8-1
8.2 Overview of the Bridge River Transmission System ........ 8-2
8.2.1 Generation from Bridge River Transmission System Is Transmitted Via Three Regional Paths ........ 8-2
8.2.2 Transmission Capacity Is Constrained When Generation is Highest and Load is Lowest ........ 8-5

8.3 Generator De-Ratings Have Allowed BC Hydro to Manage the 2L90 Circuit Within Limits ........ 8-6
  8.3.1 Since 2016, Approximately 400 MW of IPP Generation Has Connected to the Bridge River Transmission System ........ 8-7
  8.3.2 Units at the Bridge River Generating Facility Have Been De-Rated Creating Challenges for Generation Operations and Water Management ........ 8-7
8.4 Transmission Study Identified the Risk of 2L90 Circuit Reaching Its Ampacity Limits ........ 8-9
8.5 2L90 Circuit Asset Health Issues Must be Addressed ........ 8-11
  8.5.1 Description of the 2L90 Circuit ........ 8-12
  8.5.2 Many Structural Components on the 2L90 Circuit Are in Poor Condition or Will Need to be Replaced in Future Years ........ 8-15
  8.5.3 Ground Clearance Issues on the 2L90 Circuit Need to Be Addressed ........ 8-17

## Chapter 9. Alternatives Analysis

9.1 Introduction ........ 9-1
9.2 BC Hydro Considered and Dismissed Alternatives That Were Determined to Be Not Feasible ........ 9-2
  9.2.1 Doing Nothing Is Not Feasible ........ 9-2
  9.2.2 Alternative to Restore 2L91 to Operate in Parallel with 2L90 Is Not Feasible ........ 9-3
  9.2.3 Alternative to Upgrade Regional Path 3 Is Not Feasible ........ 9-3
9.3 BC Hydro Identified Three Feasible Project Alternatives ........ 9-4
  9.3.1 Alternative 1 – Increase the Maximum Capacity of the 2L90 circuit ........ 9-4
  9.3.2 Alternative 2 - Increase the Capacity of the Rosedale T1 Transformer ........ 9-7
  9.3.3 Alternative 3 – Curtail Generation from IPPs ........ 9-10
9.4 BC Hydro Undertook a Structured Approach to Evaluate the Alternatives ........ 9-11
9.5 Alternative Analysis Determined That Alternative 1 is the Leading Alternative ........ 9-12
  9.5.1 Objective 1 - Maximize System Reliability and Flexibility ........ 9-15
  9.5.2 Objective 2 - Minimize Environmental Impacts and Impacts to St’at’imc Core Interests ........ 9-16
    9.5.2.1 Risk of Impacts on Aquatic Species and Habitat ........ 9-16

9.5.2.2 Risk of Impacts to Heritage Sites and Risk of Impacts to Terrestrial Species and Habitat ............ 9-17
9.5.2.3 Risk of Impacts on Vegetation ............ 9-18
9.5.2.4 Risk of Impacts from Hazardous Wastes ............ 9-18
9.5.2.5 Likelihood of High Flows in Lower Bridge River ..... 9-18
9.5.3 Objective 3 - Minimize Total Costs ............ 9-19
9.5.4 Objective 4 - Minimize Occupational and Health Safety Risks ............ 9-20
9.5.5 Objective 5 - Minimize Impact to Stakeholders ............ 9-21

## Chapter 10. Project Description

10.1 Introduction ............ 10-1
10.2 BRT Project Lifecycle and Activities ............ 10-2
10.2.1 BRT Project Lifecycle ............ 10-2
10.2.2 Completed BRT Project Activities ............ 10-3
10.2.2.1 Conceptual Design Stage Activities ............ 10-3
10.2.3 Ongoing and Future BRT Project Activities ............ 10-4
10.2.3.1 Feasibility Design Stage Activities ............ 10-4
10.2.3.2 Definition Phase Activities ............ 10-6
10.2.3.3 Implementation Phase Activities ............ 10-6
10.3 BRT Project Scope and Technical Requirements ............ 10-7
10.3.1 Project Components and Infrastructure ............ 10-7
10.3.1.1 Increasing the Maximum Capacity of the 2L90 Circuit ............ 10-8
10.3.1.2 Refurbishing the 2L90 Circuit ............ 10-10
10.3.2 Technical Requirements ............ 10-10
10.3.2.1 Structure Requirements ............ 10-10
10.3.2.2 Wildfire Risk Requirements ............ 10-11
10.3.2.3 Environmental Requirements ............ 10-11
10.3.2.4 Right-of-Way Requirements ............ 10-12
10.4 BRT Project Costs and Assumptions ............ 10-12
10.4.1 Identification and Definition Phase Costs ............ 10-13
10.4.2 Implementation Phase Direct and Indirect Construction Costs ............ 10-13
10.4.3 Contingency, Escalation, Overhead, and Interest During Construction ............ 10-13
10.4.3.1 Contingency ............ 10-13
10.4.3.2 Escalation, Overhead, and Interest During Construction ............ 10-14

10.4.4 BRT Project Cost Range ........ 10-14
10.5 Rate Impact Analysis ........ 10-15
10.6 BRT Project Schedule ........ 10-16
10.6.1 Project Major Milestones ........ 10-16
10.6.2 Scheduling Constraints and Considerations ........ 10-17
10.7 BRT Project Permits, Approvals and Authorizations ........ 10-17
10.7.1 Environmental Assessments ........ 10-18
10.7.2 Federal Requirements ........ 10-18
10.7.3 Provincial Requirements ........ 10-19
10.7.4 Municipal Requirements ........ 10-19
10.7.5 List of Potential and Required Environmental Permits and Approvals ........ 10-19
10.8 BRT Project Impacts ........ 10-20
10.8.1 Environmental, Cultural and Socio-Economic Impacts ........ 10-20
10.8.1.1 Environmental Impact ........ 10-21
10.8.1.2 Socio-Economic Impact ........ 10-28

## Chapter 11. Indigenous Nations Consultation and Public Engagement

11.1 Introduction ........ 11-1
11.2 BC Hydro’s Consultation and Engagement with Indigenous Nations ........ 11-1
11.2.1 Identification of Indigenous Nations ........ 11-2
11.2.2 BC Hydro’s Engagement with Indigenous Nations Regarding Alternatives for the BRT Project ........ 11-6
11.2.3 Duty to Consult ........ 11-9
11.2.3.1 St’át’imc Nation ........ 11-10
11.2.3.2 Tŝilhqot'in Nation ........ 11-11
11.2.3.3 Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band ........ 11-11
11.2.4 BC Hydro’s Consultation and Engagement Activities ........ 11-12
11.2.4.1 BC Hydro’s Consultation and Engagement with the St’át’imc Nation ........ 11-12
11.2.4.2 BC Hydro’s Consultation and Engagement with the Tŝilhqot'in National Government ........ 11-23
11.2.4.3 BC Hydro’s Consultation and Engagement with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band ........ 11-24

11.2.5 Adequacy of Consultation and Accommodation....................... 11-25
11.3 Public Engagement........................................................................ 11-27
11.3.1 Introduction .................................................................................. 11-27
11.3.2 Stakeholder Engagement Approach ........................................ 11-27
11.3.3 Local Community Setting ........................................................ 11-29
11.3.4 Public Groups Included in Engagement.................................. 11-29
11.3.5 Engagement Process.............................................................. 11-30
11.3.6 Public Support and Issues Identified....................................... 11-32
11.3.7 Mitigation and Ongoing Public Engagement Activities ............ 11-32

## Chapter 12. Project Risks and Risk Management

12.1 Introduction ........................................................................................ 12-1
12.2 BRT Project Risks Were Identified and Analyzed Through BC Hydro's Established Risk Matrix.............................................................................. 12-2
12.2.1 BC Hydro Incorporated Experience from Similar Major Projects......................................................................... 12-2
12.2.2 Consequences, Probabilities and Severities Have Been Assigned to Each Identified Risk................................................ 12-3
12.3 Identification Phase Risks and Treatment Plans....................................... 12-4
12.3.1 BC Hydro is Implementing Measures to Mitigate the Risk of this Regulatory Proceeding Impacting the BRT Project ............ 12-4
12.3.2 BC Hydro will be Implementing Measures to Mitigate the Risk from the Potential Need to Acquire New Permits and Agreements...................................................................... 12-5
12.3.3 BC Hydro will be Implementing Measures to Mitigate the Risk from Difficult Terrain and Limited Access to Sites.............. 12-6
12.3.4 BC Hydro will be Implementing Measures to Mitigate the Risk of Wildfire During Construction .......................................... 12-7
12.3.5 BC Hydro will be Implementing Measures to Mitigate the Risk of Impacting Archaeological Sites During Construction ..... 12-8
12.3.6 BC Hydro will be Implementing Measures to Mitigate the Risk of Outage Requirements on the 2L90 Circuit................... 12-10

# List of Figures

## BC Hydro Bridge River Projects

### Chapter 1. Executive Summary

Figure 1-1 Combined Cumulative Incremental Rate Impact for the BR1 Project and the BRT Project........................................................ 1-4

Figure 1-2 Map of the Bridge River Generating System .................................. 1-5
Figure 1-3 Bridge River Transmission System Regional Paths ...................... 1-14

## Chapter 2. Generation and Transmission System

Figure 2-1 Map of the Bridge River Generation System .................................. 2-3
Figure 2-2 Flow of Water through the Bridge River Generation System ........... 2-5
Figure 2-3 Carpenter Reservoir Historical Average Level ................................ 2-7
Figure 2-4 Staging of Capital Projects on the Bridge River Generation System ........................................................................... 2-11
Figure 2-5 Bridge River Transmission System Regional Paths ...................... 2-25
Figure 2-6 Condition of Substations Within and Adjacent to Bridge River Transmission System ................................................................ 2-31

## Bridge River 1 Units 1 to 4 Generator Replacement Project

## Chapter 3. Project Justification

Figure 3-1 Carpenter Reservoir, Terzaghi Dam and Lower Bridge River ......... 3-4
Figure 3-2 Bridge River Generating Stations and Seton Lake .......................... 3-5
Figure 3-3 Recent and Planned Investments in the Bridge River Facility ......... 3-7
Figure 3-4 Layout of the Generating Equipment at the Bridge River 1 Generating Station ......................................................................... 3-8
Figure 3-5 Exterior of the Bridge River 1 Generating Station and Penstocks ........................................................................................ 3-8
Figure 3-6 Cutaway View of Typical Hydroelectric Generating Equipment ....... 3-9
Figure 3-7 Bridge River 1 Generating Station Asset Condition (As of Fiscal 2019) ...................................................................................... 3-14
Figure 3-8 Bulging of Stator Core Laminations ............................................... 3-16
Figure 3-9 Oil Leakage from the Governors .................................................. 3-17
Figure 3-10 Bridge River Generation System Water Flows ............................. 3-22
Figure 3-11 Number of Days Exceeding the Lower Bridge WUP Order Target Flow Schedule in 53 years With Available Generating Units 1 to 4 ......................................................................................... 3-27

## Chapter 5. Project Description and Impacts

Figure 5-1 Project Lifecycle ............................................................................ 5-8
Figure 5-2 Rate Impact Analysis .................................................................... 5-19
Figure 5-3 Number and Percentage of Days Exceeding the Lower Bridge WUP Order Target Flow Schedule in 53 Years With Different Planned Outage Duration ............................................................ 5-29

## Chapter 6. Indigenous Nations Consultation and Public Engagement

Figure 6-1 Map of St’át’imc Territory ........ 6-7
Figure 6-2 Map of Tŝilhqot'in Stewardship Agreement Engagement Zones ........ 6-8

## Bridge River Transmission Project

## Chapter 8. Project Justification

Figure 8-1 Bridge River Regional Transmission Paths ........ 8-4
Figure 8-2 Power Flow of Regional Path 1, 2, 3 in the Bridge River Area in 2030 Summer Conditions ........ 8-11
Figure 8-3 2L90 Circuit Location ........ 8-13
Figure 8-4 2L90 Circuit H-Frame Structure ........ 8-14
Figure 8-5 2L90 Circuit Three-Pole Structure ........ 8-15
Figure 8-6 2L90 Span with Low Clearance ........ 8-17

## Chapter 9. Alternatives Analysis

Figure 9-1 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 1 ........ 9-6
Figure 9-2 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 2 ........ 9-8
Figure 9-3 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 3 ........ 9-10

## Chapter 10. Project Description

Figure 10-1 Project Lifecycle ........ 10-2
Figure 10-2 2L90 Circuit Route ........ 10-9
Figure 10-3 Cumulative Incremental Rate Impacts for BRT Project Leading Alternative Cost Range ........ 10-16

## Chapter 11. Indigenous Nations Consultation and Public Engagement

Figure 11-1 Map of St’át’imc Territory and BRT Project Area ........ 11-3
Figure 11-2 Map of Tŝilhqot'in Territory and BRT Project Area ........ 11-4
Figure 11-3 Map of the Bridge River Transmission Project Alternatives ........ 11-7

# List of Tables

## BC Hydro Bridge River Projects

### Chapter 1. Executive Summary

Table 1-1 Bridge River 1 Generating Station Plant Ratings and Total Licence Flow Capacity .... 1-8
Table 1-2 Proposed Regulatory Review Process .... 1-26
Table 1-3 Outline of the Chapters and Appendices .... 1-27
Table 1-4 BR1 Project - CPCN Filings Guidelines Concordance Table .... 1-32
Table 1-5 BRT Project - CPCN Filings Guidelines Concordance Table .... 1-38
Table 1-6 First Nations Information Filing Guidelines Concordance Table .... 1-44
Table 1-7 British Columbia’s Energy Objectives .... 1-49

### Chapter 2. Generation and Transmission System

Table 2-1 Analysis of Alternatives Considered in 2014 System Study .... 2-22
Table 2-2 Condition of Circuits Within Bridge River Transmission System .... 2-30
Table 2-3 Bridge River System Valuation .... 2-33
Table 2-4 Scenario Analysis: Bridge River System Valuation .... 2-35
Table 2-5 Bridge River System - Capital Sensitivity .... 2-35
Table 2-6 Bridge River System - Discount Rate Sensitivity .... 2-36
Table 2-7 Scenario Analysis: Bridge River 1 Generating Station Valuation .... 2-36
Table 2-8 Value of Bridge River 1 Generating Station with Capital Cost Variances Applied .... 2-37
Table 2-9 Value of Bridge River 1 Generating Station with Different Discount Rates .... 2-37

## Bridge River 1 Units 1 to 4 Generator Replacement Project

### Chapter 3. Project Justification

Table 3-1 Bridge River Facility: Key Data .... 3-3
Table 3-2 Generator and Components Condition .... 3-15
Table 3-3 Bridge River 1 Generating Station Plant Ratings and Total Licence Flow Capacity .... 3-24

## Chapter 4. Alternatives Analysis

Table 4–1 Objectives, Criteria, and Measures ... 4-5
Table 4–2 Consequence Table: Alternatives Analysis Results ... 4-6
Table 4–3 Net Present Value of Cost for Alternatives ($ million) ... 4-12

## Chapter 5. Project Description and Impacts

Table 5-1 Generating Equipment Components to be Replaced or Refurbished ... 5-3
Table 5-2 Summary of BR1 Project Procurement Approach ... 5-11
Table 5-3 BR1 Project Cost Range Breakdown ... 5-14
Table 5-4 Escalation, Capital Overhead, and Interest During Construction as of April 2021 ... 5-18
Table 5-5 Project Major Milestones ... 5-21
Table 5-6 Water Licence Details ... 5-23

## Chapter 6. Indigenous Nations Consultation and Public Engagement

Table 6–1 Indigenous Nations and Consulting Organization ... 6-4
Table 6–2 Summary of Engagement with St’át’imc on the BR1 Project ... 6-15
Table 6–3 Summary of Key Interests and Concerns Raised ... 6-19

## Chapter 7. Risks and Risk Management

Table 7-1 Summary of Risk of this Proceeding Impacting the Schedule for the BR1 Project ... 7-5
Table 7-2 Summary of Changing Generator Supply Market Risk ... 7-6
Table 7-3 Summary of Risk of Resources Contracting or Transmitting COVID-19 ... 7-8
Table 7-4 Summary of Schedule Delay Risk ... 7-10
Table 7-5 Summary of Risk of Fire during Construction ... 7-12
Table 7-6 Summary of Risk of Safety Incidents in a Constrained Work Area ... 7-13
Table 7-7 Summary of Multiple Interdependent Activities Risk ... 7-14
Table 7-8 Summary of Additional Cost Risk Impacts ... 7-15
Table 7-9 Summary of Limited Accommodation Availability for Workforce Risk ... 7-16
Table 7-10 Summary of Schedule Delay Risk due to Space Constraints ... 7-17
Table 7-11 Summary of Risk of Impacting the Local Communities ... 7-18
Table 7-12 Summary of Risk of Supplier Not Delivering on Obligations Due to Credit Failure ... 7-19
Table 7-13 Summary of Seismic Event Risk During Construction ... 7-20

## Bridge River Transmission Project

### Chapter 8. Project Justification

Table 8-1 Summer Maximum Capacity of Bridge River Transmission Regional Paths .......... 8-6
Table 8-2 IPP Generation Connected to Bridge River Transmission System Since 2016 .......... 8-7
Table 8-3 Condition Assessment Values – 2L90 Circuit (Structure and Framing Components) .......... 8-16

### Chapter 9. Alternatives Analysis

Table 9-1 Objectives, Criteria, and Measures .......... 9-11
Table 9-2 Consequence Table: Alternative Analysis Results .......... 9-14
Table 9-3 Present Value of Total Costs for Each Alternative .......... 9-20

### Chapter 10. Project Description

Table 10–1 Escalation, Capital Overhead, and Interest During Construction used to Prepare the BRT Cost Estimate as of August 2020 .......... 10-14
Table 10–2 Project Cost Range Breakdown .......... 10-15
Table 10–3 Project Major Milestones .......... 10-17
Table 10–4 Potential Environmental Permits Required and Planned Actions .......... 10-19

### Chapter 11. Indigenous Nations Consultation and Public Engagement

Table 11–1 Indigenous Nations and Consulting Organizations for BRT Project .......... 11-5
Table 11–2 Indigenous Nations and Consulting Organization for Alternative 2 .......... 11-8
Table 11–3 Summary of Engagement with St'át'imc Nation on the BRT Project .......... 11-14
Table 11–4 Summary of Key Interests and Concerns Raised by the St'át'imc Nation .......... 11-19

### Chapter 12. Project Risks and Risk Management

Table 12-1 Summary of Risk of this Proceeding Impacting the BRT Project .......... 12-5
Table 12-2 Summary of Risk from Need for New Permits and Agreements .......... 12-6

Table 12-3 Summary of Risk from Difficult Terrain and Limited Access to Sites ..... 12-7
Table 12-4 Summary of Risk of Wildfire During Construction ..... 12-8
Table 12-5 Summary of Risk of Impacting Archaeological Sites During Construction ..... 12-9
Table 12-6 Summary of the Risk of Required Outages During 2L90 Circuit Construction ..... 12-10

## List of Appendices

### BC Hydro Bridge River Projects

Appendix A-1 Glossary and Abbreviations
Appendix A-2 Draft Orders
Appendix A-3 BR1 and BRT Project Rate Impact
Appendix A-4 Project Organization Structure and Governance
Appendix A-5 Capital Allocation Risk Matrix

**Appendix A-6 Indigenous Nations Consultation**
Appendix A-6-1 Overview of Settlement Agreements
Appendix A-6-2 Certainty Provisions Agreement CONFIDENTIAL
Appendix A-6-3 Relations Agreement CONFIDENTIAL
Appendix A-6-4 2011 St’át’imc (PC) Settlement Agreement CONFIDENTIAL
Appendix A-6-5 2019 High Flow Settlement Agreement CONFIDENTIAL
Appendix A-6-6 BR1 Consultation Records
Appendix A-6-7 BRT Consultation Records
Appendix A-6-8 Examples of Consultation Material CONFIDENTIAL
Appendix A-6-9 BR1 Project Submission to Tŝilhqot'in National Government
Appendix A-6-10 BR1 Project - Tŝilhqot'in National Government Response
Appendix A-6-11 BRT Project Submission to Tŝilhqot'in National Government
Appendix A-6-12 BRT Project - Tŝilhqot'in National Government Response

Appendix A-7 Project Delivery Risk Process and Matrix

### Bridge River 1 Units 1 to 4 Generator Replacement Project

Appendix B-1 Bridge River Water Use Plan Order and Variance Orders

**Appendix B-2 Bridge River System Studies**
Appendix B-2-1 2014 Bridge River System Study Summary Memo CONFIDENTIAL
Appendix B-2-2 2020 Bridge River System Study Update CONFIDENTIAL
Appendix B-2-3 2020 Bridge River Economic Analysis and System Financial Model (attachment) CONFIDENTIAL

Appendix B-3 Facility Asset Plans CONFIDENTIAL
Appendix B-4 Bridge River Facility Water Licences
Appendix B-5 BR1 Alternative Assessment Financial Model CONFIDENTIAL
Appendix B-6 BR1 Summary of Power Benefits Study CONFIDENTIAL
Appendix B-7 BR1 Preliminary Design Report CONFIDENTIAL
Appendix B-8 BR1 Project Procurement Decision CONFIDENTIAL
Appendix B-9 BR1 Project Preliminary Cost Estimate CONFIDENTIAL
Appendix B-10 BR1 Project Expenditure Breakdown by Year CONFIDENTIAL
Appendix B-11 BR1 Rate Impact Models CONFIDENTIAL
Appendix B-12 BR1 Project Schedule
Appendix B-13 BR1 Environmental Impact Statement CONFIDENTIAL
Appendix B-14 Bridge River Contract Worker Conduct Requirements Policy
Appendix B-15 BR1 Stakeholder Engagement Materials

**Appendix B-2 Bridge River System Studies**

Appendix C-1 Transmission Studies CONFIDENTIAL
Appendix C-2 IPP Generation Curtailment Description and Cost Estimate Assessment Methodology
Appendix C-3 BRT Project Alternative Assessment Financial Model - CONFIDENTIAL
Appendix C-4 BRT Project Conceptual Design Report CONFIDENTIAL
Appendix C-5 BRT Project Schedule
Appendix C-6 BRT Project Expenditure Breakdown by Year
Appendix C-7 BRT Project Rate Impact
Appendix C-8 BRT Project Preliminary Environmental Impact Statement
Appendix C-9 BRT Project Stakeholder Engagement Materials CONFIDENTIAL

# BC Hydro Bridge River Projects

# Chapter 1

## Executive Summary

# Table of Contents

1.1 Introduction ........ 1-1
1.2 BR1 Project Highlights ........ 1-5
  1.2.1 Description of the Bridge River Generation System and Bridge River Facility ........ 1-5
  1.2.2 BR1 Project is Needed to Address the Deteriorating Condition of Units 1 to 4 at the Bridge River 1 Generating Station ........ 1-6
  1.2.3 Preferred Alternative to Replace Unit 1 to 4 Generators Maximizes Reliability and Minimizes Environmental Impact, Cost and Cost Risk and Safety Risk ........ 1-7
  1.2.4 BR1 Project Description, Schedule and Impacts ........ 1-8
  1.2.5 BR1 Project Indigenous Nations Consultation and Stakeholder Engagement ........ 1-11
  1.2.6 BR1 Project Risks ........ 1-12
1.3 BRT Project Highlights ........ 1-13
  1.3.1 Description of the Bridge River Transmission System ........ 1-13
  1.3.2 BRT Project is Needed to Address System Constraints and Asset Health Issues ........ 1-15
  1.3.3 Leading Alternative is to Increase the Maximum Capacity of the 2L90 Circuit ........ 1-16
  1.3.4 BRT Project Description, Schedule and Impacts ........ 1-17
  1.3.5 BRT Project Indigenous Nations Consultation and Stakeholder Engagement ........ 1-19
  1.3.6 BRT Project Risks ........ 1-20
1.4 BC Hydro's Capability to Undertake the Project ........ 1-21
  1.4.1 Nature of the Business ........ 1-21
  1.4.2 Financial Capacity of Applicant ........ 1-21
  1.4.3 Technical Capacity of Applicant ........ 1-21
  1.4.4 Project Structure and Governance ........ 1-22
1.5 Orders Sought and Proposed Regulatory Process ........ 1-23
  1.5.1 Orders Sought ........ 1-23
  1.5.2 Proposed Regulatory Review Process ........ 1-23
  1.5.3 Proposed Project Reporting ........ 1-26
1.6 Application Structure and Concordance with BCUC Guidelines and Government Policy ........ 1-27
  1.6.1 Chapters and Appendices ........ 1-27
  1.6.2 BR1 Project – CPCN Guidelines Concordance Table ........ 1-31

1.6.3 BRT Project – CPCN Guidelines Concordance Table ............... 1-37
1.6.4 BR1 Project and BRT Project – First Nations Information Filing Concordance Table ........................................................ 1-43
1.6.5 Government of B.C. Energy Objectives and Policy Considerations ........................................................................ 1-49
1.6.5.1 British Columbia's Energy Objectives .................... 1-49
1.6.5.2 Most Recent Approved Integrated Resource Plan ....................................................................... 1-50
1.6.5.3 Section 19 of the Clean Energy Act ....................... 1-51

## List of Figures

Figure 1-1 Combined Cumulative Incremental Rate Impact for the BR1 Project and the BRT Project................................................. 1-4
Figure 1-2 Map of the Bridge River Generating System................................ 1-5
Figure 1-3 Bridge River Transmission System Regional Paths................... 1-14

## List of Tables

Table 1-1 Bridge River 1 Generating Station Plant Ratings and Total Licence Flow Capacity ................................................................. 1-8
Table 1-2 Proposed Regulatory Review Process....................................... 1-26
Table 1-3 Outline of the Chapters and Appendices ................................... 1-27
Table 1-4 BR1 Project - CPCN Filings Guidelines Concordance Table ..... 1-32
Table 1-5 BRT Project - CPCN Filings Guidelines Concordance Table ..... 1-38
Table 1-6 First Nations Information Filing Guidelines Concordance Table ........................................................................................ 1-44
Table 1-7 British Columbia’s Energy Objectives ....................................... 1-49

## 1.1 Introduction

BC Hydro applies to the British Columbia Utilities Commission (**BCUC**)[1], pursuant to sections 45 and 46 of the *Utilities Commission Act*, for a Certificate of Public Convenience and Necessity (**CPCN**) for the Bridge River 1 Units 1 to 4 Generator Replacement Project (**BR1 Project**)[2] and for a CPCN for the Bridge River Transmission Project (**BRT Project**).[3] A draft Procedural Order and draft Final Orders are provided as Appendix A-2.

The BR1 Project is needed to address the deteriorating condition of the aging generators, governors, exciters and control systems at the Bridge River 1 Generating Station, both to improve reliability and to improve water flow management in Lower Bridge River to help avoid negative impacts to fish and fish habitat and St’át’imc values.[4] BC Hydro has evaluated the alternatives for the BR1 Project using a structured decision making process, and has proposed the most cost effective alternative to meet the identified need. BC Hydro has, and will continue to, meaningfully consult and engage with the St’át’imc and other Indigenous communities with respect to the BR1 Project so that the BCUC will be able to conclude that BC Hydro’s consultation has been adequate up to the time of the BCUC’s decision. Accordingly, BC Hydro submits that the BR1 Project is in the public interest and the BCUC should issue a CPCN for the project.

The BRT Project is required to address system constraints on the Bridge River Transmission System to accommodate existing and future generation, and to address asset health issues and clearance defects to improve the reliability and safety of the 2L90 circuit.[5] BC Hydro has evaluated the alternatives for the BRT Project using a structured decision making process, and identified the most cost

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[1] A glossary of terms and abbreviations is provided as Appendix A-1.

[2] As described in section 1.2.4 and further in Chapter 5 of the Application.

[3] As described in section 1.3.4 and further in Chapter 10 of the Application.

[4] For further discussion, refer to section 1.2.2 and to Chapter 3 of the Application.

[5] For further discussion, refer to section 1.3.2 and to Chapter 8 of the Application.

effective alternative to meet the identified need. BC Hydro has, and will continue to, meaningfully consult and engage with the St’át’imc and other Indigenous communities with respect to the BRT Project, so that the BCUC will be able to conclude that BC Hydro’s consultation has been adequate up to the time of the BCUC’s decision. Subject to BC Hydro’s planned evidentiary update in this proceeding, as discussed further below, BC Hydro submits that the BRT Project is in the public interest and the BCUC should issue a CPCN for the project.

In its Decision on BC Hydro’s Fiscal 2020 to Fiscal 2021 Revenue Requirements Application, the BCUC directed BC Hydro to file a joint CPCN application so that the BR1 Project and the BRT Project could be reviewed together and stated that effective scrutiny of any investment in the Bridge River System[6] requires a view of the entire system.[7] In compliance with this direction, BC Hydro has filed this Application which includes both the BR1 Project and BRT Project. Further, Chapter 2 provides an overview of the Bridge River System including future planned projects and a forward-looking economic valuation.[8]

While this Application includes both the BR1 Project and the BRT Project, the BR1 Project is more advanced in the project lifecycle[9] than the BRT Project, and the BR1 Project schedule requires a BCUC Decision by July 2022, before the regulatory process for the BRT Project can likely be concluded.

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[6] The Bridge River System includes BC Hydro’s storage dams and generating facilities on the Bridge and Seton Rivers: La Joie dam and generating station (which impounds the Downton Reservoir), Terzaghi dam (which impounds the Carpenter Reservoir), Bridge River Generating Stations 1 and 2, and the Seton Generating station, along with the transmission station and circuits necessary to move energy from the generating stations to the provincial integrated grid: the Bridge River Terminal Station, and transmission circuits 3L02, 3L13, 3L14, 3L15, 3L16, 2L01, 2L19, 2L41, 2L90, 60L21, and 60L22.

[7] Refer to page 99 and Directive 29 of BCUC Decision and Order No. G-246-20 on BC Hydro’s Fiscal 2020 to Fiscal 2021 Revenue Requirements Application.

[8] During the Fiscal 2020 to Fiscal 2021 Revenue Requirements Application proceeding, interveners expressed interest in the economic value of the Bridge River Generation System. Refer to Transcript Volume 11, page 1906 to 1915.

[9] A description of the project lifecycle and its phases is provided in section 5.2.3 of Chapter 5 (for the BR1 Project) and in section 10.2.1 of Chapter 10 (for the BRT Project).

The BR1 Project started in 2015 and is currently in the Definition phase, as would usually be the case for a project for which BC Hydro files a CPCN Application.[10] The BR1 Project has an Expected Cost estimating accuracy range of +21 per cent and -16 per cent which is consistent with the BCUC's CPCN Guidelines.[11] Section 1.6.2 below provides a concordance table that identifies where information set out in the BCUC's CPCN Guidelines can be found for the BR1 Project.

In contrast to the BR1 Project, the BRT Project started in 2017 and is currently in the Feasibility Design stage of the Identification phase. At this stage, the BRT Project has an Expected Cost estimating accuracy range of +100 per cent and -35 per cent, which does not meet the BCUC's CPCN Guidelines. To be consistent with the BCUC's CPCN Guidelines, BC Hydro needs to complete the Feasibility Design stage and confirm whether the Leading Alternative[12] will proceed as the Preferred Alternative for the BRT Project.[13] Section 1.6.3 below provides a concordance table that identifies where information set out in the BCUC's CPCN Guidelines can be found for the BRT Project and identifies the information that is not currently available for the BRT Project and will need to be provided through an evidentiary update at a later time in this proceeding.

As of fiscal 2020, the health of the Bridge River 1 Generating Station Unit 1 to 4 generators has been assessed as unsatisfactory with an increasing probability of in-service failure within five years. Therefore, BC Hydro is filing this application now, rather than waiting until further information is available for the BRT Project, so that the BR1 Project, which will address the deteriorating condition of the aging

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[10] Prior to receiving the BCUC's Decision on the Fiscal 2020 to Fiscal 2021 Revenue Requirements Application, BC Hydro had intended to file the BR1 Project CPCN in 2020.

[11] As set out in BCUC Order No. G-20-15.

[12] Information on the alternatives considered for the BRT Project is provided in Chapter 9. The Leading Alternative for the BRT Project is evaluated against other alternatives in Chapter 9 and then described in Chapter 10.

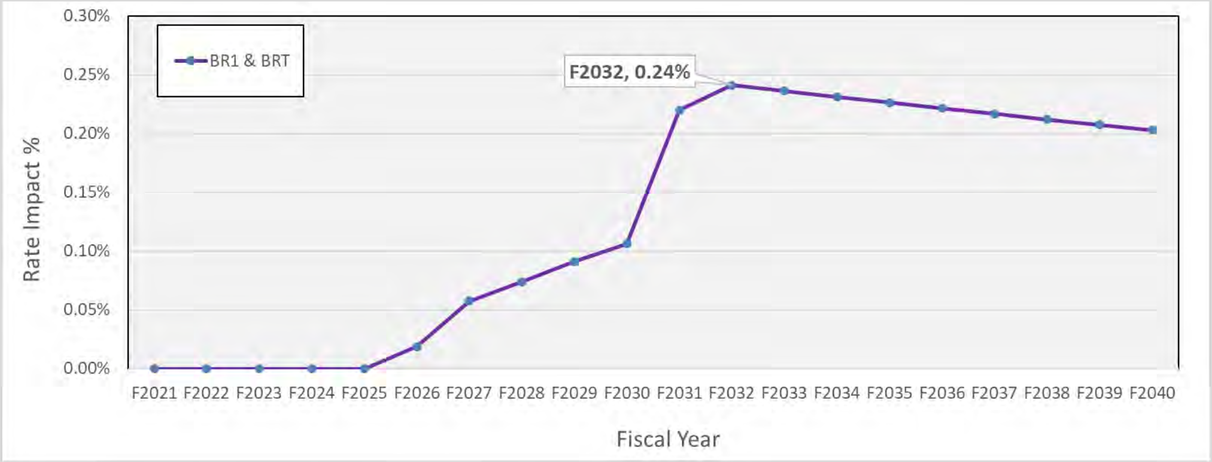
[13] Confirmation of the Preferred Alternative is focused on refining the scope and estimate of the Leading Alternative. If there is new information with regard to the Leading Alternative, or previously dismissed alternatives, which calls into question the selection of the Leading Alternative, then the alternative selection may be revisited.

generators, governors, exciters and control systems at the Bridge River 1 Generating Station, can proceed at the earliest opportunity. Failures or further de-ratings[14] of the Unit 1 to 4 generators will not only cause loss of energy and capacity but will impede BC Hydro's ability to manage water flows in Lower Bridge River and significantly increase the likelihood of impacts to fish and fish habitat and St'át'imc values.

In section 1.5.2 below, BC Hydro provides a proposed regulatory process, which contemplates two rounds of information requests on both the BR1 Project and the BRT Project, followed by an argument phase for the BR1 Project and then an evidentiary update and further process for the BRT Project.

Figure 1-1 below illustrates the combined cumulative incremental rate impact of the BR1 Project and the BRT Project based on their respective Expected Cost estimates.[15]

**Figure 1-1 Combined Cumulative Incremental Rate Impact for the BR1 Project and the BRT Project**



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[14] "De-rated" refers to operation at less than the rated/maximum capability to compensate for adverse operating conditions. Unit 4 is currently de-rated to 40 MVA (from 50 MVA).

[15] Appendix A-3 contains the financial model used to determine the rate impacts presented in Figure 1-1.

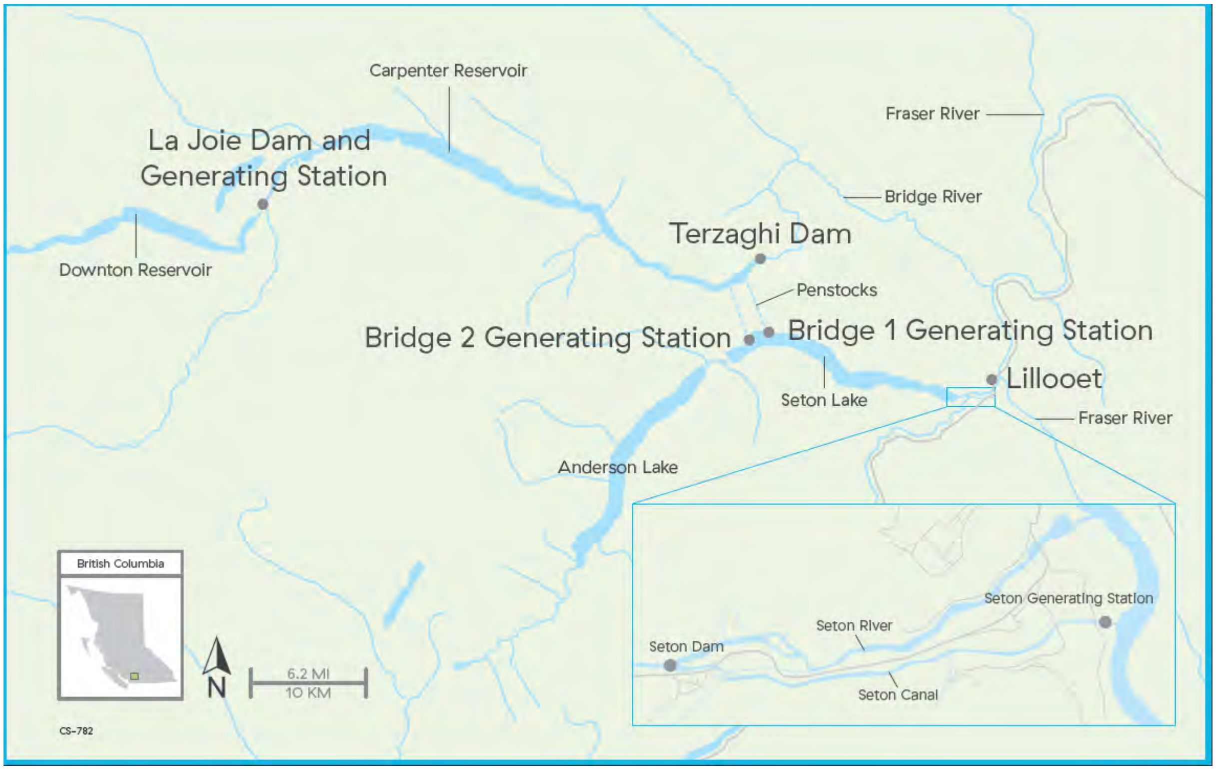
Further information on the rate impact of the BR1 Project is provided in section 5.5 of Chapter 5 and further information on the rate impact of the BRT Project is provided in section 10.5 of Chapter 10.

## 1.2 BR1 Project Highlights

### 1.2.1 Description of the Bridge River Generation System and Bridge River Facility

The Bridge River Generation System is located in the Coast Mountains of southern B.C., northeast of Pemberton and west of Lillooet. It was built between 1948 and 1960 and is a cascading system that includes three facilities: The La Joie Facility, the Bridge River Facility, and the Seton Facility, which collectively contribute approximately 5 per cent of BC Hydro's total annual hydroelectric generation, on average. Figure 1-2 below provides a map of the Bridge River Generation System.

**Figure 1-2 Map of the Bridge River Generating System**



The Bridge River Facility is the largest of the facilities in the Bridge River Generation System and consists of Terzaghi Dam, Carpenter Reservoir, Bridge River 1 Generating Station and Bridge River 2 Generating Station.

Chapter 2 of the Application provides additional details on the Bridge River Generation System.

### 1.2.2 BR1 Project is Needed to Address the Deteriorating Condition of Units 1 to 4 at the Bridge River 1 Generating Station

The BR1 Project is needed to address the deteriorating condition of Units 1 to 4 at the Bridge River 1 Generating Station. The generators and governors are in unsatisfactory and poor condition respectively, the exciters are approaching end of life and the control systems are obsolete. The condition of these assets increases the likelihood of equipment failure, which can cause unplanned outages and de-rating of equipment. Over the past few years, the Unit 4 generator has been de-rated and the overall condition of the generator components has deteriorated.[16]

The deteriorating condition of generating Units 1 to 4 needs to be addressed to:

- Maintain the value of the Bridge River 1 Generating Station by addressing the condition of the generators, governors, exciters and control systems and improving the reliability of generating Units 1 to 4; and
- Improve BC Hydro’s ability to manage water flows to comply with the 2011 Bridge River – Seton Water Use Plan (**WUP**) Order target flow schedule, meet commitments in the 2011 Agreements[17] and 2019 High Flow Settlement Agreement with the St’át’imc Nation, and maintain fish and fish habitat in Lower Bridge River.

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[16] “De-rated” refers to operation at less than the rated/maximum capability to compensate for adverse operating conditions. Unit 4 is currently de-rated to 40 MVA (from 50 MVA).

[17] The St’át’imc (Participating Communities) Settlement Agreement; the Certainty Provisions Agreement; and the Relations Agreements are collectively referred to as the 2011 Agreements. For further discussion on the 2011 Agreements, refer to section 3.4.1 of Chapter 3.

The Bridge River generating units are the primary means for BC Hydro to manage water flows in Lower Bridge River. The de-rating of the generating units at the Bridge River Facility and the reduced elevation of the Downton reservoir[18] have challenged BC Hydro's ability to manage flows within the WUP Order target flow schedule. Between 2015 and 2018, BC Hydro was unable to meet the WUP Order target flow schedule from Terzaghi Dam to Lower Bridge River. BC Hydro requested, and subsequently received, variances to the WUP Order.[19]

The risk of failure and further de-ratings to the generating units threatens to further decrease BC Hydro's ability to manage water flows. Failure to manage water flows within the WUP Order target flow schedule can impact fish and fish habitat and St'át'imc values. To improve BC Hydro's water flow management capabilities, the condition of generating Units 1 to 4 must be addressed so that they can be reliably operated up to their total licenced water flow capacity.[20]

Further information on the justification for the BR1 Project is provided in Chapter 3.

### 1.2.3 Preferred Alternative to Replace Unit 1 to 4 Generators Maximizes Reliability and Minimizes Environmental Impact, Cost and Cost Risk and Safety Risk

BC Hydro identified and evaluated three feasible alternatives to address the deteriorating condition of Units 1 to 4 at the Bridge River 1 Generating Station. All these alternatives would include replacement of the Unit 1 to 4 governors, exciters, and control systems and would either replace, refurbish, or rewind the Unit 1 to 4 generators. BC Hydro also evaluated an alternative to run the generators to failure (do nothing) and determined that this alternative was not feasible.

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[18] For further discussion on the reduced elevation of the Downton reservoir, refer to section 2.2.2 of Chapter 2.

[19] For further discussion on the WUP Order and the variances, refer to section 3.4 of Chapter 3.

[20] Licensed flow capacity is the maximum water flow rate BC Hydro is authorized to use for power generation purposes. Additional detail on the Bridge River 1 Generating Station licenses is provided in section 5.7.2 of Chapter 5.

BC Hydro's evaluation of the three feasible alternatives determined that the Preferred Alternative is to replace the Unit 1 to 4 generators, governors, exciters, and control systems. This alternative maximizes unit reliability, minimizes environmental impact, helps to meet the expectations of the St'át'imc Nation, minimizes cost risks without a material difference in cost, and minimizes overall safety risks.

Further information on the alternatives for the BR1 Project is provided in Chapter 4.

### 1.2.4 BR1 Project Description, Schedule and Impacts

The BR1 Project will replace the Unit 1 to 4 generators, governors, exciters, and control systems. Table 1-1 below outlines the plant total maximum MW and MVA ratings and the total licensed flow capacity for the Bridge River 1 Generation Station. There will be no change to the total licenced flow capacity for the Bridge River 1 Generating Station as a result of the BR1 Project.

**Table 1-1 Bridge River 1 Generating Station Plant Ratings and Total Licence Flow Capacity**

| | Plant Total Maximum MW Rating | Plant Total Maximum MVA Rating | Total Licenced Flow Capacity ($m^3/s$) |
|---|---|---|---|
| Original - 1954 | 180 | 200 | 62.3 |
| After Turbines Units 1 - 4 Replacement - 2003 | 200 | 200 | 62.3 |
| Water license issued[21] - 2011 | 200 | 200 | 65 |
| After Generator Unit 4 De-rating - 2011 | 190 | 190 | 65 |
| Current - 2021 | 190 | 190 | 65 |
| Post BR1 Project – 2030 | 230 | 230 - 260[22] | 65 |

BC Hydro expects to implement the BR1 Project in stages with staggered in-service dates for the four units. The target date for the first unit to be placed in service is in

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[21] Water license FWL 126080 was issued in 2011 to reconcile the maximum flow capacity (65 $m^3/s$) with the actual operating conditions that were authorized under the historical licenses.

[22] The MVA rating depends on the detailed design of the replacement generators.

fiscal 2028, with each unit placed into service in consecutive years until fiscal 2031. Installation and commissioning of each unit is planned to take place at the site during a planned outage over four consecutive years until all four units are replaced.

The estimated total cost range to implement the BR1 Project is between $207.1 million and $326.3 million (**BR1 Project Cost Range**), including both the capital and operating costs of undertaking the Project. The BR1 Project Cost Range is based on an Expected Cost of $243.4 million and an Authorized Cost of $326.3 million. The range reflects the estimating accuracy range of +21 per cent and -16 per cent of the Expected Cost.

BC Hydro expects to proceed to the Implementation Phase for the BR1 Project by April 2023 with an updated Expected Cost reflecting a +15 per cent and -10 per cent estimating accuracy range and an updated Authorized Cost. BC Hydro expects the updated Expected Cost to fall within the BR1 Project Cost Range.[23]

BC Hydro will undertake a public competitive process for the design, supply, installation, and commissioning of the generators and will use existing, competitively sourced blanket contracts[24] to purchase the replacement governors, exciters, and control systems, which will be installed by internal BC Hydro resources. The BR1 Project's procurement strategy will target opportunities for BC Hydro to meet its commitments to the St'át'imc Nation as reflected in the 2011 Agreements and the 2019 High Flow Settlement Agreement.[25]

The environmental impacts during construction of the BR1 Project are expected to be localized, short-term, reversible and with no measurable effect on the ecosystem. Once implemented, the BR1 Project will result in environmental benefits associated

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[23] BC Hydro's proposed regulatory process considers opportunities to provide cost estimate updates and is discussed further in section 1.5 below.

[24] Blanket contracts are long-term contracts between BC Hydro and an external vendor for the supply of items over a period of time based on predefined terms and conditions.

[25] Further information on these agreements is provided in Chapter 6.

with improved reliability and increased operational flexibility to manage flows within the WUP Order target flow schedule for Lower Bridge River.

The potential socio-economic impacts associated with the BR1 Project are similar to the impacts that were previously identified by St’át’imc communities during similar generator replacement projects at the Bridge River 2 Generating Station. The Bridge River facility is within St’át’imc Territory. The identified impacts include concerns regarding potential localized impacts on community safety and well-being, as well as potential regional impacts on the rental housing market. To mitigate potential impacts on community safety and well-being, BC Hydro has developed plans and policies similar to those undertaken with previous projects at the Bridge River 2 Generation Station that set out BC Hydro’s expectations regarding worker conduct and a procedure for addressing conduct violations. With regard to potential impacts on the rental housing market, it is expected that the increase in demand for temporary accommodation will be managed within the existing capacity of the local area. A water taxi service for travel to/from Lillooet could be provided, if required and BC Hydro will plan ahead and assist in locating suitable accommodation or suggest alternatives such as split shifts and/or schedule extensions, where possible, to manage capacity constraints and the impact on local communities. BC Hydro will continue to work with St’át’imc communities to implement these plans and policies, and to adapt to any new issues that arise related to the BR1 Project. The BR1 Project is expected to result in positive economic benefits for St’át’imc businesses and communities, through contracting and employment opportunities, including the use of the St’át’imc (Tsal’alh) owned Lil’tem’ Mountain Hotel in Seton Portage for worker accommodation.

Further information on the BR1 Project description, schedule and impacts is provided in Chapter 5.

### 1.2.5 BR1 Project Indigenous Nations Consultation and Stakeholder Engagement

The BR1 Project will take place within St’át’imc Territory and within Engagement Zone A as defined within the Tŝilhqot'in Stewardship Agreement between the Tŝilhqot'in National Government and the Government of B.C.

The BR1 Project is not anticipated to have significant potential impacts on the Tŝilhqot’in Nation or Tŝilhqot'in communities. BC Hydro informed the Tŝilhqot'in National Government of the BR1 Project and that no significant impacts are expected. The Tŝilhqot'in National Government informed BC Hydro that they have no concerns with the BR1 Project moving forward.

BC Hydro has been working with the St’át’imc Nation and the St’át’imc communities for several decades regarding their interests and concerns with regard to the Bridge River Generation and Transmission System. In May 2011, after 17 years of negotiations, the St’át’imc Nation, BC Hydro and the Government of B.C. signed a historic and comprehensive set of agreements, which settled the past, present and future impacts of the existing facilities and operations. The 2011 Agreements contemplated future repair, alteration, upgrade, removal or replacement for the Bridge River System facilities, including generating unit replacements, such as those being advanced through the BR1 Project. In 2019, BC Hydro and the St’át’imc Nation entered into another agreement, the 2019 High Flow Settlement Agreement, as an outcome of dispute resolution proceedings, in accordance with the 2011 Agreements, on how to address concerns and impacts of higher flows on Lower Bridge River.

BC Hydro has carried out consultation and engagement with the St’át’imc Nation in accordance with the terms and conditions of the 2011 Agreements and 2019 High Flow Settlement Agreement. Through this engagement, BC Hydro has confirmed to the St’át’imc Nation that the BR1 Project is not expected to result in incremental or material adverse impacts to St’át’imc’s Aboriginal rights given that the BR1 Project is replacing existing generating equipment within the existing footprint of the Bridge River 1 Generating Station. The BR1 Project will enhance BC Hydro's ability to reliably meet water flow targets through Terzaghi Dam to Lower Bridge River, therefore supporting an important core interest for St'át'imc to protect fish and fish habitat.

Through ongoing engagement, areas of concern for St'át'imc Nation have been identified related to elevated flows in the Bridge-Seton generation system, the influx of temporary workers, and procurement opportunities. These concerns have been, and will continue to be, addressed through existing relationship forums, as defined by the 2011 Agreements and 2019 High Flow Settlement Agreement. A communications and engagement plan is being developed by BC Hydro, with input from St'át'imc, to specify activities and timelines for this ongoing work.

BC Hydro's public engagement approach for the BR1 Project is focused on stakeholders and public groups within the vicinity of the Bridge River 1 Generating Station. At this time, besides some limited feedback and a few questions related to the potential economic benefits of the BR1 Project and its impact on community safety, BC Hydro has not received any additional specific concerns through the public engagement process. BC Hydro has shared information with local governments and stakeholders related to the questions and feedback received and will continue engagement activities to keep local government and stakeholders informed.

Further information on Indigenous Nations consultation and stakeholder engagement for the BR1 Project is provided in Chapter 6.

### 1.2.6 BR1 Project Risks

Consistent with BC Hydro's risk management practices and procedures, risk screenings have been conducted to identify BR1 Project risks and their associated risk treatments. A description of material risks and mitigation measures, and

BC Hydro's current expectations regarding the probability and consequence of each material risk at this stage of the BR1 Project are outlined in Chapter 7.

## 1.3 BRT Project Highlights

### 1.3.1 Description of the Bridge River Transmission System

The Bridge River Transmission System includes 10 substations[26] and three regional paths. The Bridge River Transmission System transmits power produced from the Bridge River Generation System and nearby Independent Power Producer (**IPP**) facilities, through the South Interior West, Fraser Valley, and Sunshine Coast areas, to customers in the Metro Vancouver and Fraser Valley areas through the following three regional paths, as shown in Figure 1-3 below.

- **Bridge River Regional Path 1 (circuit 2L90 and formerly 2L91):** from Bridge River Terminal Station to Kelly Lake Substation, interconnecting the Bridge River area and the South Interior West area;
- **Bridge River Regional Path 2 (circuits 3L2 and 3L5, Rosedale Transformer T1, and circuits 2L78 and 2L77):** from Bridge River Terminal Station to the Fraser Valley area and Metro Vancouver area; and
- **Bridge River Regional Path 3 (circuits 2L1, 2L2, 2L5, 2L41, 2L9 and 2L13):** from Bridge River Terminal Station to Cheekye Substation, interconnecting the Bridge River and the Sunshine Coast areas (which then interconnect to the North Shore, Metro Vancouver and Fraser Valley areas).

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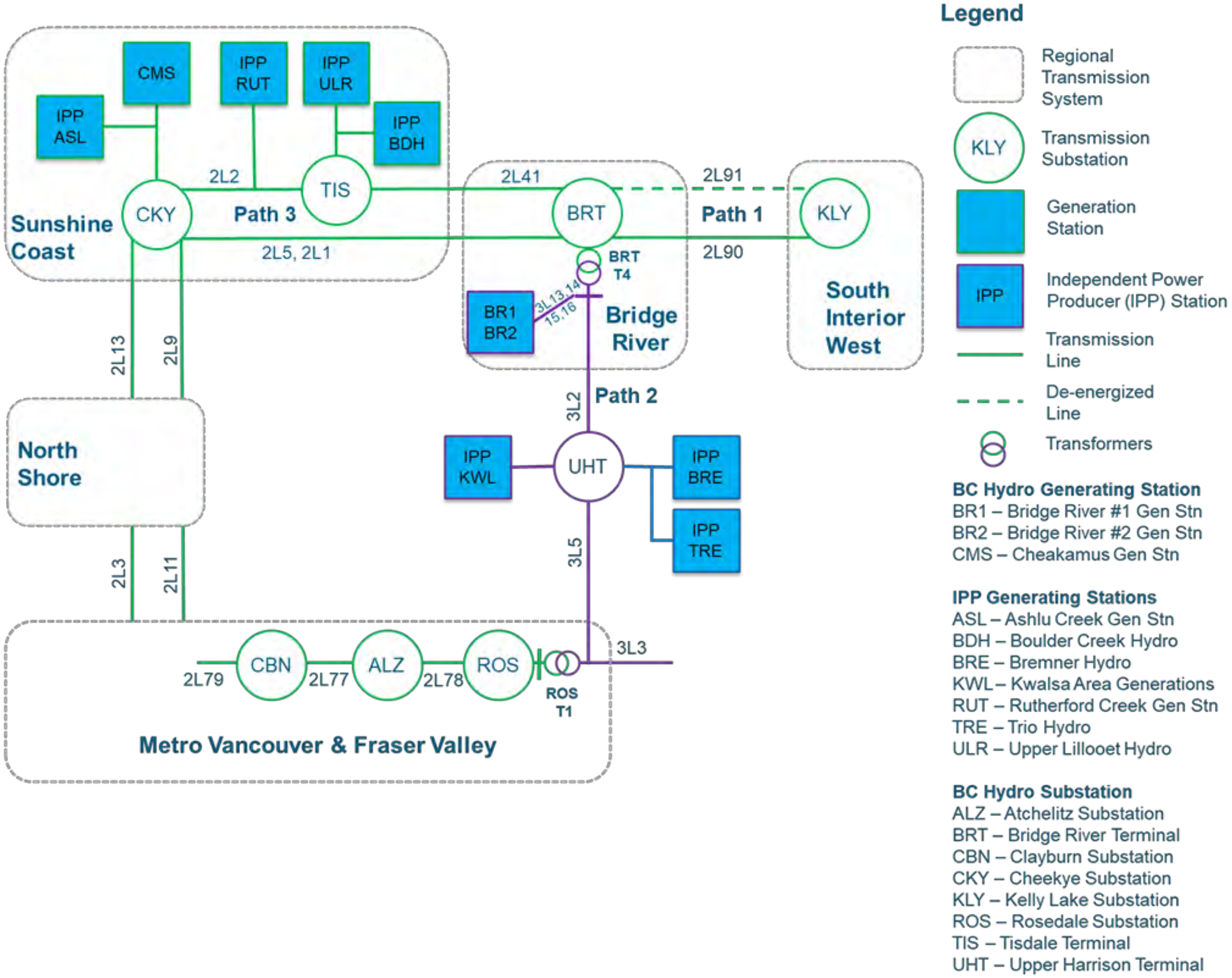
[26] The 10 substations are Atchelitz, Bridge River Terminal, Clayburn, Cheekye, Cypress, Kelly Lake, Lynn Valley, Rosedale, Upper Harrison Terminal and Walters.

Figure 1-3 Bridge River Transmission System Regional Paths



Chapter 2 of the Application provides additional details on the Bridge River Transmission System.

### 1.3.2 BRT Project is Needed to Address System Constraints and Asset Health Issues

The BRT Project is needed to address system constraints on the Bridge River Transmission System to accommodate existing and future generation, and to address asset health issues and clearance defects to improve the reliability and safety of the 2L90 circuit.

The maximum capacity[27] of the 2L90 circuit is reduced during the freshet and summer months due to higher seasonal ambient temperatures[28]. At the same time that the capacity of the 2L90 circuit is reduced, there is an increased amount of generation that needs to be moved from the Bridge River area to other areas of the province to serve customer load.

BC Hydro has been able to use limited operational measures to manage the 2L90 circuit within its maximum capacity as new IPP generation has been added to the Bridge River Transmission System primarily because of de-ratings to generating units at the Bridge River 1 and Bridge River 2 Generating Stations. However, Units 5, 6, 7 and 8 at the Bridge River 2 Generating Station either have been, or are currently being, replaced and the BR1 Project will address the de-rating of Unit 4 at the Bridge River 1 Generating Station. By 2030, the generating capacity of the Bridge River 1 and Bridge River 2 Generating Stations will be restored, and the Bridge River Facility will operate up to its total licensed flow capacity under the WUP Order.

System studies and future flow modeling show that in 2030, when the BR1 Project is completed and the generation capacity at the Bridge River Facility is restored, the

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[27] The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

[28] Ambient temperature is the temperature of the surrounding air.

amount of electric current flowing through the 2L90 circuit would reach 140 per cent of its maximum capacity during summer conditions, causing the 2L90 circuit to exceed its thermal limits and possibly leading to overheating, thermal damage and unsafe clearances. To accommodate generation in the Bridge River area, BC Hydro must address the constraints on the Bridge River Transmission System.

In addition, approximately 18 per cent of 2L90 circuit structures have significant defects requiring refurbishment within the next five years and approximately 77 per cent of the structures have defects on critical components that will need to be addressed in future years. While it is safe to operate the 2L90 circuit at the existing rating, several spans have clearance defects that need to be repaired.[29]

Further information on the justification for the BRT Project is provided in Chapter 8.

### 1.3.3 Leading Alternative is to Increase the Maximum Capacity of the 2L90 Circuit

BC Hydro identified and evaluated three feasible alternatives for the BRT Project. Based on the results of this evaluation, the Leading Alternative is to increase the maximum capacity of the 2L90 circuit from 585 A (233 MVA) to 1014 A (404 MVA) and to refurbish the 2L90 circuit. Based on the analysis that BC Hydro has completed to-date, when appropriate mitigation measures are in place, this alternative minimizes total costs without a material increase in expected environmental and archaeologic impacts. BC Hydro will work with St'át'imc communities to develop mitigation plans and policies, and to adapt to any new issues that arise related to the BRT Project.

The BRT Project is currently in the Feasibility Design stage of the Identification phase. By March 2022, BC Hydro expects to confirm whether the Leading Alternative will proceed as the Preferred Alternative. Following this decision,

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[29] BC Hydro has placed public warning and danger signage at these locations as a temporary measure until repair work is completed.

BC Hydro will file an evidentiary update to provide additional information on the BRT Project.[30]

Further information on the alternatives for the BRT Project is provided in Chapter 9.

### 1.3.4 BRT Project Description, Schedule and Impacts

The Leading Alternative for the BRT Project is to increase the maximum capacity of the 2L90 circuit from 585 A (233 MVA) to 1014 A (404 MVA) and to refurbish the 2L90 circuit.

The scope of work for the Leading Alternative for the BRT Project involves the following activities:

- Replacing 64 structures and re-contouring four sites along the 2L90 right-of-way to resolve conductor clearances;
- Replacing 34 structures to address reliability and safety related deficiencies;
- Replacing cross-arms, cross-braces, insulators and guy anchors/guards at 33 structure sites to address reliability and safety related deficiencies; and
- Upgrading approximately 63 kilometres of existing access roads and constructing approximately seven kilometres of new access roads to facilitate construction work for the project.

The planned in-service date for the BRT Project is October 2025, with all project activities scheduled to complete by April 2026.

The BRT Project has a Conceptual Expected Cost estimate of $66.2 million with an expected estimating accuracy range of +100 per cent and -35 per cent. The resulting BRT Project cost range is $43.0 million to $132.4 million (**BRT Project Cost Range**). The Conceptual cost estimate conforms to the requirements of the Association for the Advancement of Cost Engineering International (**AACE)** Class 5

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[30] BC Hydro's proposed regulatory process is discussed further in section 1.5 below.

cost estimate. As the BRT Project progresses through its lifecycle, the expected accuracy range of its cost estimate will narrow. BC Hydro expects to finalize a Feasibility Estimate for the BRT Project by November 2021. By March 2022, BC Hydro expects to confirm whether the Leading Alternative for the BRT Project, as set out in the Application, will proceed as the Preferred Alternative for the BRT Project. BC Hydro expects to proceed to the Implementation phase for the BRT Project by June 2023.[31] BC Hydro will seek input from St’át’imc when developing the BRT Project’s procurement approach in the Feasibility Design stage. Aligned with commitments and processes outlined in the 2011 Agreements and 2019 High Flow Settlement Agreement, BC Hydro will assess and recommend the best sourcing alternatives for the BRT Project with consideration of procurement risks and mitigations, Indigenous procurement opportunities, and project timing.

BC Hydro anticipates that the BRT Project may have environmental and socio-economic impacts. From a St’át’imc perspective, localized construction activities will result in impacts to culturally significant values that need to be addressed through an understanding of the interconnected nature of the ecosystem. This assessment will be refined, and mitigation measures will be developed in the Feasibility Design stage and the Definition phase for the BRT Project. This will include input and review from the St’át’imc Nation. The BRT Project will also have a positive impact on local employment and businesses during the Implementation phase. Contracting and employment opportunities for local communities will be further investigated and developed in the Feasibility Design stage and the Definition phase.

Further information on the BRT Project description, schedule and impacts is provided in Chapter 10.

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[31] BC Hydro’s orders sought and proposed regulatory process consider opportunities to provide cost estimate updates and are discussed further in section 1.5 below.

### 1.3.5 BRT Project Indigenous Nations Consultation and Stakeholder Engagement

The BRT Project will take place within St’át’imc Nation Territory and within Engagement Zone A as defined within the Tŝilhqot'in Stewardship Agreement between the Tŝilhqot'in National Government and the Government of B.C., and overlaps with the traditional territories of five additional Nations as discussed below.

BC Hydro has engaged with the St’át’imc Nation on the BRT Project in accordance with the commitments set out in the 2011 Agreements and 2019 High Flow Settlement Agreement. This has included information sharing on the BRT Project through established relationship forums, seeking input on interests and concerns related to the project as well as collaboration on the development of appropriate engagement and consultation processes.

Engagement with the Tŝilhqot'in National Government has been undertaken in accordance with the guidelines set out in the Tŝilhqot'in Stewardship Agreement. The Tŝilhqot'in National Government has not identified any concerns with the BRT Project. BC Hydro’s consultation with the Tŝilhqot'in National Government to date complies with the Tŝilhqot'in Stewardship Agreement and satisfies the duty to consult and accommodate the Tŝilhqot'in National Government.

A portion of the BRT Project area that is north and east of Lillooet, towards the Kelly Lake substation, overlaps with the traditional territories of the following Indigenous Nations, who are also being consulted on the proposed work in their traditional territories: Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band. BC Hydro is engaging with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band through established communications channels with these Nations.

The BRT Project is still in the early planning and investigation stages and consultation is ongoing. Throughout the BRT Project lifecycle, BC Hydro will continue to involve the St’át’imc Nation as stipulated under the 2011 Agreements and 2019 High Flow Settlement Agreements including the communications and engagement plan being developed for the project. BC Hydro will continue to consult with Tŝilhqot'in on any significant scope changes or additional input from the Tŝilhqot'in National Government and will respond to any questions or concerns they may have. BC Hydro will also continue engagement with the communities of Bonaparte First Nation, High Bar First Nation, Neskonlith Indian Band, Whispering Pines/Clinton Indian Band and Nooaitch Indian Band to receive any inputs and understand any issues and concerns they may have and to establish additional opportunities for participation throughout the lifecycle of the BRT Project. The findings from the BRT Project Feasibility Design stage activities, including more detailed impact assessment and consultation activities on the impact assessment with Indigenous Nations, will be included in an evidentiary update, to be filed later in this proceeding.

BC Hydro is committed to informing local government, stakeholders and the public about the BRT Project and providing opportunities for feedback. To date, ongoing engagement activities have resulted in limited feedback and few questions with respect to the BRT Project. The questions we have received are related to the proposed location of the BRT Project and clarity on the purpose and details of the BRT Project. BC Hydro has also received requests to be kept informed of the BRT Project as it progresses.

Further information on Indigenous Nations consultation and stakeholder engagement for the BRT Project is provided in Chapter 11.

### 1.3.6 BRT Project Risks

Consistent with BC Hydro’s risk management practices and procedures, risk screenings have been conducted to identify BRT Project risks and their associated risk treatments. BC Hydro has quantified the known risks at this stage of the BRT Project and has provided a description of material risks and mitigation measures.

These material risks and their associated mitigation measures and status will continue to be updated as the BRT Project moves through its project lifecycle. BC Hydro's current expectations regarding the probability and consequence of each material risk at this stage of the BRT Project are outlined in Chapter 12.

## 1.4 BC Hydro's Capability to Undertake the Project

### 1.4.1 Nature of the Business

BC Hydro is a Crown Corporation established in 1962 under the *Hydro and Power Authority Act*.[32] BC Hydro is mandated to generate, distribute and sell electricity; upgrade its power sites; and purchase power from, or sell power to, a firm or person. BC Hydro is the largest electric utility in British Columbia, serving approximately 95 per cent of the population. BC Hydro is charged with the responsibility of, among other things, owning and safely operating the generation and storage Heritage Assets set out in Schedule 1 of the *Clean Energy Act*.

BC Hydro's head office is at 333 Dunsmuir Street, Vancouver, British Columbia.

### 1.4.2 Financial Capacity of Applicant

BC Hydro has been financing the development of its electrical facilities since its inception in 1962. Currently, BC Hydro finances the development of those facilities, including upgrades of existing facilities, by borrowing funds from the Government of B.C. under the applicable provisions of the *Hydro and Power Authority Act* and the *Financial Administration Act*, and by funds generated internally through the operation of its business.

### 1.4.3 Technical Capacity of Applicant

BC Hydro has been responsible for the planning, design and construction of generation, transmission, and distribution facilities since 1962. In 2016, BC Hydro completed its second Organizational Project Management Maturity Model

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[32] R.S.B.C. 1996, c. 212.

Assessment and was placed in the top-tier of participating organizations from around the world. In that year, BC Hydro also received the Project Management Office of the Year Award from the Project Management Institute, recognizing superior organizational project management capabilities. In 2018, the Office of the Auditor General of B.C. released an independent audit of Capital Asset Management in BC Hydro and found that BC Hydro has good asset management practices as a result of a decade long plan and associated efforts. The audit had no recommendations for improvement.

BC Hydro has managed major projects similar to the BR1 Project that involved major generator replacements or refurbishments in existing operating facilities and major projects similar to the BRT Project that involved upgrading, relocating or refurbishing transmission lines.[33]

### 1.4.4 Project Structure and Governance

The organizational structure for the BR1 Project and the BRT Project is composed of full-time BC Hydro employees who have extensive experience in the range of activities required to oversee, manage, plan, and implement capital projects. BC Hydro has also retained the services of external parties to provide advice on certain aspects of the BR1 Project and the BRT Project. BC Hydro's Executive Team and Board of Directors have provided, and will continue to provide, oversight over both the BR1 Project and the BRT Project.

Further information on the organizational structure, consulting firms and governance for the BR1 Project and the BRT Project is provided in Appendix A-4.

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[33] Further information is provided in section 7.2.1 of Chapter 7 (for the BR1 Project) and section 12.2.1 of Chapter 12 (for the BRT Project).

## 1.5 Orders Sought and Proposed Regulatory Process

### 1.5.1 Orders Sought

BC Hydro requests an Order or Orders pursuant to sections 45 and 46 of the *Utilities Commission Act*:

1. Granting a CPCN for the BR1 Project as described in Chapter 5 of the Application;
2. Granting a CPCN for the BRT Project as described in Chapter 10 of the Application;
3. Directing BC Hydro to file semi-annual progress reports with the BCUC on the BR1 Project's scope, cost, schedule, risks, and ongoing consultation and mitigation plans;
4. Directing BC Hydro to file semi-annual progress reports with the BCUC on the BRT Project's scope, cost, schedule, risks, and ongoing consultation and mitigation plans;
5. Directing BC Hydro to file a Project Completion and Evaluation Report (**PCER**) for the BR1 Project three months after receiving approval of the PCER from BC Hydro's Board of Directors; and
6. Directing BC Hydro to file a PCER for the BRT Project three months after receiving approval of the PCER from BC Hydro's Board of Directors.

Further information with regard to BC Hydro's proposed project reporting is provided in section 1.5.3 below. Draft Orders are provided as Appendix A-2.

### 1.5.2 Proposed Regulatory Review Process

As discussed in section 1.1 above, the BR1 Project and the BRT Project are at different stages in the project lifecycle. In its decision on BC Hydro's Fiscal 2020 to Fiscal 2021 Revenue Requirements Application, the BCUC directed BC Hydro to file a joint CPCN application so that the BR1 Project and the BRT Project could be reviewed together.[34] The Application provides information on both the BR1 Project and the BRT Project and BC Hydro's proposed regulatory process below allows these projects to be reviewed together through two rounds of information requests.

Following two rounds of information requests on both the BR1 Project and the BRT Project, BC Hydro is proposing that the BR1 Project proceed to the argument phase and that further process be established to review an evidentiary update providing further information on the BRT Project.

However, BC Hydro is only asking the BCUC to establish a regulatory timetable up to the second round of information requests at this time and has proposed a procedural conference date where, among other things, the BCUC could consider submissions with regard to whether, following two rounds of information requests, the BR1 Project is able to move to the argument phase, while an evidentiary update providing further information on the BRT Project is reviewed.

Assuming the BCUC adopts this process, BC Hydro will provide further submissions on whether the BR1 Project can move to the argument phase, separate from the BRT Project, at the appropriate time. At this time, BC Hydro provides the following reasons for proposing this approach:

- The BR1 Project and the BRT Project are at different stages in the project lifecycle;
- BC Hydro is filing this application now, rather than waiting until further information is available for the BRT Project because, as discussed further in Chapter 3, work to address the deteriorating condition of the aging generators, governors, exciters and control systems at the Bridge River 1 Generating Station, must proceed at the earliest opportunity. To meet the BR1 Project Implementation phase start date of April 2023, BC Hydro requires a CPCN for

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[34] Refer to page 99 and Directive 29 of BCUC Decision and Order No. G-246-20 on BC Hydro's Fiscal 2020 to Fiscal 2021 Revenue Requirements Application.

the BR1 Project by no later than July 2022. This will allow BC Hydro to proceed with the procurement of the replacement generators and the First Full Funding request to maintain the BR1 Project schedule;

- To grant a CPCN for the BR1 Project, the BCUC may consider other planned investments for the Bridge River System, as outlined in Chapter 2, including the BRT Project. Specifically, the BCUC may consider the extent to which its decision on the BR1 Project depends on the BRT Project. However, a decision to grant a CPCN for the BR1 Project does not require a decision on whether to grant a CPCN for the BRT Project because:
  - ▶ The BR1 Project is needed to address the deteriorating condition of the aging generators, governors, exciters and control systems at the Bridge River 1 Generating Station. BC Hydro must address the condition of these aging assets to improve:
    - ▪ The reliability of the generating units, mitigating the risk of equipment failure as well as the potential for forced outages and further de-rating of the generating equipment; and
    - ▪ The management of water flows in the Bridge River System so that BC Hydro can comply with the WUP Order target flow schedule for Lower Bridge River, meet its commitments in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation and maintain fish and fish habitat in Lower Bridge River; and
  - ▶ The Bridge River System remains economic[35] with a positive Net Present Value (**NPV**) of $1,180 million, when planned investments and operating costs, including costs related to the BR1 Project and the BRT Project, are

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[35] During the Fiscal 2020 to Fiscal 2021 Revenue Requirements Application proceeding, interveners expressed interest in the economic value of the Bridge River Generation System. Refer to Transcript Volume 11, page 1906 to 1915.

considered. Further information on this analysis is provided in section 2.6 of Chapter 2.

Table 1-2 below sets out a proposed regulatory review process for the Application.

**Table 1-2 Proposed Regulatory Review Process**

| Item | Date |
|---|---|
| Public Notice | August 27, 2021 |
| Intervener Registration | September 15, 2021 |
| BCUC Information Request No. 1 | September 16, 2021 |
| Intervener Information Request No. 1 | September 23, 2021 |
| BC Hydro responses to BCUC and Intervener Information Request No. 1 | November 4, 2021 |
| BCUC Information Request No. 2 | December 2, 2021 |
| Intervener Information Request No. 2 | December 9, 2021 |
| BC Hydro responses to BCUC and Intervener Information Request No. 2 | January 27, 2022 |
| Procedural Conference (if required) | February 8, 2022 |
| BC Hydro Final Submission – BR1 Project | February 24, 2022 |
| Intervener Final Submission – BR1 Project | March 17, 2022 |
| BC Hydro Reply Submission – BR1 Project | April 7, 2022 |
| BCUC Decision – BR1 Project | July 2022 |
| BC Hydro Evidentiary Update – BRT Project | BC Hydro will propose a date in March 2022 |
| Further Process – BRT Project | BC Hydro will propose a review process when the evidentiary update is filed |

### 1.5.3 Proposed Project Reporting

BC Hydro proposes to file semi-annual progress reports with the BCUC, covering the BR1 Project and BRT Project implementation, scope, cost, schedule, risks, and ongoing consultation and mitigation plans. The semi-annual progress reports would be filed within 45 days of the end of each reporting period. BC Hydro proposes to file the PCERs for the BR1 Project and the BRT Project three months after receiving approval from BC Hydro’s Board of Directors.

The BR1 Project Cost Range reflects an estimating accuracy range of +21 per cent and -16 per cent of the Expected Cost. BC Hydro expects to proceed to the Implementation phase for the BR1 Project by April 2023 with an updated Expected Cost reflecting a +15 per cent and -10 per cent estimating accuracy range and an updated Authorized Cost. BC Hydro expects the updated Expected Cost to fall within the BR1 Project Cost Range. BC Hydro will provide this updated Expected Cost and updated Authorized Cost through a semi-annual progress report.

BC Hydro will provide further details on proposed reporting for the BRT Project in its evidentiary update on the BRT Project.

## 1.6 Application Structure and Concordance with BCUC Guidelines and Government Policy

### 1.6.1 Chapters and Appendices

Table 1-3 below provides an outline of the Chapters and Appendices included in the Application.

**Table 1-3 Outline of the Chapters and Appendices**

| Reference | Title | Description |
|---|---|---|
| Chapter 2 | Bridge River Generation and Transmission System | This chapter provides an overview of the Bridge River Generation System and the Bridge River Transmission System, including a forward-looking economic analysis of the Bridge River System. |
| Chapter 3 | BR1 Project Justification | This chapter provides the justification for the BR1 Project. |
| Chapter 4 | BR1 Project Alternatives Analysis | This chapter includes an overview of the alternatives considered and the alternative analysis for the BR1 Project. |
| Chapter 5 | BR1 Project Description and Impacts | This chapter provides a description of the BR1 Project’s scope and activities, procurement approach, cost, rate impact, schedule and environmental and social impacts. It also includes an overview of the BR1 Project’s procurement history, and the decisions made to minimize project cost and cost risk. |

| Reference | Title | Description |
|---|---|---|
| Chapter 6 | BR1 Project Indigenous Nations Consultation and Public Engagement | This chapter describes the consultation and engagement that BC Hydro has undertaken with Indigenous Nations and public stakeholders specific to the BR1 Project. |
| Chapter 7 | BR1 Project Risks and Risk Management | This chapter describes the risk assessment process, the identified material risks, treatment plans and the retained operational risks for the BR1 Project. |
| Chapter 8 | BRT Project Justification | This chapter provides the justification for the BRT Project. |
| Chapter 9 | BRT Project Alternatives Analysis | This chapter includes an overview of the alternatives considered and the alternative analysis for the BRT Project. |
| Chapter 10 | BRT Project Description and Impacts | This chapter provides a description of the BRT Project's scope and activities, cost, rate impact, schedule and environmental and social impacts. |
| Chapter 11 | BRT Project Indigenous Nations Consultation and Public Engagement | This chapter includes a discussion of the consultation and engagement that BC Hydro has undertaken to Indigenous Nations and public stakeholders specific to the BRT Project. |
| Chapter 12 | BRT Project Risks and Risk Management | This chapter describes the risk assessment process, the identified material risks, treatment plans for the BRT Project. |
| **Bridge River Projects** | | |
| Appendix A-1 | Glossary and Abbreviations | |
| Appendix A-2 | Draft Orders | Draft Procedural Order<br>Draft Order – BR1 Project<br>Draft Order – BRT Project |
| Appendix A-3 | BR1 and BRT Project Rate Impact | An excel spreadsheet of the rate impact model. |
| Appendix A-4 | BR1 and BRT Project Organization Structures and Governance | Information on the project teams and project governance, including organizational charts. |
| Appendix A-5 | Capital Allocation Risk Matrix | The Capital Allocation Risk Matrix is used primarily to evaluate risks related to existing assets. |

| Reference | Title | Description |
|---|---|---|
| Appendix A-6 | Indigenous Nations Consultation | A-6-1 Overview of Settlement Agreements<br>A-6-2 Certainty Provisions Agreement<br>A-6-3 Relations Agreement<br>A-6-4 2011 St'át'imc (PC) Settlement Agreement<br>A-6-5 2019 High Flow Settlement Agreement<br>A-6-6 BR1 Consultation Records<br>A-6-7 BRT Consultation Records<br>A-6-8 Examples of Consultation Material<br>A-6-9 BR1 Project Submission to Tŝilhqot'in National Government<br>A-6-10 BR1 Project - Tŝilhqot'in National Government Response<br>A-6-11 BRT Project Submission to Tŝilhqot'in National Government<br>A-6-12 BRT Project - Tŝilhqot'in National Government Response |
| Appendix A-8 | Project Delivery Risk Management Process and Matrix | The Project Delivery Risk Matrix is used primarily to evaluate risks related to the successful delivery of projects. |
| **Bridge River 1 Units 1 to 4 Generator Replacement Project** | | |
| Appendix B-1 | Bridge River Water Use Plan Order and Variance Orders | 2011 Bridge River Water Use Plan Order<br>2017 and 2018 Variance Orders |
| Appendix B-2 | Bridge River System Studies | B-2-1: 2014 Bridge River System Study Summary Memo<br>B-2-2: 2020 Bridge River System Update<br>B-2-3: 2020 Bridge River Economic Analysis and System Financial Model |
| Appendix B-3 | Bridge River Facility Asset Plan | Bridge River Facility Asset Plan<br>La Joie Facility Asset Plan<br>Seton Facility Asset Plan |
| Appendix B-4 | Bridge River Facility Water Licences | Final Water License 126080, 126287, 126288 |
| Appendix B-5 | BR1 Alternative Assessment Financial Model | A financial model (Excel spreadsheet) to compare the costs and benefits of the project and feasible alternatives, including estimates of the value of the costs and benefits of each alternative. |

| Reference | Title | Description |
|---|---|---|
| Appendix B-6 | BR1 Summary of Power Benefits Study for Bridge River 1 Unit 1 to 4 Generators and Plant Equipment Replacement | A summary of studies carried out to inform the business case for upgrading the generators and plant equipment on the units at Bridge River 1. |
| Appendix B-7 | BR1 Preliminary Design Report | This report summarizes and consolidates the Preliminary-level design activities performed, and presents the Preliminary level design information, cost estimate and recommendations to proceed for the BR1 Project. |
| Appendix B-8 | BR1 Procurement Decision (Confidential) | This appendix provides an overview of how the procurement approach for the new generators was determined. |
| Appendix B-9 | BR1 Project Cost Estimate | Cost Estimate Report – The Preliminary Level Cost Estimating Report conforms to AACEI Class 3 cost estimate requirements. |
| Appendix B-10 | BR1 Project Expenditure Breakdown by Year | BR1 Project Expenditure Breakdown by Year |
| Appendix B-11 | BR1 Rate Impact Model | Excel spreadsheet - Estimated annual incremental rate impacts due to the BR1 Project relative to the overall projected annual BC Hydro rate increase forecast, taking into account the expected project in-service date and its Expected and Authorized Cost estimates. |
| Appendix B-12 | BR1 Project Schedule | Gantt chart of the BR1 Project Schedule |
| Appendix B-13 | BR1 Environmental Impact Statement | Includes results of flow modelling and socio-economic assessment.<br>The BR1 Environmental Impact Statement identifies and assesses the BR1 Project's impact on the bio-physical environment based on valued components, identifies potential direct and indirect BR1 Project effects, and develops appropriate measures to mitigate potential adverse effects. |
| Appendix B-14 | Bridge River Contract Worker Conduct Requirements Policy | The Bridge River Worker Conduct Requirements include specific requirements for all workers while in the Bridge River area. |
| Appendix B-15 | Bridge River 1 Stakeholder Engagement Materials | Examples of materials shared with the stakeholders during engagement. |

| Reference | Title | Description |
|---|---|---|
| **Bridge River Transmission Project** | | |
| Appendix C-1 | Transmission Studies | Network Integration Transmission Service Study Report<br>Network Integration Transmission Service Study Report Study Addendum |
| Appendix C-2 | IPP Generation Curtailment Description and Cost Estimate Assessment Methodology | Overview of IPP generation curtailment and the methodology used to estimate the opportunity cost of IPP curtailment for Alternative 3. |
| Appendix C-3 | BRT Project Alternative Assessment Financial Model | A financial model (Excel spreadsheet) to compare the costs and benefits of the project and feasible alternatives, including estimates of the value of the costs and benefits of each alternative. |
| Appendix C-4 | BRT Project Conceptual Design Report | This report summarizes and consolidates the Conceptual-level design activities performed, and presents the Conceptual level design information, cost estimate and recommendations to proceed for the BRT Project. |
| Appendix C-5 | BRT Project Schedule | Gantt chart of the BRT Project schedule |
| Appendix C-6 | Project Expenditure Breakdown by Year | Project Expenditure Breakdown by Year |
| Appendix C-7 | BRT Financial Models – Rate Impact | Excel spreadsheets - Estimated annual incremental rate impacts due to the BRT Project relative to the overall projected annual BC Hydro rate increase forecast, taking into account the expected project in-service date and its Expected and Authorized Cost estimates. |
| Appendix C-8 | BRT Project – Preliminary Environmental Impact Statement | The BRT Environmental Impact Statement identifies and assesses the BRT Project's impact on the bio-physical environment based on valued components, identifies potential direct and indirect BRT Project effects, and develops appropriate measures to mitigate potential adverse effects. |
| Appendix C-9 | BRT Project Stakeholder Engagement Materials | Examples of materials shared with the stakeholders during engagement. |

### 1.6.2 BR1 Project – CPCN Guidelines Concordance Table

Table 1-4 below provides a concordance table that identifies where information set out in the BCUC's CPCN Guidelines can be found for the BR1 Project.

**Table 1-4 BR1 Project - CPCN Filings Guidelines Concordance Table**

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| **Applicant** | | |
| Name, address and description of the nature of the applicant's business and all other persons having a direct interest in project ownership or management. | Section 1.4.1, cover letter, Appendix A-4 (Project structure and governance) | *Applies to both BR1 and BRT* |
| Evidence of the financial and technical capacity of the applicant and other persons involved, if any, to undertake and operate the project. | Sections 1.4.2, 1.4.3 (Financial and Technical Capacity) | *Applies to both BR1 and BRT* |
| Name, title and address of the person with whom communication should be made respecting the application. | Cover letter | *Applies to both BR1 and BRT* |
| Name and address of legal counsel for the applicant, if any. | Cover letter | *Applies to both BR1 and BRT* |
| Organizational chart of the project team, including the names of the Project Manager and Executive Sponsor for the project. | Appendix A-4 (Project Structure and Governance) | *BC Hydro has omitted individual names for privacy reasons* |
| Outline of the regulatory process the applicant recommends for the Commission's review of the application, including how persons who were consulted about the project can raise outstanding application-related concerns with the Commission. | Section 1.5, cover letter | *Applies to both BR1 and BRT* |
| **Project Need, Alternatives and Justification** | | |
| Studies or summary statements identifying the need for the project and confirming the technical, economic and financial feasibility of the project, identifying assumptions, sources of data, and feasible alternatives considered. The applicant should identify alternatives that it deemed to be not feasible at an early screening stage, and provide the reason(s) why it did not consider them further | Sections 1.2.2, 3.3, 3.4 (BR1 Project need)<br>Appendix B-5 (BR1 Project Alternative Assessment Financial Model)<br>Chapter 4<br>(BR1 Alternative Analysis)<br>Chapter 5 (BR1 Project Description) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| A comparison of the costs, benefits and associated risks of the project and feasible alternatives, including estimates of the value of all of the costs and benefits of each alternative or, where these costs and benefits are not quantifiable, identification of the cost area or benefit that cannot be quantified. Cost estimates used in the economic comparison should have, at a minimum, a Class 4 degree of accuracy as defined in the most recent revision of the applicable AACE International Cost Estimate Classification System Recommended Practices. | Chapter 4 (BR1 Project Alternatives Analysis)<br>Appendix B-5 (BR1 Project Alternative Assessment Financial Model) | |
| A schedule calculating the revenue requirements of the project and feasible alternatives, and the resulting impacts on customer rates. | Section 5.5 (BR1 Project Rate Impact)<br>Appendix B-11 (BR1 Project Rate Impact Models)<br>Section 1.1 (BR1 and BRT Projects rate impact) | |
| Evidence of the financial and technical capacity of the applicant and other persons involved, if any, to undertake and operate the project; | Sections 1.4.2 and 1.4.3 (Financial and Technical Capacity) | |
| A schedule calculating the net present values of the incremental cost and benefit cash flows of the project and feasible alternatives, and justification of the length of the term and discount rate used for the calculation. | Appendix B-5 (BR1 Project Alternative Assessment Financial Model)<br>Section 4.5.4 (discount rate and term) | |
| A schedule and supporting discussion comparing the project and feasible alternatives in terms of social and environmental factors, and the applicant's assessment regarding the overall social and environmental impact of the project relative to the overall impact of the feasible alternatives. | Sections 4.5.2, 4.5.3 (BR1 Alternative Analysis) | |
| Information relating the project to the applicant's approved long-term resource plan filed pursuant to section 44.1 of the UCA, including the extent to which the project was considered in the plan, and, if applicable, a discussion explaining how the plan provides support and justification for the need for the project. | Section 1.6.5 (Government of B.C. Energy Objectives and Policy) | *Applies to both BR1 and BRT* |
| **Public Consultation** | | |
| Overview of the community, social and environmental setting in which the project and its feasible alternatives will be constructed and operated, and of the public who may be directly impacted by the project and its feasible alternatives. | Section 6.3.2 (BR1 Project Local Community Setting) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| Description of the information and consultation programs with the public, including the organizations, agencies and individuals consulted, the information provided to these parties, and a chronology of meetings and other communications with members of the public and their representatives. This includes consultation with both the public who may be directly impacted by the project and the public that may experience impacts on their rates and service. | Sections 6.3.2, 6.3.4 (BR1 Project Local Community Setting, Engagement Activities to Date)<br>Appendix B-15 (BR1 Project Stakeholder Engagement Materials) | |
| Description of the issues and concerns raised during consultations, the measures taken or planned to address issues or concerns, or an explanation of why no further action is required to address an issue or concern. | Section 6.3.5 (BR1 Project Public Support and Issues Identified) | |
| Identification of any outstanding issues or concerns. | Not applicable | |
| Applicant's overall assessment as to the sufficiency of the public consultation process with respect to the project, in the context of the decision which is being sought from the Commission. | Section 6.3.1 (BR1 Project Public Engagement Introduction) | |
| A statement of what future public consultation is contemplated subsequent to the preparation of the CPCN application. | Section 6.3.6 (BR1 Project Plan for Ongoing Public Engagement Activities) | |
| **Project Description** | | |
| Description of the project, its purpose and cost, including engineering design, capacity, location options and preference, safety and reliability considerations, and all ancillary or related facilities that are proposed to be constructed, owned or operated by the applicant. | Sections 5.2, 5.4 (BR1 Project Description)<br>Appendix B-7 (BR1 Project Preliminary Design Report) | |
| Outline of the anticipated construction and operation schedule, including critical dates of key events, a chart of major activities showing the critical path (e.g., GANTT chart), and the timing of approvals required from other agencies to ensure continued economic viability. | Section 5.6 (BR1 Project Schedule)<br>Appendix B-12 (GANTT chart) | |
| Description of any new or expanded public works, undertakings or infrastructure that will result from or be required by the project, and an estimate of the costs and necessary completion dates. | Section 5.8.5 (BR1 Project Public Works Impact) | |
| Human capital resources required to undertake the project. | Appendix A-4 (Project Structure and Governance) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| Risk analysis identifying all significant risks to successful completion of the project, including an assessment of the probability of each risk occurring, and the consequences and the cost to mitigate the risk. The applicant should provide a summary description of significant project risks, including an assessment of the impact of each risk, the proposed risk mitigation strategy, and to the extent known, the financial and schedule impacts if the risk is realized. The risk evaluation should incorporate a risk assessment matrix with appropriate levels of severity and probability, a risk register and risk treatment as recommended in the latest revision of AACE International Recommended Practices. | Chapters 7 (BR1 Project Risks)<br>Appendix A-7 (Project Delivery Risk Process and Matrix) | |
| Identification and preliminary assessment of potential effects of the project on the physical, biological and social environments or on potentially affected First Nations and the public, proposals for reducing potentially negative effects and maximizing benefits from positive effects, and the cost to the project of implementing the proposals | Chapter 6 (BR1 Project Indigenous Nations Consultation and Public Consultation)<br>Section 5.8 (BR1 Project Impacts and Mitigation) | |
| Identification of the customers to be served by the project and, where the project would expand the area served by the applicant, a geographical description of the expanded service area. | Not applicable | |
| A list of all required federal, provincial and municipal approvals, permits, licenses or authorizations and any applicable environmental assessment or other required project review processes. | Section 5.7 (BR1 Project Permits, Approval and Authorizations)<br>Appendix B-1 (WUP and Variance Orders)<br>Appendix B-4 (Water Licences)<br>Appendix B-13<br>(BR1 Project Environmental Impact Statement) | |
| A summary of the material conditions that are anticipated in federal, provincial and municipal approvals and confirmation that the costs of complying with these conditions are included in the cost estimate in the application. | Not applicable | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| **Project Cost Estimate** | | |
| The project cost estimate should comply with applicable AACE International Cost Estimate Classification System Recommended Practices, use the terminology in the latest revision of AACE International Recommended Practice - Cost Engineering Terminology and list the AACE Recommended Practices used in the preparation of the cost estimate. | Appendix B-9 (BR1 Project Preliminary Cost Estimate)<br>Section 5.4 (BR1 Project Cost) | |
| The project cost estimate should include the basis of estimate, the preparation effort (level of effort used to develop the cost estimate), as defined in the latest revision of the AACE International Recommended Practices, along with a description of the method of estimating used, the percentage of project definition and design complete at the time of the estimate based on the judgment of the utility's management, identification and justification of all assumptions, exclusions, inflation and discount factors, and sources of benchmarks and other data including lessons learned from relevant past projects. | Appendix B-9 (BR1 Project Preliminary Cost Estimate)<br>Section 5.4 (BR1 Project Cost) | |
| The cost estimate should be stated in nominal as well as real dollars, identify an expected accuracy range with stated confidence level and have, at a minimum, a Class 3 degree of accuracy as defined in the latest revision of the AACE International Recommended Practices. | Appendix B-9 (BR1 Project Preliminary Cost Estimate)<br>Section 5.4 (BR1 Project Cost)<br>Table 4-3 (Net Present Value of Cost for Alternatives) | |
| The cost estimate should provide:<br>a) Any funds spent in prior years attributable to the project;<br>b) A list of all project direct and indirect costs using an appropriate level of work breakdown structure, based on the nature, size and complexity of the project, by year until completion;<br>c) Escalation (including inflation) amount and justification;<br>d) Contingency amount and justification;<br>e) Interest during construction or allowance for funds used during construction and corporate overhead;<br>f) Identification and explanation of any management or other reserves;<br>g) Any legal, regulatory and other project costs, including costs associated with First Nations and public consultation and accommodation; and<br>h) The amounts and sources of any contributions in aid of construction, grants or other funding or credits related to the project. | Appendix B-9 (BR1 Project Preliminary Cost Estimate)<br>Appendix B-10<br>(BR1 Project Expenditure Breakdown by Year)<br>Section 5.4 (BR1 Project Cost) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| Identification of any cost items not included in the estimate, such as transportation costs, sunk costs and the reason for the exclusion. | Section 5.4 (BR1 Project Cost) | |
| If a Monte Carlo analysis was used to model and provide justification for the amount of project contingency included in the cost estimate, then provide the following:<br>a) The base estimate;<br>b) The P50 expected value estimate;<br>c) The P-value including contingency and the dollar value;<br>d) The P-value including reserves, if any, and the dollar value;<br>e) The P90, the input probability curves;<br>f) The relationship between the inputs and the output;<br>g) The output histogram and cumulative curves; and<br>h) Tornado graphs. | Appendix B-9 (BR1 Project Preliminary Cost Estimate)<br>Section 5.4 (BR1 Project Cost) | |
| **Government of B.C. Energy Objectives and Policy Considerations** | | |
| Discuss how the project is consistent with and will advance the government's energy objectives as set out in the *Clean Energy Act*, Part 1 – BC Energy Objectives. If the nature of the project precludes a direct link to the energy objectives, the application should discuss how the project does not hamper other projects or initiatives undertaken by the applicant or others, from advancing these energy objectives. | Section 1.6.5 (Government of B.C. Energy Objectives and Policy) | *Applies to both BR1 and BRT* |
| **New Service Areas** | | |
| N/A | | |

### 1.6.3 BRT Project – CPCN Guidelines Concordance Table

Table 1-5 below provides a concordance table that identifies where information set out in the BCUC's CPCN Guidelines can be found for the BRT Project and identifies the information that is not currently available for the BRT Project and will need to be provided, through an evidentiary update, at a later time in this proceeding.

**Table 1-5 BRT Project - CPCN Filings Guidelines Concordance Table**

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| **Applicant –** Please refer to Table 1-4 above for a concordance table for this category. | | |
| **Project Need, Alternatives and Justification** | | |
| Studies or summary statements identifying the need for the project and confirming the technical, economic and financial feasibility of the project, identifying assumptions, sources of data, and feasible alternatives considered. The applicant should identify alternatives that it deemed to be not feasible at an early screening stage, and provide the reason(s) why it did not consider them further | Sections 1.3.2, 8.4, 8.5 (BRT Project need)<br>Appendix C-3 (BRT Project Alternative Assessment Financial Model)<br>Chapter 9<br>(BRT Project Alternative Analysis)<br>Chapter 10 (BRT Project Description) | |
| A comparison of the costs, benefits and associated risks of the project and feasible alternatives, including estimates of the value of all of the costs and benefits of each alternative or, where these costs and benefits are not quantifiable, identification of the cost area or benefit that cannot be quantified. Cost estimates used in the economic comparison should have, at a minimum, a Class 4 degree of accuracy as defined in the most recent revision of the applicable AACE International Cost Estimate Classification System Recommended Practices. | Chapter 9 (BRT Project Alternatives Analysis)<br>Appendix C-3 (BRT Project Alternative Assessment Financial Model) | |
| A schedule calculating the revenue requirements of the project and feasible alternatives, and the resulting impacts on customer rates. | Section 10.5 (BRT Project Estimate of Rate Impact)<br>Appendix C-7 (BRT Project Rate Impact Models)<br>Section 1.1 (BR1 and BRT Projects Rate Impact) | *Rate impact on Leading Alternative (Conceptual Cost Estimate, +100 per cent and - 35 per cent)* |
| Evidence of the financial and technical capacity of the applicant and other persons involved, if any, to undertake and operate the project; | Section 1.4.2, 1.4.3 (Financial Capacity, Technical Capacity) | |
| A schedule calculating the net present values of the incremental cost and benefit cash flows of the project and feasible alternatives, and justification of the length of the term and discount rate used for the calculation. | Appendix C-3 (BRT Project Alternative Assessment Financial Model)<br>Section 9.5.3 (BRT Project discount rate) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| A schedule and supporting discussion comparing the project and feasible alternatives in terms of social and environmental factors, and the applicant's assessment regarding the overall social and environmental impact of the project relative to the overall impact of the feasible alternatives. | Section 9.4 (BRT Project Structured Approach)<br>Section 9.5 (BRT Project Alternative Analysis) | |
| Information relating the project to the applicant's approved long-term resource plan filed pursuant to section 44.1 of the UCA, including the extent to which the project was considered in the plan, and, if applicable, a discussion explaining how the plan provides support and justification for the need for the project. | Section 1.6.5 (Government of B.C. Energy Objectives and Policy) | *Applies to both BR1 and BRT* |
| **Public Consultation** | | |
| Overview of the community, social and environmental setting in which the project and its feasible alternatives will be constructed and operated, and of the public who may be directly impacted by the project and its feasible alternatives. | Section 11.3.3 (BRT Project Local Community Setting) | |
| Description of the information and consultation programs with the public, including the organizations, agencies and individuals consulted, the information provided to these parties, and a chronology of meetings and other communications with members of the public and their representatives. This includes consultation with both the public who may be directly impacted by the project and the public that may experience impacts on their rates and service. | Sections 11.3.3, 11.3.4, 11.3.5 (BRT Project Local Community Setting, Public Groups Included in Engagement, Engagement Process)<br>Appendix C-9 (BRT Project Stakeholder Engagement Materials) | |
| Description of the issues and concerns raised during consultations, the measures taken or planned to address issues or concerns, or an explanation of why no further action is required to address an issue or concern. | Section 11.3.6 (BRT Project Public Support and Issues Identified) | |
| Identification of any outstanding issues or concerns. | Not applicable | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| Applicant's overall assessment as to the sufficiency of the public consultation process with respect to the project, in the context of the decision which is being sought from the Commission. | Section 11.3.1 (BRT Project Public Engagement Introduction) | *BC Hydro will provide further updates on its engagement with the public through the evidentiary update on the BRT Project that will be filed later in this proceeding.* |
| A statement of what future public consultation is contemplated subsequent to the preparation of the CPCN application. | Section 11.3.7 (BRT Project Mitigation and Ongoing Public Engagement Activities) | |
| **Project Description** | | |
| Description of the project, its purpose and cost, including engineering design, capacity, location options and preference, safety and reliability considerations, and all ancillary or related facilities that are proposed to be constructed, owned or operated by the applicant. | Sections 10.2, 10.3, 10.4 (BRT Project Description)<br>Appendix C-4 (BRT Project Conceptual Design Report) | |
| Outline of the anticipated construction and operation schedule, including critical dates of key events, a chart of major activities showing the critical path (e.g., GANTT chart), and the timing of approvals required from other agencies to ensure continued economic viability. | Section 10.6 (BRT Project Schedule)<br>Appendix C-5 (GANTT chart) | |
| Description of any new or expanded public works, undertakings or infrastructure that will result from or be required by the project, and an estimate of the costs and necessary completion dates. | Section 10.3 (BRT Project Scope and Technical Requirements)<br>Appendix C-4 (BRT Project Conceptual Design Report) | |
| Human capital resources required to undertake the project. | Appendix A-4 (Project Structure and Governance) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| Risk analysis identifying all significant risks to successful completion of the project, including an assessment of the probability of each risk occurring, and the consequences and the cost to mitigate the risk. The applicant should provide a summary description of significant project risks, including an assessment of the impact of each risk, the proposed risk mitigation strategy, and to the extent known, the financial and schedule impacts if the risk is realized. The risk evaluation should incorporate a risk assessment matrix with appropriate levels of severity and probability, a risk register and risk treatment as recommended in the latest revision of AACE International Recommended Practices. | Chapters 12 (BRT Risks)<br>Appendix A-7 (Project Delivery Risk Process and Matrix) | |
| Identification and preliminary assessment of potential effects of the project on the physical, biological and social environments or on potentially affected First Nations and the public, proposals for reducing potentially negative effects and maximizing benefits from positive effects, and the cost to the project of implementing the proposals | Chapter 11 (BRT Project Indigenous Nations Consultation and Public Consultation)<br>Section 10.8 (BRT Project Impacts) | |
| Identification of the customers to be served by the project and, where the project would expand the area served by the applicant, a geographical description of the expanded service area. | Not applicable | |
| A list of all required federal, provincial and municipal approvals, permits, licenses or authorizations and any applicable environmental assessment or other required project review processes. | Section 10.7 (BRT Project Permits, Approval and Authorizations)<br>Appendix C-8 (BRT Project Preliminary Environmental Impact Statement) | |
| A summary of the material conditions that are anticipated in federal, provincial and municipal approvals and confirmation that the costs of complying with these conditions are included in the cost estimate in the application. | Not applicable | |
| **Project Cost Estimate** | | |
| The project cost estimate should comply with applicable AACE International Cost Estimate Classification System Recommended Practices, use the terminology in the latest revision of AACE International Recommended Practice - Cost Engineering Terminology and list the AACE Recommended Practices used in the preparation of the cost estimate. | Appendix C-4 (BRT Project Conceptual Design Report – Appendix H)<br>Section 10.4 (BRT Project Costs and Assumptions) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| The project cost estimate should include the basis of estimate, the preparation effort (level of effort used to develop the cost estimate), as defined in the latest revision of the AACE International Recommended Practices, along with a description of the method of estimating used, the percentage of project definition and design complete at the time of the estimate based on the judgment of the utility's management, identification and justification of all assumptions, exclusions, inflation and discount factors, and sources of benchmarks and other data including lessons learned from relevant past projects. | Appendices C-4 (BRT Project Conceptual Design Report – Appendix H)<br>Section 10.4 (BRT Project Costs and Assumptions) | |
| The cost estimate should be stated in nominal as well as real dollars, identify an expected accuracy range with stated confidence level and have, at a minimum, a Class 3 degree of accuracy as defined in the latest revision of the AACE International Recommended Practices. | Appendices C-4 (BRT Project Conceptual Design Report – Appendix H)<br>Section 10.4 (BRT Project Costs and Assumptions)<br>Appendix C-3 (BRT Project Alternative Assessment Financial Model) | *BC Hydro will provide a Class 3 cost estimate as part of the evidentiary update for the BRT Project to be filed later in this proceeding.* |
| The cost estimate should provide:<br>a) Any funds spent in prior years attributable to the project;<br>b) A list of all project direct and indirect costs using an appropriate level of work breakdown structure, based on the nature, size and complexity of the project, by year until completion;<br>c) Escalation (including inflation) amount and justification;<br>d) Contingency amount and justification;<br>e) Interest during construction or allowance for funds used during construction and corporate overhead;<br>f) Identification and explanation of any management or other reserves;<br>g) Any legal, regulatory and other project costs, including costs associated with First Nations and public consultation and accommodation; and<br>h) The amounts and sources of any contributions in aid of construction, grants or other funding or credits related to the project. | Appendices C-4 (BRT Project Conceptual Design Report – Appendix H)<br>Appendix C-6<br>(BRT Project Expenditure Breakdown by Year)<br>Section 10.4 (BRT Project Costs and Assumptions) | |

| Application Requirements | Section of the Application | Notes |
|---|---|---|
| Identification of any cost items not included in the estimate, such as transportation costs, sunk costs and the reason for the exclusion. | Section 10.4 (BRT Project Costs and Assumptions) | |
| If a Monte Carlo analysis was used to model and provide justification for the amount of project contingency included in the cost estimate, then provide the following:<br>a) The base estimate;<br>b) The P50 expected value estimate;<br>c) The P-value including contingency and the dollar value;<br>d) The P-value including reserves, if any, and the dollar value;<br>e) The P90, the input probability curves;<br>f) The relationship between the inputs and the output;<br>g) The output histogram and cumulative curves; and<br>h) Tornado graphs. | Not Applicable | *BC Hydro will provide a Monte Carlo analysis as part of the evidentiary update for the BRT Project to be filed later in this proceeding.* |
| **Government of B.C. Energy Objectives and Policy Considerations** | | |
| Discuss how the project is consistent with and will advance the government's energy objectives as set out in the *Clean Energy Act*, Part 1 – BC Energy Objectives. If the nature of the project precludes a direct link to the energy objectives, the application should discuss how the project does not hamper other projects or initiatives undertaken by the applicant or others, from advancing these energy objectives. | Section 1.6.5 (Government of B.C. Energy Objectives and Policy) | *Applies to both BR1 and BRT* |
| **New Service Areas** | | |
| N/A | | |

### 1.6.4 BR1 Project and BRT Project – First Nations Information Filing Concordance Table

Table 1-6 below provides a concordance table that identifies where information set out in the BCUC's First Nations Information Filing Guidelines for Crown Utilities can be found for the BR1 Project and BRT Project. The First Nations Information Filing Guidelines for Crown Utilities replace and supersede the CPCN Application Guidelines.

1 **Table 1-6 First Nations Information Filing Guidelines Concordance Table**

| Application Requirements | Section of the Application (BR1) | Section of the Application (BRT) | Notes |
|---|---|---|---|
| **First Nations Identification** | | | |
| Identify the First Nations potentially affected by the application or filing, including the information considered to identify these First Nations<br>Provide an overview of the linguistic, cultural or ethnographic affiliations of each of the First Nations. | Section 6.2.2 (Identification of Indigenous Nations) | Section 11.2.1 (Identification of Indigenous Nations) | |
| **Assessment of the Scope of the Duty to Consult** | | | |
| Identify the Aboriginal or treaty rights, within the meaning of section 35 of the *Constitution Act, 1982* that are potentially adversely affected by the application or filing. Specify whether the rights are treaty rights or are asserted, established, or otherwise recognized by the Government of B.C. Where claims to rights and title are asserted, identify the *prima facie* strength of the claim. Indicate the source of information used in assessing the strength of claim, including whether any advice was sought from another Crown agency | Section 6.2.3 (Duty to Consult) | Section 11.2.3 (Duty to Consult) | |
| Discuss the potential adverse impact(s) of the application or filing on the First Nation's Aboriginal or treaty rights | Section 6.2.1 (Indigenous Nations Consultation and Engagement - Introduction) | Section 11.2.4 (BC Hydro's Consultation and Engagement Activities) | |
| Assess where the scope of the duty to consult falls on the *Haida* spectrum | Section 6.2.5 (Adequacy of Consultation and Accommodation) | Section 11.2.3 (Duty to Consult) | |

| Application Requirements | Section of the Application (BR1) | Section of the Application (BRT) | Notes |
|---|---|---|---|
| **Consultation Process** | | | |
| Identify any group, body, specific band or specific person(s) that have been consulting on behalf of the First Nation in connection with the application and provide confirmation that the group,<br>body, specific band or specific person has the authority to consult. Identify the specific member bands represented by any group or body | Table 6-1 (Indigenous Nations and Consulting Organization) | Table 11-1 (Indigenous Nations and Consulting 15 Organizations for BRT Project)<br>Table 11-2 (Indigenous Nations and Consulting Organization for Alternative 2) | |
| Provide a chronology of meetings, other communications and actions | Table 6-2 (Summary of Engagement with St'át'imc on the Project)<br>Section 6.2.4.2 (Consultation and Engagement - Tŝilhqot'in National Government) | Section 11.2.4 (BC Hydro's Consultation and Engagement Activities) | |
| Provide any relevant, non-confidential written documentation regarding consultation, such as notes or minutes of meetings or phone calls, or letters received from or sent to the First Nation | Appendix A-6-6 (BR1 Consultation Records)<br>Appendix A-6-8 (Example of consultation material) | Appendix A-6-7<br>(BRT Consultation Records)<br>Appendix A-6-8<br>(Example of consultation material) | |

| Application Requirements | Section of the Application (BR1) | Section of the Application (BRT) | Notes |
|---|---|---|---|
| Identify specific issues or concerns raised by the First Nation, irrespective of whether those issues or concerns are based on the Aboriginal rights in section 35 of the *Constitution Act, 1982* | Section 6.2.4.1<br>(St’át’imc Nation)<br>Section 6.2.4.2 (Tŝilhqot'in National Government) | Section 11.2.4.1<br>(BC Hydro’s Consultation and Engagement with the St’át’imc Nation)<br>Section 11.2.4.2<br>(the Tŝilhqot'in National Government)<br>Section 11.2.4.3 (Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band) | |
| Identify whether funding was provided to the First Nation and the purpose of the funding | Section 6.2.4.1 (St’át’imc Nation) | Section 11.2.4.1 (BC Hydro’s Consultation and Engagement with the St’át’imc Nation) | |
| Identify whether other Crown agencies have consulted the First Nation in respect of the application or filing, and if relevant, the issues raised by the First Nation in these consultations and how these issues were addressed | Not applicable | Not applicable | |
| Identify where procedural aspects have been delegated to or undertaken by private sector proponents and provide a description of the proponent’s efforts | Not applicable | Not applicable | |

| Application Requirements | Section of the Application (BR1) | Section of the Application (BRT) | Notes |
|---|---|---|---|
| Describe how the specific issues or concerns raised by the First Nation, as well as any other potential adverse effects on Aboriginal rights or treaty rights, were avoided, mitigated or otherwise accommodated. Describe how these actions incorporated feedback from the First Nation. Provide an explanation where no action was taken in response to the First Nation's concern | Section 6.2.4.1<br>(St'át'imc Nation)<br>Section 6.2.4.2 (Tŝilhqot'in National Government) | Section 11.2.4.1<br>(BC Hydro's Consultation and Engagement with the St'át'imc Nation)<br>Section 11.2.4.2 (the Tŝilhqot'in National Government)<br>Section 11.2.4.3 (Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band) | |
| Provide copies of any documents which confirm that the First Nation is satisfied with the consultation and accommodation to date | Appendix A-6-10 (Tŝilhqot'in National Government Response) | Appendix A-6-12 (Tŝilhqot'in National Government Response) | |
| Provide evidence that the First Nation has been notified of the filing of the application with the Commission and has been informed on how to raise outstanding concerns with the Commission | Appendix A-6-8 (Example of Consultation Material)<br>Section 6.2.4.1 (BC Hydro's Consultation and Engagement with the St'át'imc Nation) | Appendix A-6-8 (Example of Consultation Material)<br>Section 11.2.4.1 (BC Hydro's Consultation and Engagement with the St'át'imc Nation) | |
| Conclusion<br>Provide the Crown utilities overall view as to the reasonableness of the consultation process with respect to the application or filing and whether the consultation duty has been adequately fulfilled to the point of the Commission's decision. In preparing the Crown utility's view, consider the evidence along with the following questions: | | | |

| Application Requirements | Section of the Application (BR1) | Section of the Application (BRT) | Notes |
|---|---|---|---|
| Whether the consultation process been carried out in good faith and whether it was appropriate and reasonable in the circumstances | Section 6.2.5 (Adequacy of Consultation and Accommodation) | Section 11.2.5 (Adequacy of Consultation) | *The BRT Project is still in the early planning and investigation stages and consultation is ongoing. The findings from the BRT Project Feasibility Design stage activities, including more detailed impact assessment and consultation activities on the impact assessment with Indigenous Nations, will be included in an evidentiary update, to be filed later in this proceeding.* |
| Whether final approval is being sought on the application or filing or whether further approvals are required from the Commission | Section 1.5.1 (Orders Sought) | Section 1.5.1 (Orders Sought) | |

### 1.6.5 Government of B.C. Energy Objectives and Policy Considerations

Section 44(3.3) of the *Utilities Commission Act* states that the BCUC, when deciding whether to issue a CPCN to BC Hydro, must consider

> (a) British Columbia's energy objectives,
> (b) the most recent of the following documents:
> (i) an integrated resource plan approved under section 4 of the *Clean Energy Act* before the repeal of that section;
> (ii) a long-term resource plan filed by the authority under section 44.1 of this Act, and
> (c) the extent to which the application for the certificate is consistent with the requirements under section 19 of the *Clean Energy Act*.

Each of these considerations is addressed in the subsections below.

#### *1.6.5.1 British Columbia's Energy Objectives*

British Columbia's energy objectives are defined in section 2 of the *Clean Energy Act*. The energy objectives that have some relevance to the BR1 Project and BRT Project are considered in Table 1-7 below.

**Table 1-7 British Columbia's Energy Objectives**

| Energy Objective | Commentary |
|---|---|
| (c) to generate at least 93% of the electricity in British Columbia, other than electricity to serve demand from facilities that liquefy natural gas for export by ship, from clean or renewable resources and to build the infrastructure necessary to transmit that electricity; | The BR1 Project will address the asset condition of Units 1 to 4 at the Bridge River 1 Generating Station, which is a clean or renewable resource. The BRT Project will refurbish the 2L90 circuit and increase its capacity so that BC Hydro can transmit electricity from the Bridge River Facility and nearby IPPs, all of which are clean or renewable resources.<br>As such, BR1 Project and BRT Project are consistent with, and will aid BC Hydro in continuing to achieve, British Columbia's energy objective set out in section 2(c) of the *Clean Energy Act*. |

| | |
|---|---|
| (e) to ensure the authority's ratepayers receive the benefits of the heritage assets and to ensure the benefits of the heritage contract under the BC Hydro Public Power Legacy and Heritage Contract Act[36] continue to accrue to the authority's ratepayers; | The Bridge River 1 Generating Station is a heritage asset.[37] The BR1 Project will be addressing the condition of this asset and the BRT Project will refurbish existing infrastructure required to transmit generation from the Bridge River Generation System to ratepayers, therefore helping to ensure that BC Hydro's ratepayers continue to receive the benefit of these assets. |
| (f) to ensure the authority's rates remain among the most competitive of rates charged by public utilities in North America; | As discussed in section 2.6 of Chapter 2, the Bridge River System has a positive net present value to ratepayers. By addressing the asset condition of the Bridge River 1 Generating Station and the 2L90 circuit, the BR1 Project and the BRT Project will help to maintain the Bridge River System so that BC Hydro's rates remain competitive. |
| (k) to encourage economic development and the creation and retention of jobs; | The BR1 Project and BRT Project will result in result in contracting opportunities and positive economic benefits, as discussed in Chapter 5, sections 5.8.3, and Chapter 10, section 10.8.1.2, respectively. BC Hydro's procurement approach will contribute toward new procurement targets set out in the 2011 Agreements and 2019 High Flow Settlement Agreement between the St'át'imc Nation and BC Hydro. |
| (m) to maximize the value, including the incremental value of the resources being clean or renewable resources, of British Columbia's generation and transmission assets for the benefit of British Columbia; | As discussed in section 2.6 of Chapter 2, the Bridge River System has a positive net present value to ratepayers. The BR1 Project and BRT Project will aid in maximizing the value to ratepayers from the generation and transmission assets in the Bridge River System. |
| (o) to achieve British Columbia's energy objectives without the use of nuclear power. | The BR1 Project and BRT Project will help BC Hydro achieve British Columbia's energy objectives without the use of nuclear power. |

#### *1.6.5.2 Most Recent Approved Integrated Resource Plan*

BC Hydro's last Integrated Resource Plan was submitted to government on November 15, 2013 (**2013 IRP**). Government approved the 2013 IRP on November 25, 2013. Given the time that has elapsed since the 2013 IRP, consideration of the 2013 IRP in this proceeding is moot. In June 2021, BC Hydro

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[36] There is no longer a heritage contract under the *Hydro Public Power Legacy and Heritage Contract Act*.

[37] The Bridge River generation and storage assets are included in the list of heritage assets in schedule 1 of the *Clean Energy Act.*

released its draft 2021 Integrated Resource Plan.[38] The draft 2021 Integrated Resource Plan shows that under the reference forecast, when existing and committed resources are considered, BC Hydro has a need for new energy resources in fiscal 2029 and a need for new capacity resources in fiscal 2032. The BR1 Project is required to restore the generating capacity of the Bridge River 1 Generating Station, which is included in the draft 2021 Integrated Resource Plan as an existing resource, with a total dependable capacity of 190 MW. Restored capacity, as a result of the BR1 Project, is considered in the draft Integrated Resource Plan as a planned future resource. The BRT Project is required to maintain and increase the capacity of existing transmission infrastructure so that generation from existing and committed resources can be transmitted to customers.

As discussed in section 2.6 of Chapter 2, the Bridge River System has a positive net present value to ratepayers. In the absence of the BR1 Project or the BRT Project, the investments required to maintain this positive net present value for ratepayers would not proceed and the need for new energy or capacity resources would be advanced.

#### *1.6.5.3 Section 19 of the Clean Energy Act*

Section 19 of the *Clean Energy Act*, which applies to BC Hydro, states:

> 19(1) To facilitate the achievement of British Columbia's energy objective set out in section 2 (c), a person to whom this subsection applies
>
> (a) must pursue actions to meet the prescribed targets in relation to clean or renewable resources, and
>
> (b) must use the prescribed guidelines in planning for
>
> (i) the construction or extension of generation facilities, and
>
> (ii) energy purchases.

---

[38] The draft Integrated Resource Plan can be found at this link: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/integrated-resource-plans/current-plan/draft-integrated-resource-plan.pdf

At this time, there are no prescribed targets or guidelines under section 19 of the *Clean Energy Act*. As noted in the table above, the BR1 Project and BRT Project are consistent with and will aid BC Hydro in continuing to achieve British Columbia's energy objective set out in section 2(c) of the *Clean Energy Act*.

# BC Hydro Bridge River Projects

# Chapter 2

## Generation and Transmission System

# Table of Contents

2.1 Introduction ........ 2-1
2.2 Bridge River Generation System Overview ........ 2-2
  2.2.1 Description of the Bridge River Generation System ........ 2-2
  2.2.2 Bridge River Generating Units Are the Primary Mechanism for BC Hydro to Manage Water Flows ........ 2-4
2.3 Long-Term Plan to Maintain the Bridge River Generation System at the Lowest Cost ........ 2-8
  2.3.1 Primary Risks with Bridge River Generation System Are Aging Assets, Seismic and Flow Management ........ 2-9
    2.3.1.1 La Joie Facility ........ 2-12
    2.3.1.2 Bridge River Facility ........ 2-13
    2.3.1.3 Seton Facility ........ 2-17
  2.3.2 2014 System Study Confirmed Bridge River Generation System Was Lowest Cost Option ........ 2-19
  2.3.3 BR1 Project is the Next Step in Replacing Aging Downstream Generation Equipment ........ 2-23
2.4 Bridge River Transmission System Overview ........ 2-24
  2.4.1 Description of the Bridge River Transmission System ........ 2-24
    2.4.1.1 Regional Path 2 and Path 3 ........ 2-26
    2.4.1.2 Regional Path 1 ........ 2-26
    2.4.1.3 In Recent Years, More IPP Facilities Have Connected to the Bridge River Transmission System ........ 2-27
2.5 Long Term Plan to Maintain and Operate the Bridge River Transmission System ........ 2-28
  2.5.1 Maintaining Transmission Lines in the Bridge River Transmission System ........ 2-29
  2.5.2 Asset Strategy and Asset Condition of the Substation Assets ........ 2-30
2.6 Bridge River System is Economic when Planned Investments and Operating Costs are Considered ........ 2-32
  2.6.1 Bridge River Generating Station 1 is Economic on a Stand-Alone Basis ........ 2-36

## List of Figures

Figure 2-1 Map of the Bridge River Generation System ................................ 2-3
Figure 2-2 Flow of Water through the Bridge River Generation System ....... 2-5
Figure 2-3 Carpenter Reservoir Historical Average Level ............................. 2-7
Figure 2-4 Staging of Capital Projects on the Bridge River Generation System ........................................................................... 2-11
Figure 2-5 Bridge River Transmission System Regional Paths ................... 2-25
Figure 2-6 Condition of Substations Within and Adjacent to Bridge River Transmission System ..................................................... 2-31

## List of Tables

Table 2-1 Analysis of Alternatives Considered in 2014 System Study ....... 2-22
Table 2-2 Condition of Circuits Within Bridge River Transmission System ........................................................................... 2-30
Table 2-3 Bridge River System Valuation ................................................. 2-33
Table 2-4 Scenario Analysis: Bridge River System Valuation .................... 2-35
Table 2-5 Bridge River System - Capital Sensitivity .................................. 2-35
Table 2-6 Bridge River System - Discount Rate Sensitivity ........................ 2-36
Table 2-7 Scenario Analysis: Bridge River 1 Generating Station Valuation ....................................................................... 2-36
Table 2-8 Value of Bridge River 1 Generating Station with Capital Cost Variances Applied ............................................................ 2-37
Table 2-9 Value of Bridge River 1 Generating Station with Different Discount Rates ............................................................... 2-37

## 2.1 Introduction

This chapter provides an overview of the Bridge River Generation System and the Bridge River Transmission System[39] and makes the following key points:

- The generating units at the Bridge River 1 and Bridge River 2 Generating Stations are the primary tool to meet the water flow targets set out in the WUP Order for the Bridge River Generation System as well as BC Hydro’s commitments under the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation;
- BC Hydro has a long-term plan to address identified risks for assets in the Bridge River Generation System. These investments are necessary for water flow management and to address the deteriorating condition of existing infrastructure and the seismic stability of the dams;
- Maintaining the existing Bridge River Generation System is the lowest cost option when compared to alternatives such as modifying the Bridge River Generation System or decommissioning the Bridge River Generation System;
- BC Hydro has a long-term plan to address identified risks for assets in the Bridge River Transmission System. These investments are necessary so that power can continue to be transmitted from the Bridge River Generation System and nearby IPP facilities to the customers in the Metro Vancouver and Fraser Valley areas; and

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[39] In its Decision on BC Hydro’s Fiscal 2020 to Fiscal 2021 Revenue Requirements Application, the BCUC stated that effective scrutiny of any investment in the Bridge River system requires a view of the entire system so that alternatives to the system itself are adequately considered. Refer to page 99 of Order No. G-246-20.

- When planned investments and operating costs are considered, the Bridge River System[40] remains economic[41] with a positive NPV of $1,180 million.

This chapter is structured as follows:

- Section 2.2 provides an overview of the Bridge River Generation System;
- Section 2.3 describes the long-term strategy for the Bridge River Generation System;
- Section 2.4 provides an overview of the Bridge River Transmission System;
- Section 2.5 describes the long-term strategy for the Bridge River Transmission System; and
- Section 2.6 provides an economic analysis of the Bridge River System.

## 2.2 Bridge River Generation System Overview

### 2.2.1 Description of the Bridge River Generation System

The Bridge River Generation System is located in the Coast Mountains of southern B.C., northeast of Pemberton and west of Lillooet. It was built between 1948 and 1960 and is a cascading system that includes three facilities: the La Joie Facility, the Bridge River Facility, and the Seton Facility, which collectively contribute approximately 5 per cent of BC Hydro's total annual hydroelectric generation, on average. Figure 2-1 below provides a map of the Bridge River Generation System.

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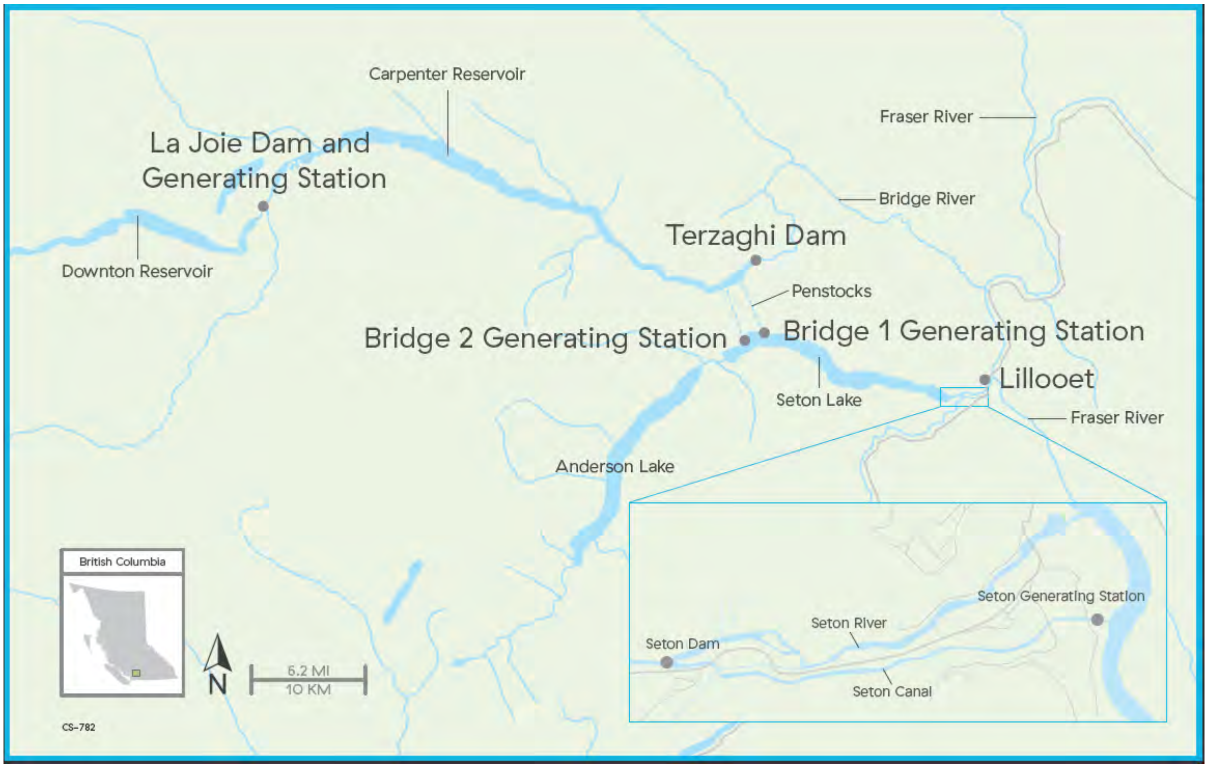
[40] The Bridge River System includes BC Hydro's storage dams and generating facilities on the Bridge and Seton Rivers: La Joie dam and generating station (which impounds the Downton Reservoir), Terzaghi dam (which impounds the Carpenter Reservoir), Bridge River Generating Stations 1 and 2, and the Seton Generating station, along with the transmission station and circuits necessary to move energy from the generating stations to the provincial integrated grid: the Bridge River Terminal Station, and transmission circuits 3L02, 3L13, 3L14, 3L15, 3L16, 2L01, 2L19, 2L41, 2L90, 60L21, and 60L22.

[41] During the Fiscal 2020 to Fiscal 2021 Revenue Requirements Application proceeding, interveners expressed interest in the economic value of the Bridge River Generation System. Refer to Transcript Volume 11, pages 1906 to 1915.

**Figure 2-1 Map of the Bridge River Generation System**



The La Joie Facility is the most upstream of the facilities and consists of La Joie Dam, Downton Reservoir, and La Joie Generating Station.

The Bridge River Facility is the largest of the facilities and consists of Terzaghi Dam, Carpenter Reservoir, Bridge River 1 Generating Station and Bridge River 2 Generating Station.

The Seton Facility is the most downstream of the facilities and consists of Seton Dam, Seton Lake, and Seton Generating Station.

Both the La Joie Generating Station and the Seton Generating Station are primarily operated as base load plants, which means that they are run 24 hours a day, seven days a week, while the Bridge River 1 and Bridge River 2 Generating Stations are often used as peaking plants, operating during the day in times of high demand and backed off at night in periods of low demand.

### 2.2.2 Bridge River Generating Units Are the Primary Mechanism for BC Hydro to Manage Water Flows

The B.C. Comptroller of Water Rights issues WUP Orders under the provincial *Water Sustainability Act* for balancing power production with other water uses at BC Hydro facilities. These Orders direct BC Hydro to undertake site-specific actions at each facility with varying combinations of operation and water flow constraints, recreation and habitat enhancement, and multi-year environmental monitoring studies.

In 2011, the Government of B.C. issued a WUP Order for the Bridge River Generation System under the *Water Sustainability Act* which was varied in 2017 and 2018.[42] Also in 2011, the Government of B.C., BC Hydro and the St’at’imc Nation signed a historic and comprehensive set of agreements, which settled the past, present and future impacts of existing facilities and operations (**2011 Agreements**).[43] BC Hydro must operate the Bridge River System in accordance with the WUP Order and the 2011 Agreements with the St’át’imc Nation. The generating units at the Bridge River 1 and Bridge River 2 Generating Stations are BC Hydro’s primary tool to meet the water flow targets in the WUP Order and to meet commitments set out in the 2011 Agreements with the St’at’imc Nation.

Figure 2-2 illustrates the flow of water through the Bridge River Generation System, which is explained further below.

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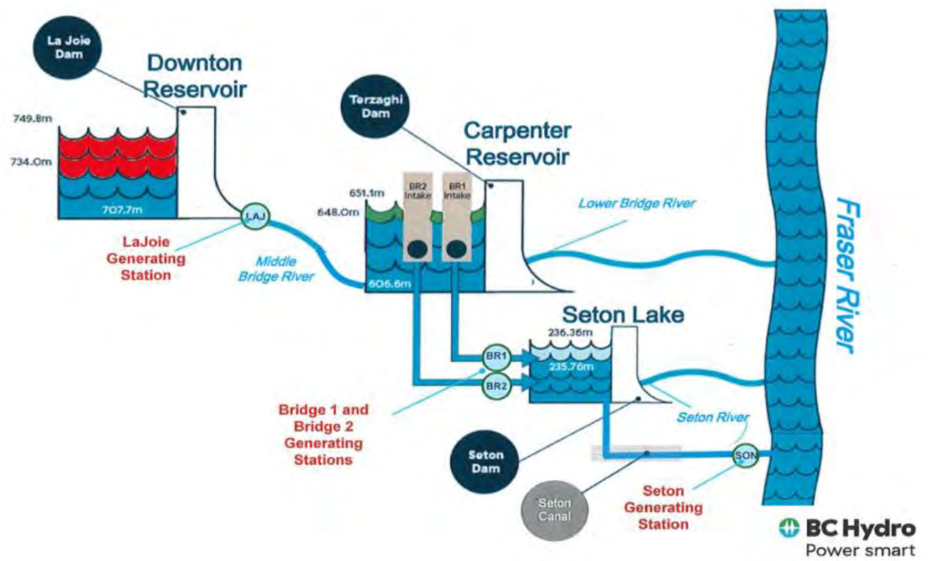
[42] The WUP Order and Variance Orders for the Bridge River Generation System are provided as Appendix B-1.

[43] These agreements include the St’át’imc (Participating Communities) Settlement Agreement, the Certainty Provisions Agreement and the Relations Agreements. A more detailed description of these agreements is provided in Appendix A-6-1.

**Figure 2-2 Flow of Water through the Bridge River Generation System**



The Bridge River Generation System diverts water from the Bridge River watershed[44] to the Seton River watershed. The Bridge River is a mid-sized river, approximately 120 kilometres long. The river is divided into:

- Upper Bridge River, which extends from the glaciers to Downton Reservoir, which is impounded[45] by La Joie Dam;
- Middle Bridge River, which extends from downstream of the La Joie Dam and Generating Station to Carpenter Reservoir, which is impounded by Terzaghi Dam; and
- Lower Bridge River, which extends downstream from Terzaghi Dam to Fraser River.

---

[44] A watershed is defined as an area of land where all the surface water drains into the same place, whether it is a creek, a stream, a river or an ocean.

[45] Impounded means confining the body of water within an enclosure.

The Bridge River basin inflows are primarily snowmelt runoff and glacial melt that occur from June to August for Downton Reservoir, and from May to July for Carpenter Reservoir and Seton Lake.

In 2015, the Downton Reservoir upper operating elevation was reduced to mitigate dam seismic risks, reducing the effective storage of Downton Reservoir by approximately 47 per cent.[46] The reduced Downton Reservoir storage capacity, resulted in higher discharges from La Joie Dam into Carpenter Reservoir during late spring and summer. This reduction in storage increases the dependence on the generating units at the Bridge River 1 and Bridge River 2 Generating Stations to pass flows out of Carpenter reservoir. Flows from Downton and Carpenter Reservoirs must be either diverted to Seton Lake, through the Bridge River 1 and Bridge River 2 Generating Stations or discharged from Terzaghi Dam to Lower Bridge River. If generating units at the Bridge River 1 and Bridge River 2 Generating Stations are not producing energy or Carpenter Reservoir is reaching capacity, flows must be released at Terzaghi Dam down Lower Bridge River. This increases the risk of exceeding the Lower Bridge River water flow targets set by the WUP Order, especially during freshet[47].

Water flow targets for Lower Bridge River were established under the WUP Order to emulate the natural hydrograph of the river systems and mitigate impacts to fish and fish habitat. Although the flows emulate the natural hydrograph, they do not replicate the natural magnitude of the flows. Therefore, the river system has been conditioned to lower flows than would normally be experienced in a natural environment. High flows can impact juvenile fish, spawning fish, and displace gravel. Due to the increased environmental impacts on Lower Bridge River, flows past Terzaghi into Lower Bridge River are avoided in favour of flows down Seton River, when possible.

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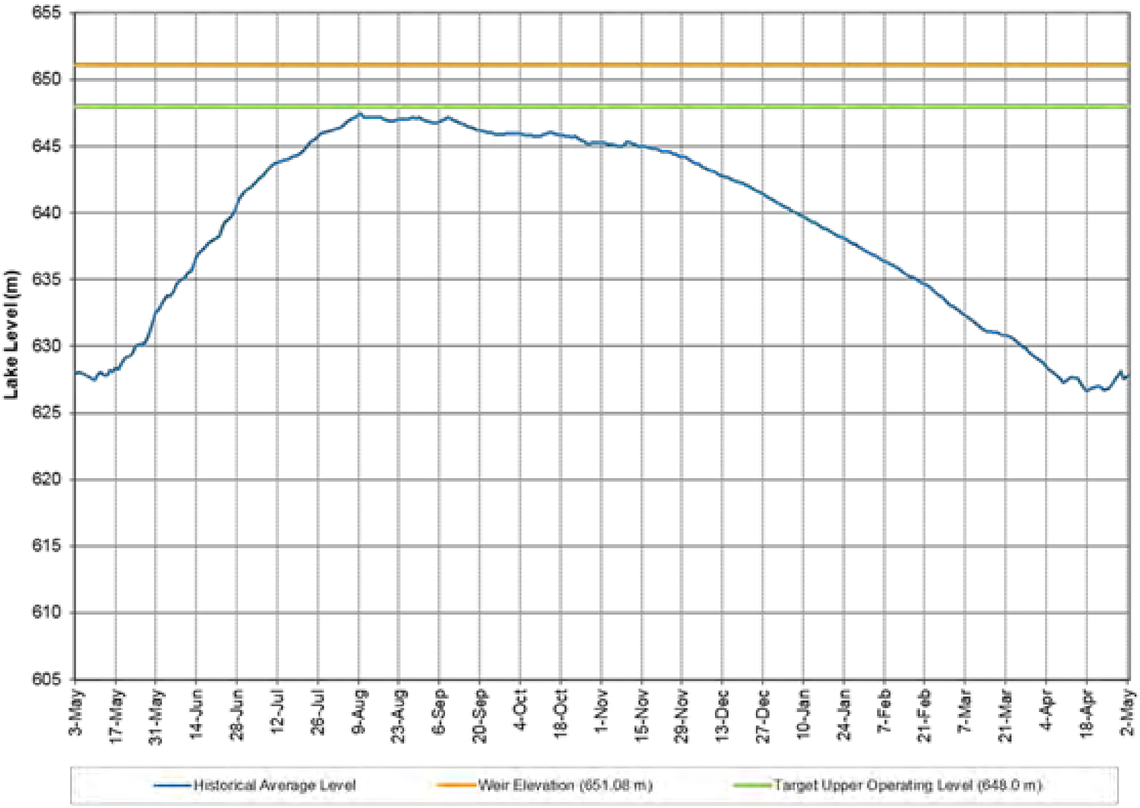
[46] The reduced storage level is a temporary mitigation measure until seismic risks are addressed through the planned La Joie Dam Upgrade Project.

[47] Freshet means the occurrence of a water flow resulting from rain or melting snow.

Terzaghi Dam impounds Middle Bridge River to form Carpenter Reservoir, the largest storage in the Bridge River Generation System. Terzaghi Dam controls flows to Lower Bridge River, which are limited by the WUP Order. Similar to most large storage reservoirs on BC Hydro's integrated system, Carpenter Reservoir is drawn down through the fall/winter period when there is higher customer energy demand and lower water inflow and the reservoir is filled through the spring/summer period when there is typically lower customer energy demand and higher water inflow. This means that during the April to May period, the Carpenter Reservoir water level is drawn down to its lowest point to prepare and provide storage for freshet water inflows. Figure 2-3 below shows the operating limits and the historical average level for Carpenter Reservoir.

**Figure 2-3 Carpenter Reservoir Historical Average Level**



When the reservoir is projected to reach its upper operating level[48], generating unit reliability becomes more important as water must be passed through the Bridge River 1 and Bridge River 2 Generating Stations to avoid flowing through Terzaghi Dam and down Lower Bridge River.

The only way to move water from Carpenter Reservoir to Seton Lake is through the Bridge River 1 and Bridge River 2 Generating Stations. Water is diverted from Carpenter Reservoir to the Bridge River 1 and Bridge River 2 Generating Stations via two power intakes. Bridge River 1 Generating Station conveys water via the power tunnel which bifurcates into two tunnels (west branch and east branch) near its downstream terminus, feeding four penstocks leading down to four generating units at Bridge River 1 powerhouse.[49] Bridge River 2 Generating Station conveys water via a single power tunnel to Seton Portage where it bifurcates into two separate penstocks feeding four generating units at the Bridge River 2 powerhouse.[50]

Downstream of the Bridge River 1 and Bridge River 2 Generating Stations, at the eastern end of Seton Lake, is Seton Dam. Water flows from Seton Lake into the Fraser River either through the Seton Canal and the Seton Generating Station or down Seton River. Seton Lake's limited storage capacity requires the reservoir to be managed by balancing fluctuations in local inflows with the discharge from the generating units at the Bridge River 1 and Bridge River 2 Generating Stations.

## 2.3 Long-Term Plan to Maintain the Bridge River Generation System at the Lowest Cost

In 2011, recognizing that many assets in the Bridge River System were in the late stages of their life cycle, BC Hydro initiated a system study to evaluate the best

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[48] Upper operating level is the normal maximum level of a reservoir or lake.

[49] The Bridge River 1 main tunnel and west branch were constructed from 1928 to 1932 and the east branch was constructed from 1949 to 1954. The four surface penstocks were constructed from 1947 to 1953.

[50] The Bridge River 2 power tunnel was constructed from 1958 to 1960.

long-term configuration for the Bridge River Generation System, which was completed in 2014 (**2014 System Study**).[51] The 2014 System Study was undertaken to help inform future investment decisions for the Bridge River Generation System. At the time, the most significant identified risk within the Bridge River Generation System was the seismic vulnerability of La Joie Dam. The 2014 System Study enabled BC Hydro to consider the system risks and mitigating investments in the Bridge River Generation System, before proceeding with the considerable investment required to address the seismic vulnerability at La Joie Dam.

This section describes the long-term strategy for the Bridge River Generation System. Specifically:

- Section 2.3.1 discusses the primary risks associated with each facility in the Bridge River Generating System, the current mitigation measures and the proposed projects to address these risks;
- Section 2.3.2 explains the seven concept alternatives that were assessed and evaluated as part of the 2014 System Study to address the primary risks of the Bridge River Generating System, the cost analysis conducted and the results confirming that the existing Bridge River Generating System was the lowest cost option; and
- Section 2.3.3 discusses the recent and planned investments, including the BR1 Project, which have been prioritized to address the primary risks associated with the Bridge River Generation System.

### 2.3.1 Primary Risks with Bridge River Generation System Are Aging Assets, Seismic and Flow Management

The primary risks associated with the Bridge River System are caused by aging assets, seismic risks and water flow management risks. BC Hydro used the 2014

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[51] The 2014 System Study is provided as Appendix B-2-1.

System Study to inform its Facility Asset Plans, which identified individual capital projects to address risks to the existing Bridge River Generation System.[52]

The projects to address identified risks are proposed to occur over time, rather than all at once. This is because ongoing operation of the Bridge River Generation System is required to manage water flows and to meet customer energy demand. In addition, projects to address identified seismic risks can be complex and must manage interim risks to the dam or other features that can arise during construction while also mitigating environmental and social impacts from altered reservoir operations. As projects to address seismic risk or to modify civil assets require the control of reservoirs and water flows, BC Hydro has prioritized projects to improve water management and, in particular, to improve generating unit reliability.

Capital projects are evaluated and prioritized based on an assessment of the likelihood and consequence of the risk being addressed by the project as well as the type of risk (i.e., reliability, reputational, financial loss, environmental and safety).[53] The prioritization and timing of capital projects also considers factors such as available mitigation options, resource availability, the number of concurrent projects that can be undertaken at a facility, as well as the cost and complexity of the work.

Figure 2-4 below shows the staging of BC Hydro’s planned and active capital projects to address risks on the Bridge River Generation System. Projects shown in green are either complete or in implementation.

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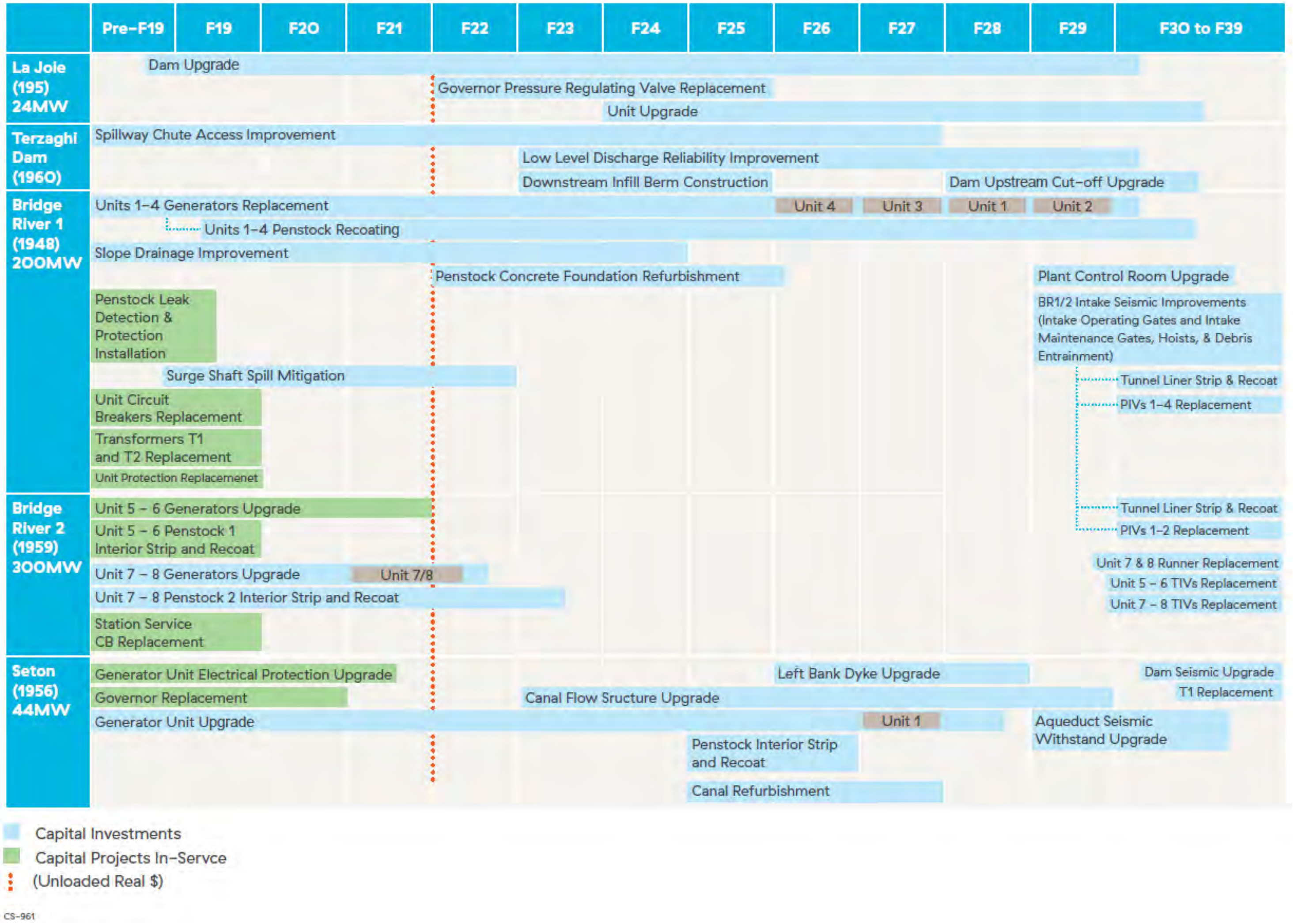
[52] Facility Asset Plans for the Bridge River Generation System are provided as Appendix B-3.

[53] For further information on the assessment of these risks, refer to BC Hydro’s Capital Allocation Risk Matrix which is provided as Appendix A-5.

**Figure 2-4 Staging of Capital Projects on the Bridge River Generation System**



The following subsections discuss the risks for each facility in the Bridge River Generation System and identify the current mitigation measures and proposed projects to address these risks.

#### *2.3.1.1 La Joie Facility*

Specific risks to the La Joie Facility include:

- **Aging Governor and Pressure Regulating Valve:** The La Joie unit governor and pressure regulating valve are in poor condition. The La Joie Governor and Pressure Regulating Valve Project will address these risks and will be initiated in fiscal 2022;
- **Aging Generating Equipment:** The generating unit at La Joie was installed in 1955. All of the existing components are original and have exceeded their life expectancy. The La Joie Unit Upgrade project is proposed to address these risks and will be initiated in fiscal 2024;
- **Seismic Risk at La Joie Dam:** The La Joie Dam was designed to have a re-enforced concrete facing. However, due to its construction method, it experienced ongoing settlements and was temporarily faced with timber until the rate of settlements reduced to an acceptable level to implement the re-enforced concrete facing. In 1971 to 1972, the timber facing was replaced with shotcrete, which was also intended as a temporary measure. The shotcrete has a history of ongoing deterioration and failures, particularly due to freeze-thaw damage.

  A seismic event could induce cracking of shotcrete with the potential for leaks that could destabilize the embankment. Failure of La Joie Dam could result in cascading failure of the downstream Terzaghi Dam and possible flooding of the lower Fraser Valley. In 2015, the Downton Reservoir operating level was reduced to mitigate the risk of a cascading failure in a seismic event. This reduction in storage capacity increases the reliance on generating equipment to pass water downstream of the dam to meet the WUP Order target flow schedule. The La Joie Dam Upgrade Project will address these risks and is currently in the Conceptual Design stage of Identification phase to evaluate and select the leading alternative while engaging with Indigenous Nations on project alternatives. This project is complex, and BC Hydro expects it will take approximately 10 years to implement a solution.

- **Seismic Risk at La Joie Intake Tower:** The La Joie intake tower passes water from Downton Reservoir into the South and North conduits[54] which convey water to the generating unit (South conduit) and downstream via a low level outlet (North conduit). If the intake were blocked or closed due to a seismic event, the ability to actively control reservoir levels would be lost and flows to Middle Bridge River would stop until the reservoir level rose to the level of the free-overflow spillway. This would result in environmental damage to Middle Bridge River caused by a period of no inflow, followed by the potential for downstream inundation, with no means of regulating flows. Conversely, if the intake equipment were stuck in the open position following a seismic event, it would be unavailable to stop flows in the event of a penstock rupture. The project to address the intakes has been included in the scope of the La Joie Dam Upgrade Project described above.

#### *2.3.1.2 Bridge River Facility*

Specific risks to the Bridge River Facility include:

- **Aging Generating Equipment:** The only way to move water from Carpenter Reservoir to Seton Lake is via the generating units at the Bridge River 1 Generating Station and the Bridge River 2 Generating Station. The Bridge River 1 Generating Station was commissioned in 1954 and Bridge River 2 Generating Station was commissioned in 1960. As discussed further in

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[54] Conduit means a channel for conveying water.

section 2.3.3 below, projects to replace the original equipment at the Bridge River 1 and Bridge River 2 Generating Stations are either complete, underway or planned;

- **Aging Penstocks at Bridge River 1 and Bridge River 2 Generating Stations:** The penstock coating system has failed, exposing penstock steel to continued deterioration. Inspections have also found that the fixed concrete foundations for the penstocks' saddles have visible cracking and defects. A penstock failure could destabilize the slope and undermine the penstock foundation and would pose a safety risk for employees in the generating stations. It would also lead to lost generation and the inability to pass water flows through the generating station, leading to excessive spills down Lower Bridge River and increased risk of impacts to fish and fish habitats. The Bridge River 1 Penstock 1-4 Concrete Foundation Refurbishment Project was initiated in fiscal 2022. BC Hydro is planning to file a CPCN Application for the Bridge River 1 Penstock 1-4 Recoating Project in fiscal 2024;
- **Seismic Risk at Bridge River 1 Generating Station:** The Bridge River 1 Generating Station was built on alluvial deposits that contain loose sands and gravels and is susceptible to significant damage during an earthquake with an annual exceedance probability[55] of 1:475 to 1:1000 years. If the generating station were to shift during a seismic event, it could damage the penstocks or decouple the generating station from the penstocks and release water towards the generating station, resulting in lost generation, the inability to manage water flows and potential safety risks. Moving the Bridge River 1 Generating Station would take approximately 20 years and would leave the system vulnerable to lost generation and flow management issues. Further, the risk reduction achieved by moving the generating station relative to the cost is low when compared to the risk reduction that can be achieved by other lower cost

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[55] The probability that an event of specified magnitude will be equaled or exceeded in any year.

projects. Therefore, BC Hydro advanced projects to address the impacts of a penstock separation, such as the Penstock Leak Detection Project which was completed in fiscal 2019, the Slope Drainage Improvement Project which is currently underway, and the Penstock Inlet Valve Project which is scheduled to be initiated in fiscal 2030;

- **Seismic Risk to Bridge River 1 and Bridge River 2 Intake Towers:** The Bridge River 1 and Bridge River 2 intake towers pass water from Carpenter Reservoir to the Bridge River 1 and Bridge River 2 Generating Stations. The intake towers' design and construction predate modern seismic design practices and they are vulnerable to damage or failure in a moderate seismic event. This creates a risk for the management of water following an earthquake because the intake towers are the only way to move water through the Bridge River 1 and Bridge River 2 Generating Stations. The Bridge River 1 and Bridge River 2 Intake Seismic Upgrade Project is proposed to address these risks and is scheduled to be initiated in fiscal 2029;

- **Seismic Risk to Bridge River 1 Penstocks:** Four penstocks carry water from the penstock inlet valves down to the generating units. The penstocks include penstock inlet valves that provide water passage isolation and emergency stop functions. A leak detection system was installed in fiscal 2018. The system will automatically close the penstock inlet valves should a leak be detected in the penstocks. While the valves are able to close under full water flow, design reviews have indicated that the valves would not be able to close under water flows that would occur if there was a full rupture of the penstock. The Bridge River 1 Unit 1 to 4 Penstock Inlet Valve Replacement Project is scheduled to be initiated in fiscal 2030 and will replace the valves with valves that are capable of closing under a full rupture event;

- **Seismic Risk at Terzaghi Dam:** The 2014 System Study recommended a detailed seismic study to review major civil works at Terzaghi Dam. This study was completed in 2015 to assess the performance of the structures at Terzaghi

Dam when subject to earthquake ground motions with a 1:10000 annual exceedance probability, commensurate with accepted industry guidelines for an extreme consequence dam.[56] The study concluded that the dam is expected to retain the reservoir with no uncontrolled release of water during and following an earthquake with an annual exceedance probability of 1:10000 years. The upstream and downstream toes of the dam are expected to experience some deformation, and the spillway chute wall is expected to experience some damage. The study concluded that the seismic withstand capacity of these elements can be improved with more modest civil works than were contemplated at the time of the 2014 System Study. The Terzaghi Downstream Infill Berm Construction Project will improve the seismic performance of the embankment dam by adding a remedial infill berm at the downstream toe of the dam and potential installation of a geomembrane that spans the spillway wall where it interfaces the embankment. This project is scheduled to be initiated in fiscal 2023.

- **Terzaghi Dam Sinkholes:** Since Terzaghi Dam was constructed in 1960, eighteen sinkholes have been observed and remediated in the dam's upstream blanket near the right abutment. The most recent sinkhole was observed and remediated in 2010. These sinkholes are believed to be the result of an incomplete seal at the bottom of a sheet pile cut-off which causes localized internal erosion of the finer foundation soils at that location. This risk is currently managed through visual inspections, continual monitoring of instrumentation installed in the sinkhole area and remediation of sinkholes as they are observed. To manage the risk in the longer term, the Terzaghi Dam Upstream Cut-off Upgrade Project is scheduled to be initiated in fiscal 2028;

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[56] For further information on dam safety consequence classifications, refer to the Dam Safety Regulation Schedule Section 2 at: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/40_2016.

- **Access Risk at Terzaghi Spillway Chute:** A rock fall hazard from the bluff above the right (south) side of the spillway needs to be addressed. The Terzaghi Spillway Chute Access Improvement Project was initiated in fiscal 2019 to allow safe access to the spillway for regular maintenance and inspection. The project is currently in the Identification phase; and

- **Water Management Risk at Terzaghi Low Level Discharge:** The low-level outlet gates are the primary means to provide environmental flow releases to Lower Bridge River. They are also required for safe flood passage or if generating units at the Bridge River Facility are unavailable, as well as for post seismic reservoir drawdown. The Terzaghi Low Level Discharge Reliability Improvement Project will improve the long-term operational reliability and maintainability of the low-level discharge system and is scheduled to be initiated in fiscal 2023.

#### *2.3.1.3 Seton Facility*

Specific risks to the Seton Facility include:

- **Aging Generating Equipment:** Failure of any one component could lead to lost generation and excessive spills down Lower Bridge River and/or Seton River. The governor and unit protection were replaced and placed in service in fiscal 2020. The Seton Unit Upgrade/Bypass Project, which was initiated in fiscal 2018, will address current generator and runner failure risks. It is currently in the Identification phase and is scheduled to be in-service at the end of fiscal 2028. BC Hydro is planning to file a CPCN Application for this project in fiscal 2024;

- **Seismic Risk at Seton Left Bank Earth Fill Dyke:** The dyke on the North side of Seton Dam could be vulnerable to a major seismic event with an annual exceedance probability of 1:2400 which, while rare, is lower than the targeted seismic withstand of a 1:10000 annual exceedance probability event. If the dyke were to fail, it could lead to uncontrolled release down Seton River affecting physical structures on the river and fish populations in the river. The risk is considered tolerable in the near term but not acceptable for the long term. The Seton Left Bank Dyke Upgrade Project will improve the seismic withstand of the dyke, including treatment for potential foundation liquefaction, and prevention of erosion during normal and flood conditions. This project is scheduled to be initiated in fiscal 2027;

- **Seismic Risk at Seton Dam:** Seton Dam was constructed on alluvial material (i.e., loose sand and gravel), which may be subject to liquefaction, displacement and settlement risks during a seismic event, potentially leading to an uncontrolled release downstream into Fraser River. The onset of liquefaction could be triggered by earthquake ground motions having an annual exceedance probability of 1:1500, which is lower than the targeted seismic withstand of a 1:10000 annual exceedance probability event. This could affect physical structures on the river as well as fish populations in the river. The risk is considered acceptable in the near term but not acceptable for the long term. The Seton Dam Seismic Upgrade Project will improve the seismic withstand capacity of Seton Dam and is scheduled to be initiated in fiscal 2034;
- **Risk at Seton Canal:** The Seton Canal carries water from Seton Lake to the single unit Seton Generating Station. There is a risk that during a seismic event, the liner of the canal could fail due to deformations arising from liquefaction of underlying soils, causing an uncontrolled release of water. Liquefaction is potentially triggered by earthquake ground motions having an annual exceedance probability of 1:5500, which is lower than the targeted seismic withstand of 1:10000 annual exceedance probability. A failure of the canal embankment could impact the Sekw'el'was community located adjacent to the canal. Lumberyard structures on the north bank of Seton River near the Highway 99 Bridge would also experience temporary flooding. To mitigate this risk, the following three projects have been identified:

- **Seton Canal Flow Control Structure Upgrade Project:** The five headworks gates at Seton Dam are required to isolate the power canal from Seton Lake Reservoir. The current gates cannot be closed under flow and are unreliable under normal conditions. The Seton Canal Flow Control Structure Upgrade Project will replace the existing gates with gates that are easier to operate and can be closed under a range of water flow conditions so that the downstream damage could be minimized, if there was a breach in the canal. This project is scheduled to be initiated in fiscal 2026;
- **Seton Canal Refurbishment Project:** Due to age and deterioration of the canal's concrete liner and joints, there is a risk that the Seton Power Canal could develop leaks of sufficient magnitude to lead to failure of the canal. The Seton Canal Refurbishment project will refurbish the canal's concrete slabs and the joints between them along the four kilometre long canal lining. This project is scheduled to be initiated in fiscal 2026; and
- **Seton Aqueduct Seismic Withstand Upgrade Project:** The aqueduct carries flows from the canal over Cayoosh Creek. Due to its form of construction and foundation on alluvial deposits, the aqueduct structure is thought to be seismically deficient, though its withstand has not been formally quantified. If the abutment soil or soil under the piers supporting the aqueduct failed, it would likely redirect canal flows into Cayoosh Creek resulting in damage to properties on Cayoosh Creek. The Seton Aqueduct Seismic Withstand Upgrade Project will mitigate the risk of aqueduct failure in the event of an earthquake. This project is scheduled to be initiated in fiscal 2029.

### 2.3.2 2014 System Study Confirmed Bridge River Generation System Was Lowest Cost Option

The 2014 System Study examined the key risks identified above and identified six key capability requirements for the Bridge River Generation System:

- Generate power from the Bridge River Generation System;
- Maintain reservoir levels within acceptable bounds under operational based loading and plant fault conditions;
- Maintain downstream river flow within acceptable bounds under operational based loading conditions;
- Be supported by Indigenous Nations;
- Maintain hydraulic control during floods; and
- Maintain hydraulic control post-earthquake.

BC Hydro worked with an external consultant, Hatch Ltd. to develop concepts for individual facility components and to develop integrated river system concepts. One of the concept alternatives initially considered in the 2014 System Study was to decommission the entire Bridge River Generation System. This would restore the Bridge River to its original state by removing generating stations, ancillary structures and all three dams. The benefits of this alternative included eliminating the risk of dam breaches and flooding due to a seismic event and restoring the natural environment.

However, decommissioning would result in the loss of generation energy and capacity, as well as the cost of replacement energy and capacity. Additionally, decommissioning disables reservoir control leading to unconstrained natural flooding of downstream communities and impacts on aquatic species such as fish and riparian habitat vulnerable to natural low or sudden changes in water level.

This alternative was eliminated in the early part of the system study and not pursued given the significant costs required to remove structures and plug the penstocks as well as to implement safety measures, protective barriers, drawdowns, alternative flow routing and environmental remediation to mitigate the impacts of returning flows to their natural state.

The following seven alternatives were advanced:

- **Concept 0:** Base Case. Refurbish La Joie Dam and La Joie Generating Station, replace Terzaghi Dam, relocate Bridge River 1 Generating Station, refurbish Bridge River 2 Generation Station and refurbish Seton Dam and Generating Station;
- **Concept 1A:** Base Case with new, higher Terzaghi Dam, new intake structure at the Bridge River 1 and Bridge River 2 Generating Stations, and decommission La Joie Dam and Generating Station;
- **Concept 1B:** Base Case with new higher La Joie Dam and a new La Joie Generating Station;
- **Concept 1D:** Base Case with lowered La Joie spillway crest;
- **Concept 3:** Decommission inter-basin diversion[57] and replace with a tunnel from Terzaghi Dam to a new generating station near Fraser River and refurbish the Seton Generating Station;
- **Concept 4:** Base Case with the replacement of the Bridge River 1 and Bridge River 2 Generating Station with a new 1000 MW pumped storage station located on the Seton reservoir; and
- **Concept 5:** Base Case with the replacement of Seton Canal with a new tunnel and a new generating facility at Seton.

Table 2-1 below provides an analysis of the costs associated with each of the seven alternatives that were advanced in the 2014 System Study. As shown in the table below, the 2014 System Study determined that the lowest cost concept, on a $/kW basis, was the base case (i.e., Concept 0).

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[57] Diverts water from the Bridge River basin to the Seton River basin.

**Table 2-1 Analysis of Alternatives Considered in 2014 System Study**

| Concept | No. 1 | No. 1A | No. 1B | No. 1D | No. 3 | No. 4 | No. 5 |
|---|---|---|---|---|---|---|---|
| **Description** | **Base Case** | **New Higher TRZ** | **New Higher LAJ** | **LAJ Reduced** | **TRZ Long Tunnel** | **Pumped Storage** | **SON Tunnel** |
| Total Project Costs ($ million) | $1,588 | $1,593 | $2,420 | $1,489 | $2,601 | $3,204 | $1,953 |
| Capacity (MW) | 544.0 | 519.0 | 561.0 | 541.0 | 573.0 | 1073.0 | 566.0 |
| $/kW | $2,290 | $3,070 | $4,310 | $2,750 | $4,540 | $2,990 | $3,450 |

As discussed above, the base case included the replacement of Terzaghi Dam and the relocation of the Bridge River 1 Generating Station. Following the 2014 System Study, BC Hydro conducted a seismic performance assessment at Terzaghi Dam which established that, with some modest upgrades as described in section 2.3.1.2 above, the dam would be capable of meeting current seismic standards. As a result of the seismic performance assessment, BC Hydro advanced more moderate dam safety projects at Terzaghi Dam rather than replacing the Terzaghi Dam, as had been originally proposed in the base case in the 2014 System Study. BC Hydro also decided not to relocate the Bridger River 1 Generating Station. Rather, after considering the length of time it would take to relocate the generating station, the risk of stranding assets and the inability to manage flows while work was in progress, BC Hydro decided to retain the seismic risk related to the location of the Bridge River 1 Generating Station and instead proceed with a component by component replacement program at the Bridge River 1 Generating Station which is more cost effective. Further information on these decisions is provided in the 2020 System Update which is provided as Appendix B-2-2. As the full replacement of Terzaghi Dam and relocation of the Bridge River 1 Generating Station were included in the base case scenario, the removal of these costs and the inclusion of more moderate investments further reduced the cost of the base case compared to the other conceptual alternatives.

### 2.3.3 BR1 Project is the Next Step in Replacing Aging Downstream Generation Equipment

As discussed further in section 2.3.1 above, solutions to address seismic risks are complex and can take time to develop and implement. Accordingly, BC Hydro has prioritized investments to address aging generation assets to mitigate water flow management risks and maintain reservoir levels while major civil works are undertaken to address identified seismic risks.

The Bridge River 1 Generating Station and Bridge River 2 Generating Station were commissioned in 1954 and 1960, respectively. By 2017, units at both facilities had exceeded their 50-year design life and were experiencing failures and unit de-ratings, reducing the overall capacity of the Bridge River 1 and Bridge River 2 Generating Stations from 500 MW to 376 MW. This has created challenges for generation operations and water management, which were already impacted as a result of the reduction of storage in the Downton Reservoir in 2015. To mitigate these generation and flow issues, work to address aging generating units was prioritized.

Generating Units 5 and 6 at the Bridge River 2 Generating Station were replaced in fiscal 2019 and fiscal 2020, respectively. Generating Units 7 and 8 at the Bridge River 2 Generating Station are being replaced in fiscal 2021 and fiscal 2022, respectively. These units were selected first as they had more capacity (75 MW each), the stator windings were in worse condition, and three of the four units had previously been de-rated. These replacements were advanced as two separate projects to minimize the length of overall outages and the associated impacts on water management.[58]

The BR1 Project is the next priority and will replace Units 1 to 4 at the Bridge River 1 Generating Station.

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[58] BC Hydro explained this approach in response to BCUC IR 2.261.1 during the Fiscal 2017 to Fiscal 2019 Revenue Requirements Application proceeding.

## 2.4 Bridge River Transmission System Overview

### 2.4.1 Description of the Bridge River Transmission System

The Bridge River Transmission System includes ten substations[59] and three regional paths. The Bridge River Transmission System transmits power produced from the Bridge River Generation System and nearby IPP facilities, through the South Interior, Fraser Valley, and Sunshine Coast areas, to customers in the Metro Vancouver and Fraser Valley areas.

As shown in Figure 2-5 below, power is transmitted from the Bridge River Generation System and nearby IPP facilities to customers in the Metro Vancouver and Fraser Valley areas through the following three regional paths. Regional Paths 2 and 3 were built between 1948 and 1960 while Regional Path 1 was constructed later, in the 1960s.

- **Bridge River Regional Path 1 (circuit 2L90 and formerly 2L91):** from Bridge River Terminal Station to Kelly Lake Substation, interconnecting the Bridge River area and the South Interior West area;
- **Bridge River Regional Path 2 (circuits 3L2 and 3L5, Rosedale Transformer T1, and circuits 2L78 and 2L77):** from Bridge River Terminal Station to the Fraser Valley area and Metro Vancouver area; and
- **Bridge River Regional Path 3 (circuits 2L1, 2L2, 2L5, 2L41, 2L9 and 2L13):** from Bridge River Terminal Station to Cheekye Substation, interconnecting the Bridge River and the Sunshine Coast areas (which then interconnect to the North Shore, Metro Vancouver and Fraser Valley areas).

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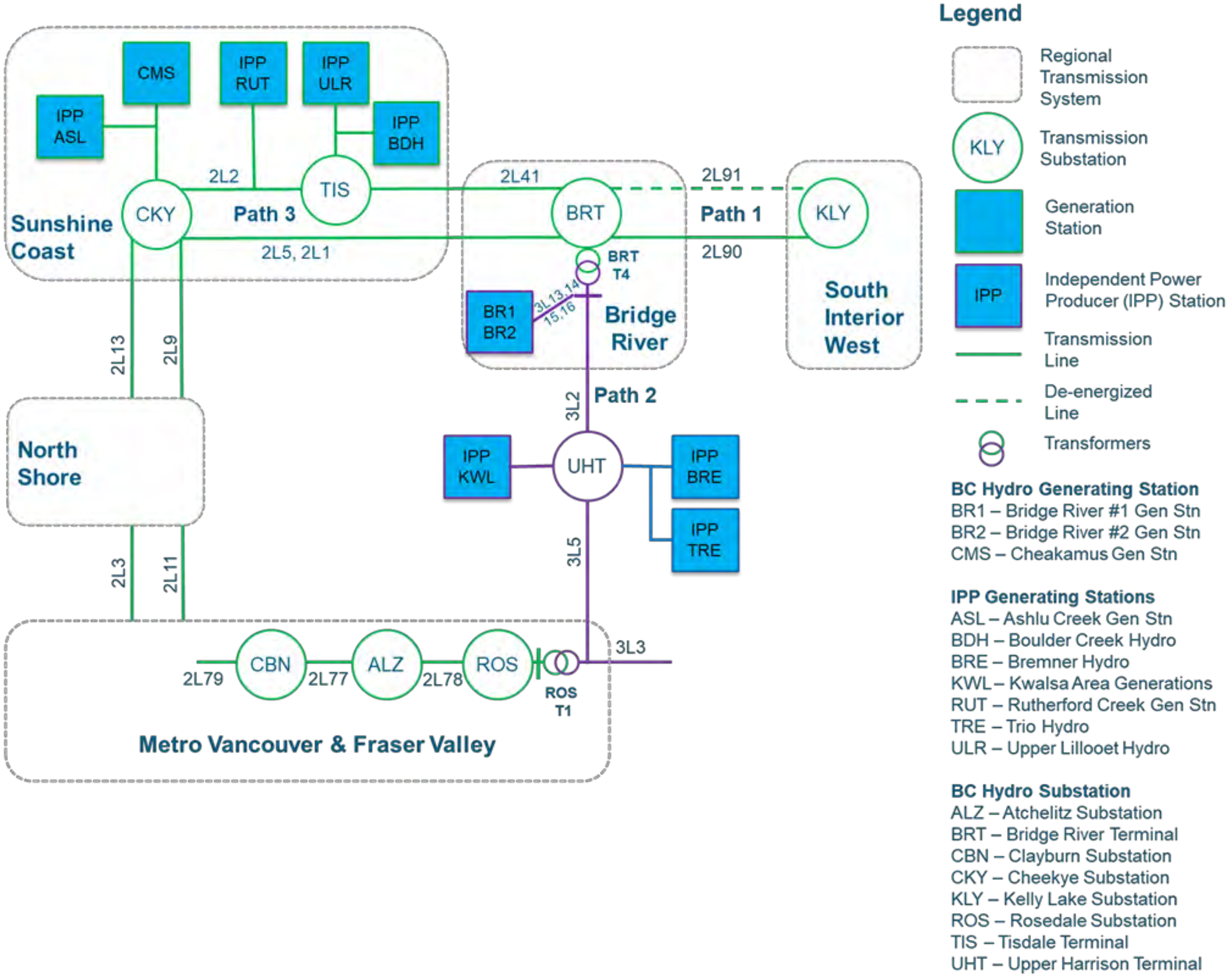
[59] The 10 substations are Atchelitz, Bridge River Terminal, Clayburn, Cheekye, Cypress, Kelly Lake, Lynn Valley, Rosedale, Upper Harrison Terminal and Walters.

**Figure 2-5 Bridge River Transmission System Regional Paths**



#### 2.4.1.1 Regional Path 2 and Path 3

Regional Path 2 was built in the mid 1950s and consisted of the 360 kV system from Bridge River Terminal Station to Rosedale Substation and extended into Ingledow Substation in the Fraser Valley.

Load growth in the 1970s and 1980s within the Fraser Valley area resulted in the development of Atchelitz Substation and Clayburn Substation and the 360 kV system between Rosedale and Ingledow was converted to a 230 kV level system. The Upper Harrison Terminal Station was built in late 2009 to accommodate the IPP facilities near and around Harrison Lake and the original single 3L2 circuit, between Bridge River Terminal Station to Rosedale Substation, was renamed 3L2 between Bridge River Terminal Station and Upper Harrison Terminal and 3L5 between Upper Harrison Terminal and Rosedale Substation.

Regional Path 3, from Bridge River Terminal Substation to Cheekye Substation in the Sunshine Coast area and south into Walters Substation in the North Shore area, was built in 1948 to serve load growth in the area. Path 3 consists of six 230 kV circuits: 2L1/2L5, 2L2/2L41 and 2L9/2L13. The Rutherford Creek IPP facility and the Upper Lillooet River IPP facility in the Pemberton and Whistler areas interconnect with these circuits.

#### 2.4.1.2 Regional Path 1

Regional Path 1 consists of a single circuit, 2L90, between Bridge River Terminal Station and Kelly Lake Substation and was built in the early 1960s. Two years after the construction of the 2L90 circuit, a parallel identical circuit, 2L91, was built and the two 230 kV circuits connected the Bridge River Generation System to the South Interior West area. Regional Path 1 provided redundancy for the original transmission paths (Regional Path 2 and 3).

In the summers of 2002 and 2004, forest fires burned down portions of the 2L90 and 2L91 circuits. In 2002, temporary repairs were made after the forest fire to restore both circuits. After the forest fire in 2004, BC Hydro repaired only the 2L90 circuit, using sections of the 2L91 circuit as necessary as the Bridge River Transmission System was able to operate in normal system conditions without the restoration of the 2L91 circuit. The sections of the 2L91 circuit not used for the repair of the 2L90 circuit were left de-energized.

#### 2.4.1.3 In Recent Years, More IPP Facilities Have Connected to the Bridge River Transmission System

The Bridge River Transmission System was originally designed and built to accommodate the full power from the Bridge River Generation System with a historic capacity of 566 MW, under normal system conditions.

The 2006 Open Call for Power and the 2010 Clean Power Call resulted in BC Hydro purchasing clean and renewable energy from IPPs under Energy Purchase Agreements with IPP facilities interconnecting to the Bridge River Transmission System. Multiple IPP plants, totalling approximately 400 MW of generation capacity have interconnected at the Upper Harrison Terminal Station and at substations and through line taps in the Cheekye, Pemberton and Whistler areas, as a result of these power calls. In addition, BC Hydro has an Electricity Purchase Agreement with an IPP that expects to connect to the Upper Harrison Terminal Station as early as the summer of 2021.

Generation from the Bridge River Generation System and nearby IPP facilities needs to be transferred from the Bridge River area to serve load in other areas of the province. The de-ratings of generating units at the Bridge River Facility, discussed in section 2.3.3 above, have reduced the amount of power that needs to be transferred from the Bridge River area to serve load in other areas of the Province. This has partially offset the impacts of increased IPP generation connecting to the Bridge River Transmission System in recent years. However, as discussed in section 2.3.3 above, the de-ratings have created challenges for generation operations and water management which cannot be sustained over the longer-term.

In 2030, when the BR1 Project is completed and the generation capacity at the Bridge River Facility is restored, there will be a total of 596 MW of BC Hydro owned generation and 474 MW of IPP generation connected to the Bridge River Transmission System. In 2017, BC Hydro conducted a transmission study to assess the impact of increased IPP generation and the restoration of generation capacity at the Bridge River Facility to the Bridge River Transmission System. This study is provided as Appendix C-1. The study shows that, in 2030, loadings on Path 2 and 3 will remain within the facility ratings; however during the summer months, when generation output is high and local load is low, the 2L90 circuit (Path 1) would need to carry up to 838 A (338 MVA), or over 160 per cent of its thermal rating of 510 A (203 MVA).[60] This would cause the 2L90 circuit to exceed its thermal limits, potentially leading to overheating, thermal damage and unsafe clearances.

The BRT Project will address system constraints on the Bridge River Transmission System.

## 2.5 Long Term Plan to Maintain and Operate the Bridge River Transmission System

BC Hydro’s long-term plan for the Bridge River Transmission System is to maintain and operate the system so that power can continue to be transmitted from the Bridge River Generation System and nearby IPP facilities to the customers in the Metro Vancouver and Fraser Valley areas.

The subsections below describe the current condition of the transmission line and substation assets in the Bridge River Transmission System and BC Hydro’s strategies to maintain those assets.

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[60] Refer to section 8.2 of Chapter 8 for a discussion of thermal ratings in general and section 8.4 of Chapter 8 for discussion of the thermal rating of the 2L90 circuit specifically.

### 2.5.1 Maintaining Transmission Lines in the Bridge River Transmission System

To maintain the circuits within Regional Paths 1, 2 and 3 of the Bridge River Transmission System, BC Hydro:

- Inspects the circuits via regular scheduled inspections, including helicopter overview inspections, detailed structure inspections, and wood pole test and treat inspections. The inspections gather asset condition data and allow BC Hydro to identify and respond to emergent issues on the line, and to prioritize future maintenance and capital improvements;
- Addresses emergent asset conditions and line outages immediately through corrective maintenance;
- Reviews asset condition data at a province-wide level annually and prioritizes projects and work programs accordingly; and
- Repairs and replaces assets through its maintenance program and through capital sustainment projects and programs.

BC Hydro uses its Asset Health methodology to compare the condition of the overall system assets. Transmission assets are assigned a rating of Good, Fair, Poor or Very Poor. The ratings are based on an aggregate of the combined condition data of all the components on the line, including asset life curves for some components as well as weightings for reliability performance. With regard to the Bridge River Transmission System:

- Regional Path 1 is in Fair condition overall; however, as shown in Table 2-2 below, major sustainment work is required within the next five years for 103 of the 351 structures on the 2L90 circuit;
- Regional Path 2 is in Fair condition with minimal maintenance work required in the next five years; and

- Regional Path 3 is in Fair condition with minimal maintenance work required in the next five years.

Table 2-2 below provides a summary of the condition of the three Regional Paths within the Bridge River Transmission System.

**Table 2-2 Condition of Circuits Within Bridge River Transmission System**

| Path | Circuit | Age | Overall Asset Health | Total Structures | Total Structures Identified for Replacement[61] |
|---|---|---|---|---|---|
| 1 | 2L90 | 58 | Fair | 351 | 103 |
| 2 | 3L2 | 69 | Fair | 332 | 0 |
| 2 | 3L5 | 69 | Fair | 192 | 0 |
| 2 | 2L78 | 69 | Fair | 69 | 0 |
| 2 | 2L77 | 69 | Fair | 89 | 1 |
| 3 | 2L1 | 73 | Fair | 363 | 6 |
| 3 | 2L41 | 73 | Fair | 159 | 0 |
| 3 | 2L2 | 73 | Fair | 154 | 0 |
| 3 | 2L5 | 73 | Fair | 135 | 0 |
| 3 | 2L9 | 73 | Fair | 234 | 0 |
| 3 | 2L13 | 73 | Fair | 304 | 0 |

The BRT Project is currently the only capital project planned for the Bridge River Transmission System and will address asset health issues to improve the reliability and safety of the 2L90 circuit. Other asset health needs for the Bridge River Transmission System will be addressed through regular maintenance and programs, as described above.

### 2.5.2 Asset Strategy and Asset Condition of the Substation Assets

Figure 2-6 below provides a summary of the condition of the substations within, and adjacent to, the Bridge River Transmission System. The percentages in the figure

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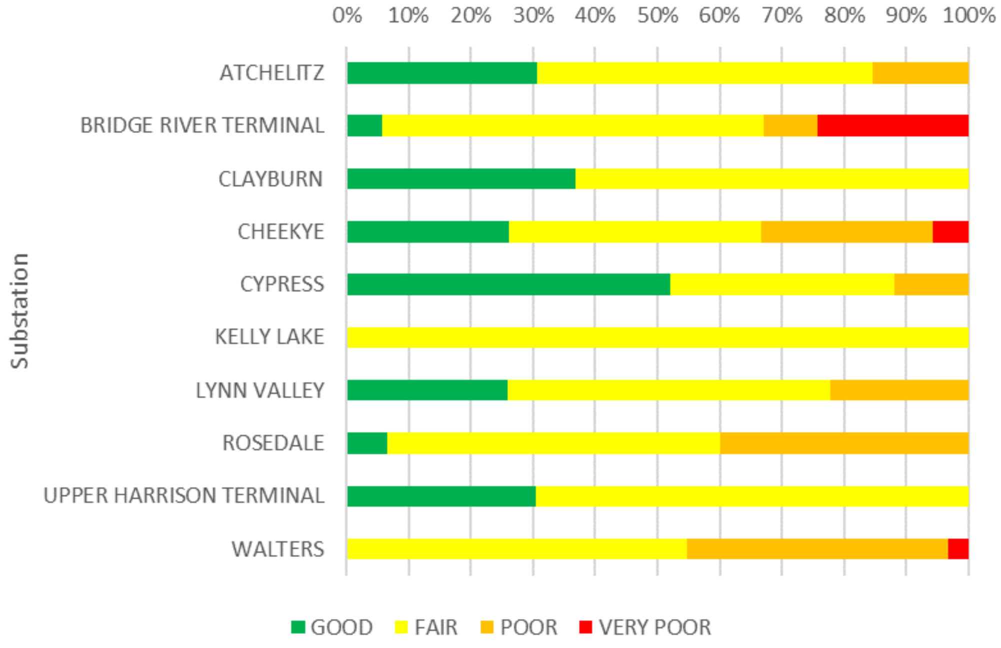
[61] Within the next five years.

below represent the percentage of the total number of assets with the condition prescribed by the Asset Health Rating methodology.

**Figure 2-6 Condition of Substations Within and Adjacent to Bridge River Transmission System**



Overall, the substation assets within, and adjacent to, the Bridge River Transmission System are currently in Fair condition, based on the Asset Health Rating methodology. However, specific substation assets, mostly disconnect switches and surge arresters[62] and the transformers at the Rosedale Substation and at the Bridge River Terminal Station, are in Poor or Very Poor condition.

BC Hydro has planned ongoing maintenance and capital projects to address investment needs at substations within the Bridge River Transmission System. Planned capital investments include the Rosedale Transformer T1 Life Extension

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[62] Disconnect switches are used to isolate the equipment from the voltage on the system during normal operations (creates a physical separation interrupting the electrical flow between equipment).
Surge arrestors protect transmission lines and adjacent equipment from electrical stresses (e.g., transient over-voltages) by diverting energy to local grounds.

Project, which will begin implementation in fiscal 2022 and the Bridge River T4 Transformer Replacement Project, which is scheduled to begin implementation in fiscal 2024.

## 2.6 Bridge River System is Economic when Planned Investments and Operating Costs are Considered

In 2020, BC Hydro completed a forward-looking economic analysis of the Bridge River System (**2020 Economic Analysis**). This analysis is provided as Appendix B-2-3.[63] The analysis estimated that, when planned investments and operating costs are considered, the Bridge River System, as configured, has a NPV of $1,180 million[64] under energy market assumptions consistent with the draft 2021 Integrated Resource Plan[65], which BC Hydro released for consultation on June 21, 2021 (**Reference Scenario**).

As discussed in section 2.2.1 above, the Bridge River generating stations operate in a cascading system, with several stations on the river processing water in sequence. The storage and regulation at each station necessarily affect the operations and by extension the value of all downstream stations. The constraints of downstream stations can also affect the operations and value of stations upstream. Accordingly, BC Hydro reviewed the Bridge River System both:

- As a whole, to ensure that the overall system continues to be economic; and
- On a facility-by-facility basis, to ensure that each investment, on its own, provides economic benefit. In some cases, this will be a direct benefit at the specific facility (i.e., energy, capacity or dam safety benefits at that facility). In

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[63] Detailed information supporting this analysis is included as a live Excel file in Appendix B-2-3 Attachment 1.

[64] This NPV is the present value of the Bridge River Generation System's energy and capacity less planned capital investments and operating costs over a 50-year period. As the system value is positive, BC Hydro did not devote resources to develop a decommissioning alternative or determine the cost to decommission the system. The valuation therefore does not reflect avoided decommissioning costs. The positive NPV of the Bridge River Generation System would be higher if those costs were included.

[65] The draft Integrated Resource Plan can be found at this link: https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/regulatory-planning-documents/integrated-resource-plans/current-plan/draft-integrated-resource-plan.pdf.

other cases, this will include indirect benefits at other facilities as a result of the storage and regulation provided at the facility being analyzed.

Table 2-3 below shows the breakdown of the Bridge River System valuation by facility under the Reference Scenario. The valuation reflects:

- A value of energy based on BC Hydro's current interim approach of valuing energy, in all years, based on the market price (levelized price of $40.90 per MWh in 2020 real dollars) and valuing capacity based on the cost of clean capacity (Revelstoke Unit 6 and pumped storage) in years where a capacity shortfall occurs (levelized price of $67.50 per kW-Year in 2020 real dollars);
- Capital projects that BC Hydro expects to undertake over the next 50 years to continue to operate the generating stations and the transmission infrastructure within the Bridge River System required to deliver energy and capacity to load, as well as an ongoing allowance for smaller sustaining capital investments that may be required;[66] and
- The ongoing operating costs including the water rentals for energy and capacity based on statutory rates and the costs of operating the facilities based on historical values.

**Table 2-3 Bridge River System Valuation**

| Reference Scenario | Present Value ($ million, except as noted) | | | |
|---|---|---|---|---|
| | **La Joie Facility** | **Bridge River Facility** | **Seton Facility** | **Bridge River System** |
| Average Annual Energy (GWh) | 127 | 2,578 | 318 | 3,023 |
| Plant Dependable Capacity (MW) | 15 | 490 | 44 | 549 |
| PV of System Energy | 120 | 2,290 | 300 | 2,710 |
| PV of System Capacity | 30 | 890 | 80 | 990 |
| **Sub-total: Value of the Facility or Bridge River System** | **150** | **3,180** | **380** | **3,710** |

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[66] Appendix B-2-3 includes a list of anticipated capital projects in the Bridge River System, and the expected timing of those projects.

| **Reference Scenario** | **Present Value ($ million, except as noted)** | | | |
|---|---|---|---|---|
| PV of Planned Generation Capital Investments | (620) | (610) | (190) | (1,420) |
| PV of Planned Transmission Capital Investments | - | - | - | (80) |
| PV of Sustaining Capital[67] | - | - | - | (160) |
| PV of Ongoing Generation Operating Costs | (70) | (580) | (90) | (740) |
| PV of Ongoing Transmission Operating Costs | - | - | - | (130) |
| Sub-total: Value of Planned Capital and Operating Costs | (690) | (1,190) | (280) | (2,530) |
| **NPV of the Facility or Bridge River System** | **(540)** | **1,990** | **100** | **1,180** |
| Note: Figures may not add / cross-add due to rounding | | | | |

The economic value of the Bridge River System is mainly derived from the Bridge River Facility. Consequently, the analysis on a facility-by-facility basis results in values that, considered in isolation, could be taken to imply that investments at the La Joie facility are uneconomic. However, it is important to recognize that the La Joie plays an important role in managing the flow of water through the Bridge River System, and in maintaining the value of the system. In particular, as well as enabling downstream generation, the storage and regulation provided by La Joie Dam and Downton Reservoir contribute to the flood routing capability of the Bridge River System, and the continued safe operation of the downstream Terzaghi Dam.

BC Hydro also conducted valuations considering a range of sensitivities for high and low market values for energy, high and low values for capacity and a large or small Load Resource Balance gap, which affects the timing of need for additional capacity resources. Under these scenarios, the NPV of the Bridge River System ranges from $100 million to $2 billion.

Table 2-4 below shows the valuation of the Bridge River Generation System under the various energy and capacity sensitivity scenarios.

---

[67] This is an allowance for unknown future sustaining capital costs which have not been allocated to a specific facility.

**Table 2-4 Scenario Analysis: Bridge River System Valuation**

| Sensitivity Scenario | Present Value ($ million) | |
|---|---|---|
| | Benefits | System NPV |
| 0: Reference Scenario | 3,710 | 1,180 |
| 1: Small Load Resource Balance Gap | 2,710 | 190 |
| 2: Large Load Resource Balance Gap | 3,760 | 1,230 |
| 3: Low Energy Price | 2,630 | 100 |
| 4: High Energy Price | 4,530 | 2,000 |
| 5: Low Capacity Value | 2,710 | 190 |
| 6: High Capacity Value | 3,740 | 1,210 |

In addition to the sensitivities to energy and capacity values, BC Hydro also considered the sensitivity of the Bridge River System to variations in capital costs and the discount rate applied.

Under the Reference Scenario for energy and capacity values, the Bridge River System remains economic with across-the-board increases in capital costs of up to 71 per cent (i.e., with required capital spending increasing up to 1.71 times the expected cost). The value of the Bridge River System under different capital spending variances is shown in Table 2-5 below.

**Table 2-5 Bridge River System - Capital Sensitivity**

| Bridge River System Value versus Capital Cost | | | | | | |
|---|---|---|---|---|---|---|
| Relative Capital Cost | 90% | 100% | 110% | 150% | 171% | 200% |
| System NPV ($M) | 1,340 | 1,180 | 1,010 | 350 | - | (480) |

Under the Reference Scenario for energy and capacity values, the Bridge River System remains economic across a range of discount rates above and below BC Hydro’s standard discount rate of 5 per cent (in nominal terms). This is shown in Table 2-6 below.

**Table 2-6 Bridge River System - Discount Rate Sensitivity**

| Bridge River System Value versus Discount Rate | | | | | |
|---|---|---|---|---|---|
| Nominal Discount Rate | 3% | 4% | 5% | 6% | 7% |
| System NPV ($M) | 2,800 | 1,850 | 1,180 | 700 | 360 |

Considering the Reference Scenario as well as a range of sensitivities, the system remains economic and provides value to BC Hydro and customers. This value to BC Hydro and customers justifies the continued investment in the generation and transmission assets of the Bridge River System.

### 2.6.1 Bridge River Generating Station 1 is Economic on a Stand-Alone Basis

BC Hydro also examined the value of the Bridge River 1 Generating Station on a stand-alone basis. Under the Reference Scenario values for energy and capacity the Bridge River 1 Generating Station has a positive value of $680 million.

Table 2-7 below shows benefits provided and the costs that must be incurred to realize those benefits, as well as the NPV of the Bridge River 1 Generating Station under the various sensitivity scenarios. As a stand-alone facility, the Bridge River 1 Generating Station remains economic across all of the scenarios that were considered.

**Table 2-7 Scenario Analysis: Bridge River 1 Generating Station Valuation**

| | Net Present Value ($ million) | | | | |
|---|---|---|---|---|---|
| **Sensitivity Scenario** | **Energy** | **Capacity** | **Capital** | **Operating** | **Facility Value** |
| 0: Reference Scenario | 1,030 | 340 | (420) | (270) | 680 |
| 1: Small Load Resource Balance Gap | 1,030 | - | (420) | (270) | 340 |
| 2: Large Load Resource Balance Gap | 1,030 | 380 | (420) | (270) | 720 |
| 3: Low Market Price | 640 | 330 | (420) | (270) | 280 |
| 4: High Market Price | 1,350 | 350 | (420) | (270) | 1,010 |
| 5: Low Capacity Value | 1,030 | - | (420) | (270) | 340 |
| 6: High Capacity Value | 1,030 | 370 | (420) | (270) | 710 |

Note: Figures may not cross-add due to rounding, With regard to capital cost sensitivity, the Bridge River 1 Generating Station remains economic even with an across-the-board capital cost increase of up to 160 per cent (i.e., up to 2.6 times the expected costs). The value of the Bridge River 1 Generating Station under different capital spending variances is shown in Table 2-8 below.

**Table 2-8 Value of Bridge River 1 Generating Station with Capital Cost Variances Applied**

| **Bridge River 1 Generating Station Value versus Capital Cost Factor** | | | | | | |
|---|---|---|---|---|---|---|
| Relative Capital Cost | 90% | 100% | 110% | 150% | 200% | 260% |
| Station NPV ($M) | 720 | 680 | 640 | 470 | 260 | - |

Under the Reference Scenario for energy and capacity values, the Bridge River 1 Generating Station also remains economic across a range of discount rates above and below BC Hydro’s standard discount rate of 5 per cent (in nominal terms). This is shown in Table 2-9 below.

**Table 2-9 Value of Bridge River 1 Generating Station with Different Discount Rates**

| **Bridge River 1 Generating Station Value versus Discount Rate** | | | | | |
|---|---|---|---|---|---|
| Nominal Discount Rate | 3% | 4% | 5% | 6% | 7% |
| Station NPV ($M) | 1,360 | 960 | 680 | 470 | 330 |

Based on this analysis, the Bridge River 1 Generating Station is economic, and investments to continue operation of the generating station and transmission of its power to load represent positive value to ratepayers.

# BC Hydro Bridge River Projects

# Bridge River 1 Units 1 to 4 Generator Replacement Project

# Chapter 3

## Project Justification

# Table of Contents

3.1 Introduction ........ 3-1
3.2 Overview of the Bridge River Facility and the Bridge River 1 Generating Station ........ 3-2
  3.2.1 Description of the Bridge River Facility ........ 3-2
  3.2.2 Bridge River Facility Asset Plan Prioritizes Investments in Reliable Generation and Water Flow Management ........ 3-5
  3.2.3 Bridge River 1 Generating Equipment Has Largely Exceeded Its Industry Life Expectancy ........ 3-7
3.3 The BR1 Project is Needed to Improve the Reliability of Bridge River 1 Generating Units 1 to 4 ........ 3-11
  3.3.1 BC Hydro Undertakes Equipment Health Assessments to Evaluate Asset Condition ........ 3-12
  3.3.2 Unit 1 to 4 Generators Are in Unsatisfactory Condition ........ 3-14
  3.3.3 Unit 1 to 4 Governors are in Poor Condition ........ 3-16
  3.3.4 Unit 1 to 4 Exciters Are Approaching End of Life ........ 3-18
  3.3.5 Unit 1 to 4 Control Systems are Obsolete ........ 3-18
3.4 The BR1 Project Is Needed to Improve Capacity and Reliability of Water Flow Management ........ 3-19
  3.4.1 BC Hydro Must Manage Water Flows Within WUP Order and Agreement Commitments ........ 3-20
  3.4.2 Bridge River Generating Units Are the Primary Mechanism for BC Hydro to Manage Water Flows ........ 3-21
  3.4.3 De-Rating of Unit 4 and Reduction in Downton Reservoir Elevation Challenges BC Hydro’s Ability to Divert Water to Seton Lake ........ 3-23
  3.4.4 BC Hydro is Currently Challenged to Manage Flows Within Targets and Has Received a Variance to the WUP Order ........ 3-24
  3.4.5 Risk of Failures and Further Deratings Threatens Ability to Manage Water Flows ........ 3-26

# List of Figures

Figure 3-1 Carpenter Reservoir, Terzaghi Dam and Lower Bridge River ........ 3-4
Figure 3-2 Bridge River Generating Stations and Seton Lake ........ 3-5

Figure 3-3 Recent and Planned Investments in the Bridge River Facility ........ 3-7
Figure 3-4 Layout of the Generating Equipment at the Bridge River 1 Generating Station ........ 3-8
Figure 3-5 Exterior of the Bridge River 1 Generating Station and Penstocks ........ 3-8
Figure 3-6 Cutaway View of Typical Hydroelectric Generating Equipment ........ 3-9
Figure 3-7 Bridge River 1 Generating Station Asset Condition (As of Fiscal 2019) ........ 3-14
Figure 3-8 Bulging of Stator Core Laminations ........ 3-16
Figure 3-9 Oil Leakage from the Governors ........ 3-17
Figure 3-10 Bridge River Generation System Water Flows ........ 3-22
Figure 3-11 Number of Days Exceeding the Lower Bridge WUP Order Target Flow Schedule in 53 years With Available Generating Units 1 to 4 ........ 3-27

## List of Tables

Table 3-1 Bridge River Facility: Key Data ........ 3-3
Table 3-2 Generator and Components Condition ........ 3-15
Table 3-3 Bridge River 1 Generating Station Plant Ratings and Total Licence Flow Capacity ........ 3-24

## 3.1 Introduction

The BR1 Project is needed to address the deteriorating condition of the aging generators, governors, exciters and control systems at the Bridge River 1 Generating Station. Addressing the condition of these aging assets will:

- Improve the reliability of the generating units, mitigating the risk of equipment failure as well as the potential for forced outages and further de-rating[68] of the generating equipment; and
- Improve the management of water flows in the Bridge River System so that BC Hydro can comply with the WUP Order target flow schedule, meet its commitments in the 2011 Agreements and 2019 High Flow Settlement Agreements with the St’át’imc Nation and maintain fish and fish habitat in Lower Bridge River.

This chapter discusses the justification for the BR1 Project and is structured as follows:

- Section 3.2 provides an overview of the Bridge River Facility. It includes a description of the Bridge River Facility and its Facility Asset Plan as well as a description of the Bridge River 1 Generating Station and the generating equipment within the station, which has largely exceeded its industry life expectancy;
- Section 3.3 explains that the BR1 Project is needed to address the aging and deteriorating condition of the Unit 1 to 4 generators, governors, exciters and control systems to maintain the value of the Bridge River 1 Generating Station; and
- Section 3.4 explains that the BR1 Project is needed to improve the management of water flows in the Bridge River System.

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[68] “De-rated” refers to operation at less than the rated/maximum capability to compensate for adverse operating conditions. Unit 4 is currently de-rated to 40 MVA (from 50 MVA).

## 3.2 Overview of the Bridge River Facility and the Bridge River 1 Generating Station

This section provides a description of the Bridge River Facility (section 3.2.1), a summary of the Facility Asset Plan for the Bridge River Facility (section 3.2.2), and an overview of the history and state of the Bridge River 1 Generating Station and the generating equipment within the station (section 3.2.3).

### 3.2.1 Description of the Bridge River Facility

As described in section 2.2.1 of Chapter 2, the Bridge River Facility consists of Terzaghi Dam, Carpenter Reservoir, Bridge River 1 Generating Station, and Bridge River 2 Generating Station. It is the largest of the three facilities in the Bridge River System and provides 4 per cent of BC Hydro’s total generating capacity and about 5 per cent of BC Hydro’s total hydroelectric generation. It generates enough electricity to power the equivalent of approximately 230,000 homes annually.

The Bridge River facility is classified as a “Key” facility, a designation given to BC Hydro hydroelectric generating stations with an installed plant capacity greater than 200 MW and reflecting the significance of the facility to BC Hydro’s entire system. In aggregate, “Key” facilities provide approximately 90 per cent of BC Hydro’s average annual energy supply.

Table 3-1 below summarizes key data for the Bridge River Facility.

**Table 3-1 Bridge River Facility: Key Data**

| Item | Characteristic |
|---|---|
| Facility Classification | Key |
| Dam Consequence Classification | Extreme |
| Original In-Service Date(s) | Bridge River 1 Generating Station: 1948 to 1954<br>Bridge River 2 Generating Station: 1959 to 1960 |
| Plant Maximum MW Rating[1] (MW) | Bridge River 1: 190 MW<br>Bridge River 2: 300 MW |
| Historic Annual Average Plant Generation (GWh) | Bridge River 1: 1074 GWh<br>Bridge River 2: 1504 GWh |

[1] This is the expected plant maximum MW rating for Bridge River 1 and Bridge River 2 Generating Stations as of June 2021.

Terzaghi Dam is a 60-metre high-zoned earth-fill embankment dam constructed between 1956 and 1960. Terzaghi Dam is located on the Bridge River and impounds Bridge River flows to form Carpenter Reservoir.

The Bridge River Facility has two generating stations: Bridge River 1 Generating Station and Bridge River 2 Generating Station. Water from Carpenter Reservoir either flows through two tunnels and six penstocks to the Bridge River 1 and Bridge River 2 Generating Stations and into Seton Lake or flows through the low level outlet gates, down Lower Bridge River.

Figure 3-1 below shows Carpenter Reservoir, Terzaghi Dam and Lower Bridge River.

**Figure 3-1 Carpenter Reservoir, Terzaghi Dam and Lower Bridge River**

From right: Carpenter Reservoir, Terzaghi Dam, and Lower Bridge River. The spillway gates are at the right-centre of the picture.

Figure 3-2 below shows the Bridge River 1 and Bridge River 2 Generating Stations, and Seton Lake.

**Figure 3-2 Bridge River Generating Stations and Seton Lake**

From left: Bridge River 1 Generating Station and Bridge River 2 Generating Station; discharges into Seton Lake

### 3.2.2 Bridge River Facility Asset Plan Prioritizes Investments in Reliable Generation and Water Flow Management

The most recent Facility Asset Plan for the Bridge River Facility (**Asset Plan**) was completed in March 2019. It discusses various assets at the Bridge River Facility, identifies key issues, risks and opportunities and prioritizes investment decisions. The Asset Plan is provided as Appendix B-3.

The Asset Plan indicates that the age and condition of the generating equipment at Bridge River 1 and Bridge River 2 Generating Stations has led to a loss of flow capacity that constrains water management in the Bridge River System. In addition, as discussed in section 2.2.2 of Chapter 2, the elevation of Downton Reservoir has been reduced to manage dam safety risks which has reduced the storage capacity available in the Bridge River System. This combined loss of storage and flow capacities has impacted BC Hydro's ability to manage flows, especially during freshet (May to July), resulting in adverse impacts to fish and fish habitat.

The Asset Plan also indicates that the aging and deteriorating condition of the generating equipment at the Bridge River 1 and Bridge River 2 Generating Stations has increased the likelihood of the Bridge River Facility experiencing extended forced outages. The annual duration of forced outages increased from 105 to 933 hours between fiscal 2014 to fiscal 2018, with an extended outage in fiscal 2016. This extended outage occurred due to an electric fault damaging a generator component and circuit breaker in the Bridge River 2 Generating Station. It lasted for 3,826 hours (approximately 160 days), primarily due to the long lead time associated with obtaining spare parts for the old equipment.

To address these issues, the Asset Plan prioritizes investments in reliable generation and water flow management. It sets out an asset replacement strategy on a component by component basis considering factors such as condition, rate of deterioration, operating environment, and asset criticality. Implementation of identified replacements that may require outages for certain periods of time have been consolidated to reduce the impact on water management in the system.

Since fiscal 2015, BC Hydro has invested approximately $251 million in the Bridge River Facility, which included replacing the Unit 5, 6, 7 and 8 generators at the Bridge River 2 Generating Station, the unit transformers and switchgear in the Bridge River 1 Generating Station, and some minor dam safety investments.

Figure 3-3 below provides a summary of the past and planned investments for the Bridge River Facility. The planned investments are reflected in BC Hydro's current capital plan at a combined total cost of $419 million.[69]

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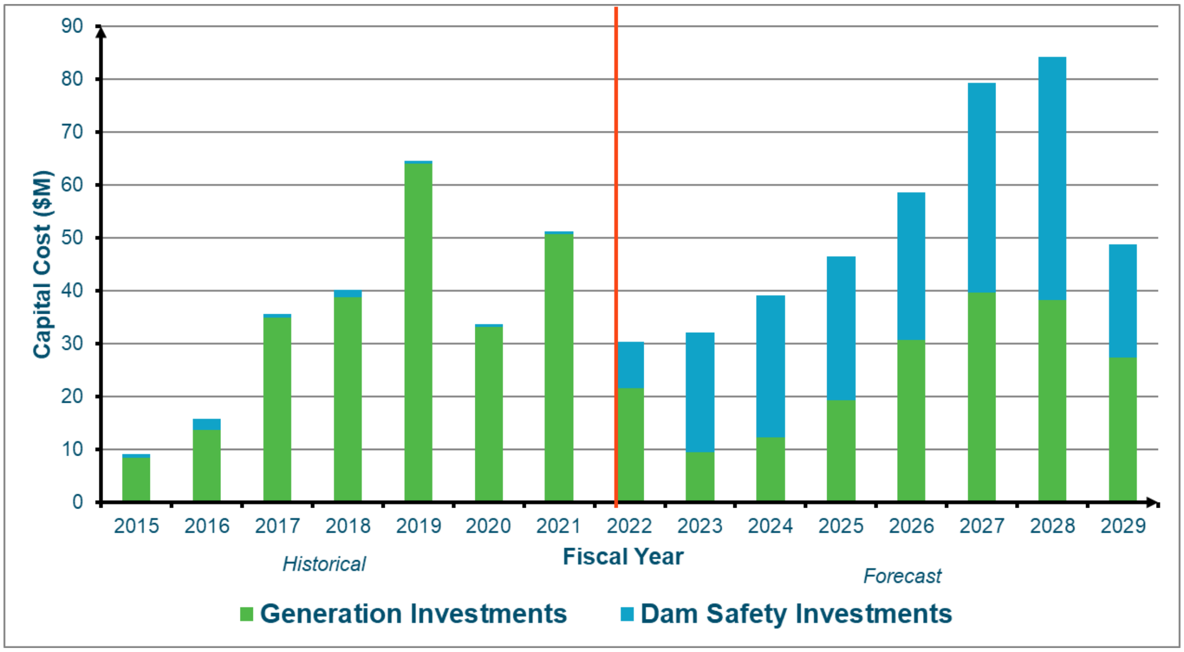
[69] A summary of the short, medium, and long-term plans for the Bridge River Facility is provided on pages 20 to 30 of the Asset Plan in Appendix B-3.

**Figure 3-3 Recent and Planned Investments in the Bridge River Facility**



### 3.2.3 Bridge River 1 Generating Equipment Has Largely Exceeded Its Industry Life Expectancy

The Bridge River 1 Generating Station consists of four 50 MVA generators. Figure 3-4 below shows the current interior layout of the Bridge River 1 Generating Station.

**Figure 3-4** **Layout of the Generating Equipment at the Bridge River 1 Generating Station**

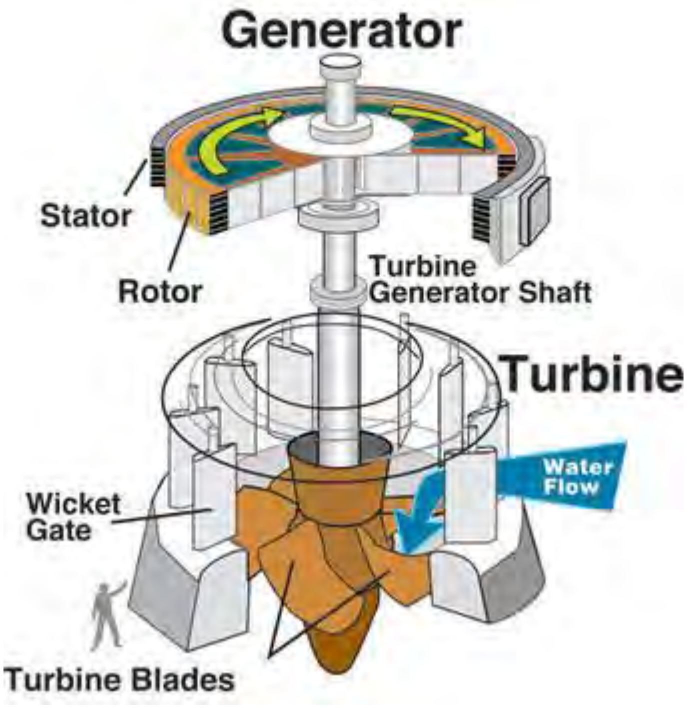
Water is diverted from Carpenter Reservoir to the Bridge River 1 Generating Station through a concrete-lined tunnel and four 1.8-metre diameter steel penstocks constructed on a steep slope. Figure 3-5 below shows the Bridge River 1 Generating Station and the four penstocks.

**Figure 3-5** **Exterior of the Bridge River 1 Generating Station and Penstocks**

Water flow available for power production through Bridge River 1 Generating Station is limited to 65 $m^3/s$ by three existing water licences.[70]

The potential energy of the water in the Carpenter Reservoir is converted to kinetic energy as it flows through the tunnel and penstocks to the four turbines in the Bridge River 1 Generating Station. Each generating unit is connected to a turbine by a single rotating shaft, and the kinetic energy is converted into electrical energy by the generators. Figure 3-6 below shows the different equipment components.

**Figure 3-6 Cutaway View of Typical Hydroelectric Generating Equipment**[71]



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[70] The three existing water licences are FWL 126080 with an expiry date of March 30, 2051; FWL 126287 with an expiry date of April 1, 2019; and FWL 126288 with an expiry date of April 1, 2019. BC Hydro submitted water licence renewal applications for all three licences on identical terms in November 2018 and has received confirmation that operation can be continued pending decision from the Comptroller of Water Rights. BC Hydro is not requesting changes to the existing licence conditions or facility footprint. The diversion water licences for the Bridge River 1 Generating Station are provided as Appendix B-4.

[71] Source: U.S. Army Corps of Engineers; https://www.usgs.gov/media/images/a-turbine-connected-a-generator-produces-power-inside-a-dam. Note that this figure is provided for illustrative purposes only to show the placement of the generator rotor and stator. While this figure shows a Kaplan turbine, the Unit 1 to 4 turbines at the Bridge River 1 Generating Facility are Pelton turbines.

The Unit 1 to 4 turbines rotate at a constant speed of 300 revolutions per minute. The Unit 1 to 4 governors regulate the water flow through the turbines to keep the speed constant and to control the power output. The control system monitors the operation of the governors and regulates the speed of the turbines. It also has protection, control, alarm and metering components that work to automatically or manually eliminate faults and provide information on the generator parameters.

The generators are made up of two main parts: the rotor and the stator. The rotor is a large circular electromagnet connected to the turbine shaft. The stator is a stationary coil of electrical conductors wound tightly around a metal core, which encircles the rotor. The stator consists of a stator frame, stator core and stator winding. The stator frame supports the core of the stator and holds the stator winding. As the rotating electro-magnetic field of the rotor passes the conductors of the stator winding, an electric current is induced in stator windings. The exciters inject current into the rotor coils, creating the electromagnetic field on the rotors and turning them into large electromagnets.

The generating equipment at the Bridge River 1 Generating Station has largely exceeded its industry life expectancy or is no longer supported. Specifically:

- The Unit 1 to 4 generators have an industry life expectancy of 50 years and have each been in service for more than 65 years;
- The Unit 1 to 4 governors have an industry life expectancy of 40 years and have each been in service for more than 65 years;
- The Unit 1 to 4 exciters have an industry life expectancy of 30 years and have been in service for more than 25 years. While the exciters are still within their industry life expectancy, they are no longer technically supported, spare parts are not available, and their design lacks standard key features in newer designs

which are required to meet North American Electric Reliability Corporation (**NERC**) Standard VAR-002-4 R3;[72]

- The Unit 1 to 4 control systems are largely original electro-mechanical components, which are now exceeding their industry life expectancy of 30 years, although some components, such as the synchronizers, have been replaced and, in the late 1980s, additional components were added when the station became automated.

BC Hydro’s maintenance program for the Bridge River Facility is intended to enable assets to perform as designed while considering performance, risks, and expenditures over the asset lifecycle. When an asset reaches end-of-life, a component by component replacement is generally the least costly and most efficient option. As discussed in section 3.3 below, generating equipment at the Bridge River 1 Generating Station now requires replacement because it has reached end-of-life and will be unable to continue to perform reliably.

## 3.3 The BR1 Project is Needed to Improve the Reliability of Bridge River 1 Generating Units 1 to 4

The BR1 Project is needed to address the deteriorating condition of Units 1 to 4 at the Bridge River 1 Generating Station. As discussed in detail in the following sections, the generators are in unsatisfactory condition, the governors are in poor condition, the exciters are approaching end of life and the control systems are obsolete. The condition of these assets increases the likelihood of equipment failure, which can cause forced outages and de-rating of generating equipment.

---

[72] NERC develops reliability standards which are adopted by local regulatory jurisdictions across North America, including BC Hydro. NERC Standard VAR-002-4 R3 “Generator Operation for Maintaining Network Voltage Schedules” requires the reporting of Automatic Voltage Regulator (AVR) or Power System Stabilizer status configuration changes to exciters. The original equipment manufacturer for the Units 1 - 4 exciters is unable to provide technical support to BC Hydro for making status configuration changes to meet a requirement in NERC Standard VAR-002-4 R3. As a result, a warning label is placed on the Units 1 - 4 exciter equipment for site staff to manually inform system operations staff of status configuration changes.

As discussed in section 2.6 of Chapter 2, BC Hydro's 2020 Economic Analysis[73] shows that the Bridge River 1 Generating Station is economic, and investment to continue operation of the station represents positive value to BC Hydro and customers. To maintain the value of the Bridge River 1 Generating Station, BC Hydro must address the condition of the generators, governors, exciters and control systems and improve the reliability of generating Units 1 to 4.

### 3.3.1 BC Hydro Undertakes Equipment Health Assessments to Evaluate Asset Condition

Equipment health assessments are a standard industry approach to assessing the reliability risk associated with major capital equipment. Approximately every four years, BC Hydro evaluates the condition of its major assets based on the latest available maintenance test and inspection data. Health assessments are based primarily on asset condition and consider factors including safety and environmental issues, reliability, design deficiencies, asset age, industry expected life, and availability of spare parts and technical expertise. Each health assessment results in an Equipment Health Rating of Good, Fair, Poor, or Unsatisfactory, which is used to rank major equipment to analyze capital investment priorities. Specifically:

- **Good** is the rating assigned to assets in as new condition, with no noticeable deterioration or defects;
- **Fair** is the rating assigned to assets where there is some normal deterioration with one or more minor defects, but the function is not affected;
- **Poor** is the rating assigned to assets where there is serious deterioration of or serious defects in at least some portions and the function of the asset is affected. These assets have an increased probability of failure and capital investments are generally required within about the next 10 years; and

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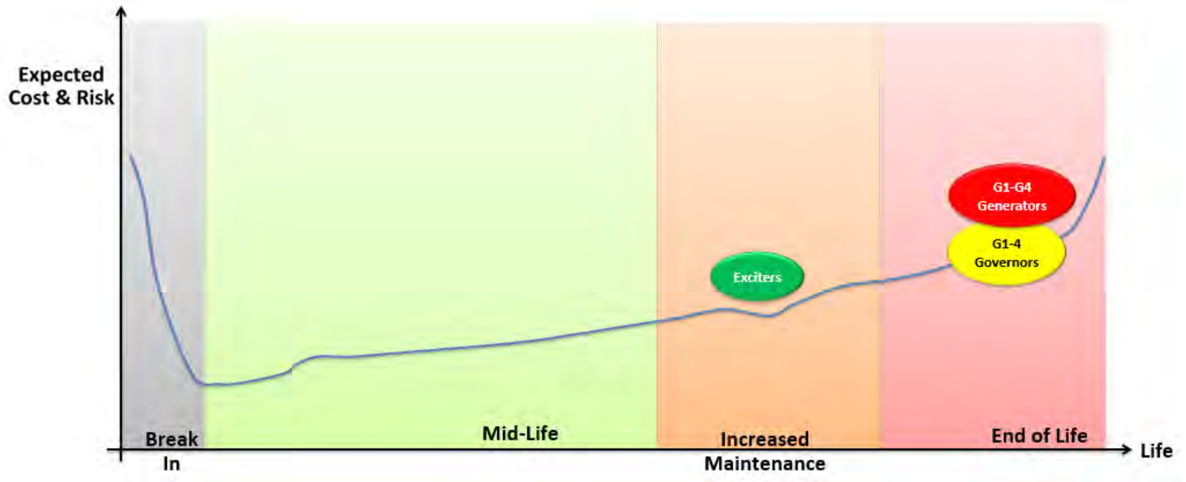
[73] The 2020 Economic Analysis is provided as Appendix B-2-3. Detailed information supporting this analysis is included as a live Excel file in Appendix B-2-3, Attachment 1.

- **Unsatisfactory** is the rating assigned to assets where there is extensive deterioration and the asset no longer functions as designed. These assets have a high probability of failure with capital investments generally required within about the next five years.

Figure 3-7 below shows where the Bridge River 1 Generating Station assets are estimated to be in their lifecycle, and the condition of the assets based on the Equipment Health Rating. The control systems are not included in the chart below as they are assessed using a different methodology based on their obsolescence and the lack of availability of spare parts as discussed in section 3.3.5 below.

The x-axis represents the asset's lifecycle, and the y-axis represents the expected cost and performance risk. Performance risk can include condition assessment, reliability or availability, and probability of failure. As shown by the y-axis below, maintenance costs and performance risks are initially higher early in the lifecycle due to increased inspections required to support warranties and risk of early failures during the equipment break-in period. The costs and risks then reduce for a period of time and rise again as these assets approach end of life. Assets reaching end of life have higher performance risk as they have progressed to a point where the component can no longer reliably fulfill its function.

**Figure 3-7 Bridge River 1 Generating Station Asset Condition (As of Fiscal 2019)**



| Good | Fair | Poor | Unsatisfactory |
|---|---|---|---|
| 🔵 | 🟢 | 🟡 | 🔴 |

### 3.3.2 Unit 1 to 4 Generators Are in Unsatisfactory Condition

As of fiscal 2020, the health of the Unit 1 to 4 generators has been assessed as "Unsatisfactory" with an increasing probability of in-service failure within five years. The units have each been in service for more than 65 years, significantly exceeding their industry life expectancy of 50 years. Over the past few years, the Unit 4 generator has been de-rated and the condition of the generator components has deteriorated. Consistent with BC Hydro's equipment health rating guidelines, these generators have been prioritized for capital investment in the short-term. While BC Hydro has previously made targeted investments to address the risk of component failures, such as rewinding a generator stator, more significant investment is now required to address the unsatisfactory condition of the generators.

Table 3-2 below provides information on the history and condition of the stators and rotors, which are the two main components of the generators.

**Table 3-2 Generator and Components Condition**

| | Unit 1 | Unit 2 | Unit 3 | Unit 4 |
|---|---|---|---|---|
| Equipment Health Rating | Unsatisfactory | Unsatisfactory | Unsatisfactory | Unsatisfactory |
| Original Nameplate Rating | 50 MVA | 50 MVA | 50 MVA | 50 MVA |
| Present Nameplate Rating | 50 MVA | 50 MVA | 50 MVA | 40 MVA |
| Stator Winding | 1948 Original | Rewound 1987 | 1949 Original | Rewound 1973 |
| Stator Winding Failures | None | 1980, 1982, 1993 | None | 1966, 1969, 1972, 2011 |
| Rotor Winding | 1948 Original | 1948 Original | 1949 Original | Reinsulated 1973 |

In addition to industry life expectancy being exceeded, the primary factors contributing to the Unsatisfactory condition of the Unit 1 to 4 generators are:

- Issues with the stator windings including loose components, oil and dust contamination and aging insulation. This may lead to in-service electrical failure of the stator winding during normal operation;
- Issues with the stator cores including looseness, fretting, laminations bulging into air ducts, and displacement at the core splits as well as signs of design deficiencies. This may lead to local overheating of the stator core and subsequently in-service failure of the stator winding;
- Issues with the field windings such as deteriorating winding insulation. This may lead to in-service electrical failure of the field winding; and
- Poor generator shaft line alignments, requiring the lower guide bearing pads of all four generators to be backed off to avoid overheating. This impacts the generators' ability to safely withstand the stress and cyclic loading during abnormal conditions such as generator short circuits and turbine overspeed.

Figure 3-8 below illustrates bulging of the stator core laminations into the air ducts.

**Figure 3-8 Bulging of Stator Core Laminations**

### 3.3.3 Unit 1 to 4 Governors are in Poor Condition

The Unit 1 to 4 governors are more than 65 years old and have exceeded their industry life expectancy of 40 years. Mechanical wear in these governors has led to issues such as oil leakage, excessive vibration, mechanical fatigue and overheating. In addition, the needles, which are the final component that regulates the water flow to the turbine, are not performing as required. As of fiscal 2020, the health of these governors has been assessed as Poor. The governors have an increased probability of failure in the next five to 10 years and have been prioritized for capital investment in the short-term.

Figure 3-9 below shows the oil leakage from the governors.

**Figure 3-9 Oil Leakage from the Governors**

In addition to industry life expectancy being exceeded, the Unit 1 to 4 governors are considered to be in Poor condition because:

- Spares and original equipment manufacturer resources are no longer available;
- Their design is obsolete and not suitable for present-day operation and control requirements; and
- There is excessive mechanical wear and tear to hydraulic and mechanical components.

### 3.3.4 Unit 1 to 4 Exciters Are Approaching End of Life

The Unit 1 to 4 exciters have an industry life expectancy of 30 years and have been in service for more than 25 years. As of fiscal 2020, their condition is assessed as Fair due to age and the lack of support from the original equipment manufacturer, which no longer manufactures the required spare parts. It is expected that the exciters will be assessed as Poor by fiscal 2025.

The Unit 1 to 4 exciters are considered to be in Fair condition and expected to be in Poor condition by fiscal 2025 because:

- The existing design is based on a single bridge rectifier that represents a single point of failure;
- The ceiling current and voltage does not meet system connection requirements;
- Increased operation and maintenance costs are expected as the equipment ages past its life expectancy;
- BC Hydro does not have adequate exciter spare parts as the manufacturer no longer carries spares for this obsolete exciter type;
- The manufacturer does not have technical expertise to support these exciters including the implementation of NERC Standard VAR-002-4 R3; and
- BC Hydro has limited internal staff knowledge on these exciters.

### 3.3.5 Unit 1 to 4 Control Systems are Obsolete

The Unit 1 to 4 control systems, which include the unit protection, control, alarm and metering system, are obsolete. Specifically, the control systems:

- Have exceeded their 30-year life expectancy, as they are original equipment that has been in use for 67 years, significantly reducing system reliability and availability. For example, vendor support to maintain and troubleshoot the aging equipment is limited and spare parts are no longer available. This creates a risk of extended forced outages and damage to generating equipment;

- Lack self-diagnostics capability, which hinders BC Hydro’s ability to troubleshoot problems effectively or be aware of developing failure modes until an actual failure occurs;
- Do not comply with BC Hydro’s current design standards. For example, most of the metering control systems are based on analog technology with instruments that may drift due to temperature change and are hard to calibrate. Other inherent design issues include a common synchroniser for all four units, and a single point of failure at both the intake building junction box and the control room marshalling panel; and
- Are challenging to operate due to legacy annunciators (i.e., devices that detect system faults). For example, multiple alarms are grouped in the annunciation panels due to limited alarm indication windows and synchronized time stamping[74] is only implemented on unit electrical protection sub-systems. This reduces the operator’s ability to analyze, troubleshoot and diagnose problems efficiently, particularly when the problems are associated with more than one sub-system.

## 3.4 The BR1 Project Is Needed to Improve Capacity and Reliability of Water Flow Management

The BR1 Project is also needed to improve BC Hydro’s ability to manage water flows to comply with the WUP Order target flow schedule for Lower Bridge River, meet commitments in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation, and maintain fish and fish habitat in Lower Bridge River.

The Bridge River generating units are the primary means for BC Hydro to manage water flows. The de-rating of generating Unit 4 and the reduced elevation of

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[74] Synchronized time stamping provides accurate event (e.g., alarm, status change) time stamps to within +/-1 milli-second relative to a centralized precision clock source such as a satellite clock. These are warehoused and displayed from a common database to assist with the diagnosis of complex event sequences in order to determine the root cause of failures.

Downton reservoir have challenged BC Hydro’s ability to meet the WUP Order water flow targets.

Between 2015 and 2018, BC Hydro was unable to meet the WUP Order target flow schedule from Terzaghi Dam to Lower Bridge River. BC Hydro requested, and subsequently received, a variance to the WUP Order.

The risk of failure and further de-ratings to the generating units threatens to further decrease BC Hydro’s ability to manage water flows. To improve BC Hydro’s water flow management capabilities, the condition of generating Units 1 to 4 must be addressed so that they can be reliably operated up to their total licenced water flow capacity.[75]

### 3.4.1 BC Hydro Must Manage Water Flows Within WUP Order and Agreement Commitments

The Bridge River System operates according to a WUP Order issued in 2011 by the Comptroller of Water Rights under the former *Water Act*. The WUP Order outlines operating constraints, physical works, and monitoring programs for the entire Bridge River System. A key target in the WUP Order is maintaining an annual average outflow of between 3 $m^3$/s and 6 $m^3$/s on the Lower Bridge River. The WUP Order is provided as Appendix B-1.

The WUP Order was developed through a consultative planning process, involving representatives from various levels of government, the St’át’imc Nation, local residents, and environmental groups, which formed the Bridge River WUP Consultative Committee. The consultation process was initiated in June 1999 and completed in December 2010. The conditions in the WUP Order reflect the recommendations of the committee as well as subsequent recommendations by the St’át’imc Nation in 2009 and 2010.

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[75] Licensed flow capacity is the maximum water flow rate BC Hydro is authorized to use for power generation purposes. Additional detail on the Bridge River 1 Generating Station licenses is provided in section 5.7.2 of Chapter 5.

The WUP Order conditions recognize environmental and St'át'imc Nation values while taking into account the interdependence of operations and high inflow variability in the Bridge River System. Operating constraints for flow conveyance and reservoir management for the entire Bridge River System are specified and prioritized in the WUP Order.

BC Hydro must also operate the Bridge River System in accordance with its obligations under the 2011 Agreements and 2019 High Flow Settlement Agreement with the St'át'imc Nation. In May 2011, after 17 years of negotiations, the St'át'imc Nation, BC Hydro and the Government of B.C. signed a historic and comprehensive set of agreements, which settled the past, present and future impacts of the existing facilities and operations. These agreements include: the St'át'imc (Participating Communities) Settlement Agreement; the Certainty Provisions Agreement; and the Relations Agreement (collectively referred to as the 2011 Agreements). A description of these agreements is provided in Appendix A-6-1.

Among other obligations, the 2011 Agreements stipulate that "unless otherwise agreed to by BC Hydro and St'át'imc (PC[76]) or lawfully ordered by the Comptroller, BC Hydro and St'át'imc (PC) agree that the flow release from Terzaghi Dam will simulate a naturalized hydro graph that will not be less than an annual average water budget of 3 $m^3/s$ (+/- 5% of 3 $m^3/s$) and will not exceed an annual average water budget of 6 $m^3/s$ (+/- 5% of 6 $m^3/s$)."[77]

### 3.4.2 Bridge River Generating Units Are the Primary Mechanism for BC Hydro to Manage Water Flows

As described in section 2.2.2 of Chapter 2, the Bridge River generating units are the primary mechanism for BC Hydro to manage water flows in the Bridge River System. Figure 3-2 illustrates the flow of water through the Bridge River Generation System.

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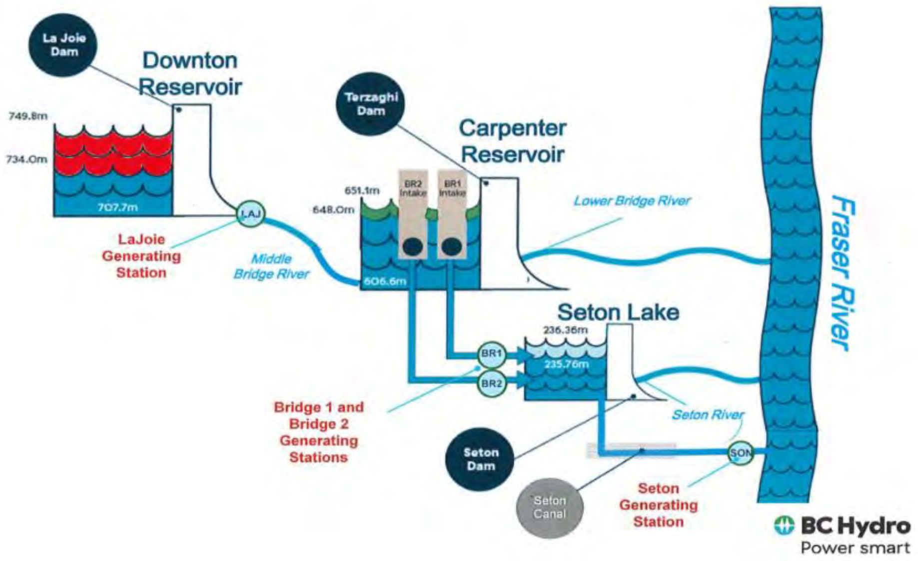
[76] PC stands for Participating Communities.

[77] Appendix A-6-4, St'át'imc (PC) Settlement Agreement, s. 5.5(b).

**Figure 3-10 Bridge River Generation System Water Flows**



As illustrated above, water from Carpenter Reservoir either flows through the Bridge River 1 and Bridge River 2 Generating Stations and into Seton Lake, or flows down Lower Bridge River. When flows in the Lower Bridge River are forecast to exceed the WUP Order target flow schedule, water will be preferentially released into Seton Lake, when possible, to minimize potential impact to fish and fish habitat in Lower Bridge River.

BC Hydro must divert a sufficient volume of water from Carpenter Reservoir through the Bridge River 1 and Bridge River 2 Generating Stations to Seton Lake to reduce the likelihood of flows from Terzaghi Dam to Lower Bridge River being above the WUP Order target flow schedule and the average annual flow target contemplated in the 2011 Agreements with the St’át’imc Nation. If BC Hydro cannot flow enough water through the Bridge River 1 and Bridge River 2 Generating Stations, then the flows down Lower Bridge River can exceed the WUP Order target flow schedule, violate commitments in BC Hydro’s 2011 Agreements with the St’át’imc Nation, and impact fish and fish habitat.

In addition to the WUP Order target flow schedule, the Carpenter Reservoir has operational limits that BC Hydro takes into consideration when operating the Bridge River Facility.

BC Hydro can manage Bridge River system flows in accordance with the WUP Order, 2011 Agreements and 2019 High Flow Settlement Agreement when the reservoirs are able to be operated at the maximum licensed storage levels and both generating stations are capable of operating at their total licensed flow capacity. At the total licensed flow capacity, Bridge River 1 Generating Station is permitted to pass 65 $m^3/s$ of water and Bridge River 2 Generating Station is permitted to pass 95 $m^3/s$ of water.

However, as discussed further below, BC Hydro is not currently able to operate the Bridge River 1 Generating Station to its total licensed flow capacity and the reduced upper operating elevation of Downton Reservoir has resulted in higher discharges from La Joie Dam into Carpenter Reservoir during late spring and summer, hampering BC Hydro's ability to manage Bridge River system water flows.

### 3.4.3 De-Rating of Unit 4 and Reduction in Downton Reservoir Elevation Challenges BC Hydro's Ability to Divert Water to Seton Lake

The Bridge River 1 Generating Station is currently operating at less than its plant maximum rating. Each generator has a nameplate rating of 50 MVA; however, the Unit 4 generator was de-rated to 40 MVA in 2011 after it failed a stator winding test during routine maintenance testing. The lost generation capacity limits BC Hydro's ability to divert water from Carpenter Reservoir to Seton Lake through the Bridge River 1 Generating Station.

Table 3-3 below outlines the historical plant total maximum MW and MVA ratings and the total licensed flow capacity for the Bridge River 1 Generation Station.

**Table 3-3 Bridge River 1 Generating Station Plant Ratings and Total Licence Flow Capacity**

| | Plant Total Maximum MW Rating | Plant Total Maximum MVA Rating | Total Licenced Flow Capacity ($m^3/s$) |
|---|---|---|---|
| Original - 1954 | 180 | 200 | 62.3 |
| After Turbines Units 1 - 4 Replacement - 2003 | 200 | 200 | 62.3 |
| Water license issued[78] - 2011 | 200 | 200 | 65 |
| After Generator Unit 4 De-rating - 2011 | 190 | 190 | 65 |
| Current - 2021 | 190 | 190 | 65 |

In 2015, the Downton Reservoir upper operating elevation was reduced to mitigate dam seismic risks, reducing the effective storage of the Downton Reservoir by approximately 47 per cent. The reduced Downton Reservoir upper operating elevation results in higher discharges from La Joie Dam into Carpenter Reservoir during late spring and summer. This reduction increases dependence on the generating units at the Bridge River 1 and Bridge River 2 Generating Stations to pass water flows to Seton River and manage water flows in Lower Bridge River. Water that does not flow through the Bridge River 1 and Bridge River 2 generating units is released from Terzaghi Dam and flows into Lower Bridge River.

The Unit 4 generator de-rating combined with the reduction in the Downton Reservoir storage capacity, as well as necessary planned outages for maintenance and capital improvement works, have challenged BC Hydro's ability to use the Bridge River generating units to manage flows from Carpenter Reservoir.

### 3.4.4 BC Hydro is Currently Challenged to Manage Flows Within Targets and Has Received a Variance to the WUP Order

Between 2015 and 2018, BC Hydro was unable to meet the target flow schedule from Terzaghi Dam to Lower Bridge River set out in the WUP Order. Water flows from Terzaghi Dam were above an annual average flow release of 6 $m^3/s$. These

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[78] Water license FWL 126080 was issued in 2011 to reconcile the maximum flow capacity (65 $m^3/s$) with the actual operating conditions that were authorized under the historical licences.

higher flows caused impacts to fish and fish habitat, including a decline in juvenile Steelhead and Coho salmon, mobilization of spawning-sized gravel out of spawning areas and impacts to already limited off-channel rearing habitats. Future higher flows on Lower Bridge River could lead to declines in river productivity.

In 2016, BC Hydro requested a variance to the WUP Order to modify the annual average water flow from Terzaghi Dam to Lower Bridge River. A variance was granted in February 2017 and extended in February 2018. The variance authorizes BC Hydro to operate outside of the WUP Order target flow schedule and under a set of guiding principles and conditions. The variance requires specific reporting and notifications and directs that BC Hydro be financially responsible for physical works and monitoring programs from operating under the variance. The monitoring programs also document additional potential impacts associated with higher flows and the effectiveness of physical works mitigation projects built as compensation for impacts. These variance orders are provided as Appendix B-1.

The St’át’imc Nation has expressed concerns with the higher flows, including the associated impacts to fish and fish habitat. These concerns led to formal dispute resolution proceedings, in accordance with the 2011 Agreements, between BC Hydro and the St’át’imc Nation on how to address the concerns and impacts of higher flows. The outcome of these proceedings was the 2019 High Flow Settlement Agreement.

The 2019 High Flow Settlement Agreement recognizes, among other goals, the need to collaboratively mitigate and restore the environmental impacts caused by higher flows. Predictable and stable flows that meet the annual average flows in Lower Bridge and Seton Rivers reflect a balancing of interests between generation and operational needs and environmental impacts. Flows that exceed these annual average target flows are of deep concern to the St’at’imc Nation given the impacts to fish and fish habitat. Not meeting the WUP target flow schedule jeopardizes the important underlying goals of these targets envisioned by the settlement agreements.[79]

### 3.4.5 Risk of Failures and Further Deratings Threatens Ability to Manage Water Flows

The condition of the generating equipment at the Bridge River 1 Generation Station means that there is a heightened risk of further limitations on BC Hydro’s ability to divert water from Carpenter Reservoir to Seton Lake. The condition of the generating equipment increases the likelihood of equipment failures, which could lead to further de-rating, or total failure of the Bridge River 1 generating units.

Additional reductions to generation capacity from de-rated or failed generators will further restrict water diversion from Carpenter Reservoir to Seton Lake and increase the likelihood of flows from Terzaghi Dam to Lower Bridge River being above the WUP Order target flow schedule and the average annual flow targets contemplated in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation.

BC Hydro undertook a flow modelling study to evaluate effects of available Bridge River 1 generating units on water flows in Lower Bridge and Seton Rivers, relative to the WUP Order target flow schedule. The modelling included 53 years of inflow data and calculated the number of days where a WUP Order target flow exceedance would occur with zero, one, two, three or four available generating units for service. The flow modelling study methodology and results are included in the Environmental Impact Statement provided as Appendix B-13.

Figure 3-11 below shows that as the number of available Bridge River 1 generating units decreases, there is a corresponding increase in WUP Order target flow exceedance for Lower Bridge River. This results in increased potential for negative impacts to water quantity and fish and fish habitat in Lower Bridge River.

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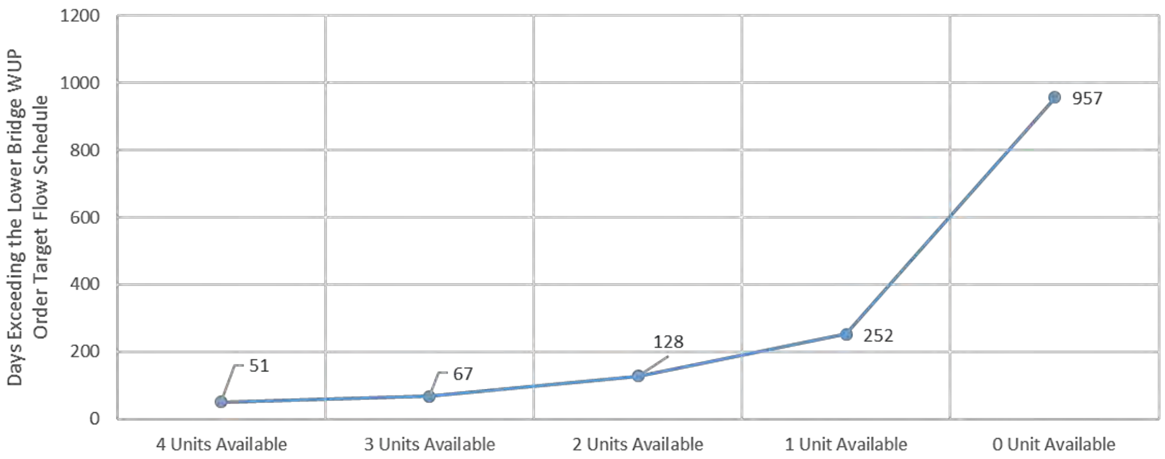
[79] A discussion of the 2019 High Flow Settlement Agreement is provided in Appendix A-6-1.

**Figure 3-11 Number of Days Exceeding the Lower Bridge WUP Order Target Flow Schedule in 53 years With Available Generating Units 1 to 4**



In summary, the Bridge River Generating units are the primary means for BC Hydro to manage water flows. To improve BC Hydro's ability to manage water flows in Lower Bridge River,[80] the condition of generating Units 1 to 4 must be addressed so that they can be reliably operated up to their total licenced water flow capacity. This will allow BC Hydro to comply with the WUP Order target flow schedule for Lower Bridge River, meet commitments in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St'át'imc Nation, and maintain fish and fish habitat in Lower Bridge River.

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[80] While the BR1 Project will improve flow management capabilities for Lower Bridge River, it is not expected to mitigate high flows in Seton River. Investments in the Bridge River System as discussed in section 2.3.1 of Chapter 2 are expected to improve flow management in Seton River.

# BC Hydro Bridge River Projects

# Bridge River 1 Units 1 to 4 Generator Replacement Project

# Chapter 4

## Alternatives Analysis

# Table of Contents

4.1 Introduction ........ 4-1
4.2 BC Hydro Considered and Dismissed Alternatives That Were Determined to Not Be Feasible ........ 4-1
  4.2.1 Alternatives to Extend the Life of Some Existing Generating Equipment Are Not Feasible ........ 4-2
  4.2.2 Alternative to Defer Investment Is Not Feasible ........ 4-3
4.3 BC Hydro Identified Three Feasible Project Alternatives ........ 4-3
4.4 BC Hydro Undertook a Structured Approach to Evaluate the Alternatives ........ 4-4
4.5 Alternative Analysis Determined That the Replace Alternative is the Preferred Alternative ........ 4-5
  4.5.1 Objective 1 - Maximizing Unit Reliability ........ 4-7
  4.5.2 Objective 2 - Minimizing Environmental Impacts ........ 4-7
  4.5.3 Objective 3 - Improving Relations with the St’át’imc Nation ........ 4-9
  4.5.4 Objective 4 - Minimizing Net Present Value of Cost and Cost Risk ........ 4-10
    4.5.4.1 Minimizing Net Present Value of Cost ........ 4-10
    4.5.4.2 Minimizing Cost Risk ........ 4-11
    4.5.4.3 Net Present Value Results ........ 4-12
  4.5.5 Objective 5 - Minimizing Safety Risks ........ 4-13

# List of Tables

Table 4–1 Objectives, Criteria, and Measures ........ 4-5
Table 4–2 Consequence Table: Alternatives Analysis Results ........ 4-6
Table 4–3 Net Present Value of Cost for Alternatives ($ million) ........ 4-12

## 4.1 Introduction

This chapter sets out BC Hydro's assessment of alternatives that were considered to meet the need to address the deteriorating condition of the aging generators, governors, exciters and control systems at the Bridge River 1 Generating Station.

BC Hydro identified three feasible alternatives and evaluated those alternatives through a structured decision-making approach. Based on the results of this evaluation, the Preferred Alternative is the Replace Alternative which would replace the Units 1 to 4 generators, governors, exciters, and control systems. This alternative maximizes unit reliability, minimizes environmental impact, helps to meet the expectations of the St'át'imc Nation, minimizes cost risks without a material difference in cost, and minimizes overall safety risks.

This chapter is structured as follows:

- Section 4.2 describes the potential alternatives that were screened out as not feasible and the reasons for dismissing these alternatives;
- Section 4.3 describes the three feasible alternatives considered to address the condition of the Units 1 to 4 generators, governors, exciters and control systems at the Bridge River 1 Generating Station;
- Section 4.4 describes the structured decision-making approach used to understand trade-offs between the alternatives as well as the objectives, criteria, and measures for comparing the alternatives; and

Section 4.5 provides a comparison and assessment of the three feasible alternatives.

## 4.2 BC Hydro Considered and Dismissed Alternatives That Were Determined to Not Be Feasible

A number of alternatives to meet the BR1 Project's objectives were screened out because BC Hydro determined that they were not feasible. Specifically, for the reasons described below, alternatives to extend the life of the existing governors, exciters and control systems, and the alternative to defer investment, were determined to not be feasible.

### 4.2.1 Alternatives to Extend the Life of Some Existing Generating Equipment Are Not Feasible

BC Hydro determined that alternatives to extend the life of the existing governors, exciters and control systems were not feasible. Specifically:

- Alternatives to extend the life of the existing governors were determined to not be feasible due to:
  - Excessive mechanical wear on hydraulic and mechanical components in the governor cabinets, oil pumps, and jet controllers;
  - Corrosion and/or contamination in the accumulators and scoring in the servomotors;
  - Extended service life, exceeding end of life expectancy;
  - Spare components and original equipment manufacturer support not being available; and
  - Obsolete design that is not suitable for present-day operation and control requirements.
- Life extension alternatives for the existing exciters were determined to not be feasible as no suitable vendor retrofit solution could be identified. Specifically, retrofitting the exciter controls would require the rectifier bridge to be replaced. However, no vendor solution could be identified due to limited vendor experience with retrofitting these exciter controls.
- Life extension alternatives for the control systems were determined to not be feasible due to inherent design issues and complexities associated with interfacing legacy electromechanical-based and obsolete control systems with new digital instrumentation.

### 4.2.2 Alternative to Defer Investment Is Not Feasible

BC Hydro considered and dismissed the alternative of deferring investment to address the deteriorating condition of the aging generators, governors, exciters and control systems at the Bridge River 1 Generating Station. The Units 1 to 4 generators are in unsatisfactory condition and if investment is deferred, there is a high likelihood that multiple generators would fail before they are replaced. Deferring investment was determined not to be feasible because it would:

- Potentially lead to additional unit failures and de-ratings, resulting in a loss of power generation capability and an increased risk of higher flows in Lower Bridge River with the associated negative environmental impacts on fish and fish habitat;
- Prevent BC Hydro from taking proactive steps to address key concerns outlined in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St'át'imc Nation, including managing the water flows from Terzaghi Dam to Lower Bridge River; and
- Potentially require expensive emergency repairs to be undertaken to keep the generating station operating while an ex-plan project is initiated to address the long-term needs of the assets. These emergency repairs would involve concurrent construction activities that require space to laydown disassembled generator components and reassemble generator components in the small assembly space in the Bridge River 1 Generating Station. This would increase the frequency and probability of safety hazards occurring due to contact with hot surfaces, exposure to welding fumes and tripping hazards.

## 4.3 BC Hydro Identified Three Feasible Project Alternatives

BC Hydro identified three feasible alternatives to address the condition of the Units 1 to 4 generating equipment. Since extending the life of the existing governors, exciters and control systems was determined to not be feasible, all three feasible alternatives involve replacing the governors, exciters and control systems. The new governors are expected to have a 40-year service life while the new exciters and control systems are expected to have a 30-year service life.

The three identified feasible alternatives are:

- **Replace:** Under this alternative, BC Hydro would replace the Units 1 to 4 generators, governors, exciters and control systems. The new Units 1 to 4 generators would have an expected service life of 50 years and would have an extended design warranty from the original equipment manufacturer;
- **Refurbish:** Under this alternative, BC Hydro would refurbish the Units 1 to 4 generators and replace the Units 1 to 4 governors, exciters, and control systems. Refurbishing the Units 1 to 4 generators would still involve the replacement of some components of the generator, as needed, such as the generator stators. The refurbished Units 1 to 4 generators would have an expected service life of 40 years; and
- **Rewind:** Under this alternative, BC Hydro would replace the windings in the stationary parts of the Units 1 to 4 generator stators (a process referred to as “rewinding”) and replace or refurbish other generator components as needed so that each unit can maintain its original 50 MVA rating. This alternative would also replace the Units 1 to 4 governors, exciters, and control systems. The rewound generators would have an expected service life of 20 years.

## 4.4 BC Hydro Undertook a Structured Approach to Evaluate the Alternatives

BC Hydro identified a set of objectives for the BR1 Project, considering the need for the BR1 Project as well as the potential risks, impacts and benefits of carrying out each alternative. The objectives are not intended to cover all the risks or benefits, but are intended to identify “what really matters” when comparing alternatives. Each objective has one or more criteria for assessing whether the objective has been achieved as well as measures to assess the degree to which each alternative meets the objectives.

Table 4–1 below lists the key objectives, criteria, and measures used to evaluate the alternatives.

**Table 4–1 Objectives, Criteria, and Measures**

| Objectives | Criteria | Measures[81] |
|---|---|---|
| Maximize Unit Reliability | Likelihood of Unit Failure / Forced Outages | Failure Rate (High/Medium/**Low**) |
| Minimize Environmental Impacts | Impacts to Fish, Wildlife and Riparian Habitat | Negative/Same as Current/**Positive** |
| Improve Relations with St’át’imc | Meeting St’át’imc Expectations | **Better than Base**/Same as Base/Worse than Base[82] |
| Minimize Net Present Value of Cost and Cost Risks | Net Present Value of Cost | $ million |
| | Likelihood of Scope Increase Due to As Found Conditions | High/Medium/**Low** |
| Minimize Safety Risks | Ability to Reduce Maintenance Hazards | Low/Medium/**High** |
| | Exposure to Construction Hazards | High/Medium/**Low** |

## 4.5 Alternative Analysis Determined That the Replace Alternative is the Preferred Alternative

Table 4–2 below provides a color-coded consequence table which summarizes how each alternative performed with respect to the objectives set out in Table 4–1 above. The colours highlight the performance of each alternative compared to one alternative, which is fixed as the point of comparison (for this analysis, the Replace Alternative). BC Hydro has determined that the Replace Alternative is the Preferred Alternative to meet the project need, because it will:

- Maximize generating unit reliability, with the lowest likelihood of leading to unit failures;

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[81] The preferred direction of the measure for the criteria is indicated in **bold** typeface.

[82] Base refers to the Replace Alternative.

- Minimize environmental impact by restoring water flow capacity, increasing operating flexibility and managing flows from Terzaghi Dam to Lower Bridge River within the WUP Order flow targets to maintain fish and fish habitat in Lower Bridge River;
- Help to meet the expectations of the St’át’imc Nation by supporting BC Hydro’s ability to meet the commitments in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation;
- Minimize cost risk with the lowest likelihood of an increase in scope and schedule delays due to unknown conditions, without a material difference in cost; and
- Minimize maintenance hazards and exposure to construction hazards.

**Table 4–2 Consequence Table: Alternatives Analysis Results**

| Objective | Criteria | Measure | Alternatives | | |
|---|---|---|---|---|---|
| | | | Rewind | Refurbish | Replace |
| Maximize Unit Reliability | Likelihood of Unit Failure / Forced Outages | Failure Rate (High/ Medium/ Low) | High | Medium | Low |
| Minimize Environment Impacts | Impacts to Fish, Wildlife and Riparian Habitat | Negative/ Same as Current/ Positive | Same as Current | Positive | Positive |
| Improve Relations with **St’át’imc** | Meeting St’át’imc Relationship Expectations | Better than Base/ Same as Base/ Worse than Base[83] | Worse | Same | Same |
| Minimize Cost and Cost Risk | Net Present Value of Cost | $ million | ($92.9) | ($57.0) | ($58.7) |
| | Likelihood of Scope Increase Due to As Found Conditions | High/ Medium/ Low | High | Medium | Low |
| Minimize Safety Risks | Ability to Reduce Maintenance Hazards | Low/ Medium/ High | Low | Medium | High |
| | Exposure to Construction Hazards | High/ Medium/ Low | Low | High | Low |
| Ranking | | | 3 | 2 | 1 |

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[83] Base refers to the Replace Alternative.

The following subsections discuss the objectives identified in Table 4–1 above and the extent to which each alternative satisfies those objectives.

### 4.5.1 Objective 1 - Maximizing Unit Reliability

This objective involves reducing the probability of a generating unit failure and maximizing the reliability of the Units 1 to 4 generators at the Bridge River 1 Generating Station. To measure the extent to which each alternative meets this objective, each alternative was assigned a likelihood (low, medium or high) of leading to unit failures.

- There is a low likelihood that the Replace Alternative would lead to unit failures as the generators would be new and would reflect current design standards.
- There is a medium likelihood that the Refurbish Alternative would lead to unit failures because, while some key components of the generators (e.g., the stator) would be replaced, other existing components would continue to be used. During the refurbished generators' 40-year design life, the re-used components would continue to age, increasing the likelihood of unit failures.
- There is a high likelihood that the Rewind Alternative would lead to unit failures due to unaddressed deficiencies with the stator core such as looseness in the stator core. Loose stator cores can cause inward insulation migration, leading to mechanical damage of the coil insulation. Loose cores also may lead to degradation of the lamination insulation, causing local overheating of the stator core and subsequently in-service failure of the stator winding.

### 4.5.2 Objective 2 - Minimizing Environmental Impacts

This objective involves restoring flow capacity, increasing operating flexibility and managing flows from Terzaghi Dam to Lower Bridge River within flow targets to maintain fish and fish habitat in Lower Bridge River.

To measure the extent to which each alternative meets this objective, each alternative was assigned a measure (negative, same or positive), as compared to BC Hydro’s current capability, based on how well the alternative would:

- Reduce the restrictions on water diversion from Carpenter Reservoir to Seton Lake; and
- Minimize the likelihood of flows from Terzaghi Dam to Lower Bridge River above the WUP Order target flows and the average annual flow target contemplated in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation.

The Replace Alternative has a positive measure meaning it would improve BC Hydro’s ability to meet this objective. It provides the most reliable water conveyance[84] and has the greatest potential to maintain the WUP Order target flow schedule for Lower Bridge River and avoid negative environmental impacts on fish and fish habitat associated with higher flows from Terzaghi Dam to Lower Bridge River. This is because the new units will:

- Operate more reliably, enabling water diversion from Carpenter Reservoir to Seton Lake; and
- Increase the nameplate rating for each generator up to a maximum of 65 MVA (from 50 MVA) to align with the nameplate rating of the existing Unit 1 to 4 turbines, enabling BC Hydro to transfer 23 per cent more generating capacity to the three remaining operational generating units, when one unit is out of service.[85] This flexibility will enhance BC Hydro’s ability to manage flows within

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[84] Water conveyance refers to the diversion of water from Carpenter Reservoir to Seton Lake to reduce the likelihood of flows from Terzaghi Dam to Lower Bridge River above the WUP Order target flows and the average annual flow target contemplated in the 2011 Agreements and 2019 High Flow Settlement Agreement.

[85] BC Hydro would not seek any amendments to the Final Water Licences as a result of the increased generator nameplate rating.

the WUP Order target flow schedule and maintain fish and fish habitat in Lower Bridge River.

The Refurbish Alternative also has a positive measure. It would provide less reliable water conveyance compared to the Replace Alternative, but more reliable water conveyance compared to the Rewind Alternative. Similar to the Replace Alternative, the Refurbish Alternative will align the rating of the generators to the existing turbines, resulting in operational flexibility and enhanced ability to minimize environmental impacts.

The Rewind Alternative was assessed to be the “same as current”, meaning it would maintain BC Hydro’s current ability to meet this objective. It would provide less reliable water conveyance compared to the Replace and Refurbish Alternatives and has a high risk of negative environmental impacts due to higher flows in Lower Bridge River.

#### 4.5.3 Objective 3 - Improving Relations with the St’át’imc Nation

BC Hydro and the St’át’imc Nation have signed the 2011 Agreements and 2019 High Flow Settlement Agreement which include commitments related to flow targets in Bridge River and Seton River and a range of other commitments to address St’át’imc core interests and overarching expectations related to developing a long-term relationship based on mutual respect and understanding. The St’át’imc Nation expects BC Hydro to invest prudently and proactively in the assets within their territory that support the St’át’imc Nation’s core interests.

To measure the extent to which each alternative meets the objective of improving BC Hydro’s relations with the St’át’imc Nation, the alternatives were assigned a measure (worse, same or better), based on how well each alternative generally supports BC Hydro’s ability to meet St’át’imc’s relationship expectations.

- The Replace Alternative is considered to be the “base” of comparison for this objective as it will do the most to support BC Hydro’s ability to meet the

St'át'imc Nation's relationship expectations. It demonstrates a commitment to addressing aging assets in the system that could impact flow management and prioritizes these investments. It will improve the reliability of the generating units, allowing BC Hydro to meet the WUP Order target flow schedule for Lower Bridge River and the average annual flow targets contemplated in the 2011 Agreements and 2019 High Flow Settlement Agreement to maintain fish and fish habitat in Lower Bridge River.

- The Refurbish Alternative was assessed to be "same as base", as it would be expected to generally achieve the same outcomes as the Replace Alternative with regard to this objective; however, the Refurbish Alternative has a higher potential for equipment failures, which could impact BC Hydro's ability to meet this objective in specific instances.
- The Rewind Alternative was assessed to be "worse", meaning it is not expected to meet St'át'imc Nation's relationship expectations as BC Hydro would not be taking prudent and proactive steps to address key concerns outlined in its agreements with the St'át'imc's Nation, including managing the water flows from Terzaghi Dam to Lower Bridge River.

### 4.5.4 Objective 4 - Minimizing Net Present Value of Cost and Cost Risk

This objective includes minimizing the NPV of cost and cost risk.

#### *4.5.4.1 Minimizing Net Present Value of Cost*

The NPV of cost measures the costs and benefits of implementing an alternative over its lifecycle. The NPV of cost for an alternative is the difference between the present value of all capital and maintenance costs over the life of the alternative and the present value of the incremental benefits expected from implementing that alternative. Appendix B-6 provides these details for each of the three feasible alternatives.

As each of the alternatives were compared considering only the incremental benefits from each alternative (including capacity and energy) and the total costs to undertake each alternative, the NPV of cost of each alternative is negative. This allows for a relative assessment of the NPV of cost for each of the alternatives.

This incremental approach does not account for the investment that is required to preserve the existing economic value of the Bridge River 1 Generating Station to the Bridge River System. As discussed in section 2.6 of Chapter 2, BC Hydro's 2020 Economic Analysis[86] shows that the Bridge River 1 Generating Station is economic, and investment to continue operation of the station represents positive value to ratepayers.

The key inputs to the NPV of cost analysis are:

1. The cost estimate[87] for the Replace, Refurbish and Rewind Alternatives;
2. The values for energy and capacity[88]; and
3. A 3 per cent real discount rate.[89]

#### *4.5.4.2 Minimizing Cost Risk*

Cost risk is evaluated by considering whether there are unknown conditions that may create uncertainties, leading to an increase in scope and causing schedule delays during the Implementation phase of an alternative. The potential for an increase in scope and schedule delays introduces a cost risk, which is reflected in a wider estimating accuracy range. A scenario analysis showing the NPV of cost using

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[86] The 2020 Economic Analysis is provided as Appendix B-2-3. Detailed information supporting this analysis is included as a live Excel file in Appendix B-2-3, Attachment 1.

[87] This is the latest AACE cost estimate available for all three assessed alternatives. It is an AACE Class 5 estimate.

[88] The incremental energy and capacity values used were 3,619 MWh/year and 10 MW for the Rewind Alternative and 4,942 MWh/year and 26 MW for the Refurbish and Replace Alternatives. These results were from a system simulation model.

[89] A real discount rate of three per cent was used. The nominal discount rate is BC Hydro's Weighted Average Cost of Capital.

the cost estimate at the upper end of the estimating accuracy range is conducted for each alternative to demonstrate the potential impact of the cost risk.

#### 4.5.4.3 Net Present Value Results

Table 4–3 below provides the present value of the lifecycle cost and the incremental benefits used to calculate a comparable[90] NPV of cost for each alternative. A working excel model for these NPV numbers is provided in Appendix B-5.

**Table 4–3 Net Present Value of Cost for Alternatives ($ million)**

| No. | Present Value of Cost and Incremental Benefits | Rewind | Refurbish | Replace |
|---|---|---|---|---|
| 1 | Service Life Units 1 to 4 Generators (years) | 20 | 40 | 50 |
| 2 | Conceptual Cost Estimate Estimating Accuracy Range | +100% / -35% | +100% / -35% | +75% / -35% |
| 3 | Total Present Value of Costs | (106.6) | (111.1) | (120.7) |
| 4 | Total Present Value of Incremental Benefits | 13.7 | 54.1 | 62.0 |
| **5** | **Net Present Value of Cost** | **(92.9)** | **(57.0)** | **(58.7)** |
| **6** | **Net Present Value of Cost if Cost Risk is Materialized** | **(203.8)** | **(165.8)** | **(143.7)** |

Based on the analysis presented in Table 4–3 above, the Replace Alternative is the preferred alternative considering both the NPV of cost and the potential to minimize cost risk. As shown, the higher negative present value of the costs to undertake the Replace Alternative is mostly offset by the higher positive present value of the incremental benefits from implementing that alternative. Accordingly, as seen in the NPV of cost results (Row 5 of Table 4–3 above), there is no material difference in the NPV of costs between the Replace Alternative and the Refurbish Alternative.

Row 2 of Table 4–3 highlights that the replacement of existing components with new components in the Replace Alternative results in lower cost risk, as represented by the narrower estimating accuracy range, compared to the Refurbish or Rewind Alternatives. The Replace Alternative has a narrower estimating accuracy range as

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[90] In this case, “comparable” means that alternatives with shorter service lives are adjusted to match the longest service life alternative.

there are fewer unknown conditions. BC Hydro's experience with generator refurbishment projects at the Ruskin, Mica, and GM Shrum generating stations is that refurbishment projects can encounter unplanned scope increases and delays.

Row 6 of Table 4–3 provides a scenario analysis that quantifies the potential impact of the cost risk in NPV of cost terms. In the analysis, the present value of the costs to undertake each alternative is based on the cost estimate at the upper end of the estimating accuracy range, while all other inputs remain the same as in the base NPV of cost analysis. This analysis shows that if the cost risk materializes, the NPV of cost for the Replace Alternative could be as high as $(143.7) million and the NPV of cost for the Refurbish Alternative could be as high as $(165.8) million.[91]

The Rewind Alternative NPV of cost is materially worse than the other feasible alternatives. As with the Refurbish Alternative, the condition of all generator components would only become apparent after disassembly, potentially increasing scope and schedule risks from unknown conditions. A similar scenario analysis shows that if the cost risk materializes, the NPV of cost for the Rewind Alternative could be as high as $(203.8) million.

### 4.5.5 Objective 5 - Minimizing Safety Risks

This objective compares the alternatives based on how well each alternative can reduce maintenance hazards and the extent to which each alternative will increase exposure to construction hazards. Minimizing safety risks is an objective for alternative evaluation because the alternative selected will have an impact on BC Hydro's ability to manage safety risks during and post-construction.

Maintenance hazards are influenced by the design of the equipment and the degree of maintenance required. With regard to exposure to construction hazards, replacing old equipment with new equipment reduces the need for concurrent construction activities which requires additional space to laydown disassembled generator

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[91] A live Excel file calculating these NPV values is provided in Appendix B-5.

components and reassemble generator components. This is an important factor to consider because the space at the Bridge River 1 Generating Station is constrained.

To measure the extent to which each alternative reduces maintenance hazards, the alternatives were assigned a measure (low, medium or high), based on the extent of the reduction achieved. To measure the extent to which each alternative increases exposure to construction hazards, the alternatives were assigned a measure (low, medium or high) based on the extent of the exposure to construction risk.

- The Replace Alternative was assessed to be “low” for exposure to construction hazards as the Units 1 to 4 generators will be new, requiring less laydown area in the constrained space of the Bridge River 1 Generating Station. Old equipment will be removed from the site after dismantling is completed, reducing construction hazards compared to the Refurbish Alternative and the Rewind Alternatives.
- The Replace Alternative was assessed to be “high” for reducing maintenance hazards as it would reduce the number of hazards that workers are exposed to during maintenance, as accessibility, safety by design, and human factors will be considered in the design of the new equipment.
- The Refurbish Alternative was assessed to be “high” for exposure to construction hazards because it would require the largest assembly area of all the feasible alternatives considered due to the need to accommodate both the new and reused components. This would increase the frequency and probability of safety hazards occurring during construction due to proximity to welding and grinding areas and reduced worker mobility, especially during emergency situations.
- The Refurbish Alternative was assessed to be “medium” for reducing maintenance hazards as there would be more new generator components under this alternative than under the Rewind Alternative.

- The Rewind Alternative was assessed to be “low” for exposure to construction hazards because the primary work of removing the old windings and replacing them with new ones would not be intensive and would not involve much exposure to construction hazards.
- The Rewind Alternative was assessed to be “low” for reducing maintenance hazards as the alternative would require ongoing maintenance on aging generators or generator components.

# BC Hydro Bridge River Projects

# Bridge River 1 Units 1 to 4 Generator Replacement Project

# Chapter 5

## Project Description and Impacts

**PUBLIC**

# Table of Contents

5.1 Introduction ........ 5-1
5.2 Project Scope, Requirements, and Activities ........ 5-1
  5.2.1 BR1 Project Will Replace Unit 1 to 4 Generators, Governors, Exciters and Control Systems ........ 5-2
  5.2.2 Technical and Safety Requirements ........ 5-4
    5.2.2.1 Equipment Design and Performance Requirements ........ 5-4
    5.2.2.2 Safety by Design ........ 5-6
  5.2.3 BR1 Project Activities ........ 5-7
    5.2.3.1 Design Activities ........ 5-8
    5.2.3.2 Procurement Activities ........ 5-9
    5.2.3.3 Outage Planning and Delivery Activities ........ 5-9
    5.2.3.4 Construction Activities ........ 5-10
    5.2.3.5 Commissioning, Testing, and Completion Activities ........ 5-10
5.3 Procurement Approach ........ 5-11
  5.3.1 Public Procurement Process for Generators ........ 5-11
  5.3.2 Blanket Contract Orders for the Governors, Exciters, Control Systems and Fire Protection System ........ 5-12
5.4 Project Cost ........ 5-13
  5.4.1 Direct Construction Costs ........ 5-15
  5.4.2 Indirect Construction Costs ........ 5-16
  5.4.3 Project Contingency ........ 5-16
  5.4.4 Escalation, Capital Overhead and Interest During Construction ........ 5-17
  5.4.5 Project Reserve ........ 5-18
5.5 Rate Impact Analysis ........ 5-19
5.6 Project Schedule ........ 5-20
  5.6.1 Project Major Milestones ........ 5-20
  5.6.2 Scheduling Constraints and Considerations ........ 5-21
5.7 Project Permits, Approval, and Authorization ........ 5-22
  5.7.1 Environmental Assessments ........ 5-22
  5.7.2 Water Licences and Water Use Plan Order ........ 5-23
  5.7.3 Municipal and Provincial Requirements ........ 5-24
5.8 Project Impacts and Mitigation ........ 5-24

5.8.1 Identification of Environmental and Socio-Economic Impacts ..... 5-24
5.8.2 Environmental Impacts ..... 5-25
  5.8.2.1 Valued Components Identified and Assessed ..... 5-25
  5.8.2.2 Managing Water Flows During Planned Outages ..... 5-27
  5.8.2.3 Managing Water Flows If More than One Unit Is Unavailable ..... 5-30
  5.8.2.4 Identified Impacts and Mitigation to Fish and Fish Habitat ..... 5-30
  5.8.2.5 Additional Environmental Monitoring Programs ..... 5-31
5.8.3 Socio-Economic Impact ..... 5-32
  5.8.3.1 Valued Components Identified ..... 5-32
  5.8.3.2 Valued Components Assessed ..... 5-33
5.8.4 Impact on Transmission System ..... 5-37
5.8.5 Public Works Impact ..... 5-37

## List of Figures

Figure 5-1 Project Lifecycle ..... 5-8
Figure 5-2 Rate Impact Analysis ..... 5-19
Figure 5-3 Number and Percentage of Days Exceeding the Lower Bridge WUP Order Target Flow Schedule in 53 Years With Different Planned Outage Duration ..... 5-29

## List of Tables

Table 5-1 Generating Equipment Components to be Replaced or Refurbished ..... 5-3
Table 5-2 Summary of BR1 Project Procurement Approach ..... 5-11
Table 5-3 BR1 Project Cost Range Breakdown ..... 5-14
Table 5-4 Escalation, Capital Overhead, and Interest During Construction as of April 2021 ..... 5-18
Table 5-5 Project Major Milestones ..... 5-21
Table 5-6 Water Licence Details ..... 5-23

## 5.1 Introduction

The chapter provides a description of the BR1 Project. The BR1 Project will replace the Unit 1 to 4 generators, governors, exciters, and control systems at the Bridge River 1 Generating Station. This chapter explains the project scope and activities, procurement approach, cost, rate impact, schedule, permits and approvals and impacts and is structured as follows:

- Section 5.2 describes the BR1 Project's scope, technical performance and safety requirements, and provides a summary of the project activities;
- Section 5.3 describes the approach to procure equipment and / or services to design, supply, install, and commission the new generators, governors, exciters, control systems and other associated scope elements;
- Section 5.4 outlines the BR1 Project's cost, including the direct and indirect construction costs, and the BR1 Project contingency and reserve. It also describes the approval process required to draw on the BR1 Project reserve;
- Section 5.5 outlines the BR1 Project's impact to ratepayers;
- Section 5.6 provides an overview of the BR1 Project's schedule including key scheduling constraints;
- Section 5.7 explains which permits, approvals, and authorizations the BR1 Project does or does not require; and
- Section 5.8 discusses the BR1 Project's potential impacts during the construction phase, including environmental and socio-economic impacts.

## 5.2 Project Scope, Requirements, and Activities

This section provides an overview of the BR1 Project scope (section 5.2.1); outlines the technical and safety requirements for the Unit 1 to 4 generators, governors, exciters, and control systems (section 5.2.2); and summarizes the BR1 Project activities completed to date as well as future planned activities (section 5.2.3).

### 5.2.1 BR1 Project Will Replace Unit 1 to 4 Generators, Governors, Exciters and Control Systems

The BR1 Project scope includes replacing the Unit 1 to 4 generators, governors, exciters, and control systems within the existing Bridge River 1 Generating Station. Specifically, the key activities of the BR1 Project involve specifying, procuring, designing, manufacturing, assembling, dismantling, installing and commissioning the following:

- Unit 1 to 4 generators, which include the stator, rotor, generator terminal connection equipment, and all other generator components above the turbines;
- Unit 1 to 4 governors, which include the mechanical and control components required to regulate the speed of the existing turbines;
- Unit 1 to 4 exciters, which include the transformer, and excitation and control modules required to regulate the generators' voltage; and
- Unit 1 to 4 control systems, which include replacement of protection, control, alarm and metering equipment for each generating unit as well as the replacement of the supervisory control and data acquisition (**SCADA**) and telecom equipment required to remotely operate the Bridge River 1 Generating Station.

In addition, the BR1 Project scope includes the supply and installation of a fire protection system above the generator floor and the refurbishment of miscellaneous generator and turbine components to improve the functioning of the generating units.

BC Hydro has also included the supply and installation of a turbine energy dissipation device that would allow for water conveyance without power generation in the preliminary cost estimate for the BR1 Project. Further information on this scope of work is provided in section 5.8.2.3 below.

Table 5-1 below provides a breakdown of the generating equipment or components that will be included in the Implementation phase scope of this BR1 Project. A detailed discussion of the BR1 Project scope is also included in the Preliminary Design Report provided as Appendix B-7.

**Table 5-1 Generating Equipment Components to be Replaced or Refurbished**

| Generating Equipment or Component | Service Life (Years) | Description |
|---|---|---|
| **Equipment or Components to be Replaced** | | |
| Generator Rotors | 50 | The rotor is a large circular electromagnet connected to the turbine shaft. |
| Generator Stators | 50 | The stator is a stationary coil of electrical conductors wound tightly around a metal core. Rotor poles generate voltage in the stator coils. |
| Generator Frame | 50 | The stator core is installed in the stator frame which is secured to the powerhouse floor via the generator soleplates. |
| Generator Bearings | 80 | Generator bearings support the rotating parts of the generator. |
| Generator Support Brackets | 80 | Support brackets support the weight of the generating equipment. |
| Generator Brush Gears | 50 | Brush gears transfer excitation currents from the excitation system to the rotor poles. |
| Generator Terminal Equipment | 50 | Terminal equipment is comprised of current transformers, voltage transformers, and surge protection devices that are used for unit protection and metering. |
| Governors and components | 40 | Governors regulate the water flow through the turbine to keep the turbine speed constant and to manage power output. |
| Exciters and components | 30 | Exciters inject current into the rotor coils turning them into large electromagnets. |
| Control Systems Components | 30 | Protection, control, alarm, and metering components work to automatically or manually eliminate faults and provide information on the generator parameters. |
| SCADA and Telecom Equipment | 30 | SCADA and telecom equipment collate and communicate information. |
| **Equipment or Components to be Refurbished** | | |
| Generator Soleplates | 80 | The metal support plate at the base of the generator.<br>The generator frame is attached to the soleplates. |
| Turbine Guide Bearings | 80 | Turbine guide bearings reduce wear, maintain alignment, and minimize friction of moving parts. |

| Generating Equipment or Component | Service Life (Years) | Description |
|---|---|---|
| Turbine Needles and Bushings | 50 | Turbine needles enable variable adjustments to accommodate changes in water flow.<br>Bushings are thin tubes that reduce friction between the rotating shafts. |
| **New Equipment or Components to be Supplied or Installed** | | |
| Generator Floor Fire Protection System | 30 | The fire protection system will include unpressurized dry piping and sprinkler heads to extinguish fire in the generator floor area once a fire is detected. |
| Turbine Energy Dissipation Device | 50 | This device would be used during an extended forced outage when a turbine and generator are out of service. It would dissipate the energy normally captured by the turbine. This will allow water to bypass the generating unit, assisting with overall system water conveyance. For further discussion, refer to section 5.8.2.3 below. |

## 5.2.2 Technical and Safety Requirements

### *5.2.2.1 Equipment Design and Performance Requirements*

This section describes the technical performance requirements for the new generators, governors, exciters, and control system components.

*Generators*

- The generators will have a minimum design life of 50 years which is consistent with current industry expectations;
- The generators will be designed to fulfil the operating conditions of the Bridge River 1 Generating Station as determined by the power system requirements, to withstand the ambient conditions and meet the technical requirements;
- The design of the generators will incorporate Safety by Design principles and provide ease of access and equipment isolation capability to support inspection, maintenance, and repair;
- The four generators will be of identical design and installation to support spare part inventories, operation and maintenance efficiencies;

- The design of the generators will not contribute to detrimental outcomes in the dynamic behaviour and/or structural strength of the existing turbine and its components;
- All required civil modifications will follow the current applicable codes and industry practices; and
- The generators will comply with the relevant NERC requirements and meet current BC Hydro standards.

*Governors*

- The governors will have a minimum design life of 40 years which is consistent with current industry expectations;
- The performance of the governors will align with the needs of the new generators and existing turbines; and
- The governors will comply with the relevant NERC requirements and meet current BC Hydro standards.

*Exciters*

- The exciters will have a minimum design life of 30 years which is consistent with current industry expectations;
- The performance of the exciters will align with the needs of the new generators and existing turbines; and
- The exciters will comply with the relevant NERC requirements and meet current BC Hydro standards.

*Control Systems*

- The control systems will have a minimum design life of 30 years which is consistent with current industry expectations; and

- The new protection and control system will comply with relevant NERC requirements and meet current BC Hydro standards.

#### *5.2.2.2 Safety by Design*

The BR1 Project will align with the BC Hydro Safety by Design principles. BC Hydro systematically identifies hazards and failure modes that pose safety risks to workers and the public during the construction, operation and maintenance of the equipment. BC Hydro then assesses these hazards and failure modes through the design process to eliminate or reduce the associated safety risks. The objective is to produce safer designs to enable safer operability and maintainability.

The BR1 Project's design has considered the following Safety by Design principles:

1. **Limits of Approach Requirements:** The equipment layouts will comply with BC Hydro's new limits of approach requirements[92], which came into effect in February 2020;
2. **Isolation Requirements:** As power sources, generators are required to be grounded as a part of the isolation process. All generator conductors will be equipped with grounding studs in accessible locations to allow application of standard work protection grounds;
3. **Lockout Requirements:** All isolating devices and cabinets need to be lockable using BC Hydro Work Protection Practices locks. In addition, in accordance with BC Hydro Occupational Safety and Health standards, they must be accessible without any special requirements;
4. **Arc Flash Mitigation:** High Voltage equipment enclosures will be constructed to contain or safely redirect the hazardous energy caused by electric faults;

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[92] Limits of approach requirements refer to the safe distances that people or equipment must maintain from exposed energized power lines or equipment.

5. **Hazardous Materials Elimination:** Hazardous materials in the existing equipment will be identified and protocols for handling, transport and disposal will be established in the Environmental Management Plan;

6. **Noise Reduction:** The ambient and localized noise output of the generator in operation will be reduced to be below 75 decibels; and

7. **Confined Space Mitigation:** No new additional confined spaces will be added as part of the project, and existing confined spaces will be eliminated or mitigated in the new equipment design, as required.

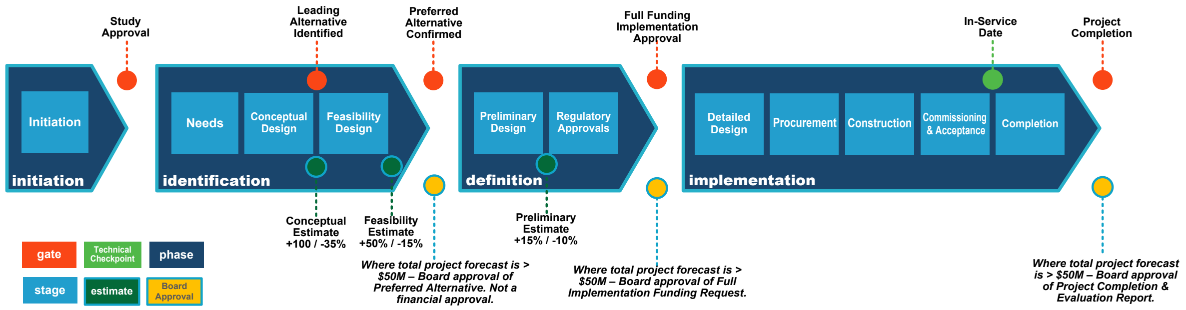
Safety By Design principles will continue to be applied during detailed design so that the systems and equipment minimize the risk of injury during construction and during operation and maintenance.

### 5.2.3 BR1 Project Activities

The BR1 Project will be executed following BC Hydro’s staged project lifecycle approach for large and more complex capital projects. This staged approach consists of the Initiation, Identification, Definition and Implementation phases, with various stages within each phase. Approvals occur at various points (gates) where key information, such as project costs, schedule, scope, and risk are presented to seek approval to continue with the project.

Figure 5-1 below provides a summary of the project lifecycle. The gates following each phase of the project lifecycle are shown as red circles, and approvals by the Board of Directors, where required, are shown in yellow circles.

**Figure 5-1 Project Lifecycle**



As illustrated in Figure 5-1, projects become more defined as they move through the project lifecycle, and the increased level of design development allows for updated cost estimates to be developed. The BR1 Project is in the Preliminary Design stage of the Definition phase in the project lifecycle.

The subsections below describe the BR1 Project activities in each phase.

### *5.2.3.1 Design Activities*

BC Hydro completed the conceptual and feasibility level design in the Identification phase. The design activities carried out in the Feasibility Design stage included the feasibility design of the new generating equipment, the feasibility level cost estimate, and the geotechnical site investigation. BC Hydro selected the replacement of all the Unit 1 to 4 generators, governors, exciters and control systems as the Preferred Alternative, which was endorsed by the Board of Directors in June 2018.

BC Hydro has completed the following Definition phase design activities: refining the design for the new generating equipment, refining the BR1 Project's constructability approach, ensuring continuing alignment with Safety by Design principles, assessing the impact of the new generators on the transmission system, and identifying any design related BR1 Project risks. The Definition phase Preliminary Design Report is provided as Appendix B-7.

BC Hydro will continue the preliminary design activities in the Definition phase and, following regulatory approvals, complete the detailed design in the Implementation phase. This includes the development of technical specifications and drawings.

#### *5.2.3.2 Procurement Activities*

During the Definition phase, BC Hydro will initiate a public procurement process for the replacement generators and identify a preferred proponent. The contract for the supply and installation of the generators will be awarded after the BR1 Project receives approval from the Board of Directors to proceed into the Implementation phase. In the Implementation phase, contracts will be awarded for the replacement of the governors, exciters, control systems, and other scope elements. The BR1 Project's procurement approach is discussed in section 5.3 below.

#### *5.2.3.3 Outage Planning and Delivery Activities*

During the construction of the BR1 Project, BC Hydro will schedule a separate planned outage for each of the four generating units. There will be one planned BR1 Project outage per year and each outage will last approximately eight months. Dismantling, installation and commissioning of the equipment will occur during the outage. Details of potential environmental impacts due to planned outages are provided in section 5.8.2.2.

The outage for the first generating unit is planned to start in fiscal 2027 and the outage for the last generating unit will finish in fiscal 2031. To reduce the risk of system impacts during capital work on the Bridge River Generation System, the BR1 Project work will be coordinated with the work of other Bridge River Generation System projects (e.g., the Bridge River 1 Penstock 1-4 Recoating Project) taking place in the same time period, so that the Bridge River 1 Generating Station outage schedule is optimized. BC Hydro will continue to inform and engage with the St'át'imc Nation on the BR1 Project outage requirements.

#### *5.2.3.4 Construction Activities*

Construction activities include the activities required to supply, install and commission the new generating equipment.

The activities that are required to supply the generating equipment include manufacturing, factory testing, quality assurance, and delivery of the generating equipment. Equipment supply activities will be monitored and controlled by BC Hydro's quality, engineering and contract management resources. Supplied generating equipment will need to be prepared and pre-assembled in the generating station. Each generator stator, rotor, and generator support brackets will be pre-assembled prior to dismantling an existing generator.

Civil works are planned so that the existing generator anchor system will be supplemented with new anchors to comply with the structural load capacity of the replacement generator.

The installation of the replacement generators will also be monitored and controlled by BC Hydro's quality, engineering, construction and contract management resources. The existing generating equipment will be dismantled and disposed. The disposal of all surplus assets and hazardous waste will be managed by BC Hydro's investment recovery and disposal resources.

#### *5.2.3.5 Commissioning, Testing, and Completion Activities*

After construction activities are completed, testing and commissioning activities will take place to validate that the new generating equipment operates and performs in accordance with the prescribed performance criteria outlined in section 5.2.2 above. Compliance to the NERC Mandatory Reliability Standards will be verified prior to approving the equipment for commercial service.

Closeout activities include development of maintenance programs, operation and maintenance training for the new generating equipment, issuing record drawings and documentation, providing a list of post-BR1 Project commitments and conditions of approvals and agreements to the responsible Key Business Unit within the Operations Business Group, and undertaking all activities required to develop the PCER.

## 5.3 Procurement Approach

To manage costs, BC Hydro will use different procurement approaches to procure the generators, governors, exciters and control systems, and fire protection system. These approaches are summarized in Table 5-2 below and discussed further in the subsections that follow.

**Table 5-2 Summary of BR1 Project Procurement Approach**

| Contract Packages | Project Delivery Methodology | Sourcing Strategy |
|---|---|---|
| Generator Replacement | Design-Build | Public Request for Proposal |
| Governor Replacement | Design-Bid-Build | Select Competition among two pre-qualified suppliers and In House |
| Exciter Replacement | Design-Bid-Build | Blanket Order and In House |
| Control System Replacement | Design-Bid-Build | Blanket Order and In House |
| Fire Protection System Replacement | Design-Build | Select Competition among four pre-qualified suppliers |

### 5.3.1 Public Procurement Process for Generators

The project delivery methodology for the replacement of the Unit 1 to 4 generators is design-build. A public procurement process for the design, supply, installation, and commissioning of the new generators will allow BC Hydro to:

- Procure the largest cost item in the BR1 Project through a standardized and transparent manner;
- Obtain a fair market price based on a comparison of the detailed proposals put forward by multiple proponents; and
- Minimize the risk of not being able to secure an acceptable proposal.

A Request for Information (**RFI**) including an information session for interested suppliers will precede the public Request for Proposal (**RFP**). BC Hydro will finalize the specifications and publish a Design-Build RFP for new generators on BC Bid.[93] The BR1 Project's schedule anticipates issuing the RFP in 2021 and awarding the contract following the BCUC's Decision on whether to grant a CPCN for the BR1 Project, and after the BR1 Project has received approval from BC Hydro's Board of Directors of the First Full Funding request and to proceed into the Implementation phase. An external fairness advisor and fairness monitor will be hired to ensure the procurement process is fair, and seen to be fair, to all proponents. Appendix B-8 provides an overview of how the procurement approach for the new generators was determined.

### 5.3.2 Blanket Contract Orders for the Governors, Exciters, Control Systems and Fire Protection System

The project delivery methodology for the governors, exciters, and control systems is design-bid-build and the project delivery methodology for the fire protection system is design-build. BC Hydro's existing blanket contract orders will be used to supply the new governors, exciters, control systems and fire protection system, which will allow BC Hydro to realize efficiencies by shortening the procurement cycle and minimizing cost through economies of scale. These existing blanket contract orders were secured through an extensive public procurement process and provide an effective way for BC Hydro to establish baseline pricing for equipment that is common to multiple planned projects in BC Hydro's capital plan.

The design and supply of the governors, exciters and fire protection system will be undertaken by the external suppliers. BC Hydro resources will design the control systems and the supply of control systems equipment will be undertaken by the external suppliers. The installation of the governors, exciters and control systems will

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[93] BC Bid is a website where B.C. public sector goods, services and construction opportunities and contract awards are published.

be carried out by BC Hydro resources. The fire protection system will be installed by the external supplier.

In addition, BC Hydro will leverage its various blanket contract orders to supply various balance of plant components that will be replaced.

Any additional procurement needs identified for the BR1 Project will be handled in accordance with BC Hydro’s procurement practices and policies. The BR1 Project’s overall procurement approach will also contribute toward new procurement targets set out in BC Hydro’s agreements between the St’át’imc Nation and BC Hydro.

## 5.4 Project Cost

The BR1 Project has a total cost estimate range of $207.1 million to $326.3 million (**BR1 Project Cost Range**). The BR1 Project Cost Range is based on an Expected Cost of $243.4 million (with an estimating accuracy range of +21 per cent and -16 per cent and an Authorized Cost of $326.3 million.

The Authorized Cost includes a Project Reserve of $82.9 million. The Authorized Cost is the sum of the Expected Cost and the Project Reserve and includes all contingencies, inflation, capital overhead, interest during construction and reserves.

The Expected Cost estimate is based on a Preliminary Level Design and conforms to AACEI[94] Class 3 cost estimate requirements. The Preliminary Level Cost Estimating Report is provided as Appendix B-9. It describes how project risks have been accounted for in the BR1 Project Cost Range and provides further details on the estimating process, basis, and assumptions.

The BR1 Project Cost Range includes life-to-date costs and forecasted direct construction costs, indirect construction costs, contingency and reserves, escalation, interest during construction, and capital overhead.

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[94] Association for the Advancement of Cost Engineering International.

Table 5-3 provides a summary of the BR1 Project Cost Range. BC Hydro has redacted commercially-sensitive information which could prejudice BC Hydro's position in future negotiations. Consistent with past practice, BC Hydro expects to provide project reporting updates to the BCUC on the BR1 Project Cost Range after receiving approval from BC Hydro's Board of Directors to advance to the Implementation phase. The updated BR1 Project Cost Range will incorporate contract award pricing for the Unit 1 to 4 generators when available.

**Table 5-3 BR1 Project Cost Range Breakdown**

| Row No. | Description | Preliminary Cost Estimate ($ millions) |
|---|---|---|
| 1 | **Pre-Implementation Phase Costs**<br>Excluding Interest During Construction and Capital Overhead | **13.4** |
| | **Implementation Phase Costs** | |
| | **Direct Construction Costs** | |
| 2 | Generator 1st Unit | [redacted] |
| 3 | Generator 2nd Unit | [redacted] |
| 4 | Generator 3rd Unit | [redacted] |
| 5 | Generator 4th Unit | [redacted] |
| 6 | Governor (all units) | [redacted] |
| 7 | Exciter (all units) | [redacted] |
| 8 | Controls (all units) | [redacted] |
| 9 | Balance of Plant (all) | [redacted] |
| **10** | **Total Direct Construction Costs** | |
| | **Indirect Construction Costs** | |
| 11 | Project Management | [redacted] |
| 12 | Engineering & Design | [redacted] |
| 13 | Indigenous Relations | [redacted] |
| 14 | Environment, Stakeholders & Properties | [redacted] |
| 15 | Procurement and Quality Assurance | [redacted] |
| 16 | Legal Costs | [redacted] |
| **17** | **Total Indirect Construction Costs** | [redacted] |

| Row No. | Description | Preliminary Cost Estimate ($ millions) |
|---|---|---|
| **18** | **Implementation Costs**<br>Before Contingency and Loadings | [redacted] |
| 19 | Contingency | [redacted] |
| 20 | Capital Overhead | [redacted] |
| 21 | Interest During Construction | [redacted] |
| **22** | **BC Hydro Expected Amount** | **243.4** |
| 23 | Project Reserve | 82.9 |
| **24** | **BC Hydro Authorised Amount** | **326.3** |
| **25** | **BR1 Project Cost Range (+21%/-16%)**[95] | **326.3 – 207.1** |

Details on the costs set out in Table 5-3 above are provided in the sub-sections below.

### 5.4.1 Direct Construction Costs

The direct construction costs include estimates for the designing, manufacturing , assembling, dismantling, installing, testing, and commissioning of the Unit 1 to 4 generators, governors, exciters, and other scope elements as outlined in section 5.2.1 above as well as the manufacturing, dismantling, installing, testing, and commissioning of the control systems. The direct construction cost estimate is based on the anticipated range of bid prices for the generators, recent historical costs and worker productivity from other similar projects. The estimates for construction management, construction safety, contract management and station field operation resources are also included in the direct construction costs. The following key assumptions were used to prepare the direct construction cost estimate:

- Major components such as each generator’s rotor and stator will be pre-assembled on-site prior to the outage periods;
- Separate outages for each generator will each last approximately eight months;

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[95] The estimating accuracy range only applies to the expected cost of the Implementation phase.

- There will be sufficient accommodations in the Seton Portage area for BR1 Project construction crews and site staff; and
- The existing generator floor has sufficient structural load capacity to support the generator components during construction.

### 5.4.2 Indirect Construction Costs

The indirect construction costs include estimates for project management, engineering and design, procurement and quality management, environmental monitoring, Indigenous relations, as well as other indirect costs associated with implementing the project. The estimates for these costs were prepared by Work Package Managers[96] based on their specific knowledge of the work and deliverables and were correlated with other recently completed generator replacement projects.

### 5.4.3 Project Contingency

An expected (or **$P_{50}$**[97]) contingency amount has been estimated for the BR1 Project using Quantitative Risk Analysis methods, applying a Monte-Carlo simulation to obtain a probabilistic distribution so that contingency and reserve amounts could be determined.

Specifically identified project cost risks are accounted for as part of the base cost, prior to calculation of contingency. The expected contingency accounts for cost risks that cannot be specifically identified and captured in the direct or indirect construction costs, but which could occur during the life of the BR1 Project. This includes non-specific risks such as:

- Changes in commodity prices for steel and copper and changes in the currency exchange rate for components and materials sourced from foreign suppliers;

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[96] The Work Package Managers are responsible and accountable for the planning and delivery of their Work Packages within the approved scope, cost, and schedule.

[97] P50 is defined as the final project cost will not exceed the cost estimate 50 per cent of the time. This is also defined as the expected cost estimate.

- Schedule delay due to productivity issues and competing demands for scarce labour resources; and
- Other risks relating to working at a remote site or unforeseen site conditions, as well as minor modifications to the scope.

Expected contingency does not include risks such as tax changes, major project scope changes, and force majeure risks.

Details on the risks accounted for in the project reserve are provided in section 5.4.5 below.

### 5.4.4 Escalation, Capital Overhead and Interest During Construction

The BR1 Project Cost Range includes estimates for escalation, capital overhead, and interest during construction. Escalation is applied to the total direct construction costs and is based on economic trends, advice from independent economists on appropriate inflation rates for the construction sector, and data from Statistics Canada. Capital overhead is calculated and applied on the total direct construction costs. Interest during construction is an estimate of the interest incurred over the life of a project. Interest is applied only to capital costs and will vary over the life of the BR1 Project with changes in the total forecast capital cost. Table 5-4 below provides the escalation, capital overhead and interest during construction assumptions used for the BR1 Project Cost Range.

**Table 5-4 Escalation, Capital Overhead, and Interest During Construction as of April 2021**

| Fiscal Year | Escalation (%) | Capital Overhead (%) | Interest During Construction (%) |
|---|---|---|---|
| 2022 | 2.5 | 2.9 | 2.94 |
| 2023 | 2.5 | 2.9 | 2.76 |
| 2024 | 2.5 | 2.9 | 2.70 |
| 2025 | 2.5 | 2.9 | 2.73 |
| 2026 to 2031 | 2.5 | 2.9 | 2.74 |
| 2032 (April 2031) and beyond | 2.0 | 2.9 | 2.74 |

### 5.4.5 Project Reserve

The Project Reserve accounts for the additional financial impact of known risks to the BR1 Project and is comprised of two distinct cost components:

- The difference between the $P_{90}$[98] contingency and the $P_{50}$ contingency, used to accommodate the same blended impact of known non-specific risks as identified under the $P_{50}$ contingency, but with a higher confidence level regarding the probability of the estimated total project cost not being exceeded; and
- Special Reserves, which includes known specific risks, which have not been assigned a probability of occurrence but may be realized by the BR1 Project. The Special Reserves for the BR1 Project are included for the following risks:
  - ▶ Risk pertaining to the competitive bidding process for the generators; and
  - ▶ Risk of higher flows requiring additional environmental monitoring and mitigation.

Access to Project Reserves will require additional financial approval from BC Hydro’s Board of Directors and Special Reserves relating to known risks are only accessible if those specific risks materialize.

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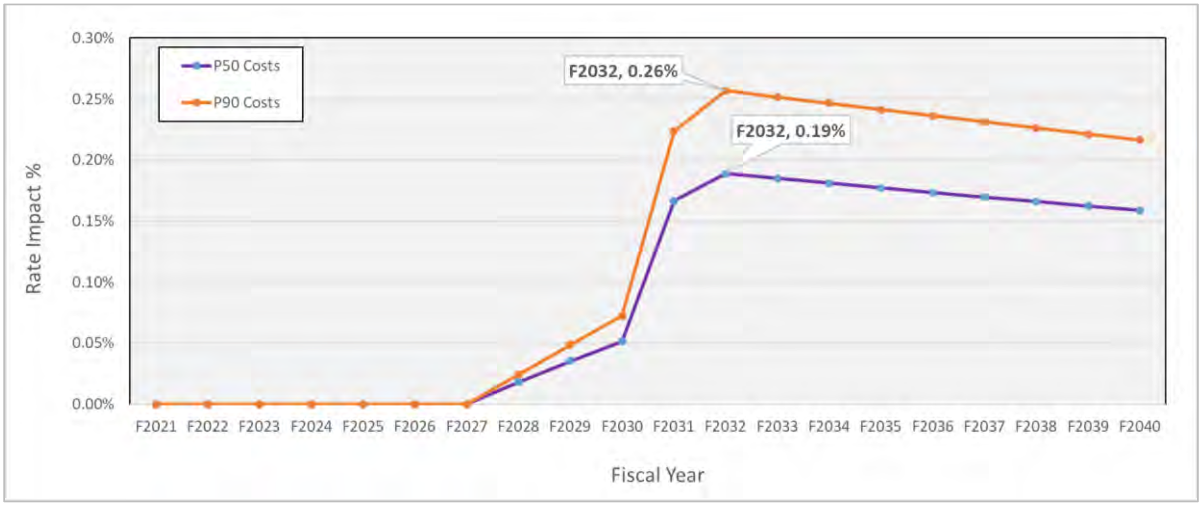
[98] $P_{90}$ is defined as the cost estimate that will not be exceeded 90 per cent of the time.

## 5.5 Rate Impact Analysis

In this section, BC Hydro discusses the impact that the BR1 Project will have on BC Hydro's revenue requirements and rates. Appendix B-11 contains the financial models (electronic spreadsheets attached) used to determine the rate impacts.

The BR1 Project would affect the following elements of BC Hydro's revenue requirements: cost of energy, amortization and finance charges. Figure 5-2 below illustrates the resulting estimated annual incremental rate impacts from the BR1 Project, assuming an in-service date of July 2030, an Expected Cost estimate of $243.4 million and an Authorized Cost estimate of $326.3 million.

**Figure 5-2 Rate Impact Analysis**



With both the Expected Cost estimate and Authorized Cost estimate, there is an initial increase in BC Hydro's revenue requirements in the early years as the generating units are placed in service. The incremental rate impact declines after fiscal 2032 because of the addition of incremental energy and capacity associated with restoring the flow capacity of the generating station, a reduction in the costs associated with forced outages and emergency repairs and lower finance charges as amortization recovered from ratepayers is used to pay down the debt over time. The financial benefits are estimated at $0.6 million annually for the total incremental system benefits from replacing the Unit 1 to 4 generators and $0.1 million for the reduced annual maintenance costs.

Based on the Expected Cost estimate, the annual increase in BC Hydro's revenue requirement would be highest (in dollar terms) in fiscal 2032 at around $10.9 million (rate impact of 0.19 per cent), the first full year when all the four generating units are in-service. A similar pattern occurs under the scenario with the Authorized Cost estimate, with the annual increase in BC Hydro's revenue requirement highest (in dollar terms) in fiscal 2032 at around $14.8 million (rate impact of 0.26 per cent).

This incremental rate impact analysis only considers the benefit of the incremental capacity and does not include the benefits of the generation life extension of the full Bridge River 1 Generating Station capacity, which is dependent on the implementation of the BR1 Project. Investment in the BR1 Project, along with the other investments described in Chapter 2, is required to preserve the capability of the Bridge River System which has a positive net present value to ratepayers. Further discussion is provided in section 2.6 of Chapter 2.

## 5.6 Project Schedule

The BR1 Project schedule has been developed so that all units are in-service by July 2030 and all BR1 Project activities, including the PCER, are completed by May 2031.

In this section, BC Hydro provides a summary of the BR1 Project's major milestones (section 5.6.1), followed by a discussion of the constraints considered when developing the schedule (section 5.6.2).

### 5.6.1 Project Major Milestones

The following table provides the estimated dates for the BR1 Project's major milestones. A detailed project schedule is set out in Appendix B-12.

**Table 5-5 Project Major Milestones**

| Description of Milestone | Estimated Date |
|---|---|
| BC Hydro files BR1 Project Application | July 2021 |
| Public Procurement Bidding for Generators Closed | March 2022 |
| Expected BCUC Decision Date | July 2022 |
| Implementation Phase Funding Approval | April 2023 |
| Award Contract for Generator Replacement | July 2023 |
| First Generating Unit Asset In-Service Date | May 2027 |
| Second Generating Unit Asset In-Service Date | May 2028 |
| Third Generating Unit Asset In-Service Date | May 2029 |
| Fourth Generating Unit Asset In-Service Date | May 2030 |
| BR1 Project In-Service Date | July 2030 |
| BR1 Project Complete | May 2031 |

### 5.6.2 Scheduling Constraints and Considerations

The project schedule is the result of a combination of required BR1 Project activities and construction period constraints. In developing the current BR1 Project schedule, BC Hydro considered the following factors:

- **Timing of the BCUC decision:** The BR1 Project schedule anticipates receiving a BCUC decision prior to advancing to the Implementation phase. The contract for the generator replacement will be awarded in the Implementation phase, once the First Full Funding request has been approved by BC Hydro's Board of Directors;
- **Longer period for the first generator:** The replacement of the first generator is expected to take longer than the subsequent replacements because the design and supply activities are on the critical path for only the first generator, and are estimated to take approximately two years and four months;
- **Assembly time:** On-site generator pre-outage assembly activities are estimated to take approximately four to six months for each generator installation;

- **Planned outages:** Four planned outages beginning in late summer and lasting for approximately eight months, annually, are required to dismantle, install and commission the generators. The timing to begin in late summer was developed in consultation with St'át'imc to avoid the freshet period and reduce impacts to fish and fish habitat; and
- **Constrained work area:** The estimated In-Service Date milestones include a six-week schedule contingency to cover additional time for installation activities and delays due to a constrained work area inside the Bridge River 1 Generating Station.

## 5.7 Project Permits, Approval, and Authorization

This section explains which permits, approvals, and authorizations the BR1 Project does or does not require. It explains that the BR1 Project does not trigger any federal or provincial assessment (section 5.7.1); discusses the applicable Final Water Licences and WUP Order (section 5.7.2); and outlines the applicability of municipal and provincial requirements (section 5.7.3).

### 5.7.1 Environmental Assessments

The BR1 Project does not trigger a review under the Federal environmental assessment process of the Federal *Impact Assessment Act* because it would not result in an expansion of a hydroelectric facility resulting in an increase in production capacity of 50 per cent or more and a total production capacity of 200 MW or more.[99]

The BR1 Project also does not trigger a review under the *BC Environmental Assessment Act* because modifications of an existing facility, such as the replacement of generators or turbines, are not reviewable.[100]

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[99] Renewable Energy designated projects must involve one or more physical activities set out in section 43(a) of the Physical Activities Regulation, SOR/2019-285.

[100] This exception is set out in Column 3, Table 7(2)(a) of the B.C. Reviewable Projects Regulation, B.C. Reg. 67/2020.

### 5.7.2 Water Licences and Water Use Plan Order

After the BR1 Project is implemented, operations will continue within the existing operational parameters. Therefore, as a result of the BR1 Project, BC Hydro is not requesting any changes to:

- The rights to use, store and divert water authorized under the existing licences;
- The existing operations under the licences and WUP Order;[101] or
- The existing footprint of the facility.

Table 5-6 below outlines the three Final Water Licences which together account for 100 per cent of the diversion rights for the purpose of generating power at the Bridge River 1 Generating Station.

**Table 5-6 Water Licence Details**

| Licence No. | Purpose | Licence Amount ($m^3/s$) |
|---|---|---|
| Final Water Licence 126287 | Diversion from Carpenter Reservoir to Bridge River Generating Station 1 | 42.5 |
| Final Water Licence 126288 | Diversion from Carpenter Reservoir to Bridge River Generating Station 1 | 19.8 |
| Final Water Licence 126080 | Diversion from Carpenter Reservoir to Bridge River Generating Station 1 | 2.7 |

BC Hydro applied to renew the term of all three Final Water Licences in November 2018 and no amendments to the Final Water Licences are required as a result of the BR1 Project. Operations of the BR1 Generating Station can continue while a decision is being made on the application. There are no statutory timelines for a decision; however, guidance documents have a target timeline of 240 days. The three existing Final Water Licences for the Bridge River 1 Generating Station are provided as Appendix B-4.

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[101] Note that a WUP Order variance is in place, which authorizes BC Hydro to operate outside of the WUP Order target flow schedule and under a set of guiding principles and conditions.

### 5.7.3 Municipal and Provincial Requirements

Under section 32(1) of the *Hydro and Power Authority Act*, BC Hydro is exempt from municipal regulatory requirements. Regardless, given that BR1 Project activities will take place on BC Hydro property and Crown land, there are no municipal regulatory requirements anticipated for the BR1 Project.

In addition, as the construction of the BR1 Project will take place in the existing Bridge River 1 Generating Station, BC Hydro does not anticipate any provincial permits or authorizations are required for the BR1 Project.

## 5.8 Project Impacts and Mitigation

This section provides a discussion on: the process of identifying environmental and socio-economic impacts from the BR1 Project (section 5.8.1); the BR1 Project's environmental impacts, including the results of the environmental assessment and mitigation plans (section 5.8.2); the BR1 Project's socio-economic impacts, including the results of the socio-economic assessment and mitigation plans (section 5.8.3); the BR1 Project's potential impact on the bulk transmission system (section 5.8.4); and the BR1 Project's public works impact (section 5.8.5).

### 5.8.1 Identification of Environmental and Socio-Economic Impacts

During the development of the BR1 Project, BC Hydro completed the following activities to identify potential socio-economic and environmental impacts:

- Assessed the BR1 Project's potential environmental impact;
- Assessed the BR1 Project's potential socio-economic impact on Indigenous Nations and local communities;
- Consulted and engaged with the St'át'imc Nation with respect to the potential identified impacts, as described in section 6.2 of Chapter 6;
- Developed management plans to mitigate potential impacts; and

- Engaged with local government, stakeholders and the public, as described in section 6.3 of Chapter 6.

BC Hydro anticipates that the BR1 Project will not result in any material adverse environmental impacts. BC Hydro has identified potential negative socio-economic impacts and has developed mitigation plans to address those impacts.

### 5.8.2 Environmental Impacts

#### *5.8.2.1 Valued Components Identified and Assessed*

BC Hydro engaged Hemmera Envirochem Inc. to conduct an Environment Impact Statement (**EIS**) to identify and assess the BR1 Project's impact on the bio-physical environment based on valued components and pathway components, as explained below, identify potential direct and indirect BR1 Project effects, and develop appropriate measures to mitigate potential adverse effects. The EIS is provided as Appendix B-13.

For the BR1 Project, the valued components and pathway components were identified based on prior experience with similar sized hydroelectric projects, and knowledge and review of existing Government of B.C. standards and guidelines, legislation, and regulations. Valued components are environmental, social, cultural, or economic elements present in the BR1 Project area that are deemed important or valuable and are assessed for potential project related impacts. A pathway component establishes linkages between project activities and valued components.

The EIS considered and assessed the environmental valued and pathway components for their potential BR1 Project-related effects on:

- **Water Quantity:** specifically, fluctuating water levels in Carpenter Reservoir, and Seton Lake, with subsequent impacts on Lower Bridge River and / or Seton River, and their potential to cause impacts to fish and fish habitat; and

- **Fish and Fish Habitat:** specifically, changes in aquatic habitat quality and connectivity and changes in fish species abundance, diversity, and distribution.

These components are discussed further in the subsections below.

The EIS did not assess heritage resources, water quality, wildlife and wildlife habitat and vegetation because the BR1 Project activities are not expected to interact with these components. Specifically, no ground disturbance or vegetation removal is required because BC Hydro plans to make use of pre-existing laydown areas, access roads and parking lots. Although the accidental release of hazardous substances could impact water quality during BR1 Project construction activities, these releases are generally preventable and will be mitigated through the application of best management practices and spill response.

The EIS concludes that negative environmental impacts associated with the BR1 Project construction are negligible, localized, short-term, reversible and not measurable. Construction activities are being planned to minimize potential negative effects to water quantity and fish and fish habitat, and the BR1 Project's Environmental Management Plan (**EMP**) will be implemented to address construction related environmental impacts (e.g., spill response and management of contaminated materials). Additionally, contractors will be required to submit plans to demonstrate how they will meet the requirements of the BR1 Project EMP and will be required to submit construction management and risk management plans prior to construction. Pursuant to commitments in the 2011 Agreements and 2019 High Flow Settlement Agreement, BC Hydro will share the BR1 Project EMP with St'át'imc for review and comment.

Once implemented, the BR1 Project is expected to result in reduced environmental risk. As discussed further in section 3.4 of Chapter 3, the new generating equipment will enable BC Hydro to better manage water flows in the Bridge River Generation System within the WUP Order targets and maintain fish and fish habitat in Lower Bridge River. Interests and issues affected by the operations of the Bridge River facilities were explored during the development of the WUP Order. The final recommendations, including the target flows, reflect a balance between fish and wildlife interests in the reservoirs and rivers. Monitoring studies are being implemented to evaluate the effectiveness of the measures and targets established in the WUP Order.

#### *5.8.2.2 Managing Water Flows During Planned Outages*

The proposed methodology for managing the planned outages for the BR1 Project has been informed by extensive collaboration between St’át’imc and BC Hydro over the past several years regarding flow management in the system. The BR1 Project anticipates one planned outage per year starting in late summer and lasting for approximately eight months. During the planned outage, the flow of water through the Bridge River 1 Generating Station will be reduced, resulting in potential impacts to water quantity, fish and fish habitat in Lower Bridge River and Seton River. To reduce the potential impacts, the generator replacements will be sequenced, starting with the unit in the poorest condition. The likelihood that any planned BR1 Project outage would contribute to flows above the WUP Order target flow schedule is low because:

- The existing generating units will be taken out of service one at a time;
- The generation/flow capacity at the Bridge River 2 Generating Station has been restored recently to allow for greater operating flexibility;
- The first unit to be replaced at the Bridge River 1 Generating Station will be Unit 4, which will result in removal of the existing de-rated equipment and therefore will have minimal impact on BC Hydro’s ability to manage flows; and
- Each new unit installation will provide a small incremental capacity compared to the original unit, and therefore each unit installation will provide cumulative additional capacity for managing the WUP Order target flow schedule.

To understand the environmental effects of generating unit planned outages, BC Hydro undertook a flow modelling study to determine the likelihood of flows into Lower Bridge River and Seton River exceeding the WUP Order target flow schedule. The risk of exceedance was calculated based on 53 years of inflow data. The flow modelling study methodology and results are included in the EIS provided as Appendix B-13.

The results of the modelling demonstrate that planned outages at the Bridge River 1 Generating Station can be expected to result in negligible impacts on water quantity and/or fish and fish habitat in Lower Bridge River. Modelling results shown in Figure 5-3 below indicate that for planned outages of eight, 10 or 12 months, exceeding the WUP Order target flow schedule for Lower Bridge River would occur in 0.2 to 0.9 per cent of 53 modelled years.[102]

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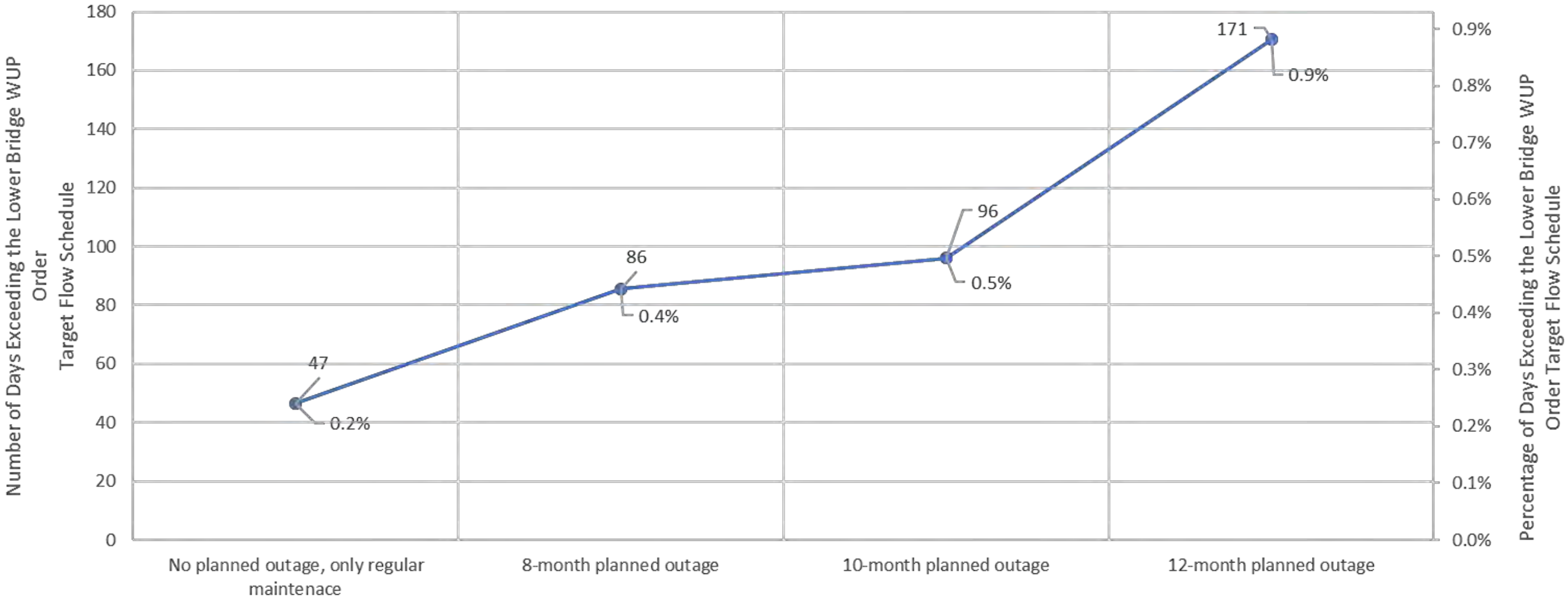
[102] The eight-month outage was modelled to represent the baseline outage. The 10-month and 12-month outage duration scenarios were modelled to determine the potential impacts of a longer planned outage.

**Figure 5-3** Number and Percentage of Days Exceeding the Lower Bridge WUP Order Target Flow Schedule in 53 Years With Different Planned Outage Duration



#### *5.8.2.3 Managing Water Flows If More than One Unit Is Unavailable*

With the phased implementation approach described in section 5.8.2.2, it is not expected that more than one generating unit will be taken out of service at any time. However, in the event that more than one unit is unavailable during the planned outage, a temporary installation of a turbine energy dissipation device could potentially mitigate the risk of higher flows by conveying water without operating the generator and turbine. A turbine energy dissipation device is currently being designed for the Wahleach Generating Station and will serve as a pilot for a similar device at the Bridge River 1 Generating Station during BR1 Project construction. While the BR1 Project cost estimate includes the budget for this device, BC Hydro will decide whether to include this device in the project implementation plan based on the performance observed at the Wahleach Generating Station. The decision to include this device will be reviewed by the Joint Planning Forum where representatives from St’át’imc and BC Hydro make recommendations on the technical scope of work.

#### *5.8.2.4 Identified Impacts and Mitigation to Fish and Fish Habitat*

The assessment area provides fish habitat for resident and anadromous salmonids as well as other fish species. Resident salmonids (Rainbow Trout, Bull Trout, Mountain Whitefish and Kokanee), anadromous salmonids (Chinook Salmon, Coho Salmon, Sockeye Salmon, Pink Salmon and Steelhead), and instream fish habitat were selected as key indicators for the fish and fish habitat valued component. Both resident and anadromous salmonids reside in the assessment area for all or part of their life cycle and in-stream fish habitat is important in sustaining fish populations. Instream fish habitat includes physical habitat for rearing, adult holding and feeding, overwintering, and spawning, as well as other measures of fish habitat including food availability (e.g., phytoplankton and zooplankton), and water quality parameters (e.g., water temperature and total dissolved gas).

As outlined in section 5.8.2.2, modelling results indicate that planned outages at the Bridge River 1 Generating Station are expected to have negligible impacts to water quantity and with the phased implementation approach to mitigate the risk of an unplanned outage during a planned outage, the likelihood of impacts to fish and fish habitat are expected to be negligible.

#### *5.8.2.5 Additional Environmental Monitoring Programs*

While operating under the approved WUP Variance Orders issued to BC Hydro by the Comptroller of Water Rights, BC Hydro has implemented additional monitoring programs to inform decisions on flow releases that could impact the rate of increase, the peak flow, the duration of discharge at various levels and the ramp down of the actual flows that influence fish and fish habitat during the BR1 Project's construction period.

The additional monitoring programs implemented include:

- St'át'imc traditional use impact;
- Ramp down monitoring and salvage;
- Sediment/substrate mapping and impact assessment;
- Juvenile chinook emergence timing, rearing habitat and abundance;
- Adult salmon and steelhead spawning/distribution using telemetry and counts;
- Assessment of vegetation community change and response to high flow events;
- Seton River fish and fish habitat monitoring;
- Carpenter fish entrainment assessment and modeling; and
- Downton Reservoir riparian vegetation.

These monitoring programs are reviewed by the Joint Planning Forum where representatives from St'át'imc and BC Hydro make recommendations on the technical scope of work. The monitoring programs are delivered by St'át'imc environmental businesses that hold contracts with BC Hydro. Where necessary, St’át’imc business entities subcontract to a variety of consultants to provide additional technical support.

BC Hydro included an estimated cost of $3.5 million for these monitoring programs in the BR1 Project cost. The actual costs will depend on the number of high flow events incurred during construction[103].

### 5.8.3 Socio-Economic Impact

#### *5.8.3.1 Valued Components Identified*

The EIS that BC Hydro commissioned from Hemmera Envirochem Inc. also included identification and assessment of the potential impacts of the BR1 Project on the social environment, including potential mitigation required to address these impacts.

Social, economic, and cultural valued components were identified based on: input received from the St’át’imc Nation on similar past BC Hydro projects; prior experience with similar-sized hydroelectric projects in the area; professional judgement; and scientific and regulatory considerations. The valued components considered were:

- **Labour Force:** specifically, changes in demand for local labour and changes in demand for non-local labour;
- **Housing and Accommodation:** specifically, changes in demand for local accommodation and changes in local accommodation availability;
- **Community Safety and Wellbeing:** specifically, changes in community safety and well-being, influx of non-local workers, and changes in demand for local emergency, health and policing services; and

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[103] As discussed in section 5.4.5, a special reserve has been set aside to mitigate this risk if it arises.

- **Transportation, Traffic and Road Safety:** specifically, changes in traffic volumes.

The socio-economic assessment concludes that negative social impacts associated with the BR1 Project are negligible (localized, short-term, reversible and not measurable on the socio-economic community) for the housing and accommodation valued component and positive for the labour force valued component.

Negative social impacts were identified for the community safety and wellbeing valued component and the transportation, traffic and road safety valued component. Construction activities are being planned to minimize potential negative effects to the social valued components and the BR1 Project's construction management plan and the Bridge River Contract Worker Conduct Requirements[104], discussed further in section 5.8.3.2 below, will be implemented to address social impacts.

The findings of the socio-economic assessment are documented in the EIS provided as Appendix B-13. Each of the valued components and the associated mitigation plans, where required, are discussed in the sub-sections below.

#### *5.8.3.2 Valued Components Assessed*

*Labour Force*

The BR1 Project is expected to have a small overall positive impact on local employment and businesses during the Implementation phase. The BR1 Project may lead to an increase in business, employment, education and training opportunities for St'át'imc communities. The ability of local residents and the St'át'imc Nation to benefit from these opportunities would depend on their skills and occupational training, as well as ongoing engagement between BC Hydro and the St'át'imc Nation to identify opportunities.

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[104] The Bridge River Contract Worker Conduct Requirements are provided as Appendix B-14.

*Housing and Accommodation*

A significant proportion of the labour resources on the BR1 Project will be from outside the local communities and will require local accommodation while working on the BR1 Project. The vacancy rate in the local area is usually high as BC Hydro’s contractors are the main population requiring temporary accommodation. Therefore, it is expected that the increase in demand for temporary accommodation will be managed within the existing capacity of the local area including the Lil’tem Mountain Hotel, Crane’s Landing RV Park, Whitecap Housing Units, Highline Pub Hotel and some Seton Portage rental houses. If local accommodation shortages occur, contractors and visitors would stay in hotels in the Lillooet area. If required, a water taxi service for travel to/from Lillooet could be provided. BC Hydro will plan ahead and assist in locating suitable accommodation or suggest alternative solutions such as split shifts and/or schedule extensions, where possible, to manage capacity constraints and the impact on local communities.

*Community Safety and Wellbeing*

The influx of temporary workers to the local area has the potential to impact the community’s sense of safety and wellbeing if external workers are involved in negative social behaviors or are disrespectful of local ways. The presence of temporary, non-local workers may also place strain on local emergency services. The St’át’imc community of Tsal'álh is adjacent to the Bridge River 1 Generating Station and close to the BR1 Project site. Tsal'álh and St’át’imc leadership have expressed concerns with the conduct of workers staying in or travelling through their communities, during previous BC Hydro projects.

BC Hydro recognises that its relationship with the St’át’imc Nation is integral to the ongoing operations of facilities in St’át’imc Territory. We are committed to developing a collaborative and respectful working relationship with the St’át’imc Nation. BC Hydro and the St’át’imc Nation jointly developed the Bridge River Contract Worker Conduct Requirements, provided as Appendix B-14, in response to specific concerns raised by the St’át’imc community of Tsal’slh. The Bridge River Contract Worker Conduct Requirements include specific requirements for all workers while in the Bridge River area, including when offsite or outside of working hours. These requirements will be implemented for the BR1 Project. These requirements supplement the Contractor Standards for Ethical Conduct that each contractor is contractually required to comply with at all times. The requirements in the Bridge River Contract Worker Conduct Requirements include:

- **Travel Requirements:** specifically, requiring compliance with applicable laws, speed limits, and school zone restrictions, and prohibiting alcohol or drug consumption;
- **Workers Accommodation Requirements:** specifically, setting forth unacceptable behaviours such as illicit drugs use or possession, disrespectful behaviour, theft, vandalism, violence, unruly parties, unlawful behavior, and failure to respect personal privacy of residents; and
- **Worker Recreation Requirements:** specifically, setting out requirements for workers taking part in recreational activities, such as obeying road and property restrictions, following local restrictions, obtaining licenses, and not hunting, fishing or harvesting on St’át’imc reserve lands.

BC Hydro will work with contractors on compliance with the Bridge River Contract Worker Conduct Requirements and will ensure that all contractors are well prepared to adhere to all of BC Hydro’s rules and regulations relating to safety, travel, the environment, and standards of conduct. If BC Hydro receives a complaint or reports of damage, it will initiate an investigation into the complaint or report. Each complaint will be managed on a case-by-case basis and the outcome will be determined by the applicable code, law or act. BC Hydro will not tolerate any criminal behaviour or activities. Contractor employees who engage in inappropriate behaviour will be directed off site and will not be permitted to work at any other BC Hydro facilities.

If measures are needed in response to the COVID-19 pandemic, the BR1 Project will operate under the requirements of the Provincial Health Office Industrial Camp Order. Currently, there are BC Hydro projects in the area successfully working under this provincial order. The BR1 Project will have an emergency response plan that outlines the planned response, equipment needed, and action plan for medical emergencies, fire or natural hazard events, and environmental spills.

*Transportation, Traffic and Road Safety*

The BR1 Project site is relatively remote with difficult road access over steep mountain terrain with unstable slope conditions. During BR1 Project construction, there would be a temporary increase in highway and secondary road traffic delivering materials and personnel to and from the construction sites. Transportation will be a combination of light trucks for personnel and heavy trucks for equipment and materials. Increases in traffic volumes could affect road and traffic conditions and potentially the safety of road users.

BC Hydro is implementing the following mitigation plans to mitigate the transportation and traffic impacts:

- To reduce traffic in the area and reduce parking requirements at site, BC Hydro will require contractors to use carpooling or shuttle services;
- To minimize the risk of accidents and risk to public safety, appropriate traffic control measures and signage will be implemented according to WorkSafeBC’s Operational Health and Safety Regulation and BC Hydro safety management policies;
- All workers and contractors will be required to follow the BC Hydro Travel Code of Conduct to ensure compliance with a basic set of rules created to maintain minimum safety requirements and respectful and lawful behaviour, and all applicable provincial laws; and

- If BC Hydro receives any motor vehicle complaints, BC Hydro will undertake an investigation into the complaint. Each complaint will be managed on a case-by-case basis and the outcome will be determined by the applicable code, law or act.

### 5.8.4 Impact on Transmission System

BC Hydro does not expect any significant incremental transmission interconnection or bulk system impacts as a result of the BR1 Project. The incremental generation output of up to 26 MW associated with the BR1 Project represents approximately 1.4 per cent of the total generation capacity in the coastal region[105]. This increase will reduce transfer demands on transmission infrastructure from the Interior to the Lower Mainland and may decrease bulk transmission losses during system peak operating periods.

### 5.8.5 Public Works Impact

No impacts are expected on public works as the BR1 Project activities will be conducted within the existing Bridge River Facility. There will be no new or expanded public works, undertakings or infrastructure required as a result of the BR1 Project.

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[105] For further discussion, please refer to section 8.3.2 in Chapter 8.

# BC Hydro Bridge River Projects

# Bridge River 1 Units 1 to 4 Generator Replacement Project

# Chapter 6

## Indigenous Nations Consultation and Public Engagement

# Table of Contents

6.1 Introduction ..... 6-1
6.2 Indigenous Nations Consultation and Engagement ..... 6-1
  6.2.1 Introduction ..... 6-1
  6.2.2 Identification of Indigenous Nations ..... 6-4
    6.2.2.1 St'át'imc Nation ..... 6-5
    6.2.2.2 Tŝilhqot'in Nation ..... 6-8
  6.2.3 Duty to Consult ..... 6-9
    6.2.3.1 The Duty to Consult and the Role of Negotiated Agreements ..... 6-9
    6.2.3.2 St’át’imc Nation ..... 6-9
    6.2.3.3 Tŝilhqot'in Nation ..... 6-13
  6.2.4 Consultation and Engagement ..... 6-14
    6.2.4.1 St’át’imc Nation ..... 6-14
    6.2.4.2 Tŝilhqot'in National Government ..... 6-22
  6.2.5 Adequacy of Consultation and Accommodation ..... 6-23
6.3 Public Engagement ..... 6-24
  6.3.1 Introduction ..... 6-24
  6.3.2 Local Community Setting ..... 6-25
  6.3.3 Stakeholder Engagement Approach ..... 6-26
  6.3.4 Engagement Activities to Date ..... 6-27
  6.3.5 Public Support and Issues Identified ..... 6-28
  6.3.6 Plan for Ongoing Public Engagement Activities ..... 6-29

# List of Figures

Figure 6-1 Map of St’át’imc Territory ..... 6-7
Figure 6-2 Map of Tŝilhqot'in Stewardship Agreement Engagement Zones ..... 6-8

# List of Tables

Table 6–1 Indigenous Nations and Consulting Organization ..... 6-4
Table 6–2 Summary of Engagement with St’át’imc on the BR1 Project ..... 6-15

Table 6–3 Summary of Key Interests and Concerns Raised ...................... 6-19

# 6.1 Introduction

This chapter describes the consultation and engagement[106] that BC Hydro has undertaken with respect to Indigenous Nations (section 6.2) and public stakeholders (section 6.3) specific to the BR1 Project.

# 6.2 Indigenous Nations Consultation and Engagement

## 6.2.1 Introduction

The BR1 Project will take place within St’át’imc Territory (**Territory**) and within Engagement Zone A as defined within the Tŝilhqot'in Stewardship Agreement among the Tŝilhqot'in National Government, Tŝilhqot’in Nation and the Government of B.C. The Tŝilhqot'in National Government represents Tŝilhqot’in Nation and Tŝilhqot'in communities for purposes of engagement under the Tŝilhqot'in Stewardship Agreement.

The BR1 Project is not anticipated to have significant potential impacts on the Tŝilhqot’in Nation or Tŝilhqot'in communities. BC Hydro informed the Tŝilhqot'in National Government of the BR1 Project and that no significant impacts are expected. The Tŝilhqot'in National Government informed BC Hydro that they have no concerns with the BR1 Project moving forward.

BC Hydro has been working with the St’át’imc Nation and the St’át’imc communities for several decades regarding their interests and concerns with the Bridge River Generation and Transmission System. The construction and operation of BC Hydro’s facilities in the Bridge River System caused significant impacts to the environment and way of life, culture, heritage and values of the St’át’imc in their Territory. In May 2011, after 17 years of negotiations, the St’át’imc Nation, BC Hydro and the Government of B.C. signed a historic and comprehensive set of

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[106] In the context of its relationships with Indigenous Nations, BC Hydro uses the term “engagement” (or “engage”) to describe its activities undertaken to satisfy the Crown’s duty to consult, but also to describe BC Hydro’s broader activities to build relationships and advance reconciliation with Indigenous Nations.

agreements, which settled the past, present and future impacts of the existing facilities and operations. These agreements include: the St’át’imc (Participating Communities) Settlement Agreement; the Certainty Provisions Agreement; and the Relations Agreement (collectively referred to as the 2011 Agreements). The 2011 Agreements contemplated future repair, alteration, upgrade, removal or replacement for the Bridge River System facilities, including generating unit replacements, such as those being advanced through the BR1 Project. A description of these agreements is provided in Appendix A-6-1.

In 2019, BC Hydro and St’át’imc entered into another agreement, the 2019 High Flow Settlement Agreement, as an outcome of dispute resolution proceedings in accordance with the 2011 Agreements, on how to address concerns and impacts of higher flows on the Lower Bridge River. A description of the 2019 High Flow Settlement Agreement is also provided in Appendix A-6-1.

Through the 2011 Agreements and 2019 High Flow Settlement Agreement, BC Hydro and St’át’imc have structured their overarching and long-standing relationship in connection with the Bridge River System facilities. A key goal of the Relations Agreement is to foster respectful and effective relations.

The 2011 Agreements and the 2019 High Flow Settlement Agreement govern how BC Hydro and St’át’imc consult in relation to the Bridge River System, including the BR1 Project. Accordingly, BC Hydro and St’át’imc have carried out engagement in accordance with the terms and conditions of the 2011 Agreements and 2019 High Flow Settlement Agreement, discussed in detail below and in Appendix A-6-1.

Through this engagement, BC Hydro has confirmed to St’át’imc that the BR1 Project is not expected to result in incremental or material adverse impacts to St’át’imc’s Aboriginal rights given that the BR1 Project is replacing existing generating equipment within the existing footprint of the Bridge River 1 Generating Station. The BR1 Project will enhance BC Hydro’s ability to reliably meet water flow targets through Terzaghi Dam to Lower Bridge River, therefore supporting an important core interest for St’át’imc to protect fish and fish habitat.

Many of the interests and concerns that St’át’imc has expressed to BC Hydro are related to BC Hydro’s broader operations and capital work in the Bridge River System as a whole (e.g., how operations and water flows can impact fish and other St’a’timc values). BC Hydro has considered St’át’imc’s interests across projects and operations as a whole.

Through ongoing engagement, areas of concern for St’át’imc have been identified related to water conveyance, the influx of temporary workers in communities and contracting opportunities. Additional information on the interests and concerns raised by St’át’imc is provided in section 5.8 of Chapter 5. These concerns have been, and will continue to be, addressed through existing relationship forums, as defined by the 2011 Agreements and 2019 High Flow Settlement Agreement. A communications and engagement plan is being developed by BC Hydro, with input from St’át’imc, to specify activities and timelines for this ongoing work.

This section is structured as follows:

- Section 6.2.2 identifies Indigenous Nations potentially affected by the BR1 Project;
- Section 6.2.3 sets out the consultation and engagement framework for the BR1 Project, which for St'át'imc Nation is set out in BC Hydro’s agreements with the St'át'imc Nation;
- Section 6.2.4 describes the consultation and engagement undertaken to date between BC Hydro and the St’át’imc Nation, and BC Hydro and the Tŝilhqot'in National Government, with respect to the BR1 Project, and our plans for continued engagement; and

- Section 6.2.5 provides BC Hydro’s assessment of the adequacy of the consultation and engagement with the St’át’imc Nation and Tŝilhqot'in National Government.

### 6.2.2 Identification of Indigenous Nations

This section identifies the Indigenous Nations potentially affected by the BR1 Project and the process BC Hydro used to identify the affected Nations and provides a high-level description of each of the Nations identified.

The Bridge River 1 Generating Station is located within St’át’imc Nation Territory. St’át’imc and BC Hydro have a long-standing relationship, and BC Hydro’s understanding of St’át’imc’s interests in the Territory is informed by over 30 years of active engagement.

The BR1 Project is also within Engagement Zone A of the Tŝilhqot'in Nation. The Engagement Zone A overlaps with a portion of St’át’imc Territory.

BC Hydro also reviewed the provincial Consultative Area Database (**CAD**) to confirm our understanding of the Indigenous Nations with a potential interest in the project area.

Table 6–1 below provides the Indigenous Nations, communities and other governing organizations identified by the provincial CAD in relation to the BR1 Project. As set out in Table 6–1, only Indigenous Nations represented by the St’át’imc Nation or Tŝilhqot'in National Government were identified.

**Table 6–1 Indigenous Nations and Consulting Organization**

| Indigenous Nations, Nation-level Organizations and Governments Identified by Provincial CAD | Indigenous Organization Responsible for Consultation |
|---|---|
| N’Quatqua First Nation | St’át’imc Authority / St’át’imc Government Services |
| Sekw’el’was First Nation | |
| T’it’q’et Administration/ P’egp’ig7lha Council | |
| Tsal’álh First Nation | |

| Indigenous Nations, Nation-level Organizations and Governments Identified by Provincial CAD | Indigenous Organization Responsible for Consultation |
|---|---|
| Xwísten First Nation | |
| St’át’imc Chiefs Council | |
| Lillooet Tribal Council[107]<br>(includes six of the St’át’imc member nations: Sekw’el’was, T’it’q’et / P’egp’ig7lha, Tsal’álh, Ts’kw’aylaxw, Xaxli’p, Xwísten) | |
| Toosey Indian Band | Tŝilhqot'in National Government |
| Tŝilhqot'in National Government | |

### *6.2.2.1 St'át'imc Nation*

St’át’imc Territory is located in south-central British Columbia and covers a total area of 2.2 million hectares. St'át'imc are the original inhabitants of the Territory which extends north to Churn Creek and to South French Bar; northwest to the headwaters of the Bridge River; north and east toward Hat Creek Valley; east to the Big Slide; south to the island on Harrison Lake and west of the Fraser River to the headwaters of the Lillooet River, Ryan River and Black Tusk. This Territory contains a rich and varied landscape of rivers, lakes, mountains and lowlands, and supports diverse ecosystems and habitats for plants, animals, and humans which St’át’imc have relied on for centuries. St'át'imc assert Aboriginal title and rights to this Territory and on May 10, 1911 the Declaration of Lillooet Tribe was signed by 17 St'át'imc Chiefs asserting that the St'át'imc are the rightful owners of the Territory and everything pertaining thereto. They also assert that they have at no time deserted this Territory or left it to others[108].

St'át'imc Nation is composed of 11 distinct and self-governing communities, each of which has distinct linguistic, cultural, familial and political ties to the St'át'imc Nation. The eleven communities include: Tsal’álh (Seton Lake), Xwísten (Bridge River),

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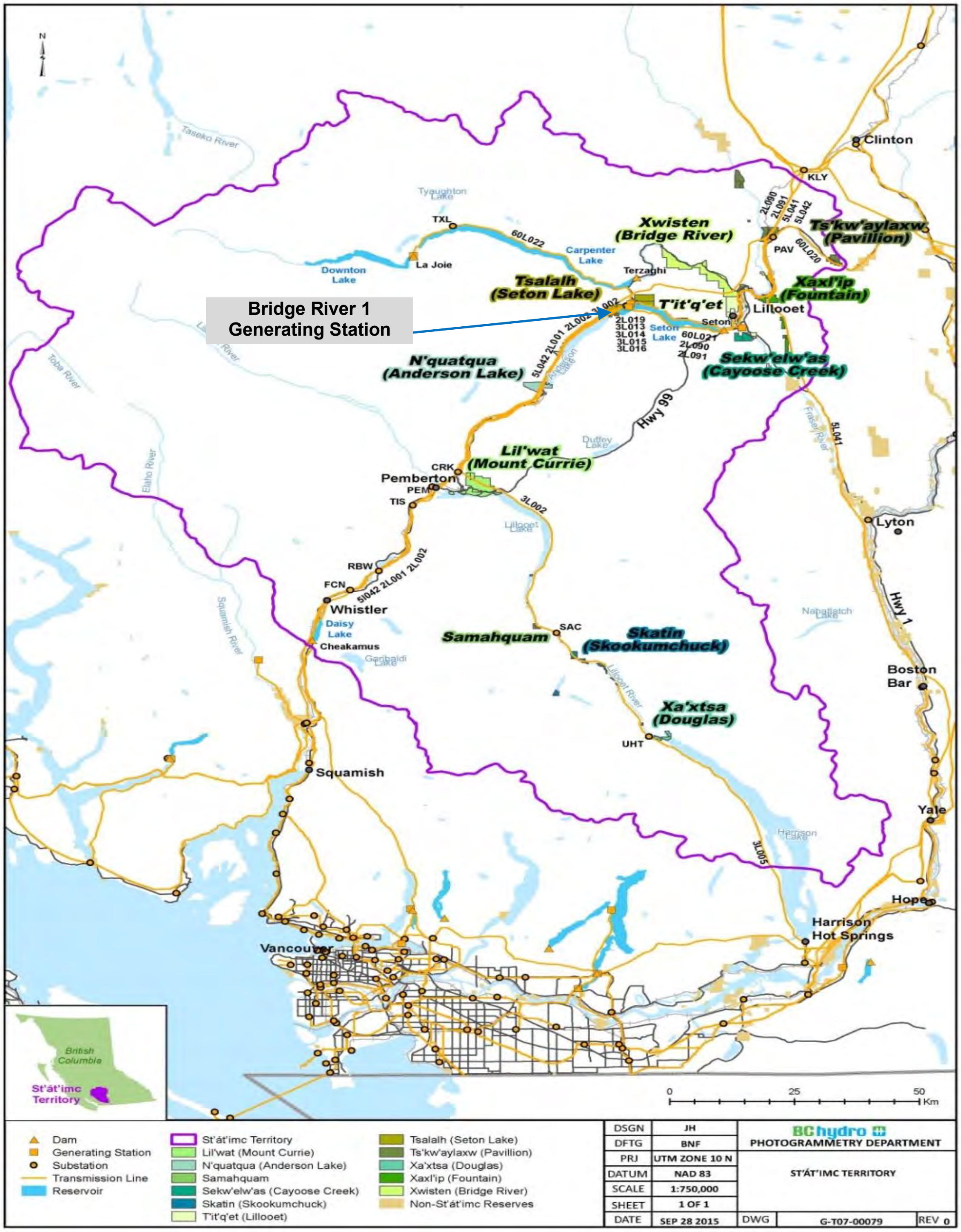
[107] All the communities represented by the Lillooet Tribal Council are represented through the St’át’imc Chiefs Council and within the St’át’imc - BC Hydro Agreements, and as such BC Hydro has not separately engaged with the Lillooet Tribal Council.

[108] Source: Stage 1 Report: A Historical Geography of the St’át’imc. St’át’imc Socio-economic Impact Assessment, October 2003.

Sekw’el’was (Cayoose Creek), N’Quatqua (Anderson Lake), T’it’q’et/ P’egp’ig7lha (Lillooet), Xaxli’p (Fountain), Ts'kw'aylaxw (Pavilion), Samahquam, Skatin, Xa’xtsa (Douglas) and Lil’wat Nation (Mount Currie). St’át’imc has identified five communities that are considered to have a greater interest in activities within the Bridge River System: Tsal’alh, Xwísten, Sekw’el’was, N’Quatqua and T’it’q’et/P’egp’ig7lha. These communities have been more directly involved in consultation and engagement activities on the BR1 Project and BC Hydro’s broader ongoing capital work at the Bridge River System facilities. In addition, Tsal’alh, being located immediately adjacent to the Bridge River System facilities, has a greater interest in local activities and potential impacts associated with the activities at those facilities.

Figure 6-1 below provides a map of St'át'imc Nation territory and the location of the 11-member communities.

1 **Figure 6-1 Map of St’át’imc Territory**

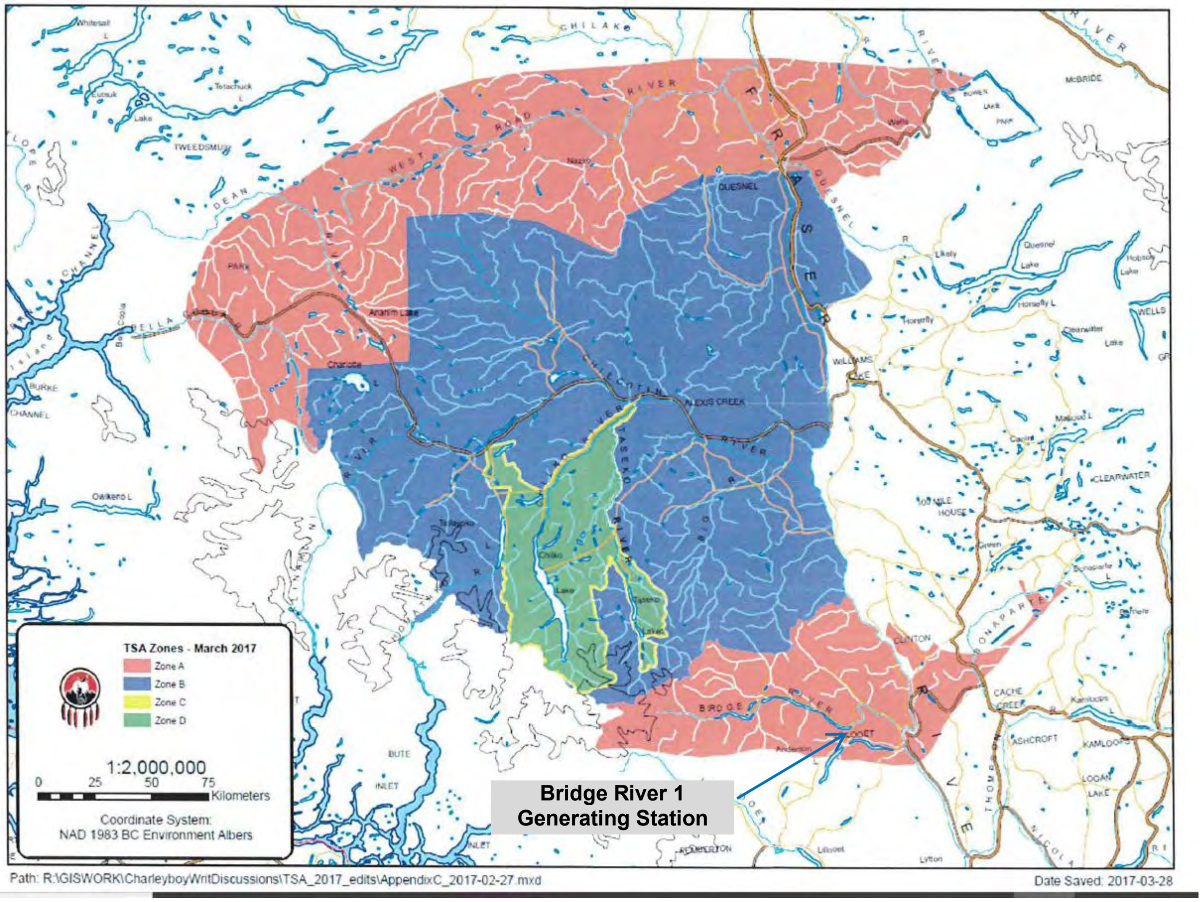


#### *6.2.2.2 Tŝilhqot'in Nation*

The BR1 Project falls within Engagement Zone A as defined within the Tŝilhqot'in Stewardship Agreement. The BR1 Project is not taking place on Tŝilhqot'in Aboriginal Title Lands.

Figure 6-2 below provides a map of Engagement Zone A and the location of the Bridge River 1 Generating Station.

**Figure 6-2 Map of Tŝilhqot'in Stewardship Agreement Engagement Zones**



### 6.2.3 Duty to Consult

#### *6.2.3.1 The Duty to Consult and the Role of Negotiated Agreements*

As a Crown agent, BC Hydro must act honourably when undertaking activities that have the potential to affect Indigenous Nations. This includes consulting with Indigenous Nations and, where appropriate, accommodating an Indigenous Nation when BC Hydro contemplates a decision or conduct that may adversely affect asserted or established Aboriginal rights or title held by that Nation.[109] The scope and content of consultation can be shaped by agreement between an Indigenous Nation and the Crown.[110]

In the case of the St’át’imc Nation, the scope and content of the duty to consult has been defined by the 2011 Agreements and 2019 High Flow Settlement Agreement. In the case of the Tŝilhqot'in Nation, the scope and content of the duty to consult has been defined by the Tŝilhqot'in Stewardship Agreement.

#### *6.2.3.2 St’át’imc Nation*

In 2011, BC Hydro and the Government of B.C. entered into a series of agreements with the St’át’imc Nation which settled (through financial payments, commitments to mitigation measures or otherwise) the past, present and future impacts of the existing Bridge River System facilities[111] and operations (the 2011 Agreements). The 2011 Agreements created new, mutually agreed processes for engagement between BC Hydro and the St’át’imc Nation, which were supplemented by a further agreement in 2019. Under the 2011 Agreements and the 2019 High Flow Settlement Agreement, BC Hydro and the St’át’imc Nation have mutually agreed to the processes through which the Crown’s duty to consult and accommodate would be

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[109] Refer to *Haida Nation v. British Columbia (Minister of Forests)*, 2010 SCC 73 (**Haida**) and the cases following it.

[110] Refer to Beckman v. Little Salmon/Carmacks First Nation, 2010 SCC 53 (**Beckman**).

[111] Bridge River System (referenced as “Bridge-Seton” in the agreements) generation facilities include the Bridge River 1, Bridge River 2, and Seton generating stations.

satisfied in respect of the Bridge River System facilities, including the BR1 Project, as further described below.

*The Relations Agreement*

One of the 2011 Agreements is the Relations Agreement. It establishes specific requirements and processes for engagement regarding the ongoing operations and maintenance of the Bridge River System facilities, as well as for “New Facilities” in the Bridge River System. The BR1 Project will not require a new water licence or material amendment to a water licence. As such, it is not a “New Facility” as defined in the Relations Agreement.[112]

As set out in the Relations Agreement, engagement requirements for ongoing operations and maintenance of the Bridge River System facilities include, among other things:

- Information sharing on various topics including operations updates, safety matters, capital plans and policies, environment and natural resources mitigation initiatives, and the health and welfare of people, fish, wildlife and habitat in St’át’imc territory;
- Preparing an Annual Operations Update that describes BC Hydro’s plans for operation, maintenance, inspection and closures, and collaborating on the review and refinement of the information in the Annual Operations Update;
- Sharing and review of Environmental Management Plans for the Bridge River System facilities;
- Providing certain notifications related to ground disturbance that could impact St’át’imc cultural heritage, work on reserve, and environmental incidents; and

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[112] Appendix A-6-1 provides more details on the definitions and requirements with regard to operation and maintenance work and a “New Facility”.

- Information sharing and collaboration on business, employment, education and training opportunities.

This engagement is informed by the goal in the Relations Agreement of fostering respectful and effective relations between the parties, including responding to interests and opportunities, such as contracting opportunities.

As outlined in section 6.2.4 below, BC Hydro has fulfilled, and will continue to fulfill, its obligations to engage with the St’át’imc Nation in accordance with the Relations Agreement.

*The 2019 High Flow Settlement Agreement*

The engagement provided for in the Relations Agreement was supplemented and expanded through the 2019 High Flow Settlement Agreement. The 2019 High Flow Settlement Agreement was entered into following a period in which BC Hydro was unable to meet certain Lower Bridge River flow targets set out in the Bridge River WUP Order and in the 2011 Agreements. St’át’imc expressed deep concern regarding the impacts of these higher flows to fish and fish habitat and their way of life. BC Hydro and St’át’imc engaged in formal dispute resolution proceedings on how to address the impact of higher flows in Lower Bridge River which led to the 2019 High Flow Settlement Agreement.

The 2019 High Flow Settlement Agreement established new processes to enable improved collaboration on BC Hydro’s capital projects and operations, including:

- A Joint Planning Forum comprised of three representatives from BC Hydro and three representatives from St’át’imc who meet monthly, or more, as required. The mandate of Joint Planning Forum includes (amongst other things) reviewing the planned timing, duration and scope of capital and maintenance projects (including outages) at the Bridge River System facilities that significantly impact water management, as well as updates as work progresses;

- An expanded, in-depth process for engagement between the St’át’imc Nation and BC Hydro on capital planning for the Bridge River System facilities, including:
    - Quarterly Capital Planning Meetings to inform the St’át’imc Nation regarding the status of capital projects; allowing the parties to engage in collaborative problem-solving discussions at the earliest possible time in a project’s life-cycle; enabling St’át’imc to provide feedback concerning potential adverse impacts; and identifying potential employment, training, and / or procurement opportunities for the St’át’imc Nation related to the capital work; and
    - Funding for the St’át’imc Nation to employ a full-time Capital Planning Manager.

As outlined in section 6.2.4 below, BC Hydro has fulfilled, and will continue to fulfill, its obligations to engage with the St’át’imc Nation in accordance with the 2019 High Flow Settlement Agreement.

### *The Certainty Provisions Agreement*

The Certainty Provisions Agreement, which is one of the 2011 Agreements, provides at section 3.5(a) that the St’át’imc Nation acknowledges that any and all obligations to consult with them regarding the Bridge River System facilities would be satisfied by the 2011 Agreements and performance by BC Hydro and the Government of B.C. of their obligations under the 2011 Agreements. In addition, under sections 3.5(b) and (d), respectively, the St’át’imc Nation acknowledges that “any infringement of any aboriginal title or rights….has been accommodated” by the 2011 Agreements and that the 2011 Agreements “are accepted voluntarily for the purpose of making full and final compromise….settlement and satisfaction of all claims” related to the existing facilities. The Certainty Provisions Agreement also states that the St’át’imc Nation agrees not to oppose any of the authorizations held or sought by BC Hydro for the existing facilities (see section 2.7(d)) and not to interfere with any of the existing facilities, including the development, operation, maintenance, repair, alteration or upgrade of such facilities (see section 2.7(c)).

BC Hydro has complied, and will continue to comply, with the provisions of the 2011 Agreements and 2019 High Flow Settlement Agreement. Further, if a disagreement arises with the St’át’imc Nation in relation to the implementation of the 2011 Agreements, including scope and content of consultation, the 2011 Agreements provide dispute resolution provisions so that disagreement can be resolved. Neither party has triggered the dispute resolution provisions in relation to consultation on the BR1 Project.

#### *6.2.3.3 Tŝilhqot'in Nation*

The Tŝilhqot'in Nation has established Aboriginal title to certain lands and, as a result, the Tŝilhqot'in Nation and the Government of B.C. entered into the Tŝilhqot'in Stewardship Agreement (amended on March 31, 2017).

Under the Tŝilhqot'in Stewardship Agreement, no engagement is required within Engagement Zone A unless the planned activity meets the criteria defined in Engagement Level 4 or 5. Engagement Level 4 criteria include: significant fish and wildlife impacts; significant water and land impacts; significant land alteration; major policy changes, including major policy changes that could result in legislation that could have a significant potential to impact Aboriginal Rights; major new access structures; Aboriginal activities or rights potentially displaced / irreplaceable in a specific area; and long standing replacements of existing tenures that created high previous impact on Aboriginal rights or title claims. Engagement Level 5 criteria include environmental assessments undertaken pursuant to the *Environmental Assessment Act*.

Though not a party to the Agreement, BC Hydro follows the protocol established by the Tŝilhqot'in Stewardship Agreement with respect to consultation on activities in the territory. For the BR1 Project, BC Hydro has concluded that the engagement requirements are on the lower end of the engagement levels described in the Tŝilhqot'in Stewardship Agreement as BC Hydro does not anticipate that the BR1 Project will have impacts that meet the criteria for Engagement Level 4 or 5.

### 6.2.4 Consultation and Engagement

This section summarizes BC Hydro’s consultation and engagement with the St’át’imc Nation and Tŝilhqot'in National Government.

#### *6.2.4.1 St’át’imc Nation*

*Collaborative Consultation and Engagement with St’át’imc Nation*

As noted above, consultation and engagement with the St’át’imc Nation on the BR1 Project has been undertaken in accordance with the 2011 Agreements and 2019 High Flow Settlement Agreement. BC Hydro has shared information on the scope and schedule for the BR1 Project, alternatives considered, workforce planning (transportation and accommodation) and potential impacts to the environment and water flows. This information has been shared through the established relationship forums, including Annual Operations Updates dating back to 2015 and, more recently, engagement through the Quarterly Capital Planning Meetings and Joint Planning Forum. These relationship forums have adapted over time based on information shared by St’át’imc with respect to their interests and to ensure information sharing, participation and reporting continue to be effective for the circumstances. More information on these relationship forums and overall relationship governance is provided in Appendix A-6. In addition to these forums, BC Hydro shared information with St’át’imc through letters, fact sheets and additional briefings. Table 6–2 below provides a summary of the engagement activities completed to date. The engagement and consultation record is provided as Appendix A-6-6.

**Table 6–2 Summary of Engagement with St’át’imc on the BR1 Project**

| Date and Forum | Discussion Topics |
|---|---|
| Annual Operations Update – 2015 | Planned replacement of Bridge River 1 Units included in information sharing on long-term generation capital plans. |
| Annual Operations Update – 2016 | Planned replacement of Bridge River 1 Units included in information sharing on long-term generation capital plans. |
| Initial Notification Letters Sent, November 18, 2016 (Unit 4 Scope Only) | Provided notification that the Bridge River 1 Unit 4 project had been initiated. Described scope, timing and alternatives being considered. Noted that the majority of work would be within the Bridge River 1 powerhouse and parking lot and that ground disturbance would be limited to two geotechnical drill holes on either side of the powerhouse. Also noted that Bridge River 1 Units 1 to 3 were in similar condition and under consideration for combining all unit replacement work into one project. |
| Annual Operations Update - 2017 | Provided an update on ongoing planning for the Bridge River 1 Unit 4 project and that the replacement of Bridge River 1 Units 1 to 3 was included in in longer-term generation capital plans. |
| June to November 2017 | Held a series of meetings related to workforce planning (accommodation and transportation) for upcoming Bridge generation capital work, starting with the Bridge River 2 generating station projects (beginning construction in 2018) and forecasting out to longer-term projects to identify opportunities to coordinate with communities and St’át’imc businesses. Shared workforce projections and discussed potential contracting opportunities related to worker transportation and accommodation. |
| October 2017 – Fact Sheet Emailed | Provided an overview of active and planned generation capital projects, including the Bridge River 1 generator replacement work, planned timing (including outage schedule), potential implications for water management, and outlook on temporary workforce volumes and potential contracting opportunities. |
| Annual Operations Update - 2018 | Noted that Bridge River 1 Generating Units 1 to 4 replacement work had been combined into one active project. Information was shared on current project activities including preliminary and detailed design of the generators, exciters and governors; the CPCN application to the BCUC; and procurement of long lead time items. |
| June 2018 – Meeting (at Bridge River) | Provided an overview of capital projects and planned outages over 10 to 15-year period at a meeting attended by St’át’imc and BC Hydro senior leadership. Discussed possible approaches, including scheduling changes, to mitigate future high flows. |

| Date and Forum | Discussion Topics |
|---|---|
| January 2019 – Capital Projects Update Meeting | Shared information on current project activities and noted that the Bridge River 1 Units 1-4 project schedule was under review. Introduced the BCUC CPCN regulatory process. |
| Annual Operations Update – 2019 | Provided an Annual Operations Update, which included an update on the schedule and regulatory process requirements. |
| June 2019 to April 2020 - Joint Steering Committee Working Group on Community Safety | Discussed Community Safety and worker code of conduct to address issues and concerns related to temporary workers in the community including cultural awareness and incident management. |
| November 25, 2019 – Quarterly Capital Planning Meeting | Held the first formal Quarterly Capital Planning Meeting following signing of 2019 High Flow Settlement Agreement for general planning purposes, including a discussion of the approach to capital project engagement. |
| February 3, 2020 – Project Fact Sheet Emailed | Provided a written fact sheet (Project Information Update) with an overview of the scope, alternatives, timing and potential impacts. |
| February 5, 2020 – Quarterly Capital Planning Meeting | Included the BR1 Project in capital plan overview discussions and highlighted the upcoming CPCN application to the BCUC and opportunities for input. |
| March 4, 2020 – St'át'imc Authority Meeting | Provided an update on recent work by BC Hydro and St'át'imc Government Services related to improving the capital project engagement process to better incorporate St'át'imc values, issues and concerns. Requested input and feedback on this work. |
| May 13, 2020 – Briefing note | Provided St'át'imc Government Services with a briefing note to support seeking direction from the St'át'imc Authority on further engagement required on the BR1 Project. The briefing note included an overview of the project and schedule and described the contents of the application to the BCUC that was being prepared, including the socio-economic assessments. Requested direction on the proposed approach for engagement related to project and regulatory activities. |
| July 6, 2020 - Email | Provided a draft socio-economic impact baseline report to St'át'imc Government Services for comment and input. |
| July 16, 2020 – Quarterly Capital Planning Meeting (virtual) | Provided an update on the BCUC CPCN application being prepared and sought input. |

| Date and Forum | Discussion Topics |
|---|---|
| July/August 2020 – Draft of BCUC application Chapter 6 (Indigenous Nations Consultation) shared with St’át’imc | Provided a draft to the St’át’imc Relations Manager for review and distribution within St’át’imc which was tabled for discussion at the August 12, 2020 St’át’imc Authority meeting. No specific issues or concerns were raised about additional potential impacts or concerns beyond those already captured in the draft. In this discussion, the parties discussed the applicability of the New Facilities definition in the Relations Agreement to this project and BC Hydro confirmed that the BR1 Project does not constitute a New Facility. St’át’imc has not raised further questions or concerns about this matter. |
| September 28 and October 22/23, 2020 – Joint Planning Forum meetings | Shared detailed flow modelling for the BR1 Project with the Joint Planning Forum and requested input on the findings and endorsement for the recommendation on outage timing. No concerns were raised, and endorsement was received at the October 2020 meeting. |
| October 6, 2020 – Project presentation to St’át’imc | Held a virtual meeting and provided a presentation on project overview, the BCUC application content and process, and draft content in the Environmental Impact Statement, with particular focus on the socio-economic analysis and flow modelling. Provided an update with regard to Directive 29 in the BCUC’s Decision on BC Hydro’s Fiscal 2020 to Fiscal 2021 Revenue Requirements Application, directing BC Hydro to file a joint application for the BR1 Project and the BRT Project and explained the associated implications for the application filing schedule. |
| November 25, 2020 – Quarterly Capital Planning Meeting | Shared an update on the project, including efforts underway to determine a revised regulatory filing schedule and expected impact to the BR1 Project in-service date. Also shared an information sheet describing the high level procurement strategy and highlighting potential opportunities for St’át’imc contracting. Followed up with additional conversations on potential contracting interests between November 2020 and February 2021. |
| February 9, 2021 | Brief update on the BR1 Project and the intention to file an application covering both the BR1 Project and the BRT Project with the BCUC. |
| April 30 to May 28, 2021 | Shared drafts of Chapters 1 to 12 of the Application for review and comment, as well as appendix materials relevant to St’át’imc consultation. Funding from BC Hydro was provided to support its review by St’át’imc’s external consultant. |
| May 20, 2021 – Presentation | Presented an overview of the BR1 Project and BRT Project Application. |
| July 12, 2021 - St’át’imc Review of application content | A memo outlining St’át’imc questions and concerns with respect to the content of the Application to the BCUC was provided to BC Hydro. Feedback has been incorporated into the Application and BC Hydro will continue to address St’át’imc’s input through further ongoing engagement. |

| Date and Forum | Discussion Topics |
|---|---|
| July 21, 2021 | BC Hydro provided a letter to St’át’imc Government Services outlining our intent to submit the Application, our commitment to continue to work together to address concerns, and how they can participate in the BCUC review process. |

*St’át’imc Interests and Concerns Raised and BC Hydro’s Responses*

This section summarizes the interests and concerns raised by St’át’imc regarding potential impacts from the BR1 Project.

Construction activities for the BR1 Project will occur primarily within the Bridge River 1 Generating Station and are not anticipated to result in any incremental adverse impacts on the Aboriginal rights of the St’át’imc Nation.

Areas of concern raised by St’át’imc related to construction activities outside of the generating station include:

- Potential temporary impacts to water flows in the Bridge-Seton Watershed related to the unit outages required for the BR1 Project and the potential impacts to fish, fish habitat and cultural uses in the rivers as a result of the outages. Further information on potential environmental impacts is provided in section 5.8.2 of Chapter 5 and Appendix B-13; and
- Potential local community impacts associated with influx of temporary workers, including impacts to cultural safety and wellbeing (e.g., culturally offensive and racist behaviour) as well as impacts to the safety of road users related to increased traffic volumes. Further information on potential socio-economic impacts is provided in section 5.8.3 of Chapter 5 and Appendix B-13.

In addition to these concerns, St’át’imc also has expressed interest in benefits from the BR1 Project, including potential contracting opportunities for St’át’imc businesses.

Table 6–3 below summarizes key interests and concerns raised by St’át’imc or a St’át’imc community and BC Hydro’s responses.

**Table 6–3 Summary of Key Interests and Concerns Raised**

| Indigenous Nation / Community | Topic | Interest / Concern | BC Hydro Response | Comments |
|---|---|---|---|---|
| St’át’imc | Water flows – impacts to fish and fish habitat | St’át’imc has raised, through various forums, concerns about the impact of BC Hydro work on fish and fish habitat in the Bridge Seton Watershed. High flow events between 2015 and 2018 resulted in flows above WUP Order target flows and there is an interest in reducing future potential impacts that could result from ongoing generation capital work required to replace end-of-life equipment in the system. | BC Hydro and St’át’imc have worked closely, including through a formal dispute resolution process, to understand and address these impacts, resulting in the 2019 High Flow Settlement Agreement.<br>The outages due to the construction of the BR1 Project have been scheduled to minimize the likelihood of system impacts and the risk is considered to be low. This has been shared with St’át’imc and there will be ongoing communication with St’át’imc throughout the project. | Discussion on flow modelling results is provided in section 5.8.2.2 of Chapter 5 and in Appendix B-13.<br>BC Hydro presented the flow modelling to the Joint Planning Forum on September 28, 2020, and no major issues or concerns were raised. |

| Indigenous Nation / Community | Topic | Interest / Concern | BC Hydro Response | Comments |
|---|---|---|---|---|
| Tsal'alh and St'át'imc | Influx of temporary workers | The community of Tsal'alh has raised concerns with regard to impacts related to workers coming into the local area, including concerns related to traffic safety and cultural sensitivity. With the COVID-19 pandemic, there have been additional concerns related to an influx of workers and potential impacts on community health. | The joint St'át'imc – BC Hydro Steering Committee established a working group in 2019 to consider these impacts and put in place measures to address and mitigate these impacts. Outcomes of this work include a Bridge River Code of Conduct with input from St'át'imc. All workers coming into the Territory must sign the code of conduct to note their acknowledgement of the requirements for working within the St'át'imc communities and are also provided with cultural awareness training at the start of on-site work.<br>With regard to the COVID-19 pandemic, new measures have been put in place at site, developed through consultation with Tsal'alh, which meet current government guidelines. BC Hydro is collaborating with St'át'imc in the development of the socio-economic analysis for this work. Section 5.8.3 of Chapter 5 provides additional details. | This ongoing work has been an important step in improving the relationship between BC Hydro and St'át'imc and in particular between Bridge River site staff and Tsal'alh. With the opportunity to continue to test and refine these processes over the next several years, it is expected that there will be well-developed processes for the BR1 Project during construction.<br>The analysis on workforce numbers is being expanded to look across projects in order to understand total impact of workers on communities in the region. This will involve collaboration with St'át'imc on how to address or mitigate any impacts. |

| Indigenous Nation / Community | Topic | Interest / Concern | BC Hydro Response | Comments |
|---|---|---|---|---|
| St'át'imc | Contracting opportunities | St'át'imc has a long-standing interest in greater access to and certainty related to contracting opportunities. The 2011 Agreements and 2019 High Flow Settlement Agreement have contracting opportunity provisions. | BC Hydro has provided information on the BR1 Project procurement approach, including a two-year look ahead (which is a commitment from the 2019 High Flow Settlement Agreement) and a more detailed fact sheet on key work packages to create an outlook for long-term investment decisions for St'át'imc businesses. There will be ongoing dialogue between St'át'imc and BC Hydro as the project progresses to identify opportunities for direct and indirect awards to St'át'imc Designated Businesses. | Ongoing conversations about contracting opportunities are aligned with implementing the processes set out in the 2011 Agreements and 2019 High Flow Settlement Agreement. |

*Ongoing St'át'imc Nation Consultation*

Consultation and engagement on the BR1 Project will be ongoing throughout the life of the BR1 Project and will include the following in accordance with the 2011 Agreements and 2019 High Flow Settlement Agreement.

- **Joint Planning Forum:** There will be ongoing engagement at the Joint Planning Forum to review outage planning in the context of seasonal flows, operating constraints, and other considerations related to fish and fish habitat. The Joint Planning Forum will determine appropriate actions required for managing any increased risk to flows, as a planning function, and as the work progresses, to react to any changing conditions. Joint Planning Forum meetings occur on a monthly basis and discussions related to the BR1 Project at this forum will occur as needed in the lead up to construction and throughout the duration of Implementation phase.

- **Environmental Management Plan:** Draft Environmental Management Plans for the project will be shared with St’át’imc for review and input.
- **Quarterly Capital Planning Meetings:** At these meetings, BC Hydro will share near- and longer-term outlooks on potential contracting opportunities associated with the BR1 Project. There will be continued dialogue around potential opportunities based on St’át’imc business capacity, interests and new partnerships. These meetings occur on a quarterly basis and discussions on the BR1 Project at the meetings will occur as needed in the lead up to construction and throughout the duration of the Implementation phase.
- **Community Impacts and Safety:** There will be additional engagement on workforce forecasts across BC Hydro projects, and engagement with St’át’imc, to further understand potential concerns and interests, including collaboration on strategies to mitigate potential negative impacts. The Bridge River Code of Conduct and related protocols will be implemented during the project, including protocols for communicating with Tsal’alh in the case of conduct violations.
- **Regulatory Process:** There will be ongoing updates and engagement on the Application and this proceeding, as required.

The specific timing for these activities will be detailed in the communication and engagement plan being developed.

#### *6.2.4.2 Tŝilhqot'in National Government*

*Consultation and Engagement Approach*

Engagement with Tŝilhqot'in National Government on the BR1 Project has been undertaken in accordance with the guidelines set out in the Tŝilhqot'in Stewardship Agreement, as described in section 6.2.3.3 above. In February 2020, BC Hydro submitted to the Tŝilhqot'in National Government Stewardship Portal basic information on the BR1 Project, including scope, alternatives, schedule and considerations related to archaeology, environment and flows. On April 1, 2020, BC Hydro received a response from the Tŝilhqot'in National Government indicating that it did not have any concerns with the BR1 Project moving forward. A copy of the response is provided in Appendix A-6-10.

Tŝilhqot'in has not raised any issues or concerns related to the BR1 Project to date.

BC Hydro will provide updates and summary information to the Tŝilhqot'in National Government if there are material changes to the BR1 Project.

### 6.2.5 Adequacy of Consultation and Accommodation

The role of the BCUC is to assess adequacy of consultation up to the time of the decision. In this case, the scope of that duty has been mutually defined by agreements between the Nations and the Crown and BC Hydro. The BCUC therefore must look to those agreements to assess where a duty is owed, the scope of that duty, and the content of meaningful consultation appropriate to the circumstances, including accommodation.[113]

With respect to the St'át'imc Nation, the 2011 Agreements and 2019 High Flow Settlement Agreement settle claims in relation to the existing facilities and set out how the parties conduct meaningful consultation and accommodation with respect to maintenance, repairs and upgrades of those existing facilities, which includes the BR1 Project. BC Hydro has consulted, and will continue to consult, in accordance with the terms of the 2011 Agreements and 2019 High Flow Settlement Agreement. BC Hydro's consultation and accommodation complies, and will continue to comply, with the terms of the 2011 Agreements and 2019 High Flow Settlement Agreement, and is, and will continue to be, consistent with the requirements of the duty to

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[113] See *Beckman*.

consult as set out in *Haida*. Therefore, BC Hydro submits that the BCUC will be able to conclude that consultation has been adequate.

St’át’imc’s concerns about elevated flows in the Bridge-Seton generation system, the influx of temporary workers and procurement opportunities are being addressed through existing processes and ongoing engagement. No other concerns with the BR1 Project were identified by St’át’imc.

Engagement with Tŝilhqot'in has been undertaken in accordance with the guidelines set out in the Tŝilhqot'in Stewardship Agreement. Tŝilhqot'in has not identified any concerns with the BR1 Project. BC Hydro’s consultation with the Tŝilhqot'in Nation to date complies with the Tŝilhqot'in Stewardship Agreement and satisfies the duty to consult the Tŝilhqot'in Nation.

Throughout the BR1 Project lifecycle, BC Hydro will continue to involve the St’át’imc Nation in accordance with the 2011 Agreements and 2019 High Flow Settlement Agreement and will continue to consult with Tŝilhqot'in under the Tŝilhqot'in Stewardship Agreement. BC Hydro will respond to any questions or concerns they raise.

## 6.3 Public Engagement

### 6.3.1 Introduction

BC Hydro is committed to ensuring local government, stakeholders and the public are informed about the BR1 Project, understand the need for the BR1 Project, and have opportunities to provide their feedback. Ongoing engagement activities have resulted in limited feedback and few questions with respect to the BR1 Project. The few questions received have generally been related to potential economic benefits of the BR1 Project and community safety (e.g., BC Hydro’s plans to mitigate the risk of transmission of COVID-19 during the construction stage). Aligning with the

International Association for Public Participation[114] (**IAP2**) best practices, BC Hydro has engaged at an appropriate level with stakeholders of the project and provided them with an opportunity to share issues or concerns for BC Hydro's consideration and response. BC Hydro has concluded that the public engagement undertaken in connection with the BR1 Project has been adequate to support its decision to file the Application. Engagement activities will continue to keep local government, stakeholders and the public informed.

### 6.3.2 Local Community Setting

The BR1 Project will largely take place within the existing Bridge River 1 Generating Station. The generating station is located near Area A and within Area B of the Squamish Lillooet Regional District in Seton Portage/Shalalth. Area B is more than 7,000 square kilometres and has a population of more than 1,700. The Bridge River 1 Generating Station is about 70 kilometres west of Lillooet and 75 kilometres northeast of Pemberton.

BC Hydro identified the following groups, in the vicinity of the Bridge River 1 Generating Station, to engage through an engagement process. These groups were identified based on BC Hydro's experience with past project consultation activities in the region:

- Chamber of Commerce: District of Lillooet;
- Municipal and Regional District Governments: District of Lillooet, Regional District Squamish-Lillooet;
- Members of the Legislative Assembly: Fraser-Nicola;
- Bridge River Valley Community Association;
- News and media organizations; and

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[114] IAP2 is an international association of members who seek to promote and improve the practice of public participation / public engagement in relation to individuals, governments, institutions, and other entities that affect the public interest in nations throughout the world. Website: https://iap2.org.

- General public.

### 6.3.3 Stakeholder Engagement Approach

BC Hydro’s engagement practices are grounded in IAP2. Aligning with these practices, stakeholders are considered to be those directly impacted by the outcome of a decision or project activities. IAP2 also provides a framework to assess the level of stakeholder engagement.

BC Hydro has pursued a public consultation approach for groups within the vicinity of the Bridge River 1 Generating Station that is commensurate with the level of expected potential impact as a result of the BR1 Project.

As the BR1 Project will largely take place within the existing Bridge River 1 Generating Station, engagement activities are focused on keeping stakeholders informed of the BR1 Project and the BR1 Project’s timeline and activities as work progresses. Engagement also includes identifying and mitigating potential stakeholder impacts (e.g., traffic, worker accommodation and water management) from the BR1 Project outside of the facility as required.

Project activities and progress are presented as part of the broader communications and engagement strategy for all planned Bridge River System capital investments. This includes recurring updates to local elected officials, chambers of commerce and other key stakeholders. This strategy was designed to meet the needs of local elected officials and community members who have formally expressed interest in learning more about BC Hydro’s capital investments in the Bridge River System as a whole and the related opportunities and potential impacts to local communities.

The specific objectives of the public engagement efforts for the BR1 Project are to:

- Ensure local government, stakeholders and the public are informed about the status of and the need for the BR1 Project;

- Provide the opportunity for input from local governments, stakeholders and the public on potential issues and concerns with the BR1 Project for BC Hydro's consideration and resolution where possible;
- Foster established, and develop new relationships, in the local communities, building on trust from previous interactions; and
- Build the groundwork for future interactions between BC Hydro and the communities.

### 6.3.4 Engagement Activities to Date

Consistent with the approach discussed above, engagement activities to date have included:

- Profiling BR1 Project work on BC Hydro's website (www.bchydro.com/bridgeriver)
- Regular delegations to the Squamish-Lillooet Regional District to provide bi-annual updates on the capital plan for the region, including the BR1 Project. Delegations took place in:
    - December 2017;
    - July 2018;
    - February 2019;
    - September 2019;
    - February 2020;
    - November 2020; and
    - April 2021.
- Regular delegations to the District of Lillooet to provide bi-annual updates on the capital plan for the region, including the BR1 Project. Delegations took place in:

  - March 2019;
  - October 2019;
  - June 2020;
  - November 2020; and
  - April 2021.
- Meetings with the Lillooet Chamber of Commerce in:
  - December 2018; and
  - May 2019;
- A Public Open House in May 2019;
- Updates in the summer 2019 and spring 2021 edition of the Bridge River System newsletter; and
- An update on the capital plan for the region which was shared with the District of Lillooet Economic Advisory Committee in May 2021.

Examples of engagement materials, including the consultation log, are provided as Appendix B-15.

### 6.3.5 Public Support and Issues Identified

Feedback received to date has been largely in-person, during engagement events. Overall, there is a general understanding of the need for the BR1 Project. Questions received about the BR1 Project have been mostly related to the benefits of installing the new equipment and any increases in capacity, operation of the equipment, related infrastructure and the BR1 Project planning process. These questions were responded to verbally during engagement meetings.

Recent feedback from local governments has centered on BC Hydro’s response to the COVID-19 pandemic and the community’s concern over virus transmission. BC Hydro is following its company-wide Pandemic Response Plan that outlines our response to various stages of an outbreak and our plans for critical and supporting functions. Our employees and contractors are following all Government of B.C. and Government of Canada requirements around social distancing and self-isolation. Our pandemic response plan has been shared with local governments, stakeholders and the public. Updates are communicated as our plan changes in response to current conditions.

### 6.3.6 Plan for Ongoing Public Engagement Activities

Engagement activities will continue to keep local government, stakeholders and the public informed. This includes continued use of delegations to local government, the Bridge River System newsletter and other in-person meetings. BC Hydro will focus on building email distribution lists as well as other digital communications tools and will also work with stakeholders such as the District of Lillooet Chamber of Commerce to help distribute communications through existing channels.

# BC Hydro Bridge River Projects

# Bridge River 1 Units 1 to 4 Generator Replacement Project

# Chapter 7

## Risks and Risk Management

# Table of Contents

7.1 Introduction ........ 7-1
7.2 BR1 Project Risks Were Identified and Analyzed Considering Past Experience and Established Risk Matrix ........ 7-2
  7.2.1 BC Hydro Incorporated Experience from 10 Similar Major Projects ........ 7-2
  7.2.2 Consequences, Probabilities and Severities Have Been Assigned to Each Identified Risk ........ 7-3
7.3 Definition Phase Risks and Treatment Plans ........ 7-5
  7.3.1 BC Hydro is Implementing Measures to Mitigate the Risk of this Regulatory Proceeding Impacting the BR1 Project Schedule ........ 7-5
  7.3.2 BC Hydro is Implementing Measures to Mitigate Bid Price Uncertainty from a Changing Generator Supply Market ........ 7-6
  7.3.3 BC Hydro is Implementing Measures to Mitigate the Risk of BR1 Project Resources Contracting or Transmitting COVID-19 ........ 7-7
7.4 Implementation Phase Risks and Treatment Plans ........ 7-9
  7.4.1 BC Hydro will be Implementing Measures to Mitigate the Risk of Delays Impacting the Required Duration of Planned Outages ........ 7-10
  7.4.2 BC Hydro will be Implementing Measures to Mitigate the Risk of Fire in the Work Area during the Construction Stage ........ 7-11
  7.4.3 BC Hydro will be Implementing Measures to Mitigate the Risk of Safety Incidents in a Constrained Work Area ........ 7-12
  7.4.4 BC Hydro will be Implementing Measures to Mitigate the Risk of Delays due to Multiple Interdependent Activities ........ 7-14
  7.4.5 BC Hydro is Implementing Measures to Mitigate Additional Cost Risk ........ 7-15
  7.4.6 BC Hydro will be Implementing Measures to Mitigate the Risk of Limited Workforce Accommodation Availability ........ 7-16
  7.4.7 BC Hydro will be Implementing Measures to Mitigate the Risk of Delay due to Space Constraints ........ 7-17
  7.4.8 BC Hydro will be Implementing Measures to Mitigate the Risk of Impacts on Local Communities ........ 7-18
  7.4.9 BC Hydro will be Implementing Measures to Mitigate the Risk of a Supplier Unable to Deliver on Contractual Obligations ........ 7-19

7.4.10 BC Hydro will be Implementing Measures to Mitigate the Risk of a Seismic Event Causing Significant Damage to the Bridge River 1 Generating Station During Construction ............ 7-19
7.5 Retained Operational Risks and Risk Management Plans ........................ 7-20
7.5.1 Bridge River 1 Generating Station Foundation Stability ............ 7-21
7.5.2 Bridge River 1 Generating Station Powerhouse Seismic Performance ........................................................................ 7-22
7.5.3 Bridge River 1 Generating Station Penstocks Seismic Withstand ........................................................................ 7-22
7.5.4 Santa Clause Mountain Slope Failure ........................................ 7-23

## List of Tables

Table 7-1 Summary of Risk of this Proceeding Impacting the Schedule for the BR1 Project ...................................................... 7-5
Table 7-2 Summary of Changing Generator Supply Market Risk ............... 7-6
Table 7-3 Summary of Risk of Resources Contracting or Transmitting COVID-19 ........................................................................ 7-8
Table 7-4 Summary of Schedule Delay Risk ............................................ 7-10
Table 7-5 Summary of Risk of Fire during Construction ........................... 7-12
Table 7-6 Summary of Risk of Safety Incidents in a Constrained Work Area ........................................................................ 7-13
Table 7-7 Summary of Multiple Interdependent Activities Risk ................. 7-14
Table 7-8 Summary of Additional Cost Risk Impacts ................................ 7-15
Table 7-9 Summary of Limited Accommodation Availability for Workforce Risk ........................................................................ 7-16
Table 7-10 Summary of Schedule Delay Risk due to Space Constraints .... 7-17
Table 7-11 Summary of Risk of Impacting the Local Communities ............. 7-18
Table 7-12 Summary of Risk of Supplier Not Delivering on Obligations Due to Credit Failure ................................................................ 7-19
Table 7-13 Summary of Seismic Event Risk During Construction .............. 7-20

## 7.1 Introduction

Over the life of the BR1 Project, risks and associated risk treatments are and will be identified, analyzed, and continuously monitored and reviewed, in accordance with BC Hydro’s project management practices and procedures, through the following key risk management activities:

- First, risks are identified based on input from the project team, Indigenous Nations and key stakeholders, as well as lessons learned from similar past projects;
- Second, a qualitative and/or quantitative risk analysis is performed for identified risks to determine their consequence type, severity and likelihood. This analysis is then used to determine the required level of oversight in accordance with the identified Project Risk Zone in the Project Delivery Risk Matrix;
- Third, appropriate treatment plans to respond to the risks are developed based on the identified Project Risk Zone and with defined timelines and risk owners; and
- Fourth, risks and reporting of risks are monitored and reviewed on a regular basis so that the appropriate audience is informed, and any required updates are made.

Further information on BC Hydro’s Project Delivery risk management process and Project Delivery Risk Matrix is provided in Appendix A-7.

BC Hydro has identified three material risks[115] in the Definition phase of the BR1 Project, 10 material risks for the Implementation phase of the BR1 Project and four material operational risks at the Bridge River 1 Generating Station that will be retained following the implementation of the BR1 Project. Associated risk treatments have been identified to manage each of these material risks.

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[115] BC Hydro defines ‘material” in this case to be any risk with a pre-treatment risk score in the Executive Risk Zone, as identified in the Project Delivery Risk Matrix, which is provided as Appendix A-7.

This chapter is structured as follows:

- Section 7.2 explains how these risks were identified and analyzed;
- Section 7.3 identifies and discusses three material risks identified for the Definition phase of the BR1 Project;
- Section 7.4 identifies and discusses 10 material risks identified for the Implementation phase of the BR1 Project; and
- Section 7.5 identifies and discusses the four retained operational risks at the Bridge River 1 Generating Station following the implementation of the BR1 Project that may impact the realization of the BR1 Project’s full benefits.

## 7.2 BR1 Project Risks Were Identified and Analyzed Considering Past Experience and Established Risk Matrix

Consistent with BC Hydro’s project management practices and procedures, risks to the BR1 Project were identified based on input from the project team, Indigenous Nations and key stakeholders, as well as lessons learned from similar past projects. Those identified risks were then analyzed and evaluated to determine their consequences and associated probabilities and severity.

### 7.2.1 BC Hydro Incorporated Experience from 10 Similar Major Projects

Over the past 15 years, BC Hydro has completed 10 major projects similar to the BR1 Project. These projects each involved major generator replacements, refurbishments or additions in existing operating facilities, totaling 25 generators, ranging in size from 70 MW to 500 MW. Specifically:

- Currently, BC Hydro is replacing Unit 1 at Wahleach Generating Station;
- At the Bridge River 2 Generating Station, BC Hydro replaced Units 5 and 6 in 2019 and is currently replacing Units 7 and 8;
- In 2020, BC Hydro replaced the Cheakamus Units 1 and 2 Generators;

- In 2018, BC Hydro refurbished the Ruskin Units 1 to 3 Generators;
- In 2016, BC Hydro added Units 5 and 6 at Mica Generating Station;
- In 2010, BC Hydro added Unit 5 at Revelstoke Generating Station;
- In 2009, BC Hydro replaced the G.M. Shrum Units 1 to 4 Generators and replaced the Mica Units 1 to 4 Generators; and
- In 2006, BC Hydro replaced the Peace Canyon Units 1 to 4 Generators.

Experience gained and lessons learned from these projects was considered, and where applicable, incorporated to identify and analyze risks for the BR1 Project. For example, BC Hydro considered past experience and lessons with regard to:

- Advancing procurement activities in the Definition phase;
- Managing the risk of encountering as-found conditions at brownfield sites;
- Managing higher flows within the Bridge River System during construction;
- Managing supplier manufacturing and logistical issues; and
- Managing accommodation constraints in the Seton Portage – Shalalth area.

### 7.2.2 Consequences, Probabilities and Severities Have Been Assigned to Each Identified Risk

BC Hydro has a Project Delivery Risk Matrix which sets out five consequence types that can be assigned to identified risks. The Project Delivery Risk Matrix is provided as Appendix A-7. The five consequence types set out in the risk matrix are:

- **Safety** risks which may result in the potential for harm to workers and/or the public;
- **Environmental** risks which may result in the potential for incidents impacting habitat and/or species;

- **Financial Loss** risks which may result in the potential for financial loss such as risks that could lead to a schedule delay, an increase in the cost of procuring equipment, or lost generation revenue;
- **Reputational** risks which may result in the potential loss of public trust or the loss of consent to operate; and
- **Reliability** risks which may result in a failure that impacts the reliability of equipment or the generating station or causes an outage for customers.

Once risks are identified and assigned a consequence type, they are analyzed and evaluated to determine the probability and severity of the consequence:

- The probability of the consequence measures the likelihood of the consequence occurring. It is assessed on a scale from L4 (0.1 per cent probability of occurrence) to L7 (60 per cent probability of occurrence);
- The severity of the consequence measures the degree of impact and is assessed on a scale from S1 to S6;[116]
- The probability and severity of the consequence measures are then combined to arrive at an overall pre-treatment risk score;[117] and
- Appropriate treatment plans are then developed, planned and/or implemented to either reduce the probability of the risk occurring, or the severity of the risk, should it occur. Residual probability and severity measures are then assigned to indicate the likelihood of occurrence and degree of impact, considering the mitigation measures that have been put in place. These measures are combined to arrive at an overall residual risk score.

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[116] For further details on the specific severity of impact by consequence type, refer to Appendix A-7.

[117] Further information on the probability and consequence measures and how those measures are combined to arrive at an overall pre-treatment risk score is provided in Appendix A-7.

## 7.3 Definition Phase Risks and Treatment Plans

Definition phase risk management focuses on the risks with the potential to impact BC Hydro’s ability to advance the BR1 Project into the Implementation phase. BC Hydro has three active material risks for the Definition phase:

1. A BCUC Order being issued later than expected or a BCUC Order declining to issue a CPCN for the BR1 Project;
2. The changing generator supply market, which may lead to greater proposal bid price uncertainty; and
3. BR1 Project resources contracting and / or transmitting COVID-19.

### 7.3.1 BC Hydro is Implementing Measures to Mitigate the Risk of this Regulatory Proceeding Impacting the BR1 Project Schedule

Table 7-1 below provides a summary of the risk of this regulatory proceeding impacting the schedule for the BR1 Project.

**Table 7-1 Summary of Risk of this Proceeding Impacting the Schedule for the BR1 Project**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Active | BC Hydro expects to proceed to the Implementation phase for the BR1 Project by April 2023. As procurement sourcing activities must be initiated ahead of this date to preserve the project in-service date schedule, BC Hydro is requesting a decision from the BCUC on whether to grant a CPCN for the BR1 Project by no later than July 2022.<br>BC Hydro has proposed a regulatory timetable that is consistent with this milestone. | Financial Loss | 10<br>**Probability:** Possible (L6)<br>**Severity:** $10M to $100M (S4) | 9<br>**Probability:** Remote (L5)<br>**Severity:** $10M to $100M (S4) |

To mitigate this risk, BC Hydro has identified and is implementing the following risk treatments:

- Developing a comprehensive Application;

- Responding to the BCUC's Decision on BC Hydro's Fiscal 2020 to Fiscal 2021 Revenue Requirements Application and to the interest of the BCUC and interveners in an overall system view and the economic value of the Bridge River System;[118]
- Proposing a regulatory schedule that allows for a decision by July 2022;[119] and
- Including a three-month schedule contingency to the BR1 Project schedule to mitigate any impact from a delay in this regulatory proceeding.

### 7.3.2 BC Hydro is Implementing Measures to Mitigate Bid Price Uncertainty from a Changing Generator Supply Market

Table 7-2 below provides a summary of the risk of a changing generator supply market, which may lead to greater proposal bid price uncertainty.

**Table 7-2 Summary of Changing Generator Supply Market Risk**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Active | The public procurement process for generators will seek bids from multiple generator suppliers.<br>Due to the changing generator supply market, including fluctuations in commodity pricing for steel and copper, as well as the remoteness of the Bridge River area, there is a risk that bidding suppliers may not accurately estimate the scope and risks associated with the generator replacement work.<br>This may result in a wide range of potential proposal bid prices. | Financial Loss | 11<br>**Probability:** Likely (L7)<br>**Severity:** \$10M to \$100M (S4) | 9<br>**Probability:** Possible (L6)<br>**Severity:** \$1M to \$10M (S3) |

To mitigate this risk, BC Hydro has identified and is implementing the following risk treatments:

- Completing an estimating analysis of the anticipated range for the generator replacement contract bid pricing and assigning a special reserve to account for

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[118] This information is provided in Chapter 2.

[119] For further information, refer to section 1.5.2 of Chapter 1.

market risks associated with the competitive bidding process for the generator replacement contract. Further information on this special reserve is provided in section 5.4.5 of Chapter 5;

- Notifying the market of the opportunity prior to the competition so that bids are received from a range of proponents through the public request for proposal process, leading to competitive prices;
- Undertaking market sounding activities in advance of the request for proposal process such as information sessions for interested suppliers;
- Arranging site visits for the bidders to ensure the location remoteness and associated risks will be accounted in their bid pricing;
- Familiarizing proponents with BC Hydro's practices and performance expectations through a Request For Information, which will precede the Request For Proposal;
- Developing comprehensive criteria for bid pricing evaluation; and
- Including the bid period of the public procurement process for the generator equipment in the Definition phase of the BR1 Project so that competitive market pricing for the replacement generators can be available at the same time as the preliminary cost estimate for First Full Funding Approval[120] is being developed.

### 7.3.3 BC Hydro is Implementing Measures to Mitigate the Risk of BR1 Project Resources Contracting or Transmitting COVID-19

Table 7-3 below provides a summary of the risk of BR1 Project resources contracting and/or transmitting COVID-19. This risk was identified in 2020 and has been successfully managed to date. With increased vaccination programs, this risk is diminishing, and BC Hydro will continue to manage the risk going forward.

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[120] First Full Funding Approval is the authorization to proceed to Implementation Phase and coincides with the Expenditure Authorization Request (**EAR**) for Implementation Phase funding and, when applicable, acceptance of regulatory approvals and license conditions.

**Table 7-3 Summary of Risk of Resources Contracting or Transmitting COVID-19**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Active | There is a diminishing risk that a resource or resources working on the BR1 Project contracts and/or transmits COVID-19.<br>This could have negative impact on the health of workers or contractors assigned to the BR1 Project. Sick or isolating workers may result in a delay in completing critical BR1 Project activities. | Safety | 10<br>**Probability:** Likely (L7)<br>**Severity:** Temporary Disability (S3) | 8<br>**Probability:** Remote (L5)<br>**Severity:** Temporary Disability (S3) |

To mitigate this risk, BC Hydro has identified and is implementing the following risk treatments:

- Following BC Hydro’s Pandemic Response Plan which complies with the Government of B.C and Government of Canada guidelines and requirements;
- Sharing BC Hydro’s Pandemic Response Plan with the St’át’imc Nation, local governments, stakeholders and the public; and
- Proactively keeping BR1 Project resources, the St’át’imc Nation, local governments, stakeholders and the public informed about BC Hydro’s response to the pandemic and plans for critical and supporting functions.

## 7.4 Implementation Phase Risks and Treatment Plans

Implementation phase risk management focuses on the risks that may potentially impact BC Hydro's ability to deliver the BR1 Project on time, on budget, and with no serious safety incidents[121] or preventable priority environmental incidents.[122]

BC Hydro has identified the following material risks[123] in the Implementation phase:

1. Contractor performance, construction delays or unanticipated events, which extend the duration of required planned outages leading to higher flows that exceed WUP Order flow targets;
2. Fire in the work area during the construction stage;
3. Potential safety incidents due to multiple workers and contractors working in a constrained work area;
4. Not meeting the BR1 Project's In-Service date due to multiple interdependent activities taking place concurrently such as detailed design, integration and supply from different original equipment manufacturers and brownfield construction within an operating generating station;
5. Additional costs, causing the project cost to exceed the BR1 Project Expected Cost Estimate;
6. Insufficient availability of local accommodations in the Seton Portage – Shalalth area for the required workforce to complete construction activities;

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[121] A serious safety incident is any incident that can reasonably be expected at the time of the incident to endanger life or cause permanent injury or violate one of BC Hydro's Life Saving Rules or WorkSafeBC's High Risk Strategies. Serious safety incidents include both traumatic injuries that are life threatening or that result in a loss of consciousness, and incidents such as chemical exposures, heat stress, and cold stress which are likely to result in a life threatening condition or cause permanent injury or significant physical impairment.

[122] Preventable priority environmental incidents are environmental incident types that pose high environmental, regulatory or reputational risk to BC Hydro. BC Hydro utilizes a suite of environmental management programs to prevent these incidents. Some key programs include developing environmental best practices, delivering environmental training and conducting environmental field reviews.

[123] While the COVID-19 pandemic is not identified as a material risk in the Implementation phase, the longer term impacts of COVID-19 post-pandemic are captured in the other identified risks and risk treatments.

7. Insufficient space for dismantling, pre-assembly, and installation of the generators, resulting in schedule delays;
8. Potential impacts to the health and safety of local communities;
9. Inability of a supplier to deliver on contractual obligations due to credit failure; and
10. A seismic event causing significant damage to the Bridge River 1 Generating Station.

### 7.4.1 BC Hydro will be Implementing Measures to Mitigate the Risk of Delays Impacting the Required Duration of Planned Outages

Table 7-4 below provides a summary of the risk of contractor performance, construction delays or unanticipated events that would extend the required duration of planned outages, leading to higher flows that exceed WUP Order flow targets.

**Table 7-4 Summary of Schedule Delay Risk**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | There is a risk that contractor performance, construction delays or unanticipated events extend the required duration of planned outages, which may lead to higher flows down Lower Bridge River that exceed the WUP Order flow targets and impact fish and fish habitat.<br>Exceeding WUP Order flow targets may cause concern for the St'át'imc Nation and require additional environmental mitigation and monitoring by the Comptroller of Water Rights.<br>There is also a cost associated with the additional environmental mitigation and monitoring required when WUP Order flow targets are exceeded. | Reputational | 11.5<br>**Probability:** Fairly Likely (L6.5)<br>**Severity:** Loss of trust - regulator and/or shareholder (S5) | 11<br>**Probability:** Possible (L6)<br>**Severity:** Loss of trust - regulator and/or shareholder (S5) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Completing an outage impacts analysis, based on 53 years of flow data, that models the high flow impacts due to various planned outage scenarios and sharing this data with the St'at'imc Nation, Comptroller of Water Rights and public stakeholders;
- Scheduling the planned outages after the break-in period for the newly replaced generators at the Bridge River 2 Generating Station;
- Scheduling one planned outage per year to avoid outage overlap;
- Minimizing outage impacts by starting planned outages in late spring / early summer, after the spring freshet;
- Minimizing the duration of planned outages and associated risk by performing constructability and staging reviews as well as pre-assembly of the replacement generators, prior to starting the planned outages;
- Including commercial terms in supply and installation contracts to reflect the importance of meeting performance milestones such as equipment delivered, pre-assembly completion and installation completion; and
- Assigning a special reserve to account for potential supplementary environmental mitigation and monitoring costs to the BR1 Project. Further information on this special reserve is provided in section 5.4.5 of Chapter 5.

### 7.4.2 BC Hydro will be Implementing Measures to Mitigate the Risk of Fire in the Work Area during the Construction Stage

Table 7-5 below provides a summary of the risk of a fire occurring in the work area during construction.

**Table 7-5 Summary of Risk of Fire during Construction**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | There is a risk that a fire may occur in the work area as a result of construction activities involving exposed flames as the space does not have automatic fire suppression.<br>This may result in minor injuries, disability or a fatality as well as damage to equipment and/or the loss of generation capability at the Bridge River 1 Generating Station. | Safety | 11<br>**Probability:** Possible (L6)<br>**Severity:** Fatality (S5) | 7<br>**Probability:** Remote (L5)<br>**Severity:** Treatment by Medical Professional (S2) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Installing an automatic fire suppression system to protect the area of the generating station where construction activities will be carried out. Installation will be completed prior to starting construction activities; and
- Requiring that all hot work procedures (e.g., welding, brazing, etc.) be completed in compliance with approved hot work permits. A hot work permit will require workers to have a fire watch monitoring safety hazards during these higher risk activities.

### 7.4.3 BC Hydro will be Implementing Measures to Mitigate the Risk of Safety Incidents in a Constrained Work Area

Table 7-6 below provides a summary of the risk of safety incidents occurring due to multiple workers and contractors working in a constrained work area.

**Table 7-6 Summary of Risk of Safety Incidents in a Constrained Work Area**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | The Bridge River 1 Generating Station has a constrained layout and a small assembly space. The station building also includes offices for the workers that operate and maintain the generating station which will be in use throughout the Implementation phase as at least three of the generating units will be operating regularly.<br>There is a risk of increased safety incidents that may result in worker injury, disability or a fatality from having workers and contractors performing operating, maintenance, and construction activities in adjoining or overlapping work areas. | Safety | 11<br>**Probability:** Possible (L6)<br>**Severity:** Fatality (S5) | 8<br>**Probability:** Possible (L6)<br>**Severity:** Treatment by Medical Professional (S2) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- BC Hydro assuming the role of Prime Contractor and assigning a BC Hydro Site Safety Coordinator to set the tone and culture for site safety and to maintain overall co-ordination and control of the site;
- Contractually requiring each contractor to develop Safety Management Plans, Safe Work Procedures and Emergency Response Plans before starting site work activities;
- Conducting daily safety meetings, safe work observations and ongoing safety audits of each contractor to ensure compliance with WorkSafeBC regulations, the contractor’s safety management system and other agreed standards and controls for occupational health and safety systems; and
- Developing an Owner’s Safety Plan and Occupational Health Identification Risk Assessment that will manage expectations related to known safety hazards.

### 7.4.4 BC Hydro will be Implementing Measures to Mitigate the Risk of Delays due to Multiple Interdependent Activities

Table 7-6 below provides a summary of the risk of not meeting the BR1 Project's In-Service Date due to multiple interdependent activities.

**Table 7-7 Summary of Multiple Interdependent Activities Risk**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | Due to scheduling constraints, multiple interdependent activities will take place concurrently. This creates a potential risk that the target Project In-Service Date milestone could be missed.<br>This may result in a delay in completing equipment replacements and continued exposure to the reliability issues with the existing generator equipment. | Financial Loss | 10.5<br>**Probability:** Fairly Likely (L6.5)<br>**Severity:** $10M to $100M (S4) | 9<br>**Probability**: Possible (L6)<br>**Severity**: $1M to $10M (S3) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Developing detailed management plans for procurement, construction, quality, environment and safety activities that clearly explain how the equipment will be manufactured, supplied, assembled, installed, commissioned and tested;
- Dividing the project scope into work packages and detailed activity lists to decrease exposure to unplanned work;
- Structuring and sequencing work activities in a manner that ensures the critical schedule path is understood and optimized;
- Assigning a dedicated BR1 Project scheduler to manage progress by frequently reviewing planned versus actual progress, resolving critical schedule path issues and employing a BC Hydro resource at the manufacturing facilities to oversee supplier's work and recovery plans, as required;

- Incorporating appropriate schedule contingencies to provide insurance for schedule risks; and
- Employing site trade resources from unions within the collective agreement between Columbia Hydro Constructors and the Allied Hydro Council[124], which contains a no-strike clause and provisions to address working conditions.

### 7.4.5 BC Hydro is Implementing Measures to Mitigate Additional Cost Risk

Table 7-8 below provides a summary of the risk of additional costs, causing the project cost to exceed the BR1 Project Expected Cost Estimate.

**Table 7-8 Summary of Additional Cost Risk Impacts**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | The complexity of the BR1 Project and the Bridge River System, the brownfield nature of the site, the required environmental monitoring, and the public procurement process creates the potential for additional cost risk impacts beyond those included in the BR1 Project Expected Cost Estimate.<br>Actions will be implemented to reduce the likelihood of these cost risks materializing and reserves will be included in the BR1 Project Authorized Cost Estimate to mitigate these cost risks, if realized. | Financial Loss | 10.5<br>**Probability:** Fairly Likely (L6.5)<br>**Severity:** $10M to $100M (S4) | 9<br>**Probability:** Possible (L6)<br>**Severity:** $1M to $10M (S3) |

To mitigate this risk, BC Hydro has identified and is implementing the following risk treatments:

- Incorporating recent experience gained from the replacement of Units 5, 6, 7 and 8 at the Bridge River 2 Generating Station as well as comparable projects implemented at other BC Hydro facilities;
- Conducting a detailed cost analysis using range estimating techniques (i.e., a Monte Carlo simulation) that consider differing levels of uncertainty for each

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[124] Columbia Hydro Constructors is a wholly owned subsidiary of BC Hydro and the Allied Hydro Council is a council of trade unions representing employees working on Columbia Hydro Constructors projects.

scope item to inform the contingency in the Expected and Authorized Cost Estimates; and

- Incorporating appropriate special reserves relating to known cost risks in the BR1 Project. Special reserves will only be accessible if those specific risks materialize. Further discussion on Project Reserves is provided in section 5.4.5 of Chapter 5.

### 7.4.6 BC Hydro will be Implementing Measures to Mitigate the Risk of Limited Workforce Accommodation Availability

Table 7-9 below provides a summary of the risk of insufficient availability of local accommodations in the Seton Portage – Shalalth area for the required workforce to complete construction activities.

**Table 7-9 Summary of Limited Accommodation Availability for Workforce Risk**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | There is a potential for the workforce required at site during construction to exceed the available local accommodations in the Seton Portage – Shalalth area due to multiple concurrent Bridge River Generation System projects.<br>This may result in reduced productivity associated with longer commute times to/from Lillooet, which will result in a reduction in overall productivity and cause delays in meeting schedule milestones. | Financial Loss | 10<br>**Probability:** Possible (L7)<br>**Severity:** $1M to $10M (S3) | 8.5<br>**Probability:** Fairly Likely (L6.5)<br>**Severity:** $100K to $1M (S2) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Prioritizing local accommodations for primary workers most likely to impact the schedule;
- Securing accommodations at hotels in Lillooet for supplementary workers and visitors;

- Assisting contractors with accommodation management and local vacancy listings; and
- As required, entering into a pre-arranged commercial agreements for reserved use of the local Lil'tem Hotel operated by the Tsah'alh Development Corporation.

### 7.4.7 BC Hydro will be Implementing Measures to Mitigate the Risk of Delay due to Space Constraints

Table 7-10 below provides a summary of the risk of schedule delay as a result of insufficient space for pre-assembly, dismantling, and installation of the generators.

**Table 7-10 Summary of Schedule Delay Risk due to Space Constraints**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | There is insufficient space in the Bridge River 1 Generating Station service bay to accommodate dismantling of the existing generators and the pre-assembly and / or installation of the replacement generators, in addition to required regular operating and maintenance activities.<br>The space constraints may result in delays to site construction activities. These delays could cause the sequencing of activities within specific areas to be modified, leading to unproductive downtime. | Financial Loss | 10<br>**Probability:** Likely (L7)<br>**Severity:** $1M to $10M (S3) | 9<br>**Probability:** Possible (L6)<br>**Severity:** $1M to $10M (S3) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Conducting an equipment pre-assembly, dismantling and installation sequence analysis to determine the best equipment staging arrangement with respect to the available floor space and the floor loading capacities; and
- Utilizing the service bay in the adjacent Bridge River 2 Generating Station for generator component pre-assembly activities.

### 7.4.8 BC Hydro will be Implementing Measures to Mitigate the Risk of Impacts on Local Communities

Table 7-11 below provides a summary of the risk of potential impacts to the health and safety of local communities due to the influx of temporary workers and contractors in the Seton Portage – Shalath area.

**Table 7-11 Summary of Risk of Impacting the Local Communities**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | The influx of temporary workers and contractors in the Seton Portage – Shalath area could lead to impacts on the health and safety of local communities. | Safety | 10<br>**Probability:** Possible (L6)<br>**Severity:** Temporary Disability (S4) | 8<br>**Probability:** Very Unlikely (L4)<br>**Severity:** Temporary Disability (S4) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Proactively working with the community of Tsal'alh and the Joint Steering Committee[125] as well as Contractors and Union Halls to increase awareness of evolving temporary worker changes and to help advance planning, preparation, coordination and communication; and
- Requiring all temporary workers to comply with a Bridge River Code of Conduct so that a basic set of rules to maintain civil behavior are followed and so that conflict with local residents is reduced. Divergence from Code of Conduct behaviors will be grounds for discipline and BC Hydro may exercise its rights under the Code of Conduct to direct workers off the work site.

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[125] The Joint Steering Committee is a group of BC Hydro and St'át'imc leadership representatives established in the 2011 Agreements to oversee implementation of the 2011 Agreements. More information on relationship governance is available in Appendix A-6.

### 7.4.9 BC Hydro will be Implementing Measures to Mitigate the Risk of a Supplier Unable to Deliver on Contractual Obligations

Table 7-12 below provides a summary of the risk of a supplier being unable to deliver on contractual obligations due to credit failure.

**Table 7-12 Summary of Risk of Supplier Not Delivering on Obligations Due to Credit Failure**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | During the public procurement process, BC Hydro will seek bids from a wide range of generator suppliers. There is a potential for some of the suppliers to be under financial strain.<br>There is a risk that a supplier might experience credit failure after being awarded a contract and subsequently be unable to eventually deliver on contractual obligations, which may lead to schedule delays and cost overruns. | Financial Loss | 10<br>**Probability:** Possible (L6)<br>**Severity:** $10M to $100M (S4) | 7<br>**Probability:** Possible (L6)<br>**Severity:** $10K to $100K (S1) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Assessing the credit history and financial situation of suppliers prior to appointing a preferred proponent;
- Performing assessments of a supplier’s financial capacity and credit rating, where appropriate, prior to awarding any contract; and
- Requiring performance security in the form of performance and labour and materials bonds or a letter of credit and a third-party guarantee.

### 7.4.10 BC Hydro will be Implementing Measures to Mitigate the Risk of a Seismic Event Causing Significant Damage to the Bridge River 1 Generating Station During Construction

Table 7-13 below provides a summary of the risk of a seismic event causing significant damage to the Bridge River 1 Generating Station during construction.

**Table 7-13 Summary of Seismic Event Risk During Construction**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | The nature of the existing powerhouse building foundation and the seismic performance of the Bridge River 1 Generating Station means that a seismic event could cause significant damage to the generating station.<br>Significant damage to the generating station during construction stage may result in minor injuries, disability, or a fatality to workers, contractors, and/or the public in or near the generating station. | Safety | 9<br>**Probability:** Very Unlikely (L4)<br>**Severity:** Fatality (S5) | 9<br>**Probability:** Very Unlikely (L4)<br>**Severity:** Fatality (S5) |

BC Hydro accepts that this risk cannot be mitigated without rebuilding the Bridge River 1 Generating Station. To mitigate this risk during the BR1 Project construction stage, BC Hydro has identified and will be implementing the following risk treatments:

- Developing an Interim Dam Safety Risk Management Plan describing any surveillance and/or safety risk measures required during construction; and
- Following the Bridge River Emergency Action Plan in the event of an earthquake. By following the Bridge River Emergency Action Plan, the consequences of an earthquake event during the BR1 Project are similar to current operational earthquake risks and are considered tolerable.

## 7.5 Retained Operational Risks and Risk Management Plans

BC Hydro recognizes that there will be retained operational risks at the Bridge River 1 Generating Station after the BR1 Project is completed. BC Hydro has identified four material retained operational risks:

1. The foundation stability of the Bridge River 1 Generating Station;
2. The seismic performance of the Bridge River 1 Generating Station powerhouse;

3. The seismic withstand of the Bridge River 1 Generating Station penstocks; and
4. The potential for slope failure at the Santa Clause Mountain.

### 7.5.1 Bridge River 1 Generating Station Foundation Stability

The BR1 Project as proposed will not improve the foundation stability of the Bridge River 1 Generating Station.

The Bridge River 1 Generating Station is situated on a soil foundation underlain by an artesian aquifer. Artesian pressures can cause the powerhouse to move and settle. This was discovered during construction of the Bridge River 1 Generating Station. To mitigate the settlement issue, offshore fill was installed to act as balancing weight. Piezometers were also added to monitor uplift pressure below the Generating Station. The settlement issue stabilized, but as a precaution, the remaining four units that were planned to be installed at the Bridge River 1 Generating Station were instead constructed at the current Bridge River 2 Generating Station location.

In 1974, ground cracking around the BR1 Generating Station and in the offshore fill was observed. Three bleeder wells were installed in 1976. These wells can be used to relieve artesian pressure, if required.

The BR1 Generating Station has performed well for 70 years with help from the stabilizing offshore fill and the bleeder wells. BC Hydro is currently looking at installing additional valves in the bleeder wells so that the wells can continue to function if one valve fails.

The existing foundation stability risk to the generating station can only be avoided by moving the Bridge River 1 Generating Station. Accordingly, BC Hydro has chosen to retain this operational risk.

### 7.5.2 Bridge River 1 Generating Station Powerhouse Seismic Performance

The BR1 Project as proposed will not improve the seismic performance of the Bridge River 1 Generating Station powerhouse.

In 1999, BC Hydro’s external consultant, Klohn Crippen conducted a seismic structural study of the Bridge River Generating Stations, calculated the seismic withstand of the Bridge River 1 Generating Station and concluded that the station would survive a 1:475 to 1:1000 year event, which at that time met the 1:475 design requirement of the National Building Code of Canada.

Since that time, the National Building Code of Canada design requirement has increased and now corresponds to an exceedance frequency of 1:2475. There is no requirement to upgrade existing structures to meet this increased design requirement.

The powerhouse at the Bridge River 1 Generating Station is vulnerable to a seismic event. The current exceedance number, calculated in a May 25, 2018 Geotechnical Design report, estimates that the Bridge River 1 Generating Station powerhouse would likely experience damage in a 1:1000 year event. There is some risk that a seismic event exceeding this level could damage the Bridge River 1 Generating Station powerhouse.

The existing seismic risk to the powerhouse can only be avoided by moving the Bridge River 1 Generating Station. Accordingly, BC Hydro has chosen to retain this operational risk.

### 7.5.3 Bridge River 1 Generating Station Penstocks Seismic Withstand

The BR1 Project as proposed will not improve the seismic withstand of the Bridge River 1 Generating Station penstocks.

The penstocks at the Bridge River 1 Generating Station are vulnerable to a seismic event. The current exceedance number, calculated in a May 25, 2018 Geotechnical

Design report, estimates that the Bridge River 1 Generating Station penstocks would have a moderate likelihood of damage in a 1:475-year event. A seismic event larger than this could lead to the decoupling of the penstocks from the Bridge River 1 Generating Station powerhouse. A penstock breach could result in damage to the powerhouse.

In fiscal 2017, BC Hydro installed a penstock leak detection system to mitigate this risk. The system will automatically detect and close the penstock inlet valves under full operating flow. Closing the penstock inlet valves protects the Bridge River 1 Generating Station and its personnel by stopping water flow before it enters the penstocks.

The current penstock inlet values are capable of closing under full generation flow but there is a risk that the hydraulics may not be to able to close in the event of full penstock rupture. As discussed further in section 2.3.1.2 of Chapter 2, BC Hydro is planning a project in fiscal 2030 to replace or upgrade the hydraulics for the penstock inlet valves.

The existing seismic risk to the penstocks can only be avoided by moving the Bridge River 1 Generating Station. Accordingly, BC Hydro has chosen to retain this operational risk.

### 7.5.4 Santa Clause Mountain Slope Failure

The BR1 Project as proposed will not improve the risks associated with a Santa Clause Mountain slope failure.

Santa Claus Mountain is located on the south side of Seton Lake, 16 kilometers upstream of Seton Dam and directly across from the Bridge River 1 and Bridge River 2 Generating Stations. The Santa Claus Mountain slope has been exhibiting progressive downward creep, has potentially unstable areas and there is a risk of slope failure.

This retained operational risk is being managed through an annual slope inspection survey. The risk can only be avoided by moving the Bridge River 1 Generating Station. Accordingly, BC Hydro has chosen to retain this operational risk.

# BC Hydro Bridge River Projects

## Bridge River Transmission Project

# Chapter 8

## Project Justification

## Table of Contents

8.1 Introduction ........ 8-1
8.2 Overview of the Bridge River Transmission System ........ 8-2
  8.2.1 Generation from Bridge River Transmission System Is Transmitted Via Three Regional Paths ........ 8-2
  8.2.2 Transmission Capacity Is Constrained When Generation is Highest and Load is Lowest ........ 8-5
8.3 Generator De-Ratings Have Allowed BC Hydro to Manage the 2L90 Circuit Within Limits ........ 8-6
  8.3.1 Since 2016, Approximately 400 MW of IPP Generation Has Connected to the Bridge River Transmission System ........ 8-7
  8.3.2 Units at the Bridge River Generating Facility Have Been De-Rated Creating Challenges for Generation Operations and Water Management ........ 8-7
8.4 Transmission Study Identified the Risk of 2L90 Circuit Reaching Its Ampacity Limits ........ 8-9
8.5 2L90 Circuit Asset Health Issues Must be Addressed ........ 8-11
  8.5.1 Description of the 2L90 Circuit ........ 8-12
  8.5.2 Many Structural Components on the 2L90 Circuit Are in Poor Condition or Will Need to be Replaced in Future Years ........ 8-15
  8.5.3 Ground Clearance Issues on the 2L90 Circuit Need to Be Addressed ........ 8-17

## List of Figures

Figure 8-1 Bridge River Regional Transmission Paths ........ 8-4
Figure 8-2 Power Flow of Regional Path 1, 2, 3 in the Bridge River Area in 2030 Summer Conditions ........ 8-11
Figure 8-3 2L90 Circuit Location ........ 8-13
Figure 8-4 2L90 Circuit H-Frame Structure ........ 8-14
Figure 8-5 2L90 Circuit Three-Pole Structure ........ 8-15
Figure 8-6 2L90 Span with Low Clearance ........ 8-17

# List of Tables

Table 8-1 Summer Maximum Capacity of Bridge River Transmission Regional Paths ........ 8-6
Table 8-2 IPP Generation Connected to Bridge River Transmission System Since 2016 ........ 8-7
Table 8-3 Condition Assessment Values – 2L90 Circuit (Structure and Framing Components) ........ 8-16

## 8.1 Introduction

This chapter provides the justification for the BRT Project. The BRT Project is needed to address system constraints on the Bridge River Transmission System to accommodate existing and future generation, and to address asset health issues and clearance defects to improve the reliability and safety of the 2L90 circuit.

The BRT Project is currently in the Feasibility Design stage. By March 2022, BC Hydro expects to confirm whether the Leading Alternative will proceed as the Preferred Alternative. Following this decision, BC Hydro will file an evidentiary update with the BCUC to provide additional information on the BRT Project.

This chapter provides the information that BC Hydro has to-date and is structured as follows:

- Section 8.2 provides an overview of the current state of the Bridge River Transmission System and explains the maximum capacity[126] of the 2L90 circuit;
- Section 8.3 explains that BC Hydro has been able to manage the 2L90 circuit within its ampacity limits as new IPP generation has been added to the Bridge River Transmission System because of de-ratings to generating units at the Bridge River 1 and Bridge River 2 Generating Stations. However, these de-ratings have created challenges for generation operations and water management which cannot be sustained over the longer-term;
- Section 8.4 explains system studies and future flow modeling which shows that in future years the amount of electric current flowing through the 2L90 circuit would reach 140 per cent of its maximum capacity during the summer months, causing the 2L90 circuit to exceed its thermal limits and possibly leading to overheating, thermal damage and unsafe clearances. To accommodate

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[126] The maximum current, in amperes, that a conductor can carry continuously under the conditions of use without exceeding its temperature rating.

generation in the Bridge River area, BC Hydro must address the constraints on the Bridge River Transmission System; and

- Section 8.5 explains that the asset health issues with the 2L90 circuit must be addressed. Approximately 18 per cent of 2L90 circuit structures have significant defects requiring refurbishment within the next five years and approximately 77 per cent of the structures have defects on critical components that will need to be addressed in future years. While it is safe to operate the 2L90 circuit at the existing rating, several spans have clearance defects that need to be repaired.[127]

## 8.2 Overview of the Bridge River Transmission System

This section provides an overview of the Bridge River Transmission System. As described below, the maximum capacity of the 2L90 circuit is reduced during the freshet and summer months due to higher seasonal ambient temperatures.[128] At the same time that the capacity of the 2L90 circuit is reduced, there is an increased amount of generation that needs to be moved from the Bridge River Transmission System to other areas of the Province to serve customer load.

### 8.2.1 Generation from Bridge River Transmission System Is Transmitted Via Three Regional Paths

Generation from the Bridge River System[129] and several nearby IPPs[130] is transmitted through three regional paths towards the Lower Mainland load centre.

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[127] BC Hydro has placed public warning and danger signage at these locations as a temporary measure until repair work is completed.

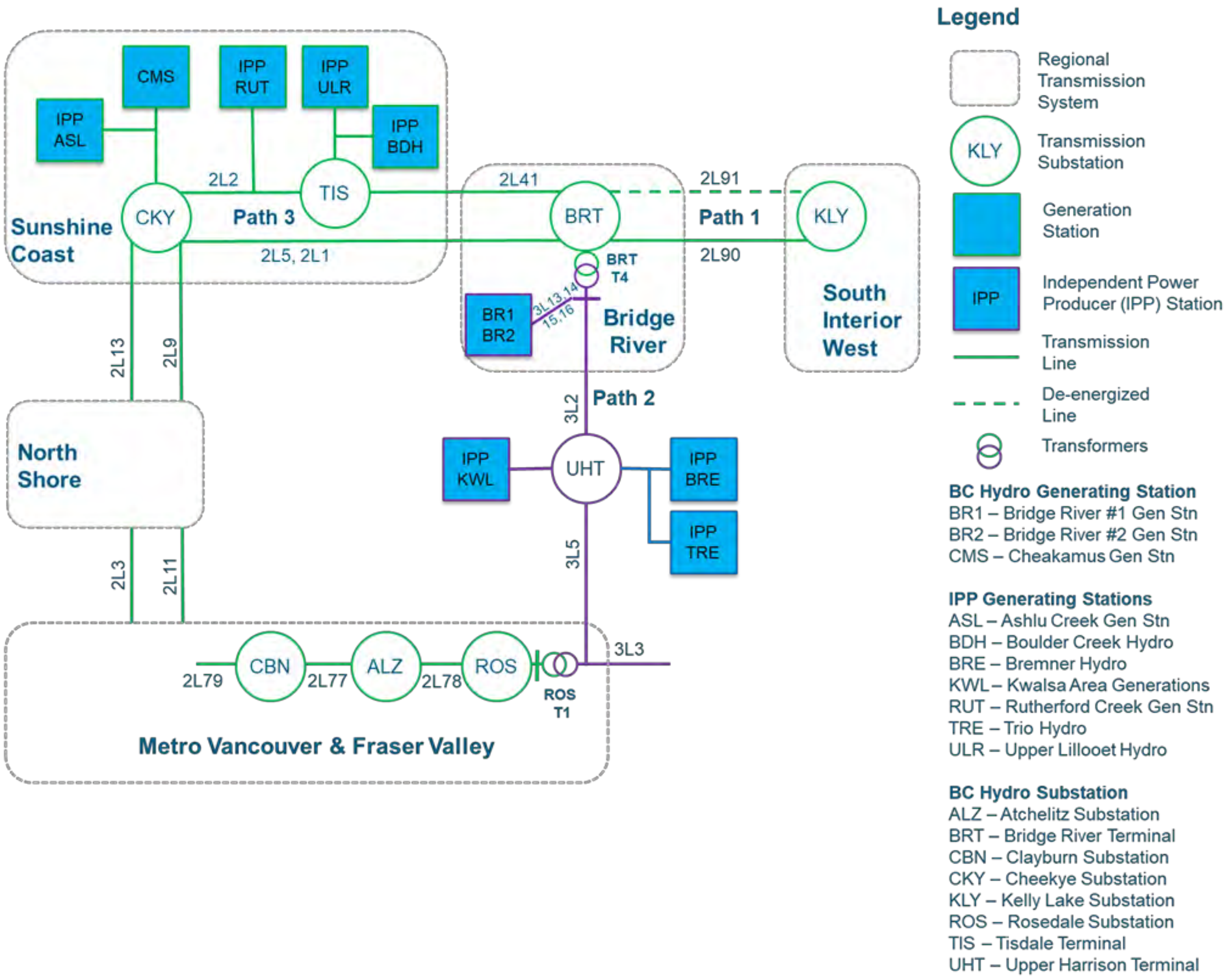
[128] Ambient temperature is the temperature of the surrounding air.

[129] The Bridge River System consists of the La Joie Generating Station, Bridge River 1 and Bridge River 2 Generating Stations, and Seton Generating Station.

[130] IPPs on these paths include: the Kwalsa projects, Upper Stave River, Northwest Stave River, Trethewy Creek, and Big Silver, all of which connect at the Upper Harrison Terminal; Rutherford Creek, Ashlu Creek, Fitzsimmons Creek, Upper Lillooet, and Boulder Creek, all of which connect along the Sea-to-Sky corridor; and Hunter Creek, which connects at Hope. Another IPP, Bremner Trio Hydro, is currently under construction and expected to connect to the Bridge River Transmission System at the Upper Harrison Terminal Station.

Figure 8-1 below shows these three regional transmission paths and the interconnected generation facilities.

Figure 8-1 Bridge River Regional Transmission Paths



**BC Hydro Generating Station**
BR1 – Bridge River #1 Gen Stn
BR2 – Bridge River #2 Gen Stn
CMS – Cheakamus Gen Stn

**IPP Generating Stations**
ASL – Ashlu Creek Gen Stn
BDH – Boulder Creek Hydro
BRE – Bremner Hydro
KWL – Kwalsa Area Generations
RUT – Rutherford Creek Gen Stn
TRE – Trio Hydro
ULR – Upper Lillooet Hydro

**BC Hydro Substation**
ALZ – Atchelitz Substation
BRT – Bridge River Terminal
CBN – Clayburn Substation
CKY – Cheekye Substation
KLY – Kelly Lake Substation
ROS – Rosedale Substation
TIS – Tisdale Terminal
UHT – Upper Harrison Terminal

### 8.2.2 Transmission Capacity Is Constrained When Generation is Highest and Load is Lowest

The transmission capacity on a circuit is constrained by thermal limits, which are reduced by higher seasonal ambient temperatures during freshet and summer months.

When electric current flows along a transmission line, heat is generated in the conductors and the temperature of the conductors increases. As the conductor temperature increases, the metal thermally expands and the amount of sag[131] in the line increases, reducing the amount of clearance between the conductor and the ground or other nearby objects. In cold ambient temperatures the conductor can dissipate heat effectively, reducing its temperature and allowing greater power transfer. As ambient temperatures increase, this reduces the amount of cooling of the conductors. Therefore, the sag increases and the electric current that can be transferred through the conductor while maintaining the same amount of clearance is decreased.

BC Hydro calculates the maximum allowable sag for each line and then determines the maximum electrical current the line can transmit at various ambient temperatures. BC Hydro also calculates an upper limit to the allowable temperatures for the components on a line, beyond which damage to the conductors and the connecting hardware could occur. Taking these factors into account, a circuit is assigned maximum ampacity ratings for a range of specific ambient temperatures.

BC Hydro operates its system within these thermal limits to prevent overheating and thermal damage and to maintain safe clearances from the ground and other nearby objects. Assigning these ratings and operating the system within them reduces the risk of forced outages and is required under several applicable Mandatory Reliability Standards.

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[131] Sag is defined as a catenary curve, the vertical difference in level between points of support (most commonly transmission towers) and the lowest point of the conductor.

The three regional paths of the Bridge River Transmission System, and their respective summer capacities (i.e., the maximum ampacity rating at an ambient temperature of 30ºC), are summarized in Table 8-1 below.

**Table 8-1 Summer Maximum Capacity of Bridge River Transmission Regional Paths**

| Regional Path | Summer Maximum Capacity (MVA) |
|---|---|
| Path 1 (circuit 2L90) | 233 |
| Path 2 (circuits 3L2 and 3L5, ROS T1, 2L78, and 2L77) | 450 |
| Path 3 (circuits 2L2 and 2L41) | 201 |
| Path 3 (circuits 2L5 and 2L1) | 318 |

BC Hydro has verified the rating of the 2L90 circuit and operates the line within this rating. However, the transmission capacity on the 2L90 circuit is constrained due to thermal limits imposed by required conductor-to-ground clearances at locations along the line. In addition, while it is safe to operate the 2L90 circuit, several spans have clearance defects that need to be repaired.[132]

At the same time that the thermal capacity of the 2L90 circuit is reduced due to higher ambient temperatures, there is an increased amount of generation that needs to be moved from the Bridge River area to other areas of the Province to serve customer load. This is because, in the summer, local load in the Bridge River area is at its lowest point and generation from run-of-river IPPs is at its highest point.

## 8.3 Generator De-Ratings Have Allowed BC Hydro to Manage the 2L90 Circuit Within Limits

Since 2016, close to 400 MW of IPP generation has connected or will be connected to the Bridge River Transmission System. BC Hydro has been able to use limited operational measures to manage the 2L90 circuit within its maximum capacity as this new IPP generation has been added primarily because of de-ratings to generating units at the Bridge River 1 and Bridge River 2 Generating Stations.

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[132] BC Hydro has placed public warning and danger signage at these locations as a temporary measure until repair work is completed.

However, these de-ratings have created challenges for generation operations and water management which cannot be sustained over the longer-term.[133]

### 8.3.1 Since 2016, Approximately 400 MW of IPP Generation Has Connected to the Bridge River Transmission System

BC Hydro entered into Electricity Purchase Agreements (**EPAs**) with IPPs in the Bridge River, Cheekye, Pemberton and Whistler areas through the 2006 Open Call for Power and the 2010 Clean Power Call. Following the calls, these projects proceeded through the development process and have been connecting to the Bridge River Transmission System in recent years.

Table 8-2 below shows the IPPs that have connected to the Bridge River Transmission System since 2016. By 2022, approximately 400 MW of IPP generation is expected to be connected to the Bridge River Transmission System.

**Table 8-2 IPP Generation Connected to Bridge River Transmission System Since 2016**

| Generation Source | Calendar Year of Increase | Path Energy Transmitted By | Generation Capacity (MW) |
|---|---|---|---|
| Kwalsa 1 & 2 | 2016 | Path 2 | 226 |
| Upper Lillooet River | 2018 | Path 3 | 107 |
| Hunter Creek | 2018 | Path 2 | 11 |
| Bremner and Trio | 2022 (expected) | Path 2 | ~50 |
| Total | | | **~400** |

### 8.3.2 Units at the Bridge River Generating Facility Have Been De-Rated Creating Challenges for Generation Operations and Water Management

The Bridge River Transmission System was originally designed and built to accommodate the full power from the Bridge River System generating facilities, under normal system conditions.

The Bridge River 1 and Bridge River 2 Generating Stations were commissioned in 1954 and in 1960, respectively. In 2012, the Bridge River 1 and Bridge River 2

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[133] For further discussion, please refer to section 2.3.3 of Chapter 2.

generating units were de-rated to 416 MW due to the aging and deteriorating condition of the units. By 2017, units at both stations had exceeded their 50-year design life and were experiencing failures and unit de-ratings, further reducing the overall capacity of the Bridge River 1 and Bridge River 2 Generating Stations from 416 MW to 376 MW.

These de-ratings reduced the amount of power that needs to be transferred from the Bridge River Transmission System to serve load in other areas of the Province, partially offsetting the impacts of the increase of IPP generation connected to the Bridge River Transmission System. However, the de-ratings have also created challenges for generation operations and water management which cannot be sustained over the longer-term.

As discussed further in section 3.4 of Chapter 3, BC Hydro must restore the generating capacity of the Bridge River Facility, in order to manage flows within the WUP Order target flow schedule, meet commitments in the 2011 Agreements and 2019 High Flow Settlement Agreements with the St’át’imc Nation, and maintain fish and fish habitat in Lower Bridge River. Accordingly, BC Hydro has prioritized projects to address asset health issues with existing generating units and restore generating capacity.

Generating Units 5 and 6 at the Bridge River 2 Generating Station were replaced in fiscal 2019 and fiscal 2020, respectively. Generating Units 7 and 8 at the Bridge River 2 Generating Station are being replaced in fiscal 2021 and fiscal 2022, respectively.

The BR1 Project is the next priority and will replace generating Units 1 to 4 at the Bridge River 1 Generating Station. Collectively, these projects will restore the overall capacity of the Bridge River Facility to 532 MW.[134]

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[134] The BR1 Project will result in 26 MW of incremental capacity. For further information, refer to section 4.5.2 of Chapter 4.

With the generating capacity at the Bridge River Facility restored, other solutions must be evaluated so that the 2L90 circuit can be managed within its ampacity limits.

## 8.4 Transmission Study Identified the Risk of 2L90 Circuit Reaching Its Ampacity Limits

In 2017, BC Hydro conducted a transmission study to assess the impact of increased IPP generation and the restoration of generation capacity at the Bridge River Facility to the Bridge River Transmission System. This study is provided as Appendix C-1.

When the BR1 Project is completed in 2030 and the generation capacity at the Bridge River Facility is restored, there will be a total of 596 MW of BC Hydro owned generation and 474 MW of IPP generation connected to the Bridge River Transmission System. During system normal operating conditions, power from these generating facilities would be distributed to the three Bridge River regional transmission paths identified in Table 8-1 above.[135]

At the time of the study, the 2L90 circuit was rated at 510 A (203 MVA) at 55ºC conductor temperature and 30ºC ambient temperature (summer) and at 1105 A (404 MVA) at 55ºC conductor temperature and 0ºC ambient temperature (winter).

The system study showed that by 2030, loading on Path 2 and 3 will remain within the facility ratings; however during the summer months, when generation output is high and local load is low, the amount of electric current flowing through the 2L90 circuit (Path 1) will reach up to 838 A (338 MVA), or over 160 per cent of its thermal rating of 510 A (203 MVA).

In spring 2021, BC Hydro studied the 2L90 circuit and identified one span that had a critical clearance deficiency. To correct this clearance deficiency, a single structure was replaced with a taller structure. After this work, the rating for the 2L90 circuit

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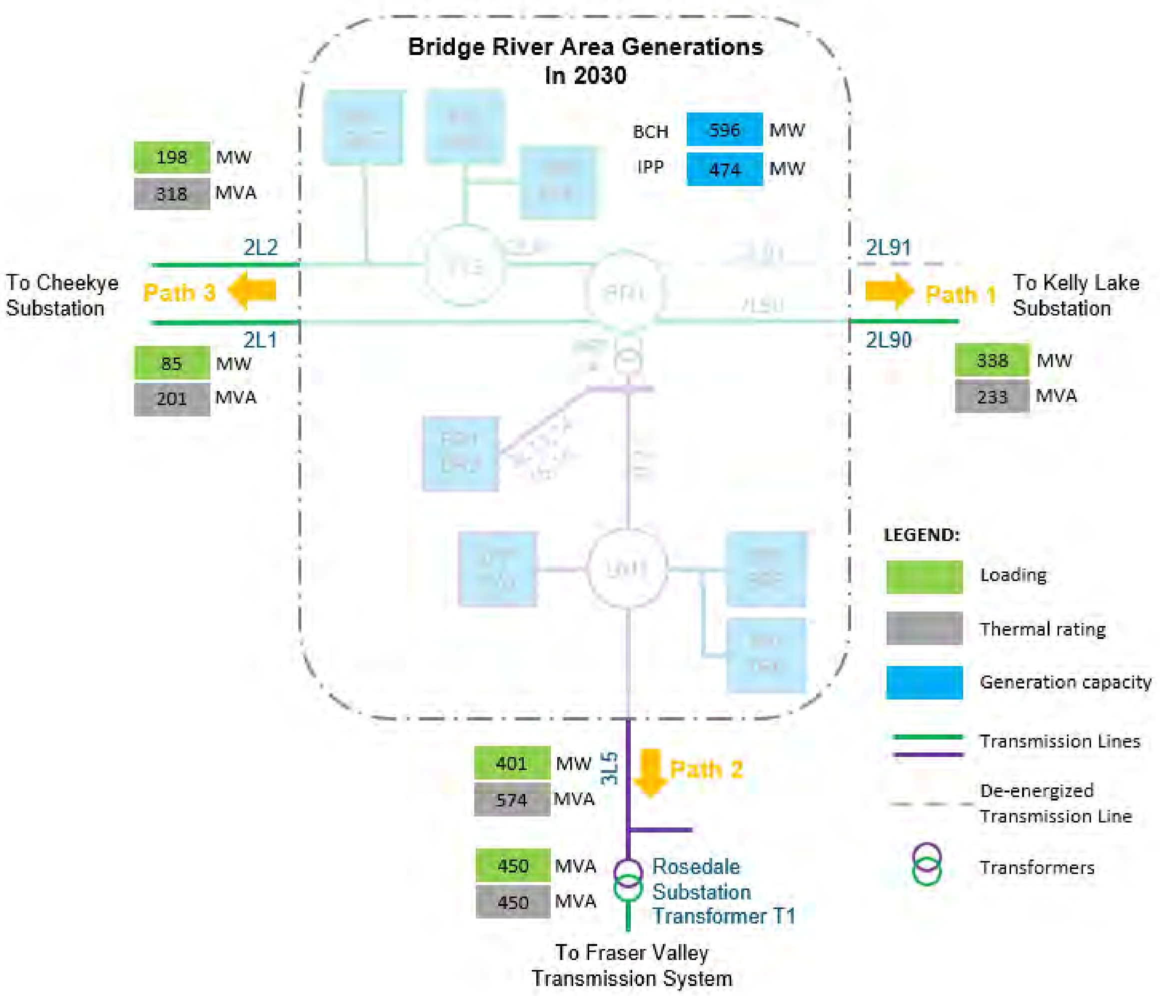
[135] The distribution of power flow depends on variety of factors including generation outputs, generation locations, generation dispatch, line impedance, voltage performance, power angles, loads, etc.

was revised to 585 A (233 MVA) at 30°C ambient temperature. By 2030, with a thermal rating of 585 A, future load flow modelling indicates that the amount of electric current flowing through the 2L90 circuit would reach 140 per cent of its maximum capacity, during the summer months, causing the 2L90 circuit to exceed its thermal limits as shown in Figure 8-2 below.

The ampacity limits on the 2L90 circuit cannot be exceeded. Otherwise, overheating and thermal damage may occur, and safe clearances cannot be maintained. Mandatory Reliability Standards require BC Hydro to operate the system within these limits. To accommodate generation in the Bridge River area, BC Hydro must address the constraints on the Bridge River Transmission System.

**Figure 8-2 Power Flow of Regional Path 1, 2, 3 in the Bridge River Area in 2030 Summer Conditions**



## 8.5 2L90 Circuit Asset Health Issues Must be Addressed

The 2L90 circuit also has asset health issues that must be addressed. Approximately 18 per cent of 2L90 circuit structures have significant defects requiring refurbishment within the next five years and approximately 77 per cent of the structures have defects on critical components that will need to be addressed in future years. While it is safe to operate the 2L90 circuit at the existing rating, several spans have clearance defects that need to be repaired.[136]

### 8.5.1 Description of the 2L90 Circuit

The 2L90 circuit was constructed in 1956 and is one of the three regional paths that are used to transmit power from the Bridge River area to load centers. Figure 8-3 below shows the location of the 2L90 circuit, which runs for approximately 76.5 km from the west end of Seton Lake at Bridge River Terminal Station, along the south side of Seton Lake, and then north along the Fraser River and overland to Kelly Lake Substation.

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[136] BC Hydro has placed public warning and danger signage at these locations as a temporary measure until repair work is completed.

**Figure 8-3 2L90 Circuit Location**

The 2L90 circuit is a 230 kV transmission line, with three phases of single conductor and wood structure construction. Following forest fires in the summers of 2002 and 2004, it was reconstructed through new construction and from the surviving segments of both the 2L90 circuit and the now de-energized 2L91 circuit. It is made up of 351 wood pole structures, including 225 H-Frame structures and 102 three-pole wood structures, with the remainder being made-up of different structure types.

Each structure typically consists of wood poles, timber cross-arms and cross braces, steel hardware and insulators, bonding, grounding and counterpoise, and where required, other support components, such as guy wires. Figure 8-4 below shows a wood H-Frame structure on the 2L90 circuit and Figure 8-5 below shows a three-pool wood structure on the 2L90 circuit.

**Figure 8-4 2L90 Circuit H-Frame Structure**

Figure 8-5 2L90 Circuit Three-Pole Structure

## 8.5.2 Many Structural Components on the 2L90 Circuit Are in Poor Condition or Will Need to be Replaced in Future Years

The overall Asset Health Rating for the 2L90 circuit is calculated to be Fair based on circuit reliability and circuit asset health indexes. However, a large portion of the individual components of the 2L90 structures are in poor and very poor condition. Without investment, the 2L90 circuit Asset Health Rating will degrade to Poor within the 10-year capital planning horizon.

BC Hydro uses Condition Assessment Values to categorize defects on individual components of transmission structures.[137] Table 8-3 below sets out the Condition Assessment Values for the approximately 350 structures on the 2L90 circuit.[138]

**Table 8-3 Condition Assessment Values – 2L90 Circuit (Structure and Framing Components)**

| Asset Health Rating (AHR) | Condition Assessment Value | Description | Percentage of Circuit 2L90 Structures (%) |
|---|---|---|---|
| Good | ~~A~~ | Component is in "like new" condition, or has no defects identified | 3 |
| Good | B | Low damage, wear or decay | 19 |
| Satisfactory | C | Moderate damage, wear or decay | 59 |
| Poor | D | High damage, wear or decay | 17 |
| Very Poor | E | Component has either broken or failed completely | 1 |

As shown in Table 8-3 above, approximately 18 per cent of the structures on 2L90 are identified as being in poor condition. This means they have significant defects requiring refurbishment within the next five years. Approximately 77 per cent of the structures have defects on critical components (i.e., wood poles, crossarms, braces, insulators) that will need to be addressed in future years.[139]

Condition defects that are not addressed will eventually lead to electrical, structural and/or mechanical failures. These failures will result in forced outages on the line, and potential safety issues to the public, both directly as a result of electrical contacts, and indirectly because faults on the line can result in the line igniting wildfires. Forced outages may also require costly emergency restoration works, can

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[137] Clearance defects are classified as a defect of the conductor component.

[138] As of BC Hydro's last detailed inspection in 2018.

[139] In the three years since the last detailed inspection was conducted in 2018, the condition of the structures will have deteriorated further, due to the onset of rot, woodpeckers and weather events.

present additional safety hazards to crews working to address deteriorating assets and can require lengthy repair periods during which the circuit would be unavailable.

### 8.5.3 Ground Clearance Issues on the 2L90 Circuit Need to Be Addressed

In addition to addressing the condition of the structures, there are several spans of the 2L90 circuit that have clearance defects that need to be repaired by either increasing the height of the structures or conducting ground recontouring. Repairing these clearance defects is required so that the 2L90 circuit can continue to be operated at its current rating. Figure 8-6 below shows an example of a low clearance span on the 2L90 circuit that needs to be addressed.

**Figure 8-6 2L90 Span with Low Clearance**

# BC Hydro Bridge River Projects

## Bridge River Transmission Project

# Chapter 9

## Alternatives Analysis

# Table of Contents

9.1 Introduction ........ 9-1
9.2 BC Hydro Considered and Dismissed Alternatives That Were Determined to Be Not Feasible ........ 9-2
  9.2.1 Doing Nothing Is Not Feasible ........ 9-2
  9.2.2 Alternative to Restore 2L91 to Operate in Parallel with 2L90 Is Not Feasible ........ 9-3
  9.2.3 Alternative to Upgrade Regional Path 3 Is Not Feasible ........ 9-3
9.3 BC Hydro Identified Three Feasible Project Alternatives ........ 9-4
  9.3.1 Alternative 1 – Increase the Maximum Capacity of the 2L90 circuit........ 9-4
  9.3.2 Alternative 2 - Increase the Capacity of the Rosedale T1 Transformer ........ 9-7
  9.3.3 Alternative 3 – Curtail Generation from IPPs ........ 9-10
9.4 BC Hydro Undertook a Structured Approach to Evaluate the Alternatives ........ 9-11
9.5 Alternative Analysis Determined That Alternative 1 is the Leading Alternative ........ 9-12
  9.5.1 Objective 1 - Maximize System Reliability and Flexibility ........ 9-15
  9.5.2 Objective 2 - Minimize Environmental Impacts and Impacts to St’át’imc Core Interests ........ 9-16
    9.5.2.1 Risk of Impacts on Aquatic Species and Habitat ........ 9-16
    9.5.2.2 Risk of Impacts to Heritage Sites and Risk of Impacts to Terrestrial Species and Habitat ........ 9-17
    9.5.2.3 Risk of Impacts on Vegetation ........ 9-18
    9.5.2.4 Risk of Impacts from Hazardous Wastes ........ 9-18
    9.5.2.5 Likelihood of High Flows in Lower Bridge River ........ 9-18
  9.5.3 Objective 3 - Minimize Total Costs ........ 9-19
  9.5.4 Objective 4 - Minimize Occupational and Health Safety Risks ........ 9-20
  9.5.5 Objective 5 - Minimize Impact to Stakeholders ........ 9-21

# List of Figures

Figure 9-1 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 1 ........ 9-6

Figure 9-2 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 2 ....... 9-8
Figure 9-3 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 3 ..... 9-10

## List of Tables

Table 9-1 Objectives, Criteria, and Measures ........................................... 9-11
Table 9-2 Consequence Table: Alternative Analysis Results..................... 9-14
Table 9-3 Present Value of Total Costs for Each Alternative ..................... 9-20

## 9.1 Introduction

This chapter sets out BC Hydro's assessment of the alternatives to meet the need to address constraints on the Bridge River Transmission System and to address asset health issues and clearance defects on the 2L90 circuit.

BC Hydro identified three feasible alternatives and evaluated those alternatives through a structured decision-making approach. Based on the results of this evaluation, the Leading Alternative is to increase the maximum capacity of the 2L90 circuit from 585 A (233 MVA) to 1014 A (404 MVA) and to refurbish the 2L90 circuit (Alternative 1). Based on the analysis that BC Hydro has completed to-date, when appropriate mitigation measures are in place, this alternative minimizes total costs without a material increase in expected environmental and archaeological impacts.

The BRT Project is currently in the Feasibility Design stage. By March 2022, BC Hydro expects to confirm whether the Leading Alternative will proceed as the Preferred Alternative. Following this decision, BC Hydro will file an evidentiary update with the BCUC to provide additional information on the BRT Project.

This chapter provides the information that BC Hydro has to-date and is structured as follows:

- Section 9.2 describes the potential alternatives that were screened out as not feasible and the reasons for dismissing these alternatives;
- Section 9.3 describes the three feasible alternatives considered to address constraints on the Bridge River Transmission System and to address asset health issues and clearance defects on the 2L90 circuit;
- Section 9.4 describes the structured decision-making approach used to understand trade-offs between the alternatives as well as the objectives, criteria, and measures for comparing the alternatives; and

- Section 9.5 provides a comparison and assessment of the three feasible alternatives.

## 9.2 BC Hydro Considered and Dismissed Alternatives That Were Determined to Be Not Feasible

A number of alternatives to meet the BRT Project objectives were screened out because BC Hydro determined that they were not feasible. For the reasons described below, doing nothing as well as an alternative to restore the 2L91 circuit and an alternative to upgrade Regional Path 3 were determined to be not feasible.

### 9.2.1 Doing Nothing Is Not Feasible

BC Hydro considered and dismissed the alternative to do nothing. Doing nothing would require BC Hydro to use its existing rights to curtail generation during freshet and summer months which are not sufficient to address the capacity constraints on the Bridge River Transmission System and would not address asset health issues and clearance defects on the 2L90 circuit.

As discussed further in section 3.4 of Chapter 3, BC Hydro must restore the generating capacity of the Bridge River Facility, in order to manage flows within the WUP Order target flow schedule, meet commitments in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation, and maintain fish and fish habitat in Lower Bridge River.

Accordingly, BC Hydro has prioritized projects, including the BR1 Project, to address asset health issues with existing generating units and restore generating capacity at the Bridge River Facility. Curtailing generation at the Bridge River Facility would counteract the benefits of restoring the generating capacity and would challenge BC Hydro’s ability to manage flows within the WUP Order target flow schedule, meet commitments in the 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation, and maintain fish and fish habitat in Lower Bridge River.

Therefore, other solutions must be evaluated so that the 2L90 circuit can be managed within its maximum capacity.

The 2L90 circuit is required to transmit power from the Bridge River area to load centres in the Lower Mainland and the Fraser Valley, to provide reactive power support for the Kelly Lake Substation, and to accommodate planned outages and maintenance on the Bridge River Transmission System. Accordingly, the 2L90 circuit must be refurbished so that asset health issues and clearance defects are addressed, and the circuit can continue to be operated safely and reliably.

### 9.2.2 Alternative to Restore 2L91 to Operate in Parallel with 2L90 Is Not Feasible

In the summers of 2002 and 2004, forest fires burned down portions of the 2L90 and 2L91 circuits. The 2L90 circuit was restored; however, portions of the 2L91 circuit were left de-energized.

BC Hydro considered and dismissed the alternative to restore the 2L91 circuit to operate in parallel with the 2L90 circuit to increase the maximum capacity from the Bridge River area to the South Interior West area.

BC Hydro determined that this alternative was not feasible due to its overall cost which was estimated to be in the $100 million range. Restoring the 2L91 circuit would not adequately address the constraints on the Bridge River Transmission System and would require future generation curtailments in the Bridge River area. The combined cost of this alternative would therefore include the cost of restoring the 2L91 circuit, the cost of refurbishing the 2L90 circuit and the opportunity cost of any required generation curtailment.

### 9.2.3 Alternative to Upgrade Regional Path 3 Is Not Feasible

BC Hydro considered and dismissed the alternative of increasing the maximum capacity of Regional Path 3 from the Bridge River area to the Sunshine Coast area. This alternative was determined to be not feasible because it would require a new

500 kV transmission line to reduce the impedance of Regional Path 3 relative to Regional Path 2. The estimated cost of this new transmission line is more than $1 billion.

## 9.3 BC Hydro Identified Three Feasible Project Alternatives

BC Hydro identified three feasible alternatives to meet the need to address constraints on the Bridge River Transmission System and to address asset health issues and clearance defects on the 2L90 circuit. The scope of work to refurbish the 2L90 circuit to address asset health issues and clearance defects is the same in all three feasible alternatives.

The three identified feasible alternatives are:

- **Alternative 1**: Increase the maximum capacity of the 2L90 circuit, along Regional Path 1, from 585 A (233 MVA) to 1014 A (404 MVA);
- **Alternative 2**: Increase the capacity of the Rosedale T1 Transformer, along Regional Path 2, from 450 MVA to 600 MVA; and
- **Alternative 3:** Curtail generation from IPPs to balance the supply of energy within the constraints of the Bridge River Transmission System.

The scope of these three feasible alternatives is described further in the subsections below.[140]

### 9.3.1 Alternative 1 – Increase the Maximum Capacity of the 2L90 circuit

As discussed in section 8.2.2 of Chapter 8, the transmission capacity on the 2L90 circuit is constrained due to thermal limits, which are further reduced as a result of higher seasonal ambient temperatures during freshet and summer months.

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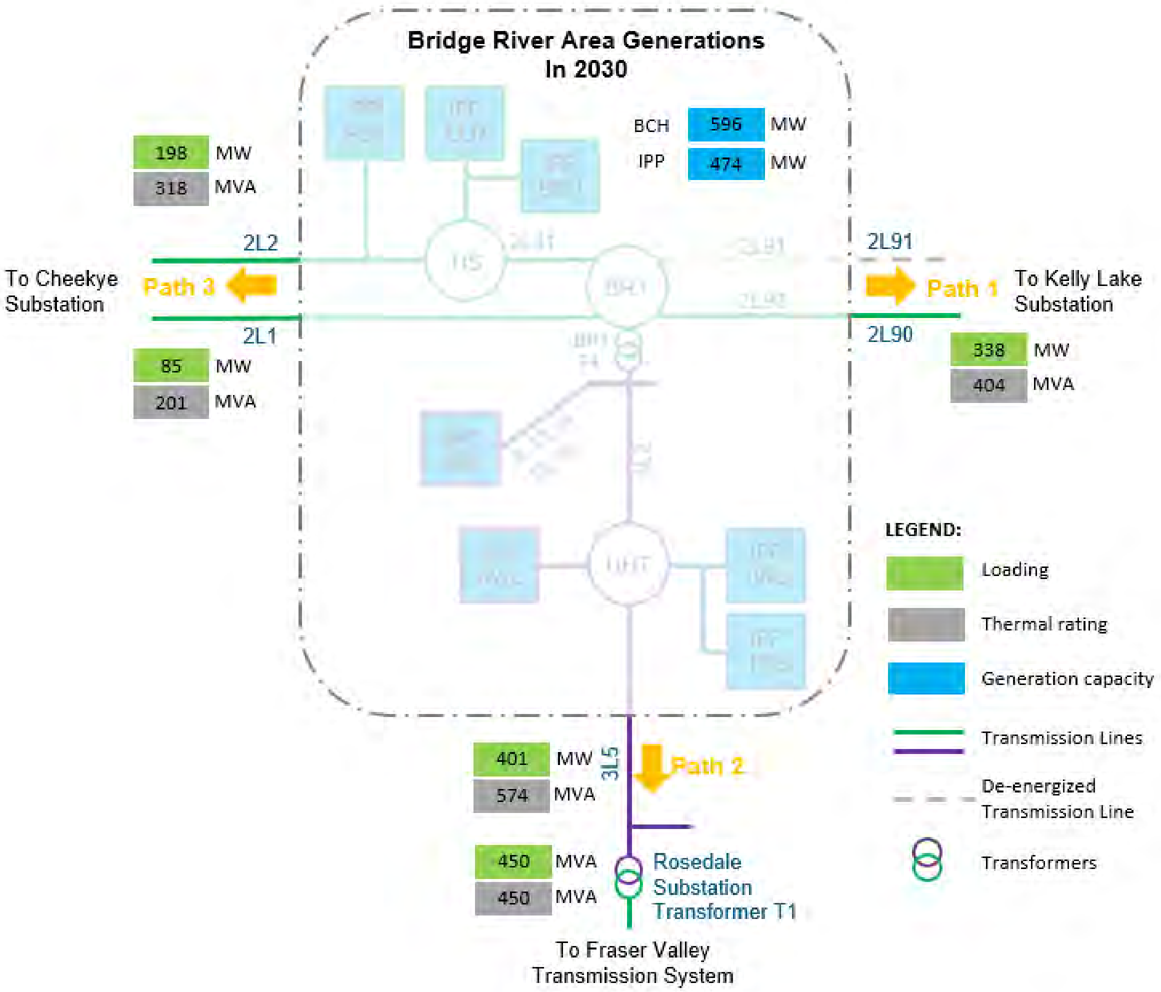
[140] For clarity, none of the three alternatives include replacement of the 2L90 conductors.

Alternative 1 would increase the thermal rating of the 2L90 circuit, increasing its maximum capacity during freshet and summer months from 585 A (233 MVA) to 1014 A (404 MVA).

Increasing the maximum capacity of the 2L90 circuit would eliminate the need for generation curtailments at the nearby IPP facilities or Bridge River Facility because additional power could be transmitted to the South Interior West area via Regional Path 1, without the 2L90 circuit exceeding its maximum capacity. The expected power flow of Regional Paths 1, 2 and 3 in 2030 summer conditions under Alternative 1 is shown in Figure 9-1 below.

**Figure 9-1 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 1**



The scope of work to increase the maximum capacity of the 2L90 circuit and to refurbish the 2L90 circuit, includes:

- Replacing 64 structures and re-contouring four sites along the 2L90 right-of-way to resolve conductor-to-ground clearance issues;
- Replacing 34 structures to address reliability and safety related deficiencies;

- Replacing cross-arms, cross-braces, insulators, guy anchors and guards at 33 structure sites to address reliability and safety related deficiencies; and
- Upgrading approximately 63 kilometres of existing access roads and constructing approximately seven kilometres of new access roads to facilitate construction work for the project.

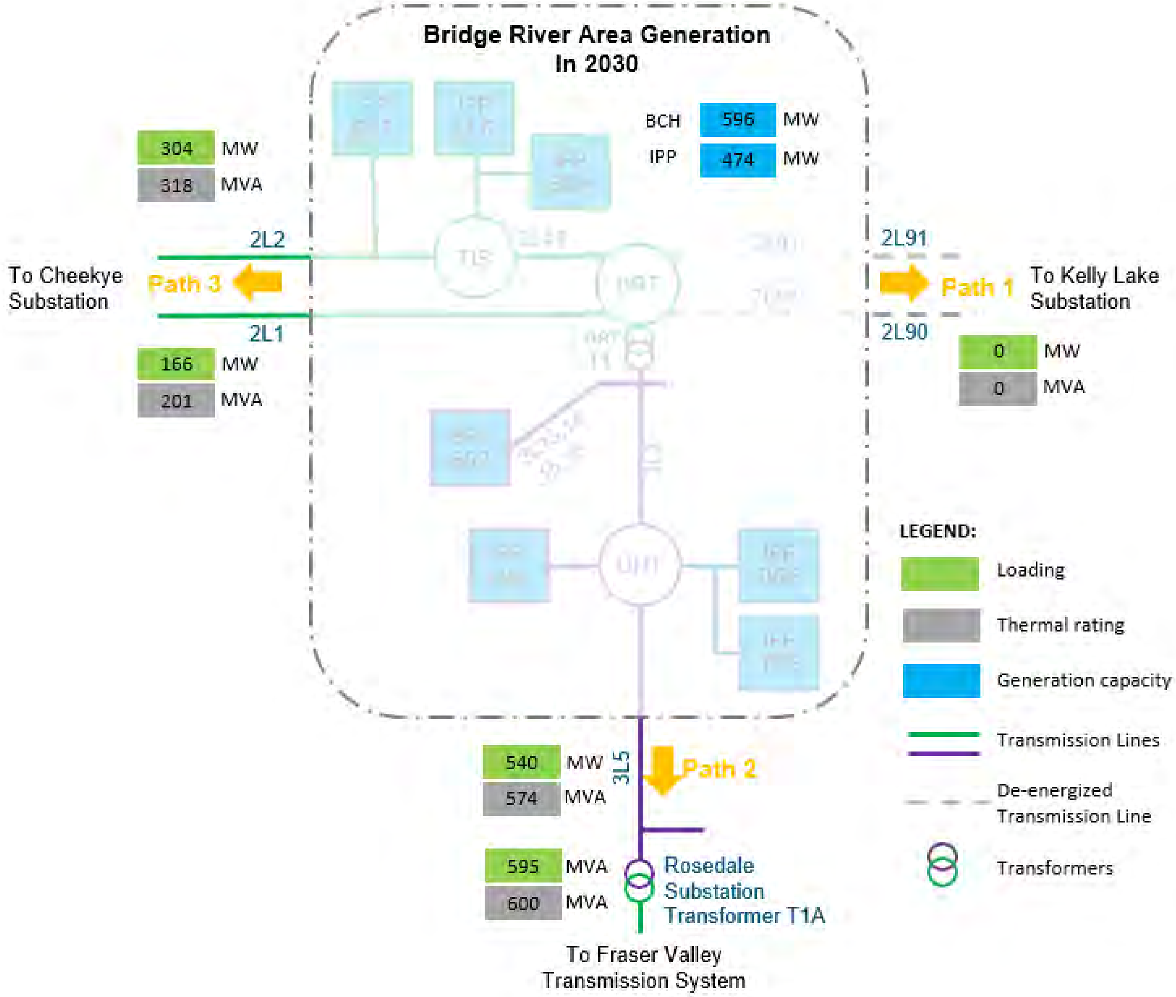
To allow for an “apples to apples” comparison and for the purpose of this analysis only, Alternative 1 also includes the scope of work required to extend the life of the Rosedale T1 transformer by 15 years and then replace the transformer when the transformer reaches end-of-life. While this work would not be included as part of the BRT Project, it is included as part of Alternative 1 in this analysis because, as discussed further in section 9.3.2 below, Alternative 2 would either replace the Rosedale T1 transformer or install new transformers so that the Rosedale T1 transformer could be used as a spare.

### 9.3.2 Alternative 2 - Increase the Capacity of the Rosedale T1 Transformer

Alternative 2 would increase the capacity of the Rosedale T1 transformer from 450 MVA to 600 MVA. Increasing the capacity of the Rosedale T1 transformer would eliminate the need for generation curtailments at the nearby IPP facilities or Bridge River Facility because additional power could be transmitted to the Fraser Valley area via Regional Path 2, without the 2L90 circuit exceeding its maximum capacity. Under this alternative, the 2L90 circuit would need to be operationally de-energized during the freshet and summer months when ambient temperatures are high and the Bridge River Transmission System is constrained, re-directing power along Regional Path 2, through the Rosedale T1 transformer.

The expected power flow of Regional Paths 1, 2 and 3 in 2030 summer conditions under Alternative 2 is shown in Figure 9-2 below.

**Figure 9-2 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 2**



BC Hydro evaluated three options (Alternative 2A, 2B and 2C) to increase the capacity of the Rosedale T1 transformer from 450 MVA to 600 MVA:

- Alternative 2A would replace the Rosedale T1 transformer with three single-phase 200 MVA transformers and a spare single-phase transformer;

- Alternative 2B would install the same equipment as Alternative 2A and the existing 450 MVA Rosedale T1 transformer would also remain installed and on standby; and
- Alternative 2C would install two new three-phase 600 MVA transformers. One transformer would replace the existing 450 MVA Rosedale T1 transformer and the second transformer would be installed as a spare.

The scope of work in Alternative 2 also includes the work required to refurbish the 2L90 circuit. Under Alternative 2, the 2L90 circuit would be operationally de-energized during the freshet and summer months when ambient temperatures are high so that it does not exceed its maximum capacity. However, the 2L90 circuit would continue to be energized and used to transmit power to load centres during all other times of the year, including during the winter peak when the ambient air temperature is low and the maximum capacity of the 2L90 circuit is higher. The 2L90 circuit would also continue to be required under Alternative 2 to provide reactive power support for the Kelly Lake Substation and to accommodate planned outages and maintenance.

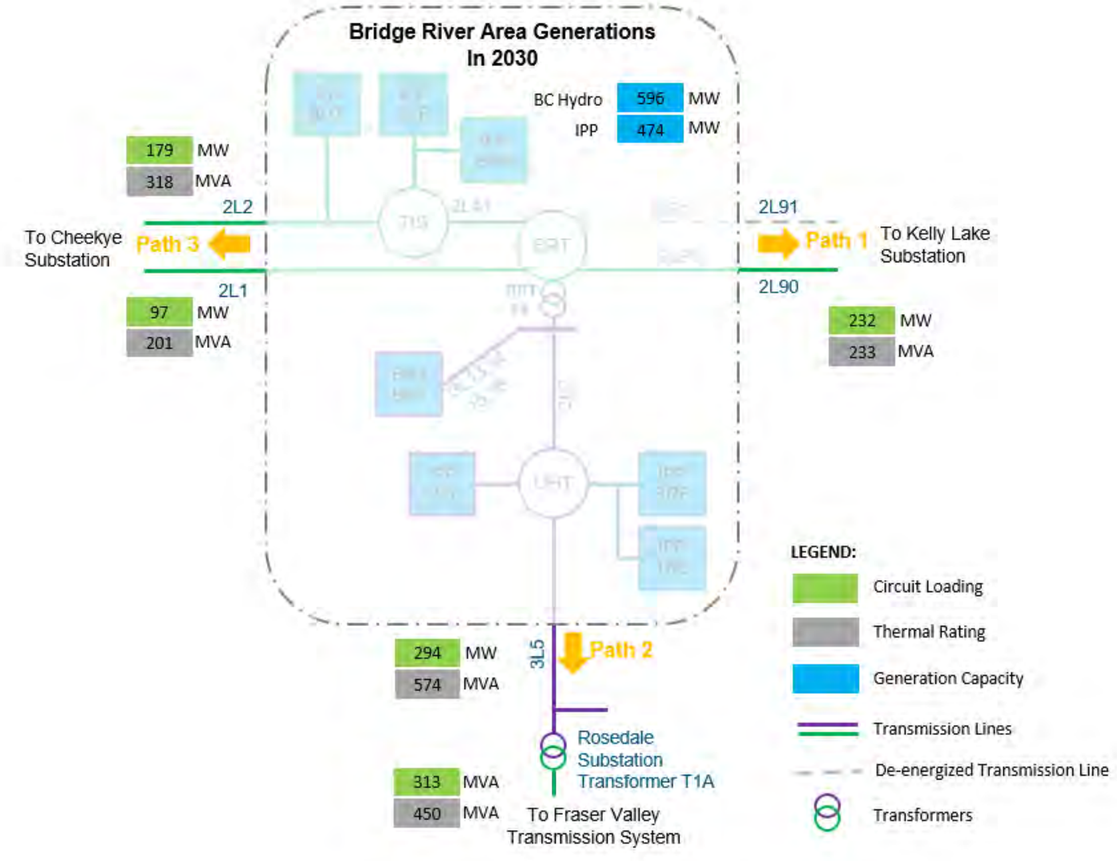
The work required to refurbish the 2L90 circuit includes:

- Replacing 31 structures and re-contouring one site along the 2L90 right-of-way to resolve conductor to ground clearance issues;
- Replacing 46 structures to address reliability and safety related deficiencies;
- Replacing cross-arms, cross-braces, insulators, guy anchors and guards at 33 structure sites to address reliability and safety related deficiencies; and
- Upgrading approximately 63 kilometres of existing access roads and constructing approximately seven kilometres of new access roads to facilitate construction work for the project.

### 9.3.3 Alternative 3 – Curtail Generation from IPPs

Alternative 3 would curtail generation from IPPs during freshet and summer months so that the 2L90 circuit does not exceed its maximum capacity. BC Hydro has some existing rights to curtail generation from IPPs; however, this alternative would require BC Hydro to negotiate amendments to existing Electricity Purchase Agreements with IPPs to secure expanded rights to issue the required curtailment orders. Issuing these curtailment orders would allow the 2L90 circuit to remain within its maximum capacity. The expected power flow of Regional Paths 1, 2 and 3 in 2030 summer conditions under Alternative 3 is shown in Figure 9-3 below.

**Figure 9-3 Power Flow of Regional Paths 1, 2 and 3 in the Bridge River Area in 2030 Summer Conditions Under Alternative 3**



Alternative 3 also includes the scope of work described in section 9.3.2 above to refurbish the 2L90 circuit. To allow for an “apples to apples” comparison and for the purpose of this analysis only, BC Hydro has also included the scope of work described in section 9.3.1 above to extend the life and replace the Rosedale T1 transformer.

## 9.4 BC Hydro Undertook a Structured Approach to Evaluate the Alternatives

BC Hydro identified a set of objectives for the BRT Project, considering the need for the BRT Project as well as the potential risks, impacts and benefits of carrying out each alternative. The objectives are not intended to cover all the risks or benefits but are intended to identify “what really matters” when comparing alternatives. Each objective has one or more criteria for assessing whether the objective has been achieved as well as measures to assess the degree to which each alternative meets the objectives.

Table 9-1 below lists the key objectives, criteria, and measures used to evaluate the alternatives.

**Table 9-1 Objectives, Criteria, and Measures**

| Objectives | Criteria | Measures[141] |
|---|---|---|
| Maximize System Reliability and Flexibility | System Flexibility | **High**/Medium/Low |
| | System Operational Risk | High/Medium/**Low** |
| | Likelihood of System Being Damaged by Fire | High/Medium/**Low** |
| Minimize Environmental Impacts and Impacts to St’at’imc Core Interests | Risk of Impacts on Aquatic Species and Habitat | High/Medium/**Low** |
| | Risk of Impacting Heritage Sites | High/Medium/**Low** |
| | Risk of Impacts to Terrestrial Species and Habitat | High/Medium/**Low** |
| | Risk of Impacts on Vegetation | High/Medium/**Low** |
| | Risk of Impacts from Hazardous Wastes | High/Medium/**Low** |
| | Likelihood of High Flow in Lower Bridge River | High/Medium/**Low** |

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[141] The preferred direction of the measure is indicated in **bold** typeface.

| Objectives | Criteria | Measures[141] |
|---|---|---|
| Minimize Total Costs[142] | Present Value of Total Costs | $ million |
| Occupational and Health Safety Impacts | Risks during Construction | High/Medium/**Low** |
| Minimize Impact to Stakeholders | Impacts to Stakeholders | High/Medium/**Low** |

## 9.5 Alternative Analysis Determined That Alternative 1 is the Leading Alternative

BC Hydro has determined that Alternative 1 is the Leading Alternative to meet the project need. Based on the analysis that BC Hydro has completed to-date, when appropriate mitigation measures are in place, this alternative minimizes total costs without a material increase in expected environmental and archaeological impacts. Specific mitigation measures that can be put in place under Alternative 1 to mitigate these impacts include:

- Avoiding the archeological site;
- Recovering archeological site information prior to land altering activities;
- Monitoring for additional archeological site information during land altering activities;
- Minimizing or completely avoiding disturbance to fish habitat;
- Maintaining fish habitat during construction activities; and
- Avoiding the removal of riparian vegetation during construction.

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[142] Unlike the BR1 Project, Minimizing Cost Risk was not identified as being a separate objective because the three alternatives are not expected to have significantly different risks as related to the escalation of their costs. The present value of each alternative, however, does include contingency, which is allocated to the cost estimates to allow for escalation of costs.

As discussed in section 10.8 of Chapter 10, mitigation measures will be further developed in the Feasibility Design stage and the Definition phase of the BRT Project.

As the BRT Project progresses through the Feasibility Design stage, the cost estimate for the Leading Alternative (Alternative 1) is likely to change as the project becomes more defined. However, this is not expected to impact the relative costs of the alternatives because a considerable portion of the investment on the 2L90 circuit is related to the scope of work to refurbish the 2L90 circuit, which is common to each of the alternatives. By March 2022, BC Hydro expects to confirm whether the Leading Alternative will proceed as the Preferred Alternative. Following this decision, BC Hydro will file an evidentiary update with the BCUC to provide additional information on the BRT Project.

Table 9-2 below provides a color-coded consequence table which summarizes how each alternative performed with respect to the objectives set out in Table 9-1 above. The colours highlight the performance of each alternative compared to one alternative, which is fixed as the point of comparison (for this analysis, Alternative 1).

**Table 9-2 Consequence Table: Alternative Analysis Results**

| Worse | Better | Similar | Point of Comparison |
|---|---|---|---|

| Objective | Criteria | Measure | Alternatives | | | | |
|---|---|---|---|---|---|---|---|
| | | | Alternative 1 | Alternative 2A | Alternative 2B | Alternative 2C | Alternative 3 |
| Maximize System Reliability and Flexibility | System Flexibility | **High**/Med/Low | High | High | High | High | High |
| | System Operational Risk | High/Med/**Low** | Low | Low | Low | Low | Low |
| | Likelihood of System Being Damaged by Fire | High/Med/**Low** | High | High | High | High | High |
| Minimize Environmental Impacts and Impacts to St’at’imc Core Interests | Risk of Impacts on Aquatic Species and Habitat | High/Med/**Low** | Low | Low | Low | Low | Low |
| | Risk of Impacting Heritage Sites | High/Med/**Low** | Med | Low | Low | Low | Low |
| | Risk of Impacts to Terrestrial Species and Habitat | High/Med/**Low** | Med | Low | Low | Low | Low |
| | Risk of Impacts on Vegetation | High/Med/**Low** | Low | Low | Low | Low | Low |
| | Risk of Impacts from Hazardous Wastes | High/Med/**Low** | Med | Low | Low | Low | Med |
| | Likelihood of High Flow in Lower Bridge River | High/Med/**Low** | Low | Low | Low | Low | Low |
| Minimize Total Costs[143] | Present Value of Total Costs | $ million | 75.1 | 85.3 | 88.6 | 79.8 | 107.9 |
| Minimize Occupational Health and Safety Risks | Risks during Construction | High/Med/**Low** | High | High | High | High | High |
| Minimize Impacts to Stakeholders | Impacts to Stakeholders | High/Med/**Low** | Low | Low | Low | Low | Low |

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[143] The Conceptual Design cost estimates that were used in the computation of the Present Value of Total Costs have an accuracy range of +100 per cent/-35 per cent.

The following subsections discuss the objectives identified in Table 9-1 above and the extent to which each alternative satisfies those objectives.

### 9.5.1 Objective 1 - Maximize System Reliability and Flexibility

This objective involves maximizing the reliability and flexibility of the Bridge River Transmission System. To evaluate the extent to which each alternative meets this objective, each alternative was assigned a measure (low, medium or high) for each of the following criteria: system flexibility, system operational risk and likelihood of system being damaged by fire.

- System flexibility refers to the ability to minimize generation curtailments when taking a planned outage. Each of the alternatives was assessed to be “high” for this criterion as each alternative will address constraints on the Bridge River Transmission System so that required planned outages can be undertaken with minimal or no generation curtailments.
- System operational risk refers to the risk of unplanned outages on the 2L90 circuit. Each of the alternatives was assessed to be “low” for this criterion as each alternative addresses constraints on the Bridge River Transmission System and refurbishes the 2L90 circuit, reducing the risk of unplanned outages.
- Likelihood of system being damaged by fire refers to the system, specifically the 2L90 circuit, being damaged by fire. Each of the alternatives was assessed to be “high” for this criterion as each alternative maintains the 2L90 circuit. The 2L90 circuit is historically vulnerable to wildfire and has poor access in some areas along the right-of-way. To address future wildfire risks, each of the three alternatives includes the consideration of fire resistant material for replacement structures in high wildfire risk sites.

### 9.5.2 Objective 2 - Minimize Environmental Impacts and Impacts to St’át’imc Core Interests

This objective involves evaluating the relative impacts on the environment and on the core interests of the St’át’imc Nation, as they are understood by BC Hydro. One of the main concerns raised by the St’át’imc Nation relates to future construction activities for the BRT Project, the clearing and recontouring land surfaces in some areas, and the potential to impact environmental, archaeological and cultural sites.[144]

To evaluate the extent to which each alternative meets this objective, each alternative was assigned a measure (low, medium or high) for each of the following criteria:

- Risk of impacts on aquatic species and habitat;
- Risk of impacting heritage sites;
- Risk of impacts to terrestrial species and habitat;
- Risk of impacts on vegetation;
- Risk of impacts from hazardous wastes; and
- Likelihood of high flows in Lower Bridge River.

#### *9.5.2.1 Risk of Impacts on Aquatic Species and Habitat*

This risk corresponds to the need:

- for outages to conduct work on the 2L90 circuit, which could increase the likelihood of flows exceeding the WUP Order flow target schedule, resulting in impacts to aquatic species and habitat; and
- to undertake construction activities to refurbish the 2L90 circuit, which could disturb fish habitat or result in the removal of riparian vegetation.

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[144] Further discussion on this point is provided in section 11.2.4.1 of Chapter 11.

Each of the alternatives was assessed as “low” for this risk. This is because:

- The outage duration required on the 2L90 circuit for all three alternatives is expected to be limited and can be managed through early outage planning and by conducting pre-outage assembly and construction works to minimize the required duration of outages; and
- While each alternative includes work to refurbish the 2L90 circuit, disturbance to fish habitat and the removal of riparian vegetation during construction can be minimized or avoid completely during construction.

#### *9.5.2.2 Risk of Impacts to Heritage Sites and Risk of Impacts to Terrestrial Species and Habitat*

The greatest risk of impacting heritage sites and of impacting terrestrial species and habitat is expected to arise from ground disturbance caused by the replacement of poles and, generally, the presence of personnel and equipment along the 2L90 circuit right-of-way, in order to conduct the required work on the 2L90 circuit.

Alternative 1 is expected to have a greater risk of impacting heritage sites and terrestrial species and habitat relative to the other alternatives because of the incremental work required to increase the maximum capacity of the circuit, in addition to the refurbishment work which is common to all of the alternatives. For this reason, Alternative 1 has been assessed to be ‘medium” for these risks while Alternatives 2 and 3 were assessed of “low” for these risks. Mitigation measures to address these risks will be developed as the BRT Project progresses and may include:

- Avoiding the site;
- Recovering archeological site information prior to land altering activities; and
- Monitoring for additional archeological site information during land altering activities.

#### *9.5.2.3 Risk of Impacts on Vegetation*

Each of the alternatives was assessed to be “low” for risk of impacts on vegetation. This risk corresponds to the vegetation impacts expected arise from ground disturbance caused by the replacement of poles and, generally, the presence of personnel and equipment along the 2L90 circuit right-of-way, in order to conduct the required work on the 2L90 circuit. While each alternative includes work on the 2L90 circuit, the risk of impacts to vegetation occurring as a result of this work is considered “low” because most of the vegetation removal will be localized and should have limited impact.

#### *9.5.2.4 Risk of Impacts from Hazardous Wastes*

The risk of impacts from hazardous waste arises from the potential for an accidental release of insulating oil into the environment from the Rosedale T1 transformer. This risk exists because the Rosedale Substation is not currently equipped with oil containment facilities. Alternative 2 addresses this risk by installing containment facilities in the Rosedale Substation and, accordingly, this alternative was assessed to be “low” for risk of impacts from hazardous waste. Alternatives 1 and 3 were assessed to be “medium”. Under Alternatives 1 and 3, oil containment facilities would be installed at the Rosedale Substation once the T1 transformer reaches end-of-life and needs to be replaced, which is expected to be approximately 15 years from now.

#### *9.5.2.5 Likelihood of High Flows in Lower Bridge River*

Alternative 1 and Alternative 2 address the constraints on the Bridge River Transmission System, minimizing the risk of high flows in Lower Bridge River. Accordingly, this risk was assessed as “low” for both Alternative 1 and Alternative 2.

For Alternative 3, the greatest risk of high flows in Lower Bridge River is expected to arise from instances where IPP generation is not curtailed as directed or expected to avoid exceeding the maximum capacity on the 2L90 circuit. However, a generation curtailment order not being followed or not performing as expected, is considered to be unlikely. Accordingly, this risk was also assessed as “low” for Alternative 3.

### 9.5.3 Objective 3 - Minimize Total Costs

BC Hydro determined the Present Value (**PV**) of cost for each alternative to evaluate and compare the lifecycle costs of the alternatives. For Alternatives 1 and 2, the PV of cost is the sum of all discounted costs over the life of the equipment. For Alternative 3, the PV of cost also includes the discounted opportunity cost of the IPP generation curtailment over 24 years.[145] For the reasons discussed in section 9.3 above, each of the alternatives include costs related to the refurbishment of the 2L90 circuit and the life extension and replacement of the Rosedale T1 transformer after 15 years.

The PV of cost for each alternative, broken down by different scopes of work, is provided in Table 9-3 below. Further information on the costs of these alternatives, as well as a working excel model, are provided as Appendix C-3. As shown in the table, Alternative 1 has the lowest PV of total costs.

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[145] Appendix C-2 provides a more detailed discussion of the IPP generation curtailment and cost estimate assessment methodology. The PV of cost for Alternative 3 does not include any costs required to negotiate expanded generation curtailment rights with IPPs. Any required costs to obtain these expanded rights would be in addition to the discounted opportunity cost of IPP generation curtailment.

**Table 9-3 Present Value of Total Costs for Each Alternative**

| Present Value [146] ($-millions) | Alternative 1 | Alternative 2A | Alternative 2B | Alternative 2C | Alternative 3 |
|---|---|---|---|---|---|
| 2L90 circuit[147] scope cost | 50.0 | 42.6 | 42.6 | 42.6 | 43.2[148] |
| Rosedale T1 transformer[149] scope cost | 25.1 | 42.7 | 46.0 | 49.6 | 25.1 |
| IPP generation curtailment cost | 0 | 0 | 0 | 0 | 39.6[150] |
| **Total** | **75.1** | **85.3** | **88.6** | **79.8** | **107.9** |

### 9.5.4 Objective 4 - Minimize Occupational and Health Safety Risks

The greatest risk to occupational health and safety during construction is expected to arise from work on the 2L90 circuit.

All work planned for the 2L90 circuit will require work from heights, on uneven terrain, and will occur in remote locations, with a significant amount of helicopter work likely required. While Alternative 1 has additional work on the 2L90 circuit relative to Alternative 2 and Alternative 3, this scope of work is relatively small compared to the scope of work on the 2L90 circuit that is included in each of these alternatives. Accordingly, each of the alternatives was assessed to be “high” for this criterion.

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[146] The PV figures in Table 9-3 were calculated using a real discount rate of 2.9 per cent or a nominal discount rate of 5 per cent per year. This corresponds to BC Hydro’s Weighted Average Cost of Capital.

[147] The cost related to the 2L90 circuit scope of work is higher for Alternative 1 since Alternative 1 includes additional work to increase the maximum capacity of the 2L90 circuit. For further information, refer to section 9.3.1.

[148] The scope of work related to the 2L90 circuit in Alternative 3 is the same as the scope of work included in Alternatives 2A, 2B and 2C; however, the Present Value is slightly higher because (i) the work would be completed one year later under Alternative 3, resulting in a longer project duration with additional project management and engineering costs; and (ii) Alternative 2 is expected to have slightly lower construction costs compared to Alternative 3 due to an increased ability to share construction resources between the 2L90 circuit work and the Rosedale T1 transformer work.

[149] There are differences in the scope of work related to the Rosedale T1 transformer for Alternatives 2A, 2B and 2C. For further information, refer to section 9.3.2.

[150] The IPP generation curtailment PV of cost is based on the following assumptions: curtailment would take place over a 24-year period and would occur in the months of May, June and July, at a rate of 1.6 times per month, for a total duration of seven days including notification, ramp-down and ramp-up periods. The reference price for energy used to estimate opportunity cost for IPP curtailment is the B.C. border sell price, forecasted in February 2021, because it reflects the revenue BC Hydro would forego for electricity sales after considering line losses and wheeling costs.

### 9.5.5 Objective 5 - Minimize Impact to Stakeholders

The greatest impact to stakeholders is expected to arise from any impact to peace and enjoyment of spaces (e.g., trails, farmland, and subdivisions) which may be in close proximity to the areas of construction at either the Rosedale Substation or along the 2L90 circuit right-of-way. The planned work for each of the alternatives does not occur in areas that would impact to peace and enjoyment of spaces by stakeholders. The 2L90 circuit is in a remote area and the construction required under Alternative 2 would be conducted within the Rosedale Substation. Accordingly, each of the alternatives was assessed to be “low” for this criterion.

# BC Hydro Bridge River Projects

## Bridge River Transmission Project

# Chapter 10

## Project Description

# Table of Contents

10.1 Introduction ........ 10-1
10.2 BRT Project Lifecycle and Activities ........ 10-2
    10.2.1 BRT Project Lifecycle ........ 10-2
    10.2.2 Completed BRT Project Activities ........ 10-3
        10.2.2.1 Conceptual Design Stage Activities ........ 10-3
    10.2.3 Ongoing and Future BRT Project Activities ........ 10-4
        10.2.3.1 Feasibility Design Stage Activities ........ 10-4
        10.2.3.2 Definition Phase Activities ........ 10-6
        10.2.3.3 Implementation Phase Activities ........ 10-6
10.3 BRT Project Scope and Technical Requirements ........ 10-7
    10.3.1 Project Components and Infrastructure ........ 10-7
        10.3.1.1 Increasing the Maximum Capacity of the 2L90 Circuit ........ 10-8
        10.3.1.2 Refurbishing the 2L90 Circuit ........ 10-10
    10.3.2 Technical Requirements ........ 10-10
        10.3.2.1 Structure Requirements ........ 10-10
        10.3.2.2 Wildfire Risk Requirements ........ 10-11
        10.3.2.3 Environmental Requirements ........ 10-11
        10.3.2.4 Right-of-Way Requirements ........ 10-12
10.4 BRT Project Costs and Assumptions ........ 10-12
    10.4.1 Identification and Definition Phase Costs ........ 10-13
    10.4.2 Implementation Phase Direct and Indirect Construction Costs ........ 10-13
    10.4.3 Contingency, Escalation, Overhead, and Interest During Construction ........ 10-13
        10.4.3.1 Contingency ........ 10-13
        10.4.3.2 Escalation, Overhead, and Interest During Construction ........ 10-14
    10.4.4 BRT Project Cost Range ........ 10-14
10.5 Rate Impact Analysis ........ 10-15
10.6 BRT Project Schedule ........ 10-16
    10.6.1 Project Major Milestones ........ 10-16
    10.6.2 Scheduling Constraints and Considerations ........ 10-17
10.7 BRT Project Permits, Approvals and Authorizations ........ 10-17
    10.7.1 Environmental Assessments ........ 10-18
    10.7.2 Federal Requirements ........ 10-18

10.7.3 Provincial Requirements ........ 10-19
10.7.4 Municipal Requirements ........ 10-19
10.7.5 List of Potential and Required Environmental Permits and Approvals ........ 10-19
10.8 BRT Project Impacts ........ 10-20
10.8.1 Environmental, Cultural and Socio-Economic Impacts ........ 10-20
10.8.1.1 Environmental Impact ........ 10-21
10.8.1.2 Socio-Economic Impact ........ 10-28

## List of Figures

Figure 10-1 Project Lifecycle ........ 10-2
Figure 10-2 2L90 Circuit Route ........ 10-9
Figure 10-3 Cumulative Incremental Rate Impacts for BRT Project Leading Alternative Cost Range ........ 10-16

## List of Tables

Table 10–1 Escalation, Capital Overhead, and Interest During Construction used to Prepare the BRT Cost Estimate as of August 2020 ........ 10-14
Table 10–2 Project Cost Range Breakdown ........ 10-15
Table 10–3 Project Major Milestones ........ 10-17
Table 10–4 Potential Environmental Permits Required and Planned Actions ........ 10-19

## 10.1 Introduction

This chapter provides a description of the BRT Project, assuming that the Leading Alternative proceeds as the Preferred Alternative for the BRT Project. As discussed in Chapter 9, BC Hydro selected a Leading Alternative for the BRT Project at the end of the Conceptual Design stage. The Leading Alternative is to increase the maximum capacity of the 2L90 circuit from 585 A (233 MVA) to 1014 A (404 MVA) and to refurbish the 2L90 circuit.

The BRT Project is currently in the Feasibility Design stage. By March 2022, BC Hydro expects to confirm whether the Leading Alternative will proceed as the Preferred Alternative. Following this decision, BC Hydro will file an evidentiary update with the BCUC to provide additional information on the BRT Project. The evidentiary update will include an updated Environmental Impact Statement with input from the St’át’imc Nation.

This chapter provides a description of where the BRT Project is in the project lifecycle and the ongoing and future project activities. It explains the scope, activities, technical requirements, cost, rate impact, schedule and impacts, assuming that the Leading Alternative proceeds as the Preferred Alternative for the BRT Project.

This chapter provides the information that BC Hydro has to-date and is structured as follows:

- Section 10.2 provides an overview of where the BRT Project is in the project lifecycle, and the ongoing and future project activities;
- Section 10.3 describes the BRT Project’s scope and technical requirements;
- Section 10.4 provides the BRT Project’s cost range, including the direct and indirect construction costs, and contingency;
- Section 10.5 provides the BRT Project’s estimated rate impact analysis;

- Section 10.6 provides an overview of the BRT Project's schedule including key scheduling constraints;
- Section 10.7 explains the required permits, approvals, and authorizations; and
- Section 10.8 discusses the BRT Project's identified environmental and socio-economic impacts.

## 10.2 BRT Project Lifecycle and Activities

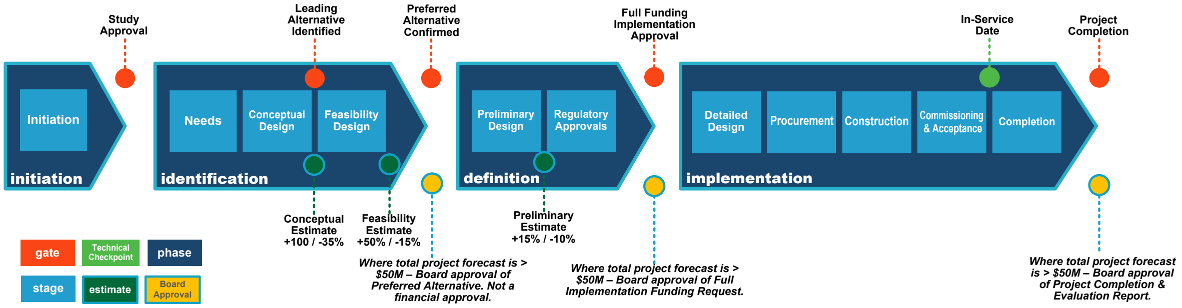
This section outlines the BRT Project lifecycle (section 10.2.1), BRT Project activities that have been completed to-date (section 10.2.2), and ongoing and future activities required to confirm whether the Leading Alternative will proceed as the Preferred Alternative and to implement the BRT Project (section 10.2.3).

### 10.2.1 BRT Project Lifecycle

The lifecycle of the BRT Project consists of four phases: Initiation, Identification, Definition and Implementation. Each phase is further divided into various stages. Approvals occur at various points (gates) in the project lifecycle where key information, such as project costs, schedule, scope, and risks are presented to seek approval to continue with the project.

Figure 10-1 below provides a summary of the project lifecycle. The gates following each phase of the project lifecycle are shown as red circles, and approvals by the Board of Directors (where required) are shown in yellow circles.

**Figure 10-1 Project Lifecycle**



As illustrated in Figure 10-1 above, projects become more defined as they move through the process, and the increased level of design development allows for updated cost estimates to be developed.

The BRT Project received BC Hydro Gate Board approval on the Leading Alternative and to advance to the Feasibility Design stage on December 16, 2020.

The BC Hydro Board of Directors does not typically review the Leading Alternative for a project. However, to facilitate the filing of the Application, the Board of Directors reviewed the rationale and the Leading Alternative for the BRT Project in June 2021.

This early review is in addition to the standard Board of Directors endorsement of the Preferred Alternative after Feasibility Design stage activities are complete, which is expected to occur in February 2022, and the Board of Directors approval of the First Full Funding request, which is expected to occur in June 2023.

The following subsections provide an overview of the completed, ongoing, and future activities for the BRT Project.

### 10.2.2 Completed BRT Project Activities

#### *10.2.2.1 Conceptual Design Stage Activities*

The purpose of the Conceptual Design stage is to define and examine the conceptual alternatives and select a Leading Alternative to carry forward into Feasibility Design stage. The BRT Project completed the Conceptual Design stage on January 29, 2021.

The conceptual level design activities included confirming system and project requirements, identifying conceptual alternatives, defining the feasible alternatives, and documenting the technical work in the Conceptual Design Report, which is provided as Appendix C-4. After the completion of the conceptual design, the Conceptual Design cost estimate was prepared for each of the feasible alternatives. An initial constructability review was also completed during the Conceptual Design stage. The Conceptual Design Report and cost estimate were inputs into the alternative analysis process discussed in Chapter 9 and informed the selection of the Leading Alternative.

### 10.2.3 Ongoing and Future BRT Project Activities

The BRT Project is currently in the Feasibility Design stage. BC Hydro anticipates completing the Feasibility Design stage, which will complete the Identification phase for the BRT Project, in March 2022. BC Hydro then expects to complete the Definition phase in June 2023, place the project into service in October 2025, and complete all BRT Project activities by April 2026. Section 10.6 below provides further discussion on the BRT Project schedule.

The subsections below describe the activities that BC Hydro is currently undertaking in the Feasibility Design stage, and the future Definition phase and Implementation phase activities required to put the BRT Project into service.

#### *10.2.3.1 Feasibility Design Stage Activities*

The final stage of the Identification phase is the Feasibility Design stage. During the Feasibility Design stage, BC Hydro will conduct the investigations and analysis required to confirm whether the Leading Alternative will proceed as the Preferred Alternative into the Definition phase. Approval of the Preferred Alternative by BC Hydro’s Board of Directors is expected to occur in February 2022.

The key activities of the Feasibility Design stage include:

- Continue engagement with the Indigenous communities on the project scope, including the development of the archaeological and environment field investigative studies;
- Continue engagement with public stakeholders on the project scope including informing the local municipalities about project activities and key milestones and providing presentations at municipal/district councils, if requested. The

project will also keep nearby residents and businesses updated and informed on the project and respond to any site-specific inquiries;

- Complete Feasibility Design for the scope of work on the 2L90 circuit;
- Undertake further site visits to confirm feasibility design and field investigative studies, including environmental, archaeological, access and geotechnical aspects, including engagement with St'át'imc;
- Update the constructability review, including an assessment of staging, outages, safety, and access complexity. An initial technical assessment of the commissioning and energization plan will also be completed;
- Complete an assessment of the public and worker safety issues associated with the Leading Alternative. Incorporate Safety by Design principles into the feasibility design and safety plans;
- Seek input from St'át'imc on the BRT Project's procurement approach, aligned with commitments and processes outlined in the 2011 Agreements and 2019 High Flow Settlement Agreement;
- Prepare and seek endorsement of the BRT Project's procurement approach. BC Hydro will assess and recommend the best sourcing alternatives for the BRT Project with the consideration of procurement risks and mitigations, Indigenous procurement opportunities, and project timing. The BRT Project will utilize existing outline agreements and master service agreements where appropriate;
- Confirm NERC Mandatory Reliability Standards requirements for the BRT Project; and
- Assess further regulatory requirements, including the need for permits and licenses to construct the BRT Project.

The BRT Project currently has a conceptual level cost estimate with an estimating accuracy range of +100 per cent and -35 per cent. BC Hydro expects to complete the activities described above by the end of 2021 to enable a feasibility level cost estimate for the BRT Project with an estimating accuracy range of +50 per cent and -15 per cent.

#### *10.2.3.2 Definition Phase Activities*

The Definition phase defines the major project components in sufficient detail to develop a preliminary level cost estimate with a target accuracy range of +15 per cent and -10 per cent and to receive approval to proceed to the Implementation phase. BC Hydro Board of Directors approval of Full Implementation Funding will be sought for the BRT Project in June 2023.

The key activities of the Definition Phase include:

- Complete the preliminary design to further advance the project definition;
- Complete outage, environmental, safety, and construction management plans to support the development of a detailed construction schedule;
- Ensure all required regulatory authorizations and Implementation phase funding are obtained;
- Verify that consultation activities with Indigenous communities have been completed for this phase and that sufficient input has been received from Indigenous communities and public stakeholders; and
- Confirm that the risks associated with executing the work in the Implementation phase are well managed and acceptable.

#### *10.2.3.3 Implementation Phase Activities*

In the Implementation phase, BC Hydro will complete the design and procurement processes, and construct the Preferred Alternative for the BRT Project. The Implementation phase consists of the following stages and key activities:

- The Detailed Design stage is the final stage of the design process. This stage will refine the Preferred Alternative so that procurement, manufacturing and construction is undertaken in accordance with the project's objectives and BC Hydro's Project and Portfolio Management System practices;
- In the Construction stage, the manufacturing and supply, installation and/or construction of the required work in accordance with the contract specifications, drawings, and the commissioning and acceptance criteria will be completed;
- In the Commissioning and Acceptance stage, testing and commissioning of the constructed BRT Project will be completed in accordance with the prescribed criteria and to ensure NERC Mandatory Reliability Standards compliance; and
- In the Completion stage, project deficiencies will be resolved, and record drawings, the PCER and other project close-out activities will be completed.

## 10.3 BRT Project Scope and Technical Requirements

### 10.3.1 Project Components and Infrastructure

The BRT Project scope involves refurbishing the 2L90 circuit that connects Bridge River Terminal Station to Kelly Lake Substation and increasing its maximum capacity from 585 A to 1014 A. This scope of work involves the following activities:

- Replacing 64 structures and re-contouring four sites along the 2L90 right-of-way to resolve conductor clearances;
- Replacing 34 structures to address reliability and safety-related deficiencies;
- Replacing cross-arms, cross-braces, insulators, and guy anchors/guards at 33 structure sites to address reliability and safety-related deficiencies; and,
- Upgrading approximately 63 kilometres of existing access roads and constructing approximately seven kilometres of new access roads to facilitate construction work.

A detailed discussion of the BRT Project scope is included in the Conceptual Design Report provided as Appendix C-4.

#### *10.3.1.1 Increasing the Maximum Capacity of the 2L90 Circuit*

The 2L90 circuit runs for approximately 76.5 kilometres from the north end of Seton Lake at Bridge River Terminal Station, running along Seton Lake and Fraser River to Kelly Lake Substation. The circuit alignment traverses some very steep terrain, accessible only by helicopter, particularly on the south side of Seton Lake. The 2L90 circuit route is shown in Figure 10-2 below.

**Figure 10-2 2L90 Circuit Route**

For illustration purposes only. Not to scale.

To increase the maximum capacity of the 2L90 circuit, some structures will need to be replaced and some ground sites will need to be recontoured so that there is adequate clearance between the line, the ground, and other nearby objects. An explanation of the maximum capacity of a transmission line and how this relates to ground clearances is provided in section 8.2.2 of Chapter 8.

#### *10.3.1.2 Refurbishing the 2L90 Circuit*

There are major[151] and moderate[152] structural defects on the 2L90 circuit that could impact the future reliability of the circuit and need to be addressed as part of the BRT Project. The majority of the structural defects require the complete replacement of the structure. In other cases, the poles will remain and only components, such as cross-arms, insulators, and/or guys, will be replaced. In addition to the major defects, there are a considerable number of minor defects, such as missing guy guards or broken number plates that do not impact the reliability of the line, but may be included in the scope of work due to the efficiencies gained by addressing these minor defects as part of the BRT Project. Further work will be conducted in the Feasibility Design stage to confirm the scope of work for the minor defects.

### 10.3.2 Technical Requirements

The technical performance requirements for increasing the maximum capacity of the 2L90 circuit are discussed in the subsections below.

#### *10.3.2.1 Structure Requirements*

The transmission line will be designed to fulfil the relevant operating conditions as determined by BC Hydro’s system operating orders and will meet BC Hydro and industry standards.

The transmission line design will meet or exceed the minimum vertical and horizontal clearances. The design shall ensure that adequate conductor clearances to ground and obstacles are maintained for the 2L90 circuit to be operated at the increased maximum capacity of 1014 A, as discussed further in section 8.2.2 of Chapter 8.

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[151] Major defects refer to components with high damage, wear or decay or to broken or completely failed components.

[152] Moderate defects refer to components with moderate damage, wear or decay.

BC Hydro will select and utilize wood pole structures, fibre reinforced polymer structures, and steel structures based on wildfire risk, terrain and access requirements for each structure replacement identified in the project scope.

The transmission line design will consider access requirements for inspections, maintenance, and repair, and meet all BC Hydro and industry standards.

#### *10.3.2.2 Wildfire Risk Requirements*

The transmission line will be designed with consideration of the risk of wildfire. The 2L90 circuit has been damaged by wildfires on multiple occasions, causing power outages ranging from 64 hours in 2016 to almost five months (or 3,363 hours) in 2004. Consideration of this risk has influenced the selection of the materials for the replacement structures. B.A. Blackwell & Associates Ltd. was engaged to perform a wildfire risk assessment on the circuit and provide recommendations. The recommendations have been considered in the Conceptual Design stage, and fibre reinforced polymer structures, which have resistance to wildfire damage compared to wood poles, have been proposed for replacement structures in the high wildfire risk sites to address the future wildfire risk.

#### *10.3.2.3 Environmental Requirements*

All construction activity on the structure sites is expected to occur within the existing right-of-way for the 2L90 circuit. The foundations for the new structures are expected to be direct pole embedment using standard earth and rock anchors and the new structures will be placed in, or in close proximity to, the locations of existing structures to minimize ground disturbance. However, some vegetation removal and road upgrades and construction will be required to allow construction personnel to access the structure sites. All environmental requirements and mitigation measures will be detailed in the BRT Project’s environmental management plan. Section 10.8 below provides a discussion on potential environmental impacts.

#### *10.3.2.4 Right-of-Way Requirements*

Most of the 2L90 circuit runs on BC Hydro’s right-of-way. All new structures for the BRT Project will be designed to stay within the existing right-of-way and BC Hydro does not expect that additional rights-of-way will be required. The existing access roads will be upgraded, and new access roads will be designed and created as needed to access the structure sites.

## 10.4 BRT Project Costs and Assumptions

The BRT Project has a Conceptual Expected Cost estimate of $66.2 million with an expected accuracy range of +100 per cent and -35 per cent. The resulting BRT Project cost estimate range is $43.0 million to $132.4 million with a confidence interval of 80 per cent (**BRT Project Cost Range**). The Conceptual cost estimate followed BC Hydro’s Project and Portfolio Management System practices and conforms to the requirements of the AACEI Class 5 cost estimate.

The BRT Project Cost Range includes actual costs, estimated direct construction and indirect construction costs, contingency, escalation, interest during construction, and capital overhead.

As the BRT Project progresses through its lifecycle, the expected accuracy range of its cost estimate will narrow. The BRT Project Expected Cost and Range will be updated at the end of the Feasibility Design stage and the Preliminary Design stage as outlined in Figure 10-1 above. After the end of the Feasibility Design stage, BC Hydro will file an evidentiary update with the BCUC to provide additional information on the BRT Project.

This section provides a discussion on the estimate to complete the Identification and Definition phases (section 10.4.1), explains what is included in the direct construction costs and indirect construction costs (section 10.4.2), explains the contingency, escalation, interest during construction, and capital overhead (section 10.4.3); and provides a table showing a breakdown of the BRT Project Cost Range (section 10.4.4).

### 10.4.1 Identification and Definition Phase Costs

The estimate for the Identification phase was prepared by subject matter experts based on their specific knowledge of the outstanding work and deliverables required to complete the phase. The Definition phase cost is estimated based on the historical percentages of Definition phase costs from similar projects.

### 10.4.2 Implementation Phase Direct and Indirect Construction Costs

The direct construction costs include estimates for the supply, installation, testing, commissioning, construction management and general construction requirements of the BRT Project. The direct construction cost estimate is based on historical costs from other similar projects.

The indirect construction costs include estimates for project management, engineering and design, procurement, quality management, environmental monitoring, indigenous relations, and other indirect costs required to implement the BRT Project. The indirect construction costs are estimated based on historical percentages of indirect construction costs on similar projects.

### 10.4.3 Contingency, Escalation, Overhead, and Interest During Construction

#### *10.4.3.1 Contingency*

A contingency amount of $12.3 million has been estimated for the BRT Project and is consistent with similar historical projects. The contingency provides for costs which cannot be specifically identified at the time of estimate preparation, but which can be foreseen to occur during the life of the project with varying degrees of probability. Some of these cost risks are schedule delays due to limited outage windows, adverse weather conditions, productivity issues, and risks relating to working conditions or unforeseen site conditions.

There are no contingency amounts included for items subject to external influences outside the BRT Project, such as tax changes and Force Majeure.

#### *10.4.3.2 Escalation, Overhead, and Interest During Construction*

The BRT Project Cost Range includes estimates for escalation, capital overhead, and interest during construction. Escalation is applied to future phase costs and is based on economic trends, advice from independent economists on appropriate inflation rates for the construction sector, and data from Statistics Canada. Capital overhead is calculated and applied on the total direct costs. Interest during construction is an estimate of the interest incurred over the course of the project until the project is placed in-service. Interest during construction is applied only to capital costs and will vary over the course of the project. Table 10–1 below provides the escalation, capital overhead and interest during construction assumptions used for the BRT Project Cost Range.

**Table 10–1 Escalation, Capital Overhead, and Interest During Construction used to Prepare the BRT Cost Estimate as of August 2020**

| Fiscal Year | Escalation (%) | Capital Overhead (%) | Interest During Construction (%) |
|---|---|---|---|
| 2021 | 2.5 | 5.1 | 3.53 |
| 2022 | 2.0 | 5.1 | 3.30 |
| 2023 | 2.0 | 5.1 | 3.25 |
| 2024 & beyond | 2.0 | 5.1 | 3.18 |

### 10.4.4 BRT Project Cost Range

Table 10–2 below provides a summary of the BRT Project Cost Range. The Conceptual Level Cost Estimate is provided as Appendix H of Appendix C-4 and contains further details on the estimating process, basis, and assumptions. Appendix C-6 contains a year-by-year breakdown of BRT Project expenditures.

**Table 10–2 Project Cost Range Breakdown**

| **Cost Components** | **Total Cost ($ million)[153]** |
|---|---|
| Early Identification Phase Actuals | 0.1 |
| Identification Phase Activities | 2.8 |
| Definition Phase Activities | 2.8 |
| **Sub-total: Identification Phase and Definition Phase Costs** | **5.7** |
| Transmission Structure Replacement | 22.4 |
| Access Road Construction | 4.8 |
| Construction & Contract Management | 3.1 |
| Other Direct Construction Cost | 3.3 |
| **Sub-total: Direct Construction Cost** | **33.6** |
| **Indirect Construction Cost** | **5.5** |
| **Sub-total: Implementation Phase Construction Costs** | **39.1** |
| Contingency on Identification Phase Activities (10 per cent) | 0.2 |
| Contingency on Definition Phase Activities (20 per cent) | 0.6 |
| Contingency on Implementation Phase Activities (30 per cent) | 11.5 |
| **Sub-total: Project Contingency** | **12.3** |
| Interest During Construction, Inflation, Capital Overhead | 9.1 |
| **Total BRT Project Conceptual Level Cost Estimate** | **66.2** |
| **Total BRT Project Cost Range (+100%/-35%)** | **132.4 - 43.0** |

## 10.5 Rate Impact Analysis

The BRT Project would affect the amortization and finance charges elements of BC Hydro’s revenue requirements. The first year in which BC Hydro’s revenue requirement would be affected by the BRT Project is fiscal 2026. Figure 10-3 below sets out the resulting estimated incremental rate impacts for each fiscal year after fiscal 2021, assuming the Conceptual Design Expected Cost estimate of $66.2 million.

Figure 10-3 also shows the cumulative incremental rate impacts of the BRT Project. Assuming the Conceptual Design Expected Cost, the highest incremental rate impact of 0.06 per cent is in fiscal 2027, which is the first full year in which

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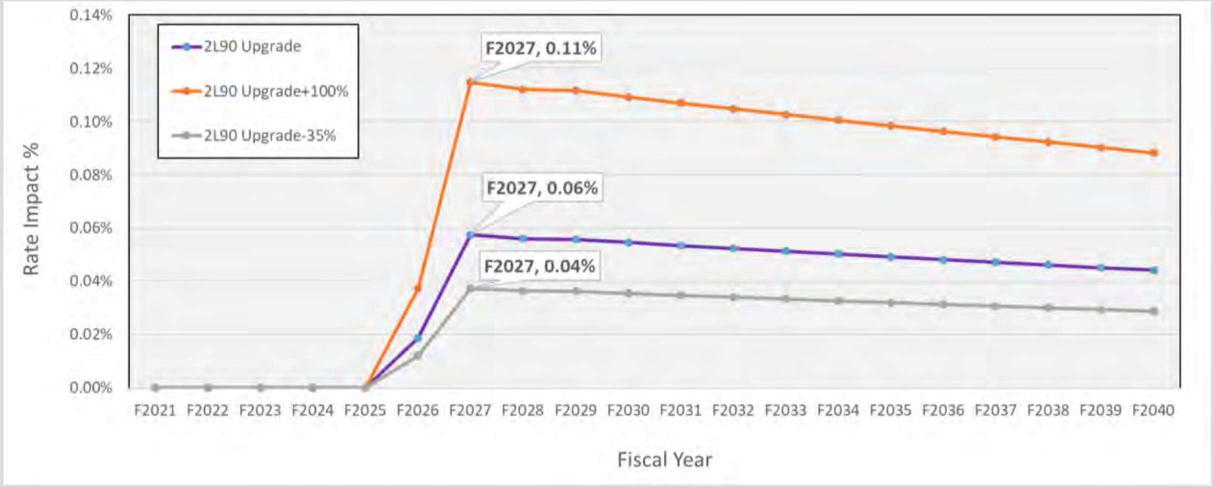
[153] Numbers may not add up due to rounding.

amortization and finance costs of all the assets are recovered from ratepayers. The incremental rate impact decreases over time, as amortization recovered from ratepayers is used to pay down the debt, and results in lower financing costs. Appendix C-7 contains the financial models used to determine the rate impacts.

**Figure 10-3 Cumulative Incremental Rate Impacts for BRT Project Leading Alternative Cost Range**



## 10.6 BRT Project Schedule

The preliminary conceptual level schedule for the BRT Project has been developed with an in-service date of October 2025 with all BRT Project activities scheduled for completion by April 2026. The following subsections set out the major milestones for the BRT Project and the constraints considered when developing the schedule. The BRT Project schedule is provided as Appendix C-5.

### 10.6.1 Project Major Milestones

Table 10–3 below provides the estimated dates for the BRT Project major milestones.

**Table 10–3 Project Major Milestones**

| Description of Milestone | Estimated Date |
|---|---|
| BC Hydro files the Application | July 2021 |
| Feasibility Estimate Finalized | November 2021 |
| Preferred Alternative Confirmed (BC Hydro Board Approval) | February 2022 |
| Evidentiary Update | BC Hydro will propose a date in March 2022 |
| Expected BCUC Decision Date | To be determined |
| Preliminary Estimate Complete | March 2023 |
| Implementation Phase Funding Approval (BC Hydro Board Approval) | June 2023 |
| BRT Project In-Service Date | October 2025 |
| BRT Project Complete | April 2026 |

### 10.6.2 Scheduling Constraints and Considerations

The project schedule is the result of a combination of required BRT Project elements and construction period constraints. The following constraints were considered and incorporated into the current BRT Project schedule:

- The need to develop a CPCN application for the BRT Project at the end of the Conceptual Design stage;
- Receiving a BCUC Decision prior to awarding a contract and advancing vegetation clearing and access construction work; and
- Three-month schedule contingency to cover additional time for installation activities and delays due to a constrained outage window.

## 10.7 BRT Project Permits, Approvals and Authorizations

BC Hydro has considered relevant permits, approvals and authorizations that may be required for the BRT Project. This section explains the environmental assessment requirements for the BRT Project (section 10.7.1), the federal permits required under the *Species At Risk Act* (section 10.7.2), the provincial authorizations required under the *Water Sustainability Act* (section 10.7.3), the applicability of municipal requirements to the BRT Project (section 10.7.4) and provides a list of all potential and required permits and approvals (section 10.7.5).

### 10.7.1 Environmental Assessments

The BRT Project does not require an environmental assessment or notification under the provincial *Environmental Assessment Act* as it does not involve an extension of the line or clearing of large areas of land. Additionally, the BRT Project does not involve any prescribed protected areas that are listed in the *Environmental Assessment Act*.

The BRT Project does not require an environmental assessment under the federal *Impact Assessment Act* as it will not result in a new electrical transmission line or new right-of-way. However, for project works on reserve lands, per Section 82 of the federal *Impact Assessment Act*, an Environmental Review Project Description form will be submitted to Indigenous Services Canada before the end of the Definition phase.

### 10.7.2 Federal Requirements

The BRT Project requires work within areas designated as critical habitat for Lewis's woodpecker under the *Species At Risk Act*. Lewis's woodpecker individuals, eggs, and active nests (residences) are protected from direct harm under the *Species At Risk Act*, the *Migratory Birds Convention Act*, and the *BC Wildlife Act*. Critical habitat intersects the transmission line at multiple locations including within the Lillooet 1 Reserve, the Fountain 1B Reserve, and the Pavilion 1 Reserve. A *Species At Risk Act* permit will be required if impacts to individuals, eggs, or nests are identified.

BC Hydro holds a *Species At Risk Act* permit authorizing the relocation of old end-of-life utility poles that are used for nesting and therefore classified as Lewis's woodpecker residences. This permit is valid until March 2025. If required to align with construction timelines, BC Hydro will apply to amend the permit in the Definition phase. Surveys to determine the presence of Lewis's woodpecker residences in poles identified for replacement will be undertaken in the Identification phase.

### 10.7.3 Provincial Requirements

The BRT Project may require notifications or approvals under the *Water Sustainability Act* for stream crossing associated with access road upgrades. The BRT Project's scope anticipates 102 stream crossings within 50 meters of the right-of-way and the modification or replacement of 22 structures that are located within 25 meters of a stream. In the Definition phase, BC Hydro will apply for all required approvals from the Ministry of Forests, Lands, Natural Resource Operations and Rural Development once work at each location has been defined and the requirements under the *Water Sustainability Act* are confirmed.

### 10.7.4 Municipal Requirements

Under section 32(1) of the *Hydro and Power Authority Act*, BC Hydro is exempt from municipal regulatory requirements. Given that BRT Project activities will be conducted within the BC Hydro right-of-way and on Crown land, there are no municipal regulatory requirements anticipated for the BRT Project.

### 10.7.5 List of Potential and Required Environmental Permits and Approvals

Table 10–4 below provides a list summarizing the potential and required permits and approvals identified in the sections above.

**Table 10–4 Potential Environmental Permits Required and Planned Actions**

| No. | Potential Permits and Approvals | Planned Action |
|---|---|---|
| 1 | Environmental Review Project Description Form submitted to Indigenous Services Canada for work on project works on reserve land, per Section 82 of the federal *Impact Assessment Act* | Will be submitted in the Definition phase. |
| 2 | May require approvals under the *Water Sustainability Act* for potential stream crossings related to access road upgrades. | Will be submitted in the Definition phase, if required. |
| 3 | May need to extend timeline of *Species At Risk Act* permit authorizing the relocation of old end-of-life utility poles used for nesting. | Will assess whether permit needs to be amended in the Definition phase. |

# 10.8 BRT Project Impacts

BC Hydro has completed the following activities to identify potential social and environmental impacts from the BRT Project. It is expected that the potential impacts identified to date can be addressed through the BRT Project EMP and other mitigation measures. This section discusses the environmental and socio-economic conditions in which the BRT Project will be undertaken (section 10.8.1), and provides a preliminary identification of the environmental impacts (section 10.8.1.1) and a preliminary identification of the socio-economic impacts (section 10.8.1.2). There is ongoing engagement with St'át'imc to identify additional values, from the St'át'imc's perspective, that need to be included in the final Environmental Impact Statement. This will be addressed through a communications and engagement plan being developed by BC Hydro, in consultation with St'át'imc, and outcomes will be included in the evidentiary update that BC Hydro plans to file later in this proceeding.

## 10.8.1 Environmental, Cultural and Socio-Economic Impacts

BC Hydro has completed the following activities to identify potential social and environmental impacts:

- Assessed the BRT Project's potential environmental impact;
- Assessed the BRT Project's potential socio-economic impact on Indigenous Nations and local communities;
- Consulted and engaged with Indigenous communities; and
- Engaged with local government, stakeholders and the public.

BC Hydro anticipates that the BRT Project may result in some adverse environmental, cultural and socio-economic impacts. BC Hydro will refine the assessment of potential negative environmental, cultural and socio-economic impacts and will further develop mitigation measures in the Feasibility Design stage and the Definition phase. Specifically, BC Hydro will undertake the following activities to fully characterize the BRT Project’s environmental, cultural and socio-economic impacts:

- Undertake environmental field surveys to further identify environmental impacts and avoidance and mitigation measures;
- Undertake additional desktop study and engagement to further identify and scope cultural and socio-economic impacts and avoidance and mitigation measures;
- Review the Bridge River Contract Worker Conduct Requirements[154] and update those requirements as required;
- Develop management plans to prevent potential impacts during implementation;
- Continue consultation and engagement with Indigenous communities as described in section 11.2 of Chapter 11; and
- Continue engagement with local government, stakeholders and the public as described in section 11.3 of Chapter 11.

#### *10.8.1.1 Environmental Impact*

BC Hydro engaged Hemmera Envirochem Inc. and St’át’imc Government Services to conduct a preliminary assessment to describe existing conditions and identify potential impacts of the BRT Project on the bio-physical environment. The findings of this assessment are documented in the preliminary Environmental Impact Statement (**pEIS**) provided as Appendix C-8. As explained in section 10.7.1 above, under both federal and provincial legislation, an environmental assessment is not triggered for the BRT Project so the pEIS does not cover all the requirements of the provincial *Environmental Assessment Act* process. Through recent engagement, St’át’imc has raised the need for additional effects assessments, including a residual effects

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[154] For further information on the Bridge River Contract Worker Conduct Requirements, refer to section 5.8.3.2 of Chapter 5 and to Appendix B-14.

assessment, a human health risk assessment and a cumulative effects assessment and BC Hydro has committed to ongoing discussion on values of concern that should be incorporated into the project and appropriate scoping for additional assessments that may be warranted.

The scope of the pEIS is to describe the biophysical environment in which the BRT Project will take place, identity potential interactions, and describe potential effects. Mitigation measures to avoid or reduce the adverse effects are described where possible and, where this is not possible, methods to fill information gaps to determine appropriate mitigation measures are proposed.

Valued components are environmental, social, cultural, or economic elements present in the BRT Project area that are deemed important or valuable and are assessed for potential project related impacts. A pathway component establishes linkages between project activities and valued components. Valued components and pathway components were identified based on prior experience with similar sized hydroelectric projects and knowledge and a review of existing Government of B.C. standards and guidelines, legislation, and regulations. Water quantity valued components were considered but excluded from the assessment because the BRT Project outages will be managed so that there are no impacts to water management in the Bridge-Seton system. Specifically, generation curtailment at the Bridge River 1 and Bridge River 2 Generating Stations is not expected to be required for the BRT Project as the 2L90 circuit will only be out of service for up to three weeks and, if curtailment were required during this time, BC Hydro would curtail IPP generation instead.

Environmental pathway and valued components with the potential to be affected by the BRT Project are:

- **Water Quality:** specifically, changes in water quality parameters;

- **Fish and Fish Habitat:** specifically, loss and disturbance of fish habitat, including riparian areas;
- **Heritage:** specifically, presence of an archaeological site, registered or previously undocumented;
- **Vegetation:** specifically, presence of at-risk plants species, presence of culturally important vegetation, and presence of invasive vegetation species;
- **Wildlife and Wildlife Habitat:** specifically, presence of species at risk and/or their residence (nest), presence of culturally important wildlife, changes in wildlife habitat quality and presence of wildlife habitat features; and
- **Cultural Sustainability:** specifically, impacts on above values identified as having potential impacts on cultural sustainability.

The pEIS assesses potential effects from the BRT Project to each valued and pathway component, describes existing conditions, and identifies mitigation measures to reduce potential negative effects or describes methods to fill information gaps to determine appropriate mitigation measures. BC Hydro will undertake field investigations in the next phase of the BRT Project to confirm project-related effects and further develop appropriate mitigation, with a focus on avoidance through design. Construction activities will be planned to minimize potential negative effects to water quality, fish and fish habitat, heritage, vegetation, wildlife and wildlife habitat and cultural sustainability. Contractors will be required to submit plans to demonstrate how they will meet the requirements of the BRT Project EMP. In addition, contractors may be required to submit construction management and risk management plans prior to construction.

#### *Water Quality*

Fifteen watercourse crossings were identified within the BRT Project area. Water is intrinsic to the St’át’imc’s belief system, is linked to spiritual practice and connectivity with the land, animals, birds and fish. BRT Project activities including pole replacements and access route upgrades may temporarily affect water quality. Erosion and sediment control issues and accidental release of hazardous substances (e.g., fuel and oil) during BRT Project construction has the potential to change surface water quality in watercourses.

BC Hydro will survey identified watercourses where BRT Project activities have potential to impact water quality. Site visits will determine the baseline condition and identify potential site-specific mitigation requirements. Post-construction surveys may also be required if project-related effects associated with sediment runoff, spills, or accidental release of hazardous substances, are identified during construction, in or near watercourses.

Erosion and spills are generally preventable, and if they do occur, they are expected to be promptly reported and responded to with appropriate actions. Effects resulting from erosion of soils or accidental release of deleterious substances are expected to be localized and temporary, and major watercourses are not expected to be affected.

Mitigation measures, including erosion and sediment control measures and spill response, will be detailed in the BRT Project's EMP. Additional mitigation measures may be added once a more detailed project design is available and pending the results of field surveys.

*Fish and Fish Habitat*

Both resident and anadromous fish reside in the BRT Project area. Fish, particularly salmon, are integral to the St'át'imc way of life. Project activities including pole replacements and access route upgrades that temporarily affect water quality may impact fish and fish habitat.

Site visits to characterize water quality at identified watercourse crossings will also assess fish presence and habitat quality. Post-construction surveys may also be required if effects related to the BRT Project that are associated with sediment run-off, spills, or accidental release of hazardous substances, are identified during construction, in or near watercourses.

Based on the limited potential effects to water quality and the implementation of standard mitigation measures, significant impacts to fish and fish habitat are not anticipated. Mitigation measures will be detailed in the BRT Project's EMP and additional mitigation measures, if required, will be incorporated following the completion of field surveys.

### *Heritage*

There are 57 registered archaeological sites within 50 metres of the 2L90 circuit, 13 of which are within the statutory right-of-way. In addition, there is moderate to high probability that unrecorded and unregistered archaeological sites exist in this area.

All ground disturbing activities required for the BRT Project have potential to interact with heritage resources. Specifically, pole replacement, access upgrades, removing and replacing bridges and culverts, vegetation clearing, and landscape re-contouring have the potential to impact protected heritage resources.

BC Hydro has submitted an application for a Heritage Investigation Permit to the Provincial Archaeology Branch. An Archaeological Impact Assessment will be conducted in accordance with the terms and conditions of this permit to assess all areas where BRT Project work is proposed to identify potential conflicts between archaeological resources and ground disturbing activities.

BC Hydro will use the results of the Archaeological Impact Assessment to avoid or manage impacts to protected heritage resources. If changes cannot be made to the BRT Project's design to avoid impacts to heritage sites, BC Hydro will develop a heritage management plan, obtain a Site Alteration Permit according to the *Heritage Conservation Act* from the Provincial Archaeology Branch, and conduct an impact assessment concurrent with ground disturbing activities.

*Vegetation*

The BRT Project area primarily consists of a managed statutory right-of-way dominated by early successional stage ecosystems. Proposed critical habitat for Whitebark pine overlaps the BRT Project area along the south side of Seton Lake and overlaps the 2L90 circuit at the east end of the lake. No at-risk ecological communities or plant species are known to occur in the BRT Project area; however, there is potential for occurrence within adjacent bio-geo-climatic zones. Numerous known occurrences of invasive vegetation occur in the BRT Project area. The BRT Project area may include vegetation that is culturally important for St'át'imc, for cultural use or forage for key species, or present opportunities to enhance these vegetation types.

BRT Project activities that require vegetation clearing have the potential to result in the removal of at-risk vegetation species, culturally important vegetation or degradation of habitat. Use of mobile industrial equipment and vehicles has the potential to result in the introduction and spread of invasive species.

BC Hydro will undertake a screening exercise to assess potential for at-risk ecological communities or at-risk plant species within the BRT Project area. Field assessments will then be undertaken to determine the presence of at-risk, culturally important and invasive plant species.

BC Hydro will use the results of the field assessment to avoid or manage impacts to vegetation. If changes cannot be made to the BRT Project's design to avoid impacts to at-risk and culturally important plants, BC Hydro will develop site-specific measures to protect at-risk plants and control the spread of invasive species. Requirements will be specified in the BRT Project's environmental management plan.

*Wildlife and Wildlife Habitat*

Multiple federal and provincial listed species have the potential to be present within the BRT Project area. Specifically, critical habitat for Lewis's woodpecker, wildlife habitat areas for Spotted owl, and ungulate winter range for Mule deer overlap the BRT Project area.

Wildlife species of key cultural importance to St'át'imc including Grizzly bears, Mule deer and Bighorn sheep may also be present in the BRT Project area and / or there may be opportunities for improving wildlife habitat for key species.

The replacement of wooden utility poles may impact Lewis's woodpecker nest sites. Improvements or replacement to bridges and culverts could affect Barn swallow nest sites or bat roosts. Activities such as ground re-contouring and installing new roads may affect wildlife habitat features such as dens, nest sites for ground-nesting birds or hibernacula for snakes. The removal of trees and other vegetation during construction activities may affect the availability of habitat for multiple species. Construction activities may also cause sensory disturbance to wildlife and improved access can increase human interactions with wildlife.

BC Hydro will undertake field assessments to identify potential interactions with species at risk and their residences, wildlife habitat, and wildlife habitat features. Surveys to be undertaken in the next phase of the BRT Project include:

- Breeding bird point count surveys at helipads, laydown or staging areas to determine the presence and potential nesting areas of at-risk birds; specifically, the Lewis's woodpecker, Lark sparrow, Olive-sided flycatcher and Long-billed curlew;
- Visual surveys for potential Lewis's woodpecker nest cavities and other protected nest sites (e.g., stick nests) on all wooden utility poles to be replaced or trees to be removed;

- Visual surveys for Barn swallow nest sites and bat roosts at any bridges requiring upgrades;
- Visual surveys for badger dens at all wooden utility poles to be replaced, access road upgrades, and recontour sites;
- Evening call-playback surveys for Common nighthawk in potential nesting areas where ground re-contouring will occur;
- Visual assessment of large, suitable trees to be removed to assess those trees for potential cavities, roosting, nesting and bear dens;
- Roost watch with use of handheld acoustic monitors at high potential roost trees slated for removal;
- Surveys for potential snake hibernacula if disturbance is expected near rock outcrops; and
- Additional surveys and enhancement opportunities for key cultural species are currently in development, in consultation with St’át’imc.

BC Hydro will use the results of the field assessment to avoid or manage impacts to wildlife and wildlife habitat. If changes cannot be made to the BRT Project’s design to avoid impacts to wildlife, BC Hydro will develop site-specific measures to protect wildlife and wildlife habitat. Requirements will be specified in the BRT Project’s environmental management plan.

#### *10.8.1.2 Socio-Economic Impact*

BC Hydro also engaged Hemmera Envirochem Inc. to conduct a preliminary assessment to describe existing conditions and identify potential impacts of the BRT Project on the social environment. The findings of the socio-economic assessment are documented in the pEIS provided as Appendix C-8. Social, economic, and cultural valued components were identified based on input received from the St’át’imc Nation on similar past BC Hydro projects, prior experience with similar-sized hydroelectric projects in the area, professional judgment, and scientific and regulatory considerations. The valued components considered were:

- **Procurement and Labour Force:** specifically, changes in demand for local labour and demand for non-local labour and local contracting opportunities
- **Housing and Accommodation:** specifically, changes in demand for local accommodation and change in local accommodation availability;
- **Community Safety and Wellbeing:** specifically, an influx of non-local workers, changes in community safety and wellbeing, changes in demand for local emergency, health and policing services; and changes to human health impacts (wildfire, electrocution due to clearance issues, electromagnetic radiation, noise, accidents); and
- **Transportation, Traffic and Road Safety:** specifically, changes in traffic volumes and changes in access.

The pEIS assesses potential effects related to the BRT Project to each valued component, describes existing conditions, and identifies mitigation measures to reduce potential negative effects or describes methods to fill information gaps to determine appropriate mitigation measures. This will be revised to include additional valued components raised by St’át’imc through recent engagement which will be included in the evidentiary update that BC Hydro plans to file later in this proceeding. In the next phase of the BRT Project, BC Hydro will confirm project-related effects and further develop appropriate mitigation measures. Construction activities are being planned to minimize potential negative effects to the social valued components and the BRT Project’s construction management plan and worker conduct requirements will be implemented to address social impacts.

The preliminary socio-economic assessment based on these valued components is summarized in the sections below.

*Procurement and Labour Force*

Lillooet is expected to be an important service centre for the BRT Project with some work occurring in the surrounding Indigenous communities of Tsal’alh, Xwísten, T’it’q’et, Sekw’el’was, Xaxli’p, and Ts’kw’aylaxw.

The BRT Project will require a construction workforce as well as the procurement of goods and services, which may create employment and business opportunities in the BRT Project area. BRT Project labour and skill demands would also require bringing workers from outside the local area, which may create an influx of non-local residents to the BRT Project area.

The BRT Project is expected to have a small overall positive impact on local employment and businesses during the Implementation phase. While mitigation is not required, BC Hydro will enhance local benefits by identifying opportunities to increase employment and procurement from local suppliers. BC Hydro recognizes commitments in the 2011 Agreements and the 2019 High Flow Settlement Agreement between BC Hydro and the St’át’imc Nation, and will continue working on their implementation, including by supporting information sharing and collaboration on business, employment, education and training opportunities.

*Housing and Accommodation*

A proportion of the labour resources on the BRT Project will be from outside the local communities and will require local accommodation while working on the BRT Project. Lillooet has the greatest capacity for accommodating out-of-town workers, and there is limited capacity in smaller communities. While the number of workers requiring accommodation is not known at this stage, increased demand is not expected to result in considerable strain on existing vacancy and availability of short-term accommodation in the BRT Project area. However, this has been raised as a concern by St’át’imc and BC Hydro has committed to further engagement to understand the potential impact, in coordination with work being carried out by the District of Lillooet to study housing impacts. BC Hydro will assist contractors to the greatest extent possible to achieve efficient booking and use of available local accommodation. If shortages of accommodation are foreseen at any point, BC Hydro will plan ahead and identify alternative solutions such as split shifts and/or schedule extensions, where possible, to minimize interference with local communities.

*Community Safety and Wellbeing*

Large construction projects in remote, rural areas of British Columbia have the potential to have adverse social and cultural effects on local communities and can disproportionately affect Indigenous communities. The influx of temporary BRT Project workers to the local area has the potential to impact the population’s sense of safety, wellbeing, and community if external workers are involved in negative social behaviors or are disrespectful of the local ways. The presence of temporary, non-local workers may also place strain on local emergency services.

Previous BC Hydro projects at the Bridge River Generating Stations resulted in concerns related to community safety and wellbeing for local residents, particularly for the community of Tsal’alh, but likely for other St’át’imc communities as well. More recently, St’át’imc Government Services raised concerns related to lack of cultural awareness and respect from BC Hydro workers and contractors at BC Hydro job sites.

BC Hydro’s relationship with St’át’imc is integral to the ongoing operations of our facilities in St’át’imc Territory and we are committed to developing a collaborative and respectful working relationship with the St’át’imc Nation. In response to previous concerns, BC Hydro and the St’át’imc have jointly developed the Bridge River Contract Worker Conduct Requirements, which are provided as Appendix B-14. These requirements are currently being reviewed to determine if they can be applied successfully to all contractors working in the St’át’imc Territory. If these requirements cannot be uniformly applied, a specific code of conduct will be developed for the BRT Project requirements, considering the BRT Project activities and the need to support cultural awareness and sensitivity for the BRT Project workforce throughout the St’át’imc Territory.

BC Hydro will work with contractors so that that they are well prepared to adhere to all of BC Hydro’s rules and regulations relating to safety, travel, the environment, and all standards of conduct.

St’át’imc has recently raised additional concerns related to potential impacts to human health, including wildfire, electrocution (clearance issues), electromagnetic radiation, noise and accidents. These will be investigated through a desktop study and outcomes will be incorporated into the final EIS and the evidentiary update that will be filed later in this proceeding.

*Transportation, Traffic and Road Safety*

The BRT Project will use main highways and secondary roads for the transport of equipment, materials, and workers to and from the BRT Project work sites, which could increase road traffic and the risk of motor vehicle accidents.

Increases in traffic volumes could affect road and traffic conditions and potentially the safety of road users. Vehicle collisions with wildlife could also increase. To reduce traffic in the area and reduce parking requirements at site, BC Hydro will require contractors to use carpooling or shuttle services.

The BRT Project also includes upgrades to approximately 63 kilometres of access roads and construction of approximately seven kilometres of new access roads. Improved or increased access could make remote areas more accessible for hunting, fishing and other recreational uses, increasing the pressure on these resources and negatively affecting existing users and cultural use. To minimize competition for harvesting and recreational resources, workers will not be allowed to hunt, fish or participate in harvesting activities in reserve lands while on- and off-work. BC Hydro will also develop an access management plan in consultation with the Indigenous Nations and local stakeholders to address potential negative impacts associated with improved and increased access.

# BC Hydro Bridge River Projects

## Bridge River Transmission Project

# Chapter 11

## Indigenous Nations Consultation and Public Engagement

**PUBLIC**

## Table of Contents

11.1 Introduction ........ 11-1
11.2 BC Hydro’s Consultation and Engagement with Indigenous Nations ........ 11-1
  11.2.1 Identification of Indigenous Nations ........ 11-2
  11.2.2 BC Hydro’s Engagement with Indigenous Nations Regarding Alternatives for the BRT Project ........ 11-6
  11.2.3 Duty to Consult ........ 11-9
    11.2.3.1 St’át’imc Nation ........ 11-10
    11.2.3.2 Tŝilhqot'in Nation ........ 11-11
    11.2.3.3 Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band ........ 11-11
  11.2.4 BC Hydro’s Consultation and Engagement Activities ........ 11-12
    11.2.4.1 BC Hydro’s Consultation and Engagement with the St’át’imc Nation ........ 11-12
    11.2.4.2 BC Hydro’s Consultation and Engagement with the Tŝilhqot'in National Government ........ 11-23
    11.2.4.3 BC Hydro’s Consultation and Engagement with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band ........ 11-24
  11.2.5 Adequacy of Consultation and Accommodation ........ 11-25
11.3 Public Engagement ........ 11-27
  11.3.1 Introduction ........ 11-27
  11.3.2 Stakeholder Engagement Approach ........ 11-27
  11.3.3 Local Community Setting ........ 11-29
  11.3.4 Public Groups Included in Engagement ........ 11-29
  11.3.5 Engagement Process ........ 11-30
  11.3.6 Public Support and Issues Identified ........ 11-32
  11.3.7 Mitigation and Ongoing Public Engagement Activities ........ 11-32

## List of Figures

Figure 11-1 Map of St’át’imc Territory and BRT Project Area ........ 11-3

Figure 11-2 Map of Tŝilhqot'in Territory and BRT Project Area ..................... 11-4
Figure 11-3 Map of the Bridge River Transmission Project Alternatives ....... 11-7

## List of Tables

Table 11–1 Indigenous Nations and Consulting Organizations for BRT Project ........................................................................... 11-5
Table 11–2 Indigenous Nations and Consulting Organization for Alternative 2 ................................................................. 11-8
Table 11–3 Summary of Engagement with St'át'imc Nation on the BRT Project ......................................................................... 11-14
Table 11–4 Summary of Key Interests and Concerns Raised by the St'át'imc Nation ....................................................... 11-19

## 11.1 Introduction

This chapter describes the consultation and engagement that BC Hydro has undertaken with respect to Indigenous Nations (section 11.2) and public stakeholders (section 11.3) specific to the BRT Project.

## 11.2 BC Hydro’s Consultation and Engagement with Indigenous Nations

The BRT Project will take place within St’át’imc Nation Territory and Engagement Zone A as defined within the Tŝilhqot'in Stewardship Agreement among Tŝilhqot'in National Government, Tŝilhqot'in Nation, and the Government of B.C. A portion of the BRT Project area that is north and east of Lillooet, towards the Kelly Lake Substation, overlaps with the traditional territories of the following Indigenous Nations, who are also being consulted on the proposed work in their traditional territories: Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band.

The information provided in Chapter 6, and in Appendix A-6, on the Tŝilhqot'in Nation and the St’át’imc Nation, the historic relationship between BC Hydro and the St’át’imc Nation, the consultation and engagement framework and, specifically, BC Hydro’s comprehensive settlement agreements with the St'át'imc Nation, is also applicable to the BRT Project. BC Hydro has not repeated this information here. However, it is important to note that the BR1 Project and the BRT Project are at different stages in the project lifecycle. Specifically, the BRT Project is still in the early planning and investigation stages and consultation is ongoing. The findings from the BRT Project Feasibility Design stage activities, including more detailed impact assessment and consultation activities on the impact assessment with Indigenous Nations, will be included in an evidentiary update, to be filed later in this proceeding.

This chapter also provides additional information not included in Chapter 6 on the Indigenous Nations of Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band, and the duty to consult and engagement activities carried out to date with these communities.

This section is structured as follows:

- Section 11.2.1 identifies Indigenous Nations potentially affected by the BRT Project;
- Section 11.2.2 discusses the consultation and engagement framework for the BRT Project with the identified Indigenous Nations (including their related consulting organizations);
- Section 11.2.3 describes the consultation and engagement undertaken to date with respect to the BRT Project, and our plans for continued engagement; and
- Section 11.2.4 discusses the adequacy of the consultation and engagement.

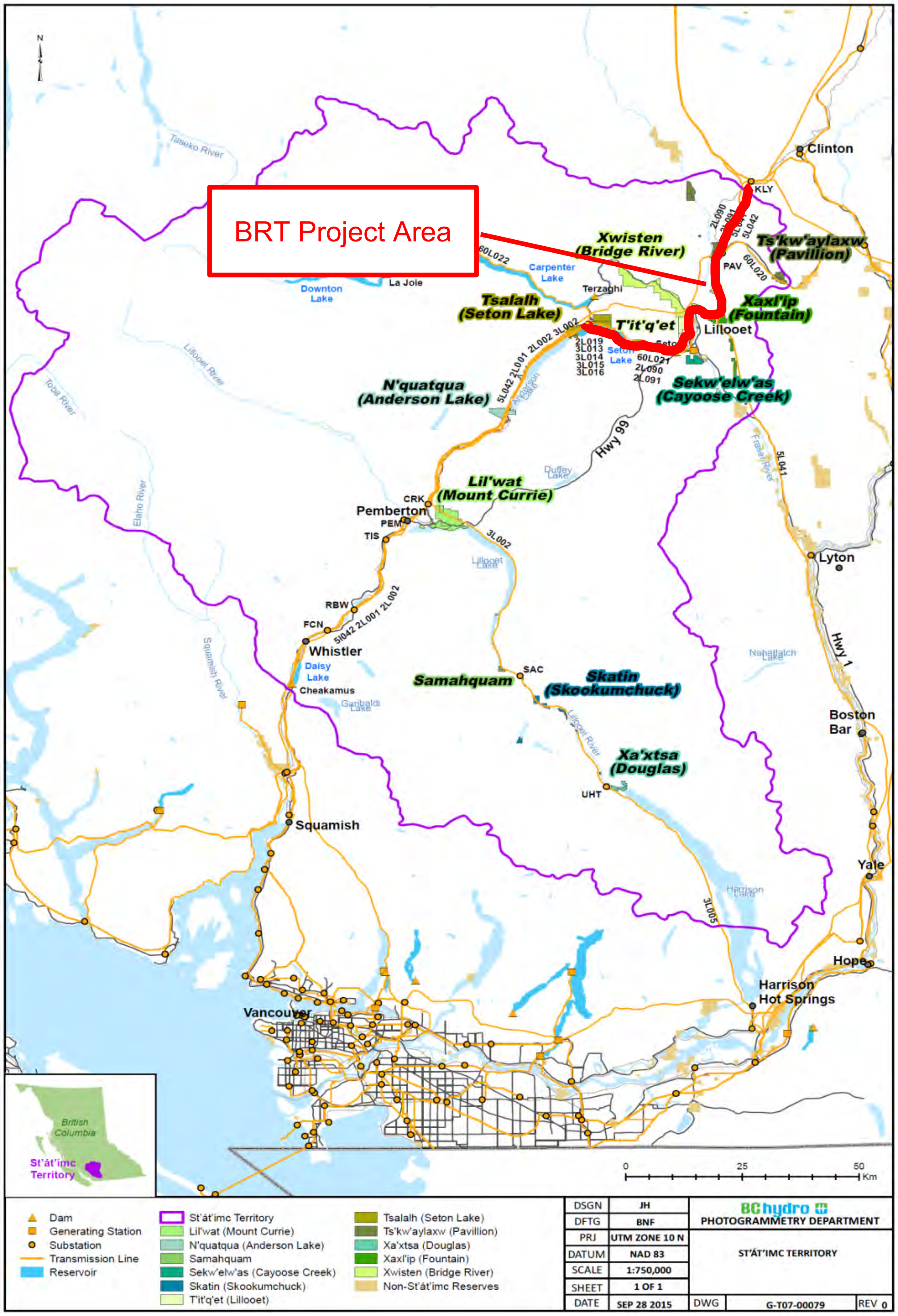
Appendix A-6 provides a discussion of the 2011 Agreements and the 2019 High Flow Settlement Agreement between BC Hydro and the St’át’imc Nation.

### 11.2.1 Identification of Indigenous Nations

This section identifies the Indigenous Nations potentially affected by the Leading Alternative for the BRT Project and describes the process BC Hydro used to identify these potentially affected Nations. It also provides a high-level description of these Nations and their territories.

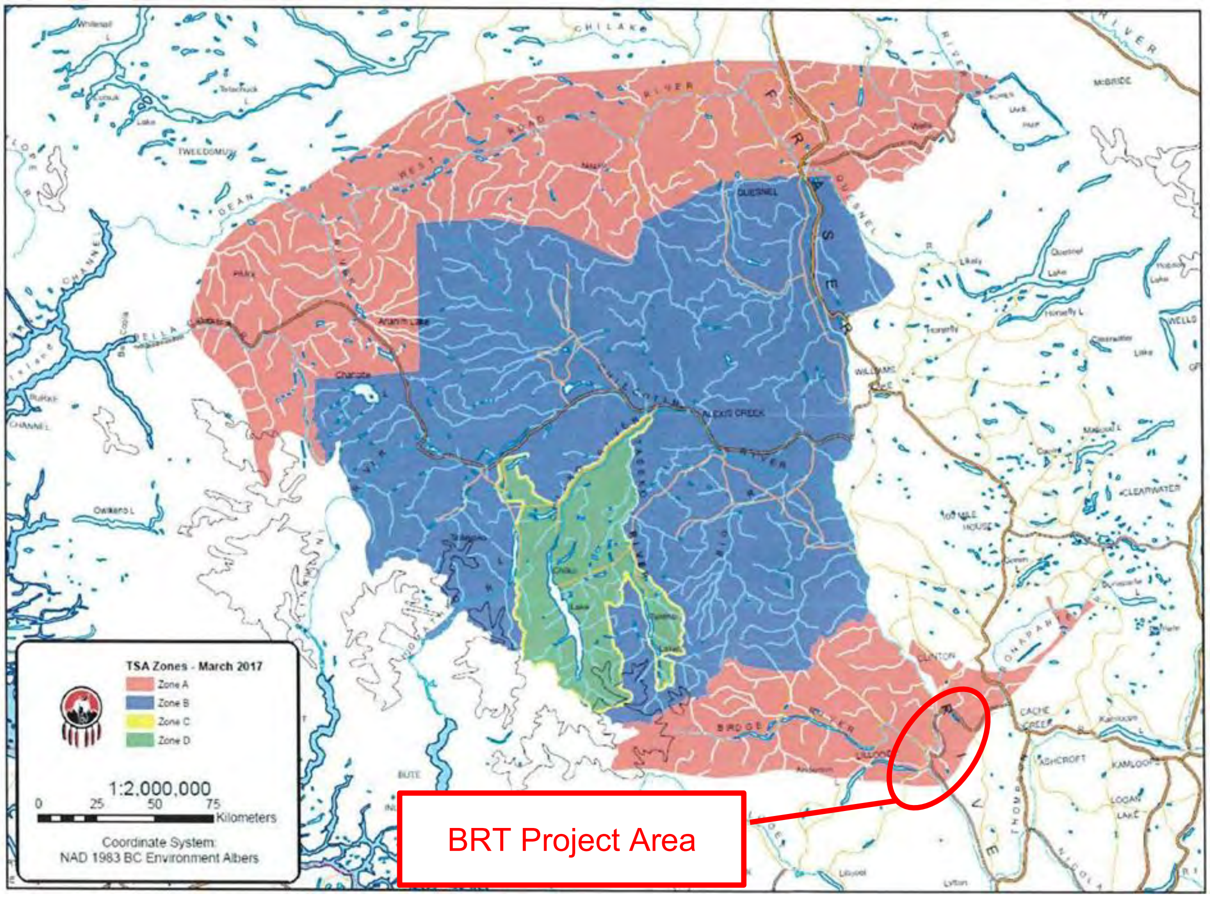
The BRT Project is located within St’át’imc Nation Territory. Figure 11-1 below illustrates the Territory and the relative location of the Leading Alternative for the BRT Project.

Figure 11-1 Map of St’át’imc Territory and BRT Project Area



The BRT Project is also within Engagement Zone A of the Tŝilhqot'in Nation. Figure 11-2 illustrates the engagement zones defined under the Tŝilhqot'in Stewardship Agreement and the relative location of the BRT Project. Engagement Zone A overlaps with a portion of St’át’imc Nation Territory and the proposed work would not take place on Tŝilhqot'in Aboriginal Title Lands.

**Figure 11-2 Map of Tŝilhqot'in Territory and BRT Project Area**



In addition to reviewing these known agreement boundary areas, BC Hydro used the provincial CAD to confirm our understanding of the Indigenous Nations with a potential interest in the BRT Project area.[155] An initial CAD search was completed in

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[155] See Chapter 6 for additional details.

2017 and confirmed the St’át’imc Nation and Tŝilhqot'in communities noted below in Table 11–1.

After the extent of work areas for the BRT Project towards the Kelly Lake Substation end of the 2L90 circuit were clarified, BC Hydro conducted a second CAD review in March 2021 and identified overlap with the additional Indigenous Nations of Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band. On April 23, 2021, these Nations were notified of the BRT Project, the alternatives that had been considered, the scope of work, potential impacts, and the upcoming CPCN application to the BCUC. BC Hydro will follow up with additional consultation, as required, once more specific areas of work and ground disturbance are confirmed through the investigative works taking place in the Feasibility Design stage of the project, in the summer and fall of 2021.

Table 11–1 below provides the Indigenous Nations, communities and other organizations identified by the provincial CAD in relation to the BRT Project.

**Table 11–1 Indigenous Nations and Consulting Organizations for BRT Project**

| Indigenous Nations, Nation-level Organizations and Governments Identified by Provincial CAD | Indigenous Organization Responsible for Consultation |
|---|---|
| Sekw’el’was First Nation | St’át’imc Government Services/ St’át’imc Authority |
| T’it’q’et Administration | |
| Tsal’álh First Nation | |
| Xwísten First Nation | |
| Xaxli’p First Nation | |
| Ts’kw’aylaxw First Nation | |
| St’át’imc Chiefs Council | |
| Lillooet Tribal Council[156] | |

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[156] Note: All the communities represented by the Lillooet Tribal Council are represented through the St’át’imc Chiefs Council and within the St’át’imc - BC Hydro Agreements, and as such BC Hydro has not separately engaged with the Lillooet Tribal Council.

| Indigenous Nations, Nation-level Organizations and Governments Identified by Provincial CAD | Indigenous Organization Responsible for Consultation |
|---|---|
| (includes six of the St’át’imc member nations: Sekw’el’was, T’it’q’et / P’egp’ig7lha, Tsal’álh, Ts’kw’aylaxw, Xaxli’p, Xwísten) | |
| Toosey Indian Band | Tŝilhqot'in National Government |
| Tŝilhqot'in National Government | |
| Bonaparte First Nation | Bonaparte First Nation |
| High Bar First Nation | High Bar First Nation |
| Neskonlith Indian Band | Neskonlith Indian Band |
| Nooaitch Indian Band | Nooaitch Indian Band |
| Whispering Pines/Clinton Indian Band | Whispering Pines/Clinton Indian Band |

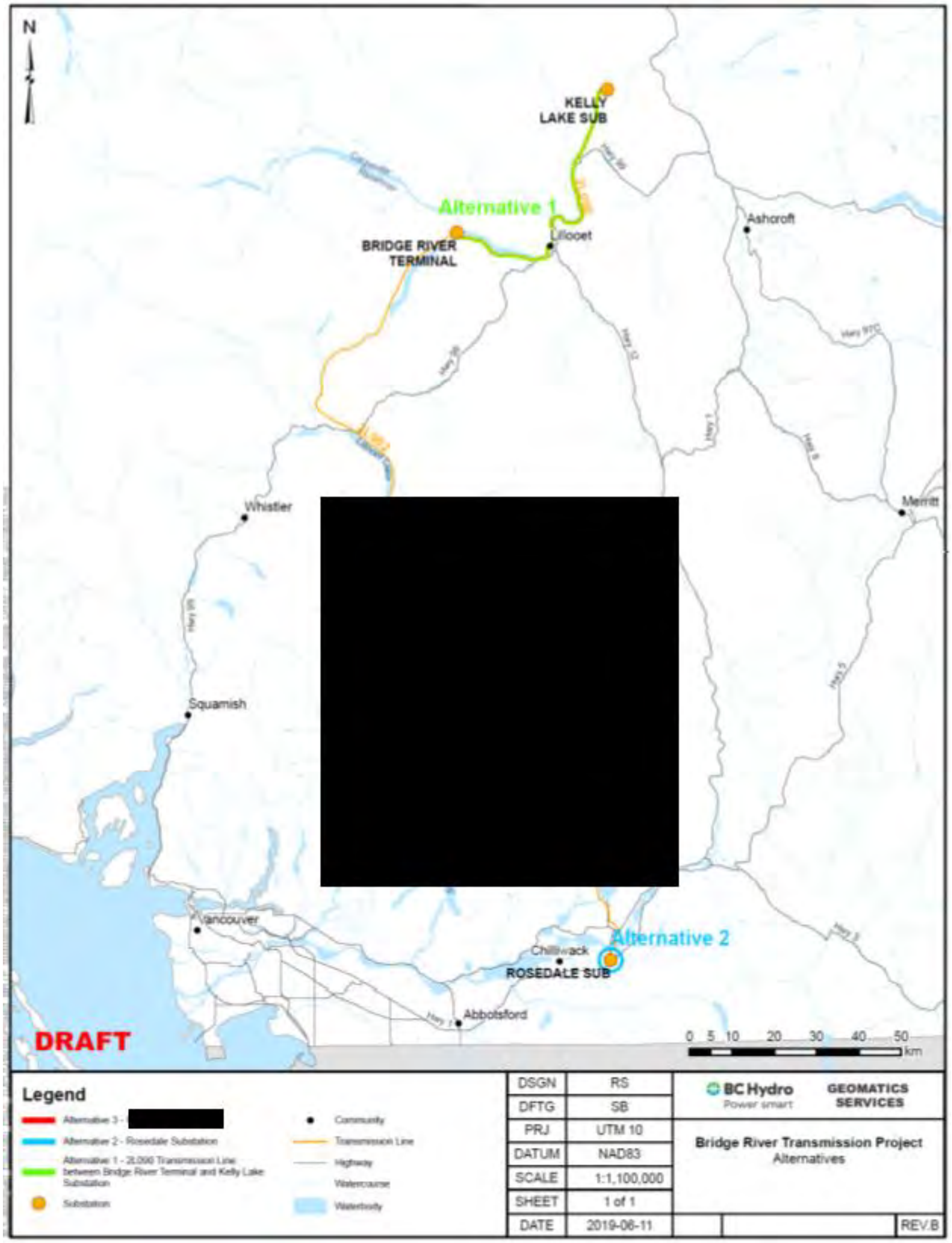
### 11.2.2 BC Hydro’s Engagement with Indigenous Nations Regarding Alternatives for the BRT Project

In the Conceptual Design stage of the project, BC Hydro also consulted with Indigenous Nations with traditional territories generally located in and around Chilliwack or the Upper Harrison areas, on the identified feasible alternatives for the BRT Project.

Consultation included all Indigenous Nations potentially impacted by the scope of work for all of the identified feasible alternatives. BC Hydro has informed all Indigenous Nations that Alternative 1 (Increase the Maximum Capacity of the 2L90 Circuit) was selected as the Leading Alternative.

Figure 11-3 below illustrates the geographic location of the three alternatives. All three alternatives include work to refurbish the 2L90 circuit, which is in the area indicated by Alternative 1 below.

**Figure 11-3 Map of the Bridge River Transmission Project Alternatives**



The information below provides a summary of the consultation that BC Hydro conducted with regard to Alternative 2 and Alternative 3. As Alternative 1 has been selected as the Leading Alternative for the BRT Project, the sections of this chapter that follow provide information on the consultation with regard to that alternative.

Alternative 2 contemplated work at the Rosedale Substation, near Chilliwack. Table 11–2 below provides the Indigenous Nations, communities and other governing organizations identified by the provincial CAD for Alternative 2.

**Table 11–2 Indigenous Nations and Consulting Organization for Alternative 2**

| Indigenous Nations, Nation-level Organizations and Governments Identified by Provincial CAD | Indigenous Organization Responsible for Consultation |
|---|---|
| Chawathil First Nation | People of the River Referrals Office |
| Kwaw-Kwaw-Apilt First Nation | |
| Skawahlook First Nation | |
| Skwah First Nation | |
| Soowahlie First Nation | |
| Cheam First Nation | Cheam First Nation |
| Peters First Nation | Peters First Nation |
| Popkum First Nation | Popkum First Nation |
| Seabird Island Band | Seabird Island Band |
| Shxw'ow'hamel First Nation | Shxw'ow'hamel First Nation |
| Sto:lo Nation | Sto:lo Nation |
| Sto:lo Tribal Council | Sto:lo Tribal Council |
| Union Bar First Nations | Union Bar First Nations |

The following consultation activities occurred with the communities identified only in relation to Alternative 2.

- BC Hydro notified the communities identified above on December 21, 2018 of the BRT Project and sent BRT Project updates on February 1, 2019, April 1, 2019, and June 17, 2020. This information described the separate geographic locations of the scopes of work in each of the alternatives. Specific to the Rosedale Substation work, ground disturbance would be required to accommodate the new 360/230 kV transformer and associated equipment (e.g. disconnects, circuit breakers), as well as access for maintenance;

- On February 12, 2019, Seabird Island Band informed BC Hydro that it had no input. On April 16, 2019, the People of the River Referrals Office informed BC Hydro that it would be engaging Chawathil, Cheam, Kwaw-Kwaw-Apilt, and Skwah First Nations. There has been no subsequent response from the People of the River Referrals Office; and
- On June 17, 2020, BC Hydro informed these communities that Alternative 1 was selected as the Leading Alternative for the BRT Project.

As of this filing, no other responses have been received.

Alternative 3 contemplated IPP generation curtailment which would be addressed through existing and new commercial agreements and did not have further potential impacts to Indigenous rights and title, beyond the scope of work related to the refurbishment of the 2L90 circuit which was included in all three alternatives. Details on Alternative 3 were included in the information shared with all the Indigenous Nations and consultation organizations listed in Table 11–1 and Table 11–2 above and no specific concerns were raised.

As of this filing, no other responses have been received.

### 11.2.3 Duty to Consult

The approach to the scope and content of the duty to consult and accommodate, and the role of negotiated agreements, as described in section 6.2.3.1 of Chapter 6 is equally applicable to the BRT Project for the St’át’imc Nation and Tŝilhqot'in Nation. Specifically, compliance with BC Hydro’s 2011 Agreements and 2019 High Flow Settlement Agreement with the St’át’imc Nation, and governing agreement between the Government of B.C. and the Tŝilhqot'in Nation, has guided the engagement requirements for the Application, as described in the sections that follow.

As it relates to Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band, and Nooaitch Indian Band, the scope and duty to consult are set out in the Supreme Court of Canada's decision in *Haida* and the cases following it. In *Haida*, the Supreme Court of Canada held that the scope of consultation required to meet this duty is context-specific and proportionate to a preliminary assessment of the strength of claim of the asserted right and the seriousness of the potential impact upon the right claimed.

#### *11.2.3.1 St'át'imc Nation*

In section 6.2.3.2 of Chapter 6 and Appendix A-6, BC Hydro describes various agreements with the St'át'imc Nation, including the 2011 Agreements and the 2019 High Flow Settlement Agreement. The 2011 Agreements contemplated future repair, alteration, upgrade, removal or replacement for the Bridge River System facilities, including transmission line upgrade and refurbishment now contemplated as part of the BRT Project. In particular, as also discussed in section 6.2.3.2, the Relations Agreement establishes specific requirements and processes for engagement regarding the ongoing operations and maintenance of the Bridge River System, as well as for "New Facilities" in the Bridge River System. The BRT Project, as currently defined, will not require any material amendment to any existing transmission line easement or right of way. As such, it is not a "New Facility" as defined in the Relations Agreement.[157]

BC Hydro's duty to consult and accommodate the St'át'imc Nation with respect to the BRT Project is satisfied by carrying out mutually agreed to processes with the

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[157] Appendix A-6 provides more details on the definitions and requirements with regard to operation and maintenance work and a "New Facility".

St’át’imc Nation, including information sharing through relationship forums, notifications and joint planning, as set out in these agreements.

#### *11.2.3.2 Tŝilhqot'in Nation*

The Tŝilhqot'in Nation has established Aboriginal title to certain lands and, as a result, the Tŝilhqot'in Nation and the Government of B.C. entered into the Tŝilhqot'in Stewardship Agreement (March 31, 2017, Amended version). BC Hydro follows the protocol established by the Tŝilhqot'in Stewardship Agreement with respect to consultation on activities in the territory. According to the protocol guidelines, because the work would not result in significant impacts and does not involve the replacement of a longstanding tenure that had created a high previous impact, the engagement requirements are on the lower end of the engagement levels described in the Tŝilhqot'in Stewardship Agreement.

#### *11.2.3.3 Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band*

BC Hydro has been working with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band and Neskonlith Indian Band, as members of the Secwepemc Nation, over the past several years to define principles, structures and processes to guide BC Hydro work in these traditional territories. This was set out through the Secwepemc Protocol Agreement that existed between the parties from 2017 and 2020 and is now captured through transition agreements that are in place to allow for the continuance of this work and to focus on priority areas, such as procurement opportunities.

BC Hydro has concluded that the duty to consult with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band[158] for the BRT Project, is at the low end of the spectrum as

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[158] Nooaitch Indian Band is not affiliated with the Secwepemc Nation and BC Hydro consults as appropriate for specific projects or activities.

described in *Haida*. This assessment is based on the view that the potential environmental and archaeological impacts of the BRT Project are anticipated to be low with avoidance or appropriate mitigation, and therefore the potential impacts to Aboriginal rights are expected to be low.

### 11.2.4 BC Hydro’s Consultation and Engagement Activities

This section summarizes consultation and engagement activities carried out to date with the Indigenous Nations identified in section 11.2.1 above, including a discussion of the potential adverse impacts raised through the engagement activities.

#### *11.2.4.1 BC Hydro’s Consultation and Engagement with the St’át’imc Nation*

*Collaborative Engagement with St’át’imc Nation*

BC Hydro has engaged with the St’át’imc Nation on the BRT Project in accordance with the commitments set out in the 2011 Agreements and 2019 High Flow Settlement Agreement. This has included information sharing on the BRT Project through established relationship forums, seeking input on interests and concerns related to the project as well as collaboration on the development of appropriate engagement and consultation processes. These relationship forums and engagement processes have evolved over time to reflect St’át’imc Nation core interests, and to deepen St’át’imc – BC Hydro engagement on work in the Territory. More information on these relationship forums and overall relationship governance is provided in Appendix A-6.

To date, BC Hydro has shared information on the need for the BRT Project work, on the alternatives that were identified in the Conceptual Design stage of the project, the structured decision making process and the criteria used to determine a Leading Alternative. Potential procurement opportunities that may arise from the alternatives have also been discussed, in line with the procurement process established between the St’át’imc Nation and BC Hydro through the 2011 Agreements and 2019 High Flow Settlement Agreement.

BC Hydro has sought input from the St’át’imc Nation on the potential environmental and socio-economic impacts related to the project. A draft summary table of valued components was shared for input in February 2021 and informed the content of the pEIS and identification of specific field studies for the Feasibility Design stage of work. Feedback was received from the St’át’imc Nation regarding the preliminary EIS, and there is ongoing engagement about how to better reflect St’át’imc interests.

The St’át’imc Nation and BC Hydro are jointly developing an engagement plan so that the field studies for the project are appropriately scoped to include St’át’imc Nation values and there is sufficient time to consider the outcomes of further study, including the field investigations, and to develop appropriate mitigation plans. The results of this work, and St’át’imc’s view on the Feasibility Design Plan and Preferred Alternative for the BRT Project, will be included in the evidentiary update on the BRT Project, that BC Hydro plans to file later in this proceeding.

BC Hydro has also provided the St’át’imc Nation with information on the regulatory approval requirements for the BRT Project, including the need to file a joint CPCN application for the BR1 Project and the BRT Project and how the St’át’imc Nation can participate in the BCUC’s process. Draft chapters for the Application were provided to the St’át’imc Nation for review in advance of filing, along with funding from BC Hydro to support its review by St’át’imc’s external consultant.

A St’át’imc Designated Business has been awarded the contract to deliver the environmental and archaeological scope of work for the project. This may involve participation from the Indigenous Nations with overlapping traditional territories.

Table 11–3 below provides a summary of key engagement activities completed to date. The detailed engagement and consultation record is provided as Appendix A-6-7.

**Table 11–3 Summary of Engagement with St’át’imc Nation on the BRT Project**

| Date and Forum | Discussion Topics |
|---|---|
| April 18 and 19, 2018 – Annual Operations Update | BRT Project was introduced as a new project in the Needs stage. The BRT Project drivers and alternatives being considered were identified. |
| March 29, 2019 – Email, Fact Sheet | BRT Project fact sheet was shared with the St’át’imc Nation and included BRT Project background and an overview of Alternatives 1 and 2 (Alternative 3 was not included in the BRT Project scope at this point). |
| May 7, 2019 – Annual Operations Update | Conceptual level BRT Project information, including alternatives, was shared, including the scoping in of Alternative 3. Input to date from St’át’imc on interests related to water conveyance, potential impacts to archaeological sites/St’át’imc cultural heritage sites and interest in procurement opportunities was noted. |
| May 27, 2019 – Conference call | Additional detail on Alternative 1 was shared, including a discussion of potential contracting opportunities and participation in environmental field work. Input was sought with regard to the selection of a Leading Alternative. |
| June 17, 2019 – Email, Fact Sheet | An e-mail with follow-up information from the May 27 conference call was sent, including updated maps, a summary of the alternatives analysis and an updated fact sheet. |
| September 17, 2019 – Conference call | An update was provided on the scope for each of the alternatives. Investigative work and opportunities for St’át’imc Nation involvement, including leading the archaeology/heritage work, was discussed. |
| February 5, 2020 – Quarterly Capital Planning Meeting | BC Hydro provided an update that the BRT Project was continuing the analysis to select a Leading Alternative and the decision would be shared once it was made. |
| June 17, 2020 – Email, Fact Sheet | Updated fact sheet was provided, indicating that the project was moving forward and Alternative 1 was to be recommended as the Leading Alternative for decision by the BC Hydro Senior Management Gate Board. |
| July 9, 2020 – Virtual update | Provided a brief update on the BRT Project as part of a general virtual meeting to provide an update on the COVID-19 pandemic and the status of BC Hydro work in the Territory. Indicated that Alternative 1 was being recommended as the Leading Alternative with a final decision expected late summer/early fall. |
| July 16, 2020 – Quarterly Capital Planning Meeting (videoconference) | Provided a further update indicating that Alternative 1 was being recommended as the Leading Alternative. |

| Date and Forum | Discussion Topics |
|---|---|
| October 6, 2020 – Virtual Meeting | During a meeting for the BR1 Project, BC Hydro provided an update that, in accordance with Directive 29 of the BCUC's recent decision on BC Hydro's Fiscal 2020 to Fiscal 2021 Revenue Requirements Application, BC Hydro would be filing a joint CPCN application for the BR1 Project and the BRT Project. |
| November 25, 2020 - Quarterly Capital Planning Meeting (videoconference) | An update was provided on the project schedule review and regulatory process requirements. A fact sheet was shared on scopes of work to support discussion on potential contracting opportunities. |
| December 18, 2020 – Notice of Opportunity (procurement document) | Shared a notice to formally offer a direct award contract opportunity related to environmental scope work, including for field work and funding to support St'át'imc's external consultant review of the draft Application. Additional follow-up meetings and email communication related to this notice were conducted. |
| February 9, 2021 - Quarterly Capital Planning Meeting (videoconference) | Provided an update that the BRT Project had moved into the Feasibility Design stage with Alternative 1 as the Leading Alternative and that field work to support detailed design would be carried out during the 2021 field season. Shared additional detail on road access and clearing scopes of work to support procurement planning. |
| February 10, 2021 – Fact sheet update | Shared a high level update on the BRT Project phase and timeline. |
| February 23, 2021 – Environmental Value Components Table Shared | Shared an outline of environmental valued components for review by the St'át'imc Nation and sought feedback on ways to improve the framework in order to align with St'át'imc Nation interests and ensure field studies would produce appropriate information/results. Received feedback from St'át'imc Government Services which was integrated into the table and shared a revised version for review by St'át'imc communities. |
| March 31, 2021 | Shared a draft of the pEIS for input and comment. St'át'imc Government Services and the St'át'imc Chiefs Council submitted comments which were incorporated into the Application based on ongoing discussion and review between BC Hydro and the St'át'imc Nation. |

| Date and Forum | Discussion Topics |
|---|---|
| April to June 2021 – meetings (April 30, June 9) and emails | Several meetings and email exchanges to discuss St’át’imc’s feedback on the pEIS including additional St’át’imc Nation values that needed to be incorporated. This included the addition of culturally important vegetation and wildlife, human health values and the addition of cultural sustainability as a separate, stand-alone valued component.<br>These revisions are being incorporated in the field program activities and outcomes will be included in the final Environmental Impact Statement. The St’át’imc Nation has also noted that the pEIS does not include a residual impacts assessment, a human health impact assessment and a cumulative effectives assessment. These require further discussion and will be captured in the communications and engagement plan. |
| April 30 to May 28, 2021 | Shared drafts of Chapters 1 to 12 of the Application for review and comment, as well as appendix materials relevant to St’át’imc Nation consultation. |
| May 20, 2021 – Presentation | BC Hydro presented an overview of the BR1 Project and BRT Project joint CPCN Application. |
| July 12, 2021 - St’át’imc Review of CPCN content | A final memo outlining St’át’imc Nation questions and concerns with respect to the content of the Application was provided to BC Hydro. Feedback has been incorporated into the Application and BC Hydro will continue to address St’át’imc’s input through further ongoing engagement. |
| July 21, 2021 | BC Hydro provided a letter to St’át’imc Government Services outlining our intent to submit the Application, our commitment to continue to work together to address concerns, and how they can participate in the BCUC review process. |

### *St’át’imc Nation Interests and Concerns Raised and Responses*

This section summarizes interests and concerns raised by the St’át’imc Nation regarding the BRT Project through the engagement activites outlined above.

The St’át’imc Nation has expressed concerns related to the BRT Project that require additional time and information through ongoing engagement to resolve or otherwise address. The communications and engagement plan to be developed by BC Hydro in collaboration with St’át’imc Government Services and St’át’imc communities will set out an approach for working together on key interests and concerns. The concerns that have been raised are largely related to the fact that the BRT Project is still in early planning stages, and that the field investigations required to inform impact assessments, have not yet occurred. Effective collaboration on these detailed investigations and planning work will be important to appropriately incorporate St’át’imc Nation interests into the design. The outcome of this process will be included in the evidentiary update that BC Hydro is planning to file later in this proceeding. St’a’timc has expressed to BC Hydro that it is critical to view this work from a cultural and holistic perspective, acknowledging the intrinsic connections that exist between the people, culture, language and land. Accordingly, and in response to St’át’imc Nation interests, BC Hydro has incorporated culturally important plant and wildlife species, and the cultural importance of water into the environmental valued components and an overarching cultural sustainability valued component. We recognize and acknowledge from the St’át’imc Nation’s feedback that culture, while anchored in history, must be considered through the lens of sustainability and present day uses.

The St’át’imc Nation has also raised more specific concerns with regard to the future construction activities proposed for the BRT Project, including pole replacements and repairs, access road construction, and clearing and recontouring land surfaces in some areas. The following interests and concerns have been raised:

- Ground disturbing activities have the potential to impact unregistered and/or unknown archaeological and St’át’imc cultural heritage sites. Further information on these potential impacts is provided in section 10.8.1.1 of Chapter 10;
- Construction activities have the potential to impact a range of environmental values, including fish and fish habitat, wildlife and wildlife habitat, vegetation and water quality. Further information on these potential impacts is provided in section 10.8.1.1 of Chapter 10. This needs to be understood from a cultural perspective, including that culturally important species may be different than

those protected under legislated measures, and recognizing the interconnectivity of impacts;

- New and/or improved access has the potential to increase penetration into the Territory by other users and there is concern about associated impacts to cultural use, cultural sites and wildlife values, including habitat quality and connectivity for Grizzly bears, Mule deer and Bighorn sheep which are of cultural significance. Further information on these potential impacts is provided in section 10.8.1.1 of Chapter 10;
- An influx of temporary workers has the potential for local community impacts associated with pressure on, or impact to, housing availability/affordability, traffic and local services (e.g., policing, health care, emergency response); and community safety and well-being. Further information on these potential impacts is provided in section 10.8.1.2 of Chapter 10.

Looking at potential impacts from a Territory perspective, the St’át’imc Nation has also indicated that certain additional effects assessments were not included in the pEIS, including a residual effects assessment, a human health risk assessment, and a cumulative effects assessment. BC Hydro has incorporated specific valued components in response to this feedback and will include further discussion on these topics in the communications and engagement plan that is discussed below.

The St’át’imc Nation has also expressed interest in potential opportunities for employment, training and contracting. Table 11–4 below summarizes key interests and concerns raised and BC Hydro’s responses.

**Table 11–4 Summary of Key Interests and Concerns Raised by the St’át’imc Nation**

| Topic | Interest/Concern | BC Hydro Response | Comments |
|---|---|---|---|
| Cultural sustainability | The BRT Project, through construction activities and expanded access, could impact culturally important plant and wildlife species as well as the sustainability of cultural practices that rely on these species. | Additional values to reflect this concern have been integrated into a revised valued components table. The field investigation program (summer/fall 2021) is being adapted to include study and other initiatives to identify potential impacts to these values as well as opportunities to enhance the landscape in promotion of cultural sustainability. | Further information and engagement required to complete impact assessment. |
| Additional effects assessments | The St’át’imc Nation has noted that a residual impacts assessment, a human health impact assessment and a cumulative effects assessment were not included in the pEIS. | BC Hydro has included additional valued components to reflect these values and is seeking additional input from the St’át’imc Nation to further understand valued components and other parameters that could inform the need for and scoping of these assessments. | Further information and engagement required to scope and determine if appropriate. |
| Impacts to fish/wildlife/vegetation | The BRT Project, through overland disturbance and other factors such as noise and vibrations, could result in impacts to fish, wildlife and vegetation. | This concern is being integrated into the Environmental Impact Statement and will be studied in the Feasibility Design stage. Plans for mitigation and avoidance will be developed with the St’át’imc Nation.<br>Beyond protected species, these plans will consider impacts to species and vegetation that are culturally significant to St’át’imc, including understanding of the intrinsic connections that exist between values. | Further information and engagement required to complete impact assessment. |

| Topic | Interest/Concern | BC Hydro Response | Comments |
|---|---|---|---|
| Impacts to St’át’imc Cultural Heritage sites | The St’át’imc Nation has indicated that the BRT Project could impact archaeological/cultural sites through ground disturbing work required for access/clearing, pole replacements/ maintenance and/or contouring. Cultural sites and uses could also be put at increased risk for impact through new/improved access, as well as impacts related to users penetrating into the Territory. | BC Hydro is working closely with the St’át’imc Nation to understand this concern through a holistic perspective and to engage on planning and undertaking environmental field work in order to collaboratively identify potential impacts and design avoidance or mitigation measures. | Further information and engagement required to complete impact assessment. |
| Increased access | The development of access roads could have direct impacts on vegetation, wildlife and water valued components. Access improvements can also increase penetration of new/more users in the Territory and have associated impacts on valued components. | This has been included as a valued component in the Environmental Impact Statement. The Access Management Plan will be developed in coordination with the St’át’imc Nation. | Further information and engagement required to complete impact assessment. |

| Topic | Interest/Concern | BC Hydro Response | Comments |
|---|---|---|---|
| Impacts to local area housing and services | The St’át’imc Nation has raised concerns that BC Hydro work in the Territory and the associated influx of temporary workers required for construction will put pressure on housing/accommodation availability and potentially on other local services including health care, policing and emergency response. | BC Hydro expects that the housing/accommodation needs for this work will not be localized but that this could be an incremental contributor to housing pressures.<br>This will be included in the socio-economic analysis and BC Hydro is looking for ways to work with the District of Lillooet on a housing analysis. This will look beyond the BRT Project to consider BC Hydro’s workforce numbers across projects over the next several years, and related implications.<br>BC Hydro is also working closely with St’át’imc on contracting and employment opportunities to optimize the use of local labour and reduce the number of workers coming from outside of the Territory. | Further information and engagement required to complete impact assessment |
| Contracting and employment opportunities | The St’át’imc Nation is interested in contracting opportunities related to the BRT Project as well as employment opportunities for individuals. The 2011 Agreements and 2019 High Flow Settlement Agreement have contracting opportunity provisions. | BC Hydro has provided high level information on the BRT Project procurement approach, through a “two-year look ahead” table and procurement information sheets. BC Hydro will continue to follow procurement process set out in the 2011 Agreements and 2019 High Flow Settlement Agreement in order to optimize opportunities for St’át’imc Nation businesses.<br>A St’át’imc Designated Business was awarded the contract for the environmental and archaeological services for the project. | Ongoing conversations about contracting opportunities are aligned with the processes set out in the 2011 Agreements and 2019 High Flow Settlement Agreement. |

*Ongoing St’át’imc Nation Consultation*

Engagement will be ongoing throughout the life of the BRT Project. BC Hydro is preparing a communications and engagement plan, with input from St’át’imc

Government Services and St’át’imc communities, and aligned with our 2011 Agreements and 2019 High Flow Settlement Agreement engagement and other commitments, to ensure the we continue to work together to address any issues raised or that arise throughout the course of the BRT Project. The plan will include:

- Engagement on scoping for the field program so that St’át’imc values are appropriately integrated;
- Involvement of St’át’imc representatives in field program activities;
- Review of field program results and the final Environmental Impact Statement;
- Collaboration on the Access Management Plan;
- Engagement on mitigation and avoidance measures to be incorporated into the Feasibility Design plan;
- Further engagement aligned with the 2011 Agreements and 2019 High Flow Settlement Agreement related to potential contracting opportunities;
- Further discussion and development of management plans to address potential socio-economic impacts, and in particular, impacts related to temporary out-of-town workers and accommodation;
- Review and input into Environmental Management Plans; and
- Further discussion on the need for and scoping of additional effects assessments.

There will also be ongoing engagement through existing relationship forums, including:

- **Quarterly Capital Planning Meetings:** Sharing of the near-term and longer-term outlooks on potential contracting opportunities across BC Hydro work in the Territory to support the St’át’imc Nation in maximizing economic benefits;

- **Joint Planning Forum:** Ongoing analysis related to outage planning in advance of construction and real-time engagement on water management issues during construction (i.e., based on current water supply forecasts and other system operations at time of construction); and
- **Engagement practices:** Broader discussions on appropriate project engagement practices between the St’át’imc Nation and BC Hydro to identify key points for information sharing, input and collaboration in the project lifecycle.

#### *11.2.4.2 BC Hydro’s Consultation and Engagement with the Tŝilhqot'in National Government*

BC Hydro is engaging with the Tŝilhqot'in National Government on the BRT Project in accordance with the guidelines set out in the Tŝilhqot'in Stewardship Agreement. In February 2021, BC Hydro submitted information on the BRT Project to the Tŝilhqot'in National Government Stewardship Portal, including the scope, alternatives, schedule and considerations related to archaeology and the environment. On April 20, 2021, the Tŝilhqot'in National Government confirmed that it had no concerns with the project. On April 26, 2021, BC Hydro provided additional details on the project background, including the alternatives considered and dismissed, so that the Tŝilhqot'in National Government had a complete record on the BRT Project. No additional questions or concerns have been raised.

The Tŝilhqot'in National Government has confirmed that they do not have any issues or concerns related to the BRT Project moving forward.

If there are any substantive scope changes, BC Hydro will notify the Tŝilhqot'in National Government and respond to any issues or concerns raised.

#### *11.2.4.3 BC Hydro's Consultation and Engagement with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band*

BC Hydro is engaging with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band through established communications channels with these Nations.

On April 23, 2021, BC Hydro notified the Bonaparte First Nation, High Bar First Nation, Neskonlith Indian Band, and Whispering Pines/Clinton Indian Band and Nooaitch Indian Band of the BRT Project, proposed scope of work and schedule, potential environmental and archaeological impacts, and regulatory requirements. BC Hydro also shared information on the alternatives considered so that input and comments could be provided.

On May 12, 2021, BC Hydro and High Bar First Nation met to discuss the BRT Project, work completed to date, and interests and concerns for the project generally. High Bar First Nation requested additional information on how the project fits within BC Hydro's longer-term planning and other capital work. They also noted a high degree of interest in procurement opportunities, and involvement in environmental and archaeological scopes of work. As it related to BC Hydro's longer-term plans including capital work, High Bar First Nation participated in the BC Hydro Integrated Resource Plan workshop on June 24, 2021. BC Hydro and High Bar First Nation held a follow-up meeting on July 6, 2021 to discuss the draft Integrated Resource Plan. High Bar noted interests related to affordability, limiting impacts on water and lands and long term energy planning. These discussions will continue in relationship forums beyond the scope of this project. No additional issues specific to long-term capital plans were raised related to the BRT Project.

BC Hydro will continue to engage with High Bar First Nation throughout the project lifecycle on environmental and archaeological scopes of work and procurement opportunities.

No comments or concerns have been received from the Bonaparte First Nation, Neskonlith Indian Band, and Whispering Pines/Clinton Indian Band and Nooaitch Indian Band. BC Hydro will continue to share information on the BRT Project and engage on any interests or concerns raised.

### 11.2.5 Adequacy of Consultation and Accommodation

*St’át’imc Nation*

The role of the BCUC is to assess adequacy of consultation up to the time of the decision. For St’át’imc, the scope and content of that duty, including any accommodation, has been mutually defined by agreements between BC Hydro and the St’át’imc Nation. This is described in more detail in section 6.2.5 of Chapter 6.

The 2011 Agreements and 2019 High Flow Settlement Agreement settle claims in relation to the existing facilities and set out how the parties conduct meaningful consultation and accommodation with respect to maintenance, repairs and upgrades of those existing facilities, which includes the BRT Project. BC Hydro has consulted, and will continue to consult, in accordance with the terms of the 2011 Agreements and 2019 High Flow Settlement Agreement. BC Hydro’s consultation and accommodation complies with, and will continue to comply with, the terms of the 2011 Agreements and 2019 High Flow Settlement Agreement, and is consistent with, and will continue to be consistent with, the requirements of the duty to consult as set out in *Haida*. Therefore, BC Hydro submits that the BCUC will be able to conclude that consultation has been adequate.

The concerns raised by the St’át’imc Nation with respect to access, involvement in archaeological and environmental work, values and scoping of impact assessments, and procurement and employment are being considered and addressed through existing processes and ongoing engagement.

*Tŝilhqot'in Nation*

Engagement with the Tŝilhqot'in Nation has been undertaken in accordance with the guidelines set out in the Tŝilhqot'in Stewardship Agreement. The Tŝilhqot'in Nation has not identified any concerns with the BRT Project. BC Hydro's consultation with the Tŝilhqot'in Nation to date complies with the Tŝilhqot'in Stewardship Agreement and satisfies the duty to consult and accommodate the Tŝilhqot'in Nation.

*Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band*

Engagement with Bonaparte First Nation, High Bar First Nation, Whispering Pines/Clinton Indian Band, Neskonlith Indian Band and Nooaitch Indian Band has been undertaken in accordance with the principles set out in *Haida,* and the cases following it. As noted above, in this case, the duty to consult is at the low end of the *Haida* spectrum. The High Bar First Nation has requested additional information on BC Hydro's long term plans, procurement opportunities and potential environmental and archaeological scopes of work. BC Hydro's consultation has, and will continue to be, consistent with the principles of the duty to consult as set out in *Haida*.

Throughout the BRT Project lifecycle, BC Hydro will continue to involve the St'át'imc Nation as stipulated under the 2011 Agreements and 2019 High Flow Settlement Agreements including the communications and engagement plan being developed for the project. BC Hydro will continue to consult with Tŝilhqot'in on any significant scope changes or additional input from the Tŝilhqot'in National Government and will respond to any questions or concerns they may have. BC Hydro will also continue engagement with the communities of Bonaparte First Nation, High Bar First Nation, Neskonlith Indian Band, Whispering Pines/Clinton Indian Band and Nooaitch Indian Band to receive any inputs and understand any issues and concerns they may have and to establish additional opportunities for participation throughout the lifecycle of the BRT Project.

BC Hydro will provide further updates on its consultation and engagement with Indigenous Nations through the evidentiary update on the BRT Project that will be filed later in this proceeding.

## 11.3 Public Engagement

### 11.3.1 Introduction

This section describes our engagement to date with the public, including government agencies and local residents, and plans for continued stakeholder engagement. Aligning with IAP2[159] best practices, BC Hydro has engaged at an appropriate level with those directly impacted by the project and provided them with an opportunity to share issues or concerns for BC Hydro's consideration and response.

BC Hydro is committed to ensuring local government, stakeholders and the public are informed about the BRT Project, understand the need for the BRT Project, and have opportunities to provide their feedback. To date, ongoing engagement activities have resulted in limited feedback and few questions with respect to the BRT Project. The questions we have received are related to the proposed location of the BRT Project and clarity on the purpose and details of the BRT Project. BC Hydro has also received requests to be kept informed of the BRT Project as it progresses. BC Hydro will provide further updates on its engagement with the public through the evidentiary update on the BRT Project that will be filed later in this proceeding.

### 11.3.2 Stakeholder Engagement Approach

BC Hydro's engagement practices are grounded in the IAP2. Aligning with these practices, stakeholders are considered to be those directly impacted by the outcome of a decision or project activities. IAP2 also provides a framework to assess the level of stakeholder engagement. BC Hydro's public engagement initially included

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[159] IAP2 is an international association of members who seek to promote and improve the practice of public participation / public engagement in relation to individuals, governments, institutions, and other entities that affect the public interest in nations throughout the world. Website: https://iap2.org.

stakeholders identified for all three BRT Project alternatives. Since the project alternatives are primarily located within existing BC Hydro rights-of-way, an existing substation property, and at existing IPP properties with no visible physical changes to the IPP facilities, BC Hydro's engagement activities focused on keeping stakeholders informed of the BRT Project and its timeline and activities as it progresses. Engagement also includes identifying and mitigating potential stakeholder impacts from the BRT Project as required.

BC Hydro has the following objectives for the BRT Project's public engagement activities:

- Ensure local governments, stakeholders and the public are informed about the status of, and the need for, the BRT Project; and
- Provide the opportunity for input from local governments, stakeholders and the public on potential issues and concerns with the BRT Project for BC Hydro's consideration and resolution, where possible.

BC Hydro also provides the BRT Project activities and progress updates in the broader communications and engagement strategy for all planned Bridge River System capital investments. The Bridge River System communications and engagement include recurring updates to local elected officials, chambers of commerce and other key stakeholders, in response to their expressed interest in learning more about BC Hydro's capital investments in the Bridge River System as a whole and the related opportunities and potential impacts to local communities.

During the COVID-19 pandemic, BC Hydro has also shared its Pandemic Response Plan with stakeholders, local governments and the public. This plan outlines our response to various stages of an outbreak and our plans for critical and supporting functions and is updated as needed in response to current conditions.

### 11.3.3 Local Community Setting

The BRT Project’s three identified feasible alternatives are in the following community locations:

*Alternative 1 (Leading Alternative)*

The work occurs along an existing BC Hydro right-of-way, which is located in the Squamish-Lillooet Regional District Area B, Thompson-Nicola Regional District Area E, and in the District of Lillooet.

*Alternative 2*

The work occurs within the existing Rosedale Substation, which is located in the Fraser Valley Regional District Area D.

The work for this alternative also occurs in the community locations that are described in Alternative 1 because the work to refurbish the 2L90 circuit is common to all three alternatives.

*Alternative 3*

This alternative could include curtailments at IPPs in the Fraser Valley.

The work for this alternative also occurs in the community locations that are described in Alternative 1 because the work to refurbish the 2L90 circuit is common to all three alternatives.

### 11.3.4 Public Groups Included in Engagement

BC Hydro identified the following groups for engagement purposes on all three alternatives. These groups were selected based on BC Hydro’s previous engagement experience in each community:

- Municipal government and staff: District of Lillooet;

- Regional District Governments: Squamish-Lillooet, Thompson-Nicola, Cariboo and Fraser Valley;
- Members of the Legislative Assembly: Chilliwack, Fraser-Nicola; and
- Adjacent landowners/residents to the impacted portion of the 2L90 circuit and the Rosedale Substation.

As the Leading Alternative for the BRT Project has now been identified, the next phase of engagement activities will proceed with the following stakeholders only:

- District of Lillooet;
- Regional District Governments: Squamish-Lillooet, Thompson-Nicola;
- Members of the Legislative Assembly: Fraser-Nicola; and,
- Landowners/residents that are adjacent to the impacted portion of the 2L90 circuit.

### 11.3.5 Engagement Process

BC Hydro has adopted a public consultation process that is commensurate with the level of expected potential impact as a result of the BRT Project, which will take place primarily within existing BC Hydro property or right-of-way. As such, engagement activities undertaken to date focused on keeping stakeholders informed of the BRT Project progress, alternatives under consideration, identification of the Leading Alternative and timelines as work progresses. Examples of the engagement materials are provided as Appendix C-9.

Engagement activities to date have included:

- Profiling the BRT Project work on the BC Hydro's website (www.bchydro.com/brt);

- Introducing the BRT Project through letters to government representatives in February 2019;
- Distributing updates to government representatives and nearby property owners and key stakeholders in April 2019, June 2019, and August 2019;
- Providing the BRT Project Leading Alternative update to all groups in June 2020;
- An update on the BRT Project and the upcoming CPCN Application in February 2021;
- Regular delegations to the Squamish Lillooet Regional District to provide bi-annual updates on the capital plan for the region, including the BRT Project. Delegations took place in:
  - December 2017;
  - July 2018;
  - February 2019;
  - September 2019;
  - February 2020;
  - November 2020; and
  - April 2021.
- Regular delegations to the District of Lillooet to provide bi-annual updates on the capital plan for the region, including the BRT Project. Delegations took place in:
  - March 2019;
  - October 2019;
  - June 2020;

  - ▶ November 2020, and
  - ▶ April 2021.
- Providing updates as part of the Bridge River System projects meetings with the Lillooet Chamber of Commerce, which started in December 2018;
- Including BRT Project information at the Bridge River System Public Open House in May 2019; and
- Including BRT Project updates in the Bridge River System newsletters in summer 2019 and spring 2021.

### 11.3.6 Public Support and Issues Identified

Feedback received to date has been limited to a few emails following the issuance of each update, including queries regarding the location of identified alternatives for the BRT Project, requests to be kept informed, and requests for more information on the existing infrastructure associated with identified alternatives for the BRT Project. BC Hydro responded to these questions by email.

### 11.3.7 Mitigation and Ongoing Public Engagement Activities

Engagement activities on the Leading Alternative will continue to keep local government, stakeholders and the public informed. This includes:

- Updates by email and mail;
- Updates on the BRT Project website;
- Reviewing and responding to any stakeholder inquiries and mitigating any issues (this may be done through emails, virtual meetings, or open houses, depending on the issue or inquiry);
- Presentations to local governments as requested;
- Information in local media as appropriate; and

- Including BRT Project updates in the Bridge River System Projects communication and engagement activities as appropriate.

# BC Hydro Bridge River Projects

## Bridge River Transmission Project

# Chapter 12

## Project Risks and Risk Management

## Table of Contents

12.1 Introduction ..... 12-1
12.2 BRT Project Risks Were Identified and Analyzed Through BC Hydro's Established Risk Matrix ..... 12-2
  12.2.1 BC Hydro Incorporated Experience from Similar Major Projects ..... 12-2
  12.2.2 Consequences, Probabilities and Severities Have Been Assigned to Each Identified Risk ..... 12-3
12.3 Identification Phase Risks and Treatment Plans ..... 12-4
  12.3.1 BC Hydro is Implementing Measures to Mitigate the Risk of this Regulatory Proceeding Impacting the BRT Project ..... 12-4
  12.3.2 BC Hydro will be Implementing Measures to Mitigate the Risk from the Potential Need to Acquire New Permits and Agreements ..... 12-5
  12.3.3 BC Hydro will be Implementing Measures to Mitigate the Risk from Difficult Terrain and Limited Access to Sites ..... 12-6
  12.3.4 BC Hydro will be Implementing Measures to Mitigate the Risk of Wildfire During Construction ..... 12-7
  12.3.5 BC Hydro will be Implementing Measures to Mitigate the Risk of Impacting Archaeological Sites During Construction ..... 12-8
  12.3.6 BC Hydro will be Implementing Measures to Mitigate the Risk of Outage Requirements on the 2L90 Circuit ..... 12-10

## List of Tables

Table 12-1 Summary of Risk of this Proceeding Impacting the BRT Project ..... 12-5
Table 12-2 Summary of Risk from Need for New Permits and Agreements ..... 12-6
Table 12-3 Summary of Risk from Difficult Terrain and Limited Access to Sites ..... 12-7
Table 12-4 Summary of Risk of Wildfire During Construction ..... 12-8
Table 12-5 Summary of Risk of Impacting Archaeological Sites During Construction ..... 12-9
Table 12-6 Summary of the Risk of Required Outages During 2L90 Circuit Construction ..... 12-10

## 12.1 Introduction

Over the life of the BRT Project, risks and associated risk treatments are and will be identified, analyzed, and continuously monitored and reviewed, in accordance with BC Hydro’s project management practices and procedures, through the following key risk management activities:

- First, risks are identified based on input from the project team and key stakeholders and considering hazards, threats, risk events, problems and consequences, as well as lessons learned from similar past projects;
- Second, a qualitative and quantitative risk analysis is performed for identified risks to determine their consequence type, severity and likelihood. This analysis is then used to determine the required level of oversight in accordance with the identified Project Risk Zone in the Project Delivery Risk Matrix;
- Third, appropriate treatment plans to respond to the risks are developed based on the identified Project Risk Zone and with defined timelines and risk owners; and
- Fourth, risks and reporting of risks are monitored and reviewed on a regular basis so that the appropriate audience is informed, and any required updates are made.

Further information on BC Hydro’s Project Delivery risk management process is provided in Appendix A-7.

The BRT Project is currently in the Feasibility Design stage. By March 2022, BC Hydro expects to confirm whether the Leading Alternative will proceed as the Preferred Alternative. Following this decision, BC Hydro will file an evidentiary update with the BCUC to provide additional information on the BRT Project, including any identified risks for the Definition phase and Implementation phase of the BRT Project as well as any identified retained operational risks following the implementation of the BRT Project.

This chapter provides the information that BC Hydro has to-date and is structured as follows:

- Section 12.2 explains how these risks were identified and analyzed; and
- Section 12.3 identifies and discusses six material risks identified in the Identification phase of the BRT Project.

## 12.2 BRT Project Risks Were Identified and Analyzed Through BC Hydro’s Established Risk Matrix

Consistent with BC Hydro’s project management practices and procedures, risks to the BRT Project were identified based on input from the project team, Indigenous Nations and key stakeholders, as well as lessons learned from similar past projects. Those identified risks were then analyzed and evaluated to determine their consequences and associated probabilities and severity.

### 12.2.1 BC Hydro Incorporated Experience from Similar Major Projects

BC Hydro has managed major projects similar to the BRT Project. For example:

- BC Hydro is currently re-locating the 5L063 circuit in Telkwa;
- BC Hydro is currently refurbishing a portion of 2L13/2L14 circuit in the Capilano Watershed;
- In 2021, BC Hydro completed construction of two new 230 kV transmission lines with wood pole H-frame construction in the Dawson-Groundbirch area of the Peace region; and
- In 2019, BC Hydro restored the 1L274 circuit overhead rating in the East Kootenay region.

Experience gained and lessons learned from these projects has been considered, and where applicable, incorporated to identify and analyze risks for the BRT Project. For example, BC Hydro considered past experience and lessons with regard to:

- Managing archeological and environmental risks;
- Conducting access planning to identify any required permits and agreements; and
- Engaging in early outage planning activities.

### 12.2.2 Consequences, Probabilities and Severities Have Been Assigned to Each Identified Risk

BC Hydro has a Project Delivery Risk Matrix which sets out five consequence types that can be assigned to identified risks. The Project Delivery Risk Matrix is provided as Appendix A-7. The five consequence types set out in the risk matrix are:

- **Safety** risks which may result in the potential for harm to workers and/or the public;
- **Environmental** risks which may result in the potential for incidents impacting habitat and/or species;
- **Financial Loss** risks which may result in the potential for financial loss such as risks that could lead to a schedule delay, an increase in the cost of procuring equipment, or lost generation revenue;
- **Reputational** risks which may result in the potential loss of public trust or the loss of consent to operate; and
- **Reliability** risks which may result in a failure that impacts the reliability of equipment or causes an outage for customers.

Once risks are identified and assigned a consequence type, they are analyzed and evaluated to determine the probability and severity of the consequence:

- The probability of the consequence measures the likelihood of the consequence occurring. It is assessed on a scale from L4 (0.1 per cent probability of occurrence) to L7 (60 per cent probability of occurrence).

- The severity of the consequence measures the degree of impact and is assessed on a scale from S1 to S6.[160]
- The probability and severity of the consequence measures are then combined to arrive at an overall pre-treatment risk score.[161]
- Appropriate treatment plans are then developed, planned and/or implemented to either reduce the probability of the risk occurring, or the severity of the risk, should it occur. Residual probability and severity measures are then assigned to indicate the likelihood of occurrence and degree of impact, considering the mitigation measures that have been put in place. These measures are combined to arrive at an overall residual risk score.

## 12.3 Identification Phase Risks and Treatment Plans

Identification phase risk management focuses on the risks with the potential to impact BC Hydro's ability to advance the BRT Project into the Definition phase. BC Hydro has identified six material risks for the Identification phase.

### 12.3.1 BC Hydro is Implementing Measures to Mitigate the Risk of this Regulatory Proceeding Impacting the BRT Project

Table 12-1 below provides a summary of the risk of this regulatory proceeding impacting the BRT Project.

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[160] For further details on the specific severity of impact by consequence type, refer to Appendix A-7.

[161] Further information on the probability and consequence measures and how those measures are combined to arrive at an overall pre-treatment risk score is provided in Appendix A-7.

**Table 12-1 Summary of Risk of this Proceeding Impacting the BRT Project**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Active | The BRT Project has not yet completed the Feasibility Design stage and as a result, the information provided in the Application for the BRT Project does not fully align with the 2015 BCUC CPCN Guidelines, at this time.<br>This could result in the BCUC finding that there is insufficient evidence to issue a CPCN for the BRT Project on the timeline that BC Hydro is seeking or declining to issue a CPCN for BRT Project. | Financial Loss | 10.5<br>**Probability** Fairly Likely (L6.5)<br>**Severity** $10M to $100M (S4) | 9<br>**Probability** Remote (L5)<br>**Severity** $10M to $100M (S4) |

To mitigate this risk, BC Hydro has identified and is implementing the following risk treatments:

- Developing a comprehensive application that aligns with the 2015 BCUC CPCN Guidelines, to the extent possible at this time;
- Proposing a regulatory schedule that allows for an evidentiary update to provide additional information on the BRT Project after BC Hydro has confirmed whether the Leading Alternative will proceed as the Preferred Alternative[162]; and
- Advancing future phase work related to design and engineering, where possible, to mitigate the impact of any additional regulatory process.

### 12.3.2 BC Hydro will be Implementing Measures to Mitigate the Risk from the Potential Need to Acquire New Permits and Agreements

Table 12-2 below provides a summary of the risk of cost and schedule impacts if new access road permits and agreements are required for construction access.

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[162] For further information, refer to section 1.5.2 of Chapter 1.

**Table 12-2 Summary of Risk from Need for New Permits and Agreements**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | BC Hydro may require new access road permits and agreements for construction access which could result in impacts to the project schedule and cost. | Financial Loss | 9.5<br>**Probability**<br>Fairly Likely<br>(L6.5)<br>**Severity**<br>$1M to $10M<br>(S3) | 8<br>**Probability**<br>Possible<br>(L6)<br>**Severity**<br>$100k to $1M<br>(S2) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Designing and utilizing existing access roads and statutory right-of-way; and
- Identifying any required new permits or agreements early in the Feasibility Design stage to allow sufficient time for acquisition without adverse project schedule impacts.

### 12.3.3 BC Hydro will be Implementing Measures to Mitigate the Risk from Difficult Terrain and Limited Access to Sites

Table 12-3 below provides a summary of the risk of schedule, cost or safety impacts due to the terrain and limited access to the sites along the 2L90 circuit. These conditions mean that a significant amount of helicopter work could be required.

**Table 12-3 Summary of Risk from Difficult Terrain and Limited Access to Sites**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | Due to the terrain and limited access to the sites along the 2L90 circuit, there is a risk that a significant amount of helicopter work could be required.<br>This may result in impact to the schedule and cost of the project as well as injuries to construction personnel working on the 2L90 circuit. | Financial Loss<br>Safety | 9.5<br>**Probability**<br>Fairly Likely (L6.5)<br>**Severity**<br>$1M to $10M (S3)<br>Worker Temporary Disability (S3) | 8<br>**Probability**<br>Remote (L5)<br>**Severity**<br>$1M to $10M (S3)<br>Worker Temporary Disability (S3) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Engaging field operations staff and the St’át’imc Nation early in Feasibility Design stage to develop acceptable site access; and
- Establishing proper site access plans, work procedures and work training to access the sites and to conduct helicopter work safely.

### 12.3.4 BC Hydro will be Implementing Measures to Mitigate the Risk of Wildfire During Construction

Table 12-4 below provides a summary of the risk of schedule, cost or safety impacts due to wildfire during construction.

**Table 12-4 Summary of Risk of Wildfire During Construction**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | Due to the high wildfire risk in the region where the 2L90 circuit is located, there is a risk of wildfire during construction.<br>This may result in impacts to the project cost or schedule and could result in injuries to construction personnel working on the 2L90 circuit. | Financial Loss<br>Safety | 9<br>**Probability** Possible (L6)<br>**Severity** \$1M to \$10M (S3)<br>Worker Temporary Disability (S3) | 8<br>**Probability** Possible (L6)<br>**Severity** \$100k to \$1M (S2)<br>Worker Treatment by Medical Professional (S2) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Requiring contractors to have an accepted Wildfire Management Plan that meets or exceed the minimum requirements of the *Wildfire Act* and Regulation; and
- Conducting wildfire risk assessment as part of the daily tailboard and communication with workers on the project.

### 12.3.5 BC Hydro will be Implementing Measures to Mitigate the Risk of Impacting Archaeological Sites During Construction

Table 12-5 below provides a summary of the risk of encountering and impacting heritage sites along the 2L90 circuit right-of-way during construction, resulting in a violation of the *Heritage Conversation Act*.

### Table 12-5 Summary of Risk of Impacting Archaeological Sites During Construction

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | Due to the scope of work required on the 2L90 circuit, there is a risk of encountering heritage and archaeological sites along the 2L90 circuit right-of-way.<br>Impacts to protected heritage sites could result in a violation of the *Heritage Conservation Act*. | Reputational<br>Financial Loss | 9<br>**Probability**<br>Possible<br>(L6)<br>**Severity**<br>Vocal minority of customers critical<br>(S3)<br>$1M to $10M<br>(S3) | 8<br>**Probability**<br>Remote<br>(L5)<br>**Severity**<br>Vocal minority of customers critical<br>(S3)<br>$1M to $10M<br>(S3) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatments:

- Avoiding known and newly discovered heritage and archaeological sites that may be impacted by utilizing structures from the de-energized 2L91 circuit where possible, and constructing structures in, or in close proximity to, existing pole locations;
- Designing site specific mitigation plans in consultation with an external archaeologist and the St’át’imc Nation; and
- Including BC Hydro’s Archaeological Chance Find Procedure[163] in the Environmental Management Plan.

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[163] BC Hydro’s Archaeological Chance Find Procedure is a procedure followed to document and protect archaeological sites when unanticipated archaeological or heritage deposits become exposed and discovered during ground altering activities within the project area.

### 12.3.6 BC Hydro will be Implementing Measures to Mitigate the Risk of Outage Requirements on the 2L90 Circuit

Table 12-6 below provides a summary of the risk of requiring outages on the 2L90 circuit during construction, which would impact the Bridge River Generating System and water management on Lower Bridge River.

**Table 12-6 Summary of the Risk of Required Outages During 2L90 Circuit Construction**

| Risk Status | Description of Risk Event and Consequence | Consequence Type | Risk Rating | Residual Risk Rating |
|---|---|---|---|---|
| Identified | There is a risk that additional outages or outages of longer duration may be required for construction works on the 2L90 circuit.<br>This may result in an impact to the Bridge River Generation System and water management on Lower Bridge River. | Environmental<br>Reputational | 9<br>**Probability**<br>Remote (L5)<br>**Severity**<br>High (S4)<br>Many customers critical (S4) | 8<br>**Probability**<br>Remote (L5)<br>**Severity**<br>Moderate (S3)<br>Small but vocal minority of customers critical (S3) |

To mitigate this risk, BC Hydro has identified and will be implementing the following risk treatment:

- Engaging in early outage planning and conducting pre-outage assembly and constructions works to minimize the required duration of outages.