625 Fisgard St.,
Victoria, BC V8W 1R7

Capital Regional District

Notice of Meeting and Meeting Agenda
Capital Regional District Board

Wednesday, April 10, 2024 | **1:10 PM** | **6th Floor Boardroom, 625 Fisgard Street, Victoria, BC**

The Capital Regional District strives to be a place where inclusion is paramount and all people are treated with dignity. We pledge to make our meetings a place where all feel welcome and respected.

1. TERRITORIAL ACKNOWLEDGEMENT

2. APPROVAL OF THE AGENDA

3. ADOPTION OF MINUTES

3.1. 24-360 Minutes of the March 13, 2024 Capital Regional District Board Meeting

Recommendation: That the minutes of the Capital Regional District Board meeting of March 13, 2024 be adopted as circulated.

Attachments: Minutes - March 13, 2024

4. REPORT OF THE CHAIR

5. PRESENTATIONS/DELEGATIONS

5.1. Presentations

5.2. Delegations

5.2.1. **24-403** Delegation - Philippe Lucas; Representing Biosolid Free BC: Re: Agenda Item: 7.2. Biosolids Monthly Update - April

6. CONSENT AGENDA

6.1. 24-335 Union of British Columbia Municipalities Grant for Disaster Risk Reduction - Climate Adaptation 2024 - Motion of Support

Recommendation: The Electoral Areas Committee recommends to the Capital Regional District Board: That the Capital Regional District Board support an application to the Union of British Columbia Municipalities Community Emergency Preparedness for the 2024 Disaster Risk Reduction - Climate Adaptation grant and direct staff to provide overall grant management.
(NWA)

Attachments: Staff Report: UBCM Grant-Disaster Risk Reduct'n-Climate Adapt'n 2024
Appendix A: CEPF Disaster Risk Reduct'n-Climate Adapt'n Grant 2024

6.2. 24-297 2023 Electoral Areas Grants-In-Aid Annual Report

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: 2023 Grants-In-Aid Annual Report
Appendix A: 2023 Electoral Areas GIA Awarded
Appendix B: 2023 Electoral Areas Safe Restart GIA Awarded

6.3. 24-296 2023 Community Works Fund Annual Report

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: 2023 CWF Annual Report
Appendix A: CWF Funding Project Balance by EAs
Appendix B: 2023 CWF Grants Awarded
Appendix C: 2023 CWF Detailed Breakdown by EA

6.4. 24-346 Community Works Fund - Disbursement Process

Recommendation: The Electoral Areas Committee recommends to the Capital Regional District Board: That the disbursement process for the Community Works Fund, as described in this report, be implemented for future third party projects.
(NWA)

Attachments: Staff Report: CWF Disbursement Process
Appendix A: Disbursement Process Chart & Project Examples

6.5. 24-343 Household Hazardous Waste Pickup in Electoral Areas - Follow-up

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: HHW Pickup in Electoral Areas - Follow-up
Appendix A: Previous HHW Pickup in Electoral Areas Staff Reports

6.6. 24-370 Port Renfrew Refuse Disposal - Local Service: 2024 Initiatives Update

Recommendation: The Port Renfrew Utility Services Committee recommends that the Electoral Areas Committee recommend to the Capital Regional District Board:
That staff be directed to:
1. Continue implementing site upgrades with funding from the Growing Communities Fund.
2. Work with the business sector on alternative solutions for commercial packaging and printed products.
3. Continue to transition the depot from caretaker managed, to a site operator model for late 2024; and
4. Continue discussions for long-term waste management in Port Renfrew with the Pacheedaht First Nation and the broader community.
(NWA)

Attachments: Staff Report: Port Renfrew Refuse Disposal – Local Service: 2024 Initiatives Up

Appendix A: Issues and Opportunities Summary

6.7. 24-243 Curbside Collection of Packaging and Printed Products - 2024 Update

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Curbside Collection of Packaging & Printed Products - Update

6.8. 24-294 Material Stream Diversion - Award of Contract ERM2022-010

Recommendation: The Environmental Services Committee recommends to the Capital Regional District Board:
1. That staff be directed to finalize negotiations, and the Chief Administrative Officer be authorized to enter into a two-year operating and construction contract, for a combined value not to exceed $12,500,000 (excluding GST) with DL's Bins, for the construction and operation of a material diversion transfer station to begin processing of clean wood, treated wood and asphalt shingles on July 1, 2024;
2. That staff be directed to return to the Environmental Services Committee with proposed bylaw amendments to shift the ban on carpet and underlay and salvageable wood to Phase 3;
3. That staff be directed to return to the Environmental Services Committee with proposed bylaw amendments to shift the implementation of the $300/tonne unsorted load rate to Phase 3; and
4. That staff immediately begin consultation on policies to restrict the flow of general refuse waste outside of the capital region.
(WP - All)

Attachments: Staff Report: Material Stream Diversion - Award of Contract ERM2022-010

Appendix A: Material Stream Diversion Request for Proposals Package

Presentation: Material Stream Diversion - Award of Contract ERM2022-010

6.9. 24-244 Extreme Heat Vulnerability Mapping and Information Portal Project

Recommendation: The Environmental Services Committee recommends to the Capital Regional District Board:
That the results of the Extreme Heat Vulnerability Mapping and Information Portal project for the capital region be referred to municipal councils, the Electoral Areas Committee and First Nations for information.
(NWA)

Attachments: Staff Report: Extreme Heat Vulnerability Mapping & Info Portal Project
Appendix A: Heat Vulnerability & Analysis Project Final Report

6.10. 24-245 Climate Projections for the Capital Region

Recommendation: [Following the March 20, 2024 Environmental Services Committee meeting, a revised Appendix A has been attached to update climate projection figures. A redlined copy of the changes is provided in the attached Supplemental.]
The Environmental Services Committee recommends to the Capital Regional District Board:
That the Climate Projections for the Capital Region (2024) report be referred to municipal councils, the Electoral Areas Committee and First Nations for information.
(NWA)

Attachments: Staff Report: Climate Projections for the Capital Region
Appendix A (Revised): Climate Projections for the Capital Region Report - 2024
Appendix A: Climate Projections for the Capital Region Report - 2024 - PCIC
Supplemental: Revisions to Climate Projections (April 2024)
Presentation: Climate Projections for the Capital Region (2024)

6.11. 24-350 Freedom of Information and Protection of Privacy Act (FOIPPA) 2023 Overview

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Freedom of Information and Protection Privacy Act 2023 Overview
Appendix A: 2023 FOI Request Metrics Tables 1- 4

6.12. 24-358 Update to Implications Section of Staff Reports

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Update to Implications Section of Staff Reports
Appendix A: Climate Implications Guidance Document
Appendix B: First Nations Implications Guidance Document
Appendix C: Equity, Diversity and Inclusion Implications Guidance Document

6.13. 24-349 Board Code of Conduct Bylaw - Complaint Process Flowchart

Recommendation: [Following the April 3, 2024 Governance Committee meeting, a revised Appendix B has been attached to correct typographical issues within the flowchart:]
The Governance Committee recommends to the Capital Regional District Board:
That the CRD Board Code of Conduct Bylaw Complaint Process Flowchart attached as Appendix B be approved.
(NWA)

Attachments: Staff Report: Board Code of Conduct Bylaw - Complaint Process Flowchart
Appendix A: Bylaw No. 4605
Appendix B (Revised): Board Code of Conduct – Complaint Process Flowchart
Appendix B: Board Code of Conduct – Complaint Process Flowchart

6.14. 24-345 Board Chair Voting Rights on Standing Committees

Recommendation: [At the April 3, 2024 Governance Committee meeting, the following report was referred to the April 10, 2024 Electoral Areas Committee meeting for information:]
There is no recommendation. This report is for information only.

Attachments: Staff Report: Board Chair Voting Rights on Standing Committees

6.15. 24-266 Motion with Notice: Supportive Housing in the Capital Region (Director Caradonna)

Recommendation: [At the April 3, 2024 Hospitals and Housing Committee meeting the following referral motion was carried:]
The Hospitals and Housing Committee recommends to the CRD Board:
To refer the following motion to staff to report back on the approach that would be taken and that a report come back to the Hospitals and Housing Committee:
"1. That the Board direct staff to work with the Reaching Home Program's Community Advisory Board and/or the Alliance to End Homelessness in Greater Victoria to undertake studies, reports, or analyses on the following topics related to supportive housing across the Capital Region:
a) A high-level regional resource inventory on services and supports within each jurisdiction that aid unhoused people (e.g. food banks, support services, indoor shelters, and so on.)
b) An analysis of the parks, public spaces, or campgrounds available for overnight sheltering for unhoused people across the region;
c) In light of the Province handing down supportive housing targets for all jurisdictions over a certain population, an assessment of the potential role for the CRD to play, in collaboration with local governments and BC Housing, in advancing regional supportive housing and sheltering objectives."
(NWA)

Attachments: Memo: Notice of Motion with Unit Map

6.16. 24-303 District of Saanich Regional Context Statement

Recommendation: The Planning and Protective Services Committee recommends to the Capital Regional District Board:
That the District of Saanich regional context statement be considered in relation to the 2018 Regional Growth Strategy (Bylaw No. 4017) and be accepted in accordance with the requirements of section 448 of the Local Government Act.
(NWP - All except SGI & SSI)

Attachments: Staff Report: District of Saanich Regional Context Statement

Appendix A: Saanich Regional Context Statement Referral

Appendix B: Regional Context Statement Evaluation

6.17. 24-304 Requirements for Consideration of Regional Growth Strategy Updates

Recommendation: [At the March 20, 2024 Planning and Protective Services Committee meeting, the report recommendation was amended with the addition of item 2 and carried as follows:]
The Planning and Protective Services Committee recommends to the Capital Regional District Board:
1. That CRD staff be directed to undertake the studies listed in Table 1: RGS Studies, identify whether additional policy direction is needed, and report back to the Planning and Protective Services Committee with these findings, and
2. That staff initiate discussions in relation to the Regional Growth Strategy in our government-to-government meetings with First Nations in 2024.
(NWA)

Attachments: Staff Report: Requirements for Consideration of RGS Updates

6.18. 24-299 Regional Parks and Trails Planning Process Update

Recommendation: The Regional Parks Committee recommends to the Capital Regional District Board:
That the updated planning process be adopted and implemented to develop future CRD regional park and trail plans.
(NWA)

Attachments: Staff Report: Regional Parks & Trails Planning Process Update

Appendix A: The Pathway for Regional Parks & Trails Mgmt Planning, 2006

Appendix B: Regional Parks & Trails Planning Process, March 2024

6.19. 24-320 Regional Parks and Trails Stewardship Plan

Recommendation: The Regional Parks Committee recommends to the Capital Regional District Board:
That CRD staff begin First Nations engagement for the development of a Regional Parks and Trails Stewardship Plan.
(NWA)

Attachments: Staff Report: Regional Parks and Trails Stewardship Plan

Appendix A: Project Steps and Tentative Timeline

6.20. 24-361 2024 Committee and External Membership Appointments - Update #3

Recommendation: There is no recommendation. This report is for information only.

Attachments: 2024 Board and Committee Membership Appointments

6.21. 24-240 Development Variance Permit for Lot 44, Section 4, Renfrew District, Plan VIP83894 - 3620 Piper Lane

Recommendation: That Development Variance Permit VA000161 for Lot 44, Section 4, Renfrew District, Plan VIP83894, to vary Juan de Fuca Land Use Bylaw, 1992, Bylaw No. 2040, to authorize the siting of a utility building as follows:
1. Part 1, Section 4.01(1)(d) to reduce the front yard requirement for an accessory building 15 m to 0.68 m; and
2. Part 1, Section 4.01(1)(h)(i) to reduce the side yard requirement for an accessory building from 1 m to 0.83 m
be approved.
(NWP - Voting Block A: JDF EA, Colwood, Langford (Goodmanson), Metchosin, Sooke)

Attachments: Staff Report: Development Variance Permit VA000161
Appendix A: Subject Property Map
Appendix B: Site Plan
Appendix C: Survey Plan and Requested Variances
Appendix D: Photos
Appendix E: Ministry of Transportation Setback Permit
Appendix F: Permit VA000161

7. ADMINISTRATION REPORTS

7.1. 24-351 CAO Quarterly Progress Report No. 1, 2024

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: CAO Quarterly Progress Report No. 1, 2024
Appendix A: Photographs of Corporate Activities and Initiatives
Appendix B: Board Priorities Dashboard Progress Q1 - 2024
Appendix C: Board Priorities - Summary of Completed Actions
Appendix D: Capital Regional District Advocacy Strategy
Appendix E: Advocacy Dashboard Progress Q1 - 2024
Appendix F: Operating Variance Financial Report Q4 - 2023
Appendix G: Capital Variance Financial Report Q4 - 2023
Appendix H: Human Resources Trends and Corporate Safety
Appendix I: People, Safety & Culture Strategic Plan
Appendix J: Corporate Communications & Engagement Strategic Plan

7.2. 24-359 Biosolids Monthly Update - April

Recommendation: There is no recommendation. This report is for information only.

Attachments: Staff Report: Biosolids Monthly Update - April

7.3. 24-384 Establishment of Bilateral Agreements with Municipalities in the Capital Regional District to Facilitate Implementation of Next Generation 9-1-1

Recommendation: That staff be directed to develop and enter into bilateral agreements with local authorities to allow the Capital Regional District to sign the Local Governing Authority Agreement with TELUS for Next Generation 9-1-1 implementation.
(WA)

Attachments: Staff Report: Establish't Bilateral Agrmt w/ Munis for NG911

Appendix A: TELUS Local Governing Authority Agreement

Appendix B: E-Comm Letter

Supplemental: Draft Sample Template (Metro Van-TELUS) Agrmt

8. REPORTS OF COMMITTEES

Regional Water Supply Commission

8.1. 24-268 Bylaw No. 4604 - Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 4, 2024

Recommendation: The Regional Water Supply Commission recommends to the Capital Regional District Board:
1.That Bylaw No. 4604, "Capital Regional District Water Conservation Bylaw No. 1, 2016, Amendment Bylaw No. 4, 2024", be introduced and read a first, second, and third time; and
(WP - All except SSI & SGI)
2.That Bylaw No. 4604 be adopted.
(WP - All except SSI & SGI, 2/3rds on adoption)

Attachments: Staff Report: Bylaw No. 4604 Water Cons. Bylaw Amendment

Appendix A: Bylaw No. 4604

Appendix B: Blacklined version of Bylaw No. 4099, Schedule A

9. BYLAWS

10. NOTICE(S) OF MOTION

11. NEW BUSINESS

12. MOTION TO CLOSE THE MEETING

12.1. 24-362 Motion to Close the Meeting

Recommendation: 1. That the meeting be closed for Appointments in accordance with Section 90(1)(a) of the Community Charter. [3 items]
2. That the meeting be closed for Labour Relations in accordance with Section (90)(1)(c) of the Community Charter. [2 items]
3. That the meeting be closed for the Expropriation of Land in accordance with Section (90)(1)(e) of the Community Charter. [1 item]
4. That such disclosures could reasonably be expected to harm the interests of the Regional District. [1 Item]
5. That the meeting be closed for Litigation in accordance with Section 90(1)(g) of the Community Charter. [2 items]
6. That the meeting be closed for Legal Update in accordance with Section 90(1)(i) of the Community Charter. [1 item]
7. That the meeting be closed for Intergovernmental Relations under Section 90(2)(b) of the Community Charter. [3 items]

13. RISE AND REPORT

14. ADJOURNMENT

Voting Key:
NWA - Non-weighted vote of all Directors
NWP - Non-weighted vote of participants (as listed)
WA - Weighted vote of all Directors
WP - Weighted vote of participants (as listed)

Meeting Minutes

Capital Regional District Board

Wednesday, March 13, 2024	1:05 PM	6th Floor Boardroom 625 Fisgard Street Victoria, BC

DIRECTORS: C. Plant (Chair), M. Little (Vice Chair), K. Armour (for B. Desjardins), P. Brent, S. Brice, J. Brownoff, J. Caradonna, Z. de Vries, S. Goodmanson, G. Holman, S. Kim (for M. Alto) (EP), D. Kobayashi, K. Murdoch, D. Murdock, C. Rintoul (for C. McNeil-Smith), C. Stock (for P. Jones), L. Szpak, M. Tait, D. Thompson, S. Tobias, A. Wickheim, K. Williams, R. Windsor (EP)

STAFF: T. Robbins, Chief Administrative Officer; N. Chan, Chief Financial Officer; A. Fraser, General Manager, Integrated Water Services; L. Hutcheson, Acting General Manager, Parks and Environmental Services; K. Lorette, General Manager, Planning and Protective Services; K. Morley, General Manager, Corporate Services; D. Elliott, Senior Manager, Regional Housing; G. Harris, Senior Manager, Environmental Protection; R. Lachance, Senior Manager, Financial Services; A. Linwood, Controller, Financial Services; B. Semmens, Manager, Financial Planning & Performance; M. Lagoa, Deputy Corporate Officer; S. Orr, Senior Committee Clerk (Recorder)

EP - Electronic Participation

Regrets: Directors M. Alto, C. Coleman, B. Desjardins, P. Jones, C. McNeil-Smith

The meeting was called to order at 1:02 pm.

1. TERRITORIAL ACKNOWLEDGEMENT

A Territorial Acknowledgement was provided in the preceding meeting.

2. APPROVAL OF THE AGENDA

MOVED by Alternate Director Stock, SECONDED by Director Goodmanson,
That the agenda for the March 13, 2024 Session of the Capital Regional District Board be approved.
CARRIED

3. ADOPTION OF MINUTES

3.1. 24-246 Minutes of the January 31, 2024 and the minutes of the February 14, 2024 Capital Regional District Board meetings

MOVED by Director Murdoch, SECONDED by Director Williams,
That the minutes of the Capital Regional District Board meetings of January 31, 2024 and February 14, 2024 be adopted as circulated.
CARRIED

4. REPORT OF THE CHAIR

It is wonderful to see you all here today. There is something about the spring that brings me hope and optimism. I have a potpourri of items I wish to share with you today. I am truly appreciative of our collective efforts (both Directors and staff) as we consider the 2024 CRD budget. It takes almost a year to develop a new budget and I thank you all for your contributions to this budget. We are proposing a budget collectively to continue to deliver the services and programs our residents rely on, and continuing to address the Collective Board Priorities we have collectively identified. However, I do see a challenge for the organization moving forward. Starting next year, we will be facing potentially larger increases with certain costs coming due. When we consider our budget guidelines for next year, we will need to be very careful and judicious in how we will move forward to balance service delivery with affordability. I wish to offer congratulations to the newly elected Chief and Councils of T'souke and Pacheedaht First Nations, I would like to thank former Chief Planes and Chief Jones for working with the CRD. For the board's benefit, I want to share that whenever an election occurs in a Nation, we send a congratulatory note and extend an invitation to collaborate and work together. I also wish to share some board meeting logistical information. Based on director feedback and consultation with staff we will be moving our morning committee meetings start time back to 9:30 am effective April 1, 2024. The challenge of arriving on time for a 9 am meeting has been pointed out and while the 9:30 am decision was made to ensure we did not run out of time for our committee work when there is a lunch hour meeting scheduled in the board room, we believe we can make it work. It is not lost on me that the challenge of getting here for 9 am is not dissimilar to the thousands of other residents who commute into the city, and it is a reminder we need to find solutions to congestion everywhere in the CRD. Directors may have already noticed they will be provided electronic meeting invites in case your plans change, however, at this time I will not be making changes to the seating plan. It is my intention to continue to see Directors move around the table to provide an opportunity for people to have a different view and to continue to see Directors get to know each other. As you will hear later in the meeting in April, we will be receiving a report on the Biosolids Consultation we undertook as well as receive a copy of the Long-Term Biosolids Management Plan. I am anticipating this will generate a great deal of discussion and debate. And to end with a topic that is not about biosolids, I wish to remind the board that in May we will be conducting our annual review of our Strategic Priorities. This will be our collective opportunity to check in with the process we are making and determine if we are satisfied with the proposed work to date or if we wish to make changes.

5. PRESENTATIONS/DELEGATIONS

There were no presentations or delegations.

6. CONSENT AGENDA

Item 6.11. was removed from the consent agenda and moved to be considered under Administration Reports as item 8.2.

MOVED by Director Brent, SECONDED by Director Kobayashi,
That consent agenda items 6.1. through 6.10. and 6.12. be approved.
CARRIED

6.1. 24-196 Core Area Inflow & Infiltration Program - 2023 Summary

This report was received for information.

6.2. 24-197 Core Area Wastewater Treatment Plant Odour Mitigation Strategy

This report was received for information.

6.3. 24-238 Union of British Columbia Municipalities Grant for Emergency Operations Centres Equipment and Training 2024 - Motion of Support

That the Capital Regional District Board support an application to the Union of British Columbia Municipalities Community Emergency Preparedness for the Emergency Operations Centres Equipment and Training Grant 2024 and direct staff to provide overall grant management.
CARRIED

6.4. 24-128 Future Housing Priorities and Partnerships Framework

This report was received for information.

6.5. 24-096 Capital Regional District External Grants Update

This report was received for information.

6.6. 24-097 Capital Regional District Investment Portfolio Holdings and Performance Annual Update

This report was received for information.

6.7. 24-132 Internal Controls Over Financial Reporting

This report was received for information.

6.8. 24-184 2024 Provincial Budget Highlights

This report was received for information.

6.9. [24-220] Literature Review of E-bike and Micro-mobility Safety

That the CRD Board advocate to the provincial government to consider amending the Motor Vehicle Act to allow electric wheelchairs and mobility scooters, and micro mobility devices, to operate in a safe manner in designated bike lanes and/or routes.
CARRIED

6.10. [24-162] Use of Rigid Bollards on CRD Regional Trails

That the CRD Board direct staff to report back on the findings of the design phase of the Trestles and Trail widening project, including but not limited to interim options and implications regarding the use of rigid bollards and possible alternatives such as flexible bollards.
CARRIED

6.12. [24-260] 2024 Committee and External Membership Appointments - Update #2

That the Board receive for information the updated 2024 Committee and External Membership Appointments as attached.
CARRIED

7. ADMINISTRATION REPORTS

7.1. [24-157] Bylaw No. 4603: 2024 to 2028 Financial Plan Bylaw, 2024

T. Robbins and N. Chan spoke to Item 7.1.

MOVED by Director Brice, SECONDED by Director Brent,
1. That Bylaw No. 4603, "2024 to 2028 Financial Plan Bylaw, 2024", be introduced and read a first, second and third time.
CARRIED

MOVED by Director Brice, SECONDED by Director Brent,
2. That Bylaw No. 4603 be adopted.
CARRIED

MOVED by Director Brice, SECONDED by Director Brent,
3. That the Staff Establishment Chart as attached in Appendix G be approved.
CARRIED

7.2. 24-242 Biosolids Monthly Update - March

L. Hutcheson presented Item 7.2. for information.

Discussion ensued regarding:
- timing of the procurement processes
- First Nations consultation
- communications with the Regional District of Nanaimo
- Organic Matter Recycling Regulation of B.C. (OMRR) update

Motion Arising:
MOVED by Director Caradonna, SECONDED by Director Tobias,
Given delays to provincial reporting on Organic Matter Recycling Regulation of B.C. (OMRR) and the Board's previous direction to initiate an academic analysis, that the Board direct staff to move forward with a third-party academic review of the scientific literature on the uses and impacts of biosolids.

Discussion ensued regarding:
- expected deliverables from a third party academic report
- amending the long term biosolids management plan based on new information
- extension of June deadline for the long term biosolids management plan

The question was called on the motion arising:
Given delays to provincial reporting on Organic Matter Recycling Regulation of B.C. (OMRR) and the Board's previous direction to initiate an academic analysis, that the Board direct staff to move forward with a third-party academic review of the scientific literature on the uses and impacts of biosolids.
CARRIED
Opposed: de Vries, Kobayashi, Little

Motion Arising:
MOVED by Director Caradonna, SECONDED by Alternate Director Armour,
That the Board direct staff and the Chair to write to relevant provincial ministries and request a six-month extension on finalizing the CRD's long-term biosolids management plan.

MOVED by Director de Vries, SECONDED by Director Brent,
That the motion arising be amended by replacing the words "relevant provincial ministries and request a six-month" with the words "request a meeting with the Minister of Environment and Climate Change Strategy to discuss an".
CARRIED

The question was called on the motion arising as amended:
That the Board direct staff and the Chair to write to request a meeting with the Minister of Environment and Climate Change Strategy to discuss an extension on finalizing the CRD's long-term biosolids management plan.
CARRIED

7.3. 24-261 Bylaw No. 4605: Board Code of Conduct Bylaw No.1, 2024

K. Morley spoke to Item 7.3.

Discussion ensued regarding the statement of commitment.

MOVED by Director Little, SECONDED by Director Szpak,
1. That Bylaw No. 4605, "Capital Regional District Board Code of Conduct Bylaw No. 1, 2024", be introduced and read a first, second and third time.
CARRIED

MOVED by Director Little, SECONDED by Director Szpak,
2. That Bylaw No. 4605 be adopted.
CARRIED

MOVED by Director Little, SECONDED by Director Szpak,
3. That the Member Statement of Commitment attached as Appendix B be approved.
CARRIED

8. REPORTS OF COMMITTEES

Finance Committee

8.1. 24-212 Bylaw No. 4588: Regional Parks Loan Authorization Bylaw No. 1, 2024

MOVED by Director Brice, SECONDED by Director Brent,
1. That Bylaw No. 4588, "Regional Parks Loan Authorization Bylaw No. 1, 2024", be introduced and read a first, second and third time.
CARRIED

MOVED by Director Brice, SECONDED by Director Brent,
2. That approval on behalf of the participating areas for Bylaw No. 4588 be obtained through the municipal and electoral area consent process, according to sections 346 and 347 of the Local Government Act, and if successful, that Bylaw No. 4588 be referred to the Inspector of Municipalities for approval.
CARRIED

8.2. 24-032 Motion with Notice: Advocacy for Province-wide Trip Reduction Program (Director Caradonna)

MOVED by Director Szpak, SECONDED by Director Caradonna,
That the CRD echo Metro Vancouver's call for the BC Government to set up a province-wide trip reduction program, and that the Chair of the CRD Board send a letter to the Premier requesting the creation of and a timeline for the introduction of a trip reduction program.

Discussion ensued regarding regional achievements in transportation.

MOVED by Director Murdoch, SECONDED by Director Brice,
That this item be referred back to the Transportation Committee.
DEFEATED
Opposed: Armour, Brent, Brice, Brownoff, Caradonna, de Vries, Goodmanson, Holman, Kim, Kobayashi, Little, Murdoch, Murdock, Plant, Rintoul, Stock, Szpak, Tait, Thompson, Tobias, Wickheim, Williams

Discussion ensued regarding:
- advocacy for mode shift and trip reduction programs
- challenges of trip reduction programs in rural and remote areas

MOVED by Director Szpak, SECONDED by Director Caradonna,
That the main motion be amended by deleting the words "echo metro Vancouver's".

Discussion ensued regarding trip reduction programs and services.

MOVED by Director Brent, SECONDED by Director Kobayashi,
That the question on the amendment to the main motion be called.
CARRIED
Opposed:Tobias

The question was called on the amendment:
That the main motion be amended by deleting the words "echo metro Vancouver's".
CARRIED

The question was called on the main motion as amended:
That the CRD call for the BC Government to set up a province-wide trip reduction program, and that the Chair of the CRD Board send a letter to the Premier requesting the creation of and a timeline for the introduction of a trip reduction program.
CARRIED
Opposed: Little, Stock, Wickheim, Williams

9. BYLAWS

There were no bylaws for consideration.

10. NOTICE(S) OF MOTION

There were no notice(s) of motion.

11. NEW BUSINESS

There was no new business.

12. MOTION TO CLOSE THE MEETING

12.1. 24-250 Motion to Close the Meeting

MOVED by Director Little, SECONDED by Director Murdoch,
1. That the meeting be closed for Appointments in accordance with Section 90(1)(a) of the Community Charter.
CARRIED

MOVED by Director Little, SECONDED by Director Murdoch,
2. That the meeting be closed for Labour Relations in accordance with Section (90)(1)(c) of the Community Charter.
CARRIED

MOVED by Director Little, SECONDED by Director Murdoch,
3. That the meeting be closed for Litigation in accordance with Section 90(1)(g) of the Community Charter.
CARRIED

MOVED by Director Little, SECONDED by Director Murdoch,
4. That the meeting be closed for Intergovernmental Relations under Section 90(2)(b) of the Community Charter.
CARRIED

MOVED by Director Little, SECONDED by Alternate Director Stock,
That the meeting be recessed for the meeting of the Capital Regional Hospital District Board.
CARRIED

The meeting recessed at 3:13 pm to convene the meeting of the Capital Regional Hospital District Board.

The meeting reconvened and went into the Closed Session at 3:48 pm.

13. RISE AND REPORT

The Capital Regional District Board rose from the closed session at 4:32 pm and reported on the following:

- In accordance with Bylaw No. 3427, that the following be appointed to the Saanich Peninsula Water Commission for term expiring December 31, 2024:
Michael Doehnel

14. ADJOURNMENT

MOVED by Director Murdoch, SECONDED by Director Goodmanson,
That the March 13, 2024 Capital Regional District Board meeting be adjourned at 4:33 pm.
CARRIED

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CHAIR

CERTIFIED CORRECT:

____

CORPORATE OFFICER

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REPORT TO ELECTORAL AREAS COMMITTEE
MEETING OF WEDNESDAY, APRIL 10, 2024

SUBJECT **Union of British Columbia Municipalities Grant for Disaster Risk Reduction - Climate Adaptation 2024 - Motion of Support**

ISSUE SUMMARY

The Capital Regional District (CRD) Protective Services Division wishes to apply under two categories of the Community Emergency Preparedness Fund (CEPF), 2024 Disaster Risk Reduction – Climate Adaptation (DRR-CA) grant funded by the Union of British Columbia Municipalities (UBCM). UBCM requires that all grant applications be accompanied by a motion of support from the local government.

BACKGROUND

CRD Protective Services Division regularly applies for UBCM CEPF grants as they become available. Successful applications allow Protective Services to undertake enhanced emergency management preparation and elevate our collective awareness of the risks facing the region.

With the new *Emergency and Disaster Management Act* (*EDMA*) in force as of December 2023, local authorities have an additional responsibility to not only prepare and maintain a risk assessment, emergency plan, and business continuity plans, these documents must also be submitted to the Ministry of Emergency Management and Climate Readiness (EMCR) for review.

As prescribed in the new *EDMA*, these new risk assessments must take into account "changes in the local climate or extreme weather events that can reasonably be expected to result from a changing global climate". Considering the above legislation, the Protective Services team intends to collaborate with the CRD's Climate Action team to determine project scope and consult the current research literature to conduct this risk assessment.

The total grant funding requested by the CRD in the two categories is $180,000. The Protective Services team is looking to apply under the *Category 1: Foundation Activities* stream of this grant for $150,000 in funding to perform a consolidated climate risk assessment and vulnerability study for the area within the CRD. These climate risk assessments are critical to meet the newly legislated requirements for updating the regional emergency plans and identifying opportunities for future mitigation and resiliency initiatives to minimize the potential impacts of climate driven emergencies.

Under this same grant the Protectives Services team, in conjunction with CRD Corporate Communications, wishes to apply for funding under *Category 2: Non-Structural Projects*. Corporate Communications is proposing to install permanent signage advising residents in vulnerable areas, such as the Juan de Fuca, Southern Gulf Islands, and Salt Spring Island, of current water restriction levels (similar to roadside Fire Danger Rating signage) and is seeking $30,000 for the construction and installation of the initiative.

The Protective Services team is endeavoring to leverage the $150,000 portion available through this grant to generate an updated consolidated risk assessment. From this re-established risk awareness foundation, Protective Services intends to build out updated emergency plans relevant for the entire region. Moreover, the information contained in a re-tooled risk assessment would be available for all the departments of the CRD, including critical infrastructure departments which are identified in the *EDMA* legislation, to use to validate or enhance their emergency and business continuity plans as required.

While the final format requirements of the risk assessments, emergency plans, and business continuity plans has yet to be determined by EMCR, risk assessments must be based on studies and surveys, Indigenous knowledge, consultation and coordination with local authorities, and consultation and cooperation with Indigenous peoples. Moreover, and specifically relevant for this grant application, *EDMA* governed risk assessments must be based on "*changes in the local climate or extreme weather events that can reasonably be expected to result from a changing global climate*" (*EDMA*; Part 4: Division 3 – Plans, Programs and Other Measures; Risk assessments: Section 51(4)(c)). With this requirement in mind, a consolidated risk assessment that considers climate change is within scope of eligibility for this grant. This effort will also consolidate any climate resiliency and planning tools and relevant reports into a single library to inform the risk assessment and share with key stakeholders to assist in their collective climate planning activities.

As well as the obvious benefits to the CRD of a successful grant application and subsequent risk assessment and signage projects, we believe the information gathered would be of value for our Indigenous and local authority partners as it would enhance our collective understanding of current and future climate related risks facing the area and would help facilitate and inform a coordinated planning effort across the region.

ALTERNATIVES

Alternative 1
The Electoral Areas Committee recommends to the Capital Regional District Board:
That the Capital Regional District Board support an application to the Union of British Columbia Municipalities Community Emergency Preparedness for the 2024 Disaster Risk Reduction – Climate Adaptation grant and direct staff to provide overall grant management.

Alternative 2
That staff be directed to not submit a grant application to the Union of British Columbia Municipalities Community Emergency Preparedness Emergency Preparedness for the 2024 Disaster Risk Reduction – Climate Adaptation grant.

IMPLICATIONS

Intergovernmental Implications
This work will increase the CRD's and our Indigenous and local authority partners' knowledge, and awareness of changes in the region's risk profile due to climate-related hazards. This satisfies the provincially mandated *EDMA* requirement to consult, coordinate, and cooperate with the CRD's partner agencies.

Financial Implications
This CEPF grant request will be for $180,000 ($150,000 and $30,000) and would allow the CRD to install drought signage and pursue risk and hazard knowledge enhancement on an accelerated timeline that would not be possible within the current budget.

Service Delivery Implications

Additional capacity funded through this grant would inform emergency and resiliency plans and enhance the CRD's ability to respond and support the citizens, critical infrastructure, and business units in the CRD during an emergency or disaster.

Alignment with Board & Corporate Priorities

Updated consolidated risk assessments funded by this grant would enhance the CRD's ability to prepare for, mitigate, respond to, and recover from an environmental or climate related disaster. The objectives of these grant funded projects would facilitate the CRD to meet the following Board and corporate priorities:

Board Priorities:

- Climate Action & Environment
  3c – Increase resilience, community and adaptation planning to address climate risks and disasters.
- First Nations
  4c – Invite, respect, and incorporate Indigenous leadership and traditional knowledge to enhance initiatives and strategies that support other priorities in the plan.

Corporate Plan:

- Climate Action
  6a-1 – Promote community capacity building on climate action.
  6a-2 – Update the climate projections for the capital region to support decision making and to help community partners understand how their work may be affected by our changing climate.
  6a-3 – Generate analysis to understand vulnerability and exposure to heat now and in the future.
- Safety & Emergency Management.
  9a-1 – Support planning for regional scale emergencies in cooperation with the Regional Emergency Management Program.
- First Nations
  15b-2 – Seek out and invite opportunities for Indigenous leadership and knowledge to inform and transform approaches to taking care of land and water, across CRD service delivery areas.
- Local Government
  16g-3 – Review and modernize fire and emergency management programs.

Alignment with Existing Plans & Strategies

Capacity generated by this grant is aligned with existing emergency preparedness and strategies for Protective Services and will be critical to meeting legislated planning requirements.

CONCLUSION

The CRD is required and motivated to maintain an effective emergency management program compliant with provincial legislation. The knowledge enhancement of climate risks and vulnerabilities that will be gained through the UBCM CEPF DRR-CA grant will greatly assist the CRD's endeavor to meet those regulatory expectations while improving response and mitigation planning capability for our citizens and partners.

RECOMMENDATION

The Electoral Areas Committee recommends to the Capital Regional District Board:
That the Capital Regional District Board support an application to the Union of British Columbia Municipalities Community Emergency Preparedness for the 2024 Disaster Risk Reduction – Climate Adaptation grant and direct staff to provide overall grant management.

Submitted by:	Shawn Carby, CD, BHSc, MAL, Senior Manager, Protective Services
Concurrence:	Kevin Lorette, P. Eng., MBA, General Manager, Planning & Protective Services
Concurrence:	Alicia Fraser, P. Eng., General Manager, Integrated Water Services
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer
Concurrence:	Ted Robbins, Chief Administrative Officer

ATTACHMENT

Appendix A: CEPF Disaster Risk Reduction - Climate Adaptation Grant 2024

Community Emergency Preparedness Fund

Disaster Risk Reduction – Climate Adaptation 2023/24 Application Worksheet

Please complete and return the worksheet with all required attachments by **March 28, 2024**. Applicants will be advised of the status of their application within 120 days of the application deadline.

All questions must be answered by typing directly in this form. **As all questions are reviewed and scored as part of the adjudication process, please do not leave any questions blank.**

If you have any questions, contact cepf@ubcm.ca or (604) 270-8226 ext. 220.

SECTION 1: Primary Applicant Information	
First Nation or Local Government full name: Capital Regional District	File number*: LGPS-10761

**Refer to the LGPS Online Application Form submission confirmation email*

SECTION 2: Detailed Project Information

1. Type of Project. Please identify each component you are applying for:

- ☒ Category 1: Foundational activities (risk mapping, risk assessments, planning)
- ☒ Category 2: Non-structural activities (non-physical such as land use planning, community education, purchase of eligible equipment)
- ☐ Category 3: Small scale structural activities

2. Project Cost and Grant Request.

a) Total proposed grant request (provide grant request breakdown below): $180,000.00

Category 1: $150,000.00

Category 2: $30,000.00

Category 3: $0.00

b) Does the proposed project include repairs and/or relocation of infrastructure that was damaged through an eligible DFA event? If yes, please provide more information.

No

3. Project Area.

a) Describe the proposed project area(s) (location, size, total number of people benefiting from this project, land use, etc.) <u>for each proposed project included in this application</u>.

Category 1 (Risk Assessment): Consolidated climate risk assessment for the Capital Regional District (CRD) (2,340 km2). Assessment focused on the three electoral areas of Juan de Fuca (5,500 residents), Salt Spring Island (11,600 residents), and the Southern Gulf Islands (6,100 residents) and the area served by CRD critical infrastructure operations supporting the 400,000+ residents of the region. Knowledge gained will be relevant for, and shared with, the 13 local governments within the capital region, as well as the 19 First Nations that maintain a traditional interest in the area. Intent is to incorporate traditional Indigenous knowledge with the additional goal of understanding how climate change could impact First Nations' cultural sites within the region. The data will also inform climate projections and emergency preparedness and business continuity planning for critical infrastructure operators in the region.

Category 2: (Water Conservation Signage) This project aims to bring water consumption awareness and the need for water conservation measures to our most vulnerable water systems in the electoral areas of the CRD, which includes the Southern Gulf Islands and the Juan de Fuca Electoral Area. The signage will have a similar look and feel to wildfire danger rating signage, with a moveable arrow to indicate what stage of water restriction the local water system is currently at.The total population of CRD Electoral Areas is approximately 23,267 residents (as per 2021 census), with significant increases in transient populations in the Spring and Summer due to high rates of tourism, particularly on Salt Spring Island.

Last year was the first year of a new water restrictions bylaw for the CRD Electoral Areas, Bylaw 4492. This new bylaw is distinct from the exisiting water restriction bylaw for the Regional Water Supply, Bylaw 4099. The need to create this new bylaw was in part driven by climate change, increased drought conditions, increased population growth in the electoral areas and the need to conserve water to ensure that there is enough drinking water to make it through the dry season. For context, many of our small systems cannot make it through the dry season and we are required to truck in drinking water. We had to do this for one of our 12 systems last year. The CRD is not the only water purveyor in the electoral areas, which created unnecessary confusion for communities about what stage of water restrictions were in effect. Last year, the CRD used small sandwich board signs in communities at key and high traffic areas to inform communities what stage of water restrictions were in effect. Feedback from communities was that the sandwich board signs were far too small and barely visible when driving past. The communities have asked for larger permanent signage that would help to clearly articulate the need for water conservation. This message is particularly critical for the high level of tourists who arrive in the Summer months, many of whom are not local and have no understanding of the dire drought conditions electoral areas face in the Summer. All signage is net new except for Pender Island where dated signage will be replaced with the new signage proposed in this project. Installing the same signage for each water system ensures that consistent branding and messaging is in place for all electoral areas. There will be a total of 13 signs. Signs will be professionally fabricated and measure 2.5 x 2.5 feet and will be mounted to posts. All signs will be installed within the water system area (exact location TBD) or with a Memorandum of Understanding (MOU), signs may be installed outside of the water service area in higher traffic areas such as at or near ferry terminals. See attachment "Water Conservation Signage Info Package (UBCM - DRR-CA Grant 2024)" for a detailed work plan, budget, quotes, design proofs and maps of water service areas.

The QR code on the sign will take people directly to their small water system webpage which provides detailed information about current water restrictions, including watering schedules, tips and tricks for water conservation and bylaw and ticketing information related to Bylaw 4492. The webpages are a one stop shop for residents and tourists to learn about the water system, including where the water supply comes from, how the water is treated and distributed, and how to sign up for emergency communciations, such as boil water advisories.

Map(s) indicating the location of the proposed project must be included with this application along with GPS coordinates.

b) Does the proposed project(s) build on other recent projects in your region? If yes, please explain. If referencing reports, please include the relevant page number(s).

Category 1: (Risk Assessment) – N/A

Category 2: (Water Conservation Signage) – N/A

c) Are there previous emergency response costs that the proposed project(s) is designed to mitigate?

None

4. Evidence and Rationale. What is the evidence and rationale for undertaking the proposed project(s)? This may include evidence of how the local natural hazard and/or climate risk is being assessed through threat levels (e.g., as identified in completed risk assessments) and projected climate risks and/or recent history (e.g., evacuation order, disaster financial assistance).

For Category 2 or 3 projects, this may also include completed risk maps, assessments or plans, environmental impact analysis, design drawings or details, record of engagement with First Nations, asset management plan (including natural assets where applicable), projected climate risks, and/or letters of support (from provincial ministries, etc.).

Category 1: (Risk Assessment) – Rationale to apply for funding to conduct a consolidated climate risk assessment comes from two sources. In the first, the province's passing of the *Emergency and Disaster Management Act (EDMA)* in December 2023 mandated that local authorities "prepare and maintain" risk assessments that considers "changes in the local climate or extreme weather events that can reasonably be expected to result from a changing global climate". It is the Capital Regional District's goal to comply with this mandate by meeting the spirit and intent of the legislation. The second driver to conduct a consolidated climate risk assessment comes from witnessing record breaking heat and cold events, atmospheric rivers, and unprecedented drought. The amplitude and frequency of these events is increasing, we would like to understand how these changing events are likely to impact the CRD.

Category 2: (Water Conservation Signage) Rationale for project: As climate change continues, the need to be more judicious with resources also increases. The proposed signage will provide, clear, accurate, and timely information about water restrictions to communities. Seeing a large professionally made water conservation sign in community generally decreases water consumption. More and more smaller island communities have incorporated this type of signage in their community and have seen significant decreases in water consumption. The impact of such community signage was shared by various BC communities (many of whom were Vancouver Island communities) on the Provincial Drought Communication Coordination call last Summer, which the CRD participated in. This call was for all levels of government communication staff across the province to share ideas of how they are getting out the message of water conservation to their communities, what is working and what is not working in terms of altering human behavior in relation to water consumption.

Having CRD specific branded signage in communities will help to differentiate CRD water systems from other water systems and water purveyors in the electoral areas. Many people including tourists and some locals may be unaware of where their water is coming from, but seeing water conservation signage in communities drives home the generic messaging to conserve water regardless of who the water purveyor is. Most other water purveyors in the electoral areas draw from the same water sources as the CRD and most other purveyors do not have signage up in the community. This signage project would likely benefit customers outside of CRD water systems as most people adhere to safety or warning signage posted which would further increase general community awareness of the need to conserve water, regardless of who the water purveyor is.

Copies or extracts of the available evidence is required to be submitted with the application. Please indicate what documentation is being submitted *and provide a specific reference to the sections of documents that should be reviewed.*

Category 2: (Water Conservation Signage) - Refer to attached Water Conservation Info Package. All pages need to be reviewed.

5. Alignment with Intent of DRR-CA funding.

a) Describe how the proposed project(s) considers climate change in the project methodology and adapts to the impacts of climate change through the final deliverables.
Category 1: (Risk Assessment) The proposed project is directly attributed and related to the CRD's desire to understand how climate change is going to impact the region. A consolidated climate risk assessment will formalize emergency managers' anecdotal observations and identify forthcoming risks that have not presented any forewarning evidence. This assessment will inform critical infrastructure operations planning such as water, wastewater and solid waste for emergency and business continuity requirements under the *EDMA.*

Category 2a: (Water Conservation Signage) The proposed signage is a visual reminder for all community members and visitors of the urgent need to conserve water during drought season. Our hope is that the signs would have a stronger impact on tourists, who are the group we are trying to target the most for behavioral changes. Tourism to the electoral areas is extremley high in the Summer months which creates a substantial strain on the water systems that are already struggling to keep up with supply for residents during the dry season. Visitors to the electoral areas would likely be unaware of the water needs of these smaller communities and would be more likley to conserve water if they saw prominent signage displayed in key areas of town, particularly at ferry terminals. We want drought awareness and water conservation to be the first message that visitors receive when they arrive in these communities. Prominent, permanent water conservation signage would achieve this goal. Additionally, permanent signage is a reminder to the community to conserve water year round and not just in the dry season. Small behavioral changes to water usage goes a long way to conserving the resources of these vulnerable water systems. The more people conserve water, the better their communities will fare during drought season. Higher adherence to water conservation measures means a lower risk of having to truck in drinking water to communities. As climate change continues to negatively impact the environment, causing longer, hotter and drier temperatures, permanent community signage is a visual reminder to all locals and visitors for the ongoing need to conserve water year round, despite what season it is and what is happening with the weather.

b) How will the proposed project(s) lead to increased understanding of the social, cultural, and/or environmental impacts of natural hazards and/or climate-related risks?

Category 1: (Risk Assesment) This initiative's sole intent is to increase the CRD's understanding of the social and environmental impacts of natural hazards and climate-related risks. The consolidated climate risk assessment will incorporate current empirical data, climate change forecasts, and traditional Indigenous knowledge.

Category 2: (Water Conservation Signage) Permenant water conservation signage will help to alter human behavior. Well designed and strategically placed signs are effective communication tools for spreading a message. Water conservation is a continual and ever changing educational awareness need, particularly in the face of climate change and longer, hotter, drier Summers. Permanent community signage will help increase water conservation awareness year round. The more water that is conservered in each community, the less impacts of climate change will be felt within communities during drier months. Water conservation is a community effort that starts with community education and awareness of the need to conserve water and how to conserve water. Each sign will have a unique short URL and QR code related specifically to each water system where additional information on water conservation can be found. Each water system webpage also provides information on the current water restrictions, lawn watering schedules, water bylaws, and emergency communications, all of which will further increase community awareness and understanding of the need for water conservation and emergency preparedness year round.

c) Will the proposed project(s) identify or achieve co-benefits (e.g., assessing multiple hazards, protecting valuable cultural assets, reducing greenhouse gas emissions, improving community health and wellbeing, enhancing biodiversity)?

Category 1: (Risk Assessment) The risk assessment the CRD is envisioning would very much assess multiple hazards, protecting valuable cultural assets, and improve community safety.

Category 2: (Water Conservation Signage) The proposed project is singular in nature and focuses on the need for water conservation year round. If people access the short URL or QR code on the sign, they will be taken directly to their water systems webpage. The webpage provides a signifcant amount of information and resources on water conservation. Additionally, the webpage also provides information about where the system's water source comes from and how the water is treated and distributed to users of the system. When people understand where their water comes from and the intricacies involved in providing high quality, potable drinking water they begin to make strong personal connections to how precious the water supply is and what they can do to protect the water system. Knowledge is power, the more educated people are about their water source, the more likley they are to change their behaviors to protect the water source and ensure that there is enough water to survive long dry summers and droughts. The webpage also provides information on how to sign up for CRD's emergency notification system which is an opt in system that informs users of critical life safety information related to emergencies. Users can sign up for alerts through SMS or email. In the case of water, boil water advisory (BWA) notifications are shared through the notification system. Many of the small water systems struggle with water quality issues year round due to high turbidity and algae blooms that are increasing with climate change. Some water systems require BWAs for several months at a time due to poor water quality. A simple water conservation sign which points users to a website they may not have known existed, could provide significant health and wellbeing benefits to an individual if they choose to register for the emergency notification system.

6. **Engagement with First Nations and/or Indigenous Organizations.** As noted in the Program Guide, engagement with First Nations and/or Indigenous organizations in advance of submission of the application is required. Please identify the specific bands, Treaty First Nations, and/or Indigenous organizations that were engaged in advance of submitting the application as well as the specific traditional territory, reserve or other First Nation's land that may be impacted by the proposed project(s).

a) Which First Nations and/or Indigenous organizations were engaged as part of the development of this application?
Category 1: (Risk Assessment) First Nations in the CRD were consulted to participate on the development of the *EDMA* legislation. We have not engaged Nations in the preparation of this application as the CRD believes it must produce an updated climate risk assessment to comply with *EDMA* requirements regardless of First Nations capacity to contribute content and direction. Moreover, the CRD is actively working on how best to utilize the Indigenous Engagement Requirement

funds dispersed by Emergency Management and Climate Readiness (EMCR) for First Nations and local governments to collaborate on matters of emergency management.

Please see our entry in section 6a as a demonstration of how the CRD intends to proceed with First Nation engagement on this risk assessment initiative.

Category 2: (Water Conservation Signage) Bylaw 4492 does not apply to water not provided under a Water System operated by the CRD. Currently, there are no First Nations communities within the CRD Electoral Areas that are serviced by CRD water systems.

b) Which First Nations and/or Indigenous organizations will participate in the proposed activities and what specific role will they play?

Category 1: (Risk Assessment)

The CRD Protective Services Division has consulted with the CRD Indigenous Engagement team and have utilized the provincial Profiles of Indigenous (PIP) data base, to assist identifying all the Nations that maintain a traditional interest in the region. The Nations the CRD intends to engage on matters of traditional knowledge and culturally significant sites are as follows:

paaʔčiidʔatx̣ (Pacheedaht First Nation)

Scia'new First Nation

T’Sou-ke Nation

Cowichan Tribes

Halalt First Nation

Lyackson First Nation

Penelakut Tribe

sc̓əwaθən məsteyəx^{w} (Tsawwassen)

Semiahmoo First Nation

Snuneymuxw First Nation

Stz'uminus First Nation

Ts'uubaa-asatx (Formerly Lake Cowichan)

Songhees Nation

x^{w}sepsum (Esquimalt Nation)

BOḰEĆEN (Pauquachin First Nation)

MÁLEXEŁ (Malahat First Nation)

SȾÁUTW (Tsawout First Nation)

W̱JOŁEŁP (Tsartlip First Nation)

W̱SIḴEM (Tseycum First Nation)

Category 2: (Water Conservation Signage) None - There are no First Nations communities within the CRD Electoral Areas that are serviced by CRD water systems. The hope is that CRD water conservation signage will encourage water conservation for the entire community including First Nations regardless of who the water purveyor is.

c) Describe the specific traditional territory, reserve or other First Nation's land that may be impacted by the proposed project(s)

Category 1: (Risk Assessment) Defining the specific traditional territory each of the above Nations maintains a connection which is beyond the scope of this application.

The following Nations have reserve lands within the CRD:

paaʔčiidʔatx̣ (Pacheedaht First Nation)

Scia'new First Nation

T'Sou-ke Nation

Songhees Nation

xʷsepsum (Esquimalt Nation)

BOḰEĆEN (Pauquachin First Nation)

SȾÁUTW (Tsawout First Nation)

W̱JOȽEȽP (Tsartlip First Nation)

W̱SIḴEM (Tseycum First Nation)

Category 2: (Water Conservation Signage) None - There are no First Nations communities within the CRD Electoral Areas that are serviced by CRD water systems.

d) Indicate the extent to which staff and/or elected officials have undertaken Indigenous Cultural Safety and Cultural Humility Training

Category 1: (Risk Assessment) We cannot comment on the Cultural Safety and Cultural Humility training undertaken by elected officials.

CRD staff take in-house Cultural Perspectives training as part of their onboard training material. As well, the personnel from our partner local authorities have similar Cultural Safety and Cultural Humility training as part of their onboard orientation.

Category 2: (Water Conservation Signage) The CRD requires First Nations Cultural Safety and Humility Training for all staff. Staff who have not yet had a chance to take said training can connect with trained staff within the First Nations Relations department for guidance on anything First Nations related.

If applicable, please submit evidence of support for the proposed activities from First Nations and/or Indigenous organizations identified above. This could be in the form of a letter, email, or other correspondence.

7. Comprehensive and Cooperative Approach.

a) Identify any partners (e.g., local governments, equity organizations, agricultural sector, critical infrastructure owners) that will participate in the proposed project and the specific role they will play.
Category 1: (Risk Assessment) The exact scope of local government partner participation is yet to be determined. We anticipate having CRD Emergency Programs personnel manage the risk assessment project with a contractor conducting partner facilitation, information synthesis, and report writing. CRD owned critical infrastructure operations (water, wastewater, solid waste, etc.) will be engaged as part of the process as they will be an end user of the resulting report. Partner local governments and First Nations will be invited to participate in risk brainstorming sessions as a means to crowd-source all the nuance of risks and hazards facing the region.
Category 2: (Water Conservation Signage) Signs will be fabricated and installed by a third party company called Signpad. Installations and community interactions around signage installs will be managed by CRD staff.

b) Describe how the proposed project will contribute to a comprehensive, cooperative, and regional approach to disaster risk reduction-climate adaptation.
Category 1: (Risk Assessment) This project contributes to a comprehensive, cooperative, and regional approach to disaster risk reduction-climate adaptation primarily in the vastness and variability of the geographic area under consideration. Secondarily, while the CRD's mandated emergency management focus is on the three electoral areas of Juan de Fuca, Salt Spring Island, and Southern Gulf Islands, and for our critical infrastructure services, it is our objective to consult with our neighbouring jurisdictions and share the information discovered with this initiative. We would expect the geoclimatic zone to be consistent across the CRD such that climate related information would be transferrable.
Category 2: (Water Conservation Signage) Having professional permanent water conservation signage within communities that are deemed vulnerable due to unstable water systems will significantly improve the availability of water to said water systems. Signage includes a weblink and QR code that link to the local CRD water system webpage which provides a plethora of water conservation information and additional information about the water system. As residents and visitors educate themselves about where their water comes from and how to simply and effectively conserve water, overall water consumption is expected to lower. Lower water consumption during drought season means that there is more water available for life safety issues such as wildfires and maintaining a healthy drinking water supply. Higher rates of water conservation during the Summer months substantially lowers the risk of having to truck in drinking water. Water conservation signs are becoming the norm in smaller communities and communities with vulnerable water supplies, this is particularly true for Vancouver Island communities. Similar water conservation signage to what is being proposed in this grant application already exists in Tofino, Comox Valley Regional District, Parksville, and Campbell River. While none of these communities are part of the CRD, the message is clear, water conservation is

everyones responsibility, no matter where you travel. Water conservation messaging leads to behavioral changes in water use for many people. Once water conservation behaviors become second nature, people are more likley to employ conservation measures wherever they travel. The more people that reduce their water consumption, the more water will be available during drought months or unexpected climate change incidents that may adversely impact water supplies.

c) Describe how diverse populations, including equity-denied populations, will be involved or benefit from this project (e.g., engagement considers non-English speaking populations, DRR-CA measures benefit equity-denied populations).

Category 1: (Risk Assessment) The intent of this consolidated climate risk assessment is anticipated to benefit all residents and visitors to the CRD. A supplemental benefit to the diverse populations, including equity-denied populations of the area would be the realization that forecast, climate change-driven extreme temperatures could exceed the heating and cooling capabilities of residential living areas and identify the need to aggressively pursue local government led warming or cooling solutions. This is pure speculation at this point, but we hope that an updated climate risk assessment will clarify for the CRD that we are either on the right track and have adequately planned for the future or that we are going to be grossly underprepared in our current state of readiness.

Category 2: (Water Conservation Signage) Signage has been thoughtfully designed to be as inclusive as possible. Signage utilizes a universal stop light colour palette of green, amber (yellow), and red to indicate danger ratings and water availability levels. Orange has been added to the stop light colour palette to allow for the three stages of water conservation the CRD has. Green indicates no water restrictions, amber (yellow) indicates moderate restrictions, orange indicates high restrictions, and red indicates extreme water restrictions. If a person is colour blind, they can read the words within each colour that indicate the degree of water restriction in effect. If a person does not speak English they can rely on the colours on the sign or the scale moving from left to right (no restrictions to highest level of restrictions). Numbers are also used on the sign to indicate the severity rating of water restrictions. Numbers are universal and when utilized in a linear scale are generally assumed to mean that the higher the number the worse the situation is. For those with visual impairment, the QR code can be scanned which will link to the water system webpage that can be read with a screen reader or other adaptive technologies. The addition of other visual elements such as a raindrop to indicate the sign is referring to water will also be considered in the final design to increase accessibility for people with low literacy or people who do not speak English.

If applicable, please submit evidence of support for the proposed activities from partners identified above. This could be in the form of a letter, email or other correspondence.

8. **Qualified Professionals.** Disaster risk reduction-climate adaptation activities can require specialized technical knowledge and experience to provide meaningful results to your community. If applicable, please outline your procurement process to engage the

necessary subject matter expertise (Qualified Professionals) required for the proposed project(s) and the criteria you will use to make the selection.

Category 1: (Risk Assessment) As emergency managers, we do not consider ourselves experts in the field of climate change. Our first objective in this new risk assessment initiative is to consult with the CRD's own in-house Climate Action team to glean their advice on scoping the project and who we ought to consult. We fully anticipate procuring the services of contractors that specialize in climate adaptation and risk assessment.

The CRD's procurement process is a standard tender-based system in that we would launch this initiative with a request for quote (RFQ) via a bid-based procurement process. Selection of the appropriate vendor would rest on the bidder's ability to demonstrate they could meet the terms of the project at a competitive price.

Category 2: (Water Conservation Signage) N/A. No technical experts need to be consulted for this project. Signs will be fabricated and installed by a third party company called Signpad. Installations and community interactions around signage installs will be managed by CRD staff.

SECTION 3: CATEGORY 1 – Detailed Project Information

Only complete this section if you are applying for a project under Category 1: Foundational Activities. If this project includes flood risk mapping, confirm that you have contacted EMCR in advance of submitting the application and provide the date and contact person:

☐ We have contacted EMCR: NA

9. Proposed Category 1 Activities. What specific activities will be undertaken as part of the proposed project? Please refer to Section 6 of the *Program and Application Guide* for eligibility and note that activities must align with the required workplan and budget.

This proposed initiative endeavours to integrate information from multiple sources and disciplines (e.g., empirical data, research-based climate change forecasts, traditional Indigenous knowledge, etc.) to identify the natural hazard and climate related risk profile that the CRD will face into the reasonably foreseeable future. This renewed risk-oriented dataset will feed into the CRD's phased approach to re-draft its comprehensive emergency management plans.

10. Proposed Deliverables and Outcomes.

a) What specific deliverables will result from this project?

A direct outcome from this endeavour is a risk assessment product that either supports the CRD's current effort and decisions on matters of emergency management, or exposes future vulnerability that we can adapt our approach to mitigate. The ultimate deliverable would be a well informed CRD Protective Services Division and critical infrastructure operations that are responsive to future threats as opposed to reactive in the face of a radically changing climate.

b) If applicable, how does this project address and/or inform existing or future amendments to local plans, policies, building codes, floodplain zoning bylaws, and/or public awareness/education?

The intent of this renewed risk assessment is to establish a comprehensive and anchored foundation from which to build emergency plans that address the climate hazards of the future. In addition to informing the CRD's Protective Services Division and critical infrastructure operations, we anticipate a consolidated risk assessment could inform future infrastructure projects or CRD Bylaws if it exposes a previously unforeseen vulnerability (e.g., protracted drought in combination with increased extreme heat event frequency).

SECTION 4: CATEGORY 2 – Detailed Project Information

Only complete this section if you are applying for a project under Category 2: Non-Structural Projects

11. Proposed Category 2 Activities. What specific activities will be undertaken as part of the proposed project? Please refer to Section 6 of the *Program & Application Guide* for eligibility and note that activities must align with the required workplan and budget.

Fabrication and installation of community centric water conservation signage. CRD staff will oversee the installation of signs and manage community engagement and communications around sign installations.

12. Proposed Deliverables & Outcomes.

a) What specific deliverables will result from this project?

Professional fabricated water conservation signage

b) If applicable, how does this project address and/or inform existing or future amendments to local plans, policies, building codes, floodplain zoning bylaws, and/or public awareness/education?

Water conservation measures are here to stay. Even if specific ammendments are made to Bylaw 4492 there will always be stages of water conservation that communities must abide by. The longer the signs are up in a community the more impactful they will be and with time, we are expecting to see tangible behavioral pattern shifts in the way people use water. Permanent water conservation signage will encourage residents and visitors to reduce their water consumption year round which will support current and future water needs for communities during climate crises.

13. Monitoring & Performance Measures. Describe how the project will be monitored and what performance measurements will be used (e.g., work progress reports, timeline review, resource planning, procurement plan and roll out).

The success of this project will be measured by community feedback and reviews of real time water usage data. The CRD uses SCADA software to monitor the health and operational needs of its water systems. Usage rate data can be extracted from SCADA and analyzed to track water consumption trends. In theory, professional water conservation signage should drive users of the system to consume less water. According to the Provincial Drought Communications call that the CRD attended last Summer, similar signs to the ones proposed in this project were successful in decreasing community water consumption. To a much lesser degree, any media coverage of the community signs can also be analyzed as to the success or failure of the project. The ongoing maintenance of the signs will be the responsibility of the CRD.

SECTION 5: CATEGORY 3 – Detailed Project Information

Only complete this section if you are applying for a project under Category 3: Small-Scale Structural Projects

14. Proposed Category 3 Activities.

a) What specific activities will be undertaken as part of the proposed project? Include key activities and steps that will be taken to complete the project.

Refer to Section 6 of the Program & Application Guide for eligibility and note that activities must align with the required work plan and budget.

b) Have discussions taken place with applicable agencies to prepare for all required permits and regulatory approvals? Have the required approvals, authorizations and permits to complete the proposed project been applied for or received?

c) How do you intend to ensure the project is completed to provincial and federal standards?

d) List any potential implementation risks that may impact your ability to deliver on the project and explain what mitigation measures are in place to address them (e.g., staff capacity, procurement, severe weather, permitting (DMA, WSA, DFO), in-stream works fishery window, Land Right of Way requirements).

e) How will the project be developed and constructed to ensure that project risk is not increased, or transferred, to any parties or to the environment (e.g., transfer of flood risk downstream, destruction of fish habitat, introduction of pollutants to the environment).

15. Evidence of Completed Foundational Activities.

Describe the risk assessment process, options assessment (e.g., structural and non-structural, benefit cost analysis) and engagement process that was utilized to determine the proposed project.

Copies or extracts of the available evidence is required to be submitted with the application. Please indicate what documentation is being submitted and provide a specific reference to the sections of documents that should be reviewed.

16. **Asset Management.** Project sustainability and lifecycle costing are important considerations for structural mitigation projects. Many organizations have implemented asset management practices consistent with Asset Management for Sustainable Service Delivery: A BC Framework.

    Outline any ongoing asset management / lifecycle maintenance considerations for the project, and how these will be addressed as part of your organization's asset management framework (at a minimum please include details on ownership, lifetime, operation and maintenance, and budgets).

17. **Proposed Outcomes.** For each of the following, please describe the extent to which the proposed project will:

    a) Prevent, eliminate, or reduce the impacts of hazards through construction of disaster risk reduction-climate adaptation works.

    b) Reduce disaster-related financial liabilities (e.g., history or likelihood of future Disaster Financial Assistance (DFA) claims).

18. **Monitoring & Performance Measures.** Describe how the project will be monitored and what performance measurements will be used (e.g., work progress reports, timeline review, resource planning, procurement plan and roll out, etc.).

SECTION 6: Required Attachments

Only complete applications will be considered for funding.

The following separate attachments are required to be submitted as part of the application:

- ☒ Band Council resolution, Treaty First Nation resolution, or local government Council or Board resolution indicating support for the current proposed activities and willingness to provide overall grant management.
- ☒ Detailed work plan that includes a breakdown of work activities, tasks, deliverables or products, resources, timelines (start and end dates), and other considerations or comments.
- ☒ Detailed budget that indicates the proposed expenditures from CEPF and aligns with the proposed activities outlined in the Application Worksheet. Although additional funding or support is not required, any other grant funding or in-kind contributions must be identified. Applicants are encouraged to use the new LGPS Budget and Financial Summary Tool.
- ☒ Map(s) indicating the location of the proposed project(s).
- ☒ If applicable, copies of any relevant documents that support the rationale for this project must be included with this application.
- ☐ For regional projects only: Band Council resolution, Treaty First Nation resolution, or local government Council or Board resolution from each sub-applicant that clearly states their approval for the primary applicant to apply for, receive, and manage the grant funding on their behalf. Resolutions from partnering applicants must include this language.

SECTION 7: Signature This worksheet is required to be signed by an authorized representative of the applicant *(i.e., staff member or elected official)*. Please note all application materials will be shared with the Province of BC.

I certify that to the best of my knowledge: (1) all information is accurate, (2) the area covered by the proposed project is within the applicant's jurisdiction (or appropriate approvals are in place) and (3) it is understood that this project may be subject to a compliance audit under the program.

Name: Corey Anderson	Title: Manager, Emergency Programs
Signature*: **An original or certified digital signature is required.*	Date: March 28, 2024

Documents should be submitted as Word, Excel, or PDF files. Total file size for email attachments cannot exceed 20 MB.

All documents should be submitted to Local Government Program Services, Union of BC Municipalities by e-mail: cepf@ubcm.ca. Please note "2024 DRR-CA" in the subject line.

Detailed Workplan:

Consolidated Climate Risk Assessment Workplan

Duration: 24 months

Objective: Conduct a consolidated climate risk assessment to identify, evaluate, and prioritize risks associated with climate change for the Capital Regional District.

Phase 1: Preparation (Months 1-3)

1. Project Initiation
    - Define project scope, objectives, and deliverables.
    - Establish project team roles and responsibilities.
    - Kick-off meeting with interest holders, including First Nations representatives.
2. Interest Holder Engagement
    - Identify key interest holders.
    - Conduct interest holder analysis.
    - Plan and conduct consultation workshops with interest holders, including respectful collaboration with First Nations communities.
3. Data Collection and Review
    - Identify relevant data sources (e.g., climate data, socio-economic data, infrastructure data).
    - Gather historical climate data for the region including traditional Indigenous knowledge.
    - Review existing risk assessments and reports.

Phase 2: Risk Identification (Months 4-7)

1. Climate Hazard Identification
    - Identify and assess potential climate hazards (e.g., extreme weather events, sea-level rise, temperature changes).
    - Analyze historical climate trends and projections.
2. Vulnerability Assessment
    - Identify vulnerable sectors, populations, and infrastructure.
    - Assess the exposure and sensitivity of assets to climate hazards.
3. Risk Mapping
    - Develop visualization products for climate risks and vulnerabilities.
    - Integrate hazard, exposure, and vulnerability data.

Phase 3: Risk Evaluation (Months 8-14)

1. Quantitative Risk Assessment
    - Develop quantitative models to assess the likelihood and impact of climate risks.
    - Estimate potential economic losses and damages.
2. Qualitative Risk Assessment
    - Conduct expert workshops to evaluate non-quantifiable risks and uncertainties.
    - Identify potential cascading effects and interdependencies.
3. Prioritization of Risks
    - Develop criteria for risk prioritization.
    - Prioritize climate risks based on their severity, likelihood, and consequences.

Phase 4: Reporting and Implementation (Months 15-20)

1. Finalize Climate Risk Assessment Report
    - Compile all findings, analyses, and recommendations into a comprehensive report.
    - Review and finalize the report with input from interest holders, including First Nations representatives.
2. Dissemination of Results
    - Present key findings and recommendations to decision-makers and interest holders, including First Nations communities.
    - Publish the report and share it with relevant agencies and organizations.
3. Monitoring and Evaluation
    - Develop a monitoring and evaluation framework to track the implementation of adaptation measures.
    - Establish mechanisms for regular review and updates of the risk assessment.

Conclusion: This detailed workplan outlines the activities and timeline for conducting a consolidated climate risk assessment over a 24-month period (4 months built in for contingency), with a focus on respectful collaboration with First Nations communities and engagement with all interest holders. Our structured approach to identify, evaluate, and prioritize climate risks, will build resilience to climate change impacts while honoring the perspectives and contributions of diverse interest holders.

Proposed 2024 UBCM DRR-CA Budget	Budgeted	Actual	Difference	Notes
Administration				
Internal Staff Grant Administration	$ 15,000.00		0%	
Collaboration Facilitation				
First Nation Consultation	$ 5,000.00		0%	
Local Government/Multi-jurisdictional Consultation	$ 3,000.00		0%	
Subject Matter Expertise	$ 15,000.00		0%	
Contractor Services				
Project Contractor	$ 112,000.00		0%	
Total	$ 150,000.00	$ -	0%	

Work Plan & Budget

Water Conservation Signage

Making a difference...together

Capital Regional District | Category 2 – UBCM - DRR-CA 2023/24

Work Plan

The work plan for this project is quite simple. Once funding is approved for the project, the vendor (Signpad) can begin fabrication of the signage which is estimated to take approximately 30 days. Once fabrication is completed, installation of signage is estimated to take 15-30 days. Since the majority of the signage will be installed on the Southern Gulf Islands, travel to and from the smaller islands is dependent on staff availability to travel and ferry schedules, therefore install times may exceed 30 days. The total length of time for this project is estimated at 90 days, allocated as follows, 60 days for the fabrication and installation of signage and an additional 30 days added for contingency time should unexpected delays occur during the project.

Budget

The estimated budget for this project is $30,000. A quote from the vendor (Signpad) for the signage is estimated at $19,260.15, the quote includes the cost for fabrication and installation of all 13 signs. The quote provided is dated September 2023 and the actual cost of the signage may increase due to higher material costs in 2024. Please note the quote was obtained last Summer as the CRD was hoping to have EMCR cover the cost of permanent water conservation signage through their expense authorization process but were denied and told to pursue UBCM grant funding for the project instead. A phone call with Signpad on March 28, 2024 indicated that material costs are expected to increase by 3-5% beginning in April 2024. The additional $10,000 is allocated for staff administration time related to project management and communications for the project, travel expenses and a small contingency fund of $3,000 - $4,000 should any unexpected expenses arise related to the project.

The Sign Pad
103-2675 Wilfert Road Victoria, British Columbia V9B 6M3
office@thesignpad.com
(250) 590-7785

HST/GST #: 875297509 RT0001
www.thesignpad.com

Quote 5214

Water Convservation SIgnage

QUOTE DATE
Thu, 09/21/2023

QUOTE EXPIRY DATE
Sat, 10/21/2023

TERMS
Due on receipt

ORDERED BY
CRD

CONTACT INFO
Monique Booth
mbooth@crd.bc.ca
(250) 360-3165

#	ITEM	QTY	UOM	U.PRICE	TOTAL (EXCL. TAX)	TAX	TAXABLE
1	**QTY 13 - 1/4" thick Alupanel signs** Sized at 48" wide x 32" tall CNC to to size with drill / dwell holes to accept slotted bolt through for adjustable arrow Long term gloss UV overlaminate applied to signs for long term duration Includes 6mm CNC routed sign with cnc routed arrow and push-thru peg Includes heavy duty angle supports on back-premounted into 4x4 treated lumb er Lumber to be painted white or black to match sign struture.	13	Unit	$516.00	$6,708.00	$335.40	Y
2	**Installation** Installation at the following locations Includes travel, ferry time Includes concrete in place footers. Dig footers and set in place. • SSI (five signs) • Saturna (one) • Pender (two) • Port Renfrew (one) • Mayne (two) • Galiano (one) • Metchosin/Sooke (one)	13	Unit	$895.00	$11,635.00	$581.75	Y

This handcrafted quote is based on the specific information you've given us and is valid for 30 days.

When you approve this quote, you are agreeing to pay 100% of the quoted price. We require a 50% deposit to begin work on your project. Once we receive your deposit, we'll schedule your project and email you an estimated completion date. The remaining balance is due upon completion of your order.

Need to make that changes?
No problem - but please realize, changes to quantity or specifications will affect your price. We will provide you with an updated quote based on the changes.

Subtotal:	**$18,343.00**
Sales Tax:	**$917.15**
Total:	**$19,260.15**

Tax Totals

G(5.0%)	$917.15

SIGNATURE:

DATE:

WATER RESTRICTIONS

Magic Lake Estates

No Restrictions	Stage 1 MODERATE	Stage 2 HIGH	Stage 3 EXTREME

Please conserve water every day!

More info: www.crd.bc.ca/magiclake-ws

CRD

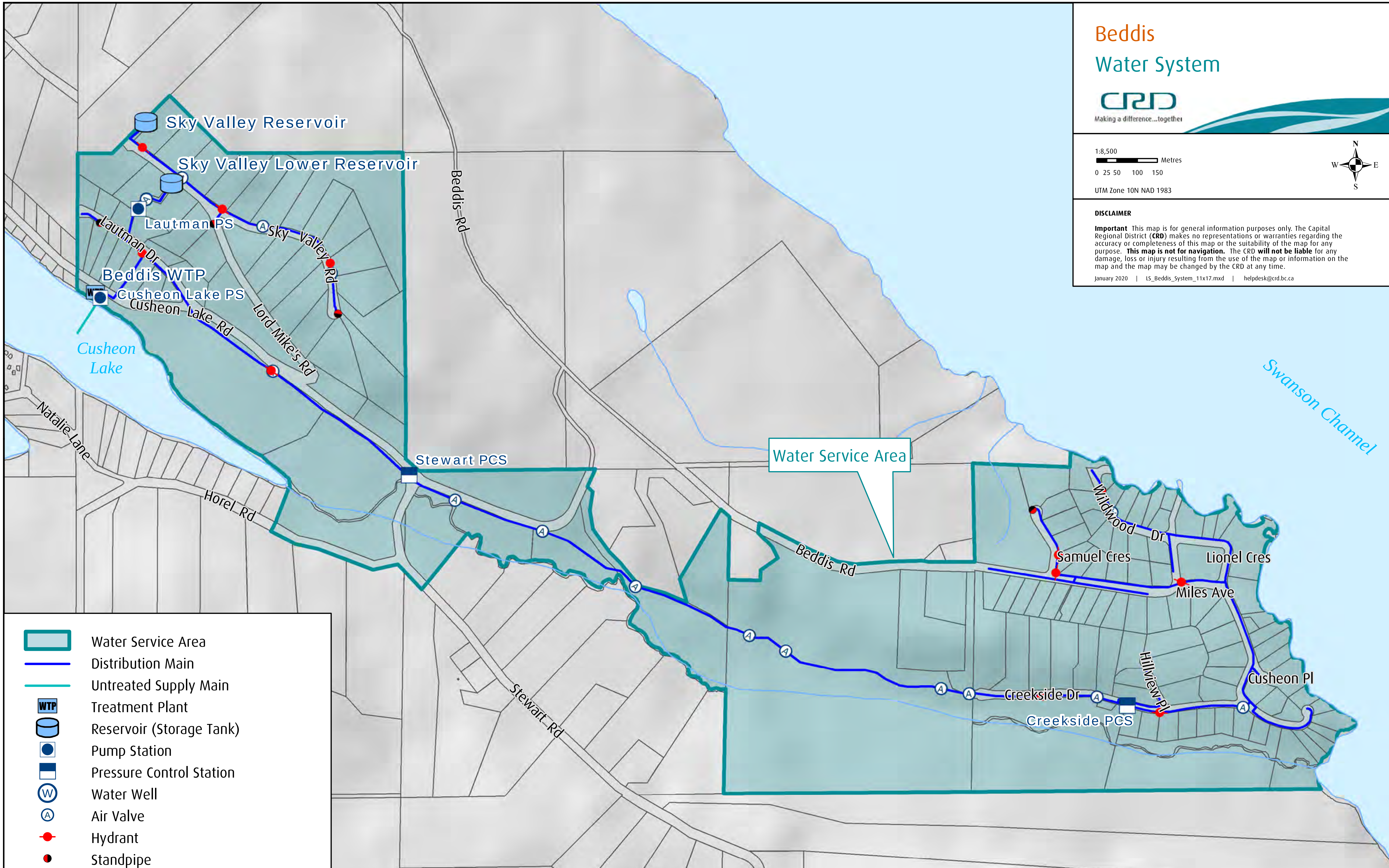
4x4 treated Posts-
Paint CRD blue.
Exterior Grade - satin finish

Painted wood / treated 4x4.
Shown in brown for illustrative purposes, but
will actually be painted CRD pantone.

2.5 x 2.5 aluminum angle.
Bonds sign face to wood uprights.
Fastened with bolts. SEcured to front sign face.
with structural adhesive so no fastners are visible on
face of sign.. Shown pink for componenet differentiation.
But will be paintd white to match back of sign.

6mm thick Aluminum Composite panel Arrow
Bonded through-bolt goes throgh slot in sign face
to allow for moving to different states.
Backside has hole in through-bolt to allow
for a lock to beplaced on sign.
Shown in green for illustrative purpose
to show differnet components

6mm thick Aluminum Composite panel
with gloss overlaminate. Shown in blue for illustrative
purpose to show differnet components


Beddis
Water System
Making a difference...together
1:8,500
Metres
0 25 50 100 150
UTM Zone 10N NAD 1983
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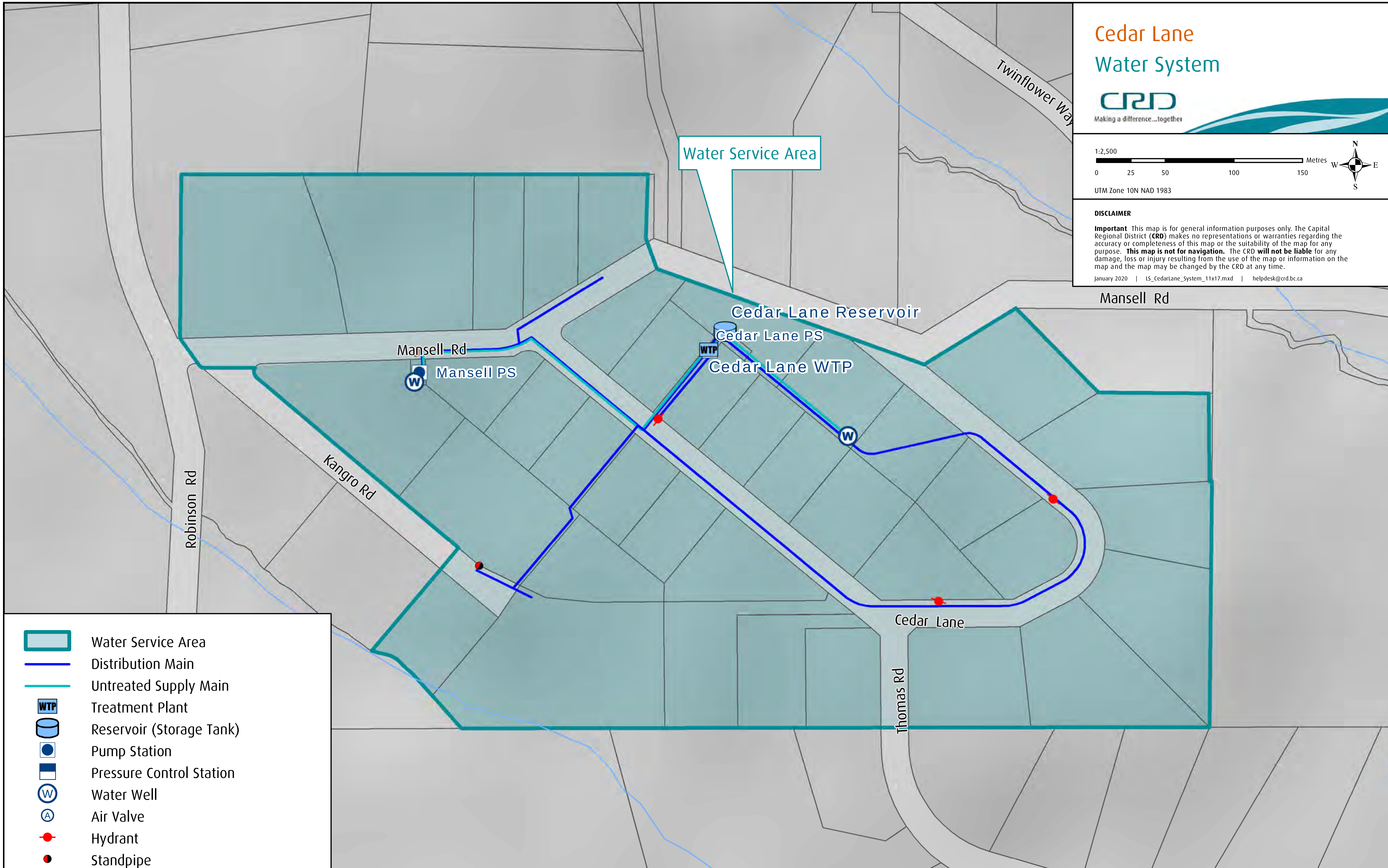
January 2020 | LS_Beddis_System_11x17.mxd | helpdesk@crd.bc.ca
Sky Valley Reservoir
Sky Valley Lower Reservoir
Lautman PS
Lautman Dr
Sky Valley Rd
Beddis WTP
Cusheon Lake PS
Cusheon Lake Rd
Lord Mike's Rd
Cusheon Lake
Beddis Rd
Natalie Lane
Horel Rd
Stewart PCS
Stewart Rd
Water Service Area
Swanson Channel
Wildwood Dr
Samuel Cres
Lionel Cres
Miles Ave
Hillview Pl
Cusheon Pl
Creekside Dr
Creekside PCS
Water Service Area
Distribution Main
Untreated Supply Main
WTP
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
W
Water Well
A
Air Valve
Hydrant
Standpipe



Cedar Lane
Water System
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1:2,500
0 25 50 100 150 Metres
N W E S
UTM Zone 10N NAD 1983
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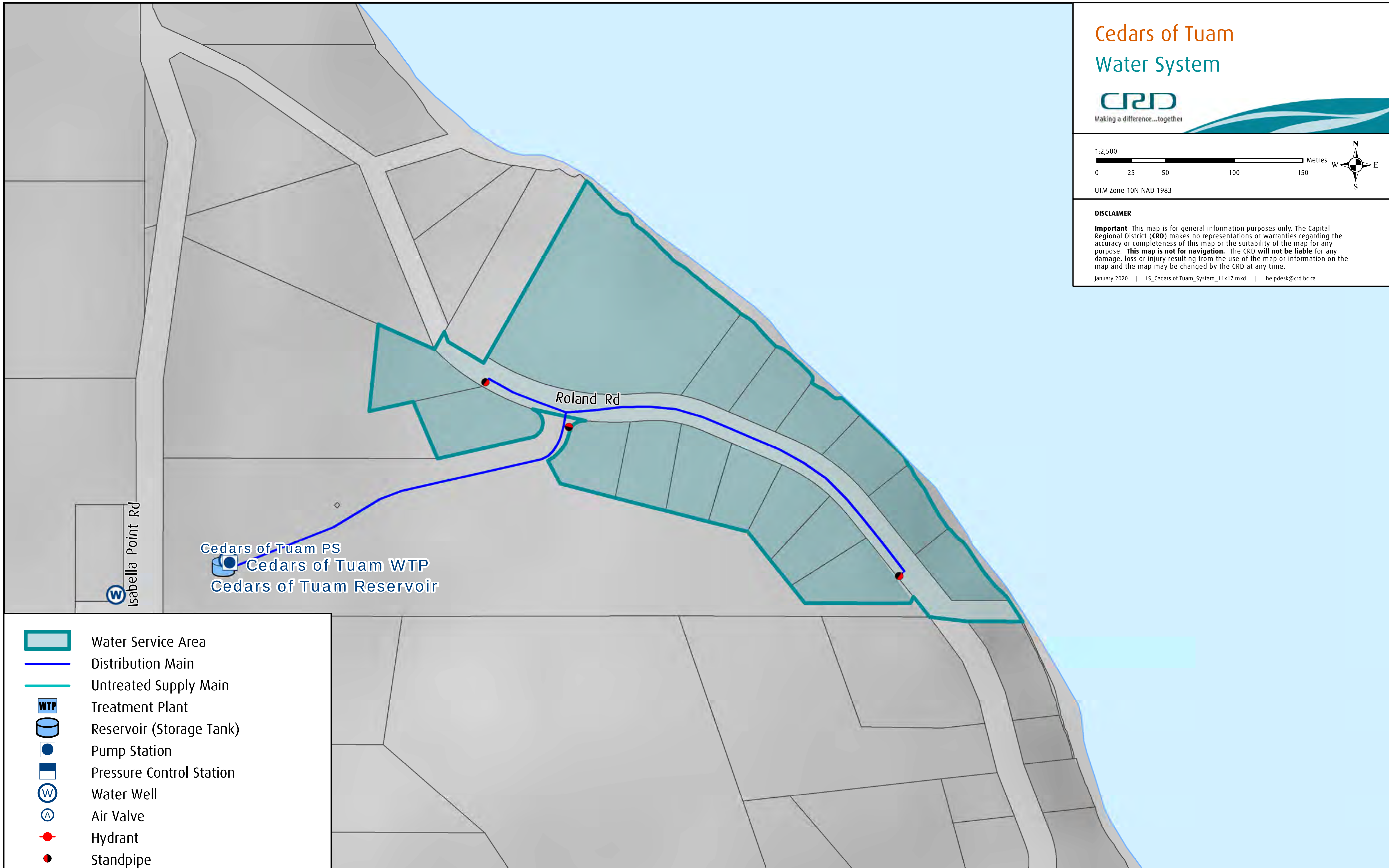
Water Service Area
Twinflower Way
Mansell Rd
Cedar Lane Reservoir
Cedar Lane PS
Cedar Lane WTP
Mansell Rd
Mansell PS
Kangro Rd
Robinson Rd
Cedar Lane
Thomas Rd
Water Service Area
Distribution Main
Untreated Supply Main
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
Water Well
Air Valve
Hydrant
Standpipe



Cedars of Tuam
Water System
Making a difference...together
1:2,500
0 25 50 100 150 Metres
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UTM Zone 10N NAD 1983
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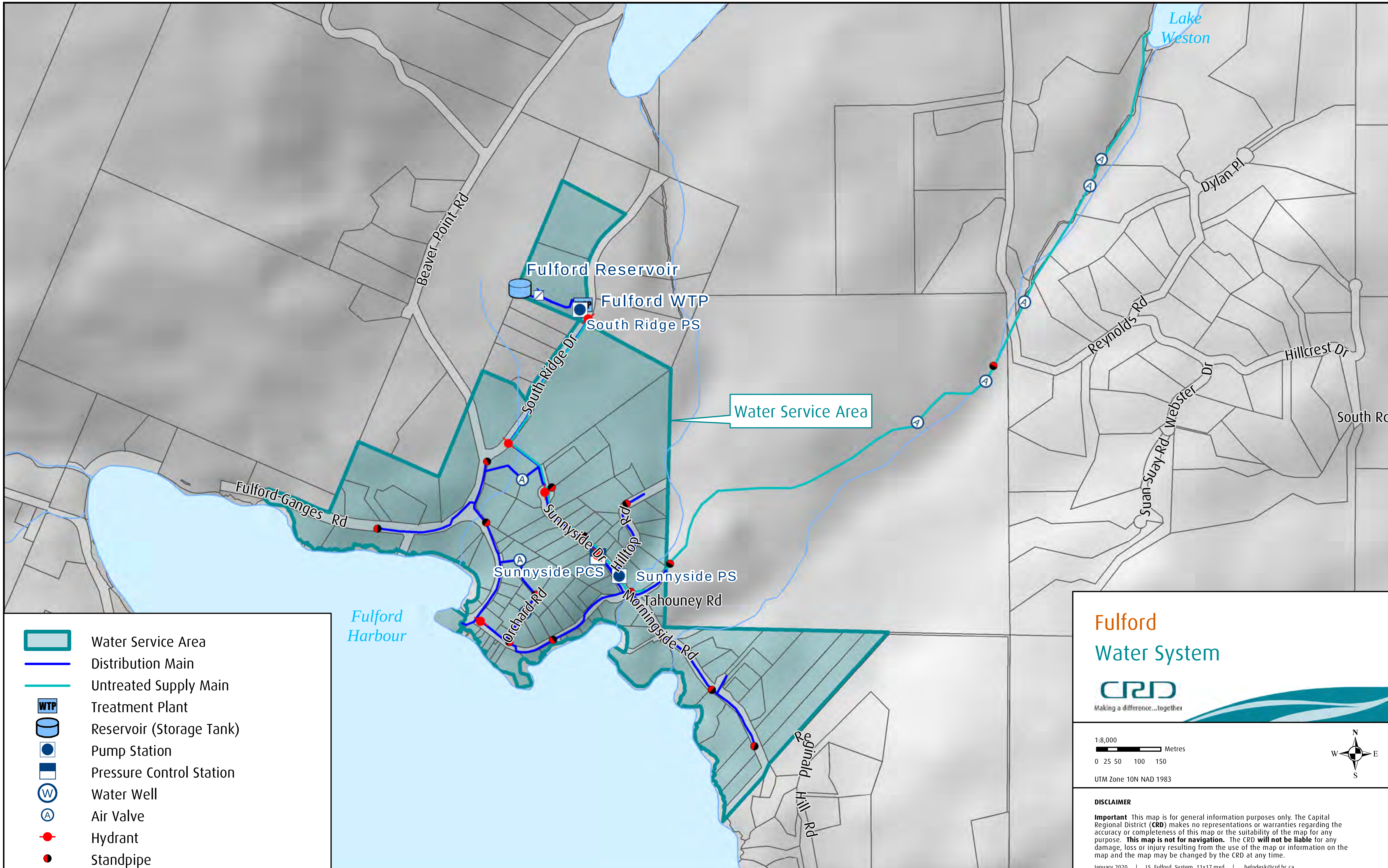
Roland Rd
Isabella Point Rd
Cedars of Tuam PS
Cedars of Tuam WTP
Cedars of Tuam Reservoir
Water Service Area
Distribution Main
Untreated Supply Main
WTP
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
W
Water Well
A
Air Valve
Hydrant
Standpipe



Fulford
Water System
Making a difference...together
Lake Weston
Fulford Reservoir
Fulford WTP
South Ridge PS
Water Service Area
Sunnyside PCS
Sunnyside PS
Fulford Harbour
Beaver Point Rd
South Ridge Dr
Fulford-Ganges Rd
Sunnyside Dr
Hilltop Rd
Orchard Rd
Tahouney Rd
Morningside Rd
Reginald Hill Rd
Dylan Pl
Reynolds Rd
Hillcrest Dr
Webster Dr
Suan-Suay Rd
South Rd
Water Service Area
Distribution Main
Untreated Supply Main
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
Water Well
Air Valve
Hydrant
Standpipe
1:8,000
Metres
0 25 50 100 150
UTM Zone 10N NAD 1983
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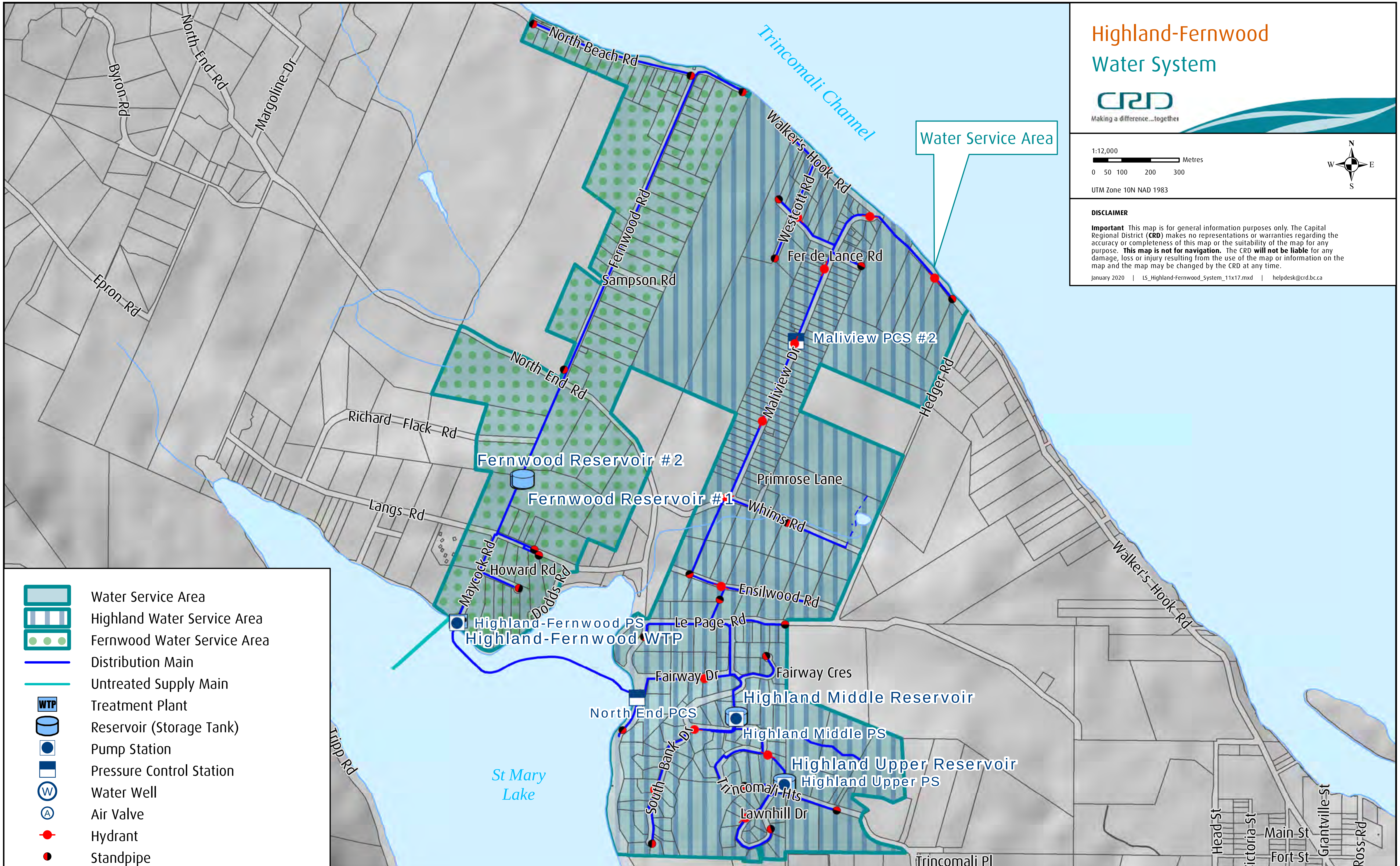

Highland-Fernwood
Water System
CRD
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1:12,000
Metres
0 50 100 200 300
UTM Zone 10N NAD 1983
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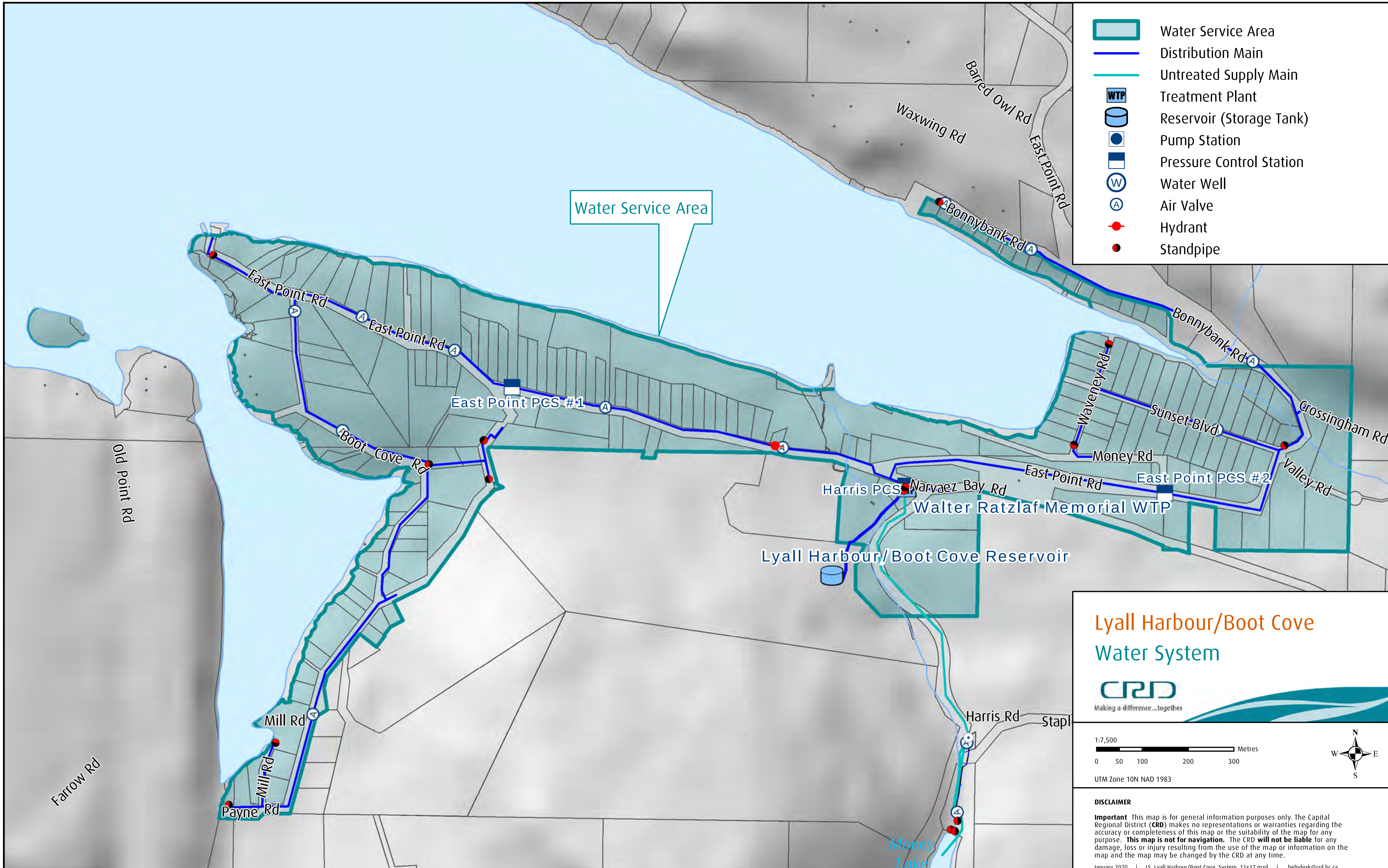
Water Service Area
Trincomali Channel
North Beach Rd
Walker's Hook Rd
Westcott Rd
Fer de Lance Rd
Maliview PCS #2
Maliview Dr
Hedger Rd
Fernwood Rd
Sampson Rd
North End Rd
Byron Rd
North-End-Rd
Margoline-Dr
Epron Rd
Richard Flack Rd
Langs Rd
Fernwood Reservoir #2
Fernwood Reservoir #1
Primrose Lane
Whims Rd
Maycock Rd
Howard Rd
Dodds Rd
Ensilwood Rd
Le Page Rd
Highland-Fernwood PS
Highland-Fernwood WTP
Fairway Dr
Fairway Cres
Highland Middle Reservoir
North End PCS
Highland Middle PS
South Bank Dr
Highland Upper Reservoir
Highland Upper PS
Trincomali Hts
Lawnhill Dr
Trincomali Pl
St Mary Lake
Tripp Rd
Head St
Victoria St
Main St
Fort St
Grantville St
Ross Rd
Water Service Area
Highland Water Service Area
Fernwood Water Service Area
Distribution Main
Untreated Supply Main
WTP
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
W
Water Well
A
Air Valve
Hydrant
Standpipe


Water Service Area
Distribution Main
Untreated Supply Main
WTP
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
Water Well
Air Valve
Hydrant
Standpipe
Water Service Area
Barred Owl Rd
Waxwing Rd
East Point Rd
Bonnybank Rd
East Point Rd
East Point Rd
East Point PCS #1
Boot Cove Rd
Old Point Rd
Waveney Rd
Sunset Blvd
Crossingham Rd
Money Rd
East Point Rd
East Point PCS #2
Valley Rd
Harris PCS
Narvaez Bay Rd
Walter Ratzlaf Memorial WTP
Lyall Harbour/Boot Cove Reservoir
Mill Rd
Mill Rd
Payne Rd
Farrow Rd
Harris Rd
Stapl
Money Lake
Lyall Harbour/Boot Cove
Water System
CRD
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1:7,500
Metres
0 50 100 200 300
UTM Zone 10N NAD 1983
N W E S
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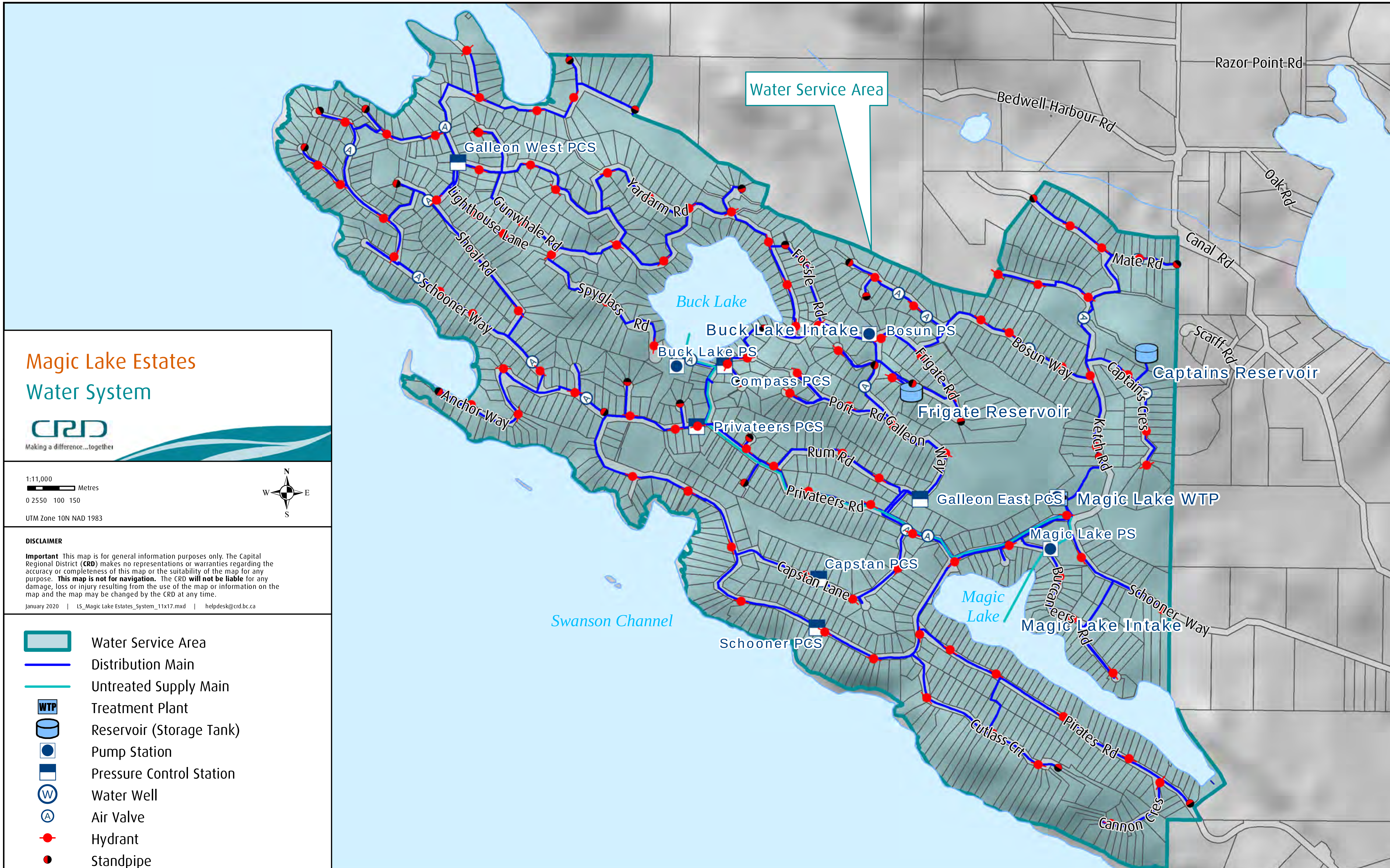
Magic Lake Estates Water System



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Port Renfrew Water System

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1:6,500

0 25 50 100 150 Metres

UTM Zone 10N NAD 1983

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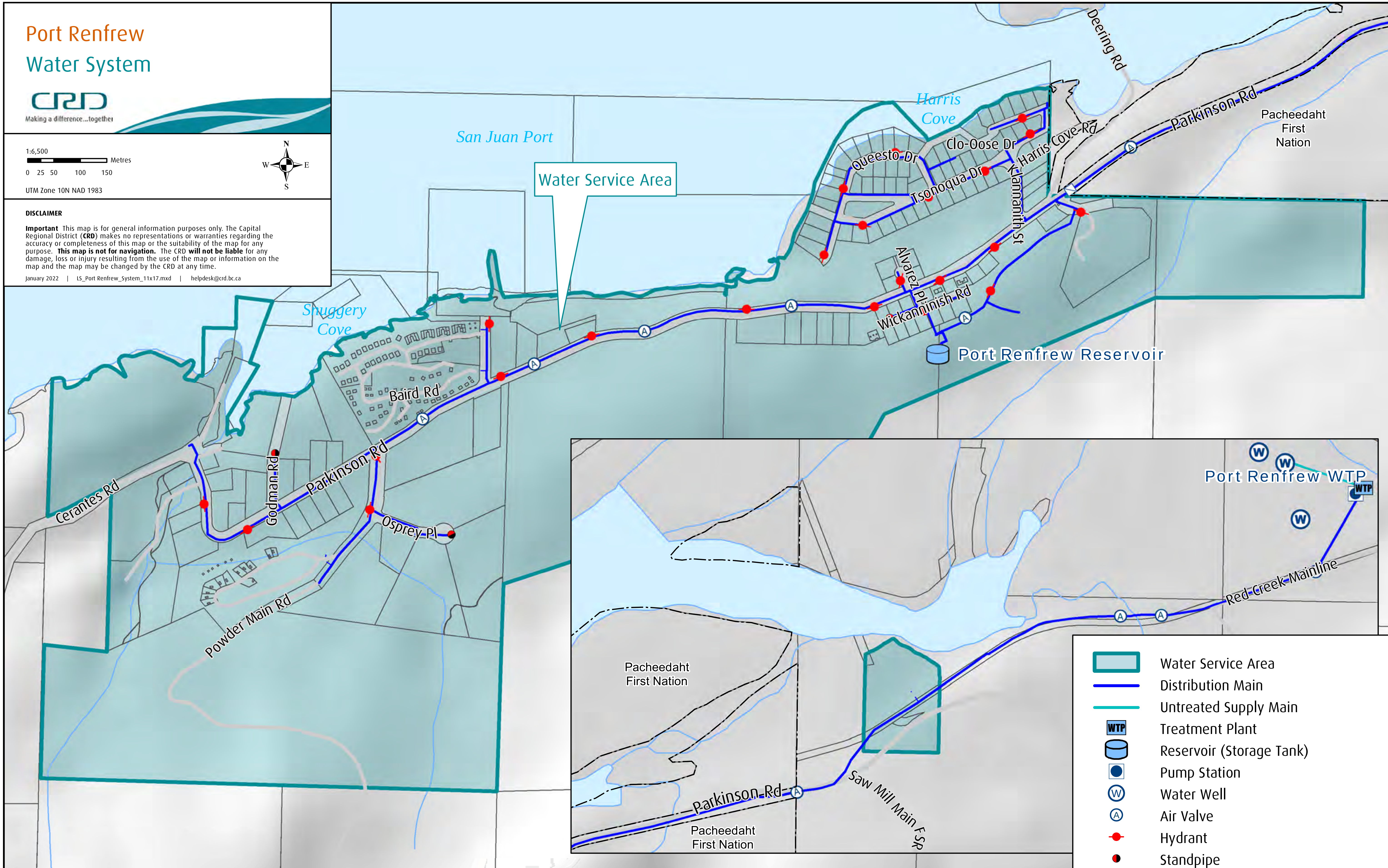

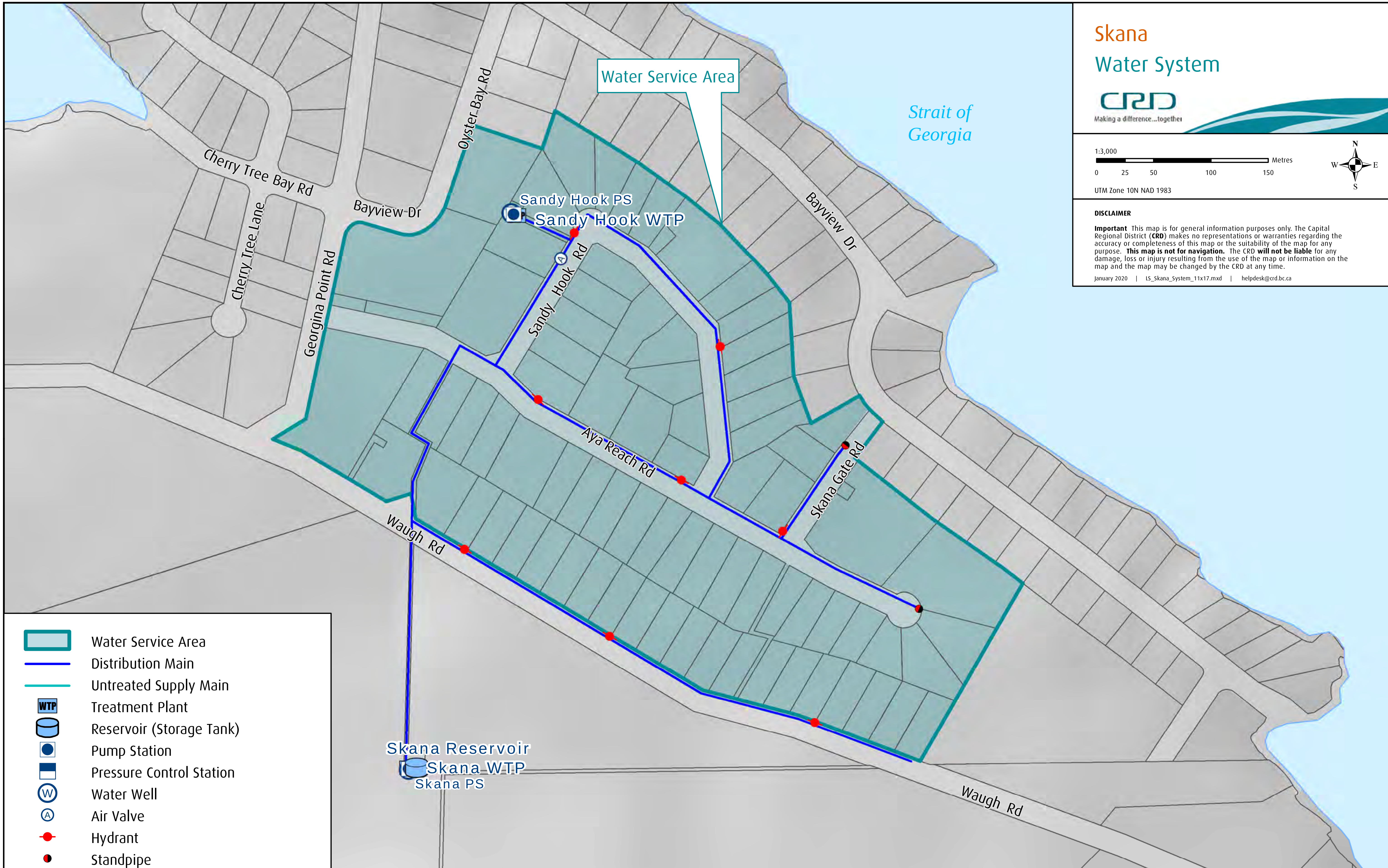
Skana
Water System
Making a difference...together
1:3,000
0 25 50 100 150 Metres
N S W E
UTM Zone 10N NAD 1983
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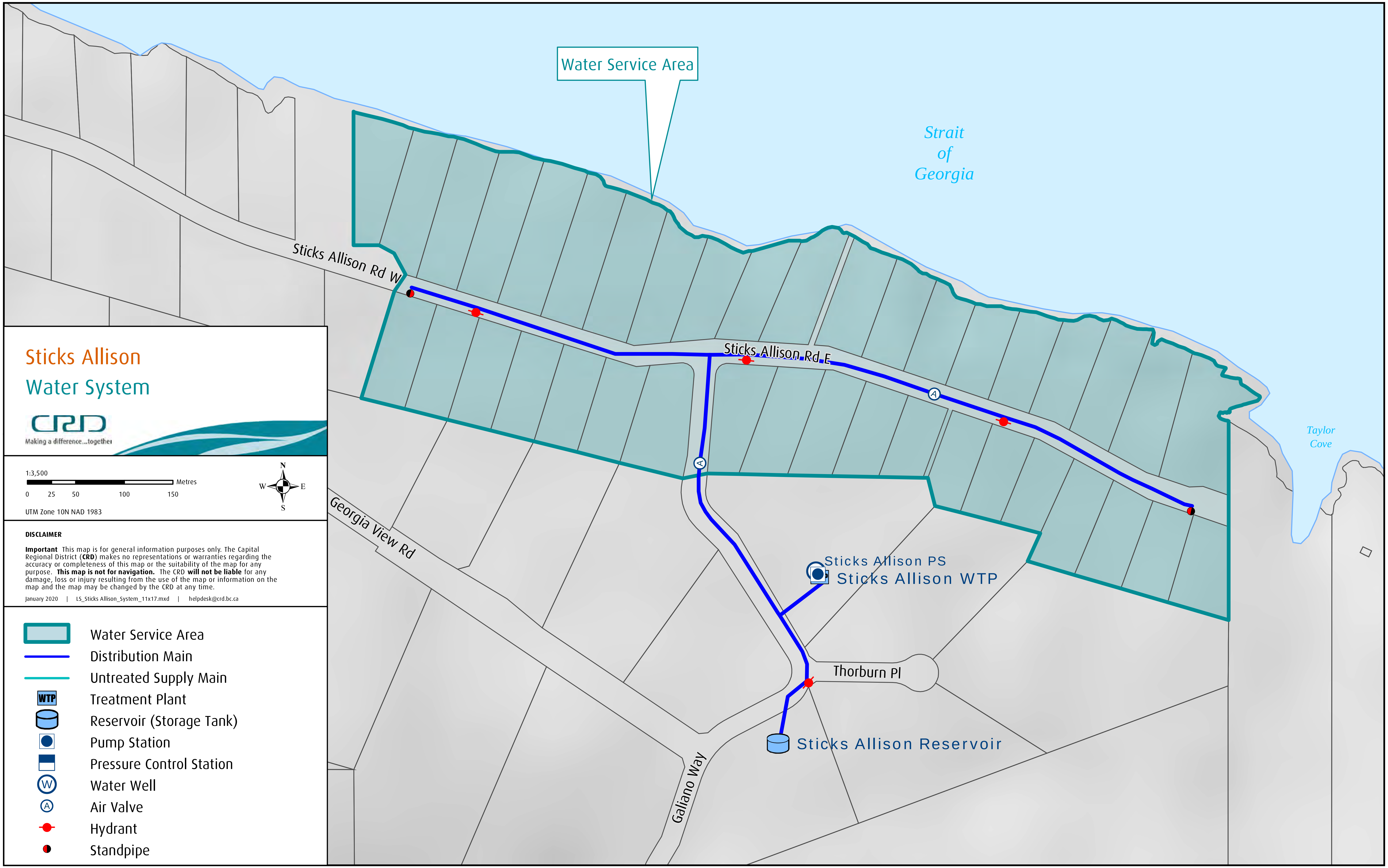
Water Service Area
Strait of Georgia
Cherry Tree Bay Rd
Cherry Tree Lane
Georgina Point Rd
Oyster Bay Rd
Bayview Dr
Bayview Dr
Sandy Hook PS
Sandy Hook WTP
Sandy Hook Rd
Aya Reach Rd
Skana Gate Rd
Waugh Rd
Waugh Rd
Skana Reservoir
Skana WTP
Skana PS
Water Service Area
Distribution Main
Untreated Supply Main
WTP
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
Water Well
Air Valve
Hydrant
Standpipe



Sticks Allison
Water System
Making a difference...together
1:3,500
0 25 50 100 150 Metres
N S W E
UTM Zone 10N NAD 1983
DISCLAIMER
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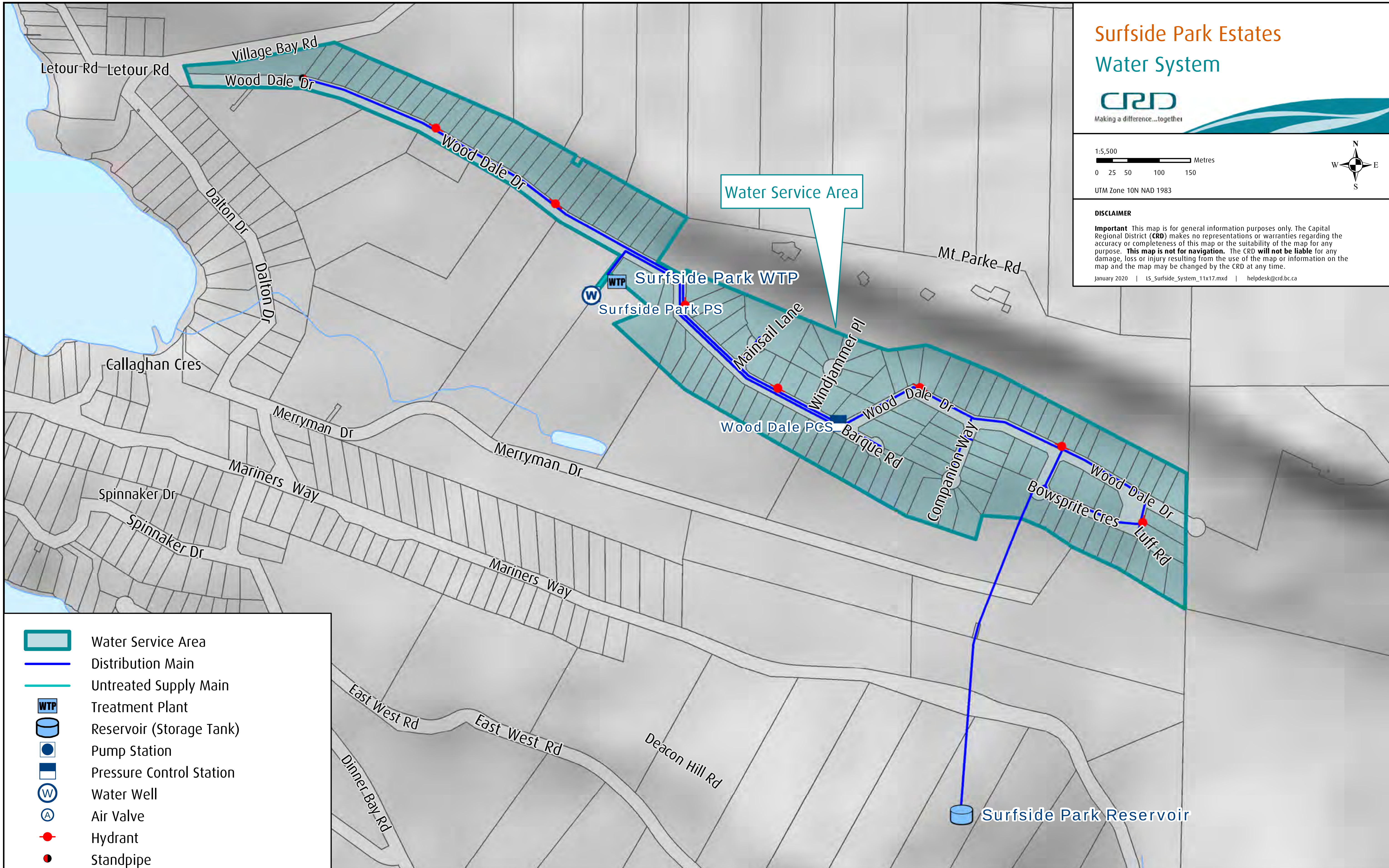
January 2020 | LS_Sticks Allison_System_11x17.mxd | helpdesk@crd.bc.ca
Water Service Area
Distribution Main
Untreated Supply Main
WTP
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
W
Water Well
A
Air Valve
Hydrant
Standpipe
Water Service Area
Strait of Georgia
Taylor Cove
Sticks Allison Rd W
Sticks Allison Rd E
Georgia View Rd
Galiano Way
Thorburn Pl
Sticks Allison PS
Sticks Allison WTP
Sticks Allison Reservoir



Surfside Park Estates
Water System
Making a difference...together
1:5,500
Metres
0 25 50 100 150
UTM Zone 10N NAD 1983
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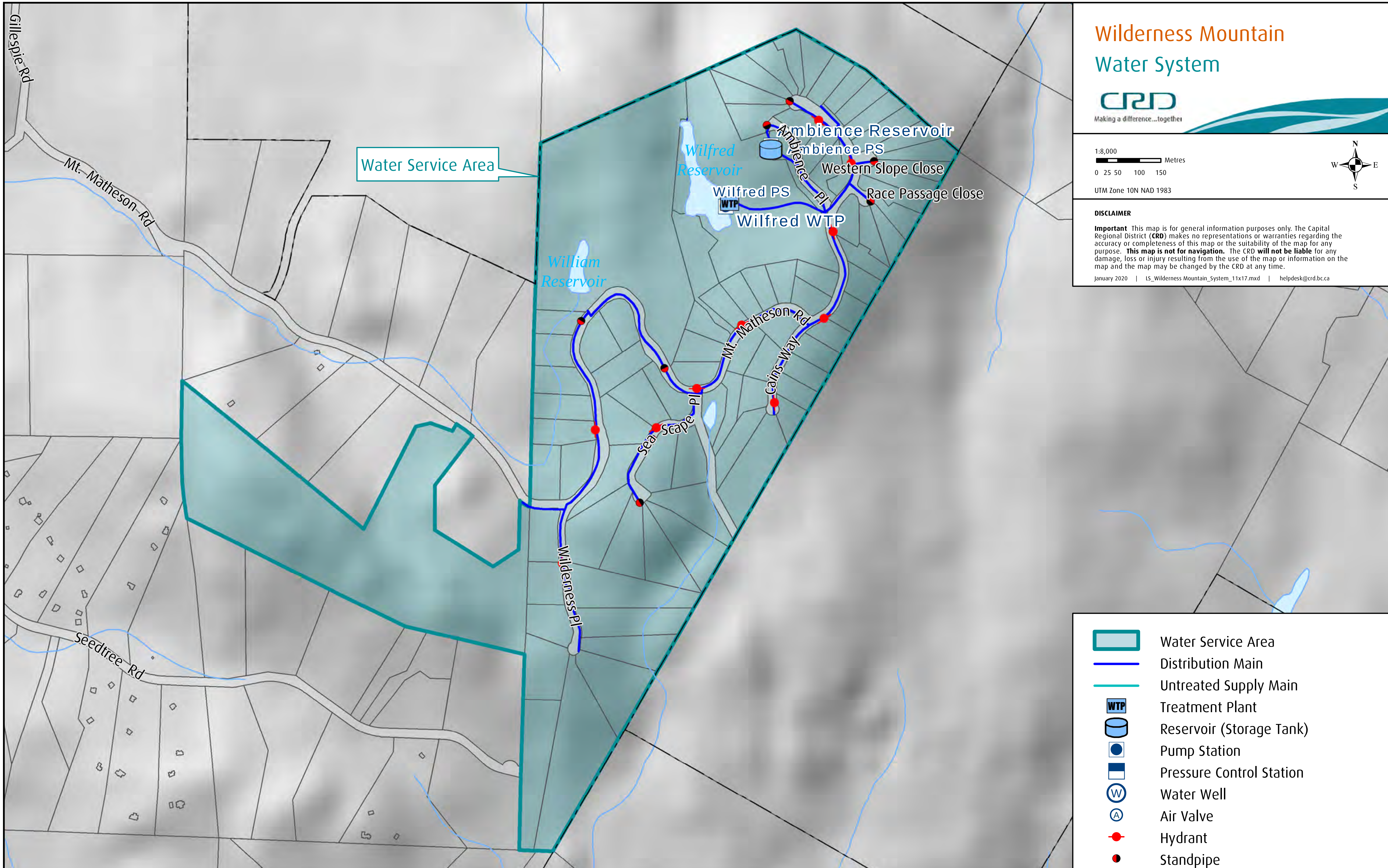
January 2020 | LS_Surfside_System_11x17.mxd | helpdesk@crd.bc.ca
Water Service Area
Surfside Park WTP
Surfside Park PS
Wood Dale PCS
Surfside Park Reservoir
Village Bay Rd
Letour Rd
Letour Rd
Wood Dale Dr
Wood Dale Dr
Dalton Dr
Dalton Dr
Callaghan Cres
Merryman Dr
Merryman Dr
Mariners Way
Mariners Way
Spinnaker Dr
Spinnaker Dr
Mainsail Lane
Windjammer Pl
Wood Dale Dr
Barque Rd
Companion Way
Bowsprite Cres
Wood Dale Dr
Luff Rd
Mt Parke Rd
East West Rd
East West Rd
Deacon Hill Rd
Dinner Bay Rd
Water Service Area
Distribution Main
Untreated Supply Main
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
Water Well
Air Valve
Hydrant
Standpipe


Wilderness Mountain
Water System
CRD
Making a difference...together
1:8,000
Metres
0 25 50 100 150
UTM Zone 10N NAD 1983
N
W
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S
DISCLAIMER
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January 2020 | LS_Wilderness_Mountain_System_11x17.mxd | helpdesk@crd.bc.ca
Water Service Area
Gillespie_Rd
Mt. Matheson Rd
Seedtree Rd
Wilfred Reservoir
William Reservoir
Ambience Reservoir
Ambience PS
Ambience Pl
Western Slope Close
Race Passage Close
Wilfred PS
WTP
Wilfred WTP
Mt. Matheson Rd
Cains Way
Sea Scape Pl
Wilderness Pl
Water Service Area
Distribution Main
Untreated Supply Main
Treatment Plant
Reservoir (Storage Tank)
Pump Station
Pressure Control Station
Water Well
Air Valve
Hydrant
Standpipe

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REPORT TO ELECTORAL AREAS COMMITTEE
MEETING ON WEDNESDAY, APRIL 10, 2024

SUBJECT **2023 Electoral Areas Grants-In-Aid Annual Report**

ISSUE SUMMARY

This report provides a summary of Electoral Area (EA) Grants-In-Aid (GIA) activity, including COVID-19 Safe Restart Grants, for the period of January 1, 2023 through December 31, 2023.

BACKGROUND

Under the Supplementary Letters Patent (SLP), dated March 24, 1977, and amended April 17, 1985, the Capital Regional District (CRD) has authority to deliver core GIA within the EAs. These are one-time grants provided through annual tax requisition to community groups that deliver projects in the Juan de Fuca (JDF), Salt Spring Island (SSI) and Southern Gulf Islands (SGI) EAs.

Under the existing SLP authority, the CRD has been administering a second GIA stream funded by one-time COVID-19 Safe Restart Grants since 2021. Through engagement with staff, EA Directors allocated some Safe Restart grant funding to provide a top-up to the core GIA budget. All Safe Restart funding has been awarded to projects as of December 31, 2023.

For both GIA streams, applications are accepted on a rolling basis and are reviewed throughout the year. EA Directors and the SSI Local Community Commission (LCC) support projects that are selected based upon demonstrated benefit to the community respectively, and in alignment with GIA guidelines and grant program criteria. In principle, GIA fund special projects and activities beyond the scope of CRD services are excluded from requisition funding. Appendix A details core GIA projects awarded in 2023. Appendix B details Safe Restart GIA Awarded in 2023.

IMPLICATIONS

Service Delivery Implications

The one-time funding through GIA provides much needed relief to organizations that provide key services to the community above the scope of CRD services. In 2023, many of these projects included events, capacity building and small capital projects related to health, housing and community safety and engagement.

Financial Implications

The following two tables provide a summary of 2023 GIA awarded within each EA for both the core GIA and Safe Restart GIA.

Table 1: Core GIA Awarded for 2023

	2023			2022		
	Budget ($)	**# of Applications**	**Amount Awarded ($)**	**Budget ($)**	**# of Applications**	**Amount Awarded ($)**
JDF	31,144	2	3,192	32,667	-	-
SSI	43,484	12[1]	39,000	69,127	11	46,039
SGI	100,000	22	100,762	102,514	20	103,351
Total	**174,628**	**36[2]**	**142,954**	**204,308**	**31**	**149,390**

[1]This number includes one project which was split between Core GIA and Safe Restart GIA
[2]This number does not include two 2022 projects that was cancelled, and GIA funds returned

In the reporting period, two 2022 applications were cancelled, and the funds were returned. Remaining funds at the end of 2023 are carried over to 2024 GIA budgets for each EA.

Table 2: Safe Restart GIA Awarded for 2023

	2023			2022		
	Budget ($)	**# of Applications**	**Amount Awarded ($)**	**Budget ($)**	**# of Applications**	**Amount Awarded ($)**
JDF	-	-	-	18,505	4	18,505
SSI	10,000	2[1]	10,000	35,000	3	25,000
SGI	-	-	-	-	-	-
Total	**10,000**	**2**	**10,000**	**53,505**	**7**	**43,505**

[1]This number includes one project which was split between Core GIA and Safe Restart GIA

Safe Restart GIA funds were fully spent in 2023.

CONCLUSION

Core GIA and Safe Restart GIA are awarded throughout the year under the authority of SLP. Applications with EA Directors and SSI LCC support are reviewed on a continuous basis and are assessed against eligibility criteria. Organizations who deliver projects in the EA can access the funding for special projects, including events and small capital requests. Funds that are not spent are carried over through next year's GIA budget.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Lia Xu, MSc., CPA, CGA, Finance Manager, Local Services and Corporate Grants
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENTS

Appendix A: 2023 Electoral Areas Grants-In-Aid Awarded
Appendix B: 2023 Electoral Areas Safe Restart Grants-In-Aid Awarded

APPENDIX A

2023 Electoral Areas Grants-In-Aid Awarded

Total Amount Awarded to Projects: $142,954

Total Number of Projects: 36

JUAN DE FUCA ($3,192)

No.	Applicant	Project	Amount Awarded ($)
1	Otter Point, Shirley, Jordan River Resident and Ratepayers Association	Message Board Repairs	1,692
2	Sheringham Point Lighthouse Preservation Society	Defibrillator Installation	1,500
		Total	**3,192**

SALT SPRING ISLAND ($39,000)

No.	Applicant	Project	Amount Awarded ($)
1	Capital Bike	Everyone Rides SSI	3,475
2	Salt Spring Chamber of Commerce	Ganges Garbage and Recycling Pilot Program	5,000
3	Salt Spring Community Alliance	Goodwill Ambassador Program	5,000
4	Salt Spring Community Energy	Electricity Salt Spring Month of Events	4,600
5	Salt Spring Island Weavers and Spinners Guild	Support for Basic Furnishings	1,000
6	Salt Spring Literacy	Learning Space Equipment	1,000
7	Transition Salt Spring Island	Support for Furnishings and Equipment	925
8	Salt Spring Island Chamber of Commerce	Summer Outdoor Concert Series 2023	4,000
9	Salt Spring Island Printmakers Society	Furnishings for SSI Printmakers Society Studio Space	1,000
10	Salt Spring Community Health Society	Electric Mobile Health Van	5,000
11	Copper Kettle Community Partnership	Food Gifts for the Undernourished	5,000
12	Salt Spring Film Festival Society	Equipment Upgrades for Digital Files	3,000
		Total	**39,000**

SOUTHERN GULF ISLANDS ($100,762)

No.	Applicant	Project	Amount Awarded ($)
1	Institute for Multidisciplinary Ecological Research in the Salish Sea	Xetthecum Eco-cultural Mapping Project	5,000
2	Pender Ocean Defenders	Critical Distance Exhibit	2,900
3	Salish Sea Marine Rescue Society	Multifunctional Displays for Rescue Craft	4,500
4	Mayne Island Housing Society	Pre-Development Costs of Salish Grove Housing Development	10,000
5	Galiano Literary Festival	Website Design and Build	4,362
6	Galiano Trails Society	Walking Trail	10,000
7	Piers Island Association	Waste Removal and Recycling Event	5,000
8	Saturna Athletics Association	Funding Support for Tractor Replacement	5,000
9	Salish Sea Inter Island Transportation Society	2023 Tour des Isles Festival	5,000
10	Mayne Island Conservancy Society	Public Education Event for Feral, Invasive Fallow Deer	1,000
11	Diverse and Inclusive Salt Spring Island Society	Salt Spring Pride Festival	1,000
12	Yellowhouse Art Centre Society	Arts Programming Space Enhancement - Equipment	2,500
13	Active/Passive Performance Society	Galiano Events Lighting Package	1,500
14	South Pender Historical Society	History of South Pender	2,500
15	Pender Island Farmers Institute	Pender Island Fall Fair	1,500
16	Gulf Islands Centre of Ecological Learning Society	Summer Earth Education Programs	2,750
17	Ptarmigan Arts Society	Professional Recording of Medicine	4,250
18	Mayne Island School PAC	Teacherage Restoration Project	10,000
19	Southern Gulf Island Community Resource Centre	CRISP Festival	2,000
20	Mayne Island Housing Society	Salish Grove Architectural Designs	10,000
21	Galiano Club	Commercial Freezer	5,000
22	Southern Gulf Islands Community Resource Centre	Housing NOW - Housing Inventory	5,000
		Total	**100,762**

PROJECTS CANCELLED

No.	Applicant	Project Title	Amount Returned ($)
1	SGI: Saturna Island Tourism Association	Saturna Island Hiking Trails Map (2022)	(1,000)
2	SSI: Royal Canadian Legion	Purchase of a Backup Generator (2022)	(5,000)
		Total	**(6,000)**

APPENDIX B

2023 Electoral Areas Safe Restart Grants-In-Aid Awarded

Total Amount Awarded to Projects: $10,000

Total Number of Projects: 2

JUAN DE FUCA ($-)

Juan De Fuca fully allocated Safe Restart Grants-in-Aid funds to projects in 2022.

SALT SPRING ISLAND ($10,000)

No.	Applicant	Project	Amount Awarded ($)
1	Diverse and Inclusive Salt Spring Island Society	Salt Spring Pride Festival	5,000
2	Salt Spring Community Health Society	Electric Mobile Health Van	5,000
		Total	**10,000**

SOUTHERN GULF ISLANDS ($-)

Southern Gulf Islands fully allocated Safe Restart Grants-in-Aid funds to projects in 2021.

REPORT TO ELECTORAL AREAS COMMITTEE
MEETING ON WEDNESDAY, APRIL 10, 2024

SUBJECT **2023 Community Works Fund Annual Report**

ISSUE SUMMARY

This report provides a summary of Community Works Fund (CWF) activity for the period of January 1, 2023 through December 31, 2023.

BACKGROUND

CWF is one of three program streams under the Canada Community-Building Fund (CCBF) Program. The CCBF transfer is from the federal government, and Union of British Columbia Municipalities (UBCM) administers the CCBF program on behalf of the province through a trilateral agreement. The agreement between the Government of Canada-Province of BC-UBCM provides a 10-year commitment (2014-2024) to deliver funding to local governments for infrastructure and capacity-building projects. This agreement provides the administrative framework for the program. It sets out the funding allocation, program delivery and eligible categories.

To receive funding, local governments are required to enter into an agreement with UBCM as the program administrator. Funding is distributed to local governments through UBCM on a per capita basis. In alignment with Capital Regional District (CRD) Board Direction (August 2014), CWF funds are reallocated to the three Electoral Areas (EAs): Juan de Fuca (JDF), Salt Spring Island (SSI) and Southern Gulf Islands (SGI) on a per capita basis. Once funds are distributed, staff administer the program through a continuous application process.

The CRD has been a recipient of CWF under two agreements: 2005-2014 and 2014-2024. Appendix A provides a summary of activity since 2006 and remaining balances at the end of 2023. The current agreement (2014-2024) expired on March 31, 2024, and final payment was received in 2023 under the current agreement. In 2023, UBCM and the province formalized a joint approach to renewal discussions with the federal government for a renewed CCBF agreement. The CRD received a letter in March 2024 stating that UBCM is hoping to have a 10-year renewal agreement signed by July 2024. Until the renewal agreement is signed, the program will continue to operate under the terms and conditions of the existing agreement. Staff will bring a report back to the Board once a new agreement is finalized.

IMPLICATIONS

Service Delivery Implications

CRD services and third parties in the EAs are eligible to access CWF funding. The funding is used to support the diverse needs and local priorities in each of the EAs. Often, the third-party requests provide services to communities and areas where the CRD has no service authority.

In 2023, successful projects under CWF's eligible categories included recreational, drinking water, wastewater, fire halls and fire stations, community energy systems and culture and tourism infrastructure projects. The agreement also requires local governments to commit to asset management practices. Appendix B details a list of projects that were awarded in 2023. Appendix C details projects by recipient type and project category.

Financial Implications

2023 Activity

Tables 1 and Table 2 provide an overview of CWF allocation and activity in the EAs for the past two years.

Table 1: Distribution of CWF Funds to EAs

	Population (2021 Census)[1]	%	2023 Allocation ($)	Population (2021 Census)[1]	%	2022 Allocation ($)
□D□	5,531	24	291,531	5,531	24	279,432
SSI	11,635	50	613,263	11,635	50	587,814
SGI	6,101	26	321,575	6,101	26	308,230
Total	**23,267**	**100**	**1,226,369**	**23,267**	**100**	**1,175,476**

1. In 2021, these numbers are derived from the new Statistics Canada census and were updated in February 2022. In alignment with CRD Board direction (August 2014), the population numbers were used for CWF distribution to the EAs.

Table 2: CWF Funding Awarded to Projects

	2023		2022	
	# of Applications	Amount Awarded ($)	# of Applications	Amount Awarded ($)
□D□	1	30,000	14	905,000
SSI	20	1,197,330	13	2,071,050
SGI	4	189,000	1	80,000
Total	**25**	**1,416,330**	**28**	**3,056,050**

Unspent Funds

Since 2014, the CRD has awarded $12.3 million to projects. The CRD has $3.6 million in funding remaining under the current agreement at the end of 2023. Some CRD services have identified CWF as a potential funding source in the 2024-2028 capital plans to utilize the unspent funds.

In the last few years through the Annual Expenditures Reports (AER) to UBCM, the CRD was required to forecast unspent funds. 2023 AER will be the last report under the current agreement and will include additional reporting to identify and provide timelines for the use of remaining unspent funds. Until a 10-year new agreement is signed, unspent funds can be continued to be spent under the terms and conditions of the current agreement. It is anticipated that the new agreement might have provisions regarding unspent funds.

CONCLUSION

The 2023 CWF Annual Report provides a summary of funding activity in 2023. The program is administered through a continuous application process for third parties and CRD services in the EAs. Applications must have EA Director support and are subject to availability of funds and program eligibility, which is coordinated through a rigorous pre-screening and application process. The current agreement expired on March 31, 2024, pending a new agreement. Staff anticipate a new agreement in July and will bring back a report to the Board.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Lia Xu, MSc., CPA, CGA, Finance Manager, Local Services and Corporate Grants
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENTS

Appendix A: Community Works Fund Funding Assigned to Projects and Balance Remaining by Electoral Area, April 1, 2006 – December 31, 2023
Appendix B: 2023 Community Works Fund Grants Awarded
Appendix C: 2023 Community Works Fund Detailed Breakdown by Electoral Area

APPENDIX A

Community Works Fund Funding Assigned to Projects and Balance Remaining by Electoral Area April 1, 2006 – December 31, 2023

CWF Overview	**Juan de Fuca ($)**	**Salt Spring Island ($)**	**Southern Gulf Islands ($)**	**Total ($)**
CWF Allocation by Electoral Area	4,259,883	9,342,268	4,440,057	18,042,208
LESS: Funding Assigned to Projects	(3,405,555)	(8,298,209)	(4,139,889)	(15,843,653)
PLUS: Project Surpluses	82,518	171,896	188,045	442,458
PLUS: Interest Earnings	305,340	560,511	125,081	990,932
CWF Balance Remaining	**1,242,185**	**1,776,466**	**613,294**	**3,631,945**

APPENDIX B

2023 Community Works Fund Grants Awarded

Total Amount Awarded to Projects: $1,416,330

Total Number of Projects: 25

JUAN DE FUCA ($30,000)

No.	CRD Service	Project	Eligible Category	Amount Awarded ($)
1	Port Renfrew Sewer	Port Renfrew Wastewater Treatment Plant Generator Upgrade	Wastewater	30,000
			Total	**30,000**

SALT SPRING ISLAND ($1,197,330)

No.	CRD Service	Project	Eligible Category	Amount Awarded ($)
1	Ganges Sewer Utility	MBR Lifting Brackets Ganges WWTP	Wastewater	55,000
2	Salt Spring Island Pool and Parkland Combined Service	Pool Electric Upgrades	Recreational	235,000
3	Salt Spring Island Recreation	Dance Floor Installation and Water Filtration System Replacement	Recreational	20,000
4	Cedar Lane Water Service	Cedar Lane Water Treatment Plan Manganese Removal System Construction	Drinking Water	95,000
5	Beddis Water Service	Beddis Water Treatment Plant Intake Design and Construction	Drinking Water	66,000
6	Highland-Fernwood Water Service	Highland-Fernwood Water Treatment Plant Intake Design and Construction	Drinking Water	43,000
7	Salt Spring Island Pool and Parkland Combined Service	Rainbow Road Recreation Centre Heat Pump Installation	Community Energy Systems	100,000
8	Fulford Water Service	Design and Installation of Fulford Water Treatment Plant Lifting Apparatus	Drinking Water	50,000
9	Beddis Water Service	Beddis Water Pressure Reducing Station New Strainers	Drinking Water	10,000
10	Beddis Water Service	Design and Installation of Beddis Water Treatment Plant Lifting Apparatus	Drinking Water	50,000
11	Fulford Water Service	Fulford Water Treatment Plant New Turbidity Meter	Drinking Water	4,000
12	Fulford Water Service	Fulford Water Treatment Plant New Pump Impellers	Drinking Water	6,000
13	SSI Community Parks	Drummond Park Upgrades	Recreational	50,000
14	Beddis Water Service	Beddis Water Treatment Booster Pump Variable Frequency Drive (VFD) Capacitor Replacement	Drinking Water	5,000
15	Highland-Fernwood Water Service	Highland Fernwood Lifting Apparatus	Drinking Water	40,000
16	SSI Community Parks	Revitalization of Centennial Park in Ganges Village Uplift	Recreational	198,000
17	Salt Spring Island Recreation	Dance Floor Installation and Water Filtration System Replacement Uplift	Recreational	13,330
18	Salt Spring Island Library	Salt Spring Island Library Archives Climate Control System Replacement	Cultural Infrastructure	70,000
			CRD Service Total	**1,110,330**

No.	Third Party	Project	Eligible Category	Amount Awarded ($)
1	Fulford Community Hall	Fulford Community Hall Roof Water Catchment System	Drinking Water	40,000
2	Transition Salt Spring Society	Mount Maxwell Road Flooding and Sedimentation Disaster Mitigation	Wastewater	47,000
			Third Party Total	**87,000**
			Total	**1,197,330**

SOUTHERN GULF ISLANDS ($189,000)

No.	CRD Service	Project	Eligible Category	Amount Awarded ($)
1	Lyall Harbour Boot Cove Water Service	Saturna Island - Harris Road - Culvert Replacement for the Water Service	Drinking Water	30,000
2	Southern Gulf Island Harbours Commission	Miners Bay Dock Revitalization	Tourism Infrastructure	30,000
3	Magic Lake Estates Water Local Service	Magic Lake Estates Water Treatment Plant - EV Charging Station	Community Energy Systems	5,000
			Total	**65,000**

No.	Third Party	Project	Eligible Category	Amount Awarded ($)
1	South Galiano Volunteer Fire Department Society	Fire Hall Community and Training Facility	Fire Halls and Fire Stations	124,000
			Third Party Total	**124,000**
			Total	**189,000**

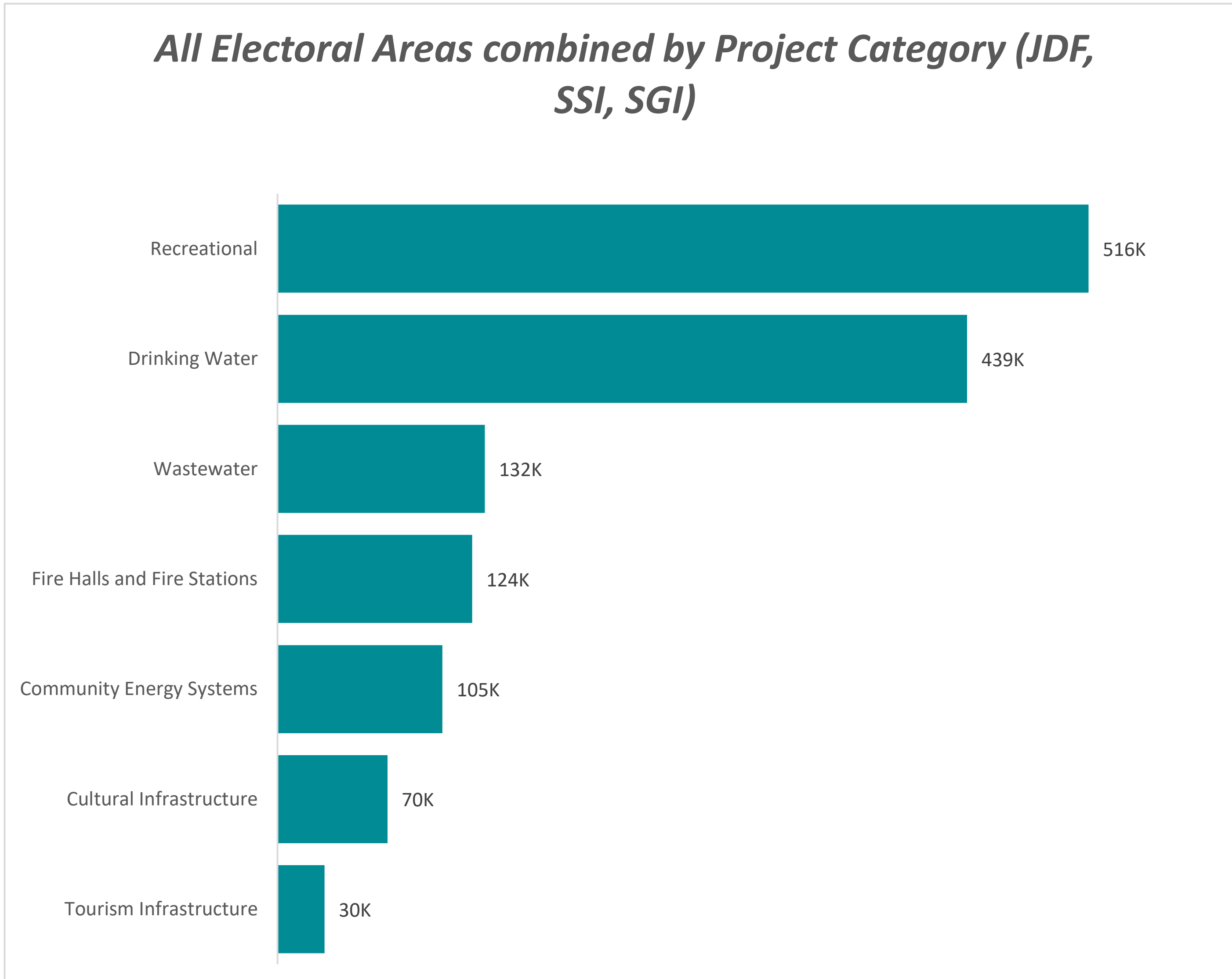
***These projects have been approved by CRD and remain subject to UBCM / federal approval through completion of the Annual Expenditures Report.**
****These projects reflect commitment of projects that have been awarded and do not reflect CWF disbursement.**

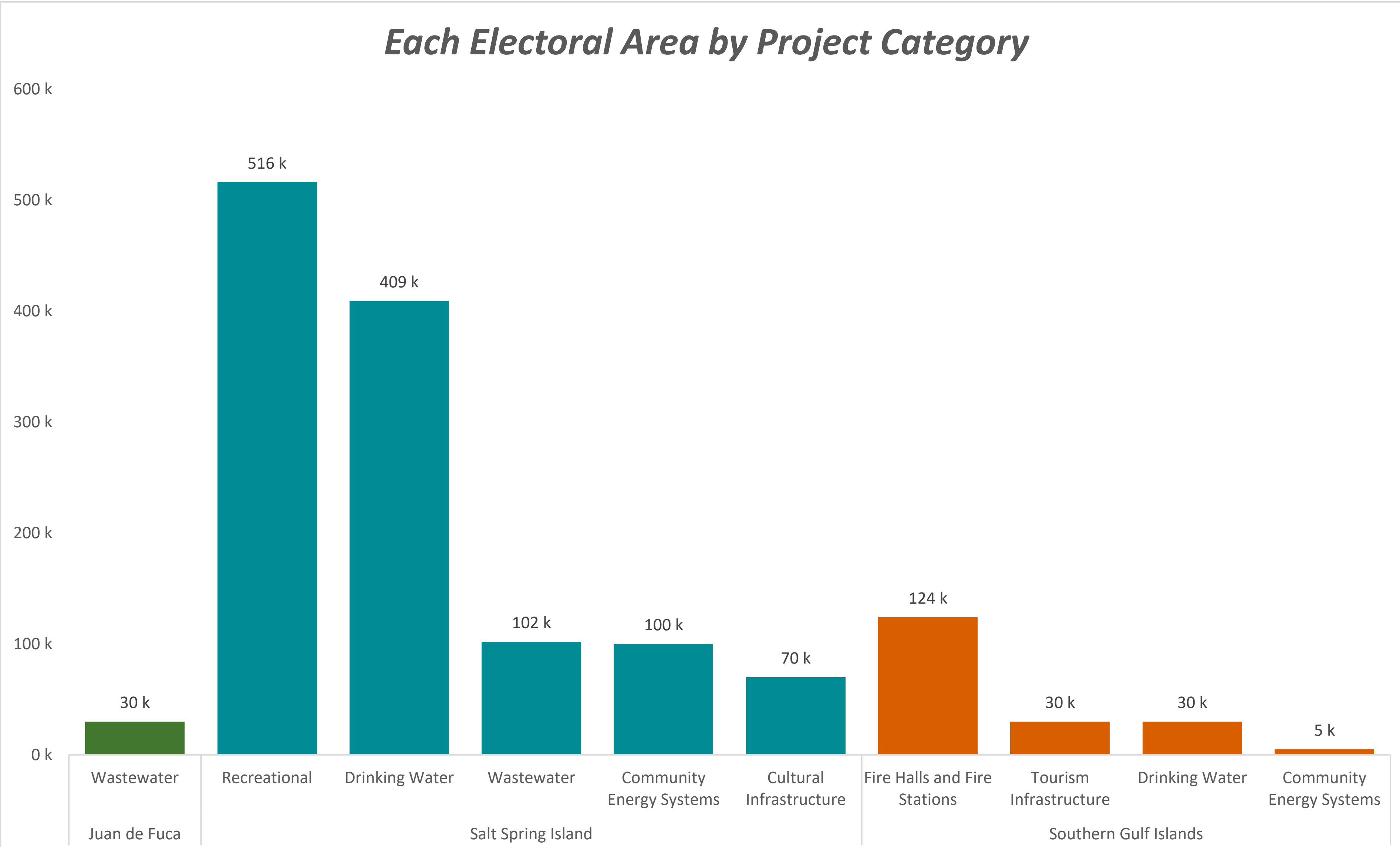
2023 Community Works Fund Detailed Breakdown by Electoral Area

Project Categories under CWF

To be eligible under CWF, as per the Agreement, a proposed project must meet the “Ultimate Recipient” and “Infrastructure” definitions and reflect one of the Eligible Project Categories.

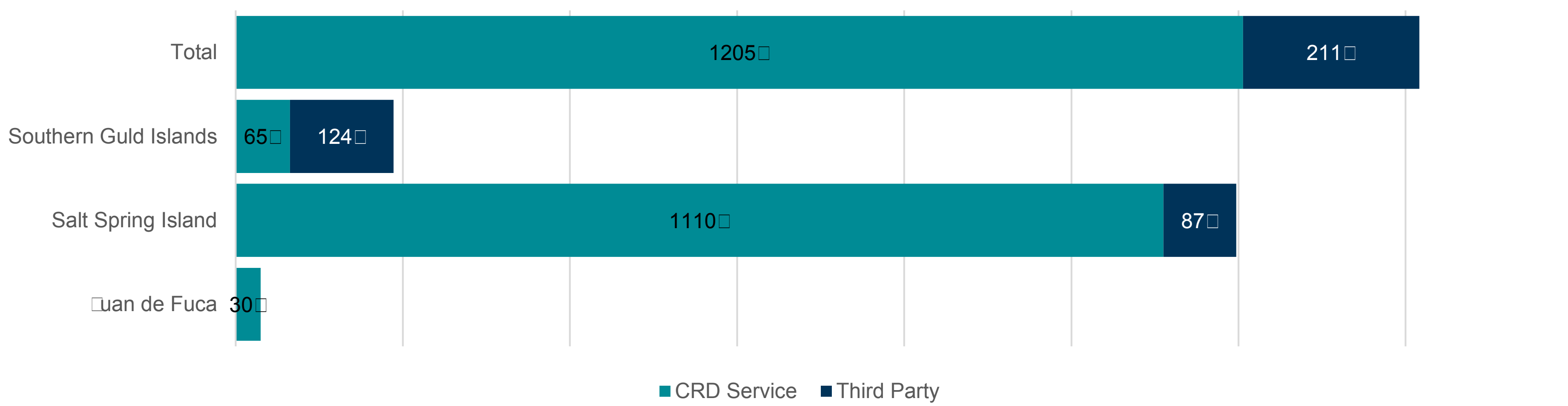
Eligible Project Categories
Local roads, bridges
Short-sea shipping
Short-line rail
Regional and local airports
Broadband connectivity
Public transit
Drinking water
Wastewater
Solid waste
Community energy systems
Brownfield redevelopment
Sport infrastructure
Recreational infrastructure
Cultural infrastructure
Tourism infrastructure
Disaster mitigation
Capacity building
Fire Halls and Fire Stations




Each Electoral Area by Project Category
600 k
500 k
400 k
300 k
200 k
100 k
0 k
30 k
516 k
409 k
102 k
100 k
70 k
124 k
30 k
30 k
5 k
Wastewater
Recreational
Drinking Water
Wastewater
Community Energy Systems
Cultural Infrastructure
Fire Halls and Fire Stations
Tourism Infrastructure
Drinking Water
Community Energy Systems
Juan de Fuca
Salt Spring Island
Southern Gulf Islands

Electoral Area by Recipient Type

The following graph provides a summary of grants provided to CRD Services and Third Parties in each EA (and collectively) for 2023.



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REPORT TO ELECTORAL AREAS COMMITTEE
MEETING OF WEDNESDAY, APRIL 10, 2024

SUBJECT **Community Works Fund – Disbursement Process**

ISSUE SUMMARY

To develop and implement a revised disbursement process for Third Party recipients of Community Works Funds (CWF), mitigating risk and improving program compliance.

BACKGROUND

Formerly known as the Gas Tax, CWF is one of three funding streams delivered through the Canada Community-Building Fund (CCBF). This is a tripartite agreement between the Federal Government, the Province of British Columbia (BC) and the Union of BC Municipalities (UBCM). The program supports local government infrastructure and capacity building through eligible capital projects.

CWF is distributed to local governments annually through UBCM (the program administrator) on a per capita basis. In alignment with Capital Regional District (CRD) Board Direction (given on August 2014), the funds are re-allocated to the three Electoral Areas (EA) on a per capita basis. Once the funds are allocated to EAs, CRD staff administer the program through an application process from CRD services and third parties. Once approved, funds are fully transferred to CRD services, or for third parties, after a contribution agreement is executed.

The third-party contribution agreement requires the recipient to complete the project in accordance with program rules to retain funding received. The recipients are also required to provide documentation regarding progress and project expenses upon request. Historic practice has resulted in audits being conducted when staff are informed of concerns or required through UBCM in their annual reporting process.

On March 13, 2024, the CRD Board directed staff to develop a revised disbursement process for third-party recipients of CWF, replacing the current process of advancing CWF funds upon execution of the contribution agreement. The new disbursement process aims to mitigate risk and improve program compliance while balancing administrative impact for both the CRD and third parties.

ALTERNATIVES

Alternative 1
The Electoral Areas Committee recommends to the Capital Regional District Board:
That the revised disbursement process for the Community Works Fund, as described in this report, be implemented for future third party projects.

Alternative 2
That this report be referred back to staff for additional information.

IMPLICATIONS

Alignment with Board & Corporate Priorities

CRD Board Priorities under Governance commits to cultivate greater transparency, accountability and engagement through CRD work. The CRD has also identified this in its 2023-2026 Corporate Plan under Community Need 13. Business Processes and Systems to respond to best practices, comply with the legislative requirements and deliver sustainable budgets. Revising the disbursement process for CWF will increase transparency and accountability to public and program funders by the CRD and third-party recipients. By defining the disbursement process in more detail, the CRD will face less uncertainty ensuring the projects will be more efficient, benefiting the community and residents in the EAs by third parties.

Financial Implications

The current process of advancing approved CWF funds to third parties represents a risk to ongoing administration and funding of the program. In the event of non-compliance, pursuing reimbursement from third parties through negotiation or litigation results in additional expenses, such as staff time. A new disbursement process to release CWF in milestone installments, based on project completion status, is recommended. This will ensure projects are completed in alignment to contractual requirements and funds are spent in a transparent and accountable manner.

With the new disbursement process, projects will be classified into two categories based on risk profile: large projects representing awards greater than $50,000 and small projects representing awards less than or equal to $50,000. Historical review of the third-party awards between 2020 and 2023 is summarized in Table 1.

Table 1: Third-Party Awards 2020-2023

Awards	Large Project (>$50,000)	Small Project (<=$50,000)	Total
No. of Awards (% of Total)	6 (21%)	22 (79%)	28
$ of Awards (% of Total)	1,734,000 (75%)	566,220 (25%)	2,300,220

$50,000 was chosen as the threshold to balance administrative burden to both the CRD and third parties while managing risk to the program. Projects less than $50,000 are generally simpler, have shorter timeframes to complete, and present less risk. The revised disbursement process by category is outlined in Table 2.

Table 2: Disbursement Process by Project Category

Project Status	Installment Payment Schedule	
	Large Project (>$50,000)	Small Project (<=$50,000)
Advance- Upon Signing Agreement	25%	75%
Interim - 50% Completion	50%	N/A
Final - 100% Completion	25%	25%

Project completion will be measured as the percentage of total project costs incurred rather than the total CWF awarded, as there are often cost-shared projects with recipients' own funding to fund ineligible and eligible expenditures, thus reducing the risk of incomplete projects receiving full CWF funding.

Appendix A is a high-level process flow chart with project examples. The examples of a large project (□$50□ award) and a small project (□□$50□ award) are both demonstrated on how the CWF installments would be released to recipients based on the project completion status.

Service Delivery Implications

By implementing a revised disbursement process, the CWF program will be more resilient towards unexpected issues and funding risk exposure. The revised process, which will align with corporate objectives, also recognizes the financial constraints encountered by third party recipients□ therefore, the partial advance disbursement is still available, allowing project work to commence immediately.

Additional administrative activities will be required for CRD staff and Third-Party recipients, CRD staff will need to accommodate by allocating more administration capacity. Previously staff had limited involvement with third party projects after the initial approval and payment. This more rigorous process will require staff to manage additional communication and documentation as well as review and payment process. The amount of additional administrative effort will fluctuate with the number of third-party applications approved. Recipients will be required to submit an interim progress report (large project□$50,000 CWF award only) and a final project report to receive the full CWF payment. Through these reports, recipients are required to submit an itemized list of costs with vendor invoice and payment information on project reports. This will allow staff to review ongoing expenses for eligibility and perform additional audits if required.

The revised disbursement process framework will be designed to mitigate risk and improve program compliance while balancing administrative impact for both the CRD and the third parties.

CONCLUSION

The current process of advancing CWF funds to third parties upon approval represents risk to ongoing administration and funding of the program. A revised disbursement process is recommended to ensure that projects are completed in alignment to contractual requirements and that funds are spent in a transparent and accountable manner.

RECOMMENDATION

The Electoral Areas Committee recommends to the Capital Regional District Board:
That the disbursement process for the Community Works Fund, as described in this report, be implemented for future third party projects.

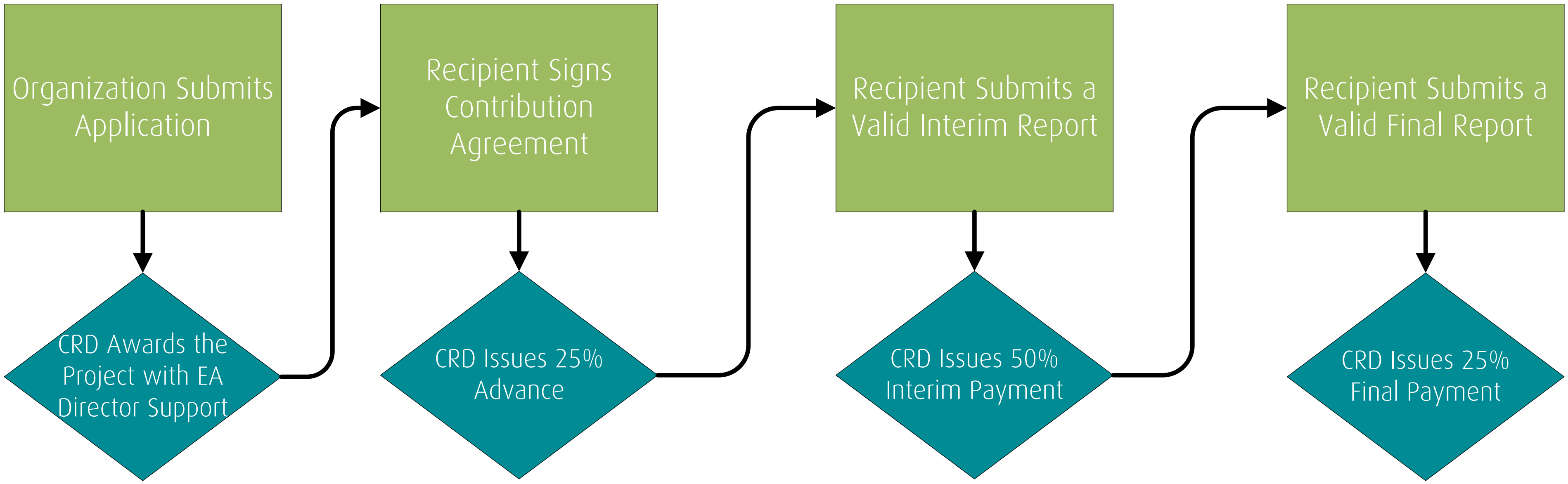
Submitted by:	Lia Xu, MSc., CPA, CGA, Finance Manager, Local Services and Corporate Grants
Concurrence:	Nelson Chan, MBA, FCPA, FCMA, Chief Financial Officer
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Disbursement Process Chart and Project Examples

CWF – Large Project Process Flow Chart & Example (>$50K CWF Award)

Appendix A

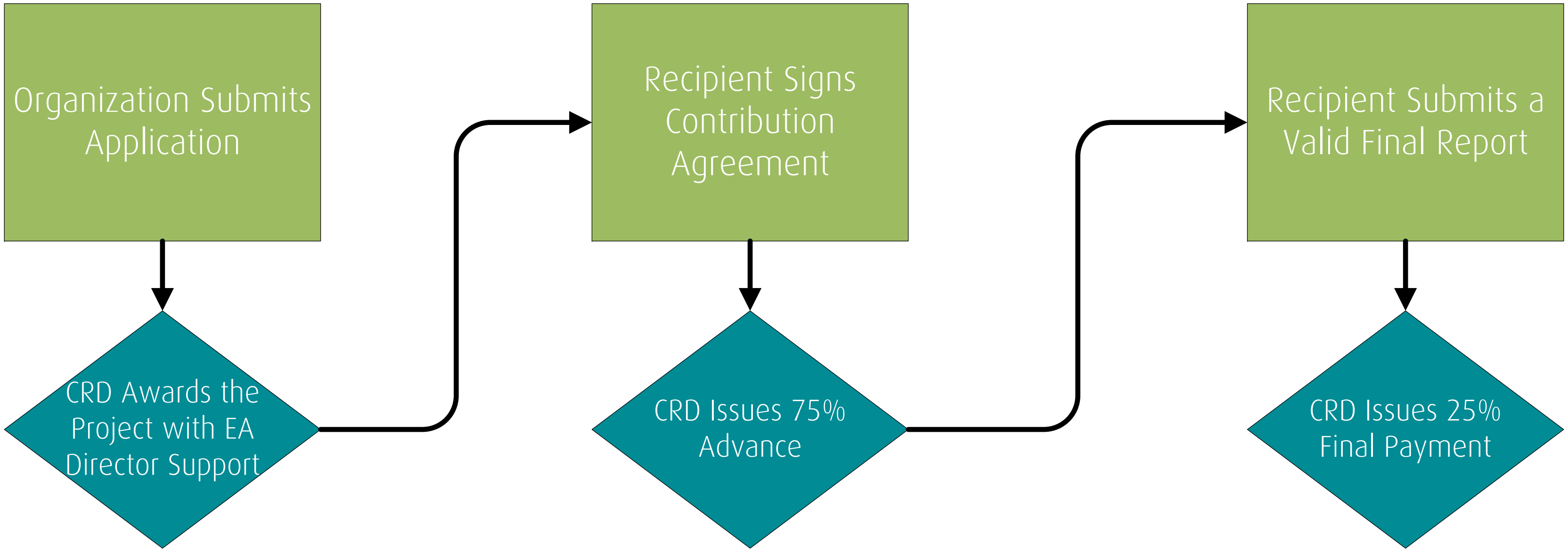


Disbursement Example – $200K Project, $100K CWF Award

	Advance	Interim	Final
Project Status	Upon Agreement Signed	50% Complete	100% Complete
Total Project Costs	$0	$100,000	$200,000
Disbursement Amount	$25,000 (25% of Award)	$50,000 (50% of Award)	$25,000 (25% of Award)
Total Disbursement	$25,000	$75,000	$100,000

CWF – Small Project Process Flow Chart & Example (<=$50K CWF Award)

Appendix A



Disbursement Example – $100K Project, $50K CWF Award

	Advance	Final
Project Status	Upon Agreement Signed	100% Complete
Total Project Costs	$0	$100,000
Disbursement Amount	$37,500 (75% of Award)	$12,500 (25% of Award)
Total Disbursement	$37,500	$50,000

REPORT TO ELECTORAL AREAS COMMITTEE
MEETING OF WEDNESDAY, APRIL 10, 2024

SUBJECT **Household Hazardous Waste Pickup in Electoral Areas – Follow-up**

ISSUE SUMMARY

To provide information on household hazardous waste (HHW) disposal education for the electoral area residents, and costs and feasibility of HHW pick-up in the Juan de Fuca Electoral Area.

BACKGROUND

At the December 13, 2023 Electoral Areas Committee (EAC) meeting, staff were directed to report back on options to provide education and information on disposal of HHW for electoral area residents; and to investigate a program and assess costs and feasibility for a HHW roundup in the Juan de Fuca Electoral Area once every 3 years. Previous staff reports on this topic are included as Appendix A.

On an ongoing basis, the Capital Regional District (CRD) promotes its HHW program in the form of campaigns, including a direct mail out to 125,000 homes in the capital region, partnering on the pesticide reduction initiative, and with source control programs, as well as messaging through an annual illegal dumping/abandoned waste campaign. The CRD also distributed customer handouts to HHW product retailers, and developed and distributed education materials to communities when the mobile HHW roundup events were discontinued in 2016. The CRD continues to provide guidance on how to safely dispose of many types of common HHW items at the Hartland Depot. This information can be found on the CRD's website.

The development of a more comprehensive education and information program for communities in the electoral areas would entail working closely with the Gulf Islands Depots and the Port Renfrew Depot to develop messaging and outreach materials on HHW. Working directly with depot staff, this work could include the development of newsletters or fact sheets that are specific to each island and the Port Renfrew depot around types of products (accepted and not accepted), collection and proper disposal of HHW. Staff can complete this work with existing resources and this work fits within the 2024 work plan.

Staff have investigated the costs of hosting a HHW roundup within the Juan De Fuca Electoral Area. Preliminary estimates provided by a qualified third party to conduct a mobile collection event identified costs would range from $20,000 to $50,000 per event, depending on volume and type of products received, as well as travel logistics and subsequent transport of material to sorting and processing facilities. If an event were held in the Juan De Fuca Electoral Area, staff recommend that the event be held within the surrounding East Sooke Area as the communities of Port Renfrew and Willis Point are both serviced by nearby depots accepting many HHW products.

The Environmental Resource Management budget for the HHW service is limited to the Hartland Depot operation and community education; and the costs for mobile collection events are not currently included.

The 2016 decision to discontinue HHW roundup events in electoral area communities, was made in part due to an expansion of provincial extended producer responsibility programs placing the responsibility for end disposal of HHW products on producers. Through expansion of the *BC Recycling Regulation*, it is expected that by 2025, collection programs will be operational in the province for orphan materials, such as compressed canisters (fuel, adhesives, bear spray) propane tanks, fire extinguishers and more, providing additional return opportunities for consumers.

CONCLUSION

The Environmental Resource Management (ERM) budget for the household hazardous waste (HHW) service is limited to the Hartland Depot operation and community education; and the costs for mobile collection events are not currently included. The development of a more comprehensive education and information program for communities in the electoral areas would entail working closely with the Gulf Islands Depots and the Port Renfrew Depot to develop messaging and outreach materials on HHW. Staff will undertake this work using existing resources. Costs to reinstate a mobile round up HHW collection service within the Juan De Fuca Electoral Area is estimated to be $20,000 to $50,000 per event. These costs are not currently included within the ERM budget. Through expansion of the *BC Recycling Regulation*, it is expected that by 2025, collection programs will be operational to receive and manage more HHW materials at depots across the province, including with Electoral Areas.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Tom Watkins, Acting Senior Manager, Environmental Resource Management
Concurrence:	Larisa Hutcheson, P. Eng., Acting General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Previous Household Hazardous Waste Pickup in Electoral Areas Staff Reports (September 13 and December 13, 2023)

Making a difference...together

APPENDIX A

ERM 23-52

REPORT TO ELECTORAL AREAS COMMITTEE
MEETING OF WEDNESDAY, DECEMBER 13, 2023

SUBJECT **Household Hazardous Waste Pickup in Electoral Areas – Update**

ISSUE SUMMARY

To report back on discussions with Electoral Area fire departments regarding the storage of household hazardous waste (HHW) in the Electoral Areas.

BACKGROUND

At the June 14, 2023 CRD Board meeting, staff were asked to investigate the cost and feasibility of Hartland funding a one-time HHW pickup on four islands in the Southern Gulf Islands, Juan de Fuca and Salt Spring Island.

The September 13 Electoral Areas Committee (EAC) staff report (Appendix A) indicated that preliminary estimates to have a qualified third party conduct mobile collection events in these communities range from $20,000 to $50,000 per community, depending on volume and type of products received, as well as travel logistics and subsequent transport of material to sorting and processing facilities. The Environmental Resource Management (ERM) budget for the HHW service is limited to the Hartland Depot operation and community education; costs for mobile collection events are not currently included in the ERM budget. The total cost to provide one-time HHW events in the six Electoral Area communities is estimated to be $200,000.

The acceptance of both provincially-regulated (Extended Producer Responsibility) and non-regulated HHW at the Hartland Depot offers residents a one-stop drop for their unwanted products, and provides for safe and efficient collection, consolidation and packaging for transportation to processing. Cost for delivery of the service is approximately $800,000 per year.

The CRD's Protective Services staff reached out to Electoral Area fire chiefs, and the collective feedback was that there is no heightened level of concern for firefighter safety due to storage of HHW. They did indicate that a local public drop-off opportunity would be appreciated by the Electoral Areas.

ALTERNATIVES

Alternative 1
The Electoral Areas Committee recommends to the Capital Regional District Board:
That household hazardous waste collection not be expanded, and Electoral Area residents continue to take their household hazardous waste to the specialized regional infrastructure at the Hartland Depot.

Alternative 2
The Electoral Areas Committee recommends to the Capital Regional District Board:
1. That the regional household hazardous waste management be expanded to include a final one-time mobile collection event in the Capital Regional District's Electoral Areas; and
2. That the 2024 Environmental Resource Management budget be amended to include $200,000 to fund the one time mobile collection event.

IMPLICATIONS

Financial Implications

The cost for the delivery of the regional HHW collection service at the Hartland Depot is approximately $800,000 per year.

The estimated cost to conduct mobile collection events in the Electoral Area communities ranges from $20,000 to $50,000 per community. The total cost to provide one-time HHW event in the six Electoral Area communities is estimated to be $200,000.

CONCLUSION

At the September 13, 2023 Electoral Areas Committee meeting, Capital Regional District staff were asked to speak to fire departments within the Electoral Areas to examine if they have any concerns with the storage of household hazardous waste (HHW) in the Electoral Areas. The collective feedback from fire chiefs was that there is no heightened level of concern for firefighter safety due to storage of HHW. Staff recommend that HHW collection not be expanded to the Electoral Areas and that residents continue to take their HHW to the specialized regional infrastructure at the Hartland Depot.

RECOMMENDATION

The Electoral Areas Committee recommends to the Capital Regional District Board:
That household hazardous waste collection not be expanded, and Electoral Area residents continue to take their household hazardous waste to the specialized regional infrastructure at the Hartland Depot.

Submitted by:	Russ Smith, Senior Manager, Environmental Resource Management
Concurrence:	Larisa Hutcheson, P. Eng., General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Staff Report: Household Hazardous Waste Pickup in Electoral Areas – Electoral Areas Committee (September 13, 2023)

Making a difference...together

APPENDIX A

ERM 23-33

REPORT TO ELECTORAL AREAS COMMITTEE
MEETING OF WEDNESDAY, SEPTEMBER 13, 2023

SUBJECT **Household Hazardous Waste Pickup in Electoral Areas**

ISSUE SUMMARY

At the June 14, 2023 Capital Regional District (CRD) Board meeting, staff were asked to investigate the cost and feasibility of Hartland funding a one-time household hazardous waste (HHW) pickup on the four islands in the Southern Gulf Islands, Juan de Fuca and also on Salt Spring Island.

BACKGROUND

In 2004, the CRD launched a HHW collection program at the Hartland Depot to support residents of the region with safe end-of-life management of their unwanted and expired HHW products. This no-charge program includes both products covered under Extended Producer Responsibility (EPR) through the *BC Recycling Regulation*, such as paint and motor oil, as well as non-EPR products (orphans) like propane tanks and pool chemicals.

Subsequently, the HHW collection area at the Hartland Depot was retrofitted in 2009 to support this growing service, with a focus on safety for the public, staff and contractors and improvements for receipt, sorting, storage and subsequent transport of material. The ability to receive and manage orphan materials at the Hartland Depot is a unique service our region provides to residents and is heavily reliant on the infrastructure investment, staffing and contractor services to support this operation. The cost for delivery of this service is approximately $800,000 per year (2023 numbers) net of revenue from the services agreements for products covered under EPR. A complete list of HHW items currently accepted at the Hartland Depot is included as Appendix A.

In addition to the Hartland Depot program, and in support of a proactive strategy to remove additional residual HHW products from the waste stream, the CRD had also facilitated and funded collection of HHW from municipal yards, non-profit reuse organizations and gulf island recycling depots. Between 2006 and 2015, the CRD provided 26 mobile round-up events in Electoral Area communities. These ancillary collection programs were discontinued in 2016. This decision was made due to a number of factors, including: concerns around safety at these collection sites; decreasing volumes collected; a decision to focus resources towards the collection infrastructure available for residents region-wide at the Hartland Depot; and expansion of provincial EPR programs providing collection for many HHW products in Electoral Area communities, making the mobile round-up events somewhat redundant.

Education materials were developed and distributed in 2016 to communities impacted by the discontinuation of the biennial mobile HHW round-up events on the Gulf Islands. Residents were encouraged to take a “pack-in, pack-out” approach to managing their unwanted HHW products, as most of these items would have been purchased from off-island locations. This communication also included information about allowances and restrictions for both regular and dangerous goods sailings on the BC Ferries.

The range of products included in provincial EPR programs, and the associated collection of these materials within Electoral Areas, has expanded over the years, as well as the number of collection points throughout the province and in our region. A list of locations within Electoral Area communities that accept this material on an ongoing basis can be found in Appendix B. Through expansion of the *BC Recycling Regulation*, it is expected that by 2025, collection programs will be operational in the province for orphan items such as compressed canisters (fuel, adhesives, bear spray) propane tanks, fire extinguishers and more aerosols, battery types and electronic accessories, providing additional return opportunities for consumers.

Reinstatement of mobile HHW collection service within the Electoral Area communities would involve the following key items:

- securing locations and dates for events
- hiring a contractor to manage the events including all aspects of collection, packaging, transportation and processing as well as site safety
- advertising and promotion

Preliminary estimates provided by a qualified third party to conduct mobile collection events in these communities range from $20,000 to $50,000 per community, depending on volume and type of products received, as well travel logistics and subsequent transport of material to sorting and processing facilities. The Environmental Resource Management (ERM) budget for the HHW service is limited to the Hartland Depot operation and community education; costs for mobile collection events are not currently included in the ERM budget. The total cost to provide one-time HHW events in the six Electoral Area communities is estimated to be $200,000.

CONCLUSION

The acceptance of both provincially-regulated (Extended Producer Responsibility) and non-regulated household hazardous waste at the Hartland Depot offers residents a one-stop drop for their unwanted products, and provides for safe and efficient collection, consolidation and packaging for transportation to processing. Cost for delivery of the service is approximately $800,000 per year. Off-site Capital Regional District collection programs were conducted between 2006 and 2015, but discontinued due to concerns around site safety, reducing volumes and a renewed focus on the centralized collection infrastructure at the Hartland Depot. Through expansion of the *BC Recycling Regulation*, it is expected that by 2025, collection programs will be operational for items such as compressed canisters (fuel, adhesives, bear spray) propane tanks, fire extinguishers and more aerosols, battery types and electronic accessories.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Russ Smith, Senior Manager, Environmental Resource Management
Concurrence:	Larisa Hutcheson, P. Eng., General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENTS

Appendix A: Hartland Depot – Accepted Household Hazardous Waste Products
Appendix B: Household Hazardous Waste Collection Locations within Electoral Areas
Appendix C: BC Ferries – Dangerous Goods Information

What is Household Hazardous Waste?

Household hazardous waste (HHW) is any waste from your home that you consider to be dangerous or unsure of. It includes any leftover household products that are marked flammable, corrosive, explosive or poisonous. Common examples include pesticides, varnishes, paints, cleaners, and batteries.

Items accepted at the Hartland HHW facility:

Automotive Products
Air conditioning refrigerants
Antifreeze
Autobody filler
Automobile batteries – lead acid
Brake fluid
Carburetor cleaner
Car wax with solvent
Diesel fuel
Chrome polish
Engine degreaser
Fuel additives
Gasoline (in ULC approved container)
Grease
Hardeners (MEKP)
Oil filters
Starter fluids
Transmission fluid
Used motor oil and containers
Windshield washer fluid

Batteries
General household batteries
Lead acid batteries
Lithium-ion Batteries
Small Ni-Cad batteries (re-chargeable)
E-mobility batteries

Glues & Cements
Liquid glues only
(dispose of hardened glue as regular garbage)

Hobby Supplies
Chemistry sets
Kerosene
Photography chemicals

Household Products
Abrasive cleaners
Aerosol products
All-purpose cleaners
Ammonia
Disinfectants
Bleach
Drain cleaner
Floor wax strippers
Furniture polish and waxes
Linseed oil
Metal cleaners
Oven cleaners
Rust remover
Shoe polish (liquid)
Spot and stain remover
Toilet bowl cleaner
Upholstery and rug cleaners
Lighter fluid
Muriatic acid
Tub and tile cleaners
Window cleaners

Tanks & Containers
Butane tanks
Gas tanks
Helium tanks
Kerosene containers
Pesticide containers
Propane tanks
Fire extinguishers

Gardening and Pest Control
All fungicides
All herbicides
All insecticides
Chemical fertilizers
Flea/tick pet products
P.C.P Act
Rat poison
Slug bait
Wood preservatives

Mercury Items
Compact fluorescent light bulbs (CFLs)
Fluorescent tubes/ballasts
Metal halide lamps
Thermometers
Thermostats
Ultraviolet lamps
Pure Mercury

Miscellaneous
Barbecue starters
Smoke detectors
Swimming pool and spa/hot tub chemicals
Cell phones
Electronics with re-chargeable batteries
Home heating oil

Paints & Solvents
Acetone
Empty containers
Latex paint
Lead based paint
Marine paint
Oil-based paint
Paint thinner and strippers
Plastic
Spray paint
Varnish or lacquer
Other solvents

Personal Care Products
Antibacterial soap
Foot powder
Hair dye
Hairspray
Hydrogen peroxide
Jewelry cleaner
Nail polish and remover
Perm lotion or solution
Rubbing alcohol

Items NOT accepted at the Hartland HHW facility:

Ammunition
Call your local police/ fire department for information.

Flares
Visit myrecyclopedia.ca and search flares for events and facilities that accept flares.

Pharmaceuticals
Return all unused medication to pharmacies participating in the return program, free of charge.

For more information on Household Hazardous Waste please visit our website at **www.crd.bc.ca/hhw** or call the CRD Infoline at **250.360.3030.**

HOUSEHOLD HAZARDOUS WASTE COLLECTION LOCATIONS WITHIN ELECTORAL AREAS

Electoral Area	Household Hazardous Waste – Extended Producer Responsibility Materials	Household Hazardous Waste – Non-Extended Producer Responsibility
SOUTHERN GULF ISLANDS		
Galiano Island		
Galiano Island Recycling Depot	• Paint • Light bulbs/tubes • Smoke and CO Alarms • Single-use batteries • Rechargeable batteries • Oils/filters/containers (2024)	
Mayne Island		
Mayne Island Recycling Depot	• Paint • Light bulbs/tubes • Smoke and CO Alarms • Electronics • Single-use batteries • Rechargeable batteries • Empty oil/antifreeze jugs	• Inkjet/toner cartridges
Pender Island		
Pender Island Recycling Depot	• Paint • Light bulbs/tubes • Smoke and CO Alarms • Single-use batteries • Rechargeable batteries • Oils/filters/containers • Antifreeze • Automotive batteries • Thermostats	
Pender Island Firehall		• Propane cylinders/tanks
Saturna Island		
Saturna Island Recycling Depot	• Paint • Electronics • Household batteries • Lightbulbs/tubes • Motor oil/antifreeze	• Inkjet/toner cartridges
Darryl’s and James’s Digs	• Automotive batteries • Antifreeze • Smoke and CO Alarms • Thermostats	• Propane cylinders/tanks

Electoral Area	Household Hazardous Waste – Extended Producer Responsibility Materials	Household Hazardous Waste – Non-Extended Producer Responsibility
SALT SPRING ISLAND		
Salt Spring Island Recycling Depot	• Paint • Pesticides, solvents, gasoline • Light bulbs/tubes • Smoke and CO Alarms • Electronics • Single-use batteries • Rechargeable batteries • eMobility batteries • Automotive batteries • Thermostats	• Inkjet/toner cartridges
Pharmasave/Lower Ganges	• Single-use batteries • Rechargeable batteries	
Harbour Authority Salt Sprint Island	• Oils/filters/containers	
Salt Spring Garbage & Recycling		• Propane cylinders/tanks
JUAN DE FUCA		
Port Renfrew Garbage & Recycling Depot	• Paint • Paint plus • Electronics • Light bulbs/tubes • Motor oil • Cooking oil	• Propane tanks and canisters • Fire extinguishers

Common dangerous goods

Carefully review the list below. If you plan to travel with dangerous goods, or you're shipping a trailer with dangerous cargo, you need to complete a dangerous goods shipping document ahead of travel. Print your completed document and present it to the ticket agent when you arrive at the terminal.

Diesel, gasoline and propane do not require dangerous goods documentation if within the limits described in the list below.

Complete dangerous goods shipping document
PDF 77 KB | 2 pages

If your particular product is not listed or you have any questions about travelling with dangerous good, you can email us at dg.bcf@bcferries.com, call 250-978-1152, or fax 250-386-1652.

Aerosols no larger than 1 litre are allowed.

Automotive antifreeze is not considered dangerous and can be carried in any amount.

Auxiliary fuel tanks that form an integral part of the vehicle, connected by a fuel line to the engine fuel system, and firmly secured and protected from external damage, are permitted. Auxiliary fuel tanks are not to be confused with spare gas tanks (see Gasoline).

Adhesive products containing flammable liquid, such as contact cement, have special requirements. Check with the terminal staff for information on acceptable quantities.

Air bottles, scuba tanks and enriched air

- *Oxygen* for personal use is allowed in cylinders up to 5 litre water capacity. No transferring between containers is permitted.
- *Scuba tanks* (compressed air) for personal use is unlimited and must be declared
  - All full or partially-full tanks require a dangerous goods shipping document
  - All full or partially-full tanks are to be transported in closed, locked vehicles, or in open vehicles, provided the tanks are out of sight
- *Enriched air* must be declared and fully documented
  - The number of enriched air tanks may not exceed 8 per consignment (tank size not to exceed 20 kg). Enriched air tanks follow the same conditions of transportation as Scuba tanks for safe stowage in vehicles.
- Empty tanks not containing air are not considered dangerous goods under the *Transport of Dangerous Goods Regulations*, as long as the valves are open and not under pressure
- Foot passengers may take these tanks on board, provided the tanks are taken immediately to the main vehicle deck for stowage during the voyage. The vessel's officer will identify to foot passengers a safe stowage area on the vessel.
- These tanks are not considered baggage and our employees are not permitted to handle them or to transport them in our baggage vans

Ammunition for small arms, rifles and shotguns are permitted on our ferries in small quantities, provided they are securely packaged and carried separately from the firearm.

Batteries for automobiles are permitted. New vehicle batteries and up to 3 used batteries can be transported.

Boat/RV gas can be carried in spare tanks. See gasoline for the amounts of gas which can be carried in spare tanks.

Coleman's fuel, naphtha and white gas products used to fill camp stoves and lanterns are permitted in 5 litre metal containers in vehicles, but foot passengers are prohibited from carrying them.

Cleansers like bleach and other household cleansers may be carried on our ferries in a carton designed to keep them upright and secure to avoid spillage and harmful fumes.

Diesel fuel in tidy tanks of 450 litres or less is permitted. No dangerous goods documentation required if you travel with amounts of diesel fuel within this limit.

Firearms may be transported under strict conditions.

- Firearms must be transported in compliance with Canadian Firearms Regulations. Firearms transported in vehicles must be:
  - Unloaded
  - Not visible from outside the vehicle
  - Locked inside vehicle when unattended
- Foot passengers are not permitted to transport firearms, except on sailings between Port Hardy (Bear Cove) and Prince Rupert, and between Prince Rupert and Graham Island (Skidegate) on Haida Gwaii. On these routes, foot passengers with firearms must:
  - Declare firearms to the ship's officer once on board
  - Be responsible for securing the firearms in a locker designated by the ship's officer
- Airsoft guns, pellet guns, crossbows, bow and arrows, axes and similar items of concern are subject to restrictions, including:
  - Foot passengers are not permitted to transport any items of concern with them; if they have any, these must be stored in checked luggage
- Items of concern transported in vehicles must be:
  - Not visible from outside the vehicle
  - Locked inside the vehicle when unattended
- On-duty police officers, armoured car personnel, or peace officers authorized to carry restricted firearms in the performance of their duties are permitted by law to possess and transport firearms

Fire extinguishers can be carried on BC Ferries as long as they are firmly packaged or secured to prevent them from moving.

Fireworks are prohibited on BC Ferries. Some pyrotechnics are permitted if they are used as safety equipment for a vehicle or are equipment being transported. These pyrotechnics will normally fall under the category of Class 1 - 1.4S.

Foot passenger carry-on commodities are allowed on the car deck, as long as the deck officer gives their authority, and a suitable storage area is available on the car deck.

- Passengers may carry outboard motors, chain saws, etc. onto the car deck only. This type of equipment is not permitted in passenger areas.
- A foot passenger may carry no more than 1 cylinder of propane, not exceeding 15 kg (30 litres). The cylinder must be carried on board by the customer and must be stowed on the car deck in a location designated by the ship's officer.

Fuel oils in tank truck quantities can be transported as long as the flash point of products is not less than 37.8°C for the following fuels:

- UN 1202
- UN 1223
- UN 1267
- UN 1268
- UN 1300
- UN 1863

Gasoline in approved containers is permitted on BC Ferries in limited amounts, not exceeding 25 litres. However, foot passengers are not allowed to carry gasoline on board the ferry.

- The following may carry 1 spare container of gasoline:
    - RVs and vehicles
    - Vehicle carrying a boat on top
    - Vehicle carrying or towing jet skis or quads
- The following may carry 2 spare containers of gasoline:
    - Boat towed behind a vehicle

Note: No dangerous goods documentation required if you travel with amounts of gasoline within the limits above.

Gases, including most compressed gases and some liquefied gases, are acceptable. To prevent damage, cylinders must be properly secured within the vehicle.

Hay bales may be carried, but must be secured within a closed vehicle or the load must be completely tarped to prevent random ignition. A dangerous goods shipping document is required and is transported under UN 1327, and in addition Class 4.1 placarding must be displayed when transporting over 500kgs (1100lbs).

Helium can be transported aboard BC Ferries. All full or partially full tanks require a dangerous goods shipping document, and must be transported in closed, locked vehicles; or in open vehicles, provided the tanks are out of sight.

Kirpans are permitted for all of our passengers who are practicing members of the Sikh religion. All passengers travelling with Kirpans must do the following while aboard our ferries:

- Keep the Kirpan sheathed
- Keep the Kirpan worn underneath clothing
- Keep the Kirpan not visible to other passengers

Marine pollutants are hazardous to aquatic life and humans; therefore, all marine pollutants must be identified on a dangerous goods shipping document.

Methanol in the fuel tank of a race car is permitted up to a maximum of 25 litres. A maximum of 2 additional containers are permitted, but must be completely secured and labelled.

Oxygen for personal medical use is permitted, but cylinders may not exceed 5 litre water capacity.

- Cylinders that are not in a portable unit must be secured within the transport vehicle
- The transfer of liquid oxygen from the liberator or bulk container to the stroller or portable container on board the vessel is prohibited
- Please notify terminal staff if you are carrying personal medical oxygen

Paint and related paint products, including lacquer, enamel, stain, shellac, varnish, polish, liquid filler and liquid lacquer base, paint thinners or reducing compounds are allowed for personal use, and if purchased at a public retail outlet.

- If you're transporting commercial quantities, check with the terminal of departure for details of flash point limits for flammable products
- Latex or water-based paint is not subject to regulations

Propane valves must be closed and sealed with the tags issued at the ticket booth, and the cylinders must be upright and firmly secured to prevent tipping.

- Commercial vehicles are prohibited from carrying propane tanks
- RVs are permitted:
  - 2 x 25 kg cylinders (50 litre water capacity each) connected to a regulator and secured in or on the vehicle
  - 1 x 15 kg (30 litre water capacity) for a barbecue
- Passenger vehicles are permitted:
  - 1 x 15 kg (30 litre water capacity)

- *Important propane safety alert:*
    - The brass valve in a propane cylinder will be damaged if it comes in contact with anhydrous ammonia. This deterioration will lead to cracking of the valve body or its components and can ultimately result in a violent, unexpected expulsion of the valve from the cylinder, causing personal injury or death.

Note: No dangerous goods documentation required if you travel with amounts of propane within the limits above.

Service vehicles, including welding, refrigeration and plumbing vehicles, or any vehicle having a service repair function, may be classed as a service vehicle. Service vehicles travelling in marine mode are required to present a shipping document for dangerous goods. Call the terminal of departure for details on limits.

Wheelchairs (motorized) have no restrictions when they are in use, but there are some precautions when they are carried as cargo or freight:

- The battery must be securely in place, disconnected, with the terminals insulated to prevent short-circuiting
- The chair itself must be securely anchored so that it will not move

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ERM 24-09

REPORT TO PORT RENFREW UTILITY SERVICES COMMITTEE
MEETING OF THURSDAY, FEBRUARY 15, 2024

SUBJECT **Port Renfrew Refuse Disposal – Local Service: 2024 Initiatives Update**

ISSUE SUMMARY

To provide an update on the continued operation of the Port Renfrew Garbage and Recycling Depot and to present both short and long-term planning options for the local refuse service.

BACKGROUND

The Port Renfrew Refuse Disposal Local Service is administered by the Capital Regional District (CRD) and delivered through a depot collection service model. Funded by the local community through tax requisition, the Pacheedaht First Nation and the CRD's solid waste function under the authority of Bylaw No. 1745, the 2024 budget for the service is $110,631.

As described in staff reports presented to this committee in 2023, a number of issues are arising for the service, including garbage collection capacity and transportation costs, the pending retirement of the site's long-time caretaker and withdrawal of Recycle BC's support for residential packaging and printed products in relation to site concerns and collection infrastructure. Appendix A contains a complete list of issues and opportunities that have arisen to date or have been identified for future consideration.

Growing activity in this community is putting demands on the existing solid waste system. Increased volumes of waste material being generated, especially seasonally, are taxing the existing depot capacity and funding model for this service. In addition, illegal dumping activity, particularly of construction material and bulky items, has increased.

The current depot attendant is a caretaker who resides on the property as part of his compensation package. This is a longstanding arrangement that has proven mutually beneficial to both the caretaker and the community; however, it is not supported by site zoning, and the practice poses some liability risk to the CRD. Given this, and with the depot caretaker retiring in November 2024, a new approach will be required for operating this depot in the future.

To address these issues and to mitigate impacts associated with increasing expenses, funding through the Growing Communities Fund was pursued, and $262,500 (75%) has been secured. To access the grant funds, the service is required to supply the remaining 25% of the project costs ($87,500), of which $30,000 will be provided through a Community Works Fund Grant. This has been added to the 2024-2028 capital plan. It is expected that this $350,000 will address the imminent concerns for the service around collection capacity and transportation, the transition of depot management from caretaker to operator model, Recycle BC's concerns and provide opportunity to conduct a study for the future of the service.

ALTERNATIVES

Alternative 1
The Port Renfrew Utility Services Committee recommends to the Electoral Areas Committee:

That staff be directed to:
1. Continue implementing site upgrades with funding from the Growing Communities Fund.
2. Work with the business sector on alternative solutions for commercial packaging and printed products.
3. Continue to transition the depot from caretaker managed, to a site operator model for late 2024; and
4. Continue discussions for long-term waste management in Port Renfrew with the Pacheedaht First Nation and the broader community.

Alternative 2
That this report be referred back to staff for additional information.

IMPLICATIONS

Alignment with Existing Plans & Strategies

The 2021 CRD Solid Waste Management Plan (SWMP) identifies roles in the solid waste system, including the responsibility of producers, consumers (generators), industry and local governments. Working with local generators of waste material to develop and deliver an efficient service for this community supports goals associated in the SWMP, including having informed citizens who effectively participate in proper waste management practices and reducing the per/capita disposal rate for the region.

The Port Renfrew Official Community Plan update, scheduled to take place in 2024, provides an opportunity to engage with the community, including the Pacheedaht First Nation about a longer-term vision for the service. It is expected that this project will begin in February 2024, once a Citizens Committee representing various interests in Port Renfrew is formed.

Financial Implications

The primary function of the service is to provide local collection of garbage from both residents and businesses. Favourable recycling markets for items like scrap metal and cardboard, as well as collection agreements for regulated items such as paint, tires and batteries, have allowed the serviced to expand and provide a local option for the community to manage its recyclables. Given the withdrawal of Recycle BC support, the downturn in commodity markets and increase in both volumes and costs associated with transportation, there are limits to what the current funding model can support regarding continuing this broad-spectrum service.

The current caretaker arrangement includes residential access to the site and provision of utilities (hydro, water, telephone and septic services), as well as a stipend of $1,148/month. In addition, as part of the compensation package, the caretaker has access to profitable scrap metal material and beverage containers dropped off at the site, returning and retaining the deposit refund. The revenue generated from this salvaging activity will be better understood in 2025 as site management transitions to an operator and those revenues are returned to the service. Staff estimate this revenue potential at approximately $40,000-$60,000 per year when compared to similar-sized depots in other communities.

In addition, with the caretaker's retirement in 2024, and the transition to having the site managed by an operator, there will be a financial impact on the service in 2025. Options include having the site managed by a CRD employee through a new position (2025) or contracting the work out to a non-profit community organization, as is done with residential recycling services on Salt Spring Island and the Southern Gulf Islands. Staff recommend posting for a 12-month term position in the summer of 2024, with an extended term or permanent position considered in the 2025 budget. Preliminary estimates for a part-time position are $50,000 annually. If recruitment is unsuccessful, contracting the work out could be explored, particularly if the community signals an interest in establishing a non-profit community organization model.

Site utilities, including hydro, water and portable toilet service are funded by the service and will need to be maintained for continued operation of the site.

First Nations Reconciliation

The Pacheedaht First Nation has indicated interest in operating its own waste and recycling transfer station, potentially for the entire Port Renfrew community. Timing for these discussions could progress as improvements at the existing site progress this year.

Social Implications

An adjustment to the hours the depot is open will need to be explored and right-sized for this community, and the funding available for the service. The recycling depots located in the Southern Gulf Island Electoral Area are open 4-10 hours/week. In comparison, the Port Renfrew caretaker has been opening the depot 56-70 hours/week, depending on the season. In addition, the agreement with Recycle BC requires that an attendant be present during all hours the depot is open. The inability to provide this under the caretaker model is one of the reasons the Recycle BC agreement and associated support is currently suspended.

When the adjustment to hours is made, strategies will need to be considered to address illegal dumping outside of the facility's gate and potentially in the community.

CONCLUSION

There are a number of challenges and opportunities for the Port Renfrew Refuse Disposal Services arising. It is expected that short-term issues such as garbage collection and transportation efficiencies, transitioning site management to an operator model, and addressing site infrastructure concerns can be addressed through funding secured through the Growing Communities Grant. In addition, the hours and services provided at site will need to be reviewed and right-sized for the community and funding available. There is an opportunity to investigate long-term planning for the service through the Port Renfrew Official Community Plan update scheduled to be conducted in 2024.

RECOMMENDATION

The Port Renfrew Utility Services Committee recommends to the Electoral Areas Committee:
That staff be directed to:

1. Continue implementing site upgrades with funding from the Growing Communities Fund.
2. Work with the business sector on alternative solutions for commercial packaging and printed products.
3. Continue to transition the depot from caretaker managed, to a site operator model for late 2024; and
4. Continue discussions for long-term waste management in Port Renfrew with the Pacheedaht First Nation and the broader community.

Submitted by:	Russ Smith, Senior Manager, Environmental Resource Management
Concurrence:	Larisa Hutcheson, P. Eng., General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Issues and Opportunities Summary

APPENDIX A

ISSUES AND OPPORTUNITIES SUMMARY
PORT RENFREW REFUSE DISPOSAL – LOCAL SERVICE
February 2024

ISSUE/OPPORTUNITY	COMMENTS
Port Renfrew Garbage and Recycling (Depot) Operation	
Caretaker arrangement – not supported by site zoning	• Caretaker's retirement in November 2024 provides an opportunity to transition site management to an operator model.
Depot hours	• Hours of operation will need to be right-sized (reduced) to better align with size of community and budget for service.
Depot Infrastructure	
Culvert repair	• Community works grant funding has been secured to fund repair of the failing culvert, which is scheduled to take place in the late spring of 2024.
Capacity issues related to increased demand and seasonal activity in the community	• Pilot was conducted in the summer of 2023, where bins were serviced regularly (twice weekly). • Compaction bins budgeted for with the Growing Communities Fund work will provide the ability to collect and store a larger volume of garbage onsite and improve hauling efficiencies.
Partnership with Pacheedaht First Nation	
Increased volume of material generated from both residential and commercial activity	• Expanded capacity at the Depot and scope of recyclables accepted provides safe, secure collection of waste materials, while long-term alternatives for the community are pursued. • Reestablishing practice of directing Pacheedaht First Nation garbage and recycling to the Depot should increase diversion and reduce confusion and illegal dumping activity with all material generated in the community being accepted at one central location.
Expenses and Funding	
Increasing costs	• Operating efficiencies in association with transportation costs will be realized with the purchase of compaction bins with Growing Communities Fund. • Bylaw No. 2583 allows for a per bag fee to be charged to those not contributing to the service (Note: not currently implemented). This is something that with limiting the depot hours an operator could implement and manage.
Lower commodity markets and beverage container deposit revenue	• With the departure of the site caretaker, there is the opportunity to redirect the beverage container deposit and scrap metal revenue, currently included in the caretaker's compensation package, directly towards a funding source for the service
Withdrawal of Recycle BC support for residential packaging and paper	• Site improvements and development of an alternative option for commercial packaging and printed products is expected to address Recycle BC's concerns. Reinstatement of Recycle BC's support for the

ISSUE/OPPORTUNITY	COMMENTS
	community will reduce expenses that have been required to maintain the service in the interim. • Recycle BC's five-year plan is currently with the Province for approval. The draft plan introduced proposed criteria for communities to qualify for services, it is unclear at this time what impact this may have on existing service areas such as Port Renfrew and the Southern Gulf Islands.
Long-Term Planning	
Growing Communities Fund - $350,000	• Funds secured through the Growing Communities Fund will be directed to site improvements, as well as a business case study for the service.
Port Renfrew Official Community Plan 2024 Update	• This provides the opportunity to consult with the Port Renfrew community on the refuse service, including current service model (depot), location, scope of items accepted and associated financial contributions.

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ERM 24-11

REPORT TO ENVIRONMENTAL SERVICES COMMITTEE
MEETING OF WEDNESDAY, MARCH 20, 2024

SUBJECT **Curbside Collection of Packaging and Printed Products – 2024 Update**

ISSUE SUMMARY

To provide an update regarding the implementation of the new six-year contract with GFL Environmental Incorporated (GFL) for the provision of residential blue box curbside collection of packaging and printed products that began January 1, 2024.

BACKGROUND

At its October 12, 2022 meeting, the Capital Regional District Board approved a motion directing staff to enter into a six-year contract with GFL to provide residential curbside blue box collection from January 1, 2024 to December 31, 2029. GFL began service on January 2 but experienced roll-out challenges that have now largely been resolved. These challenges included:

- delayed delivery of the full fleet of specialized collection trucks due to a labour disruption
- changing collection days in some areas to optimize collection routes
- new collection crews learning collection routes
- increased volumes of recyclable materials following the Christmas holiday season
- a large snowfall event in early January that resulted in cancellation of collection for three days

The largest of these challenges was the delay in the delivery of the full fleet of 25 collection trucks, which meant that glass collection had to be suspended for the month of January because the back-up temporary replacement trucks were not configured to pick up three separate streams of materials. Glass collection resumed on February 1, but the large backlog of glass that then needed to be collected proved challenging, and there were days when not all materials were able to be collected on the scheduled collection day. Recovery collections were undertaken by GFL, including on weekends, and this backlog has now been cleared. Recyclable material volumes have now largely returned to normal levels and scheduled collections are now being fully completed.

As of the end of February, GFL has received 20 of the 25 trucks that were ordered in October 2022 for the program. The last three compressed natural gas fueled trucks are expected by mid-March and will continue to be replaced by the rental trucks until they are received. The remaining two trucks will be all-electric powered, but they are not expected to be delivered until the end of March due to manufacturing delays and will be put into service once they are received.

Understanding that its offices in Langford may not be convenient to many residents, GFL has been working to establish a distribution network for residents to obtain new and replacement blue boxes and bags throughout the region. There are now over 10 different distribution locations, including several municipal halls in the capital region.

CONCLUSION

The contract with GFL Environmental to provide curbside blue box collection began January 1, 2024, with a few roll-out challenges, including a delay in the delivery of collection trucks, resulting in the temporary suspension of glass collection, and there was inclement weather. These service delivery challenges have now largely been resolved, and service has normalized in the region. Two new all-electric collection trucks are expected to be received by the end of March and put into service as part of the program.

RECOMMENDATION

There is no recommendation. This report is for information only.

Submitted by:	Russ Smith, Senior Manager, Environmental Resource Management
Concurrence	Larisa Hutcheson, P.Eng., Acting General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

**REPORT TO ENVIRONMENTAL SERVICES COMMITTEE
MEETING OF WEDNESDAY, MARCH 20, 2024**

SUBJECT **Material Stream Diversion – Award of Contract ERM2022-010**

ISSUE SUMMARY

To provide an update on implementation of Hartland Landfill policy changes approved by the Capital Regional District (CRD) Board in December 2023, and to seek direction on next steps, including award of contract for construction and operation of a material diversion transfer station (MDTS).

BACKGROUND

In December 2023, the CRD Board passed a motion to adopt bylaw amendments, to come into effect in 2024, to divert materials from Hartland Landfill in alignment with the CRD's Solid Waste Management Plan.

Phase 1 of the Hartland policy changes were successfully implemented beginning January 1, 2024, including a ban on clean wood waste, changes to the tipping fee structure, introduction of a hauler waste stream collector incentive program, increases in fine rates, reductions for early payment of fines, and introduction of an education and warning program. To date, 22 Hartland commercial customers representing approximately 70% of Hartland's total general refuse tonnages have registered for the waste stream collector incentive. In the month of January, staff issued 30 warning tickets/MTIs to provide education around the clean wood ban, and 104.7 tonnes of clean wood was diverted from landfilling for recycling/energy recovery. Staff will continue to provide regular updates on implementation.

Phase 2 of the Hartland policy changes is planned to come into effect July 1, 2024, and includes further policy bans and tipping fee modifications. To support the execution of Phase 2 of the material diversion strategy, a Request for Proposals (RFP) for proponent to construct and operate a MDTS at Hartland to manage the processing, utilization, on-site operations and transportation of source-separated materials from Hartland Landfill was issued in September 2023, and closed January 2024.

Learnings through January's Phase 1 implementation have provided staff with valuable information about market response and participation. Phase 2 currently includes introduction of a new $300/tonne tipping fee for loads of unsorted renovation and demolition materials that contain banned items including wood waste. Market response to date suggests that under current market conditions, the $300/tonne rate will incent Hartland customers to seek lower cost landfill disposal options out of region, rather than divert banned materials, including wood waste. This is counter to the Solid Waste Management Plan objectives, and presents financial risk to the solid waste service, as these tipping fees would be paid out of region. To address this risk, staff recommend adding a Phase 3 of implementation in 2026 and shifting the implementation of $300/tonne rate to Phase 3, to allow the market time to develop processes to ensure removal of banned materials from refuse loads. To eliminate the risk of general refuse waste exiting the region during Phase 3, staff also recommend that the CRD immediately begin consultation on policies to restrict the flow of general refuse waste outside the capital region. These policies could be implemented as part of Phase 3 and would be subject to future consideration by the CRD Board. Additional material bans including rigid plastics could also be considered as part of Phase 3.

ALTERNATIVES

Alternative 1
The Environmental Services Committee recommends to the Capital Regional District Board:
1. That staff be directed to finalize negotiations, and the Chief Administrative Officer be authorized to enter into a two-year operating and construction contract, for a combined value not to exceed $12,500,000 (excluding GST) with DL's Bins, for the construction and operation of a material diversion transfer station to begin processing of clean wood, treated wood and asphalt shingles on July 1, 2024;
2. That staff be directed to return to the Environmental Services Committee with proposed bylaw amendments to shift the ban on carpet and underlay and salvageable wood to Phase 3;
3. That staff be directed to return to the Environmental Services Committee with proposed bylaw amendments to shift the implementation of the $300/tonne unsorted load rate to Phase 3; and
4. That staff immediately begin consultation on policies to restrict the flow of general refuse waste outside of the capital region.

Alternative 2
The Environmental Services Committee recommends to the Capital Regional District Board:
1. That staff be directed to finalize negotiations, and the Chief Administrative Officer be authorized to enter into a two-year operating and construction contract, for a combined value not to exceed $12,500,000 (excluding GST) with DL's Bins, for the construction and operation of a material diversion transfer station to begin processing of clean wood, treated wood and asphalt shingles on July 1, 2024;
2. That staff be directed to return to the Environmental Services Committee with proposed bylaw amendments to shift the ban on carpet and underlay and salvageable wood to Phase 3.

Alternative 3
That this report be referred back to staff for additional information.

IMPLICATIONS

Alignment with Board & Corporate Priorities

The proposed two-year contract under Alternative 1 aligns with the Board's desire to optimize the diversion of solid waste and maximize resource recovery from waste materials by executing new policies for diverting waste.

Service Delivery Implications

To support the execution of Phase 2 of the material diversion strategy, a RFP for proponent to construct and operate a MDTS at Hartland Landfill was issued in September 2023, and closed in January 2024. The RFP Package is included as Appendix A. Two submissions were received from Emterra Environmental and DL's Bins.

Staff have evaluated the MDTS proposals on technical and financial merit and conducted negotiations with the preferred proponent. Market feedback obtained through the procurement process identified that the costs to process and transport materials diverted from the landfill are higher than identified through the 2021 Market Sounding that was completed. A full financial evaluation is included in the financial implications section of this report.

Both proposals included options for processing clean and treated wood waste, asphalt shingles, and carpet and underlay. Neither proponent provided an option for salvageable wood, however negotiations with the preferred proponent have indicated that this could be considered as part of a Phase 3 alternative. Various options for staging were presented to allow for control of costs.

Staff recommend award of contract for the construction and operation of the MDTS to DL's Bins, enabling the start of Phase 2 policies July 1, 2024.

On the basis feedback obtained through procurement, staff recommend entering into a two-year 'pilot project' contract for the diversion and recycling/recovery of clean wood, treated wood and asphalt shingles. This two-year pilot will enable vendor learning on operational process and end-markets, allow the CRD to fully understand costs of material diversion, and minimize over all costs to the solid waste service.

At the end of the two-year pilot, and pending Board direction at that time, a new Phase 3 of implementation of the material diversion strategy would be implemented. Phase 3 could include a follow-on contract, terms of which are to be negotiated during the pilot period. This contract would extend the operation of the transfer station for a further 5 years, and expand accepted materials to include carpet and underlay, salvageable wood, books and rigid plastic. Additional capital investments at that time would be required to enable additional material streams, and a full financial evaluation would be brought forward at that time. Implementation of the ban on salvageable wood and carpet and underlay would be moved to Phase 3. Additional material bans on books and rigid plastics could also be considered at that time.

Alignment with Existing Plans & Strategies

Implementation of the proposed contract has the potential to divert up to 36,500 tonnes of waste per year from Hartland Landfill's active face, which would align with the Solid Waste Management Plan goal to target an annual disposal rate of 250kg per capita by 2031. Phase 3 could result in additional diverted tonnages.

Financial Implications

Alternative 1 (2-year contract) capital and operating expenditures over the 2-year contract are estimated to be $12.5 million ($3.5 million capital and $9 million operating), to be partially offset by diversion tipping fee revenue of $750,000 (20,000 tonnes). The shortfall will be funded within the 2024/25 Environmental Resource Management budget approvals and reserves.

Alternative 2 (2-year contract) capital and operating expenditures over the 2-year contract are estimated to be $12.5 million ($3.5 million capital and $9 million operating), to be partially offset by diversion tipping fee revenue of $750,000 (20,000 tonnes). The shortfall will be funded within the 2024/25 Environmental Resource Management budget approvals and reserves.

CRD Financial Services assisted in evaluating the long-term financial implications of the alternatives. The reserve balances have been projected to provide an indication of financial health and the need for tax requisition. Neither alternative is projected to require requisition support within the current 5-year planning horizon. Below is a summary of the proposed changes to tipping fees, and the implementation date:

Mandatory Recyclables		
Material Type	**Tipping Fee (per tonne)**	**Landfill Ban Implementation Date**
Clean Wood	segregated diversion $80	Phase 1
Treated Wood	segregated diversion $110	Phase 2
Asphalt Shingles	segregated diversion $110	Phase 2
Salvageable Wood	segregated diversion $0	Phase 3
Carpet and Underlay	segregated diversion $110	Phase 3
Renovation and Demolition Waste		
Clean	segregated diversion $150	Phase 2
Mixed	segregated diversion $150, with $500 fine in effect	Phase 2
Mixed	segregated diversion $300, with $500 fine in effect, potential flow control policies	Phase 3

Phase 1: January 1, 2024
Phase 2: July 1, 2024
Phase 3: 2026

CONCLUSION

The Capital Regional District (CRD) Board passed a motion to adopt the Hartland Landfill Tipping Fee and Regulation Bylaw and CRD Ticket Authorization Bylaw on December 13, 2023. The approval of these bylaws supports the goals and strategies of the CRD's Solid Waste Management Plan. Two proposals were received from the Request for Proposals issued in September 2023, one from Emterra Environmental and the other from DL's Bins. Upon review of the two proposals, staff recommend commencing a contract with DL's Bins for the processing, utilization, on-site operations and transportation of source-separated materials from Hartland Landfill.

RECOMMENDATION

The Environmental Services Committee recommends to the Capital Regional District Board:

1. That staff be directed to finalize negotiations, and the Chief Administrative Officer be authorized to enter into a two-year operating and construction contract, for a combined value not to exceed $12,500,000 (excluding GST) with DL's Bins, for the construction and operation of a material diversion transfer station to begin processing of clean wood, treated wood and asphalt shingles on July 1, 2024;

2. That staff be directed to return to the Environmental Services Committee with proposed bylaw amendments to shift the ban on carpet and underlay and salvageable wood to Phase 3;
3. That staff be directed to return to the Environmental Services Committee with proposed bylaw amendments to shift the implementation of the $300/tonne unsorted load rate to Phase 3; and
4. That staff immediately begin consultation on policies to restrict the flow of general refuse waste outside of the capital region.

Submitted by:	Russ Smith, Senior Manager, Environmental Resource Management
Concurrence	Larisa Hutcheson, P.Eng., Acting General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Material Stream Diversion Request for Proposals Package

APPENDIX A

ProposalRequest

PARKS & ENVIRONMENTAL SERVICES | ENVIRONMENTAL RESOURCE MANAGEMENT

Request for Proposals

RFP No. ERM2022-010

Processing, Utilization, On-Site Operations and Transportation of Source-Separated Materials from Hartland Landfill

September 2023

CAPITAL REGIONAL DISTRICT

Request for Proposals

Contents

List of Appendices and Submittal Forms

CAPITAL REGIONAL DISTRICT

REQUEST FOR PROPOSALS
Processing and Utilization of Source-Separated Materials from Hartland Landfill

RFP NO. ERM2022-010

1. Instructions to Proponents

1.1. Invitation

The Capital Regional District ("CRD") invites detailed proposals from contractors (the "Proponents") in strict accordance with these Proposal Documents (CRD, RFP No. ERM2022-010). The proposals will be evaluated for the selection of a contractor (or contractors) with the intent to enter into a contract (the "Contract") to provide the services described in Appendix "A".

1.2. Closing Time and Date for Submission of Proposals

The CRD will accept physical copies of each proposal plus **one copy on a USB stick**, in accordance with the instructions contained herein, at the following specific physical location:

Attention: Allison Chambers
Senior Administrative Secretary
Environmental Resource Management

Address: Capital Regional District
625 Fisgard Street
Victoria, BC, V8W 2S6

On or before the following date and time (the "Closing Time"):

Time: 4:00 pm PST
Date: 16 October 2023

The CRD reserves the right to extend the Closing Time at its sole discretion.

Proposals must not be sent electronically.

1.3. Not a Tender

This is a Request for Proposal and not a tender call.

1.4. Proposal Documents

Each Proponent will ensure it provides its correct name, address, email address, telephone and number to the CRD at the time the Proponent receives a set of Proposal Documents.

Failure to return the attached Receipt Confirmation Form to the CRD Representative listed in section 1.5 within five (5) days of receiving the Proposal Documents may result in no further communication regarding this RFP.

Please use and reference the above RFP number on all correspondence.

Proponents are advised to read and respond appropriately to all sections of the RFP.

Incomplete proposals may be rejected at the sole discretion of the CRD.

1.5. Inquiries

All inquiries related to this RFP, including whether or not the Contract has been awarded, should be directed in writing to the person named below (the "CRD Representative"). Information obtained from any person or source other than the CRD Representative may not be relied upon.

Name: **Allison Chambers**
Address: **625 Fisgard Street, Victoria BC, V8W 2S6**
Telephone: **250.360.3084**
Email: **achambers@crd.bc.ca**

Inquiries should be made no less than seven (7) days prior to Closing Time. The CRD reserves the right not to respond to inquiries made less than seven (7) days prior to Closing Time. Inquiries and responses will be recorded and may be distributed to all Proponents at the discretion of the CRD.

Proponents finding discrepancies or omissions in the Contract or RFP or having doubts as to the meaning or intent of any provision, should immediately notify the CRD Representative. If the CRD determines that an amendment is required to this RFP, the CRD Representative will issue a written addendum to the Proponents. No oral conversation will affect or modify the terms of this RFP or may be relied upon by any Proponent.

1.6. Information Meeting and Site Visit

An information meeting will be hosted by the CRD Representative to discuss the CRD's requirements under this RFP, a site visit will also be hosted at this time. The information meeting and site visit are optional. **At the time of issuance of this RFP a meeting has been scheduled as follows:**

Date: 5 October 2023
Time: 2:00 pm to 4:00 pm PST
Location: In-person, Victoria, BC

To RSVP attendance, as well as receive the attachments for Appendix A, proponents must become a Proponent of record by submitting the Receipt Confirmation Form (Appendix E).

1.7. Addenda

If the CRD determines that an amendment is required to this RFP, the CRD will issue a written addendum to all Proponents of record that will be incorporated into and become a part of this RFP. Failure to acknowledge and address all addenda in a Proposal may render the Proposal invalid.

1.8. Late Proposals

Proposals received after the Closing Time will not be accepted or considered. Delays caused by any delivery, courier or mail service(s) will not be grounds for an extension of the Closing Time. Proposals received after the Closing Time will be returned unopened to the Proponent.

1.9. Amendments to Proposals

Proposals may be revised by written amendment, provided they are delivered to the location set out in section 1.2. An amendment must be signed by an authorized signatory of the Proponent in the same manner as provided by section 2.3.

1.10. CRD's Right to Modify Terms and Negotiate

The CRD, at its sole discretion, reserves the right to modify the terms of the RFP at any time before the Closing Time. The CRD also reserves the right following the Closing Time, and in accordance with the terms of this RFP, to negotiate with one or more Preferred Proponents any modification or variation of the terms of the RFP, including any of the documents referred to in the definition of "Contract" herein or any modification or variation of the terms of any Proposal, including price, that the CRD considers to be in its best interests. For certainty, and without limiting the foregoing, the CRD may, for the purpose of entering into a Contract with any Proponent, amend the description of the required work included in this RFP so that it accurately reflects the services to be provided by the Proponent.

1.11. Examination of Contract Documents and Site

Each Proponent will be deemed to have carefully examined and understood the requirements and limitations of the RFP, including all attached Appendices, the Contract and the Site (as applicable) prior to preparing and submitting a Proposal, with respect to any and all facts which may influence the decision to prepare and submit a Proposal.

2. Proposal Submission Form and Contents

2.1. Package

Each Proposal must be submitted using a two-envelope process. One envelope must contain the Proponent's price, fee schedule or cost of its Proposal and be clearly marked "Financial Proposal" and the other envelope must contain the balance of the Proposal and be clearly marked "Technical Proposal". Proposals must be in a sealed package and marked on the outside with the Proponent's name, title of the Project and RFP number.

2.2. Form of Proposal

Proponents must submit their Proposal in accordance with the instructions set out in Appendix "B" – Form of Proposal, including Submittal Forms A to F.

2.3. Signature

The Proposal should be signed by a person authorized to sign on behalf of the Proponent and include the following:

(a) If the Proponent is a corporation, then the full legal name of the corporation should be included, together with the names of the authorized signatories. The Proposal should be executed by all of the authorized signatories, or by one or more of them provided that a copy of the corporate resolution authorizing those persons to execute the Proposal on behalf of the corporation is submitted.

(b) If the Proponent is a partnership or joint venture, then the legal name of the partnership or joint venture and the name of each partner or joint venturer should be included and each partner or joint venturer should sign personally (or, if one or more person(s) having signing authority for the partnership or joint venture should provide evidence to the satisfaction of the CRD that the person(s) signing have signing authority for the partnership or joint venture). If a partner or joint venturer is a corporation then such corporation should sign as indicated in subsection (a) above.

(c) If the Proponent is an individual, including sole proprietorship, the name of the individual should be included.

3. Evaluation and Selection

3.1. Evaluation Team

The evaluation of Proposals will be undertaken on behalf of the CRD by the Evaluation Team. The Evaluation Team may consult with others including CRD staff members, third party contractors and references, as the Evaluation Team may in its discretion decide is required.

3.2. Evaluation Criteria

The Evaluation Team will compare and evaluate each Proposal to determine the Proponent's strength and ability to provide the Services in order to determine the Proposal which is most advantageous to the CRD. Specific criteria and their importance are outlined in the Evaluation Form attached as Appendix "C."

3.3. Litigation

In addition to any other provision of this RFP, the CRD may, in its absolute discretion, reject a Proposal if the Proponent, or any officer or director of the Proponent submitting the Proposal, is or has been engaged directly or indirectly in a legal action against the CRD, its elected or appointed officers, representatives or employees in relation to any matter.

In determining whether or not to reject a Proposal under this section, the CRD will consider whether the litigation is likely to affect the Proponent's ability to work with the CRD, its contractors and representatives and whether the CRD's experience with the Proponent indicates that there is a risk the CRD will incur increased staff and legal costs in the administration of the Contract if it is awarded to the Proponent.

3.4. Additional Information

The Evaluation Team may, at its discretion, request clarifications or additional information from any Proponent with respect to any Proposal. The Evaluation Team may consider such clarifications or additional information in evaluating a Proposal.

3.5. Interviews

The Evaluation Team may, at its discretion, invite some or all of the Proponents to appear before the Evaluation Team to provide clarifications of their Proposals. In such event, the Evaluation Team will be entitled to consider the answers received in evaluating Proposals.

3.6. Multiple Preferred Proposals

The CRD reserves the right and discretion to divide up the Services, either by scope, geographic area, or on any other basis as the CRD may decide, and to select one or more Preferred Proponents to enter into discussions and/or negotiations with the CRD for one or more Contracts to perform all or a portion or portions of the Services. In addition to any other provision of this RFP, Proposals may be evaluated on the basis of advantages and disadvantages to the CRD that might result or be achieved from the CRD dividing up the Services and entering into one or more Contracts with one or more Proponents.

3.7. Negotiation of Contract and Award

If the CRD selects one or more Preferred Proponents, then it may enter into a Contract with the Preferred Proponent(s), or enter into discussions with the Preferred Proponent(s) to attempt to negotiate the terms of the Contract(s), and such discussions may include but are not limited to negotiating amendments to the Scope of Services and the Preferred Proponent's price(s).

If at any time the CRD reasonably forms the opinion that a mutually acceptable agreement is not likely to be reached within a reasonable time, the CRD may give the Preferred Proponent(s) written notice to terminate discussions, in which event the CRD may then either open discussions and/or negotiations with another Proponent or Proponents, or terminate the RFP and retain or obtain the Services in some other manner.

Proponents will be notified in writing when a Contract has been awarded.

4. General Conditions

4.1. No CRD Obligation

This RFP does not commit the CRD in any way to select a Preferred Proponent, or to proceed to discussions or negotiations for a Contract, or to award any Contract, and the CRD reserves the complete right to at any time reject all Proposals, and to terminate this RFP process for any reason.

4.2. Proponents Expenses

Proponents are solely responsible for their own expenses in preparing, submitting Proposals, and for any meetings, negotiations or discussions with the CRD or its representatives and contractors relating to or arising from this RFP.

4.3. No Contract

By submitting a Proposal and participating in the process as outlined in this RFP, Proponents expressly agree that no contract of any kind is formed under, or arises from, this RFP, prior to the signing of a formal written Contract.

4.4. Conflict of Interest

A Proponent shall disclose in its Proposal any actual or potential conflicts of interest and existing business relationships it may have with the CRD, its elected or appointed officials or employees. The CRD may rely upon such disclosure.

4.5. Solicitation of CRD Staff, Board Members and Contractors

Proponents and their agents will not contact any member of the CRD Board, CRD staff or CRD contractors with respect to this RFP, other than the CRD Representative named in section 1.5, at any time prior to entering into a Contract or the cancellation of this RFP.

4.6. Disclaimers/Limitations of Liability

Neither acceptance of a Proposal nor execution of a Contract constitute approval of any activity or development contemplated in any Proposal that requires any approval, permit or license pursuant to any federal, provincial, regional or municipal statute, regulation or bylaw. It is the responsibility of the Proponent to obtain such approval, permit or license prior to commencement of the work under the anticipated Contract.

The CRD, its elected officials, appointed officers, employees, agents, contractors and volunteers expressly disclaim any and all liability for representations or warranties expressed, implied or contained in, or for omissions from this RFP package or any written or oral information transmitted or made available at any time to a Proponent by or on behalf of the CRD. Nothing in this RFP is intended to relieve a Proponent from forming its own opinions and conclusions in respect of this RFP.

The CRD, its elected officials, appointed officers, employees, agents, contractors and volunteers will not be liable to any Proponent for any claims, whether for costs, expenses, losses, damages, or loss of anticipated profits, or for any other matter whatsoever, incurred by a Proponent in preparing and submitting a Proposal, or participating in negotiations for a Contract, or other activity related to or arising out of this RFP. By submitting a Proposal, each Proponent shall be deemed to have agreed that it has no right to make such claims.

4.7. Confidentiality

The RFP documents, or any portion thereof and any other confidential information to which a Proponent may have access as a result of this RFP process, may not be used by a Proponent for any purpose other than submission of Proposals.

By submitting a Proposal, every Proponent agrees not to divulge, release or otherwise use any information that has been given to it or acquired by it from the CRD on a confidential basis as a result of or during the course of the RFP process.

4.8. Ownership of Proposals and Freedom of Information

Each Proposal submitted, as well as any other documents received from a Proponent, become the property of the CRD, and as such are subject to the *Freedom of Information and Protection of Privacy Act* (“FIPPA”). FIPPA grants a general right of access to such records, but also includes grounds for refusing the disclosure of certain information.

Proponents are asked to specifically identify information contained in their Proposal that is submitted on a confidential basis. Subject to any requirement for access under FIPPA, the CRD will hold in confidence any such information received from a Proponent. However, the CRD specifically reserves the right to distribute information about any Proposal internally to its own directors, officers and employees, to its contractors and contractors where the distribution of that information is considered by the CRD to be necessary to its internal consultation process.

4.9. Time

The timing for the submission and receipt of Proposals and any amendments thereto shall be determined by reference to the CRD local area network time.

4.10. Acceptance of Terms

The submission of a Proposal constitutes the agreement of the Proponent that all the terms and conditions of this RFP are accepted by the Proponent and incorporated in its Proposal.

APPENDIX "A" – DESIGN, CONSTRUCTION AND OPERATION SPECIFICATIONS

1. Background

The Capital Regional District (CRD) governs 13 municipalities and 3 electoral areas located on the southern end of Vancouver Island. The Hartland Landfill (Landfill) is owned and operated by the CRD and is located approximately 14 kilometers (km) northwest of the City of Victoria, at 1 Hartland Ave, Victoria, BC, as shown in Figure 1 below.

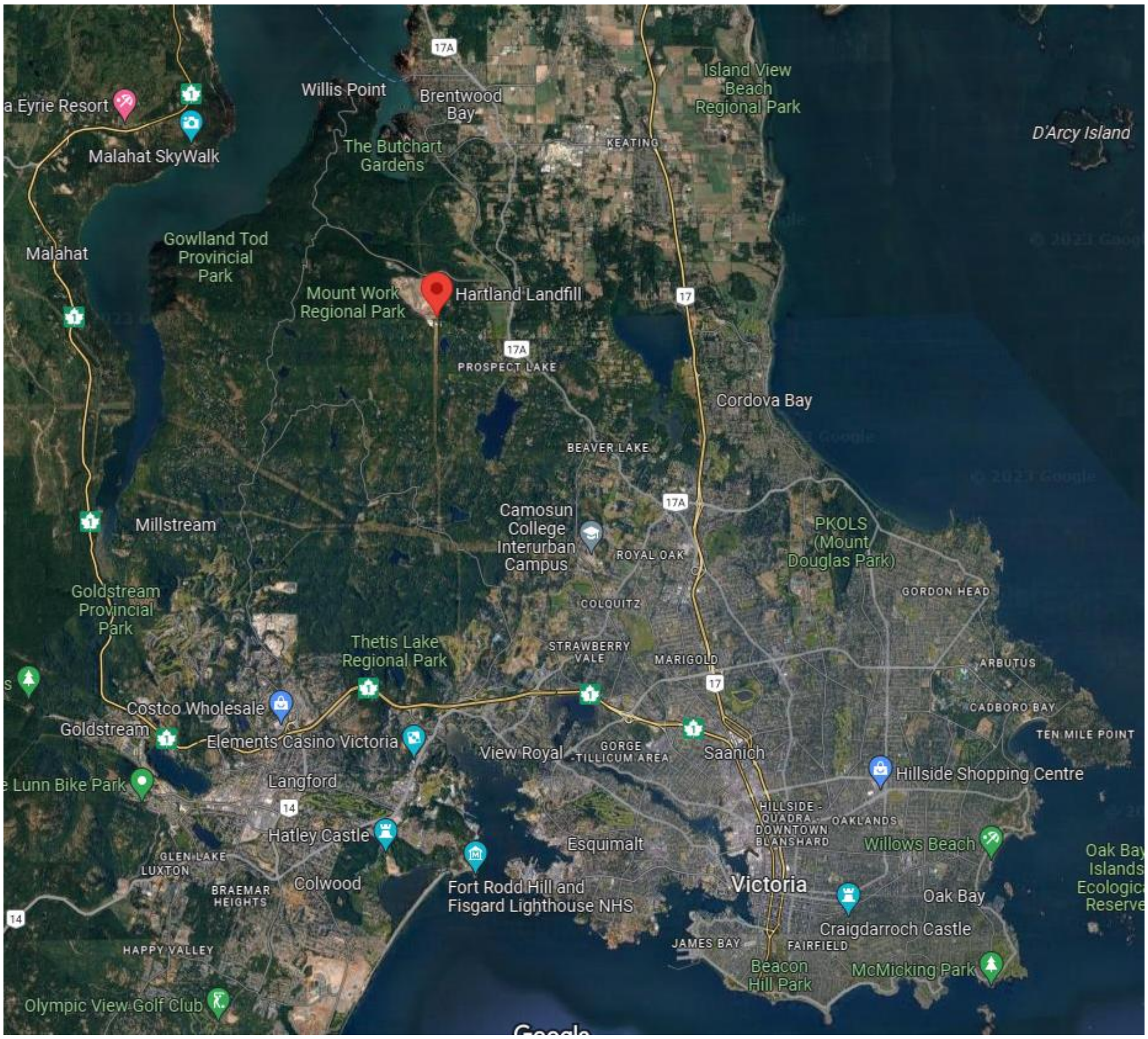


Figure 1 Landfill Location

The Landfill is a multi-purpose facility that provides the following waste management services and functions:

a) Landfill disposal of municipal solid waste for residential and commercial customers;
b) Landfill disposal of controlled waste;
c) Residential drop-off recycling depot for:
   - Household recyclable materials;
   - Extended Producer Responsibility (EPR) materials;
   - Household hazardous waste materials;
   - Reusable goods;
   - Food scraps, yard and garden material;

d) Residential and commercial food waste;
e) Leachate collection, treatment, and disposal;
f) Landfill gas collection, processing, conversion utilization and sale;
g) Administration and weigh scale facilities;
h) Learning Centre; and
i) Any other waste disposal and diversion initiatives as approved by the CRD Board.

In 2022, the Landfill accepted approximately 180,000 tonnes of solid waste for disposal and diverted over 16,640 tonnes of materials at the Hartland Public Drop-off Depot. In alignment with the CRD's Solid Waste Management Plan which follows the BC Ministry of Environment & Climate Change Strategy's (ENV) Pollution Prevention Hierarchy (Figure 2) to prioritize waste reduction, reuse and recycling as their first approach to waste management, the CRD intends to implement new policies in January 2024, to divert up to an additional 40,550 tonnes of material annually. This will be done through landfill bans on clean wood, treated wood, salvageable wood, asphalt roofing shingles, carpet and underlay, and optional materials such as books not accepted in the Recycle BC program and rigid plastics, all of which accounts for approximately 24% of the current mixed waste stream.

Figure 2 ENV Waste Reduction Hierarchy

With the landfill bans in place, surcharges will be applied to renovation and demolition loads containing these or other mandatory recyclable materials. The CRD currently operates a rental waste shredder at the Landfill's active face to improve their compaction rate.

In May 2022, the CRD Board endorsed the staff report titled *Meeting the Solid Waste Management Plan Targets through Material Stream Diversion*, which supports the procurement process for further material diversion (Attachment 1). In 2022, the CRD conducted a Waste Stream Composition Study (Attachment 2).

2. Definitions

Operations: refers to all on-site operations, including but not limited to transportation, loading, hauling, storage, reusing, recycling, repurposing, and pre-processing of material, parking, operation of equipment and management of the Material Diversion Transfer Station.

Works: refers to work required to design, construct, operate, and maintain the Material Diversion Transfer Station, including but not limited to equipment procurement, site and civil works, installation work, permitting and approvals and coordination with the CRD.

Material Diversion Transfer Station (MDTS): designated area where listed source-separated materials are consolidated, temporarily stored, processed, reused and repurposed for beneficial use off-site.

MDco: Material Diversion Transfer Station Contractor.

BUA: Beneficial Use Area: designated area encompassing both the Material Diversion Transfer Station and the Biosolids Mixing Area.

Biosolids Mixing Area: designated area where the CRD will be mixing and blending biosolids, adjacent to the Material Diversion Transfer Station.

End Users: refers to end use facilities where diverted and/or processed materials from the MDTS are transported to for beneficial use.

3. Partnership

The CRD encourages proponents to consider opportunities for indigenous employment, business involvement, and community opportunities for works at the Landfill, located in traditional territory of the W̱SÁNEĆ peoples. Proponents are encouraged to procure goods and services from W̱SÁNEĆ-affiliated businesses and to consider partnerships and joint ventures to benefit these communities. This is not a local preference, and each proponent will be evaluated on its merits at the time of submission.

4. Purpose

Through this Request for Proposals (RFP), the CRD invites submissions from Proponents with the capacity, ability and experience to design, build and operate (onsite operations, transportation/hauling as required and management of end use contracts) a MDTS to be located at the Landfill intended for the reuse, recycle, repurpose, or otherwise beneficially process the five source-separated waste streams listed below that will be diverted from the Landfill's active face through upcoming landfill bans. The scope additionally includes design and construction of the subgrade and final asphalt surface for the entire BUA (MDTS and Biosolids Mixing Area) however the CRD will operate the Biosolids Mixing Area. The CRD's preference is to enter into a single agreement with a single entity who has the capacity, ability and experience to complete the above scope of work.

This RFP relates solely to the MDTS operations, and reuse, recycle, repurpose, or recovery of the selected source-separated waste streams from the Landfill. Participation in this RFP will not restrict Proponents from participating in other CRD procurements.

Figure 3 below illustrates the scope of work discussed in this RFP and outlines interfaces with existing CRD operations.

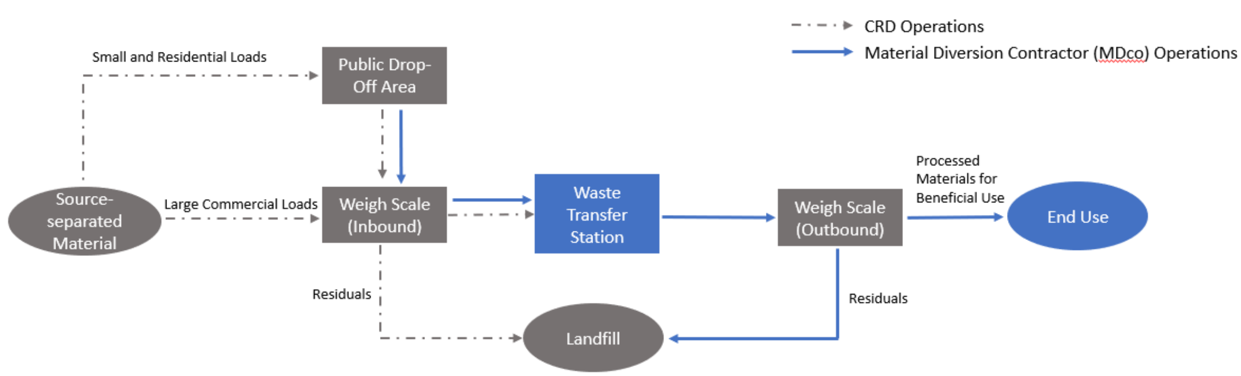


Figure 3 MDco Scope Design and Operations

The following materials will be collected at the Public Drop-Off Area or transported directly to the MDTS:

1. Clean Wood

2. Treated Wood
3. Asphalt roofing shingles
4. Carpet and underlay
5. Salvageable wood (in stacking racks)

Optional materials that will not be banned from the Landfill, but which the CRD would like to obtain pricing for pre-processing through the MDTS include:

6. Books (includes textbooks, novels, soft and hardcover books)
7. Rigid Plastics (non-EPR).

The following specifications present the minimum design considerations for the MDTS to be located at the Landfill. These specifications are broken into:

I. Design Specifications
II. Operations & Maintenance (O&M) specifications

5. Safety

MDco shall be solely and completely responsible for ensuring the safety of all employees. All contractors, where allowed by the Workers Compensation Act, must be registered with the Workers' Compensation Board (WorkSafeBC). The Contractor shall comply, at all times, with the WorkSafeBC Regulation. A current copy of the Contractor's Occupational Health and Safety Program, and site-specific safety plan as outlined in the WorkSafeBC OHS Regulation, must be made available to the CRD, upon request.

Health Hazards:

a) Oxygen deficiency
b) Build-up of highly toxic or flammable gases such as methane and hydrogen sulphide
c) Contact with refuse could cause skin irritations, cuts or abrasions
d) Handling of waste asbestos and controlled waste
e) Exposure to leachate
f) Exposure to septage and sewage sludge

5.1 Silica:

a) Dusty conditions (dust may contain silica)

5.2 Fire Hazards:

a) Ignition of pockets of methane gas may result in fire or explosion
b) Exposed decomposing waste may result in spontaneous combustion
c) The contents of some solid waste loads, such as lithium-ion batteries, may result in fires

5.3 Buried Refuse Stability Hazards:

a) Landfilled refuse may be unstable

5.4 Water Hazards:

a) Water hazards of varying depths exist on the landfill site

5.5 Slope Hazards:

a) Steep slopes of varying degrees exist on the landfill site

5.6 Traffic Hazards:

a) CRD staff, haulers, the general public, and various on-site contractors heavily utilize the Landfill roads

5.7 Power Lines:

a) BC Hydro power lines are situated throughout the landfill property

5.8 Personal Protective Equipment

a) Contractor personnel must wear personal protective equipment, including at a minimum, high visibility apparel and safety footwear.
b) Contractor personnel must utilize continuous air monitoring devices capable of measuring carbon monoxide, oxygen, hydrogen sulphide and the lower explosive limit for methane when working in potentially hazardous atmospheres.
c) Contractor personnel must be prepared to use respirators with appropriate filters, conduct respirator maintenance when required, and maintain fit-testing records on-site.
d) Unauthorized personnel shall not enter electrical switch rooms or controls rooms, including opening or closing of any switch, disconnect or circuit breaker on the property.
e) Due to the extreme fire hazard, contractors must obey the no smoking bylaw at Hartland Landfill.
f) All equipment must be well maintained.

6. Site and Operational Considerations

a) The CRD will provide approximately 1.3 hectares, denoted as MDTS Footprint in Drawing No. 24-W1067-1 – Location Plan, Vehicle Access Routing, Table of Contents and General Notes, for the purpose of this Work.
b) The MDTS Footprint currently consists of those features shown on Drawing No. 24-W1067-2 – Hartland Material Diversion Transfer Station Area Development Gravel Grading Plan, Detail and Coordinate Table.
c) The MDTS Footprint consists of a below grade smooth PVC membrane currently covered by 25 millimetres (mm) of sand, approximately 300mm of 25mm minus crush and varying depths of a topsoil, peat and compost mix. This is shown in Drawing No. 24-W1067-2 – Gravel Grading Plan, Detail and Coordinate Table.
d) A Waste Composition Study of Shredded Construction and Demolition Waste at the Hartland Landfill was conducted in February 2023 (Attachment 3).
e) The CRD has a program in place to identify asbestos containing materials and ensure they are properly disposed of. More information can be found in Attachment 4.
f) The CRD will make available a 100 feet (ft) x 110 ft sprung structure at no cost to MDco. Details of the sprung structure can be found in Attachment 5.
g) A paved area currently designated as the “Food Scraps Area” will be made available to the MDco on an as-needed basis, and with approval from the CRD, if additional footprint is required for MDTS operations. This is shown in Drawing No. 24-W1067-1.
h) The CRD has provided a Traffic Plan (Drawing No. 24-W1067, Section 14 Drawings) which outlines traffic flow requirements from the main Landfill gate to/from the MDTS boundary.
i) The CRD has provided a Fire Control Plan in Attachment 6.

j) MDco will not have access to any CRD services other than those explicitly mentioned within this Appendix A.
k) If required by MDco, the CRD can provide a location for a site trailer for MDco staff during operations at the current bird storage location indicated in Drawing No. 24-W1067-1. Two control buildings may also be available for MDco, pending decommissioning of the existing Gas Plant.
l) The footprint allocated for the MDTS is located on a closed portion of the Landfill; as a result, settlement of this area should be expected and accounted for during design and operation by MDco.
m) MDco will have priority access to the existing CRD weigh scales located at the entrance to the Landfill.
n) MDco will be able to dispose of waste at the active landfill face at no cost; however, MDco will be required to obtain a weigh scale ticket for any waste disposed of.
o) Potable water is not available near the MDTS.
p) Non-potable water is not available near the MDTS. Coordination with the CRD will be required to fill MDco holding tanks if non-potable water is required for operations.
q) Electrical service is not available near the MDTS.
r) The CRD will be stripping and cleaning up the MDTS footprint and a final survey will be provided to confirm the existing grade and fill requirements.
s) MDco will have access to CRD shot rock piles to crush aggregate needed for fill in the area.

7. Source-Separated Materials

Disposal bans on the source-separated materials listed below will be implemented at the Landfill as of January 2024, with the exception of rigid plastics and books which will not be banned from landfill disposal. Estimated annual tonnages provided for each material represent the maximum (100%) landfill diversion, based on the 2022 waste composition analysis. The CRD has no guaranteed minimums as these material tonnages are estimates and are expected to vary based on program participation.

a) **Clean Wood Waste**: Clean wood includes wood products that are untreated, unstained, unpainted and does not include any antisapstain, coatings, resins or glues, such as pallets, crating, wood fencing, wood shingles, wooden doors and clean renovation and demolition wood waste (up to 5,500 tonnes).
b) **Treated Wood Waste**: Treated wood includes engineered wood products or pressure treated, stained, or painted wood, and wooden furniture that may or may not contain nails or other metal fasteners (up to 22,000 tonnes).
c) **Salvageable Wood**: Painted or clean, minimum 4 ft in length. Nails are acceptable.
d) **Asphalt Roofing Shingles**: Asphalt roofing shingles includes shingles composed of a felt mat saturated with asphalt, with small rock granules added (up to 9,000 tonnes).
e) **Carpet and Underlay**: Carpet and underlay includes flooring material made of woven wool, silk, cotton or synthetic fibers and foam padding underlayment where tack stripping material has been removed (up to 4,000 tonnes).
f) **Books**: Books include textbooks, novels, softcover and hardcover books that are not currently accepted in the Recycle BC program (up to 60 tonnes). This does not include magazines, newspapers and phone directories.

g) **Rigid Plastics (non-EPR):** Hard plastic materials and products that are not included under EPR. This may include items such as plastic lawn chairs, kids toys, drums, etc. (up to 3,000 tonnes).

The CRD is currently in the process of completing a Shredded Waste Composition Analysis and will share the complete analysis results with proponents once it is available. The analysis is limited to mixed, unsorted construction and demolition waste only; however, the CRD is open to providing feedstock samples to proponents who would prefer to conduct their own testing.

If beneficial to MDco Operations, asphalt roofing shingles, carpet and underlay may be available from the Cowichan Valley Regional District (CVRD); however, minimum tonnages are not guaranteed. The CVRD received 525 tonnes of asphalt roofing shingles in 2022. Tonnages were not available for carpet and underlay. MDco may choose optionally to bid on transporting and accepting these materials. Refer to Appendix B, Submittal Form F- Other Services.

8. Design and Construction

The following section describes the scope of work and objectives related to the Design and Construction of the MDTS.

8.1 Design and Construction - Scope of Work

The CRD is seeking submissions from Proponents to design, permit, procure, supply, build, install, commission, operate and maintain a MDTS to be located at the Landfill. The MDTS shall be capable of reusing, recycling, repurposing, or otherwise pre-processing of the materials included in Section 7 above.

MDco's minimum scope of work shall include:

a) Detailed Engineering Designs (60%, draft Issued For Construction (IFC)) of the proposed MDTS. These shall include but are not limited to:
   i. Civil Drawings:
      1) Existing Conditions
      2) Site Layout
      3) Base Grades
      4) Final Grades
      5) Stormwater Management Plan

   ii. Structural Drawings:
      1) Foundations Drawings, if required
      2) Stockpile Loading Calculations (including the approximate anticipated height of stockpiles)

   iii. Utility Tie-in Drawings, if required.

b) Development of Plans including but not limited to:
   i. Schedule incl. Basis of Schedule
   ii. Project Execution Plan
   iii. Traffic Plan – this plan shall incorporate the CRD's Traffic Management Plan (Drawing No. 24-W1067, Section 14 Drawings).

iv. Permit List – this shall outline any permits required by MDco for construction and operation of the MDTS
v. Emergency Response Plan - this plan shall incorporate the CRD’s Emergency Response Plan
vi. Environmental Plan
vii. Site Specific Health and Safety Plan (inclusive of plot plan)
    1) Fire suppression
    2) CRD Contractor Occupational, Health □ Safety Project Checklist

viii. Stormwater Management and Erosions and Sediment Control Plan
ix. Operations and Maintenance (O□M) Plan
x. Monthly Report Template
xi. Closure Plan

c) Procurement of all equipment□
d) Temporary utilities and consumables required for Project Construction□
e) Site and civil works□
f) Structural installation work, if required□
g) Mechanical installation work, if required□
h) Electrical installation work, if required□
i) Permitting and approvals□
j) Coordination with the CRD throughout design, construction, and O□M□
k) Any other related work required to design, construct, operate and maintain the MDTS

MDco may propose alternative designs to those provided in this RFP. However all design and deliverables are subject to final approval by the CRD.

8.2 Design and Construction – Objectives

a) Throughout the design phase of the project, MDco shall consider and account for all health and safety design features, not limited to those mentioned within this document, that are required to construct, install, commission, test, operate and maintain the MDTS in a safe manner and in accordance with the BC Workers Compensation Act, BC Occupational Health and Safety Regulation, Policy, and Guidelines, including CRD protocols.

b) MDco shall design the MDTS such that all operations (storage, processing, hauling, parking, etc.) are completed on an asphalt binder surface with an aggregate base layer. Preference will be given to proposals which utilize recycled materials (such as recycled roadbase or concrete) for the asphalt surface and/or aggregate layer. Both the asphalt surface and aggregate layer shall be designed to adequately protect the below-grade PVC membrane. The CRD is open to alternative cost saving designs, such as modifications to the design surface and/or subgrade once the below grade PVC liner is adequately protected at all times and stormwater and leachate collection objectives are achieved. The gravel and road grading details (ref.: Drawing No. 24-W1067-2) provided are typical details□MDco may propose alternative materials for the asphalt and aggregate layer with approval from the CRD.

c) MDco shall design and operate the MDTS such that the maximum allowable load/stress on the below grade smooth PVC membrane is not exceeded. The technical specifications of the PVC membrane is available for reference as Attachment 8.

d) MDco may propose alternative traffic flows within the footprint of the MDTS for approval by the CRD.

e) An area located northeast of the MDTS shall be designated for biosolids mixing (□3,000 m^2) as indicated Drawing No. 24-W1067-1). This biosolids mixing area will remain available exclusively for the CRD's use.

f) MDco shall design and construct the subgrade and final asphalt surface for the entire BUA (MDTS and Biosolids Mixing Area).

g) Drawing No. 24-W1067-2 provides indicative site grading to manage stormwater. MDco may provide alternative site grading for approval by the CRD. However, all stormwater from the biosolids mixing area shall be routed towards the existing leachate collection system located on the eastern portion of the BUA as shown in Drawing No. 24-W1067-3.

h) MDco shall install effective treatment works for sediment control/solids reduction (e.g., catch basins, etc.) of all storm water run-off.

i) MDco shall design and construct the MDTS such that the quantity and type of materials coming in and out of the facility can be quantified. This can incorporate the use of CRD's weigh scales at the main gate.

j) The CRD would prefer to minimize teeing into existing utilities wherever possible.

9. Operations and Maintenance

The following section describes the scope of work and objectives related to the O&M of the MDTS.

9.1 Operations and Maintenance - Scope of Work

O&M of the MDTS shall include but is not limited to:

a) All loading and transportation of material from the MDTS, Kitchen Scrap Area, Public Drop Off Area and/or any other area which MDco may source material for the MDTS. (Commercial customers will be directed to offload source-separated materials directly at the MDTS).

b) Reusing, recycling, repurposing, or otherwise pre-processing of material at the MDTS in preparation for transfer to pre-approved End Use facilities.

c) All loading and transportation of material from the MDTS to pre-approved End Use facilities.

d) Loading and transportation of material not suitable for end-processing from the MDTS to the active face.

e) Supply and operate all necessary equipment for site operations and hauling.

f) Weighing of all material and material types processed and disposed. Loaded hauling/transportation equipment shall pass through the Landfill scale house for the CRD to accurately track material diversion. MDco will be provided with scale privileges to minimize standby time at the Landfill.

g) Maintain treatment works for sediment control/solids reduction in good working order. The CRD reserves the right to require additional treatment of SW if discharges result in a non-compliance of the landfill's Sewer Discharge Authorization under *Bylaw 2922, Capital Regional District Sewer Use Bylaw*, or other non-compliances under the Landfill's Operational Certificate. At no time, shall the contractor discharge *Hazardous Waste* as defined by the *BC Hazardous Waste Regulation*. The CRD will perform audit of stormwater discharges to confirm compliance.

h) Securing contracts with End Users, including negotiating, managing and holding any relevant contracts with End Users.

i) Maintaining records and providing the CRD with Monthly Reports.

j) Coordination with other contractors as required.

k) Utility/fuel consumption and recording.

l) Adhering to CRD Plans, local bylaws, standards and regulations.

m) Overall management of the MDTS including but not limited to:
   i. Educate users on material diversion locations,
   ii. Provide an Environmental, Health and Safety Plan,
   iii. Provide pre-processing capacity for materials on-site as required for End Use facilities
   iv. Coordinate with End Users to determine and conduct any necessary testing and pre-processing requirements of the End Use facility,
   v. Site Maintenance – including but not limited to:
      1) Maintain a clean Site by regularly removing source-separated materials,
      2) Ensuring the Site is free from loose or blowing garbage,
      3) Dust control as required,
      4) Snow removal,
      5) Fire Suppression,
      6) Asphalt/surface maintenance,
      7) Ensuring adequate protection at all times of the below grade smooth PVC membrane system
      8) Maintaining the CRD's Good Neighbour Policy.

9.2 Operations and Maintenance - Objectives

a) MDco shall operate and maintain the MDTS such that the quantity and type of material coming into and out of the facility can be quantified. This can incorporate the use of CRD's weigh scales at the main gate.

b) The MDco shall provide the CRD with a selection of available End Use options, associated costs per tonne and contamination tolerances for each option. These may include:
   i. Low volume options focused on innovative use of materials aligned with the waste hierarchy to reuse and recycle materials, supporting the development of a circular economy.
   ii. High volume options focused on maximizing diversion potential (e.g., wood waste to hog fuel).
   iii. Pilot projects with set timelines and objectives that could lead to innovation in the industry.

   The CRD is interested in End Use options which move waste higher up the waste hierarchy as per the ENV Waste Reduction Hierarchy. The CRD shall be able to select/prioritize End Use options available.

c) The CRD intends to evaluate Proponents on their methodology to continually seek out more cost effective or innovative material end-markets.

d) The consolidation and loading of materials shall be completed in a timely manner as there is limited ability for material stockpiling onsite.

9.3 Tolerances for Contamination

A maximum of 10-15% contamination threshold (by weight or volume, whichever is higher) for mandatory recyclables will be accepted at the start of the project. This will apply to the clean and treated wood, asphalt shingles, and carpet and underlay.

If contaminated/hazardous material is encountered at the MDTS, MDco shall notify the CRD and isolate the load to prevent material contamination. The MDco will be responsible for relocating mixed loads to the waste shredding stockpile at the Landfill's active face.

10. Operating Hours

The MDTS will not be accessible to the public; the public will only be permitted access to the Public Drop-Off for drop-off/pick-up. The MDTS will have the same operating hours as the Public Drop-off, which is currently open 9 am to 5 pm on weekdays and 7 am to 2 pm on Saturdays (closed Sunday and Holidays). In 2024, the CRD intends to pilot longer opening hours by extending the weekday hours by two hours to a total of 10 hours on weekdays and extending Saturday hours by 3 hours for a total of 8 hours. Exact opening hours will be confirmed with MDco.

11. Schedule

The CRD's tentative and non-binding schedule is provided below. This reflects an estimate of the process timelines at this stage and is provided solely for the convenience of the Proponent(s). The CRD will review proposal responses and request follow up interviews with shortlisted proponents. The following is the CRD's anticipated schedule:

Request for Proposals Steps	Date
RFP - Issued	September 18, 2023
Information Meeting (Optional)	October 5, 2023
Proponent's Site Visit (Optional)	October 5, 2023
Question Period Close	October 6, 2023
RFP - Closing	October 16, 2023
RFP - Award	November 10, 2023
In Service Target Date	January 31, 2024

The CRD's preference is for MDTS to be operational and in service starting in January 2024. The CRD understands that site prep and equipment lead time may make this target date challenging. Proponents are encouraged to consider project delivery options that can allow for some materials processing (e.g., limited streams or volumes) to begin in January 2024, even in advance of the full construction of the MDTS.

12. Length of Contract

The CRD is interested in contracting out operation of the MDTS for a 5-year term.

13. Attachments

To receive the attachments for this Appendix A, proponents must become a Proponent of record by submitting the Receipt Confirmation Form (Appendix E).

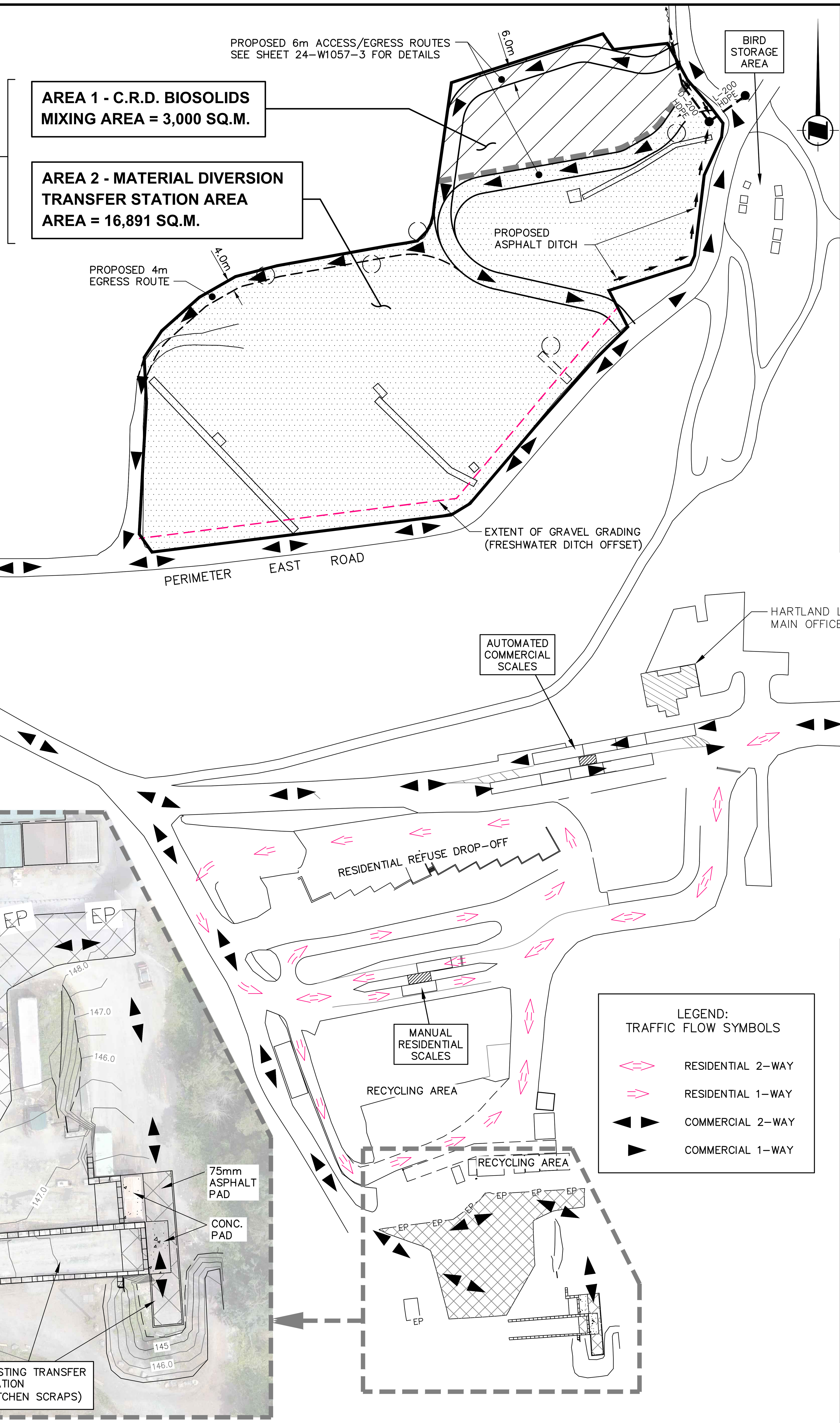
- Attachment 1: Staff Report: Meeting the Solid Waste Management Plan Targets through Material Stream Diversion
- Attachment 2: 2022 Solid Waste Stream Composition Study
- Attachment 3: Shredded Composition & Demolition Waste at the Hartland Landfill
- Attachment 4: Pre-approval application for Renovation & Demolition Waste
- Attachment 5: Sprung Structure Drawings
- Attachment 6: Hartland Landfill Fire Safety Plan
- Attachment 7: Current Bird Storage Location
- Attachment 8: Technical specifications of the PVC membrane

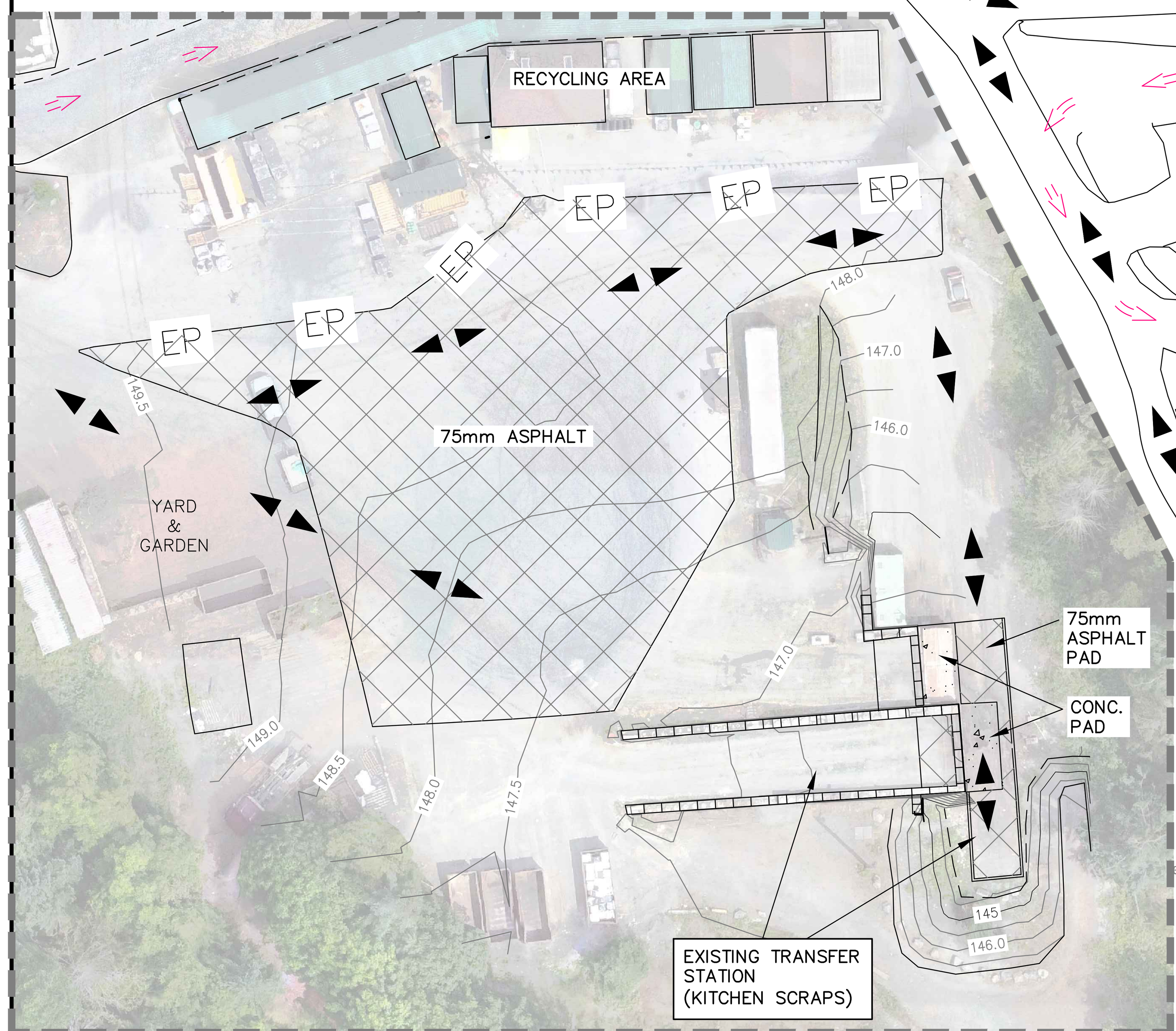
14. Drawings

WORKSITE AREA SUMMARY TABLE	
DESCRIBED AREA:	AREA (m^2)
AREA 1 – C.R.D. BIOSOLIDS MIXING AREA	3,000
AREA 2 – MATERIAL DIVERSION TRANSFER STATION AREA	16,891
TOTAL AREA	19,891

AREA 1 - C.R.D. BIOSOLIDS MIXING AREA = 3,000 SQ.M.

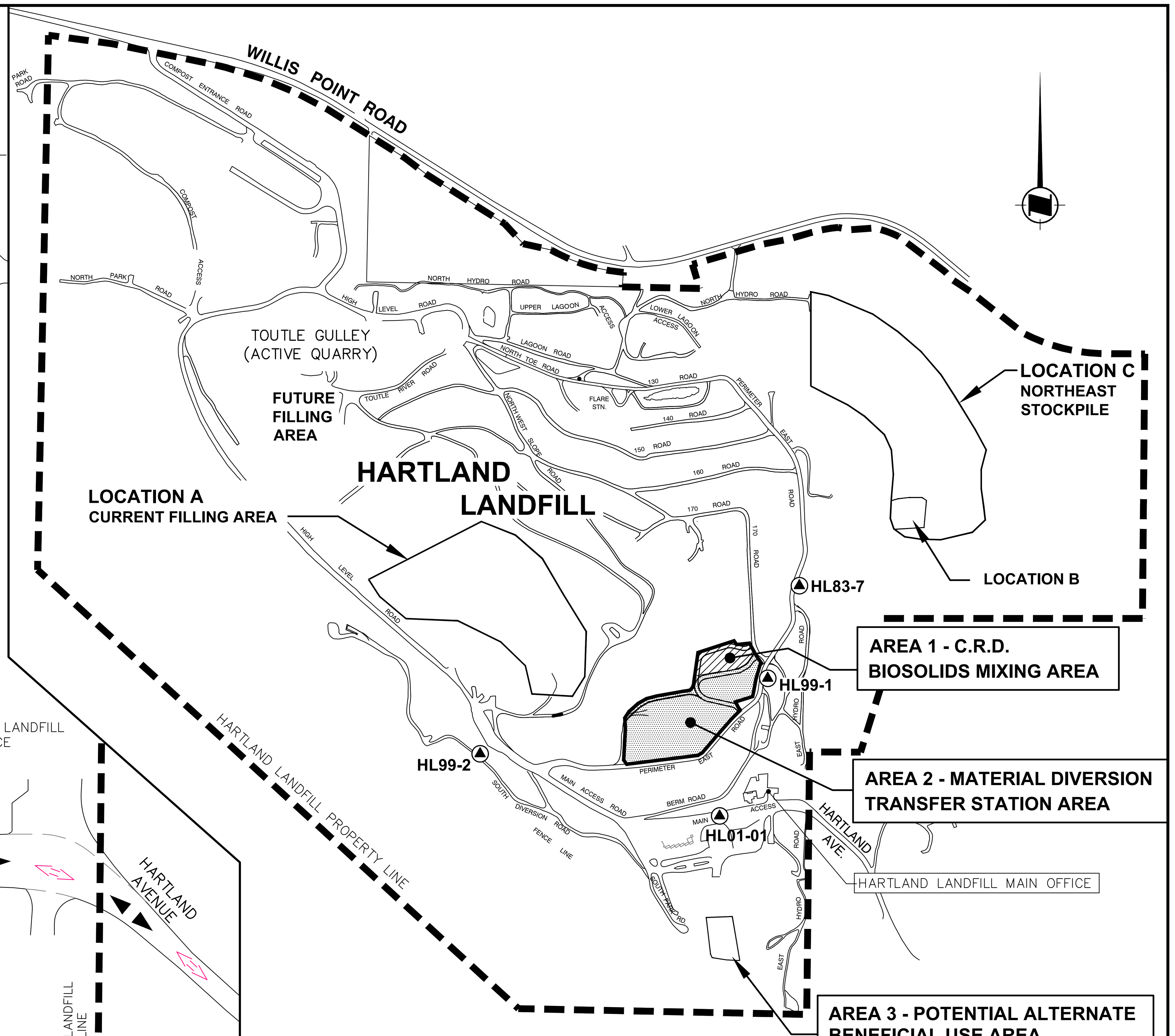
AREA 2 - MATERIAL DIVERSION TRANSFER STATION AREA AREA = 16,891 SQ.M.





INSET – AREA 3
1:400

VEHICLE ACCESS ROUTING
1:1000



LOCATION PLAN
1:5000

NOTES:

- CONTRACTOR TO COORDINATE WORKS WITH ENGINEER AT ALL PHASES OF CONSTRUCTION. ACTIVE LANDFILLING OCCURRING.
- ALL DETAIL SHOWN ON THESE DRAWINGS TO BE CONFIRMED IN THE FIELD.
- ANY ITEMS NOT SHOWN ON DRAWINGS TO BE REPORTED TO THE ENGINEER.
- ANY PORTION OF EXISTING LINER SYSTEM FOUND DAMAGED OR DAMAGED DURING CONSTRUCTION MUST BE REPORTED IMMEDIATELY TO THE ENGINEER.
- CONTRACTOR WILL REPAIR ANY DAMAGE TO EXISTING INFRASTRUCTURE.
- REMOVE DEBRIS AND VEGETATION WITHIN THE PROJECT AREA. DISPOSE OF WITHIN ACTIVE LANDFILLING AREA (CELL 3), OR AS DIRECTED BY THE ENGINEER.
- COORDINATES SHOWN ARE TO NAD83 UTM.
- ELEVATIONS ARE TO CANADIAN GEODETIC VERTICAL DATUM 28 (CGVD28) – METRES.
- EXISTING SURVEY MONUMENT COORDINATES AND ELEVATIONS (PER LOCATION PLAN):

MON. HL01–01	MON. HL83–7	MON. HL99–1	MON. HL99–2
N 5375706.614	N 5376053.443	N 5375913.974	N 5375800.291
E 466055.365	E 466175.318	E 466127.784	E 465694.922
ELEV. 150.032	ELEV. 162.585	ELEV. 171.022	ELEV. 186.376

LIST OF DRAWINGS

DWG. No.	TITLE
24–W1067–1	LOCATION PLAN, VEHICLE ACCESS ROUTING, TABLE OF CONTENTS AND GENERAL NOTES
24–W1067–2	DEDICATED BENEFICIAL USE AREA – GRAVEL GRADING PLAN, DETAIL AND COORDINATE TABLE
24–W1067–3	C.R.D. BIOSOLIDS MIXING AREA & MATERIAL DIVERSION TRANSFER STATION AREA – SITE PLAN, ACCESS ROAD PROFILE AND MANHOLE DETAIL
24–W1067–4	PROFILES AND DETAILS AND HEAT MAP

1:400 0 8 24m
1:1000 0 20 60m
1:5000 0 100 300m

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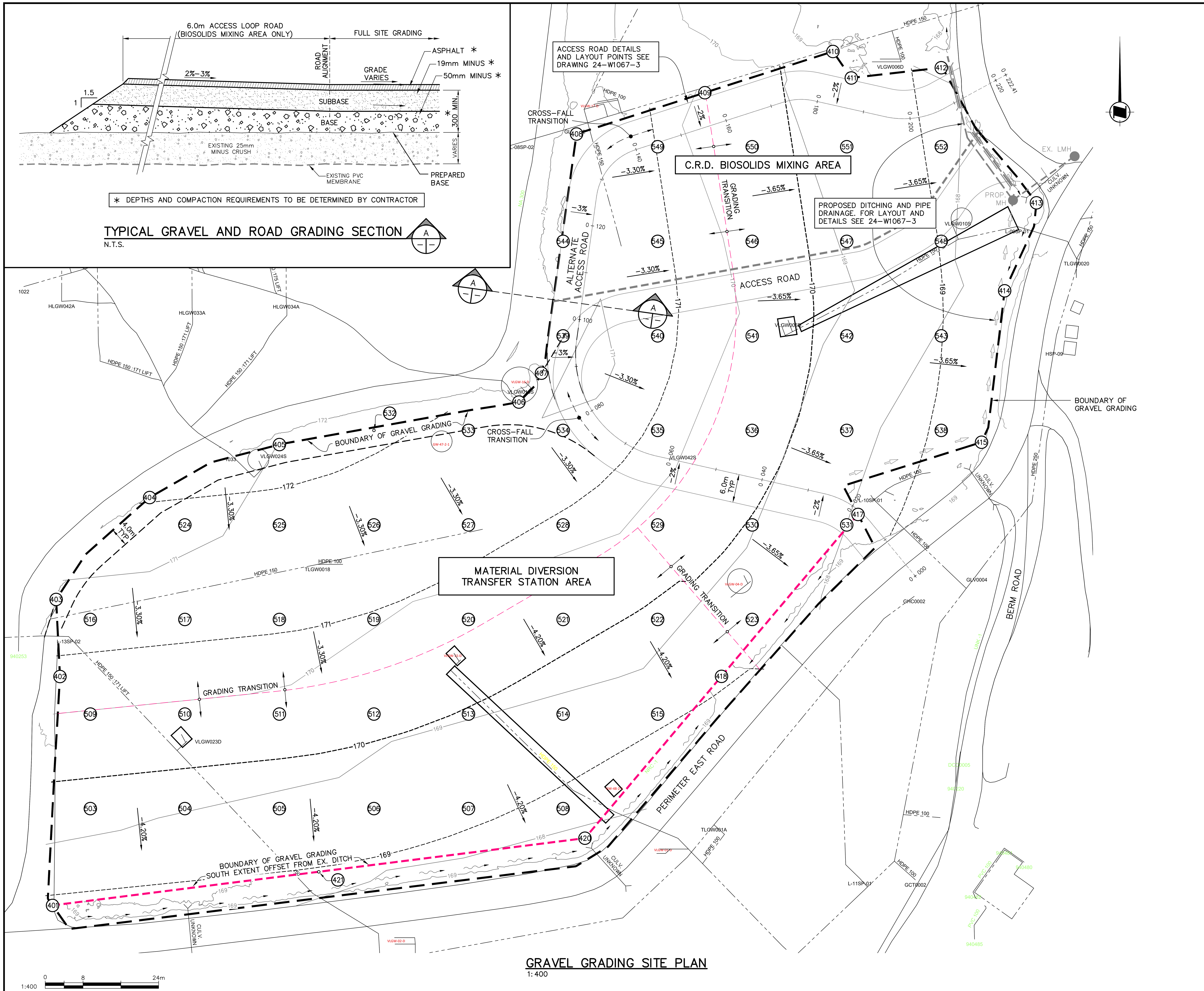
SCALE HORIZONTAL	SHOWN	CHECKED	SR
SCALE VERTICAL		APPROVED	IW

HARTLAND LANDFILL
HARTLAND MATERIAL DIVERSION TRANSFER STATION AREA DEVELOPMENT
LOCATION PLAN, VEHICLE ACCESS ROUTING, TABLE OF CONTENTS AND GENERAL NOTES

PROJECT REFERENCE ERM2022–010 | DRAWING NUMBER 24–W1067–1 | ISSUE 1 | SHT. No. 1 OF 4



TYPICAL GRAVEL AND ROAD GRADING SECTION

N.T.S.

GRAVEL GRADING SITE PLAN

1:400

COORDINATE TABLE – TOP OF GRAVEL LAYOUT				
Point #	Northing	Easting	Elevation	Description
401	5375789.515	465912.022	168.909	TOP OF GRAVELS – BOUNDARY
402	5375837.938	465913.593	170.855	TOP OF GRAVELS – BOUNDARY
403	5375854.239	465912.780	171.392	TOP OF GRAVELS – BOUNDARY
404	5375875.800	465932.559	172.033	TOP OF GRAVELS – BOUNDARY
405	5375887.000	465960.000	172.298	TOP OF GRAVELS – BOUNDARY
406	5375895.994	466010.666	171.801	TOP OF GRAVELS – BOUNDARY
407	5375902.104	466015.438	171.826	TOP OF GRAVELS – BOUNDARY
408	5375952.704	466022.857	171.531	TOP OF GRAVELS – BOUNDARY
409	5375961.436	466050.000	170.603	TOP OF GRAVELS – BOUNDARY
410	5375970.151	466077.088	169.578	TOP OF GRAVELS – BOUNDARY
411	5375964.559	466080.953	169.469	TOP OF GRAVELS – BOUNDARY
412	5375966.728	466100.000	168.770	TOP OF GRAVELS – BOUNDARY
413	5375938.133	466120.121	168.205	TOP OF GRAVELS – BOUNDARY
414	5375919.531	466113.399	168.521	TOP OF GRAVELS – BOUNDARY
415	5375887.492	466108.502	168.584	TOP OF GRAVELS – BOUNDARY
417	5375872.222	466082.387	169.293	TOP OF GRAVELS – BOUNDARY
418	5375837.975	466053.510	169.100	TOP OF GRAVELS – BOUNDARY
420	5375803.729	466024.632	168.495	TOP OF GRAVELS – BOUNDARY
421	5375796.622	465968.327	168.960	TOP OF GRAVELS – BOUNDARY
503	5375810.000	465920.000	169.731	TOP OF GRAVELS – GRID
504	5375810.000	465940.000	169.646	TOP OF GRAVELS – GRID
505	5375810.000	465960.000	169.562	TOP OF GRAVELS – GRID
506	5375810.000	465980.000	169.424	TOP OF GRAVELS – GRID
507	5375810.000	466000.000	169.170	TOP OF GRAVELS – GRID
508	5375810.000	466020.000	168.819	TOP OF GRAVELS – GRID
509	5375830.000	465920.000	170.567	TOP OF GRAVELS – GRID
510	5375830.000	465940.000	170.482	TOP OF GRAVELS – GRID
511	5375830.000	465960.000	170.397	TOP OF GRAVELS – GRID
512	5375830.000	465980.000	170.234	TOP OF GRAVELS – GRID
513	5375830.000	466000.000	169.944	TOP OF GRAVELS – GRID
514	5375830.000	466020.000	169.549	TOP OF GRAVELS – GRID
515	5375830.000	466040.000	169.125	TOP OF GRAVELS – GRID
516	5375850.000	465920.000	171.229	TOP OF GRAVELS – GRID
517	5375850.000	465940.000	171.163	TOP OF GRAVELS – GRID
518	5375850.000	465960.000	171.094	TOP OF GRAVELS – GRID
519	5375850.000	465980.000	170.944	TOP OF GRAVELS – GRID
520	5375850.000	466000.000	170.675	TOP OF GRAVELS – GRID
521	5375850.000	466020.000	170.274	TOP OF GRAVELS – GRID
522	5375850.000	466040.000	169.842	TOP OF GRAVELS – GRID
523	5375850.000	466060.000	169.478	TOP OF GRAVELS – GRID
524	5375870.000	465940.000	171.819	TOP OF GRAVELS – GRID
525	5375870.000	465960.000	171.747	TOP OF GRAVELS – GRID
526	5375870.000	465980.000	171.557	TOP OF GRAVELS – GRID
527	5375870.000	466000.000	171.246	TOP OF GRAVELS – GRID
528	5375870.000	466020.000	170.913	TOP OF GRAVELS – GRID
529	5375870.000	466040.000	170.508	TOP OF GRAVELS – GRID
530	5375870.000	466060.000	169.954	TOP OF GRAVELS – GRID
531	5375870.000	466080.000	169.428	TOP OF GRAVELS – GRID
532	5375890.000	465980.000	172.147	TOP OF GRAVELS – GRID
533	5375890.000	466000.000	171.815	TOP OF GRAVELS – GRID
534	5375890.000	466020.000	171.449	TOP OF GRAVELS – GRID
535	5375890.000	466040.000	170.926	TOP OF GRAVELS – GRID
536	5375890.000	466060.000	170.300	TOP OF GRAVELS – GRID
537	5375890.000	466080.000	169.613	TOP OF GRAVELS – GRID
538	5375890.000	466100.000	168.906	TOP OF GRAVELS – GRID
539	5375910.000	466020.000	171.786	TOP OF GRAVELS – GRID
540	5375910.000	466040.000	171.135	TOP OF GRAVELS – GRID
541	5375910.000	466060.000	170.464	TOP OF GRAVELS – GRID
542	5375910.000	466080.000	169.737	TOP OF GRAVELS – GRID
543	5375910.000	466100.000	169.009	TOP OF GRAVELS – GRID
544	5375930.000	466020.000	171.739	TOP OF GRAVELS – GRID
545	5375930.000	466040.000	171.088	TOP OF GRAVELS – GRID
546	5375930.000	466060.000	170.419	TOP OF GRAVELS – GRID
547	5375930.000	466080.000	169.698	TOP OF GRAVELS – GRID
548	5375930.000	466100.000	168.976	TOP OF GRAVELS – GRID
549	5375950.000	466040.000	170.986	TOP OF GRAVELS – GRID
550	5375950.000	466060.000	170.307	TOP OF GRAVELS – GRID
551	5375950.000	466080.000	169.585	TOP OF GRAVELS – GRID
552	5375950.000	466100.000	168.864	TOP OF GRAVELS – GRID

NOTES:

EXISTING GROUND SHOWN (TOP OF 25mm MINUS) IS NOT YET CONSTRUCTED AT TIME OF THIS GRADING DESIGN. POSITIONAL ACCURACY TO BE CONSIDERED AS SUCH. UPON COMPLETION OF PREPARATION OF THE 25mm EXISTING GROUND, A SURVEY WILL BE COMPLETED BY C.R.D. THEREFORE DESIGN SHOWN IS SUBJECT TO CHANGE.

INFERRED DEPTH OF EXISTING PVC LINER BELOW 'ASSUMED' EXISTING GRAVELS (DESIGN GRADING) IS 1.002m AVERAGE.

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SCALE VERTICAL		APPROVED	IW

HARTLAND LANDFILL

HARTLAND MATERIAL DIVERSION TRANSFER STATION AREA DEVELOPMENT
GRAVEL GRADING PLAN, DETAIL AND COORDINATE TABLE

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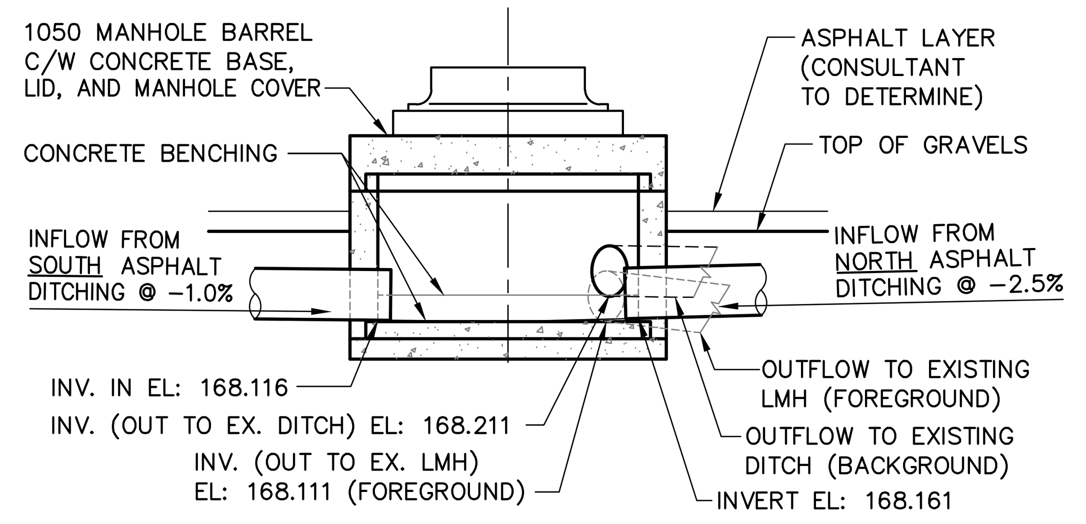
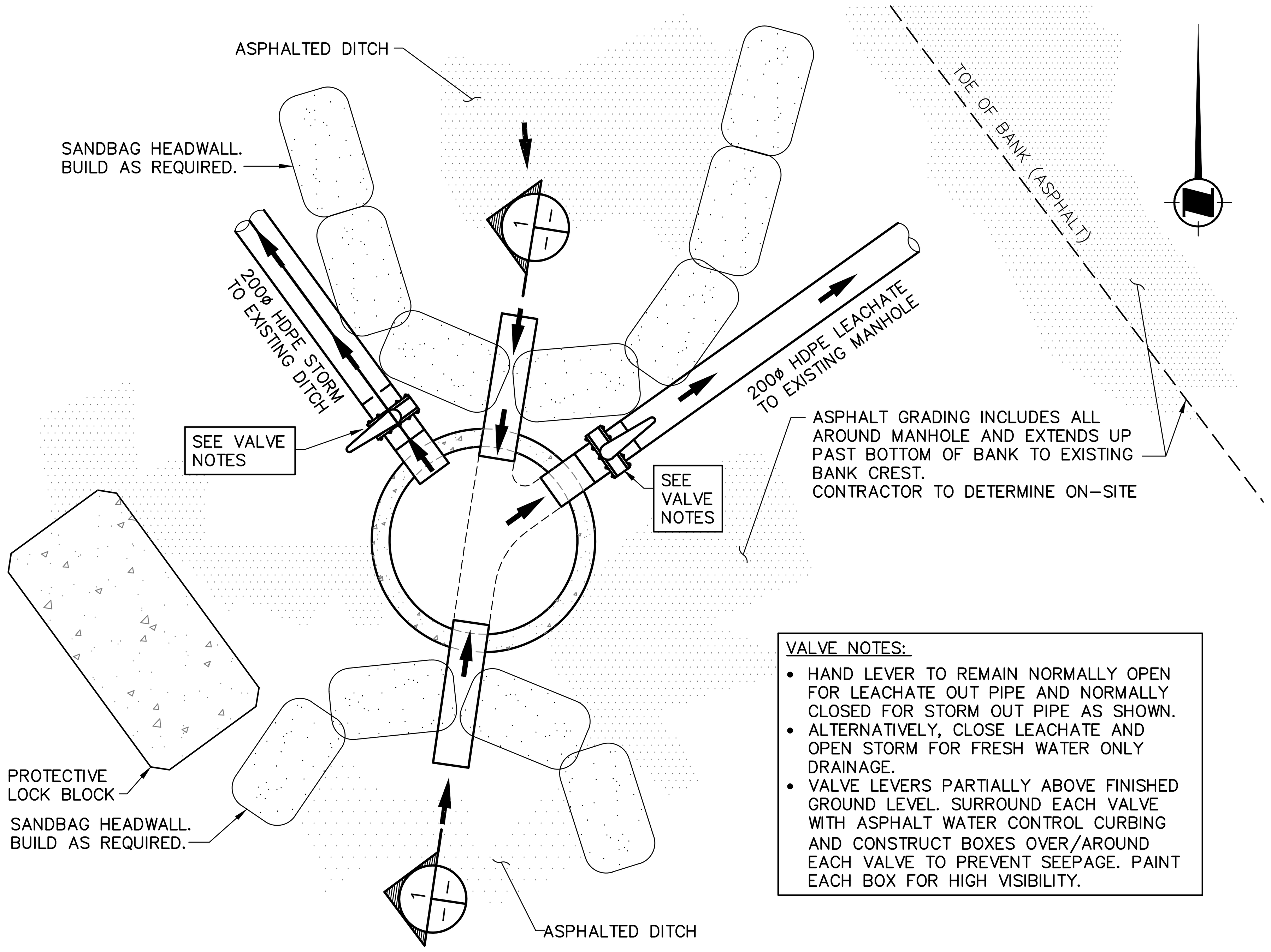
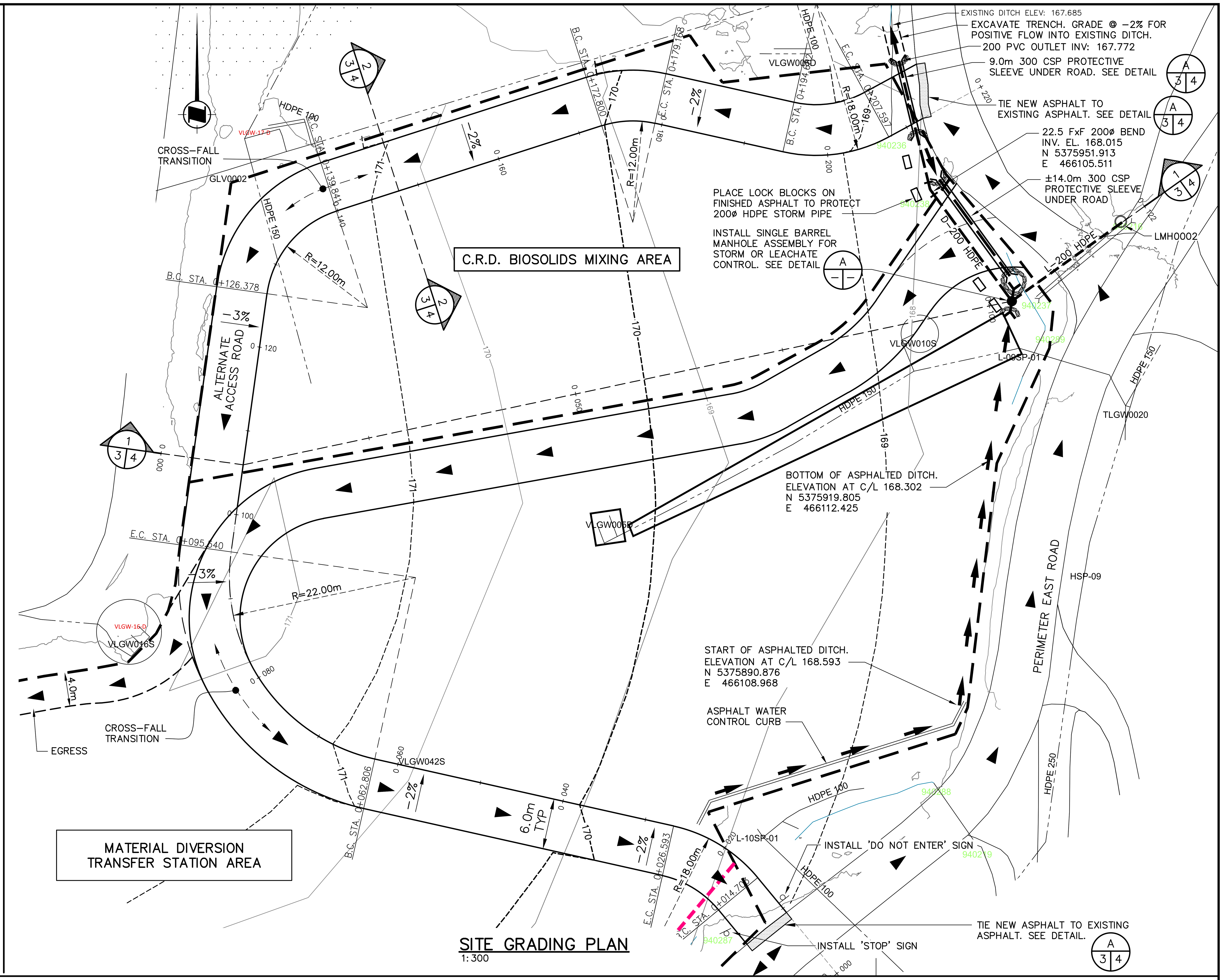


SECTION DETAIL
1:25

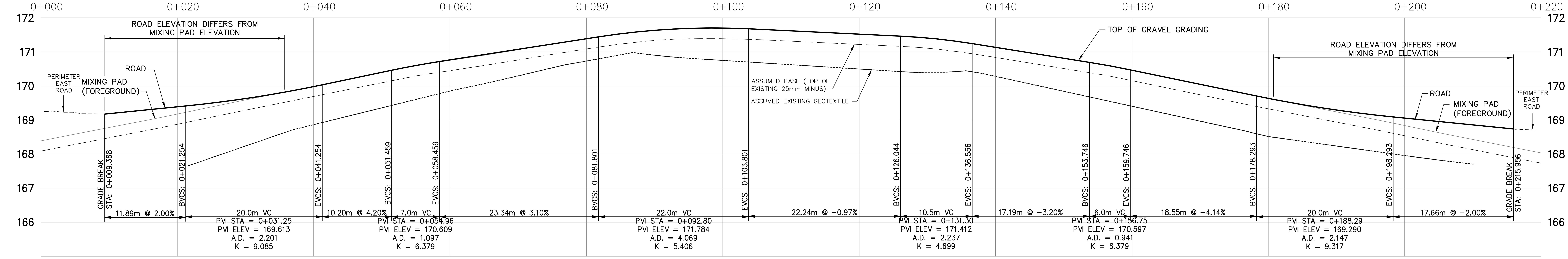


VALVE NOTES:
- HAND LEVER TO REMAIN NORMALLY OPEN FOR LEACHATE OUT PIPE AND NORMALLY CLOSED FOR STORM OUT PIPE AS SHOWN.
- ALTERNATIVELY, CLOSE LEACHATE AND OPEN STORM FOR FRESH WATER ONLY DRAINAGE.
- VALVE LEVERS PARTIALLY ABOVE FINISHED GROUND LEVEL. SURROUND EACH VALVE WITH ASPHALT WATER CONTROL CURBING AND CONSTRUCT BOXES OVER/AROUND EACH VALVE TO PREVENT SEEPAGE. PAINT EACH BOX FOR HIGH VISIBILITY.

MANHOLE DETAIL
1:25



SITE GRADING PLAN
1:300



PROFILE ALONG INSIDE EDGE OF ALTERNATE ACCESS ROAD
1:300(H), 1:60(V)

ISSUE	DATE	BY	REVISION DESCRIPTION - COLUMN 1	ENG.	ISSUE	DATE	BY	REVISION DESCRIPTION - COLUMN 2	ENG.	SEAL	No.	DATE	ISSUE
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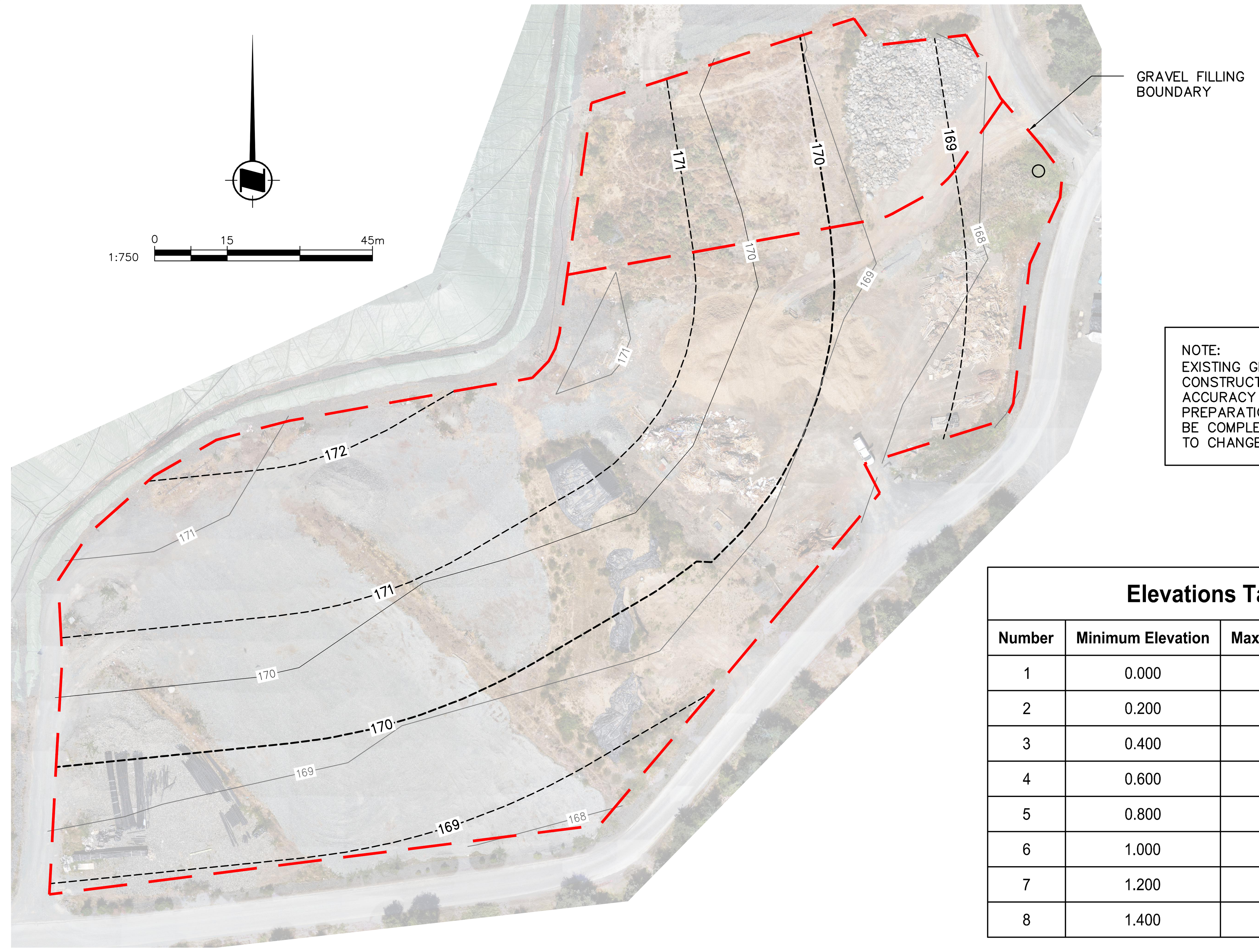
SCALE VERTICAL		APPROVED	IW

HARTLAND LANDFILL

HARTLAND MATERIAL DIVERSION TRANSFER STATION AREA DEVELOPMENT C.R.D. BIOSOLIDS MIXING AREA & MATERIAL DIVERSION TRANSFER STATION AREA – SITE PLAN, ACCESS ROAD PROFILE AND MANHOLE DETAIL

PROJECT REFERENCE ERM2022-010 | DRAWING NUMBER 24–W1067–3 | ISSUE 1 | SHT. No. 3 OF 4



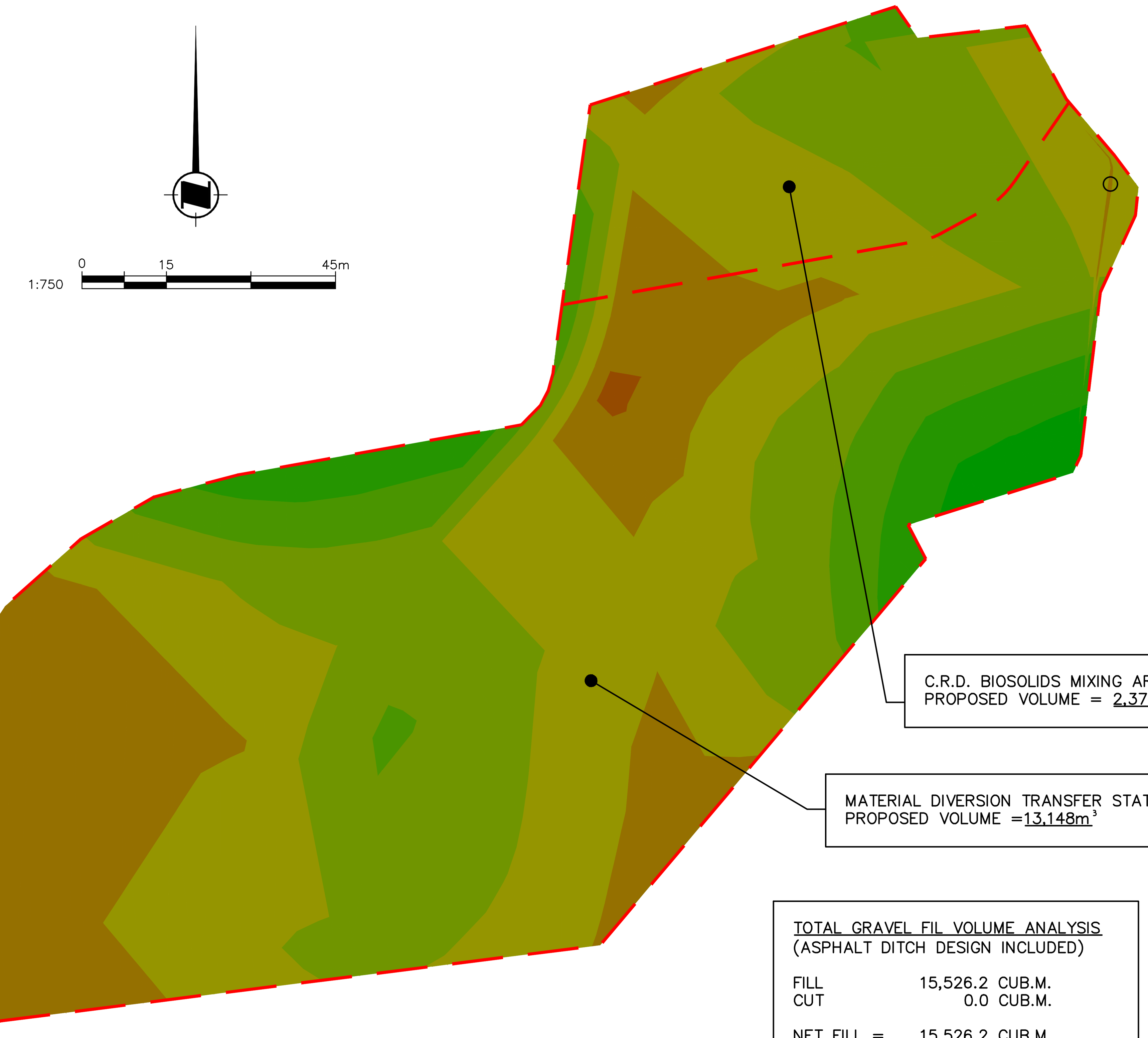
SITE PLAN – EXISTING TOPOGRAPHY
1:750

NOTE:
EXISTING GROUND SHOWN (TOP OF 25mm MINUS) IS NOT YET CONSTRUCTED AT TIME OF THIS GRADING DESIGN. POSITIONAL ACCURACY TO BE CONSIDERED AS SUCH. UPON COMPLETION OF PREPARATION OF THE 25mm EXISTING GROUND, A SURVEY WILL BE COMPLETED BY C.R.D. THEREFORE DESIGN SHOWN IS SUBJECT TO CHANGE.

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	0.000	0.200	
2	0.200	0.400	
3	0.400	0.600	
4	0.600	0.800	
5	0.800	1.000	
6	1.000	1.200	
7	1.200	1.400	
8	1.400	1.630	

FILL REQUIRED TO MEET DESIGN

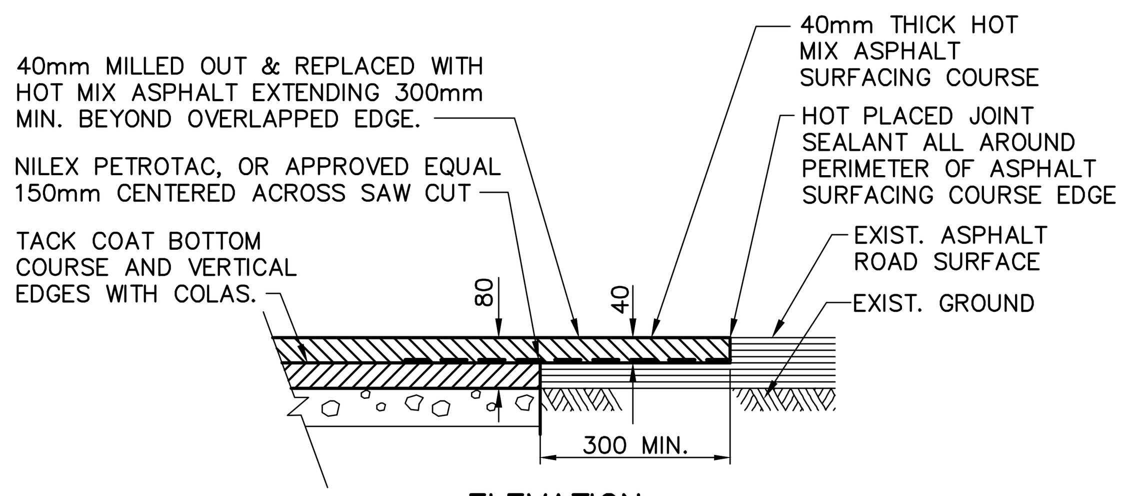


TOTAL GRAVEL FIL VOLUME ANALYSIS
(ASPHALT DITCH DESIGN INCLUDED)

FILL 15,526.2 CUB.M.
CUT 0.0 CUB.M.

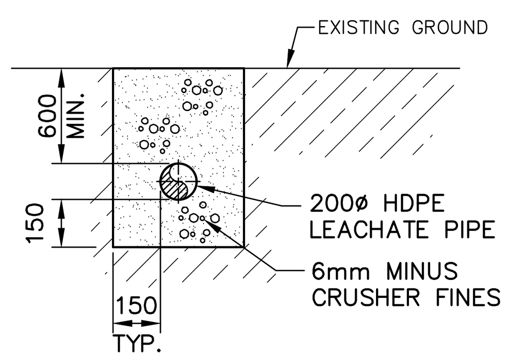
NET FILL = 15,526.2 CUB.M.

SITE PLAN – GRAVEL FILLING ANALYSIS
1:750



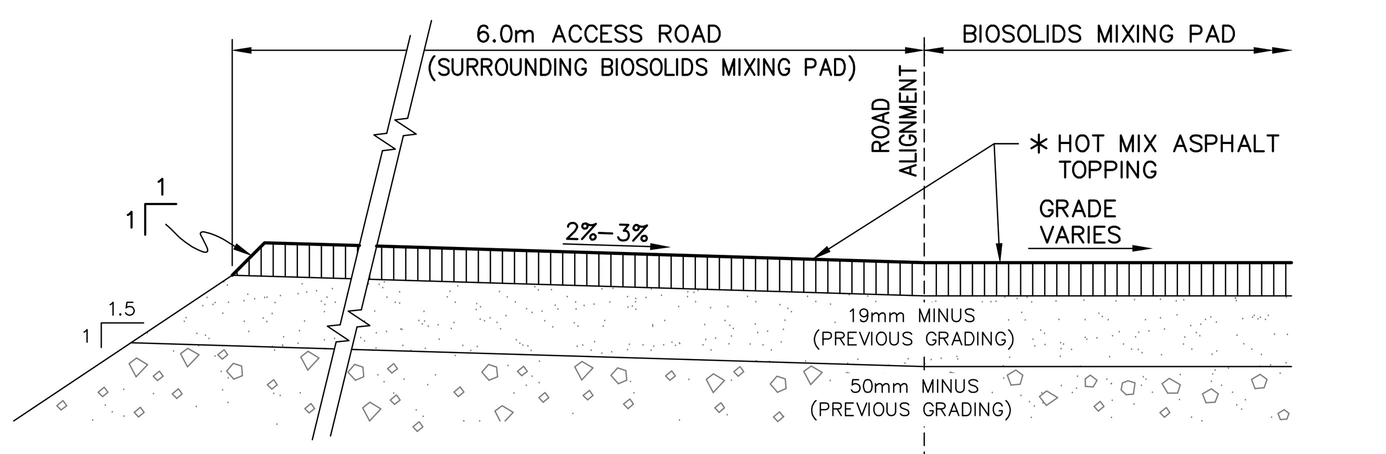
ELEVATION

TYPICAL NEW TO EXISTING ASPHALT CONNECTION DETAIL (A, 3 | 4)
N.T.S.



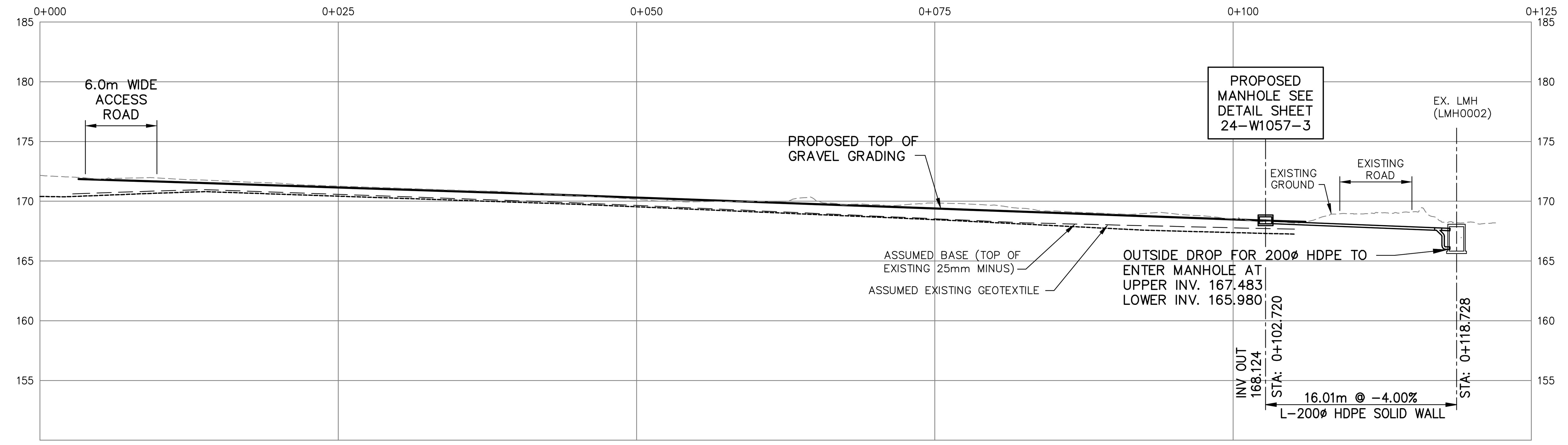
ELEVATION

TYPICAL LEACHATE TRENCH DETAIL
NTS



* CONTRACTOR TO DETERMINE ASPHALT THICKNESS, COMPACTION AND REQUIRED MATERIAL VOLUME

TYPICAL ASPHALT AND ROAD GRADING SECTION (2, 3 | 4)
1:25



SECTION THRU C.R.D. BIOSOLIDS MIXING AREA (1, 3 | 4)
1:300 (H&V)

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HARTLAND LANDFILL

HARTLAND MATERIAL DIVERSION TRANSFER STATION AREA DEVELOPMENT
PROFILES & DETAILS AND HEAT MAP

PROJECT REFERENCE ERM2022–010 | DRAWING NUMBER 24–W1067–4 | ISSUE 1 | 4 | SHT. No. 4 OF 4

APPENDIX “B” – FORM OF PROPOSAL

Proposals must include the information outlined in this section. To facilitate evaluation, proposals should be organized as follows:

1. THE FIRM

1.1 Project Experience

Provide details of the firm’s experience with similar projects, including experience with:

- Material processing
- Transportation/hauling coordination
- Operations in waste facilities or similar.

1.2 Location of Firm

List the location(s) of the firm, both local and global if applicable.

1.3 Identify as First Nations

Confirm whether the Firm identify as First Nations and include:

- Experience working with First Nations
- Intention of including First Nations subcontractors for the proposed work.

2. THE PERSONNEL

Provide details of the proposed project team, including:

- Relevant experience.
- Provide a team organization chart, including any subcontractors. Outline each team member’s role and their qualifications. Include resumes of key team members or subcontractor in an Appendix.
- Local knowledge.

3. THE METHOD

3.1 Project Understanding

In your own words, demonstrate your understanding of the project by summarizing the project requirements, identifying important aspects and needs.

3.2 Environment, Health and Safety

Provide details of your safety program and environmental management system. Describe how each will be implemented for this project both in construction and operations.

3.3 15% Design

Provide the following as part of a 15% preliminary design:

- Preliminary Site Layout (including usage of the Food Scraps area on an as needed basis if required)
- Preliminary Traffic Flow / Traffic Management Plan
- Preliminary Stormwater Management Plan

- Tie-in and Utility Requirements (if any)

3.4 Schedule

Provide a proposed progress schedule in the form of a bar graph indicating the start and completion times of the various project stages. Refer to “Submittal Form B- Schedule”. The schedule should include:

- □ey work activities and deliverables in terms of weeks after notification to award.
- Assumptions for review periods (i.e., documents submitted to the CRD for review and approval).
- Major Milestones

3.5 Ope□ations and Maintenance Methodolog□

Provide a proposed operations and maintenance methodology, outlining your technical approach to address the projects ‘Operations and Maintenance – Scope of Work’ outlined in Schedule A. The methology should include but is not limited to:

- General description of material process flow (including usage of the Food Scraps area on an as needed basis if required)
- Onsite pre-processing equipment and requirements
- Approach to securing various End Use Options for pre-processed material
- A selection of current available End Use options. Include relevant experience with End Use options or End Users if available.
- Assumptions, issues, constraints, and other factors which may affect operations
- Any additional work that may be required to ensure success.

Preference may be given to responses that address additional items (requirements or approach) that were not specifically provided for in the scope of work but will add value to the project’s overall success.

3. RE□ERENCES

Provide references for the firm and all key team members and subcontractors. Refer to “Submittal form C- References”.

4. □INANCIAL PROPOSAL (EN□ELOPE T□ O)

Financial proposals shall be provided in a separate sealed envelope. The financial proposal envelopes will not be opened until after the technical evaluation of all proposals has been completed. The Financial Proposal will be evaluated based on the fee schedule and total upset prices submitted by the Proponent. Financial proposals shall include all commercial considerations including the following:

- State the legal name of the firm and authorized signature of individuals who will be responsible for the services:
  - Disbursements shall also be broken down and shown by work activity. Also provide subtotals by hours and by fees for each firm involved, if applicable. Refer to attached “Submittal Form A – Payment Terms”.
  - Provide itemized costs of any services which will be varied or excluded from the present Scope of Services. Refer to attached “Submittal Form D – Excluded Services” and “Submittal Form E – Proposed Variation to the Scope of Services”.

- Provide an itemized price for any other or additional services outside the present Scope of Services believed to be essential to completion of the project. Refer to attached “Submittal Form F – Other Services”.
- Pricing shall be in Canadian dollars, excluding 5% GST
- Rates shall be fixed for the duration of the contract except as explicitly noted in the contractor’s proposal.
- Travel disbursement for out-of-town personnel shall be quoted on the most economical travel methods.
- Fees are to be billed on an hourly basis. Fees and disbursements are to be billed to a maximum upset total price, except as provided for. State number of hours of work per day

6. SUBMITTAL FORMS

In addition to the information included within this Appendix B, Proposals must include the following submittal forms to be considered complete:

1. Submittal Form A: Payment Terms
2. Submittal Form B: Schedule
3. Submittal Form C: References
4. Submittal Form D: Excluded Services
5. Submittal Form E: Proposed Variation to the Scope of Services
6. Submittal Form F: Other Services

APPENDIX “C” – EVALUATION FORM

Capital Regional District
REQUEST FOR PROPOSALS

Processing, Utilization, On-Site Operations and Transportation of Source-Separated Materials from Hartland Landfill
RFP No. ERM2022-010

Evaluation of Technical Proposals
(Maximum 100 Points)

	POINTS	Proponents								
1. THE FIRM 1.1 Experience with similar projects:										
a) Material Processing	2									
b) Transportation/hauling coordination	2									
c) Onsite operations	2									
1.2 Location of firm	2									
1.3 Identify as First Nations	2									
TOTAL FIRM	**10**									
2. THE PERSONNEL 2.1 Project Team										
a) Experience	4									
b) Qualifications	4									
c) Local knowledge	2									
TOTAL PERSONNEL	**10**									

Evaluation Form, continued

	POINTS	P□oponents								
Total B□ought □o□□a□d										
3. T□E MET□OD										
3.1 Project understanding	2									
3.2 Health, Environment and Safety	2									
3.3 15% Design	6									
3.4 Schedule	2									
3.5 Operations □ Maintenance Methodology	8									
TOTAL MET□OD	**20**									
4. □INANCIAL PROPOSAL										
Capital Cost (CAPEX)	25									
Operating Cost (OPEX)	35									
TOTAL □INANCIAL	**60**									
TOTAL POINTS	**100**									

Capital Regional Dist□ict P□oponents Polic□ - E□aluation P□ocedu□es

Technical merit (the firm, the personnel and the method) is awarded a maximum of 40 points. Each technical presentation will be evaluated on the basis of the firm□s experience, competence of its personnel and acceptability of the method proposed.

A firm□s technical proposal shall be deemed qualified only if it complies with all requirements contained in the Request for Proposal.

Only proposals whose technical scores are within 15% of the proposal awarded the highest technical score will have their financial proposals opened and evaluated. All other financial proposals will be returned unopened upon appointment of the selected firm. The only exception to this policy is when the proposal of the second-ranked firm is more than 15% below the highest technical score and still technically qualified. In such a case, the second-ranked firm would have its financial proposal opened to avoid a non-competitive situation.

In all cases, the CRD reserves the right to cancel the competition and call for new proposals.

Financial proposals can be awarded a maximum of 60 points. The financial proposal with the lowest cost of fees will be awarded 60 points, which will be added to the technical score, resulting in the firm's total score. The percentage by which each of the remaining firms' proposed costs exceeds the cost of the lowest qualified proposal will be the percentage by which the 60 points is reduced, prior to adding it to the technical score resulting in each firm's total score.

For example, if the proposed cost of Firm A exceeds the lowest proposed cost (Firm B) by 10%, Firm A will add 60 minus (10% of 60), or 54 points to its technical score. The firm receiving the highest total score will be judged to have the best value to the Region.

COSTS INCLUDED IN PROPOSAL EVALUATION

All personnel fees, salaries, wages and reimbursable expenses will be taken into account in the proposal evaluation.

DEBRIEFING

Subsequent to final selection of a firm for contract award, all other proposing firms have the right to receive a debriefing on the strengths and weaknesses of their proposal. Points awarded by evaluation teams for both technical and financial proposals will remain confidential and may not be divulged to any proposing firm.

Minimum Technical Score

Technical proposals must achieve a score of at least 28 points (70%) to be considered “technically qualified”. Financial proposals for firms failing to achieve the minimum technical score will not be opened.

SCHEDULE "□"

□ENDOR'S PROPOSAL

SCHEDULE “G”

□ENDOR’S FEE PROPOSAL

APPENDIX “E” - RECEIPT CON□IRMATION □ORM

P□ocessing, Utili□ation, On-site Ope□ations and T□anspo□tation o□Sou□ce Sepa□ated Mate□ials □□om □a□tland Land□ill

Re□uest □o□P□oposals No. ERM2022-010

Please complete this form and return it within five (5) working days from receipt to:

Allison Chambers
Parks □ Environmental Services
Capital Regional District
625 Fisgard Street
Victoria, BC V8W 2S6
Telephone: 250.360.3084
Email: achambers@crd.bc.ca

Failure to return this form may result in no further communication regarding the Request for Proposals.

COMPANY: ______________________________

ADDRESS: ______________________________

____

CONTACT PERSON: ______________________________

CONTACT EMAIL: ______________________________

CONTACT PERSON: ______________________________

CONTACT EMAIL: ______________________________

P□ONE: ______________________________

I have received a copy of the above-noted Request for Proposal, and (check one item)

☐ we will be submitting a proposal

☐ we will NOT be submitting a proposal

SIGNATURE: ______________________________

TITLE: ______________________________

DATE: ______________________________

SUBMITTAL FORM “A”
PAYMENT TERMS

CAPEX

The CRD will pay MDco for the Design and Construction of the MDTS through Milestone Payments. MDco shall provide the expected Milestone Payment amounts equal to the total CAPEX for the Project.

Table 1 – Design and Construction Payment Schedule

Milestone Payment	Amount	Estimated Payment Date
Approved Issued for Construction Design		
Asphalt Paving		
Equipment Delivery		
Construction Completion		
Total		

OPEX

The CRD will pay MDco for the Operation of the MDTS through a monthly Fixed Minimum and Variable Processing costs as outlined in the tables below.

Table 2 – Fixed Minimum Monthly Costs

Fixed Minimum Monthly Costs[1]	Unit Rate	Unit	Quantity	Total Costs ($)
Management Costs		$/month		$ -
Equipment Costs[2]		$/month		$ -
Staffing		$/month		$ -
Maintenance		$/month		$ -
Diesel		$/L		$ -
Electricity		NA		$ -
Potable Water		NA		$ -
Non-Potable Water		$/month		$ -
Total Fixed Minimum Monthly Costs				**$ -**

1. Fixed monthly costs assumes that end user contracts are secured. If end users are unavailable, the CRD retains the right to pause transfer service until end user contracts are in place.
2. MDco may recommend alternative delivery models for financing and owning equipment to maximize the value retention of equipment.

Table 3 – Variable Monthly Processing Costs

Variable Monthly Processing Costs	Unit Rate[1]	Unit	Quantity (tonnes)	Total Costs ($)
Clean Wood		$/tonne		$ -
Treated Wood		$/tonne		$ -
Asphalt Roofing Shingles		$/tonne		$ -
Carpet and Underlay		$/tonne		$ -
Books		$/tonne		$ -
Rigid Plastics (non-extended producer responsitility)		$/tonne		$ -
Waste to Active Area (Loading, Hauling/Transportation)		$/tonne		$ -
Total Variable Monthly Processing Costs				**$ -**

1. Includes Loading, Processing, Hauling/Transportation

Please note that the costs in Table 4 below is intended to provide indicative costing for the CRD, with the understanding that they are nonbinding to MDco for the purposes of this proposal.

Table 4 – □ixed Monthl□ End Use Costs

□ixed Monthl□ End Use Costs	End Use Options	End Use Option Unit Rate[1] ($/tonnes)	Range (tonnes)	Quantit□ (tonnes)	Total Costs ($)
Clean Wood			0 - 200		$ -
			□ 200		$ -
			0 - 200		$ -
			□ 200		$ -
Treated Wood			0 - 1000		$ -
			□ 1000		$ -
			0 - 1000		$ -
			□ 1000		$ -
Asphalt Roofing Shingles			0 - 300		$ -
			□ 300		$ -
			0 - 300		$ -
			□ 300		$ -
Carpet and Underlay			0 - 150		$ -
			□ 150		$ -
			0 - 150		$ -
			□ 150		$ -
Books			N/A		$ -
			N/A		$ -
Rigid Plastics (non-extended producer responsibility)			0 - 100		$ -
			□ 100		$ -
			0 - 100		$ -
			□ 100		$ -
Total □ixed Monthl□ End Use Costs					**$ -**

1. Includes End User Invoice and markup

Table 5 – Total Monthl□ Costs

Total Monthl□ Costs	Total Costs ($)
Total Fixed Minimum Monthly Costs	$ -
Total Variable Monthly Processing Costs	$ -
Total Fixed Monthly End Use Costs	$ -
Total Monthl□ Costs	**$ -**

Table 6 – P□o□isional Costs

P□o□isional Costs	Total Costs ($)
Rock Crushing ($/tonne) [1]	$ -

[1] Shot Rock will be available from the CRD at no cost to MDco for crushing and use on site. if beneficial to MDco.

SUBMITTAL FORM "B"
SCHEDULE

Provide a list of specific project activities and tasks in relation to the Scope of Services.

Provide a bar chart schedule which identities those project activities and tasks, and the duration of each activity and task.

The schedule shall include the key milestones noted in the RFP and should include:

- Key work activities and deliverables in terms of weeks after notification to award.
- Assumptions for review periods (i.e., documents submitted to the CRD for review and approval).
- Major Milestones

Identify submission of key project deliverables.

SUBMITTAL FORM "C"
REFERENCES

Provide at least five recent (within the last 10 years) references that show specific relevance to this project. Provide project name, project date/duration, project location, contract name, contact title/position, phone number and fax number.

Indicate names of key personnel (key team members and subcontractors) used on the referenced projects that will be involved on this project.

Sample Table

Project Name	Project Location	Project Date/Duration	Client Contact Name	Client Contact Title/Position	Client Contact Phone Number	Client Contact Email Address

SUBMITTAL FORM "D"
EXCLUDED SERVICES

Provide details of any services which will be excluded from the present Scope of Services and make reference to the sections mentioned. Provide itemized costs to be credited to the CRD.

Include time estimates of such excluded services.

The CRD reserves the right to accept any or all of the proposed exclusion of services.

SUBMITTAL □ORM “E”
PROPOSED □ARIATION TO T□E SCOPE O□ SER□ICES

Summarize the proposed variations to the Scope of Services. Include benefits and/or capital cost savings from such variations. Provide cost or fee estimates of such variations to the Scope of Services.

The CRD reserves the right to accept any or all of the proposed variations.

SUBMITTAL FORM "□"
OTHER SERVICES

Provide details of any services which could be provided which are outside the current Scope of Services but are believed to be essential to the successful completion of the Project. Include time and costs estimates of such additional services.

The CRD reserves the right to accept any or all of the proposed other services.

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625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6

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CAPITAL REGIONAL DISTRICT
PROCESSING AND UTILI□ATION O□ SOURCE-SEPARATED MATERIALS □ROM □ARTLAND LAND□ILL
REQUEST □OR PROPOSALS ERM2022-010
ADDENDUM NO. 1

This letter shall serve as confirmation that the revisions included herein as Addendum No. 1 shall form part of the Request for Proposals (RFP) Documents for RFP No. ERM2022-010.

ADDENDUM NO. 1:

Revise the Request for Proposals as follows:

Inst□uctions to P□oponents

Delete: From Section 1.2 Closing Time and Date for Submission of Proposals

The CRD will accept physical copies of each proposal plus **one cop□ on a USB stick**, in accordance with the instructions contained herein, at the following specific physical location:

Attention: Allison Chambers
Senior Administrative Secretary
Environmental Resource Management

Add□ess: Capital Regional District
625 Fisgard Street
Victoria, BC, V8W 2S6

On or before the following date and time (the "Closing Time"):

Time: 4:00 pm PST
Date: 16 Octobe□2023

The CRD reserves the right to extend the Closing Time at its sole discretion.
Proposals must not be sent electronically.

Replace with:

The CRD will accept electronic copies emailed to achambers@crd.bc.ca or physical copies of each proposal plus **one cop□ on a USB stick**, in accordance with the instructions contained herein, at the following specific physical location:

Attention: Allison Chambers
Senior Administrative Secretary
Environmental Resource Management

Add□ess: Capital Regional District

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625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6

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www.crd.bc.ca

625 Fisgard Street
Victoria, BC, V8W 2S6

On or before the following date and time (the "Closing Time"):

Time: 10:00 am PST
Date: 31 October 2023

The CRD reserves the right to extend the Closing Time at its sole discretion.

<u>Delete: From Section 1.6 Information Meeting and Site Visit</u>

An information meeting will be hosted by the CRD Representative to discuss the CRD's requirements under this RFP, a site visit will also be hosted at this time. The information meeting and site visit are optional. **At the time of issuance of this RFP a meeting has been scheduled as follows:**

Date: 5 October 2023
Time: 2:00 pm to 4:00 pm PST
Location: In-person, Victoria, BC

To RSVP attendance, as well as receive the attachments for Appendix A, proponents must become a Proponent of record by submitting the Receipt Confirmation Form (Appendix E).

<u>Replace with:</u>

Section 1.6 Information Meeting, Site Visit and Collaborative Meetings

An information meeting will be hosted by the CRD Representative to discuss the CRD's requirements under this RFP, a site visit will also be hosted at this time. The information meeting and site visit are optional. **At the time of issuance of this RFP a meeting has been scheduled as follows:**

Date: 5 October 2023
Time: 2:00 pm to 4:00 pm PST
Location: In-person, Victoria, BC

To RSVP attendance, as well as receive the attachments for Appendix A, proponents must become a Proponent of record by submitting the Receipt Confirmation Form (Appendix E).

The CRD will make available certain personnel, consultants and advisors (the "***CRD Representatives***") to participate in collaborative discussions with the Proponents (the "***Collaborative Meetings***"). It is expected that Collaborative Meetings will be held via a virtual meeting platform with screen sharing capabilities, unless otherwise permitted at the discretion of the CRD. The CRD expects that Proponents will make available all necessary consultants to attend the Collaborative Meetings.

Unless otherwise agreed by the CRD, each Proponent will be granted a maximum of 2 hours of dedicated Collaborative Meeting time with the CRD. The purpose of the Collaborative Meetings is to provide a process that will assist the Proponents to develop optimal solutions for the Project while minimizing the risk that a Proponent's solution is unresponsive to this RFP, subject to ensuring equal access to relevant and significant information for all Proponents, and in particular:

1. to permit the Proponent to provide the CRD's Representatives with comments and feedback on material issues such as provisions of the Initial Agreement and
2. to present potential solutions and approaches that the Proponent may be considering for various aspects of its Proposal.

Each Proponent should submit to the CRD a proposed Collaborative Meeting request (e.g., dates, duration and potential topics) by October 6, 2023 at 2:00 pm to permit the CRD to schedule its resources. The CRD will provide feedback on the proposed request and will schedule the agreed upon Collaborative Meetings with each Proponent.

At least three (3) Business Days in advance of each Collaborative Meeting, each Proponent should submit its proposed meeting agenda (including any consultants and advisors a Proponent would like in attendance from the CRD Representatives) and a list of prioritized issues the Proponent would like to discuss, and any materials relevant to such issues. The CRD may provide Proponents with comments on the agenda and a list of any prioritized issues the CRD would like to discuss.

If the CRD considers it desirable or necessary to offer more Collaborative Meeting hours to Proponents, the CRD may, in its discretion, amend the total hours allocated to each Proponent. The CRD expects the Collaborative Meetings to take place as follows:

a. the CRD will determine which CRD Representatives will be present at any Collaborative Meeting

b. except as may be expressly stated otherwise in this RFP, including Section 4.8, the CRD will retain all information received from a Proponent during a Collaborative Meeting(s) as strictly confidential, and will not disclose such information to the other Proponents or any third party. The CRD may disclose such information to its consultants and advisors who are assisting or advising the CRD with respect to the Project

c. at each Collaborative Meeting, a Proponent may have such officers, directors, employees, consultants and agents of the Proponent and the Proponent Team members present as the Proponent considers reasonably necessary for effective communication with the CRD and to fulfil the objectives of the Collaborative Meeting provided that the CRD may, in its discretion, limit the number of participants at any meeting.

d. to facilitate free and open discussion at the Collaborative Meetings, Proponents should note that any comments provided by or on behalf of the CRD during any Collaborative Meeting, including in respect of any particular matter raised by a Proponent or which is included in any documents or information provided by a Proponent prior to or during the Collaborative Meeting, and any positive or negative views, encouragement or endorsements expressed by or on behalf of the CRD during the Collaborative Meetings to anything said or provided by

Proponents, will not in any way bind the CRD and will not be deemed or considered to be an indication of a preference by the CRD even if adopted by the Proponent

e. if for the purposes of the preparation of its Proposal a Proponent wishes to rely upon anything said or indicated at a Collaborative Meeting, then the Proponent must submit an inquiry describing the information it would like to have confirmed and request that the CRD provide that information to the Proponent in written form and, if such information relates to a clarification, explanation or change to a provision of this RFP or the Design-Build Agreement, request an Addendum to this RFP clarifying and amending the provision in question and

f. by participating in the Collaborative Meetings, a Proponent confirms its agreement with these procedures and acknowledges that the meetings are an integral part of the Competitive Selection Process as described in this RFP and are in the interests of all parties.

Delete: From Section 2.1 Package

Each Proposal must be submitted using a two-envelope process. One envelope must contain the Proponent's price, fee schedule or cost of its Proposal and be clearly marked "Financial Proposal" and the other envelope must contain the balance of the Proposal and be clearly marked "Technical Proposal". Proposals must be in a sealed package and marked on the outside with the Proponent's name, title of the Project and RFP number.

Replace with:

Each Proposal must be submitted using a two-email or two-envelope process. One email or envelope must contain the Proponent's price, fee schedule or cost of its Proposal and be clearly marked "Financial Proposal" and the other email or envelope must contain the balance of the Proposal and be clearly marked "Technical Proposal". Physical proposals must be in a sealed package and marked on the outside with the Proponent's name, title of the Project and RFP number. Email subject line must be marked with the Proponent's name, title of the Project and RFP number.

Delete: From Appendix A Section 4. Purpose

Through this RFP, the CRD invites submissions from Proponents with the capacity, ability and experience to design, build and operate (onsite operations, transportation/hauling as required and management of end use contracts) a MDTS to be located at the Landfill intended for the reuse, recycle, repurpose, or otherwise beneficially process the five source-separated waste streams listed below that will be diverted from the Landfill's active face through upcoming landfill bans. The scope additionally includes design and construction of the subgrade and final asphalt surface for the entire BUA (MDTS and Biosolids Mixing Area) however the CRD will operate the Biosolids Mixing Area. The CRD's preference is to enter into a single agreement with a single entity who has the capacity, ability and experience to complete the above scope of work.

This RFP relates solely to the MDTS operations, and reuse, recycle, repurpose, or recovery of the selected source-separated waste streams from the Landfill. Participation in this RFP will not restrict Proponents from participating in other CRD procurements.

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Replace with:

Through this RFP, the CRD invites submissions from Proponents with the capacity, ability and experience to design, build and operate (onsite operations, transportation/hauling as required and management of end use contracts) a MDTS to be located at the Landfill intended for the reuse, recycle, repurpose, or otherwise beneficially process the five source-separated waste streams listed below that will be diverted from the Landfill's active face through upcoming landfill bans. The scope additionally includes design and construction of the subgrade and final asphalt surface for the entire BUA (MDTS and Biosolids Mixing Area) however the CRD will operate the Biosolids Mixing Area. The CRD's preference is to enter into a single agreement with a single entity who has the capacity, ability and experience to complete the above scope of work.

This RFP relates solely to the Specifications included in this Appendix A including MDTS design, build, operations, and reuse, recycle, repurpose, or recovery of the selected source-separated waste streams from the Landfill. Participation in this RFP will not restrict Proponents from participating in other CRD procurements.

Delete: From Appendix A Section 11: Schedule

The CRD's tentative and non-binding schedule is provided below. This reflects an estimate of the process timelines at this stage and is provided solely for the convenience of the Proponent(s). The CRD will review proposal responses and request follow up interviews with shortlisted proponents. The following is the CRD's anticipated schedule:

Request for Proposals Steps	**Date**
RFP - Issued	September 18, 2023
Information Meeting (Optional)	October 5, 2023
Proponent's Site Visit (Optional)	October 5, 2023
Question Period Close	October 6, 2023
RFP - Closing	October 16, 2023
RFP - Award	November 10, 2023
In Service Target Date	January 31, 2024

The CRD's preference is for MDTS to be operational and in service starting in January 2024. The CRD understands that site prep and equipment lead time may make this target date challenging. Proponents are encouraged to consider project delivery options that can allow for some materials processing (e.g., limited streams or volumes) to begin in January 2024, even in advance of the full construction of the MDTS.

Replace with:

The CRD's tentative and non-binding schedule is provided below. This reflects an estimate of the process timelines at this stage and is provided solely for the convenience of the Proponent(s). The CRD will review proposal responses and request follow up interviews with shortlisted proponents. The following is the CRD's anticipated schedule:

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Request for Proposals Steps	Date
RFP - Issued	September 18, 2023
Information Meeting (Optional)	October 5, 2023
Proponent's Site Visit (Optional)	October 5, 2023
Deadline for Collaborative Meeting Request (Optional)	October 6, 2023 at 2:00 pm
Deadline for Collaborative Meeting	October 20, 2023
Question Period Close	October 20, 2023
Deadline for Issuing Addenda	October 24, 2023
RFP - Closing	October 31, 2023 at 10:00 am
RFP - Award	December, 2023
In Service Target Date	Quarter 1, 2024

The CRD's preference is for MDTS to be operational and in service starting in January 2024. The CRD understands that site prep and equipment lead time may make this target date challenging. Proponents are encouraged to consider project delivery options that can allow for some materials processing (e.g., limited streams or volumes) to begin in January 2024, even in advance of the full construction of the MDTS.

<u>The CRD received the following questions regarding the RFP:</u>

Question 1:
Please confirm that this RFP is for a design and build, as well as operations. The title of the RFP doesn't indicate design and build.

Response 1:
The RFP Design Construction and Operation Specifications are outlined in Appendix A. For clarity, this is a design, build and operate. Thanks for pointing out the inconsistency in the RFP title.

Question 2:
Can you extend the closing of this RFP to the end of October?

Response 2:
The closing date for the RFP has been extended per the above addendum.

Question 3:
We (Heritage Lumber adam@heritagelumber.ca) have interest in the Salvaged Wood component only, but I know proposals are preferred for all the materials. I anticipate the companies bidding on the other materials and full RFP don't know how to manage/handle the salvaged wood to sort what's of value, especially smaller dimensions that will be coming from Victoria's deconstruction policy. Is there room for two companies in the RFP due to this?

Response 3:
While RFP Section 3.6 allows for the services from this RFP to be divided amongst multiple vendors, the CRD's preference is to enter into a single agreement with a single entity with the

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capacity, ability and experience to complete the full scope of work. This may require proponents to subcontract and/or develop partnerships with other vendors in responding to this RFP.

Question 4:
Can we arrange a commercially confidential/sensitive meeting with the CRD? Our bid team would greatly benefit from the opportunity to discuss the RFP with the CRD directly.

Response 4:
The CRD will meet with any proponent that requests a Collaboration meeting. See addendum to section 1.6 above.

All Proponents shall acknowledge receipt and acceptance of this Addendum No. 1 by signing and dating in the spaces provided below and submitting the signed Addendum with the Proposal. Proposals submitted without this Addendum may be considered incomplete.

September 27, 2023

____
PROPONENT - Please print name

____________________________________ ____________________________________
SIGNATURE DATE

RFP No. ERM2022-010

Parks & Environmental Services
625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6
T: 250.360.3000
www.crd.bc.ca

CAPITAL REGIONAL DISTRICT
PROCESSING AND UTILIZATION OF SOURCE-SEPARATED MATERIALS FROM HARTLAND LANDFILL
REQUEST FOR PROPOSALS ERM2022-010
ADDENDUM NO. 2

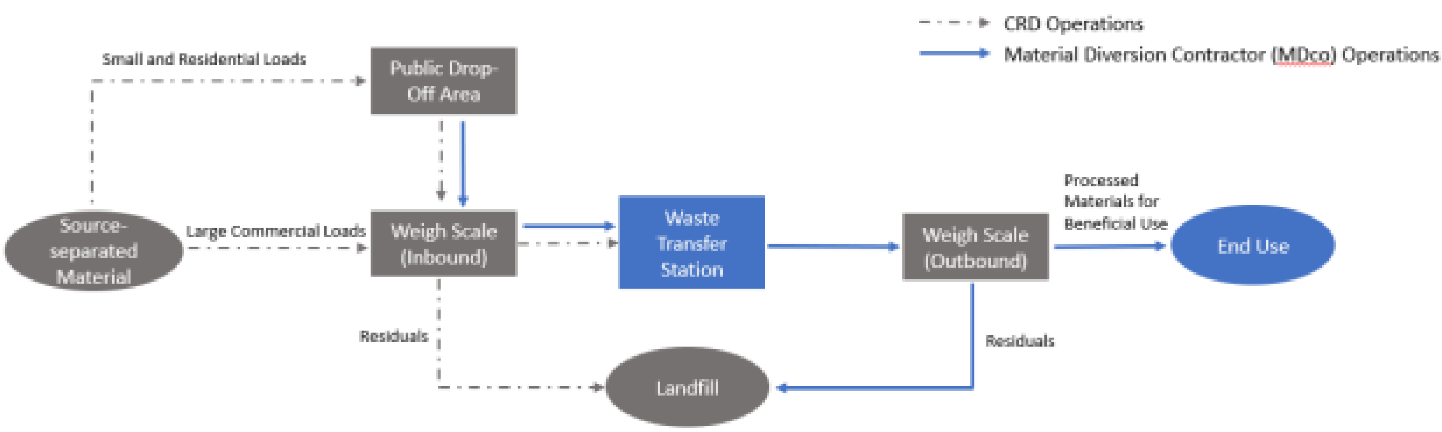
This letter shall serve as confirmation that the revisions included herein as Addendum No. 2 shall form part of the Request for Proposals (RFP) Documents for RFP No. ERM2022-010.

ADDENDUM NO. 2:

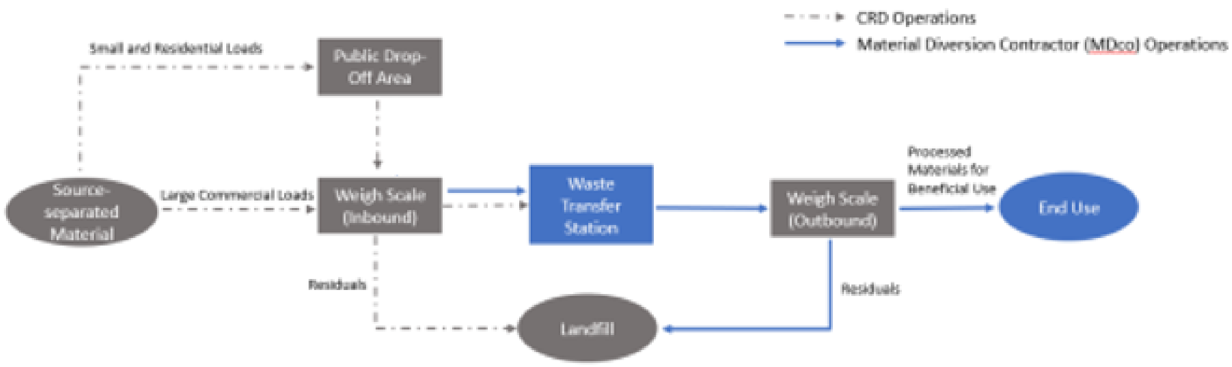
Revise the Request for Proposals as follows:

Instructions to Proponents

Delete: from Appendix A Section 4 Purpose Figure 3



<u>Replace with:</u>



<u>Delete: from Appendix A section 9. Operations and Maintenance</u>

a) All loading and transportation of material from the MDTS, □itchen Scrap Area, Public Drop Off Area and/or any other area which MDco may source material for the MDTS. (Commercial customers will be directed to offload source-separated materials directly at the MDTS).

<u>Replace with</u>

a) All loading and transportation of material from the MDTS, □itchen Scrap Area, and/or any other area which MDco may source material for the MDTS but excludes the transportation of source-separated materials from the Public Drop Off Area. (Commercial customers will be directed to offload source-separated materials directly at the MDTS).

<u>Delete: From Appendix A Section 13 Attachments</u>

13. Attachments

To receive the attachments for this Appendix A, proponents must become a Proponent of record by submitting the Receipt Confirmation Form (Appendix E).

- Attachment 1: Staff Report: Meeting the Solid Waste Management Plan Targets through Material Stream Diversion
- Attachment 2: 2022 Solid Waste Stream Composition Study
- Attachment 3: Shredded Composition □ Demolition Waste at the Hartland Landfill
- Attachment 4: Pre-approval application for Renovation □ Demolition Waste
- Attachment 5: Sprung Structure Drawings
- Attachment 6: Hartland Landfill Fire Safety Plan
- Attachment 7: Current Bird Storage Location
- Attachment 8: Technical specifications of the PVC membrane

Replace with:

13. Attachments

To receive the attachments for this Appendix A, proponents must become a Proponent of record by submitting the Receipt Confirmation Form (Appendix E).

- Attachment 1: Staff Report: Meeting the Solid Waste Management Plan Targets through Material Stream Diversion
- Attachment 2: 2022 Solid Waste Stream Composition Study
- Attachment 3: Shredded Composition □ Demolition Waste at the Hartland Landfill
- Attachment 4: Pre-approval application for Renovation □ Demolition Waste
- Attachment 5: Sprung Structure Drawings
- Attachment 6: Hartland Landfill Fire Safety Plan
- Attachment 7: Current Bird Storage Location
- Attachment 8: Technical specifications of the PVC membrane
- Attachment 9: Source-Separated Materials Available from the Cowichan Valley Regional Regional District
- Attachment 10: Technical Memorandum-Results of Waste Composition Study of Shredded Construction □ Demolition Waste

Note: Attachment 9 is attached to this Addendum as Appendix A.

The CRD received the following questions regarding the RFP:

Question 1:
Referring to the biosolids mixing area, please confirm that surface water can go into the drainage ditch□

Response 1:
Yes, surface water from the biosolids portion of the Material Diversion Transfer Station (MDTS) can drain into a nearby ditch. Surface water can be toggled to leachate/stormwater and valves can be closed as needed to contain water within the footprint of the MDTS.

Question 2:
How long has the area been closed where the material diversion transfer station is to be located□

Response 2:
The area has been closed for approximately 30 years. The area has been used to store aggregate and settling of the ground has occurred.

Question 3:
Is there venting of landfill gas□

Response 3:
Active gas wells are present in the area of the MDTS and will be maintained by the CRD. There is no passive venting, the gas infrastructure is maintained under negative pressure.

Question 4:
Is there a measure of the subsidence in the area

Response 4:
No there is no measure of settling, there are some constraints on loading and the integrity of the area must be maintained.

Question 5:
Can we be provided the lab sampling methods and dates for the shredded construction and demolition waste

Response 5:
Please see Appendix B attachment 10, provided through this Addendum 2. Please let us know through the Inquiries process (Section 1.5 of this RFP) if you have further questions about the available data.

Question 6:
Can shot rock be processed where it is currently stored

Response 6:
Yes, shot rock is currently stored just north of the area and can be crushed there and hauled to the MDTS for use.

Question 7:
How will the materials arrive on site and be processed

Response 7:
The CRD expects that materials will arrive in dedicated loads to the landfill - see section 9.3 of the RFP for further information.

Question 8:
Will bylaw officers be present

Response 8:
Yes, bylaw officers will be present at the MDTS site.

Question 9:
Will the contractor have access to CRD scales and scales staff

Response 9:
Yes, the contractor can make use of the scales and CRD scales staff, in particular for internal hauling purposes. The contractor will have priority at the auto scales.

Question 10:
Can the contractor have access to CRD bins for the transportation of public loads?

Response 10:
The transportation of source-separated materials in CRD bins from the public drop of area is secured by another CRD contractor. As per this addendum, section 9a) from RFP Appendix A, the transportation of material from the Public Drop Off Area has been removed from the scope of this RFP.

Question 11:
We acknowledge that the RFP ERM2022-010 states in section 4.2 that proponents are solely responsible for their own expenses in preparing and submitting proposals, but we kindly request clarification regarding the possibility of reimbursement for proposal preparation costs. Given the complexity of the RFP, which includes a design, build and operation contract, this proposal necessitates not only proponent resources and staff time, but also the engagement of external experts, engineers, consultants and other professionals. Would the CRD be open to considering this reimbursement request?

Response 11:
As per section 4.2 of the RFP, proponents are solely responsible for their own expenses in preparing, submitting Proposals, and for any meetings, negotiations or discussions with the CRD or its representatives and contractors relating to or arising from this RFP.

Question 12:
Can I visit the site with my subcontractor?

Response 12:
Yes. To arrange for a site visit, please contact Allison following the Inquiries process (section 1.5) of the RFP.

All Proponents shall acknowledge receipt and acceptance of this Addendum No. 2 by signing and dating in the spaces provided below and submitting the signed Addendum with the Proposal. Proposals submitted without this Addendum may be considered incomplete.

October 12, 2023

PROPONENT - Please print name

SIGNATURE

DATE

RFP No. ERM2022-010

Source-Separated Materials Available from the Cowichan Valley Regional District

The Cowichan Valley Regional District (CVRD) operates three waste transfer stations but does not have a local landfill, solid waste is transported off-site to Washington State. The CVRD is continually looking to increase diversion rates and reduce solid waste volumes. However, due to the comparatively smaller population of the district, the volumes of potentially divertible material are more limited. By combining CVRD tonnages with those of the Capital Regional District (CRD), the CVRD hopes to gain more interest from prospective haulers and processors and potentially reduce costs to the CVRD.

CVRD recycling centres provide a one-stop-drop recycling collection point for residential materials related to all provincial Extended Producer Responsibility diversion programs including used oil and antifreeze, batteries, electronics, appliances, and outdoor power equipment. Outside of the provincial programs, the CVRD also provides collection of couches, mattresses, rubble, and clean and painted wood at the recycling centres. The CVRD would like to expand this already robust program to include carpet and underlay, asphalt shingles, and potentially books, and rigid plastics.

The CVRD landfilled 44,188 tonnes of material in 2022 and diverted 40,269 tonnes of material (including food organics). In addition to asphalt roofing shingles and carpet and underlay, the CVRD would like to consider the option to divert rigid plastics and books. While the CVRD does not have tonnages available for these streams, a waste composition study completed in 2017 identified that 4.7% of the residential garbage collected consisted of non-beverage rigid plastic packaging and durable plastic products.

The CVRD operates three recycling centres where garbage and recyclable materials are collected through public drop off:

Recycling Centre	Address	Hours
Bings Creek Recycling Centre	3900 Drinkwater Rd, Duncan.	Daily from 8 to 5 except Statutory holidays
Peerless Recycling Centre	10830 Westdowne Road, Ladysmith	April 1 to October 31 Wed to Sun 9 to 5 November 1 to March 31 Wed, Sat, Sun 9 to 5
Meade Creek Recycling Centre	8855 Youbou Rd, Lake Cowichan	April 1 to October 31 Tues, Wed, Sat, Sun 9 to 5 November 1 to March 31 Wed, Sat, Sun 9 to 5

Technical Memorandum

10 October 2023

To	Liz Ferris	**Contact No.**	250-360-3643
Copy to	Deacon Liddy	**Email**	lferris@crd.bc.ca
From	Laura Hnatiuk	**Project No.**	12590255
Project Name	Technical Advisor - Biosolids Beneficial Use and Resource Recovery Strategies		
Subject	Results of Waste Composition Study of Shredded Construction & Demolition Waste		

1. Introduction

The Capital Regional District (CRD) is undertaking a construction and demolition (C&D) waste shredding pilot at the Hartland Landfill. The purpose of the shredding trial is to understand the costs, impact on operations, and potential for preservation of Landfill airspace by reducing bulk. A waste composition study was undertaken to quantify and characterize the shredded C&D material. Understanding the composition and key specifications such as energy content, presence of chemicals, and particle size will be used to determine potential alternative end uses and support the development of the CRD's Resource Recovery Strategy.

Shredded C&D waste samples were collected at the Hartland Landfill and sent to GHD to undertake an asbestos test (performed by ALS Environmental), physical audit, waste characterization, and identification of three samples for further lab analysis. A total of seventeen (17) samples were obtained by CRD Landfill operators over a four-week period, from December 6th to December 31, 2022, which were included in the audit.

1.1 Purpose of this Memorandum

The primary objective of this Technical Memorandum is to summarize and present the results of the shredded C&D waste audit and characterization study, and results of the lab analysis based off of the Lafarge specifications for end use as low carbon fuel. The methodology and physical profile are discussed in the following sections. Data and field notes are provided in Attachment 1, and a photo log is provided in Attachment 2.

1.2 Scope and limitations

This technical memorandum has been prepared by GHD for Capital Regional District. It is not prepared as, and is not represented to be, a deliverable suitable for reliance by any person for any purpose. The matters discussed in this memorandum are limited to those specifically detailed in the memorandum and are subject to any limitations or assumptions specially set out.

2. Methodology

2.1 C&D Waste Sample Collection Methodology

Representative samples of shredded C&D materials were collected by CRD Landfill operators as follows:

1. CRD purchased 20 litre lidded buckets to store samples.
2. A designated CRD Landfill operator pulled contents from an area of the shredded C&D pile and placed the contents into one bucket.
3. The bucket was labelled with the date, lidded, and stored at secure location at the landfill.
4. One bucket of material was collected per day.
5. Steps 2 to 4 were repeated for a total of 17-days.

The buckets were stored until all 17 samples were collected. After collection, the CRD shipped the buckets to the GHD office in Vancouver. The buckets were received by GHD on January 1, 2023.

2.2 Asbestos Screening Methodology

The inbound C&D waste used in the shredding trial was prohibited to contain asbestos and was pre-screened by the CRD. However, an asbestos test was undertaken to confirm the materials were free of asbestos prior to undertaking the audit. A health and safety plan attached in Attachment 3 was developed to perform the asbestos test and waste audit. GHD reviewed WorkSafeBC's guidance documents in handling asbestos and donned the appropriate personal protective equipment (PPE) as a precautionary measure.

On January 23, 2023, a composite sample was obtained from the 17 buckets to test for asbestos as per the following:

1. One bucket was opened, and its contents were placed onto a tray.
2. The tray was agitated and tilted such that fines accumulated at the bottom edge of the tray.
3. A portion of the fines was obtained and transferred into a double-layered HDPE bag.
4. The contents on the tray were placed back into their respective bucket.
5. Steps 1-4 were repeated for each bucket until a composite sample was created.

The composite sample was sent to ALS Environmental for asbestos testing. The results were received on Jan 27th, 2023. Asbestos was deemed non-detectable at the 0.25% (w/w) limit of reporting. A copy of the asbestos test results is included in Attachment 4.

2.3 Waste Audit Methodology

The waste audit was performed by GHD on February 1 and 2, 2023. The steps were completed in the following sequence:

1. A data collection sheet was created in Excel to record the composition results.
2. GHD purchased thirty sorting pails, two tables, three large trays, disinfectant, and one Starfrit electronic scale (model 93016). The scale was precise up to 1 gram (g) increments.
3. A workstation was setup by placing the sorting pails/trays, scale, and a laptop onto the tables.
4. The weight of one sorting pail was recorded and logged into the data sheet.
5. The contents of one sample bucket were then placed onto a tray, and a photo was captured of its mixed composition.
6. Materials from the mixed composition tray pile were separated into sorting pails.

7. Bulky contents were separated until the pile was reduced to 10 mm to 25 mm shreds.
8. The shreds were placed into a separate sorting pail. The fines remaining in the mixed composition tray were then placed into a separate sorting pail.
9. A photo was captured of the sorted sample bucket components in their respective sorting pails. Interesting miscellaneous material finds were photographed.
10. Each sorting pail and its components were weighed on the scale. The mass of the sorting pail was subtracted from the mass displayed on the scale via Excel, and the resulting mass was logged in the data sheet.
11. Steps 5 to 10 were repeated for 16 buckets. Field notes on certain bucket characteristics were noted in the data sheet.
12. A photolog was generated and is included in Attachment 2.

2.4 Lab Analysis Methodology

The CRD is seeking information on the energy and chemical content, and particle size within the C&D materials deposited at Hartland, based off of specifications for use as an alternative solid fuel in cement plants. Three buckets were sent for lab analysis based on the lowest (844 g in sample from December 29), closest to average (1,541 g in sample from December 13), and highest wood and plastic contents (3,105 g in sample from December 31). A copy of the lab results is attached as Attachment 5.

The specifications typically require chemistry criteria be met to qualify for potential use as alternative solid fuel. This criterion was provided by Geocycle, included in Attachment 6, and outlines the typical chemistry specifications for low carbon fuel use in cement plants. No generally agreed upon limit values exist, as different criteria are applied depending on the local context in regard to the receiving plant and their regulatory authorities.

The buckets were sent to ALS Environmental to test for the following parameters:

– Sieve screening: 4”, 3”, 2” sizes
– Proximate & Ultimate Analysis
– Calorific Analysis
– Chlorine Content
– Total Metals
– Mercury Content

3. Results & Discussion

The waste audit data and field notes are attached in Attachment 1. It is important to note the following limitations to the data. Sixteen out of seventeen bucket samples were sorted, as the sample dated December 19 was not audited due to heavy moisture. A photo of this sample and its sorted bulk contents is included for visual inspection in Attachment 2. Moreover, the accumulation of dust, dirt, mould, and water on the surface of wood contents and the small material sizes created challenges in identifying clean or treated wood. Consequently, wood content was separated into the following categories: non-painted wood, painted/finished wood, and plywood/particle board.

Table 1 in Attachment 1 depicts an overall summary of all the sample contents combined by mass and proportion. Minimum and maximum columns for each major material category are included to show the variance between bucket samples. For example, the minimum amount of wood observed within a sample was 569 g (15.1% of the sample) and the maximum was 2173 g (60.7% of the sample).

Table 2 in Attachment 1 presents the mass and proportion waste category results by each sample. Wood content was lowest (569 g) in the December 29 sample and highest (2173 g) in the December 7 sample. The average wood content based on all the samples combined was 1105 g per sample, with the December 23 sample containing wood content closest to the average (1080 g).

Figure 1 in Attachment 1 visually presents the summary table data. The C&D sample contents are mostly composed of wood (38.8%), plastic (14.5%), and shreds/fines (19.4%). Shreds were categorized as 10 mm to 25 mm pieces deemed too small to characterize. Figure 2 depicts the proportion of high heating value (HHV) materials (wood and plastic) within all the samples combined. Wood/plastic materials compose 65.5% of the sample contents, with the remaining 34.5% being non-wood/plastic materials. Figure 3 depicts the variance in composition and weight of each sample. As shown by Figure 3 and the photolog, the samples were not consistent in terms of composition and condition.

The lab results from the shredded C&D materials are compared for each criteria, and presented in Table 3.1 below.

Table 3.1 Lab Analysis and Alternative Fuel Criteria Comparison

Criteria[1]	Typical Limit(s)	Sample Lab Results		
		December 13	December 29	December 31
Heat Value	– Typical heat values in the range of 15-30 MJ/kg. – No less than 13 MJ/kg.	– 10.6 MJ/kg	– 17.5 MJ/kg	– 14.8 MJ/kg
Particle Size	– Maximum 5% passing 450 microns' screen – No larger than 1.5" for three dimensional pieces. – No larger than 2" for two dimensional pieces.	– 77% (wt./wt.) of contents are larger than 2"	– 97% (wt./wt.) of contents are larger than 2"	– 96% (wt./wt.) of contents are larger than 2"
Contamination[2]	– Should be as free of contamination as possible (i.e., rocks, dirt, metals, other non-combustible materials).	– 16% (wt./wt.) of contents are non-combustible	– 0% (wt./wt.) of contents are non-combustible	– 1.4% (wt./wt.) of contents are non-combustible
Moisture	– Maximum 20% (lower is better).	– 18.25%	– 15.66%	– 32.20%
Ash	– Maximum 20% (lower is better)	– 38.33% (as received) – 46.64% (moisture free)	– 47.78% (as received) – 55.38% (moisture free)	– 18.36% (as received) – 21.27% (moisture free)
Sulfur	– Maximum 1%	– 1.41%	– 0.52%	– 0.48%
Chlorine	– Maximum 0.10%	– 0.10%	– 0.15%	– 2.21%

[1] The chemistry requirements are a guideline only, and there may be additional flexibility or restrictions (e.g., volume, price, etc.).

[2] Contamination was not analysed by the lab. Resultant weight fractions of non-combustible materials were calculated from field data.

4. Key Findings & Conclusions

GHD concluded the following based on the lab analysis results:

– **Calorific Content:** Heat values were within range for two out of three lab samples. There is potential to use CRD's shredded C&D waste as an alternative fuel in cement manufacturing.

– **Chlorine Content:** Two out of three lab samples did not meet typical criteria for chlorine content.

– **Particle Size:** All three lab samples did not meet typical criteria for particle size. Additional shredding pre-treatment may be needed depending on the receiving plant's size specifications.

– **Moisture:** One out of three lab samples did not meet typical criteria for moisture content. Additional drying pre-treatment may be needed depending on the receiving plant's moisture specifications.

– **Ash:** All three lab samples did not meet the criteria for maximum ash content, with the exception of one moisture free sample.

– **Sulfur:** Two out of three lab samples met the criteria for maximum sulfur content.

Attachments

Attachment 1

Data, Figures and Field Notes

Date(s): Feb 1st 2023, Feb 2nd 2023

Auditor(s): Abram Robiso, Anastassia Alexeeva, Jason Wilson

Notes:

(1) General - Difficult to discern between treated and untreated wood due to moisture, dirt, and weathering.
(2) General - Shreds category refers to 10mm to 25mm pieces too small to characterize. Composed of mostly wood, plastic, and sand/dirt.
(3) Dec 7 - Painted wood included nails.
(4) Dec 8 - High water content.
(5) Dec 10 - Weight data for paper materials distorted due to water.
(6) Dec 17 - High water content. Fines dissolved in water.
(7) Dec 19 - Components not weighed. Picture of bulky sorted materials included in photolog for visual inspection.

Table 1 - Summary of All Samples

Major Category	Min. Grams Observed	Max. Grams Observed	Total Grams	Min. % Observed	Max. % Observed	% of Total
Flooring & Insulation	0	377	2,970	0	14.6%	6.5%
Wood	569	2173	17,728	15.1%	60.7%	38.8%
Masonry	0	327	1,661	0	8.1%	3.6%
Plastic	86	954	6,602	4.2%	24.4%	14.5%
Glass	0	9	16	0	0.2%	0.0%
Metals	0	393	1,624	0	9.8%	3.6%
Paper	0	573	2,645	0	15.9%	5.8%
Textiles	0	625	2,609	0	34.2%	5.7%
Misc./Other	0	279	932	0	8.8%	2.0%
Shreds/Fines	0	3564	8,847	0	71.4%	19.4%
Total Weight (g)	45,634					

Figure 1 - Composition of All Samples

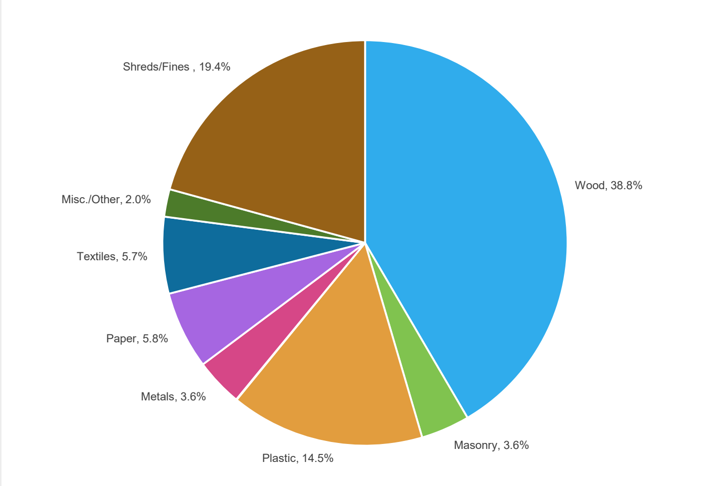


Figure 2 - Wood & Plastic in All Samples

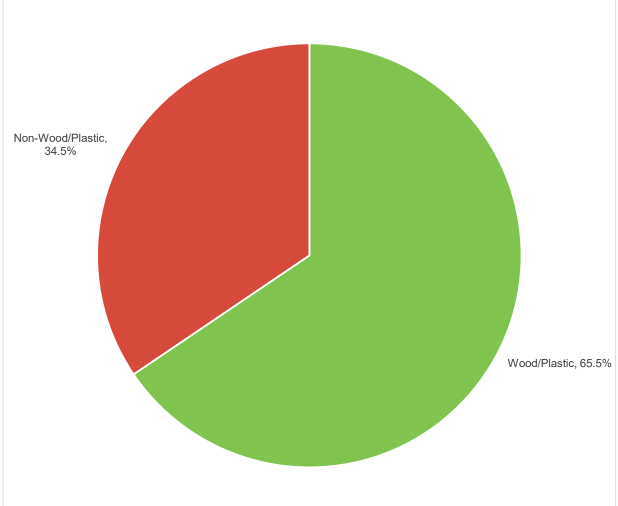


Figure 3 - Composition Per Sample

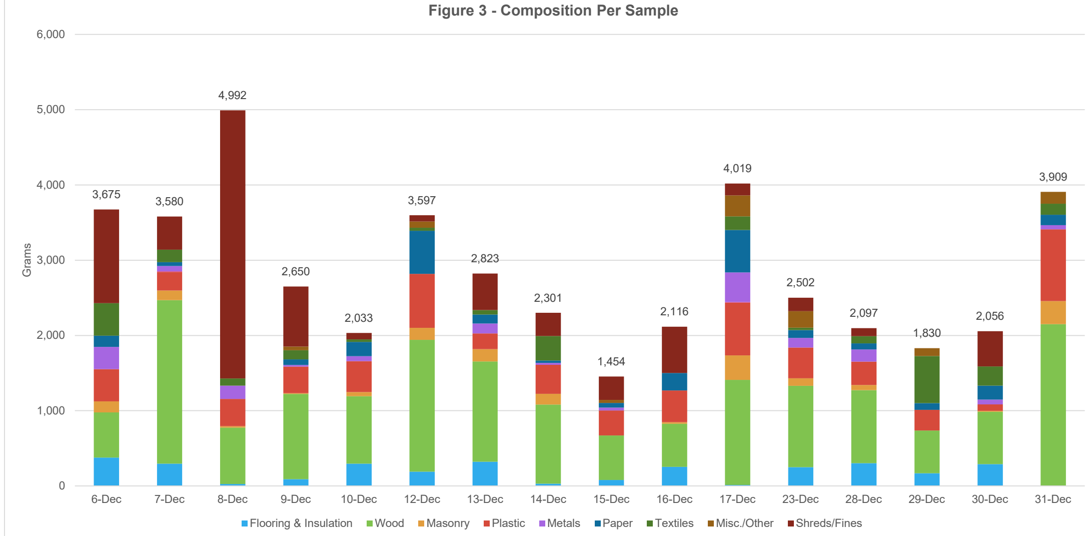


Table 2 - Composition Data by Mass and Proportion

Shredded C&D Waste Stream			6-Dec		7-Dec		8-Dec		9-Dec		10-Dec		12-Dec		13-Dec		14-Dec	
Major Category	**#**	**Minor Category**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**
Flooring & Insulation	1	Wood Flooring	24	0.7%	264	7.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2	Linoleum	0	0.0%	10	0.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	3	Foam Insulation	0	0.0%	4	0.1%	0	0.0%	40	1.5%	14	0.7%	1	0.0%	0	0.0%	28	1.2%
	4	Paper/Wood Insulation	0	0.0%	19	0.5%	23	0.5%	20	0.8%	0	0.0%	0	0.0%	168	6.0%	0	0.0%
	5	Fiberglass Insulation	353	9.6%	0	0.0%	0	0.0%	0	0.0%	210	10.3%	0	0.0%	0	0.0%	0	0.0%
	6	Ceramic Tiles	0	0.0%	0	0.0%	0	0.0%	27	1.0%	72	3.5%	186	5.2%	155	5.5%	0	0.0%
Wood	7	Plywood/Particle Board	100	2.7%	241	6.7%	77	1.5%	385	14.5%	74	3.6%	355	9.9%	0	0.0%	123	5.3%
	8	Painted/Finished Wood	281	7.6%	189	5.3%	276	5.5%	93	3.5%	286	14.1%	773	21.5%	394	14.0%	288	12.5%
	9	Non-Painted Wood	220	6.0%	1,743	48.7%	399	8.0%	657	24.8%	536	26.4%	627	17.4%	938	33.2%	643	27.9%
Masonry	10	Asphalt (Non-Roofing)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	11	Asphalt Roofing Shingles	146	4.0%	0	0.0%	20	0.4%	12	0.5%	55	2.7%	78	2.2%	108	3.8%	142	6.2%
	12	Stones/Rocks	0	0.0%	128	3.6%	0	0.0%	0	0.0%	0	0.0%	82	2.3%	55	1.9%	0	0.0%
Plastic	13	PET (#1) Plastic Food and Beverage Bottles	0	0.0%	0	0.0%	0	0.0%	34	1.3%	0	0.0%	28	0.8%	0	0.0%	0	0.0%
	14	HDPE (#2) Plastic Jugs, Crates, Totes and Drums	0	0.0%	0	0.0%	0	0.0%	15	0.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	15	LDPE (#4) Plastic Film, Milk Cartons	0	0.0%	12	0.3%	189	3.8%	46	1.7%	0	0.0%	0	0.0%	96	3.4%	95	4.1%
	16	PP (#5) Chip bags, Yogurt Containers	0	0.0%	26	0.7%	103	2.1%	8	0.3%	21	1.0%	1	0.0%	0	0.0%	15	0.7%
	17	PS (#6) Styrofoam	0	0.0%	8	0.2%	0	0.0%	6	0.2%	0	0.0%	61	1.7%	0	0.0%	0	0.0%
	18	Other Plastic (#7)	32	0.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	361	10.0%	0	0.0%	127	5.5%
	19	Hard/Rigid Plastic	135	3.7%	51	1.4%	15	0.3%	143	5.4%	42	2.1%	0	0.0%	58	2.1%	0	0.0%
	20	Thick Plastic Films	188	5.1%	14	0.4%	35	0.7%	76	2.9%	259	12.7%	132	3.7%	0	0.0%	48	2.1%
	21	Rubber	3	0.1%	0	0.0%	0	0.0%	10	0.4%	0	0.0%	0	0.0%	0	0.0%	9	0.4%
	22	Foam (Furniture Fill, Recycled Foam, Etc.)	70	1.9%	136	3.8%	20	0.4%	15	0.6%	89	4.4%	134	3.7%	55	1.9%	91	4.0%
Glass	23	Industrial Glass	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	24	Glass Food and Beverage Bottles or Jars	0	0.0%	7	0.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Metals	25	Aluminum or Steel Food and Beverage Cans	0	0.0%	0	0.0%	0	0.0%	20	0.8%	0	0.0%	0	0.0%	0	0.0%	6	0.3%
	26	Construction Wiring	110	3.0%	11	0.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	10	0.4%
	27	Industrial Metals	185	5.0%	59	1.6%	176	3.5%	0	0.0%	66	3.2%	0	0.0%	131	4.6%	10	0.4%
Paper	28	Fine Paper	0	0.0%	0	0.0%	0	0.0%	32	1.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	29	Non-Corrugated Cardboard (Boxboard Shoe Boxes, Cereal Boxes, etc.)	0	0.0%	41	1.1%	0	0.0%	20	0.8%	21	1.0%	534	14.8%	88	3.1%	14	0.6%
	30	Paper Cups	0	0.0%	0	0.0%	0	0.0%	0	0.0%	23	1.1%	0	0.0%	0	0.0%	0	0.0%
	31	Tissue	101	2.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	32	Other paper	49	1.3%	11	0.3%	0	0.0%	0	0.0%	147	7.2%	39	1.1%	31	1.1%	18	0.8%
	33	Corrugated Cardboard	0	0.0%	0	0.0%	0	0.0%	22	0.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Textiles	34	Clothing	0	0.0%	125	3.5%	77	1.5%	123	4.6%	0	0.0%	17	0.5%	34	1.2%	325	14.1%
	35	Carpet and Backing	433	11.8%	0	0.0%	18	0.4%	0	0.0%	33	1.6%	23	0.6%	27	1.0%	0	0.0%
	36	String/Yarn	0	0.0%	40	1.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other/Misc.	37	Wallpaper	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	38	Misc. Electronics	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	39	Diaper	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	40	Toys (Stuffed Animal, Balls)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	41	Plastic Christmas Tree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	83	2.3%	0	0.0%	0	0.0%
	42	Unknown (Dec 9 - Logged in Photos)	0	0.0%	0	0.0%	0	0.0%	49	1.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	43	Trophy	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	44	Shoes	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Shreds/Fines	45	10mm - 25mm Shreds	1,245	33.9%	335	9.4%	1,955	39.2%	592	22.3%	78	3.8%	0	0.0%	389	13.8%	0	0.0%
	46	Fines	0	0.0%	106	3.0%	1,609	32.2%	205	7.7%	7	0.3%	82	2.3%	96	3.4%	309	13.4%
Totals (g)			3,675		3,580		4,992		2,650		2,033		3,597		2,823		2,301	

Shredded C&D Waste Stream			15-Dec		16-Dec		17-Dec		23-Dec		28-Dec		29-Dec		30-Dec		31-Dec	
Major Category	**#**	**Minor Category**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**	**g**	**%**
Flooring & Insulation	1	Wood Flooring	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	2	Linoleum	0	0.0%	0	0.0%	0	0.0%	9	0.4%	211	10.1%	0	0.0%	0	0.0%	0	0.0%
	3	Foam Insulation	0	0.0%	124	5.9%	11	0.3%	0	0.0%	0	0.0%	167	9.1%	290	14.1%	0	0.0%
	4	Paper/Wood Insulation	65	4.5%	130	6.1%	0	0.0%	21	0.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	5	Fiberglass Insulation	12	0.8%	0	0.0%	0	0.0%	204	8.2%	92	4.4%	0	0.0%	0	0.0%	0	0.0%
	6	Ceramic Tiles	0	0.0%	0	0.0%	0	0.0%	16	0.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Wood	7	Plywood/Particle Board	182	12.5%	88	4.2%	194	4.8%	79	3.2%	0	0.0%	77	4.2%	303	14.7%	301	7.7%
	8	Painted/Finished Wood	27	1.9%	420	19.8%	183	4.6%	464	18.5%	288	13.7%	330	18.0%	243	11.8%	1,280	32.7%
	9	Non-Painted Wood	384	26.4%	65	3.1%	1,021	25.4%	537	21.5%	682	32.5%	162	8.9%	150	7.3%	570	14.6%
Masonry	10	Asphalt (Non-Roofing)	0	0.0%	0	0.0%	14	0.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	11	Asphalt Roofing Shingles	0	0.0%	21	1.0%	80	2.0%	36	1.4%	47	2.2%	0	0.0%	13	0.6%	305	7.8%
	12	Stones/Rocks	0	0.0%	0	0.0%	233	5.8%	65	2.6%	21	1.0%	0	0.0%	0	0.0%	0	0.0%
Plastic	13	PET (#1) Plastic Food and Beverage Bottles	0	0.0%	17	0.8%	0	0.0%	0	0.0%	0	0.0%	38	2.1%	0	0.0%	0	0.0%
	14	HDPE (#2) Plastic Jugs, Crates, Totes and Drums	7	0.5%	0	0.0%	3	0.1%	0	0.0%	0	0.0%	167	9.1%	0	0.0%	0	0.0%
	15	LDPE (#4) Plastic Film, Milk Cartons	31	2.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	81	2.1%
	16	PP (#5) Chip bags, Yogurt Containers	16	1.1%	17	0.8%	0	0.0%	0	0.0%	134	6.4%	31	1.7%	0	0.0%	0	0.0%
	17	PS (#6) Styrofoam	44	3.0%	0	0.0%	9	0.2%	15	0.6%	0	0.0%	1	0.1%	0	0.0%	15	0.4%
	18	Other Plastic (#7)	0	0.0%	0	0.0%	248	6.2%	237	9.5%	0	0.0%	1	0.1%	0	0.0%	141	3.6%
	19	Hard/Rigid Plastic	18	1.2%	105	5.0%	0	0.0%	0	0.0%	10	0.5%	0	0.0%	86	4.2%	304	7.8%
	20	Thick Plastic Films	149	10.2%	179	8.5%	305	7.6%	56	2.2%	0	0.0%	11	0.6%	0	0.0%	269	6.9%
	21	Rubber	0	0.0%	0	0.0%	60	1.5%	8	0.3%	0	0.0%	14	0.8%	0	0.0%	0	0.0%
	22	Foam (Furniture Fill, Recycled Foam, Etc.)	69	4.7%	104	4.9%	74	1.8%	92	3.7%	168	8.0%	12	0.7%	0	0.0%	144	3.7%
Glass	23	Industrial Glass	0	0.0%	0	0.0%	9	0.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	24	Glass Food and Beverage Bottles or Jars	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Metals	25	Aluminum or Steel Food and Beverage Cans	37	2.5%	0	0.0%	33	0.8%	0	0.0%	0	0.0%	0	0.0%	11	0.5%	0	0.0%
	26	Construction Wiring	0	0.0%	0	0.0%	0	0.0%	129	5.2%	93	4.4%	0	0.0%	52	2.5%	56	1.4%
	27	Industrial Metals	0	0.0%	0	0.0%	360	9.0%	0	0.0%	69	3.3%	0	0.0%	0	0.0%	0	0.0%
Paper	28	Fine Paper	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	31	1.7%	0	0.0%	0	0.0%
	29	Non-Corrugated Cardboard (Boxboard Shoe Boxes, Cereal Boxes, etc.)	63	4.3%	96	4.5%	290	7.2%	72	2.9%	79	3.8%	42	2.3%	82	4.0%	0	0.0%
	30	Paper Cups	0	0.0%	0	0.0%	0	0.0%	23	0.9%	0	0.0%	9	0.5%	0	0.0%	0	0.0%
	31	Tissue	0	0.0%	12	0.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	67	1.7%
	32	Other paper	0	0.0%	123	5.8%	271	6.7%	8	0.3%	0	0.0%	8	0.4%	48	2.3%	28	0.7%
	33	Corrugated Cardboard	0	0.0%	0	0.0%	3	0.1%	0	0.0%	0	0.0%	0	0.0%	55	2.7%	44	1.1%
Textiles	34	Clothing	0	0.0%	0	0.0%	32	0.8%	32	1.3%	96	4.6%	383	20.9%	255	12.4%	0	0.0%
	35	Carpet and Backing	0	0.0%	0	0.0%	149	3.7%	0	0.0%	0	0.0%	242	13.2%	0	0.0%	145	3.7%
	36	String/Yarn	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other/Misc.	37	Wallpaper	9	0.6%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	38	Misc. Electronics	0	0.0%	0	0.0%	22	0.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	39	Diaper	0	0.0%	0	0.0%	257	6.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	40	Toys (Stuffed Animal, Balls)	30	2.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	104	5.7%	0	0.0%	0	0.0%
	41	Plastic Christmas Tree	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	42	Unknown (Dec 9 - Logged in Photos)	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
	43	Trophy	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	159	4.1%
	44	Shoes	0	0.0%	0	0.0%	0	0.0%	219	8.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Shreds/Fines	45	10mm - 25mm Shreds	257	17.7%	30	1.4%	0	0.0%	149	6.0%	82	3.9%	0	0.0%	459	22.3%	0	0.0%
	46	Fines	54	3.7%	585	27.6%	158	3.9%	31	1.2%	25	1.2%	0	0.0%	9	0.4%	0	0.0%
Totals (g)			1,454		2,116		4,019		2,502		2,097		1,830		2,056		3,909	

Attachment 2

Photolog

Photo 1 Dec 6 - Mixed Composition

Photo 2 Dec 6 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 3 Dec 7 - Mixed Composition

Photo 4 Dec 7 – Paper/Wood Insulation

Photos 5/6 Dec 7 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 7 Dec 8 - Mixed Composition

Photos 8/9 Dec 8 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 10 Dec 9 - Mixed Composition

Photo 11 Dec 9 - Interesting Item - Unknown

Photo 12 Dec 9 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 13 Dec 10 - Mixed Composition

Photo 14 Dec 10 - Interesting Item - Charger Casing

Photo 15 Dec 10 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 16 Dec 12 - Mixed Composition

Photo 17 Dec 12 – Interesting Item- Christmas Tree Decor

Photos 18/19 Dec 12 - Sorted Composition

Photo 20 Dec 13 - Mixed Composition

Photo 21 Dec 13 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 22 Dec 14 - Mixed Composition

Photo 23/24 Dec 14 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 25 Dec 15 - Mixed Composition

Photo 26 Dec 15 – Interesting Item - Toy

Photo 27 Dec 15 – Interesting Item - Wallpaper


Photos 28/29 Dec 15 – Sorted Composition

Photo 30 Dec 16 - Mixed Composition

Photo 31 Dec 16 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 32   Dec 17- Mixed Composition

Photo 33   Dec 17 – Interesting Item - Unknown Foam

Photos 34/35/36 Dec 17 - Sorted Composition

Photo 37 Dec 19 - Sorted Composition

Photo 38 Dec 23 - Mixed Composition

Photo 39 Dec 23 - Sorted Composition

Site Photographs
TA - Biosolids and Resource Recovery
02/01/2023

Photo 40 Dec 28 - Mixed Composition

Photo 41 Dec 28 - Sorted Composition

Photo 42 Dec 29 - Mixed Composition

Photo 43 Dec 29 - Sorted Composition

Photo 44 Dec 30 - Mixed Composition

Photo 45 Dec 30 - Sorted Composition

Photo 46 Dec 31- Mixed Composition

Photo 47 Dec 31 - Sorted Composition

Attachment 3

Health and Safety Plan

HSE009 Job Safety and Environmental Analysis (JSEA)

Reference Documentation	HSE306 HSE Business Management SOP
Purpose of Form	JSEAs outline a safe and environmentally responsible method of work, identification of individual training needs, plant / machinery and equipment, inspection and legislative requirements for a specific activity taking into consideration the hazards and risks involved in completing the activity (during routine, non-routine and emergency working conditions).
Responsibility for Completion	Project Manager (or delegate) to complete in consultation with the GHD job team (includes identification and delivery of training).
Frequency of Completion and Review	JSEA to be developed prior to commencement of site work and reviewed at no more than 6 monthly intervals, or where there are significant changes to the job scope, equipment, environment, personnel or statutory framework. PD or qualified delegate responsible for review and approval.

Project Name & Description:	CRD - Shredded C&D Composition Analysis: Perform an confirmatory asbestos test on a consolidated sample of shredded C&D materials (pre-screened for asbestos) received from the CRD's Hartland Landfill. Once test is back, perform a full waste audit and characterization study on the 17 buckets. Send three buckets to the lab for energy and chemical analysis.	**Activity Location:**	GHD Office, Vancouver, BC
Project Number:	12590255 — **Activity:** Waste Audit and Sampling	**Activity Date:**	January 25, 2023 February 1, 2023 February 2, 2023

Sequential Task Step (Include a number to make for easy reference in Pre-Work Assessment)	**Hazards** What could cause injury or ill health, damage to property or damage to the environment (e.g. Water way, Refueling)	**Event & Potential Outcome** What could go wrong (e.g. fall in water / diesel spill) and what might happen as a result (e.g. person drowns / soil contamination)	**Initial Risk Rating** Consequence	Likelihood	Risk Rating	**Control Measures** (Hazards are to be eliminated wherever possible or minimised where elimination is not reasonably practicable. Consider Hierarchy of Control - Elimination, Substitution, Isolation, Engineering Controls, Administrative Controls, Personal and Environmental Protective Equipment).	**Ref Guide** (e.g. Hazard Guides, SOP's)	**Residual Risk Rating** Consequence	Likelihood	Risk Rating	**Person (s) Responsible** (for implementing control measures)
Note: Consequence should be assessed first so that the likelihood rating is the likelihood of the selected consequence occurring.											
1.0 Setting up and taking down asbestos test site	Trip and fall hazards, lifting strain	Slippery conditions could cause a slip or fall accident. Lifting table and buckets could cause back strain and injury.	B	3	Low	Be aware of surroundings. Continuously inspect work areas for slip, trip and fall hazards. Never step onto obstacles unless you make sure you have a good foothold and are confident of their stability. Where possible walk around potential obstacles. Ensure propoer lifting procedures are followed when lifting heavy items. Seek immediate attention if injury from trip, fall or muscle strain occurs.	HSEG221 Slip and Trips	B	3	Low	GHD Staff
2.0 Performing asbestos test	Exposure to asbestos and other potentially harmful chemicals and sharp materials	Exposure to ACM may result in long term injury and increased risk of cancer. Exposure to other unknown harmful chemicals or sharps may cause immediate, short and long term	D	4	Significant	Review Worksafe BC's "Safe work Practices for Handling Asbestos" and " Safe work Practices for Asbestos Laboratories" guidance documents. Use of appropriate PPE. Seek immediate attention if injury from chemical or sharps occur.	Worksafe BC Safe work Practices for Handling Asbestos and Safe work Practices for Asbestos Laboratories	C	2	Low	GHD Staff
3.0 Setting up and taking down C&D audit site	Trip and fall hazards, lifting strain	Slippery conditions could cause a slip or fall accident. Lifting table and buckets could cause back strain and injury.	B	3	Low	Be aware of surroundings. Continuously inspect work areas for slip, trip and fall hazards. Never step onto obstacles unless you make sure you have a good foothold and are confident of their stability. Where possible walk around potential obstacles. Ensure proper lifting procedures are followed when lifting heavy items. Seek immediate attention if injury from trip, fall or muscle strain occurs.	HSEG221 Slip and Trips	B	3	Low	GHD Staff
4.0 Performing C&D waste audit	Exposure to potentially harmful chemicals and sharp materials	Exposure to unknown harmful chemicals or sharps may cause immediate, short and long term injury.	C	3	Moderate	Use of appropriate PPE.		C	2	Low	GHD Staff
4.1 Performing C&D waste audit	Risk of vehicle/pedestrian incident	Audit to be undertaken on active loading dock at GHD office. Incoming and outgoing vehicle may collide with auditor or audit set up and materials.	D	1	Moderate	Be aware of surroundings. Set up audit site in area of high visibility for incoming and outgoing vehicles. Locate audit site where vehicles do not enter. Do not use cell phones or perform other distracting activities while undertaking audit. Seek immediate attention if injury from vehicle contact occurs.		D	1	Moderate	GHD Staff
4.2 Audit Site Clean up	Inadequate clean up of audited materials and supplies may result in injury from residue.	Residue from audited C&D materials may remain on table, scale, buckets or other audit equipment causing injury to other users.	B	2	Negligible	Ensure the audited C&D materials are carefully placed back in buckets and sealed. Ensure audit equipment is thoroughly sanitized with alcohol spray to remove any chemical or sharp residues.		B	2	Negligible	GHD Staff

Inspection and maintenance required for this activity:	Relevant sections of Legislation, Codes of Practice or Standards applying to this activity:	Provide details of statutory and non-statutory certificates/ permits/approvals required for this activity & location if required:
N/A	GHD HSE Standard Operating procedures	N/A

Emergency Arrangements:		Plant/machinery and personal and/or environment protective equipment required:	Certifications / training and e-learning required to complete activity PM to confirm with project team:
Role	**Name & Contact Number**	Tyvex Suit Safety Glasses N95 Face Mask Gloves - puncture proof First Aid Kit Sanitizing Wipes	N/A
Project Manager	Deacon Liddy, 604-214-051(		
Client Contact	Andrea Panich , 250-360-3219		
HSE Manager	Justin Brusatore, 604-248-397:		
Emergency Services			
Nearest Hospital	Vancouver General Hospital, Jim Pattison Pavilion, 899 W 12th Ave, Vancouver, BC V5Z 1M9		
Information to provide in case of an emergency			
Assembly Point			
Nearest Rd / St and distance			
Local landmarks			

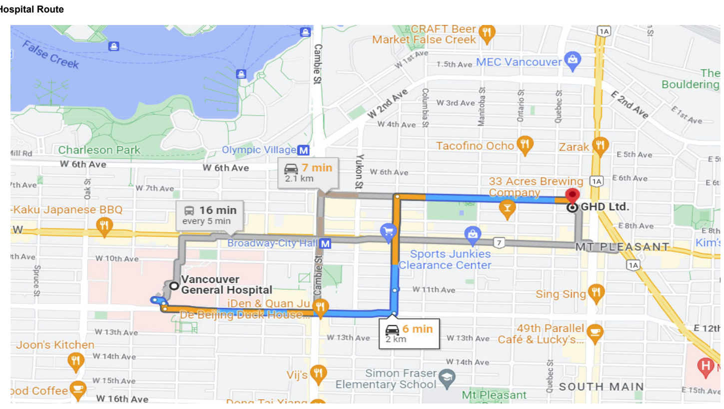
Created by PM Nam (or suitable delegate)	Signature	Date	Reviewed & Approved by PD Name (or suitably skilled and experienced delegate)	Signature	Date	PD Review in HSE Database?
Laura Hnatiuk			Justin Brusatore	Justin Brusatore	2/10/2023	Yes

By signing, I understand and agree to work to this JSEA, referenced procedures and have completed listed training. I am empowered to stop work if any person's safety or the environment are at risk.

GHD Project Team Name	Position	Qualification	Signature	Date
Abram Robiso	EIT			
Laura Hnatiuk	Zero Waste Coordinator			
Anastassia Alexeeva	EIT			
Jason Wilson	Waste Management Engineer			

Notes: Print a sufficient number of Pre-Work Assessment (single or multi-day) sheets for the number of days on site.

Map with Hospital Route



Attachment 4

Asbestos Test Results

CERTIFICATE OF ANALYSIS

Work Order	: **VA23A1595**	Page	: 1 of 2
Client	: **GHD Limited**	Laboratory	: Vancouver - Environmental
Contact	: Laura Hnatiuk	Account Manager	: Amber Springer
Address	: 138 E 7th Ave Suite 100 Vancouver BC Canada V5T 1M6	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 12590255	Date Samples Received	: 23-Jan-2023 16:15
PO	: ----	Date Analysis Commenced	: 27-Jan-2023
C-O-C number	: 17-866380	Issue Date	: 27-Jan-2023 15:19
Sampler	: ----		
Site	: C&D Waste		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Trace Chometsky	Account Manager Assistant	Internal Subcontracting, Cincinnati, Ohio

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
% (w/w)	% weight/weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Soil/Solid**

(Matrix: **Soil/Solid)**

				Client sample ID	**Sample 1**	----	----	----	----
				Client sampling date / time	23-Jan-2023 12:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**VA23A1595-001**	--------	--------	--------	--------
					Result	----	----	----	----
Asbestos/Other Fibres									
Asbestos, <2mm	1332-21-4	ASTM D7521	0.25	% (w/w)	See Attached	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

right solutions. right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA23A1595**	Page	: 1 of 4
Client	: **GHD Limited**	Laboratory	: Vancouver - Environmental
Contact	: Laura Hnatiuk	Account Manager	: Amber Springer
Address	: 138 E 7th Ave Suite 100 Vancouver BC Canada V5T 1M6	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 12590255	Date Samples Received	: 23-Jan-2023 16:15
PO	: ----	Issue Date	: 27-Jan-2023 15:19
C-O-C number	: 17-866380		
Sampler	: ----		
Site	: C&D Waste		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Asbestos/Other Fibres : Asbestos by Sieving & PLM										
Double bagged HDPE Sample 1	ASTM D7521	23-Jan-2023	----	----	----		27-Jan-2023	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Asbestos by Sieving & PLM	ASTM D7521 Cincinnati - Environmental - 4388 Glendale-Milford Road Cincinnati Ohio United States 45242	Soil/Solid	ASTM D7521-16	Sample is dried and passed through nested sieves into a collection pan. The fine (<106um), medium (>106um <2mm) and coarse (>2mm <19mm) fraction are analyzed separately by stereomicroscopy and polarized light microscopy (PLM) using calibrated visual area estimation. If asbestos is identified in the fine fraction at a level below 1%, a point count approach is performed. If no asbestos is found in the fine fraction, TEM analysis can be conducted upon client request. If particle fraction (>19mm) is found, it can be analyzed by the regular PLM method EPA 600/R-93/116 as per client request and will be reported separately.

QUALITY CONTROL REPORT

Work Order	:	**VA23A1595**	Page	:	1 of 2
Client	:	GHD Limited	Laboratory	:	Vancouver - Environmental
Contact	:	Laura Hnatiuk	Account Manager	:	Amber Springer
Address	:	PO BOX 1000 625 Fisgard Street Victoria BC Canada V8W 2S6	Address	:	8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:		Telephone	:	+1 604 253 4188
Project	:	12590255	Date Samples Received	:	23-Jan-2023 16:15
PO	:	----	Date Analysis Commenced	:	27-Jan-2023
C-O-C number	:	17-866380	Issue Date	:	27-Jan-2023 15:19
Sampler	:	---- ----			
Site	:	C&D Waste			
Quote number	:	----			
No. of samples received	:	1			
No. of samples analysed	:	1			

This Quality Control Report contains the following information:

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Trace Chometsky	Account Manager Assistant	USA - Cincinnati Internal Subcontracting, Cincinnati, Ohio

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

27-Jan-2023

Reporting
ALS Environmental
8081 Lougheed HWY
Suite 100
Burnaby, BC V5A 1W9

Re: **VA23A1595** Work Order: **23010827**

Dear Reporting,

ALS Environmental received 1 sample on 26-Jan-2023 11:17 AM for the analyses presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested.

QC sample results for this data met laboratory specifications. Any exceptions are noted in the Case Narrative, or noted with qualifiers in the report or QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained from ALS Laboratory Group. Samples will be disposed in 30 days unless storage arrangements are made.

The total number of pages in this report is 8.

If you have any questions regarding this report, please feel free to contact me.

Sincerely,

Shawn Smythe

Electronically approved by: Hannah Ponder

Shawn Smythe
Project Manager

Report of Laboratory Analysis

Client: ALS Environmental
Project: VA23A1595
Work Order: **23010827**

Work Order Sample Summary

Lab Samp ID	Client Sample ID	Matrix	Tag Number	Collection Date	Date Received	Hold
23010827-01	VA23A1595-001	Soil		1/23/2023 15:30	1/26/2023 11:17	☐

Client: ALS Environmental
Project: VA23A1595
Work Order: 23010827

Case Narrative

It is the responsibility of the client to notify the lab of any certification requirements in writing via the chain of custody as this may determine the preparation and analytical procedures employed.
Laboratory accreditation does not in any way constitute approval or endorsement by any accrediting body or agency of the federal government. Please contact ALS Cincinnati QA/QC Manager for accreditation identifications and certifications.
All sample collection is performed outside of ALS and is the sole responsibility of the client. Sample condition acceptable upon receipt except where noted. Estimates of concentration are semi-quantitative and are made on an area basis. Results apply only to portions of samples analyzed. Samples disposed after 60 days.
All analytical data (results) and technical content (comments) related to the preparation and analysis of the samples stated herein is the responsibility of the analyst. Raw data is reviewed and validated by a qualified peer analyst and imported into the Laboratory Information Management System (LIMS) where it is formatted by the cover letter signatory charged with compiling and sending the final LIMS generated report to the client.
The reporting limit (RL) for asbestos in bulk materials is 1% and is a function of the quantity of sample analyzed, the nature of any matrix interferences, sample preparation, and fiber size and distribution. Results reported as ND indicate that no asbestos was detected. Results reported as Trace indicate that asbestos was detected at some level confidently determined to be <1% which is considered inconclusive according to New York ELAP.
ALS performs variety of PLM methods for asbestos in bulk building materials including EPA 600/R-93/116, NIOSH 9002, ELAP 198.1, and ELAP 198.6. In addition, we perform a modified uncertified version of EPA 600/R-04/004 for asbestos in vermiculite which reports asbestos as present or absent only, an in-house developed uncertified method ALS SOP ENV 004 for asbestos in soil, and asbestos in soil by ASTM D7521.
Regardless of the method requested, all samples are examined according to mandatory method protocol. Any optional method protocol are eliminated from the initial analysis but may be performed upon client request. These may include; insufficient sample volume rejection*, phase separation of layered or heterogeneous samples, ashing to remove organic interferences, acid dissolution to remove mineral carbonate interferences, point counting**, and analysis by transmission electron microscopy (TEM) is recommended to verify all ND PLM results.
All samples are examined by stereomicroscope for the determination of homogeneity, texture, friability, color, and extent of fibrous components. Non-asbestos materials such as foil, paper, metal, plastic, pebbles, or organic debris are ignored and a subsample of the remaining material homogenized by some means for examination by polarized light microscope (PLM). Information obtained via both stereomicroscope and PLM are used in the final qualitative and quantitative analysis of fibrous components.
NOTE: Any visible building debris in soil samples such as pieces of drywall, roofing material,

insulation, concrete, etc., are not included in the soil analysis. If present, these are considered possible asbestos containing materials (ACM) and may be analyzed as separate samples upon client request.
*Sufficient sample volume is material dependent. For samples such as floor tiles, roofing felts, sheet insulation, etc., three to four square inches of the layered material is preferred. For materials such as ceiling tiles, loose fill insulation, pipe insulation, etc., one cubic inch (~15cc) is preferred. For samples of thin coating materials such as paints, mastics, spray plasters, etc., a smaller sample size may be suitable. For vermiculite analysis, a one gallon ziploc bag full of dry, loose material is acceptable. For ENV 004 soil samples, a 4oz jar is recommended. The ASTM D7521 Soil method requires a minimum of 8oz and a maximum of 16oz of homogeneous soil.
**PLM samples at or near the 1% detection limit may be analyzed by the 400 point count analysis which refers to method EPA 600/M4/82/020, or AHERA method EPA 40 CFR Part 763, Sub. E, App. E as these are synonymous

ALS Environmental

Date: *27-Jan-23*

Client: ALS Environmental
Project: VA23A1595

Work Order: 23010827

Lab ID: 23010827-01A
Client Sample ID: VA23A1595-001

Collection Date: 1/23/2023 3:30:00 PM
Matrix: SOIL

Analytical Results

Analyses	Result	Units		
Asbestos by PLM				Date Analyzed: **1/27/2023**
Macroscopic Examination	Prep Date: **1/27/2023**		**E600/R-93/116**	Analyst: **MRS**
Color	Brown			
Description	Debris			
Homogeneity	Heterogenous			
Texture	Fibrous			
Other Materials			**E600/R-93/116**	
Cellulose	>50<=60	%		
Fiberglass	>5<=10	%		
Non-fibrous	>20<=30	%		
Other fibers	ND	%		
Resin/binder	ND	%		
Asbestiform Minerals			**E600/R-93/116**	
Amosite	ND	%		
Anthophyllite	ND	%		
Chrysotile	ND	%		
Crocidolite	ND	%		
Tremolite - actinolite	ND	%		
Total asbestos	**ND**	**%**		

Note:

ALS Environmental

Date: 27-Jan-23

Client: ALS Environmental
Project: VA23A1595
WorkOrder: **23010827**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL

Acronym	Description
DUP	Method Duplicate
E	EPA Method
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SDL	Sample Detection Limit
SW	SW-846 Method

Units Reported	Description
%	

ALS Environmental

Sample Receipt Checklist

Client Name: **ALS-VANCOUVER**
Date/Time Received: **26-Jan-23 11:17**

Work Order: **23010827**
Received by: **AB**

Checklist completed by	Alec Bolender	26-Jan-23	Reviewed by:	Hannah Ponder	26-Jan-23
	eSignature	Date		eSignature	Date

Matrices: soil
Carrier name: DHL

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Sample(s) received on ice?	Yes ☐	No ☑	
Temperature(s)/Thermometer(s):	11.4	119059	
Cooler(s)/Kit(s):			
Date/Time sample(s) sent to storage:	1/26/23 11.17		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑
pH adjusted?	Yes ☐	No ☐	N/A ☑
pH adjusted by:	-		

Login Notes:

Client Contacted:
Date Contacted:
Person Contacted:

Contacted By:
Regarding:

Comments:

CorrectiveAction:

Chain of Custody

Vancouver - Environmental
8081 Lougheed Highway
Burnaby BC Canada V5A 1W9

97797

Destination Lab:	**USA - Cincinnati**
Address:	4388 Glendale-Milford Road Cincinnati OH United States 45242
Client:	Capital Regional District
Work Order Number:	**VA23A1595**
Original Receipt Date/Time	Instructions Received
23/01/2023 19:15	

23010827

Relinquished By	
Date/Time	
Received By	[illegible] /ALS
Date/Time	1-26-23 1117
Receipt Temp	

Return as Indicated: Results: alsev.datasublet@alsglobal.com Invoice: alsev.datasublet@alsglobal.com Electronic Data: alsev.datasublet@alsglobal.com

Attention: Amber Springer

ALS Sample ID	Client ID	Matrix	Container Type	Test Codes	Method Description	Due Date	Sampling Date and Time	Remarks
VA23A1595-001	Sample 1	Soil/Solid	Double bagged HDPE	ASTM D7521	Asbestos by Sieving & PLM	07-02-2023	23/01/2023 15:30	

AB 1-26-23 / 8 / 11.4 °C / 119059 DHC

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 866380

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	GHD Limited
Contact:	Laura Hnatiuk
Phone:	604-248-3658
	Company address below will appear on the final report
Street:	138 E 7th Ave
City/Province:	Vancouver, BC
Postal Code:	V5T 1M6
Invoice To	Same as Report To ☐ YES ☑ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	CRD
Contact:	Andrea Panich apanich@crd.bc.ca

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: laura.hnatiuk@ghd.com

Email 2: ~~Reference PO~~

Email 3: ~~apanich@crd.bc.ca~~

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: apanich@crd.bc.ca

Email 2:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ · 3 day [P3-25%] ☐ · 2 day [P2-50%] ☑

EMERGENCY: 1 Business day [E - 100%] ☐ · Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:

Job #: 12590255

PO / AFE:

LSD: C&D waste

ALS Lab Work Order # (lab use only): 1595

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#:

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Contact: | Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Asbestos	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	Sample 1	23-01-23	12:30	Product	1	✓		

Environmental Division
Vancouver
Work Order Reference
VA23A1595
Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☑

INITIAL COOLER TEMPERATURES °C:

FINAL COOLER TEMPERATURES °C: 18.8

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: JH	Date: 01/23/23	Time: 4:15

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Attachment 5

CRD and C&D Shredding Lab Sample Analysis (ALS)

ALS Canada Ltd.

right solutions.
right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA23A5145**	Page	: 1 of 4
Client	: **Capital Regional District**	Laboratory	: Vancouver - Environmental
Contact	: Andrea Panich	Account Manager	: Amber Springer
Address	: PO BOX 1000 625 Fisgard Street Victoria BC Canada V8W 2S6	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Mar-2023 11:00
PO	: ----	Date Analysis Commenced	: 01-May-2023
C-O-C number	: 20-1017661	Issue Date	: 01-May-2023 16:42
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kaitlyn Gardner	Account Manager Assistant	Internal Subcontracting, Tucson, Arizona

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
%	percent
mg/kg	milligrams per kilogram

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Soil/Solid**

(Matrix: **Soil/Solid**)

				Client sample ID	Dec 29	Dec 13	Dec 31	----	----
				Client sampling date / time	29-Dec-2022	13-Dec-2022	31-Dec-2022	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**VA23A5145-001**	**VA23A5145-002**	**VA23A5145-003**	--------	--------
					Result	Result	Result	----	----
Sample Preparation									
Dry & grind	----	GRIND	-	-	See attached	See attached	See attached	----	----
Metals									
Aluminum	7429-90-5	EPA3052	12.5	mg/kg	See attached	See attached	See attached	----	----
Antimony	7440-36-0	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Arsenic	7440-38-2	EPA3052	5	mg/kg	See attached	See attached	See attached	----	----
Barium	7440-39-3	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Beryllium	7440-41-7	EPA3052	0.25	mg/kg	See attached	See attached	See attached	----	----
Cadmium	7440-43-9	EPA3052	0.25	mg/kg	See attached	See attached	See attached	----	----
Calcium	7440-70-2	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Chromium	7440-47-3	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Cobalt	7440-48-4	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Copper	7440-50-8	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Iron	7439-89-6	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Lead	7439-92-1	EPA3052	5	mg/kg	See attached	See attached	See attached	----	----
Lithium	7439-93-2	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Magnesium	7439-95-4	EPA3052	12.5	mg/kg	See attached	See attached	See attached	----	----
Manganese	7439-96-5	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Molybdenum	7439-98-7	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----

Analytical Results

Sub-Matrix: Soil/Solid (Matrix: Soil/Solid)				Client sample ID	Dec 29	Dec 13	Dec 31	----	----
				Client sampling date / time	29-Dec-2022	13-Dec-2022	31-Dec-2022	----	----
Analyte	CAS Number	Method	LOR	Unit	VA23A5145-001	VA23A5145-002	VA23A5145-003	--------	--------
					Result	Result	Result	----	----
Metals									
Nickel	7440-02-0	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Phosphorus	7723-14-0	EPA3052	12.5	mg/kg	See attached	See attached	See attached	----	----
Potassium	7440-09-7	EPA3052	12.5	mg/kg	See attached	See attached	See attached	----	----
Selenium	7782-49-2	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Silicon	7440-21-3	EPA3052	12.5	mg/kg	See attached	See attached	See attached	----	----
Silver	7440-22-4	EPA3052	12.5	mg/kg	See attached	See attached	See attached	----	----
Sodium	7440-23-5	EPA3052	12.5	mg/kg	See attached	See attached	See attached	----	----
Strontium	7440-24-6	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Tin	7440-31-5	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Titanium	7440-32-6	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Vanadium	7440-62-2	EPA3052	1.25	mg/kg	See attached	See attached	See attached	----	----
Zinc	7440-66-6	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Zirconium	7440-67-7	EPA3052	2.5	mg/kg	See attached	See attached	See attached	----	----
Elemental Composition									
Chloride, acid soluble	16887-00-6	CL(HNO3)	0.01	%	See attached	See attached	See attached	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA23A5145**	Page	: 1 of 5
Client	: **Capital Regional District**	Laboratory	: Vancouver - Environmental
Contact	: Andrea Panich	Account Manager	: Amber Springer
Address	: PO BOX 1000 625 Fisgard Street Victoria BC Canada V8W 2S6	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Mar-2023 11:00
PO	: ----	Issue Date	: 01-May-2023 16:40
C-O-C number	: 20-1017661		
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Elemental Composition : Acid Soluble Chloride										
Compliant container Dec 13	CL(HNO3)	13-Dec-2022	----	----	----		01-May-2023	----	----	
Elemental Composition : Acid Soluble Chloride										
Compliant container Dec 29	CL(HNO3)	29-Dec-2022	----	----	----		01-May-2023	----	----	
Elemental Composition : Acid Soluble Chloride										
Compliant container Dec 31	CL(HNO3)	31-Dec-2022	----	----	----		01-May-2023	----	----	
Metals : Metals in Soil/Solid by HNO3,HCl and HF digestion										
Compliant container Dec 13	EPA3052	13-Dec-2022	----	----	----		01-May-2023	----	----	
Metals : Metals in Soil/Solid by HNO3,HCl and HF digestion										
Compliant container Dec 29	EPA3052	29-Dec-2022	----	----	----		01-May-2023	----	----	
Metals : Metals in Soil/Solid by HNO3,HCl and HF digestion										
Compliant container Dec 31	EPA3052	31-Dec-2022	----	----	----		01-May-2023	----	----	
Sample Preparation : Grinding of solid material										
Compliant container Dec 31	GRIND	31-Dec-2022	----	----	----		01-May-2023	180 days	121 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Sample Preparation : Grinding of solid material										
Compliant container Dec 29	GRIND	29-Dec-2022	----	----	----		01-May-2023	180 days	123 days	✓
Sample Preparation : Grinding of solid material										
Compliant container Dec 13	GRIND	13-Dec-2022	----	----	----		01-May-2023	180 days	139 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Acid Soluble Chloride	CL(HNO3) Tucson - Environmental - 4208 S. Santa Rita Ave. Tucson Arizona United States 85714	Soil/Solid	ASTM C114	Samples are heated to boiling in dilute nitric acid to extract acid soluble chloride. Solids are then removed from the acid solution using a filter apparatus. An aliquot of NaCl is added to the filtrate and the solution is titrated with $AgNO_3$. The chlorine is quantified by using a chloride ISE to generate a calibration curve.
Metals in Soil/Solid by HNO3,HCl and HF digestion	EPA3052 Tucson - Environmental - 4208 S. Santa Rita Ave. Tucson Arizona United States 85714	Soil/Solid	EPA 3052/6010C	Sample is digested by HNO3,HCl and HF and analyzed by ICPOES.
Grinding of solid material	GRIND Tucson - Environmental - 4208 S. Santa Rita Ave. Tucson Arizona United States 85714	Soil/Solid	ALS Tucson In-house	Solids samples are ground using a grinder.

ALS Canada Ltd.

right solutions. right partner.

QUALITY CONTROL REPORT

Work Order	: **VA23A5145**	Page	: 1 of 2
Client	: Capital Regional District	Laboratory	: Vancouver - Environmental
Contact	: Andrea Panich	Account Manager	: Amber Springer
Address	: PO BOX 1000 625 Fisgard Street Victoria BC Canada V8W 2S6	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 08-Mar-2023 11:00
PO	: ----	Date Analysis Commenced	: 01-May-2023
C-O-C number	: 20-1017661	Issue Date	: 01-May-2023 16:40
Sampler	: ---- ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kaitlyn Gardner	Account Manager Assistant	USA - Tucson Internal Subcontracting, Tucson, Arizona

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

April 2 , 202

Ser ice Re uest No T2 00

Ms. Amber Springer
ALS En ironmental - Canada
0 Lougheed Hwy, Suite 00
Burnaby, BC V A W

Laboratory Results for:

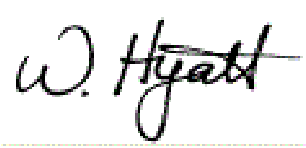
Dear Ms.Springer,

Enclosed are the results of the sample(s) submitted to our laboratory March 2 , 202
For your reference, these analyses ha e been assigned our ser ice re uest number **T2300517.**

All analyses were performed according to our laboratory s uality assurance program. All results are intended to be considered in their entirety, and ALS En ironmental is not responsible for use of less than the complete report. Results
apply only to the items submitted to the laboratory for analysis and indi idual items (samples) analyzed, as listed in the report.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental



Wendy Hyatt
Laboratory Director

ADDRESS 20 S Santa Rita A enue, Tucson, AZ
PHONE 20 06 FAX 20 62 2
ALS Group USA, Corp.
dba ALS En ironmental

Chain of Custody

Vancouver - Environmental
8081 Lougheed Highway
Burnaby BC Canada V5A 1W9

104438

Destination Lab:	USA - Tucson		
Address:	4208 S. Santa Rita Ave. Tucson AZ United States 85714		
Client:	Capital Regional District		
Work Order Number:	VA23A5145		
Original Receipt Date/Time		Instructions Received	
08/03/2023 12:00			

T2300517 5
ALS Environmental - Canada

Relinquished By

Date/Time

Received By Diego M.

Date/Time 3/2/23 1134

Receipt Temp

Return as Indicated: Results: alsev.datasublet@alsglobal.com Invoice: alsev.datasublet@alsglobal.com Electronic Data: alsev.datasublet@alsglobal.com

Attention: Amber Springer

ALS Sample ID	Client ID	Matrix	Container Type	Test Codes	Method Description	Due Date	Sampling Date and Time	Remarks
VA23A5145-001	Dec 29	Soil/Solid	Compliant container	CL(HNO3), GRIND, EPA3052	Acid Soluble Chloride, Grinding of solid material, Metals in Soil/Solid by HNO3,HCl and HF digestion	14-03-2023	29/12/2022 01:00	
VA23A5145-002	Dec 13	Soil/Solid	Compliant container	CL(HNO3), GRIND, EPA3052	Acid Soluble Chloride, Grinding of solid material, Metals in Soil/Solid by HNO3,HCl and HF digestion	14-03-2023	13/12/2022 01:00	
VA23A5145-003	Dec 31	Soil/Solid	Compliant container	CL(HNO3), GRIND, EPA3052	Acid Soluble Chloride, Grinding of solid material, Metals in Soil/Solid by HNO3,HCl and HF digestion	14-03-2023	31/12/2022 01:00	

* Please refer to attached email for full list of analysis

4208 S.Santa Rita Ave.
Tucson, AZ 85714
T: +1 520 573 1061
www.alsglobal.com

ALS Canada

Sample Receipt Form

T2300517 5
ALS Environmental - Canada

Client/Project: ~~Captial Regional District~~ ✓W

Work Order Number:

Received by: Diego Mendez

Date & Time: 3/21/2023 1134

Matrix: Solid

Samples were received via?: DHL

Samples were received in: Bucket

Were custody seals on containers? (●) Yes ( ) No ( ) NA

If yes, how many and where? 1

If present were custody seals intact? (●) Yes (●) No

If present, were they signed and dated? ( ) Yes (●) No

Arrival Temp C	Temp Blank C	Tracking Number
ambient	n/a	WAYBILL 23 5165 8400

Packing material used?

Did all the bottles arrive in good condition (unbroken)? (●) Yes ( ) No ( ) NA

If No, record comments below

Did all sample labels and tags agree with COC? (●) Yes ( ) No ( ) NA

If No, record discrepancies below

Were all the appropriate containers and volumes received for the tests indicated? (●) Yes ( ) No ( ) NA

Are samples received deemed acceptable? (●) Yes ( ) No

MSDS included with paperwork? No

Comments:

3 ~~10~~ gallon buckets
5

As a part of ISO 17025 protocols, ALS must notify clients that the quoted analytical methods performed by ALS may have minor modifications from the methods as published. These modifications are written into our Standard Operating Procedures and do not impact the quality of the data. Receipt of this document will be considered as acceptance of the procedures used by the laboratory for analysis unless notified by the client.
Modifications may include, but are not limited to:

- The analysis of a sample matrix that differs from that stated in the published method (example - ASTM D5865 Standard Test Method for Gross Calorific Value of Coal and Coke is used for other matrices such as biomass, Tire Derived Fuel, etc.).
- Analyzing a sample mass that differs from those in the published method (example - to accommodate samples with high concentrations of analyte, samples of limited volume, or to comply with the instrument manufacturer's operating guidelines).
- Instruments used for the analysis may differ from those listed in the published method (example - using ICP- OES when the method references flame Atomic Absorption Spectroscopy)

Client: ALS Environmental - Canada
8081 Lougheed Hwy, Suite 100
Burnaby, BC V5A 1W9
Attn: Amber Springer

Project: VA23A5145 **Date Received:** March 21, 2023

Certificate of Analysis

Sample ID:	Sample Date:		Lab #:	Moisture, Total D3173 wt%		Chlorine, Total 5050/9056 Moist. Free mg/kg		Mercury, Total D6722 Moist. Free ppb		
VA23A5145-001 Dec 29	12/29/22	0100	T2300517-001	15.66		1,484		23		
VA23A5145-002 Dec 13	12/13/22	0100	T2300517-002	18.25		1,011		53		
VA23A5145-003 Dec 31	12/31/22	0100	T2300517-003	32.20		22,148		354		

Client: **ALS Environmental - Canada**
8081 Lougheed Hwy, Suite 100
Burnaby, BC V5A 1W9
Attn: **Amber Springer**

Project: **VA23A5145** **Date Received:** **March 21, 2023**

Certificate of Analysis

Sample ID:	Sample Date:		Lab #:	Heating Value Wire Free D5865			Heating Value With Wire D5866			Wire Content D6700
				As Received BTU/lb	Moist. Free BTU/lb	Moist. Free MMBTU/Ton*	As Received BTU/lb	Moist. Free BTU/lb	Moist. Free MMBTU/Ton*	Air Dried wt%
VA23A5145-001 Dec 29	12/29/22	0100	T2300517-001	7,516	8,911	17.82	n/a	n/a	n/a	n/a
VA23A5145-002 Dec 13	12/13/22	0100	T2300517-002	4,571	5,592	11.18	4,354	5,326	10.65	4.7
VA23A5145-003 Dec 31	12/31/22	0100	T2300517-003	6,355	9,373	18.75	n/a	n/a	n/a	n/a

Notes:

TDF sample required freezing with liquid nitrogen prior to the coarse and fine grinding steps.

ALS Environmental - Tucson, AZ

Particle Size Analysis by Sieving

ASTM C117, C136, D421 & D422 - Sediment / Soil		Wet Sieve		Dry Seive	X	**Analyst:**	ALENA ESTRADA
ASTM E828 - RDF and Biomass Fuels	X					**Analysis Date:**	4/18/2023
						Analyst Review:	AE 4/18/23
						Supervisor Review:	WH 4/28

Client: ALS Environmental - Canada

Project: VA23A5145

	Lab No.		T2300517-001	
	Client Sample ID		VA23A5145-001 Dec 29	
Starting Sample	Container Wt. g	Sx & Cont Wt. g	Sx (AR, AD or MF)	Begin Sx Wt. g
	1853.24	3494.26	AR	1641.02
Screen Sizes	Container Wt.	Sample + Cont. Wt.	Retained	Passing
	g	g	wt%	wt%
4"	332.40	1860.61	91.34	8.66
3"	323.32	386.31	3.76	4.90
2"	370.56	399.15	1.71	3.19
Pan	332.58	385.97	3.19	
	Finish Wt. g	1673.18	Recovered Sx %	102.0

	Lab No.		T2300517-002	
	Client Sample ID		VA23A5145-002 Dec 13	
Starting Sample	Container Wt. g	Sx & Cont Wt. g	Sx (AR, AD or MF)	Begin Sx Wt. g
	2028.27	5412.12	AR	3383.85
Screen Sizes	Container Wt.	Sample + Cont. Wt.	Retained	Passing
	g	g	wt%	wt%
4"	332.40	1664.03	39.74	60.26
3"	323.32	944.83	18.55	41.72
2"	370.56	990.31	18.49	23.22
Pan	332.58	1110.83	23.22	
	Finish Wt. g	3351.14	Recovered Sx %	99.0

	Lab No.		T2300517-003	
	Client Sample ID		VA23A5145-003 Dec 31	
Starting Sample	Container Wt. g	Sx & Cont Wt. g	Sx (AR, AD or MF)	Begin Sx Wt. g
	1975.84	4902.40	AR	2926.56
Screen Sizes	Container Wt.	Sample + Cont. Wt.	Retained	Passing
	g	g	wt%	wt%
4"	332.40	2591.06	77.71	22.29
3"	323.32	659.79	11.58	10.71
2"	370.56	577.09	7.11	3.61
Pan	332.58	437.38	3.61	
	Finish Wt. g	2906.46	Recovered Sx %	99.3

	Lab No.			
	Client Sample ID			
Starting Sample	Container Wt. g	Sx & Cont Wt. g	Sx (AR, AD or MF)	Begin Sx Wt. g
Screen Sizes	Container Wt.	Sample + Cont. Wt.	Retained	Passing
	g	g	wt%	wt%
4"				
3"				
2"				
Pan				
	Finish Wt. g	0.00	Recovered Sx %	

Remarks:

Particle Size Analysis by Sieving

ASTM D422

Rev 03.1 (removed calculation for residual moisture and corrected Retained % calculation to be based on Finish Wt. instead of Begin Sx Wt.)

Client: ALS Environmental - Canada
8081 Lougheed Hwy, Suite 100
Burnaby, BC V5A 1W9

Attn: Amber Springer

Project: VA23A5145 **Date Received:** March 21, 2023

Certificate of Analysis

Total Metals by ICP-OES	ID	VA23A5145-001 Dec 29	VA23A5145-002 Dec 13	VA23A5145-003 Dec 31		
	Units	T2300517-001	T2300517-002	T2300517-003		
Aluminum	mg/kg	3,945	19,067	29,729		
Antimony	mg/kg	< 79	< 87	< 65		
Arsenic	mg/kg	< 16	36	15		
Barium	mg/kg	131	132	283		
Beryllium	mg/kg	< 2	< 3	< 2		
Cadmium	mg/kg	< 8	< 9	< 7		
Calcium	mg/kg	22,510	49,670	13,634		
Chromium	mg/kg	10	56	37		
Cobalt	mg/kg	< 40	< 43	< 33		
Copper	mg/kg	12	34	16		
Iron	mg/kg	7,163	7,965	15,261		
Lead	mg/kg	< 16	< 17	28		
Lithium	mg/kg	< 24	< 26	20		
Magnesium	mg/kg	4,233	3,873	4,420		
Manganese	mg/kg	106	221	165		
Molybdenum	mg/kg	< 79	< 87	< 65		
Nickel	mg/kg	< 40	< 43	< 33		
Phosphorus	mg/kg	267	359	186		
Potassium	mg/kg	1,830	3,957	13,795		
Selenium	mg/kg	< 40	< 43	< 33		
Silicon	mg/kg	11,953	91,242	83,128		
Sodium	mg/kg	3,059	3,794	3,369		
Strontium	mg/kg	59	114	62		
Tin	mg/kg	17	22	24		
Titanium	mg/kg	936	1,433	2,641		
Vanadium	mg/kg	16	25	40		
Zinc	mg/kg	193	133	1,536		
Zirconium	mg/kg	< 16	41	54		

Note: Values reported on a dried basis.

Total Metals - Samples digested with HNO3, HCl & HF acids in microwave. Analysis was by ICP-OES.

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 - 1017661

Canada Toll Free: 1 800 668 9878

Page of

ALS www.alsglobal.com

Report To — Contact and company name below will appear on the final report

Company: Capital Regional District
Contact: Andrea Panich
Phone: 250-360-3219

Company address below will appear on the final report

Street: 625 Fisgard St
City/Province: Victoria / BC
Postal Code: V8W 1R7

Invoice To
Same as Report To ☐ YES ☐ NO
Copy of Invoice with Report ☐ YES ☐ NO
Company:
Contact:

Reports / Recipients
Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2
Email 3

Invoice Recipients
Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax
Email 2

Turnaround Time (TAT) Requested
☐ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-routine tests

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

Project Information
ALS Account # / Quote #: CARD 100
Job #:
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)
AFE/Cost Center: PO#
Major/Minor Code: Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (ALS use only):
ALS Contact:
Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Grind	Heating value	Mercury EPA	Chlorine EPA	Total metals EPA	Sieve analysis 4", 1.3", 2"	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	December 29	29-12-22	—	C+D waste	1	✓	✓	✓	✓	✓	✓			N
	Dec 13	13-12-22	—	C+D waste	1	✓	✓	✓	✓	✓	✓			N
	Dec 31	31-12-22	—	C+D waste	1	✓	✓	✓	✓	✓	✓			N

Environmental Division
Vancouver
Work Order Reference
VA23A5145
Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO
Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for resu...

SAMPLE RECEIPT DETAILS (ALS use only)
Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED
Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO
Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A
INITIAL COOLER TEMPERATURES °C
FINAL COOLER TEMPERATURES °C: 14 14 14

SHIPMENT RELEASE (client use)
Released by: Andrea Panich Date: March 07, 2023 Time: 14:30

...(ALS use only)
Received by: Date: Time:

FINAL SHIPMENT RECEPTION (ALS use only)
Received by: JC Date: 8 Mar 23 Time: 11am

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Canada Ltd.

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right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA23B4478**	Page	: 1 of 3
Amendment	: **1**		
Client	: **Capital Regional District**	Laboratory	: ALS Environmental - Vancouver
Contact	: Andrea Panich	Account Manager	: Amber Springer
Address	: PO BOX 1000 625 Fisgard Street Victoria BC Canada V8W 2S6	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 23-Jun-2023 13:00
PO	: ----	Date Analysis Commenced	: 22-Sep-2023
C-O-C number	: ----	Issue Date	: 23-Sep-2023 09:42
Sampler	: Luke Novy		
Site	: ----		
Quote number	: VA22-CARD100-006		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Paolo Obillo	Account Manager Assistant	Internal Subcontracting, Tucson, Arizona

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Waste**

(Matrix: **Soil/Solid**)

				Client sample ID	March 9 1/3	March 10 2/3	March 18 3/3	----	----
				Client sampling date / time	09-Mar-2023 00:00	10-Mar-2023 00:00	18-Mar-2023 00:00	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*	VA23B4478-001	VA23B4478-002	VA23B4478-003	--------	--------
					Result	Result	Result	----	----
Physical Tests									
Ash	----	PROXIMATE/1J	0.01	%	see attached	see attached	see attached	----	----
Volatile matter	----	PROXIMATE/1J	0.01	%	see attached	see attached	see attached	----	----
Elemental Composition									
Carbon	----	ULTIMATE/1J	0.05	%	see attached	see attached	see attached	----	----
Hydrogen	1333-74-0	ULTIMATE/1J	0.05	%	see attached	see attached	see attached	----	----
Nitrogen	7727-37-9	ULTIMATE/1J	0.05	%	see attached	see attached	see attached	----	----
Oxygen, calculated	7782-44-7	ULTIMATE/1J	0.05	%	see attached	see attached	see attached	----	----
Sulfur	7704-34-9	ULTIMATE/1J	0.005	%	see attached	see attached	see attached	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA23B4478**	Page	: 1 of 5
Amendment	: 1		
Client	: **Capital Regional District**	Laboratory	: ALS Environmental - Vancouver
Contact	: Andrea Panich	Account Manager	: Amber Springer
Address	: PO BOX 1000 625 Fisgard Street Victoria BC Canada V8W 2S6	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 23-Jun-2023 13:00
PO	: ----	Issue Date	: 23-Sep-2023 09:42
C-O-C number	: ----		
Sampler	: Luke Novy		
Site	: ----		
Quote number	: VA22-CARD100-006		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Elemental Composition : Ultimate										
HDPE Pail March 18 3/3	ULTIMATE	18-Mar-2023	----	----	----		22-Sep-2023	----	189 days	
Elemental Composition : Ultimate										
HDPE Pail March 10 2/3	ULTIMATE	10-Mar-2023	----	----	----		22-Sep-2023	----	197 days	
Elemental Composition : Ultimate										
HDPE Pail March 9 1/3	ULTIMATE	09-Mar-2023	----	----	----		22-Sep-2023	----	198 days	
Physical Tests : Proximate Analysis										
HDPE Pail March 18 3/3	PROXIMATE	18-Mar-2023	----	----	----		22-Sep-2023	----	189 days	
Physical Tests : Proximate Analysis										
HDPE Pail March 10 2/3	PROXIMATE	10-Mar-2023	----	----	----		22-Sep-2023	----	197 days	
Physical Tests : Proximate Analysis										
HDPE Pail March 9 1/3	PROXIMATE	09-Mar-2023	----	----	----		22-Sep-2023	----	198 days	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by “mod”).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Proximate Analysis	PROXIMATE Tucson - Environmental - 4208 S. Santa Rita Ave. Tucson Arizona United States 85714	Soil/Solid	ASTM D7582(D3173,D3174,D3175)	D7582: Proximate Analysis of Coal and Coke by Macro Thermogravimetric Analysis D3173: Moisture in the Analysis Sample of Coal and Coke D3174: Ash in the Analysis Sample of Coal and Coke from Coal D3175: Volatile Matter in the Analysis Sample of Coal and Coke
Ultimate	ULTIMATE Tucson - Environmental - 4208 S. Santa Rita Ave. Tucson Arizona United States 85714	Soil/Solid	ASTM D4239A/D5373	D4239: Sulfur in the Analysis Sample of Coal and Coke Using High-Temperature Tube Furnace Combustion. D5373: Determination of Carbon, Hydrogen and Nitrogen in Analysis Samples of Coal and Carbon in Analysis Samples of Coal and Coke.

ALS Canada Ltd.

right solutions. right partner.

QUALITY CONTROL REPORT

Work Order	: **VA23B4478**	Page	: 1 of 2
Amendment	: **1**		
Client	: Capital Regional District	Laboratory	: ALS Environmental - Vancouver
Contact	: Andrea Panich	Account Manager	: Amber Springer
Address	: PO BOX 1000 625 Fisgard Street Victoria BC Canada V8W 2S6	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 23-Jun-2023 13:00
PO	: ----	Date Analysis Commenced	: 22-Sep-2023
C-O-C number	: ----	Issue Date	: 23-Sep-2023 09:42
Sampler	: Luke Novy ----		
Site	: ----		
Quote number	: VA22-CARD100-006		
No. of samples received	: 3		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Paolo Obillo	Account Manager Assistant	USA - Tucson Internal Subcontracting, Tucson, Arizona

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

September 22, 202 Ser ice Re uest No T2 0 6

Ms. Amber Springer
ALS En ironmental - Canada
0 Lougheed Hwy, Suite 00
Burnaby, BC V A W

Laboratory Results for: VA23B4478

Dear Ms.Springer,

Enclosed are the results of the sample(s) submitted to our laboratory September 0 , 202
For your reference, these analyses ha e been assigned our ser ice re uest number **T2301569.**

All analyses were performed according to our laboratory s uality assurance program. All results are intended to be considered in their entirety, and ALS En ironmental is not responsible for use of less than the complete report. Results
apply only to the items submitted to the laboratory for analysis and indi idual items (samples) analyzed, as listed in the report.

Respectfully submitted,

ALS Group USA, Corp. dba ALS Environmental

Wendy Hyatt
Laboratory Director

ADDRESS 20 S Santa Rita A enue, Tucson, AZ
PHONE 20 06 FAX 20 62 2
ALS Group USA, Corp.
dba ALS En ironmental

Chain of Custody
Vancouver - Environmental
8081 Lougheed Highway
Burnaby BC Canada V5A 1W9

T2301425 ~~5~~ DB 9/8/23
ALS Environmental - Canada
VA23B4478

124165

Destination Lab:	USA - Tucson
Address:	4208 S. Santa Rita Ave. Tucson AZ United States 85714
Client:	Capital Regional District
Work Order Number:	VA23B4478
Original Receipt Date/Time	Instructions Received
23/06/2023 14:00	

T2301569 5
ALS Environmental - Canada
VA23B4478

Relinquished By
Date/Time
Received By
Date/Time 8/5/23 1240
Receipt Temp

Return as Indicated: Results: alsev.datasublist@alsglobal.com Invoice: alsev.datasublist@alsglobal.com Electronic Data: alsev.datasublist@alsglobal.com
Attention: Amber Springer

ALS Sample ID	Client ID	Matrix	Container Type	Test Codes	Method Description	Due Date	Sampling Date and Time	Remarks
VA23B4478-001	March 9 1/3	Soil/Solid	HDPE Pail	see COC		17-07-2023	09/03/2023 01:00	
VA23B4478-002	March 10 2/3	Soil/Solid	HDPE Pail	"		17-07-2023	10/03/2023 01:00	
VA23B4478-003	March 16 3/3	Soil/Solid	HDPE Pail	"		17-07-2023	16/03/2023 01:00	

See attached CoC for analysis

Page 1 of 1

4208 S.Santa Rita Ave.
Tucson, AZ 85714
T: +1 520 573 1061
www.alsglobal.com

T2301569 5
ALS Environmental - Canada
VA23B4476

DB 9/8/23

Sample Receipt Form

~~T2301425 5~~
~~ALS Environmental - Canada~~
~~VA23B4476~~

Client/Project: ALS Canada

Work Order Number:

Received by: Cynthia Vroegh

Date & Time: 8/15/2023 1240

Matrix: Solid

Samples were received via?: DHL

Samples were received in: Bucket (3)

Were custody seals on containers? ○ Yes ● No ○ NA

If yes, how many and where?

If present were custody seals intact? ○ Yes ● No

If present, were they signed and dated? ○ Yes ● No

Arrival Temp C	Temp Blank C	Tracking Number
Ambient	NA	1439790074

Packing material used?

Did all the bottles arrive in good condition (unbroken)? ● Yes ○ No ○ NA — If No, record comments below

Did all sample labels and tags agree with COC? ● Yes ○ No ○ NA — If No, record discrepancies below

Were all the appropriate containers and volumes received for the tests indicated? ● Yes ○ No ○ NA

Are samples received deemed acceptable? ● Yes ○ No

MSDS included with paperwork? No

3 - 5gl buckets

NOTES:

As a part of ISO 17025 protocols, ALS must notify clients that the quoted analytical methods performed by ALS may have minor modifications from the methods as published. These modifications are written into our Standard Operating Procedures and do not impact the quality of the data. Receipt of this document will be considered as acceptance of the procedures used by the laboratory for analysis unless notified by the client.
Modifications may include, but are not limited to:

- The analysis of a sample matrix that differs from that stated in the published method (example - ASTM D5865 Standard Test Method for Gross Calorific Value of Coal and Coke is used for other matrices such as biomass, Tire Derived Fuel, etc.).
- Analyzing a sample mass that differs from those in the published method (example - to accommodate samples with high concentrations of analyte, samples of limited volume, or to comply with the instrument manufacturer's operating guidelines).
- Instruments used for the analysis may differ from those listed in the published method (example - [illegible] Spectroscopy)

Client: ALS Environmental - Canada
8081 Lougheed Hwy, Suite 100
Burnaby, BC V5A 1W9
Attn: Amber Springer

Project: VA23B4478 **Date Received:** September 8, 2023

Certificate of Analysis

Sample ID:	Sample Date and Time		Lab #:	Moisture, Total	Volatile Matter		Fixed Carbon		Ash	
					D7582 Proximate by Automated TGA System					
				wt%	As Received wt%	Moist. Free wt%	As Received wt%	Moist. Free wt%	As Received wt%	Moist. Free wt%
VA23B4478-001 March 9 1/3	3/9/23	0100	T2301569-001	17.82	38.51	46.86	5.34	6.50	38.33	46.64
VA23B4478-002 March 10 2/3	3/10/23	0100	T2301569-002	13.73	34.81	40.35	3.68	4.27	47.78	55.38
VA23B4478-003 March 18 3/3	3/18/23	0100	T2301569-003	13.67	54.92	63.61	13.05	15.12	18.36	21.27

Client: ALS Environmental - Canada
8081 Lougheed Hwy, Suite 100
Burnaby, BC V5A 1W9
Attn: Amber Springer

Project: VA23B4478 **Date Received:** September 8, 2023

Certificate of Analysis

Sample ID:	Sample Date and Time		Lab #:	Carbon, Total	Hydrogen, Total	Nitrogen, Total	Oxygen	Sulfur, Total		
					D5373		Calculated	D4239		
				Moist. Free wt%	Moist. Free wt%	Moist. Free wt%	Moist. Free wt%	Moist. Free wt%		
VA23B4478-001 March 9 1/3	3/9/23	0100	T2301569-001	24.29	2.45	1.05	24.15	1.41		
VA23B4478-002 March 10 2/3	3/10/23	0100	T2301569-002	24.13	2.59	0.88	16.50	0.52		
VA23B4478-003 March 18 3/3	3/18/23	0100	T2301569-003	41.59	5.82	1.64	29.20	0.48		

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here
(lab use only)

COC Number: 14 -

Page 1 of 1

Report To	Andrea Panich
Company:	Capital Regional District
Contact:	Andrea Panich
Address:	625 Fisgard Street
Phone:	250-360-3219
Invoice To	Same as Report To ☑ Yes ☐ No
	Copy of Invoice with Report ☑ Yes ☐ No
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ Yes ☐ No

☐ Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax apanich@crd.bc.ca

Email 2

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax apanich@crd.bc.ca

Email 2

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)

- R ☑ Regular (Standard TAT if received by 3 pm - business days)
- P ☐ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
- E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
- E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge

Specify Date Required for E2,E or P:

Project Information

ALS Quote #:	Account # : CARD100
Job #:	
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only)	

Oil and Gas Required Fields (client use)

Approver ID:	Cost Center:
GL Account:	Routing Code:
Activity Code:	
Location:	

ALS Contact: Selam Worku Sampler: Luke Novy

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

Environmental Division
Vancouver
Work Order Reference
VA23B4478

Telephone : +1 604 253 4188

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Sieve Analysis on 4", 3" and 2"	Sieve Analysis to report % material that passes through 0.5 mm	Number of Containers
	March 9 1/3	09-Mar-23	unknown	Shredded C&D waste	✓	✓	1
	March 10 2/3	10-Mar-23	unknown	Shredded C&D waste	✓	✓	1
	March 18 3/3	18-Mar-23	unknown	Shredded C&D waste	✓	✓	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☐ No

Are samples for human drinking water use? ☐ Yes ☐ No

Special Instructions / Specify Criteria to add on report (client Use)

N/A

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☐ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C

FINAL COOLER TEMPERATURES °C 22°C

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: APanich	Date: June 21/23	Time: 3:00pm	Received by:	Date:	Time:	Received by: DJ	Date: Jun 23	Time: 13:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Attachment 6

Non-Haz Solid Spec Sheet

01 January, 2022

ALTERNATE NON-HAZARDOUS SOLID FUEL FOR USE IN RICHMOND KILN

General Description and Non-Technical Specification

Description:

Alternate Solid Fuel (ASF) is defined as: A fossil fuel substitute derived from non-hazardous materials that have been processed into a form for use as fuel. The non-hazardous materials used to produce ASF can be derived from either:

1) Post-consumer sources - material that has been recovered or diverted from the Municipal Solid Waste stream or from the residue of Material Recovery Facilities or,
2) Post-production sources - materials that have been recovered ***directly*** from manufacturing or industrial processes or activities.

These options represent the two most common sources of materials for the production of ASF. Cement kilns are also capable of utilizing hazardous materials however this document will not discuss use of those materials.

The following is a list of the more common materials used to produce ASF. This list is intended only to suggest possible materials that can be used as ASF in a cement kiln. It ***IS NOT*** a complete list of materials that cement kiln can utilize for fuel.

Plastics (no PVC)
Plastic films
Paper and paper products
Coated paper (plastic, wax ete)
Cardboard (waxed and plain)
Wood based materials
Biomass based products
Carpet & Carpet Backing
Foam
Textiles
Rubber
Roofing materials (shingles, tar paper etc.)
Containers, Packaging and Wrapping
Fiberglass
Other non-haz solid waste

Non-technical Specifications:

The following non-technical specifications ensure the responsible use of ASF as a supplemental fuel in the manufacture of cement, with the primary concerns being maintenance of high standards of environmental performance in cement manufacture, and maintenance of the high quality of cement products. Emissions to air, land and water will not be adversely affected by the use of ASF, and will be confirmed by environmental monitoring as required by the responsible environmental authority.

ASF shall meet the following specifications, which are similar to coal, and other fossil fuels. One element of concern for the cement plant is chlorine. This element can have an adverse affect on the cement manufacturing process and ultimately affect the quality of the cement product.

Heat Value:
ASF as used shall have a low heat value of no less than 13 GJ/Mt, without prior plant agreement, with typical heat values in the range of 15 GJ to 30 GJ/Mt.

Size:
It is understood that potential alternate fuel materials can originate in a large variety of shapes and sizes. Prior to use in a cement kiln as ASF, the material must be sized appropriately to match the requirements of the receiving kiln. Typical size specifications are no more than 5% passing 450 microns' screen (especially for combustible dusts like wood) and no larger than 1.5" for three-dimensional pieces and no larger than 2" for two dimensional pieces.

Contamination:
When sourcing materials for the production of ASF, the material should be as free of contamination as possible (i.e. rocks, dirt, metals, other non-combustible materials). Given the sources of materials used to produce ASF, it is recognized that it may not be possible to completely eliminate this contamination. Therefore, any processing facility set up to produce ASF will need to be able to reduce contamination to levels permissible by the receiving facility.

Typical ASF Chemistry Specification Guideline*:

Description	Maximum Percent
Moisture	20% (lower is better)
Ash	20% (lower is better)
Sulfur	1.0 %
Chlorine	0.10 %

Note: This table is intended as a guideline only as there may be additional flexibility or restrictions depending on situation (volume, price, deep evaluation)

Lab Analysis Required to Qualify (and Permit) an ASF:

Proximate Analysis and Ultimate Analysis
Net Calorific Values
Chlorine %
Total Metals – SALM (EPA 6020A)
Mercury total by CVAA (BCMOE/EPA)

Making a difference...together

Parks □ Environmental Services
625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6

T: 250.360.3000
www.crd.bc.ca

CAPITAL REGIONAL DISTRICT
PROCESSING AND UTILI□ATION O□ SOURCE-SEPARATED MATERIALS □ROM □ARTLAND LAND□ILL
REQUEST □OR PROPOSALS ERM2022-010
ADDENDUM NO. 3

This letter shall serve as confirmation that the revisions included herein as Addendum No. 3 shall form part of the Request for Proposals (RFP) Documents for RFP No. ERM2022-010.

ADDENDUM NO. 3:

Revise the Request for Proposals as follows:

Inst□uctions to P□oponents

Delete: From Section 1.2 Closing Time and Date for Submission of Proposals

The CRD will accept electronic copies emailed to achambers@crd.bc.ca or physical copies of each proposal plus **one cop□ on a USB stick**, in accordance with the instructions contained herein, at the following specific physical location:

Attention: Allison Chambers
Senior Administrative Secretary
Environmental Resource Management

Add□ess: Capital Regional District
625 Fisgard Street
Victoria, BC, V8W 2S6

On or before the following date and time (the “Closing Time”):

Time: 10:00 am PST
Date: 31 October 2023

The CRD reserves the right to extend the Closing Time at its sole discretion.

Replace with:

The CRD will accept electronic copies emailed to achambers@crd.bc.ca or physical copies of each proposal plus **one cop□ on a USB stick**, in accordance with the instructions contained herein, at the following specific physical location:

Attention: Allison Chambers
Senior Administrative Secretary
Environmental Resource Management

Address: Capital Regional District
625 Fisgard Street
Victoria, BC, V8W 2S6

On or before the following date and time (the "Closing Time"):

Time: 10:00 am PST
Date: 3 January 2024

The CRD reserves the right to extend the Closing Time at its sole discretion.

Delete: from Appendix A Section 11: Schedule

Request for Proposals Steps	Date
RFP - Issued	September 18, 2023
Information Meeting (Optional)	October 5, 2023
Proponent's Site Visit (Optional)	October 5, 2023
Deadline for Collaborative Meeting Request (Optional)	October 6, 2023 at 2:00 pm
Deadline for Collaborative Meeting	October 20, 2023
Question Period Close	October 20, 2023
Deadline for Issuing Addenda	October 24, 2023
RFP - Closing	October 31, 2023 at 10:00 am
RFP - Award	December, 2023
In Service Target Date	Quarter 1, 2024

The CRD's preference is for MDTS to be operational and in service starting in January 2024. The CRD understands that site prep and equipment lead time may make this target date challenging. Proponents are encouraged to consider project delivery options that can allow for some materials processing (e.g., limited streams or volumes) to begin in January 2024, even in advance of the full construction of the MDTS.

Replace with:

Request for Proposals Steps	Date
RFP - Issued	September 18, 2023
Information Meeting (Optional)	October 5, 2023
Proponent's Site Visit (Optional)	October 5, 2023
Deadline for Collaborative Meeting Request (Optional)	December 13, 2023 at 2:00 pm
Question Period Close	December 13, 2023
Deadline for Issuing Addenda	December 18, 2023
RFP - Closing	January 3, 2024
RFP - Award	February 2024
In Service Target Date	July 1, 2024

~~The CRD's preference is for MDTS to be operational and in service starting in January 2024. The CRD understands that site prep and equipment lead time may make this target date challenging. Proponents are encouraged to consider project delivery options that can allow for some materials~~

~~processing (e.g., limited streams or volumes) to begin in January 2024, even in advance of the full construction of the MDTS.~~

All Proponents shall acknowledge receipt and acceptance of this Addendum No. 3 by signing and dating in the spaces provided below and submitting the signed Addendum with the Proposal. Proposals submitted without this Addendum may be considered incomplete.

October 17, 2023

____
PROPONENT - Please print name

____ __________________________________
SIGNATURE DATE

RFP No. ERM2022-010

Making a difference...together

Parks & Environmental Services
625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6

T: 250.360.3000
www.crd.bc.ca

CAPITAL REGIONAL DISTRICT
PROCESSING AND UTILIZATION OF SOURCE-SEPARATED MATERIALS FROM HARTLAND LANDFILL
REQUEST FOR PROPOSALS ERM2022-010
ADDENDUM NO. 4

This letter shall serve as confirmation that the revisions included herein as Addendum No. 4 shall form part of the Request for Proposals (RFP) Documents for RFP No. ERM2022-010.

ADDENDUM NO. 4:

Revise the Request for Proposals as follows:

Instructions to Proponents

Delete: from Appendix A Section 9 Operations and Maintenance

g. Maintain treatment works for sediment control/solids reduction in good working order. The CRD reserves the right to require additional treatment of SW if discharges result in a non-compliance of the landfill's Sewer Discharge Authorization under Bylaw 2922, Capital Regional District Sewer Use Bylaw, or other non-compliances under the Landfill's Operational Certificate. At no time, shall the contractor discharge Hazardous Waste as defined by the BC Hazardous Waste Regulation. The CRD will perform audit of stormwater discharges to confirm compliance.

Replace with:

g. Maintain treatment works for sediment control/solids reduction in good working order. Stormwater run-off from the Biosolids Mixing Area must comply with the landfill's Sewer Discharge Authorization under Bylaw 2922, Capital Regional District Sewer Use Bylaw for discharge to leachate collection. All stormwater run-off from the MDTS, must comply with the BC Approved and Working Water Quality Guidelines for relevant parameters. At no time, shall the contractor discharge Hazardous Waste as defined by the BC Hazardous Waste Regulation.The CRD will perform audit of stormwater discharges to confirm compliance and reserves the right to require additional treatment of stormwater if discharges result in a non-compliance of the applicable regulatory criteria, or other non-compliances under the Landfill's Operational Certificate.

The CRD received the following questions regarding the RFP:

Question 1:
Are there engineered stamped foundation drawings for the sprung structure?

***Response* 1:**
The CRD does not have engineered stamped foundation drawings for the sprung structure. Questions related to the structure should be directed to Sprung Structures.

Question 2:
Are CRD staff giving direction to people that are coming into the MDTS area backing them into positions to dump or is it up to the contractor to staff the site to do this task

***Response* 2:**
The contractor will be designated Prime and responsible for providing direction to the people coming to the MDTS area, and for backing them into positions to unload the material at the MDTS.

Question 3:
Currently on page 6 section 6p it stated there is no potable water available at the MDTS site. This is incorrect as it is across the road by the bird storage area. Are we allowed to bring the 2" line across the road. In section q it also states there is no electrical power available. Outside the fence line of Hartland Landfill there is a source of power by the new water tank installed for the Residuals Treatment Facility. Would we not be able to explore electrical power from this power line. Can the CRD not explore with hydro the availability of power from this line

***Response* 3:**
Proposals should be structured assuming potable water is not available near the MDTS as per Appendix A Section 6.o) Site and Operational Considerations. The CRD may be able to provide small volumes of electricity or water at the site and will discuss this with the preferred proponent, if relevant.

Question 4:
On page 11 of Appendix A Section 10 Operating Hours, it states they MDTS will have current operating hours on weekdays if 9am to 5pm and 7am to 2pm on Saturdays. Currently contractors on weekdays are allowed access from 6am-5pm and Saturdays from 6am-230pm. Are we not allowed to follow the same operating hours

***Response* 4:**
Proposals should be structured assuming the hours listed in the RFP Appendix A section 10. Operating Hours. The final operating hours will be negotiated with the preferred proponent.

Question 5:
To contain any possible oil spills that may happen in the facility, does the CRD not want oil separators installed

***Response* 5:**
The proponent shall design and install the required mitigation methods such that all run-off from the MDTS complies with applicable bylaws as referred to in revised Appendix A Section 9.1 Operations and Maintenance (see above *replace with*).

Question 6:
Is there a digital version satellite image of the area or drawings that can be provided in a CAD format that we can work with

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***Response* 6:**
Yes, the CRD will provide ortho and CAD drawings, and will issue these as soon as possible. Ortho and CAD drawings will also be included in the updated drawing package which the CRD is aiming to issue the first week of November.

Question 7:
Regarding Appendix B – Form of Proposal, specifically section 3.3 15% design, would the CRD be so kind as to provide further clarification on the definition and/or quantification of “15% design”?

***Response* 7:**

- Preliminary Site Layout (including usage of the Food Scraps area on an as needed basis if required)
  - General Arrangement of the MDTS to support Project Understanding and Operations and Maintenance Methodology.

- Preliminary Traffic Flow / Traffic Management Plan
  - Preliminary Drawing or Plan to demonstrate general traffic flow patterns into, throughout and out of the MDTS

- Preliminary Stormwater Management Plan
  - Outline of Stormwater Management Plan demonstrating understanding of key stormwater design, construction and maintenance objectives indicated throughout the RFP and MDco’s general approach to achieving these objectives.

- Tie-in and Utility Requirements (if any)
  - List of any tie-in and utility requirements such as potable water, non-potable water, electrical etc.

Question 8:
Regarding the Submittal form “A” Payment Terms, specifically Table 1 – Design and Construction Payment Schedule, can the CRD kindly clarify the meaning of “Approved Issue for Construction Design”?

***Response* 8:**
“Approved Issued for Construction (IFC) Design” refers to the CRD’s approval of the proponent’s final design which shall be signed and sealed by an engineer licensed in the province of British Columbia. The IFC design is the design in which the MDTS will be constructed based on.

Question 9:
Would the CRD be open to a negotiated RFP process? If so, could the CRD provide an outline of this process and its timeline, relative to the CRD Board meeting in December 2023?

***Response* 9:**
As per Addendum No. 3 issued on October 17, 2023, the RFP process timeline has been adjusted. RFP submissions are due January 3, 2024.

Question 10:
In Addendum No. 2, question 6: there are two piles located towards the North side of the site. One is kind of Northeast and one is Northwest. Which pile can we use and set up a crusher at?

***Response* 10:**
A crusher can be set up on the Northeast side shot rock pile. The specific location will be included in the updated drawing package which the CRD is aiming to issue the first week of November.

Question 11:
For the Asphalt pad how thick would the CRD like it 4” or 6”?

***Response* 11:**
Asphalt thickness shall be determined by the proponent based the performance-based requirements outlined in Appendix A Section 8.2. These include but are not limited to ensuring protection of the below grade PVC liner, drainage and MDTS operations and maintenance.

Question 12:
Is the CRD removing or lowering the current gas lines and standpipes that are in the way? Are CRD staff doing this or do you want a contractor to do this task?

***Response* 12:**
The CRD is preparing an updated drawing package based on actual cut/fill and grading design and will include further detail on the existing gas lines and standpipes in this package. We anticipate issuing this package the first week of November.

Question 13:
Who and how are the existing holes in the liner being repaired in the MDTS area before work on the pad begins?

***Response* 13:**
The CRD is aware of and acknowledges the presence of existing holes/tears in the PVC liner. These holes/tears will not be repaired prior to MDTS work commencing. However, the proponent will be required to minimize further damage to the PVC liner by adhering to the requirements in Appendix A Section 8.2. Appendix A, Section 8.2 will be updated and provided via an addendum to be issued the first week of November to reflect this question and response.

Question 14:
Do you have a ditch design that you would like? If so, can we please get a cross section for it or would you like us to come up with a design?

***Response* 14:**
The CRD will be providing a typical asphalted ditch detail for reference only. This will be provided via the revised drawing package to be issued the first week of November. The proponent will be required to design the ditch consistent with the requirements listed in Appendix A to facilitate drainage, operations and maintenance such as allowing for the cleanout of sediment which may build up in the ditch.

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Question 15:
The CRD did a recent study to identify end uses for the listed materials in the RFP. Would the CRD be open to sharing those results?

***Response* 15:**
The CRD is aware of the following businesses that may be able to provide end-use markets for the targeted materials streams in this RFP. The CRD does not have relationships with these vendors and MDco is responsible for identifying, contracting and negotiations with End Users (see Appendix A sec. 9.1h).

- Heritage Lumber
- Blue Planet Recycling
- NorthStar Clean Technologies
- Empower Environmental
- Reclaim Plastics
- Ecowaste

Question 16:
Will there be a big stockpile to process for the winning bidder or will the ban be delayed?

***Response* 16:**
The CRD will not be stockpiling materials in advance of the July 1 target in-service date.

Question 17:
We would like to request samples for lab analysis, as detailed in the attached Excel spreadsheet. Could the CRD please advise on the preferred sample pickup/delivery method? Our lab representative can directly collect the samples from the CRD site if that's more convenient.

***Response* 17:**
The CRD can make available samples of materials currently received at Hartland Landfill. The CRD is unable to pre-process samples to meet laboratory specifications and proponents will need to arrange for any necessary preprocessing to meet laboratory analysis requirements. Samples can be picked up at the Hartland Landfill or the CRD can arrange shipping of samples in mega bags or some other means. If a proponent would like to speak further about sampling, please arrange a collaboration meeting.

Question 18:

Would the CRD be willing to provide additional landfill visits, specifically to the location of the future transfer station footprint?

Response 18:
Yes, to arrange for a site visit, please contact Allison Chambers following the Inquiries process (section 1.5) of the RFP.

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All Proponents shall acknowledge receipt and acceptance of this Addendum No. 4 by signing and dating in the spaces provided below and submitting the signed Addendum with the Proposal. Proposals submitted without this Addendum may be considered incomplete.

October 24, 2023

____
PROPONENT - Please print name

____ __________________________________
SIGNATURE DATE

RFP No. ERM2022-010

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CAPITAL REGIONAL DISTRICT
PROCESSING AND UTILIZATION OF SOURCE-SEPARATED MATERIALS FROM HARTLAND LANDFILL
REQUEST FOR PROPOSALS ERM2022-010
ADDENDUM NO. 5

This letter shall serve as confirmation that the revisions included herein as Addendum No. 5 shall form part of the Request for Proposals (RFP) Documents for RFP No. ERM2022-010.

ADDENDUM NO. 5:

Revise the Request for Proposals as follows:

Instructions to Proponents

Delete: From Appendix A Section 6 Site and Operational Considerations

a) The CRD will provide approximately 1.3 hectares, denoted as MDTS Footprint in Drawing No. 24-W1067-1 – Location Plan, Vehicle Access Routing, Table of Contents and General Notes, for the purpose of this Work.
b) The MDTS Footprint currently consists of those features shown on Drawing No. 24-W1067-2 – Hartland Material Diversion Transfer Station Area Development Gravel Grading Plan, Detail and Coordinate Table.
c) The MDTS Footprint consists of a below grade smooth PVC membrane currently covered by 25 millimetres (mm) of sand, approximately 300mm of 25mm minus crush and varying depths of a topsoil, peat and compost mix. This is shown in Drawing No. 24-W1067-2 – Gravel Grading Plan, Detail and Coordinate Table.
d) A Waste Composition Study of Shredded Construction and Demolition Waste at the Hartland Landfill was conducted in February 2023 (Attachment 3).
e) The CRD has a program in place to identify asbestos containing materials and ensure they are properly disposed of. More information can be found in Attachment 4.
f) The CRD will make available a 100 feet (ft) x 110 ft sprung structure at no cost to MDco. Details of the sprung structure can be found in Attachment 5.
g) A paved area currently designated as the “Food Scraps Area” will be made available to the MDco on an as-needed basis, and with approval from the CRD, if additional footprint is required for MDTS operations. This is shown in Drawing No. 24-W1067-1.
h) The CRD has provided a Traffic Plan (Drawing No. 24-W1067, Section 14 Drawings) which outlines traffic flow requirements from the main Landfill gate to/from the MDTS boundary.
i) The CRD has provided a Fire Control Plan in Attachment 6.
j) MDco will not have access to any CRD services other than those explicitly mentioned within this Appendix A.
k) If required by MDco, the CRD can provide a location for a site trailer for MDco staff during operations at the current bird storage location indicated in Drawing No. 24-W1067-1. Two

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control buildings may also be available for MDco, pending decommissioning of the existing Gas Plant.

l) The footprint allocated for the MDTS is located on a closed portion of the Landfill as a result, settlement of this area should be expected and accounted for during design and operation by MDco.
m) MDco will have priority access to the existing CRD weigh scales located at the entrance to the Landfill.
n) MDco will be able to dispose of waste at the active landfill face at no cost however, MDco will be required to obtain a weigh scale ticket for any waste disposed of.
o) Potable water is not available near the MDTS.
p) Non-potable water is not available near the MDTS. Coordination with the CRD will be required to fill MDco holding tanks if non-potable water is required for operations.
q) Electrical service is not available near the MDTS.
r) The CRD will be stripping and cleaning up the MDTS footprint and a final survey will be provided to confirm the existing grade and fill requirements.
s) MDco will have access to CRD shot rock piles to crush aggregate needed for fill in the area.

Replace with:

a) The CRD will provide approximately 1.3 hectares, denoted as MDTS Footprint in Drawing No. 24-W1067-1 – Location Plan, Vehicle Access Routing, Table of Contents and General Notes, for the purpose of this Work.
b) The MDTS Footprint currently consists of those features shown on Drawing No. 24- W1067-2 – ~~Hartland Material Diversion Transfer Station Area Development~~ Gravel Grading Plan, Detail and Coordinate Table.
c) The MDTS Footprint consists of a below grade smooth PVC ~~membrane~~ liner currently covered by 25 millimetres (mm) of sand, approximately 300mm of 25mm minus crush and varying depths of a topsoil, peat and compost mix. This is shown in Drawing No. 24-W1067-2 – Gravel Grading Plan, Detail and Coordinate Table. The CRD is aware of and acknowledges the presence of existing holes/tears in the PVC liner. While the CRD is aware of these holes/tears they will not be repaired prior to MDTS work commencing.
d) A Waste Composition Study of Shredded Construction and Demolition Waste at the Hartland Landfill was conducted in February 2023 (Attachment 3).
e) The CRD has a program in place to identify asbestos containing materials and ensure they are properly disposed of. More information can be found in Attachment 4.
f) The CRD will make available a 100 feet (ft) x 110 ft sprung structure at no cost to MDco. Details of the sprung structure can be found in Attachment 5.
g) A paved area currently designated as the “Food Scraps Area” will be made available to the MDco on an as-needed basis, and with approval from the CRD, if additional footprint is required for MDTS operations. This is shown in Drawing No. 24-W1067-1.

h) The CRD has provided a ~~Traffic Plan~~ Vehicle Access Routing (Drawing No. 24-W1067-1, ~~Section 14 Drawings~~) which outlines traffic flow requirements from the main Landfill gate to/from the MDTS boundary.
i) The CRD has provided a Fire Control Plan in Attachment 6.
j) MDco will not have access to any CRD services other than those explicitly mentioned within this Appendix A.
k) If required by MDco, the CRD can provide a location for a site trailer for MDco staff during operations at the current bird storage location indicated in Drawing No. 24-W1067-1. Two control buildings may also be available for MDco, pending decommissioning of the existing Gas Plant.
l) The footprint allocated for the MDTS is located on a closed portion of the Landfill as a result, settlement of this area should be expected and accounted for during design and operation by MDco.
m) MDco will have priority access to the existing CRD weigh scales located at the entrance to the Landfill.
n) MDco will be able to dispose of waste at the active landfill face at no cost however, MDco will be required to obtain a weigh scale ticket for any waste disposed of.
o) Potable water is not available near the MDTS.
p) Non-potable water is not available near the MDTS. Coordination with the CRD will be required to fill MDco holding tanks if non-potable water is required for operations.
q) Electrical service is not available near the MDTS.
r) The CRD will be stripping and cleaning up the MDTS footprint and a final survey will be provided to confirm the existing grade and fill requirements.
s) MDco will have access to CRD shot rock piles to crush aggregate needed for fill in the area.

Delete: From Appendix A Section 8 Design and Construction

b) Development of Plans including but not limited to:
   i. Schedule incl. Basis of Schedule
   ii. Project Execution Plan
   iii. Traffic Plan – this plan shall incorporate the CRD's Vehicle Access Routing (Drawing No. 24-W1067 – 1 Drawing).
   iv. Permit List – this shall outline any permits required by MDco for construction and operation of the MDTS
   v. Emergency Response Plan - this plan shall incorporate the CRD's Emergency Response Plan
   vi. Environmental Plan
   vii. Site Specific Health and Safety Plan (inclusive of plot plan)
      1) Fire suppression
      2) CRD Contractor Occupational, Health Safety Project Checklist

   viii. Stormwater Management and Erosions and Sediment Control Plan
   ix. Operations and Maintenance (OM) Plan

x. Monthly Report Template
xi. Closure Plan

Replace with:

b) Development of Plans including but not limited to:
   i. Schedule incl. Basis of Schedule
   ii. Project Execution Plan
   iii. Traffic Plan – this plan shall incorporate the CRD's ~~Traffic Management Plan~~ Vehicle Access Routing (Drawing No. 24-W1067 – 1 Drawing).
   iv. Permit List – this shall outline any permits required by MDco for construction and operation of the MDTS
   v. Emergency Response Plan - this plan shall incorporate the CRD's Emergency Response Plan
   vi. Environmental Plan
   vii. Site Specific Health and Safety Plan (inclusive of plot plan)
      1) Fire suppression
      2) CRD Contractor Occupational, Health Safety Project Checklist
   viii. Stormwater Management and Erosions and Sediment Control Plan
   ix. Operations and Maintenance (OM) Plan
   x. Monthly Report Template
   xi. Closure Plan

Delete: From Appendix A Section 8.2 Design and Construction – Objectives

b) MDco shall design the MDTS such that all operations (storage, processing, hauling, parking, etc.) are completed on an asphalt binder surface with an aggregate base layer. Preference will be given to proposals which utilize recycled materials (such as recycled roadbase or concrete) for the asphalt surface and/or aggregate layer. Both the asphalt surface and aggregate layer shall be designed to adequately protect the below-grade PVC membrane. The CRD is open to alternative cost saving designs, such as modifications to the design surface and/or subgrade once the below grade PVC liner is adequately protected at all times and stormwater and leachate collection objectives are achieved. The gravel and road grading details (ref.: Drawing No. 24-W1067-2) provided are typical detailsMDco may propose alternative materials for the asphalt and aggregate layer with approval from the CRD.

c) MDco shall design and operate the MDTS such that the maximum allowable load/stress on the below grade smooth PVC membrane is not exceeded. The technical specifications of the PVC membrane is available for reference as Attachment 8.

Replace with:

b) MDco shall design the MDTS such that all operations (storage, processing, hauling, parking, etc.) are completed on an asphalt binder surface with an aggregate base layer. Preference will be given to proposals which utilize recycled materials (such as recycled roadbase or concrete) for the asphalt surface and/or aggregate layer. Both the asphalt surface and aggregate layer shall be designed to adequately protect the below-grade PVC ~~membrane~~ liner and mitigate further damage. The CRD is open to alternative cost saving designs, such as modifications to the design surface and/or subgrade once the below grade PVC liner is adequately protected at all times and stormwater and leachate collection objectives are achieved. The gravel and road grading details (ref.: Drawing No. 24-W1067-2) provided are typical details MDco may propose alternative materials for the asphalt and aggregate layer with approval from the CRD.

c) MDco shall design and operate the MDTS such that the maximum allowable load/stress on the below grade smooth PVC ~~membrane~~ liner is not exceeded. The technical specifications of the PVC ~~membrane~~ liner is available for reference as Attachment 8. MDco will be required to demonstrate this in their design.

Delete : From Appendix A Section 9 Operations and Maintenance

m) Overall management of the MDTS including but not limited to:
   i. Educate users on material diversion locations,
   ii. Provide an Environmental, Health and Safety Plan,
   iii. Provide pre-processing capacity for materials on-site as required for End Use facilities
   iv. Coordinate with End Users to determine and conduct any necessary testing and pre-processing requirements of the End Use facility,
   v. Site Maintenance – including but not limited to:
      1) Maintain a clean Site by regularly removing source-separated materials,
      2) Ensuring the Site is free from loose or blowing garbage,
      3) Dust control as required,
      4) Snow removal,
      5) Fire Suppression,
      6) Asphalt/surface maintenance,
      7) Ensuring adequate protection at all times of the below grade smooth PVC membrane system
      8) Maintaining the CRD's Good Neighbour Policy.

Replace with:

m) Overall management of the MDTS including but not limited to:
   vi. Educate users on material diversion locations,
   vii. Provide an Environmental, Health and Safety Plan,
   viii. Provide pre-processing capacity for materials on-site as required for End Use facilities

ix. Coordinate with End Users to determine and conduct any necessary testing and pre-processing requirements of the End Use facility,

x. Site Maintenance – including but not limited to:
   1) Maintain a clean Site by regularly removing source-separated materials,
   2) Ensuring the Site is free from loose or blowing garbage,
   3) Dust control as required,
   4) Snow removal,
   5) Fire Suppression,
   6) Asphalt/surface maintenance,
   7) Ensuring adequate protection at all times of the below grade smooth PVC ~~membrane~~ liner system to mitigate further damage
   8) Maintaining the CRD's Good Neighbour Policy.

Delete: From Appendix A Section 13 Attachments

13. Attachments

- Attachment 1: Staff Report: Meeting the Solid Waste Management Plan Targets through Material Stream Diversion
- Attachment 2: 2022 Solid Waste Stream Composition Study
- Attachment 3: Shredded Composition Demolition Waste at the Hartland Landfill
- Attachment 4: Pre-approval application for Renovation Demolition Waste
- Attachment 5: Sprung Structure Drawings
- Attachment 6: Hartland Landfill Fire Safety Plan
- Attachment 7: Current Bird Storage Location
- Attachment 8: Technical specifications of the PVC membrane
- Attachment 9: Source-Separated Materials Available from the Cowichan Valley Regional District
- Attachment 10: Technical Memorandum-Results of Waste Composition Study of Shredded Construction Demolition Waste

Replace with:

- Attachment 1: Staff Report: Meeting the Solid Waste Management Plan Targets through Material Stream Diversion
- Attachment 2: 2022 Solid Waste Stream Composition Study
- Attachment 3: Shredded Composition Demolition Waste at the Hartland Landfill
- Attachment 4: Pre-approval application for Renovation Demolition Waste
- Attachment 5: Sprung Structure Drawings
- Attachment 6: Hartland Landfill Fire Safety Plan
- Attachment 7: Current Bird Storage Location
- Attachment 8: Technical specifications of the PVC liner
- Attachment 9: Source-Separated Materials Available from the Cowichan Valley Regional District
- Attachment 10: Technical Memorandum-Results of Waste Composition Study of Shredded Construction Demolition Waste
- Attachment 11: Revised Drawing Package and CAD Files

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<u>The CRD received the following questions regarding the RFP:</u>

Question 1:
Does the CRD plan on backing off the January 1 start date or landfilling the segregated material?

***Response 1*:**
Refer to Addendum 4, question 16 for information on stockpiling materials in advance of the in-service target date of July 1, 2024.

Question 2:
Addendum 3, question 6: Is there a digital version satellite image of the area or drawings that can be provided in a CAD format that we can work with?

***Response* 2:**
Appendix A section 14 Drawings has been updated and included in this package as Attachment 11.

Question 3:
Addendum 3, question 12: Is the CRD removing or lowering the current gas lines and standpipes that are in the way? Are CRD staff doing this, or do you want a contractor to do this task?

Response 3:
The CRD has prepared an updated drawing package based on actual cut/fill and grading design, refer to drawing No. 2 in Attachment 11.

Question 4:
Addendum 3, question 13: Who and how are the existing holes in the liner being repaired in the MDTS area before work on the pad begins?

***Response* 4:**
The CRD is aware of and acknowledges the presence of existing holes/tears in the PVC liner. These holes/tears will not be repaired prior to MDTS work commencing. However, the proponent will be required to minimize further damage to the PVC liner by adhering to the requirements in Appendix A Section 8.2. Appendix A, Section 8.2 will be updated and provided via an addendum to be issued the first week of November to reflect this question and response.

Question 5:
Addendum 3, question 14: Do you have a ditch design that you would like? If so, can we please get a cross section for it, or would you like us to come up with a design?

***Response* 5:**
The CRD has provided a typical asphalted ditch detail for reference only. This is provided in Attachment 11 drawing No. 3. The proponent will be required to design the ditch consistent with the requirements listed in Appendix A to facilitate drainage, operations and maintenance such as allowing for the cleanout of sediment which may build up in the ditch.

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All Proponents shall acknowledge receipt and acceptance of this Addendum No. 5 by signing and dating in the spaces provided below and submitting the signed Addendum with the Proposal. Proposals submitted without this Addendum may be considered incomplete.

November 1, 2023

____
PROPONENT - Please print name

____________________________________ ______________________________
SIGNATURE DATE

RFP No. ERM2022-010

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CAPITAL REGIONAL DISTRICT
PROCESSING AND UTILIZATION OF SOURCE-SEPARATED MATERIALS FROM HARTLAND LANDFILL
REQUEST FOR PROPOSALS ERM2022-010
ADDENDUM NO. 6

This letter shall serve as confirmation that the revisions included herein as Addendum No. 6 shall form part of the Request for Proposals (RFP) Documents for RFP No. ERM2022-010.

ADDENDUM NO. 6:

Revise the Request for Proposals as follows:

Instructions to Proponents

The CRD received the following question regarding the RFP:

Question 1:
Upon reviewing Addendum No. 5, we noticed on page 6 that bidders are instructed to delete "Attachment 8: Technical specifications of the PVC membrane" and replace it with "Technical specifications of the PVC liner." However, an updated Attachment 8 reflecting this change was not included with the addendum.

Could the CRD please clarify if an updated document will be provided, or should we proceed with the attachment as simply re-titled?

***Response 1*:**
The CRD does not intend to modify the title of Attachment 8, the instruction in Addendum No. 5 to delete/add "Attachment 8 Technical specifications of the PVC membrane" and replace it with "Technical specifications of the PVC liner" was to change how attachment 8 is referred to in the contract, the contents of the report remain the same.

All Proponents shall acknowledge receipt and acceptance of this Addendum No. 6 by signing and dating in the spaces provided below and submitting the signed Addendum with the Proposal. Proposals submitted without this Addendum may be considered incomplete.

November 8, 2023

____
PROPONENT - Please print name

______________________________ ______________________________
SIGNATURE DATE

RFP No. ERM2022-010

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CAPITAL REGIONAL DISTRICT
PROCESSING AND UTILIZATION OF SOURCE-SEPARATED MATERIALS FROM HARTLAND LANDFILL
REQUEST FOR PROPOSALS ERM2022-010
ADDENDUM NO. 7

This letter shall serve as confirmation that the revisions included herein as Addendum No. 7 shall form part of the Request for Proposals (RFP) Documents for RFP No. ERM2022-010.

ADDENDUM NO. 7:

Revise the Request for Proposals as follows:

Instructions to Proponents

Delete: Submittal Form "A"

SUBMITTAL FORM "A"
PAYMENT TERMS

CAPEX
The CRD will pay MDco for the Design and Construction of the MDTS through Milestone Payments. MDco shall provide the expected Milestone Payment amounts equal to the total CAPEX for the Project.

Table 1 – Design and Construction Payment Schedule

Milestone Payment	Amount	Estimated Payment Date
Approved Issued for Construction Design		
Asphalt Paving		
Equipment Delivery		
Construction Completion		
Total		

OPEX
The CRD will pay MDco for the Operation of the MDTS through a monthly Fixed Minimum and Variable Processing costs as outlined in the tables below.

Table 2 – Fixed Minimum Monthly Costs

Fixed Minimum Monthly Costs[1]	Unit Rate	Unit	Quantity	Total Costs ($)
Management Costs		$/month		$ -
Equipment Costs[2]		$/month		$ -
Staffing		$/month		$ -
Maintenance		$/month		$ -
Diesel		$/L		$ -
Electricity		NA		$ -
Potable Water		NA		$ -
Non-Potable Water		$/month		$ -
Total Fixed Minimum Monthly Costs				**$ -**

1. Fixed monthly costs assumes that end user contracts are secured. If end users are unavailable, the CRD retains the right to pause transfer service until end user contracts are in place.
2. MDco may recommend alternative delivery models for financing and owning equipment to maximize the value retention of equipment.

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Table 3 – Variable Monthly Processing Costs

Variable Monthly Processing Costs	Unit Rate[1]	Unit	Quantity (tonnes)	Total Costs ($)
Clean Wood		$/tonne		$ -
Treated Wood		$/tonne		$ -
Asphalt Roofing Shingles		$/tonne		$ -
Carpet and Underlay		$/tonne		$ -
Books		$/tonne		$ -
Rigid Plastics (non-extended producer responsitility)		$/tonne		$ -
Waste to Active Area (Loading, Hauling/Transportation)		$/tonne		$ -
Total Variable Monthly Processing Costs				**$ -**

1. Includes Loading, Processing, Hauling/Transportation

Please note that the costs in Table 4 below is intended to provide indicative costing for the CRD, with the understanding that they are nonbinding to MDco for the purposes of this proposal.

Table 4 – Fixed Monthly End Use Costs

Fixed Monthly End Use Costs	End Use Options	End Use Option Unit Rate[1] ($/tonnes)	Range (tonnes)	Quantity (tonnes)	Total Costs ($)
Clean Wood			0 - 200		$ -
			> 200		$ -
			0 - 200		$ -
			> 200		$ -
Treated Wood			0 - 1000		$ -
			> 1000		$ -
			0 - 1000		$ -
			> 1000		$ -
Asphalt Roofing Shingles			0 - 300		$ -
			> 300		$ -
			0 - 300		$ -
			> 300		$ -
Carpet and Underlay			0 - 150		$ -
			> 150		$ -
			0 - 150		$ -
			> 150		$ -
Books			N/A		$ -
			N/A		$ -
Rigid Plastics (non-extended producer responsibility)			0 - 100		$ -
			> 100		$ -
			0 - 100		$ -
			> 100		$ -
Total Fixed Monthly End Use Costs					**$ -**

1. Includes End User Invoice and markup.

Table 5 – Total Monthly Costs

Total Monthly Costs	Total Costs ($)
Total Fixed Minimum Monthly Costs	$ -
Total Variable Monthly Processing Costs	$ -
Total Fixed Monthly End Use Costs	$ -
Total Monthly Costs	**$ -**

Table 6 – Provisional Costs

Provisional Costs	Total Costs ($)
Rock Crushing ($/tonne) [1]	$ -

[1] Shot Rock will be available from the CRD at no cost to MDco for crushing and use on site, if beneficial to MDco.

Replace with:

SUBMITTAL FORM "A" (Revised per Addendum 7)
PAYMENT TERMS

CAPEX
The CRD will pay MDco for the Design and Construction of the MDTS through Milestone Payments. MDco shall provide the expected Milestone Payment amounts equal to the total CAPEX for the Project.

Table 1 – Design and Construction Payment Schedule

Milestone Payment	Amount	Estimated Payment Date
Approved Issued for Construction Design		
Asphalt Paving		
Equipment Delivery		
Construction Completion		
Total		

OPEX
The CRD will pay MDco for the Operation of the MDTS through a monthly Fixed Minimum and Variable Processing costs as outlined in the tables below.

Table 2 – Fixed Minimum Monthly Costs

Fixed Minimum Monthly Costs[1]	Unit Rate	Unit
Management Costs		$/month
Equipment Costs[2]		$/month
Staffing		$/month
Maintenance		$/month
Diesel		$/L
Electricity		NA
Potable Water		NA
Non-Potable Water		$/month
Total Fixed Minimum Monthly Costs		

1. Fixed monthly costs assumes that end user contracts are secured. If end users are unavailable, the CRD retains the right to pause transfer service until end user contracts are in place.
2. MDco may recommend alternative delivery models for financing and owning equipment to maximize the value retention of equipment.

Table 3 – Fixed Unit Rate Monthly Costs

Fixed Unit Rate Monthly Costs	**Fixed Unit Rate[1]**	**Unit**
Clean Wood		$/tonne
Treated Wood		$/tonne
Asphalt Roofing Shingles		$/tonne
Carpet and Underlay		$/tonne
Books		$/tonne
Rigid Plastics (non-extended producer responsibility)		$/tonne
Waste to Active Area (Loading, Hauling/Transportation)		$/tonne
Total Fixed Unit Rate Monthly Costs		

1. Includes Loading, Processing, Hauling/Transportation

Please note that the costs in Table 4 below is intended to provide indicative costing for the CRD, with the understanding that they are nonbinding to MDco for the purposes of this proposal.

Table 4 – Monthly Pass-through End-Use Costs

Monthly Pass through End-Use Costs[1]	**End Use Options**	**End Use Option Unit Rate[2] ($/tonnes)**	**Range (tonnes) per Month**
Clean Wood			0 - 200
			□200
			0 - 200
			□200
Treated Wood			0 - 1000
			□1000
			0 - 1000
			□1000
Asphalt Roofing Shingles			0 – 400
			□400
			0 – 400
			□400
Carpet and Underlay			0 - 150
			□150
			0 - 150
			□150
Books			N/A
			N/A
Rigid Plastics (non-extended producer responsibility)			0 - 100
			□100
			0 - 100
			□100
Total Monthly Pass-through End-Use Costs			

1. Includes End User Invoice and markup.
2. Monthly Pass-through End-Use costs refers to the costs MDco will receive from the End-User for the processing of various quantities and types of waste materials. These costs shall be actuals provided by the End-User which will be passed from MDco to the CRD (pass-through costs).

Making a difference...together

Parks & Environmental Services
625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6

T: 250.360.3000
www.crd.bc.ca

Table 5 – Provisional Costs

Provisional Costs	Total Costs ($)
Rock Crushing ($/tonne) [2]	$ -

1. Shot Rock will be available from the CRD at no cost to MDco for crushing and use on site. if beneficial to MDco.

The CRD received the following question regarding the RFP:

Question 1:
In the pricing schedule, **Table 4: Fixed** Monthly End Use Costs: during our meetings we clarified that End Use Cost is **variable** and will fluctuate over time. Our understanding is that the CRD agreed with this approach (Variable Cost). Please clarify this point.

***Response 1*:**

Please refer to revised Submittal Form “A”, appended to this Addendum as Appendix A. For clarity with the Submittal Form “A” – Payment Terms, Table 3 has been renamed to Fixed Unit Rate Monthly Costs. The intent with Table 3 is to obtain a fixed unit rate per tonne per month, with the understanding that the total cost will vary depending on the actual tonnes of material processed.

Table 4 has been renamed to Monthly Pass-through End-Use Costs, and ‘Range (tonnes)’ has been clarified to be ‘Range (tonnes) per month’. The intent with Table 4 is for MDco to provide the CRD with estimated pass-through costs for End Use processing. Invoices that MDco will receive from the End-Users for the processing of various quantities and types of waste materials will be passed on to the CRD for payment.

Question 2:
Please confirm the quantities of the onsite gravel materials (in Cubic meters).

Response 2:
The CRD will make available one of its shot rock stockpiles to allow the proponent to crush the aggregates required for construction. Storage of the finished aggregate piles is limited to the area within the biosolids mixing /diversion depot limits. The Proponent shall provide the following information in its tender: the aggregate specifications, quantity, method of supply (i.e., Crushing CRD shot rock onsite or procuring aggregates from offsite) and cost/m^3 to supply the various aggregates.

Question 3:
Please advise what will be the landfill gate rates for 2024 onwards.

Response 3:
The CRD does not believe that gate rates are relevant for the RFP, to view Hartland rates, please visit https://www.crd.bc.ca/service/waste-recycling/hartland-landfill-facility/rates-accepted-items .

Question 4:
We would like to know if the construction scope can be executed in 2 phases. Is there any timeframe for the biosolids footprint area?

Response 4:
The CRD is open to phasing of construction with a targeted in-service date of July 1, 2024. The CRD would like the biosolids footprint completed as soon as possible. However, the paved biosolids mixing area must be completed no later than September 30, 2024.

Parks & Environmental Services
625 Fisgard Street, PO Box 1000
Victoria, BC, Canada V8W 2S6
T: 250.360.3000
www.crd.bc.ca

Question 5:
We are requesting that the CRD consider a deadline extension for the proposal.

Response 5:
There will be no further deadline extensions, and all responses must be received by the deadline of January 3, 2024 at 10:00 am PST.

All Proponents shall acknowledge receipt and acceptance of this Addendum No. 7 by signing and dating in the spaces provided below and submitting the signed Addendum with the Proposal. Proposals submitted without this Addendum may be considered incomplete.

December 18, 2023

____
PROPONENT - Please print name

____
SIGNATURE

____
DATE

RFP No. ERM2022-010

APPENDIX A

SUBMITTAL FORM "A" (Revised per Addendum 7)
PAYMENT TERMS

CAPEX

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Books		$/tonne
Rigid Plastics (non-extended producer responsibility)		$/tonne
Waste to Active Area (Loading, Hauling/Transportation)		$/tonne
Total Fixed Unit Rate Monthly Costs		

1. Includes Loading, Processing, Hauling/Transportation

Please note that the costs in Table 4 below is intended to provide indicative costing for the CRD, with the understanding that they are nonbinding to MDco for the purposes of this proposal.

Table 4 – Monthl□ Pass-th□ough End-Use Costs

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			0 - 1000
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Asphalt Roofing Shingles			0 – 400
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Books			N/A
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Rigid Plastics (non-extended producer responsibility)			0 - 100
			□100
			0 - 100
			□100
Total Monthl□ Pass-th□ough End-Use Costs			

1. Includes End User Invoice and markup.
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Table 5 – P□o□isional Costs

P□o□isional Costs	Total Costs ($)
Rock Crushing ($/tonne) [1]	$ -

1. Shot Rock will be available from the CRD at no cost to MDco for crushing and use on site, if beneficial to MDco.

Material Stream Diversion – Award of Contract ERM2022-010

Environmental Services Committee

April 19, 2023

CRD

Background

Rethink waste

- Phase 1 - January 1, 2024 implementation:
  - Clean wood waste ban
  - Tipping fee structure changes
  - Waste Stream Collector Incentive Program
  - Fine rates increases, new warning system
- 104.7 tonnes of clean wood was diverted from landfilling in January
- The Waste Stream Collector Incentive Program's 22 registrants represent approximately 70% of Hartland's total general refuse tonnages
- Provided staff with valuable information about market response and participation for implementing subsequent phases

CRD

Procurement

- To support Phase 2, a Request for Proposals was issued from September 2023 to January 2024 to construct and operate a Material Stream Diversion Transfer Station at Hartland Landfill to process wood (clean, treated and salvageable), asphalt shingles and carpet and underlay
- Two submissions were received from Emterra Environmental and DL's Bins
- Neither proponent provided an option for salvageable wood and processing costs for carpet and underlay weren't financially sustainable
- Negotiations with the preferred proponent have indicated both could be considered as part of a Phase 3 alternative

Award of Contract

Rethink waste

- Finalize negotiations and enter into a two-year operating and construction contract, for a combined value not to exceed $12,500,000 (excluding GST) with DL's Bins
- DL's Bins will construct and operate the Material Stream Diversion Transfer Station to begin processing clean wood, treated wood and asphalt shingles on July 1, 2024

CRD

Waste Flow Restrictions

- Market response to date suggests the $300/tonne mixed renovation and demolition rate will incent Hartland customers to seek lower cost landfill disposal options out of region, rather than divert banned materials, including wood waste.
- Staff recommend adding a Phase 3 (2026) to implement the $300/tonne mixed renovation and demolition rate to allow customers time to adjust to the new policies.
- Staff recommend the CRD begin consultation on policies to restrict the flow of general refuse waste outside the capital region ahead of Phase 3 implementation.

Tipping Fee Schedule

Material Type	Tipping Fee (per tonne)	Landfill Ban Implementation	Date
MANDATORY RECYCLABLES			
Clean Wood	segregated diversion $80	Phase 1	January 1, 2024
Treated Wood	segregated diversion $110	Phase 2	July 1, 2024
Asphalt Shingles	segregated diversion $110	Phase 2	July 1, 2024
Salvageable Wood	segregated diversion $0	Phase 3*	2026
Carpet and Underlay	segregated diversion $110	Phase 3*	2026
RENOVATION AND DEMOLITION WASTE			
Clean	segregated diversion $150	Phase 2	July 1, 2024
Mixed	segregated diversion $150, with $500 fine in effect	Phase 2*	July 1, 2024
Mixed	segregated diversion $300, with $500 fine in effect, potential flow control policies	Phase 3*	2026

* Subject to board direction

Thank you

Liz Ferris | 250.360.3643 | lferris@crd.bc.ca

@crdvictoria

Capital Regional District

CRDVictoria

crd.bc.ca

Making a difference...together

ECA 24-12

REPORT TO ENVIRONMENTAL SERVICES COMMITTEE
MEETING OF WEDNESDAY, MARCH 20, 2024

SUBJECT **Extreme Heat Vulnerability Mapping and Information Portal Project**

ISSUE SUMMARY

To provide the results of the Capital Region Extreme Heat Vulnerability Mapping and Information Portal project.

BACKGROUND

In 2018, a Regional Hazard Risk and Vulnerability Assessment (HRVA) for the capital region of BC was undertaken by the Regional Emergency Management Partnership, and extreme heat was identified as a hazard of regional significance. In the summer of 2021, BC experienced an extreme heat wave that claimed more than 700 lives, with 24 of those in the capital region.

To support emergency planning and local climate adaptation planning efforts, the Capital Regional District (CRD), with support from municipal partners, accessed a $150,000 Union of British Columbia Municipalities grant from the Community Emergency Preparedness Fund to undertake a regional extreme heat vulnerability mapping initiative. The intention of this initiative was to support the integration of extreme heat disaster risk reduction and climate adaptation planning through the development of a mapping product that provides a highly localized picture of vulnerability to heat in the capital region.

The CRD's Climate Action service worked collaboratively with local government climate/sustainability and emergency management program staff, and Island Health, to scope and execute the project. During the technical phase, CRD staff coordinated multiple workshops for representatives from all local governments in the region, including methodology review and project outputs, and undertook other key engagements to get technical input and guidance. Updates have been provided throughout the project via existing inter-municipal staff committees (climate and emergency management) and directly with key stakeholders, as required.

This project involved the development of three main indices:

- Extreme Heat Exposure
- Demographic Vulnerability Index
- Building Vulnerability Index

Each index was developed and analyzed with distinct methodologies, ranging from individual buildings to broader administrative geographic units. Results are provided in a project report (Appendix A).

As part of the grant initiative, the Capital Region Extreme Heat Information Portal has been collaboratively developed with project partners and the Province (GeoBC). This portal presents the data and analyses through interactive geographic maps for public exploration of their risk levels. Additionally, authorities have login access to the portal with more extensive maps and layers. The Extreme Heat Information Portal can be found at: https://heat.prepareyourself.ca.

Next Steps

The project findings can be used for a variety of purposes and will serve as important data input for further regional emergency and climate adaptation related mitigation, planning and policy initiatives.

The public portal, with accompanying geographic information system and products, will be shared directly with CRD and local government staff, regional emergency management programs, Island Health and provincial and federal agencies and can be used in educational initiatives. Staff will continue to connect with First Nations to provide the data and explore its applicability to their needs. As this work is very novel, staff will continue to connect with local governments to share learnings and resources and support the development of a provincial heat mapping guidance resource document.

The CRD remains committed to supporting established inter-municipal and inter-agency committees, seeking opportunities for enhanced collaboration. Recognizing the dynamic nature of technology and scientific advancements, ongoing risk modelling focused on extreme heat will be imperative to continuously update emergency preparedness, planning and response strategies.

ALTERNATIVES

Alternative 1
The Environmental Services Committee recommends to the Capital Regional District Board:
That the results of the Extreme Heat Vulnerability Mapping and Information Portal project for the capital region be referred to municipal councils, the Electoral Areas Committee and First Nations for information.

Alternative 2
That this report be referred back to staff for additional information.

IMPLICATIONS

Alignment with Board & Corporate Priorities

The recommendations align with the Board's priority Climate Action & Environment initiative 3c to increase resilience, community and adaptation planning to address climate-related risks and disasters.

Alignment with Existing Plans & Strategies

The recommendations align with goal 2 of the CRD Climate Action Strategy to support the region on its pathway to livable, affordable and low-carbon communities that are prepared for climate change, and specifically contribute to the completion of action 2-4d to expand data collection and mapping efforts to identify vulnerabilities to the impacts of climate change.

Intergovernmental Implications

The data and mapping components can help local authorities to recognize priority areas for risk reduction and enhanced emergency response efforts. By examining vulnerability to heat, emergency managers can strategically prioritize interventions and resources in areas most in need of attention. The data can also be used when updating local hazard, risk, and vulnerability analyses (i.e., HRVAs). CRD staff will continue to engage the region's local governments through the CRD's Climate Action Inter-Municipal Working and Task Force on better understanding new climate adaptation related policy approaches and supporting implementation of existing programs and policies in a collaborative manner.

CONCLUSION

Working collaboratively with and on behalf of local governments in the capital region, the CRD secured a $150,000 grant from the Union of British Columbia Municipalities Community Emergency Preparedness Fund to initiate the Extreme Heat Vulnerability Mapping and Information Portal Project for the capital region. The data analyzed is provided in the new public Extreme Heat Information Portal. This work will help guide planning and decision-making to improve community resilience, emergency planning and public health strategies across the capital region.

RECOMMENDATION

The Environmental Services Committee recommends to the Capital Regional District Board:
That the results of the Extreme Heat Vulnerability Mapping and Information Portal project for the capital region be referred to municipal councils, the Electoral Areas Committee and First Nations for information.

Submitted by:	Nikki Elliott, BES, MPA, Manager, Climate Action Programs
Concurrence:	Larisa Hutcheson, P.Eng., Acting General Manager, Parks & Environmental Services
Concurrence:	Ted Robbins, B. Sc., C. Tech., Chief Administrative Officer

ATTACHMENT

Appendix A: Heat Vulnerability Data & Analysis Project Final Report – Licker Geospatial Consulting Company and Thrive Consulting (February 2024)

Heat Vulnerability Data & Analysis Project

Final Report

Prepared for Capital Regional District

February, 2024

Licker Geospatial Consulting Co.

2405 East Hastings St
Vancouver BC, V5K 1Y8

Thrive Consulting

Climate & Resilience Planning

Table of Contents

Key Terminology and Abbreviations

2021 extreme heat event	The fatal extreme heat event (also commonly referred to as the “heat dome”) that was experienced throughout much of British Columbia in late June, 2021.
Adaptive capacity	The characteristics of a community that increases resilience against extreme heat impacts, such as income and available shade-providing tree canopy.
AHP	Analytical Hierarchy Process
BCCDC	British Columbia Centre for Disease Control
BIR	Building Information Report
CRD	Capital Regional District
DA	Dissemination area
DSM	Digital Surface Model
DTM	Digital Terrain Model
Exposure	The distribution of extreme heat across the community
GCM	Global Circulation Model
IPCC	Intergovernmental Panel on Climate Change
LGeo	Licker Geospatial Consulting Co.
LiDAR	Light detection and ranging
LST	Land surface temperature
NDVI	Normalised difference vegetation index quantifies the greenness of vegetation.
Sensitivity	The characteristics of a community that increase susceptibility to extreme heat impacts, such as age and health
Urban heat island	The effect of urban islands capturing significantly more heat than surrounding, natural environments

List of Tables and Figures

Executive summary

In response to the recent extreme heat events in British Columbia, the Capital Regional District (CRD) has commissioned a comprehensive study to understand and address extreme heat vulnerability in the Capital Region. This report describes the collaborative effort between Licker Geospatial Consulting Co (LGeo), Thrive Consulting (Thrive), and the CRD and participating municipal partners and presents findings and recommendations emergent from the Heat Vulnerability and Data Analysis Project.

The Heat Vulnerability and Data Analysis Project's primary goal has been to develop a holistic understanding of extreme heat vulnerability across the capital region to inform regional partners in decision-making for emergency response, climate change adaptation and resilience planning, and public health initiatives and program design. The Project's significance has been underlined by the extreme heat event in 2021 (referred also as the "2021 heat dome"), which resulted in severe health impacts across the Province and brought to light the urgent need for extreme heat analyses and assessments across various levels of governments.

The methodology of this Project was developed in collaboration with consultants, local governments, and health agencies (Island Health and the BCCDC) involved in the effort. The effort includes three distinct phases in which a vulnerability-related index is produced. The three indices included in this effort are broadly described below.

- The *Socio-demographic Vulnerability Index*, which assesses the levels of community sensitivity to adverse impacts brought upon by extreme heat, and likewise the community's adaptive capacity to mitigate the impacts of extreme heat. Determinants of Socio-demographic Vulnerability include factors such as age, income, and chronic health conditions. The socio-demographic index involved an engagement process in which subject matter experts and those with lived experience helped develop a weighting schema for socio-demographic determinants of vulnerability. This weighting schema provides contextually-specific insight into regional characteristics of community derived vulnerability. The validation of this index showed the highly vulnerable areas in this index are aligned with observed hospitalisations and mortalities during the 2021 heat event.

- The *Heat Exposure Layer*, which describes the distribution of perceived outdoor temperature during the 2021 heat event. Determinants that describe extreme heat exposure include factors such as environmental composition (i.e. whether the local environment is heavily treed), land surface characteristics, measured temperatures during the 2021, and others. The heat exposure layer facilitates a nuanced understanding of outdoor extreme heat distribution across different urban and rural landscapes.

- The *Buildings Vulnerability Index*, which assesses the propensity of individual buildings to absorb and maintain heat during a heat wave. Determinants of building-specific vulnerability include factors such as building type, age, and height. The characteristics of a building contribute to the capacity a building has to cool (or remain cool) during an extreme heat event. Areas that score as highly vulnerable in the buildings index can present opportunities for emergency response, but also longitudinal planning that includes implementation of building retrofit programs.

The development of each index included engagements that spanned across the Project timeline in workshop and meeting formats. These various outreach and connection points helped to include perspectives from subject matter experts, those with lived experience in responding to extreme heat events, and other project stakeholders. The engagement objectives were to (1) confirm direction of approach, (2) confirm and refine selected determinants of vulnerability, and (3) allow for validation and feedback on the created vulnerability indices. The Project also includes an outreach phase, in which data and supporting language are hosted virtually for end-users to freely explore and employ the indices as needed.

The key findings of the vulnerability assessment at a municipal scale are summarised below. The findings are informed by the distribution of vulnerability indices, as well as geospatial analysis of vulnerability at the municipal scale:

- Amongst all of the incorporated areas in the CRD, the top demographic consideration was consistently either: percentage of the population who are renters or percentage of the population who are seniors. The seniors finding is unsurprising as that was the highest weighted variable in the socio-demographic risk model.
- When combining buildings risk with socio-demographic vulnerability we note that Victoria, Saanich and Sidney have the most buildings which are in very vulnerable areas for both buildings and socio-demographics at 1,174, 806 and 628 residential buildings respectively. When examined by percentage of total residential buildings, Sidney, Victoria and Esquimalt are the top three ranked communities with 19%, 13%, and 8% of all residential buildings being in both very high risk categories for buildings and sociodemographics. Conversely, Metchosin, Highlands and North Saanich have no buildings in these two categories.
- With regards to air temperature, we note that Langford, Highlands and Colwood all have significant areas of their community in highest heat quintile (>=36.6℃ daily average air temperature) at 61%, 49% and 32% respectively, which may increase risk in the communities. Conversely, communities more proximal to the ocean all have lower percentages of their communities in the highest heat quintile with Oak Bay, Sidney and Esquimalt at 5%, 2%, 1% of land area respectively.
- As urban heat is in many ways influenced by land use change and development, it is impactful to note that 84%, 56% and 48% of Langford, Colwood and Highlands' residential buildings are in the highest heat quintile. However, all three of these communities have relatively lower socio-demographic risk and only 6% (648), 1% (54) and 0% (0) of Langford, Colwood and Highlands' residential buildings are in both the highest quintiles for air temperature and socio-demographics

Additionally, the distribution of indices allow for the identification of areas that have overlapping vulnerability concerns. These areas score highly vulnerable according to all three indices: heat exposure, socio-demographic, and buildings. They are priority areas for emergency response and extreme heat risk reduction planning. Of note: Saanich has 454 residential buildings in the three highest quintiles for heat risk, buildings risk and socio-demographic risk (1% of all residential buildings in the community), Victoria has 229 (2% of residential buildings) and Langford has 98 (1% of residential buildings in langford). Overall, there are 929 buildings in all three very high risk categories.

The Project's assessment of vulnerability to extreme heat in the Capital region allows for emergent recommendations that aim to actionably and equitably mitigate adverse extreme heat impacts. Key recommendations of this effort are included below.

- Integrate the use of these indices in planning for climate change adaptation, risk reduction, and emergency response with a focus on overlapping vulnerability.
- Nuance urban forestry and green infrastructure with vulnerability data. Tree planting and shade provisioning are elements of extreme heat adaptive capacity, and should be prioritised in areas that are presented as highly vulnerable.
- Strategically allocate resources, such as emergency response. Our analysis presents areas in which there are both high overlapping vulnerabilities and also a dearth of emergency response service coverage.
- Integrate the findings into local governments' hazard, risk, and vulnerability analysis (HRVAs) updates to allow for informed policy-making and climate action planning.
- Prioritise building retrofit programmes to highly vulnerable buildings. Take a multi-hazard perspective.

The Heat Vulnerability Data and Analysis Projects presents a significant step towards the enhancement of the CRD's capacity to support resilience planning through data-informed decision-making. The effort detailed in this report presents insights into region-specific vulnerabilities from heat exposure, socio-demographic, and buildings perspectives. The effort allows for nuanced vulnerability analyses and presents targeted recommendations. Indeed, the implementation of this Project's recommendations is anticipated to significantly contribute to building public health resilience, enhancing emergency preparedness, and equitable building retrofit programs and urban planning in the region. This report serves as both a tool for the CRD and municipal partners and also as a foundational study for ongoing research and adaptation strategies in regional and local government efforts in addressing extreme heat vulnerability.

Introduction

Climate change is already influencing our lives in British Columbia (BC) and more locally in the Capital Region. Over the next years and decades, we expect BC to see an increase in climate-related hazards, specifically extreme heat events[1]. We know these have, and will continue to, negatively affect the physical and mental health of residents living in the Capital Region[2,3]. Indeed, the fatal 2021 extreme heat event in BC (also referred to as the "2021 heat dome") underscored the significance in assessing and analysing localised impacts of extreme heat events. That said, there are many opportunities to act to reduce these impacts through properly understanding the risk, advancing emergency preparedness and response measures, enhancing adaptive capacity, and implementing risk reduction measures.

In this context, the Capital Regional District (CRD), in collaboration with municipal partners, initiated the Heat Vulnerability Data and Analysis Project, which aims to address extreme heat concerns localised to the Capital Region (the "Region"). Supported by the consultant team, Licker Geospatial Consulting (LGeo) and Thrive Consulting (Thrive), the Project has been designed to broaden the CRD's understanding of communities' vulnerability to extreme heat across the Capital Region through the development of three indices that refer to the 2021 heat event as a design event. These indices present an holistic approach to assessing extreme heat, and are summarised below:

- The *Heat Exposure Layer* describes extreme heat as it is distributed across the Region. This index uses factors such as land cover, local environmental factors, and incoming solar radiation to measure perceived temperature.

- The *Socio-demographic Vulnerability Index* describes population-specific determinants of vulnerability across the Region. This index is contextually-specific to the Region's communities and was informed through an engagement process. This index is formed by socio-demographic factors such as age, income, and chronic disease.

- The *Building Vulnerability Index* describes building-specific vulnerability across the Region. This index is described at the building footprint scale, and uses factors such as building type, age, and reflectivity to measure vulnerability.

These vulnerability indices are calculated from a comprehensive process of data collation, engagement, novel methods development, and validation. The Project's engagement and validation process has included a diverse group of subject matter experts, those with lived experience, and other project stakeholders. The Project's outcome is intended to inform the

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[1] Nature. (2021). Climate change made North America's deadly heatwave 150 times more likely. Nature. https://doi.org/10.1038/d41586-021-01869-0

[2] ClimateReady BC. (n.d.). Extreme Heat. Retrieved from https://climatereadybc.gov.bc.ca/pages/extreme-heat

[3] Henderson, S. B., McLean, K. E., Lee, M., & Kosatsky, T. (2021). Extreme heat events are public health emergencies. British Columbia Medical Journal, 63(9), 366-367. Retrieved from https://bcmj.org/bccdc/extreme-heat-events-are-public-health-emergencies

CRD's capacity to support local government's planning and decision-making processes as they relate to extreme heat adaptation and resilience building. The development of each of the three indices was conducted in close collaboration with the CRD, municipal partners and Island Health. The CRD and their project team influenced the design and evolution of the project through their combined expertise, specialised and contextual insights, and subject matter expertise.

1.1. *Objectives and scope*

The primary objectives of this Project have been to:

- Facilitate group workshops and meetings with the project team and other key stakeholders to discuss, refine, and validate data collection and methodology;
- Determine key attributes which contribute to vulnerability, sensitivity or adaptive capacity to extreme heat;
- Assemble and document localised data to be used as inputs for modelling vulnerability/adaptive capacity;
- Create three aforementioned indices based on research, engagement, and data collection;
- Develop extreme heat event vulnerability data layers to be hosted on an interactive dashboard for end-users; and
- Develop a final report that disseminates methods and results to key stakeholders.

1.2. *Issue addressed*

In 2018 the CRD identified extreme heat as a hazard of regional significance through a Regional Hazard Risk and Vulnerability Assessment (HRVA)[4]. In 2021, BC experienced an extreme heat wave that claimed more than 700 lives[5]. To address the growing risks posed by extreme heat, the region requires highly localised extreme heat vulnerability data to serve multiple initiatives related to emergency response, climate resilience and adaptation, forthcoming building retrofit programs, and regional and local/municipal planning activities. To this end, a multiple index-based approach encompassing three individual indices has been developed for this project.

The three developed indices that measure vulnerability through socio-demographic, heat exposure, and buildings lenses provide a *localised* understanding of vulnerability to extreme heat in the region. Potential end-use cases of these vulnerability indices may include:

- Supporting emergency planning and local climate adaptation planning efforts;
- Supporting the integration of extreme heat disaster risk reduction and climate adaptation planning;
- Building risk awareness and setting priorities for the implementation of disaster risk reduction initiatives;
- Supporting risk communication and planning efforts; and

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[4] Regional Emergency Management Partnership in the Capital Region. (2018). Annual Report.
[5] Henderson, S. B. et al (2021)

- Serving multiple initiatives related to emergency response, resilience and climate adaptation, forthcoming building retrofit programs, and regional and local/municipal planning activities.

1.3. Novelty and significance

A focus of this project has been to contextualise the extreme heat assessment to the localised scale relevant to the capital region. As a result, in collaboration with the CRD-led project team, this project has developed several novel approaches that may apply to other studies seeking to complete similar assessments. Below are some identified areas of novelty and significance that have been designed to localise the project to the region.

The Socio-demographic Vulnerability Index has been developed through an analytical hierarchy process (AHP), in which a group of project stakeholders, local subject matter experts, and those with lived experience, were engaged. Those engaged included local and regional governments, health practitioners, First Nation representatives, emergency services and first responders, and climatologists and meteorologists. The AHP engagement sought to inform our understanding of the relevance and importance of determinants of Socio-demographic Vulnerability that are specific to the region. Notably, this engagement approach advances from similar, previous assessments that solely employ statistical methods to determine the relevance and importance of determinants of vulnerability[6,7].

This project also introduces novel approaches in assessing building-by-building vulnerability through a highly localised analysis of extreme heat at the building footprint scale. This project addresses a common gap in such assessments, in that a significant discrepancy in the degree of vulnerability exists between outdoor and indoor heat[8]. That is to say, specific building characteristics can affect a building's level of vulnerability despite its position in the distribution of outdoor heat exposure. Many heat-related deaths, especially those observed during extreme events, can be credited to indoor heat exposure[9, 10]. This project successfully attributes multiple determinants of building vulnerability to building footprints throughout the region[11], that include dwelling type, building age, building height, solar insolation, rooftop albedo and cooling capacity.

The measurement of heat exposure has also been advanced in this project. While previous assessments have used varying approaches to assessing the distribution of extreme heat

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6 Université Laval. (2023). Summary Report. Retrieved from https://vaguesdechaleur.ffgg.ulaval.ca/wp-content/uploads/2023/07/summary-report_ulaval.pdf

7 Conlon, K. C., Mallen, E., Gronlund, C. J., Berrocal, V. J., Larsen, L., & O'Neill, M. S. (2020). Mapping human vulnerability to extreme heat: A critical assessment of heat vulnerability indices created using principal components analysis. Environmental Health Perspectives. https://doi.org/10.1289/EHP4030

8 Alam, M., Sanjayan, J., Zou, P. X. W., Stewart, M. G., & Wilson, J. (2016). Modelling the correlation between building energy ratings and heat-related mortality and morbidity. *Sustainable Cities and Society*, *22*, 29–39. https://doi.org/10.1016/j.scs.2016.01.006

9 Samuelson, H., Baniassadi, A., Lin, A., Izaga González, P., Brawley, T., & Narula, T. (2020). Housing as a critical determinant of heat vulnerability and health. *Science of The Total Environment*, 720, 137296. https://doi.org/10.1016/j.scitotenv.2020.137296

10 CDC, 2013. Heat illness and deaths—New York City, 2000–2011. MMWR Morb. Mortal. Wkly Rep. 62, 617.

11 See validation considerations in section 2.3.6

exposure[12,13]; such approaches often fail to capture either the localised distribution of heat exposure or fail to capture the human experience of extreme heat exposure. For example, while weather stations may accurately measure temperature and humidity levels during a heat wave, the interpolation between stations as an assessment of heat exposure distribution results in the loss of nuance that exists at localised contexts. Further, while monitoring land surface temperatures from satellite imagery can provide a localised understanding of the distribution of extreme heat, it inadequately captures the levels of discomfort that is experienced by a typical individual. The project team has sought to find the balance between appropriate measurement and nuanced distribution by developing an assessment of air temperature during the 2021 heat event.

While this approach has recently been employed by researchers elsewhere[14,15] and within the Region[16], the application of such an assessment within a larger extreme heat vulnerability assessment remains, to our knowledge, a first of its kind.

1.4. *Engagement and outreach*

The focus of engagement and outreach for this project was two-fold: the first being the project team and extensions thereof (i.e. broader end-user groups from around the region) and the second being key stakeholders and local subject matter experts from around the region (e.g. climate scientists, public health officials, etc.) (See figure 1 for a summary of engagement structure). Initial efforts were also made to reach out to First Nations' representatives in the region; some of whom are working on similar extreme heat assessment and response planning projects. Further effort and funding allocation is required in this area to integrate First Nation's data and values into a regional analysis and related efforts going forward.

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[12] Typically using landsat surface temperature or degree cooling days
[13] Yu, J., Castellani, K., Yao, A., Cawley, K., Zhao, X., & Brauer, M. (2020). Mapping spatial patterns in vulnerability to climate change-related health hazards. University of British Columbia.
[14] Ho, H. C., Knudby, A., Sirovyak, P., Xu, Y., Hodul, M., & Henderson, S. B. (2014). Mapping maximum urban air temperature on hot summer days. Remote Sensing of Environment, 154, 38-45.
[15] Xu, Y., Knudby, A., & Ho, H. C. (2014). Estimating daily maximum air temperature from MODIS in British Columbia, Canada. International Journal of Remote Sensing, 35(24), 8108-8121. https://doi.org/10.1080/01431161.2014.978957
[16] Steve Young at the City of Victoria partnered with Simon Fraser University to develop an air temperature model (2002-2012) for Victoria, available here:
https://vicmap.maps.arcgis.com/apps/webappviewer/index.html?id=ae03a6af3648414fb7bf60f8f7bb4d7d

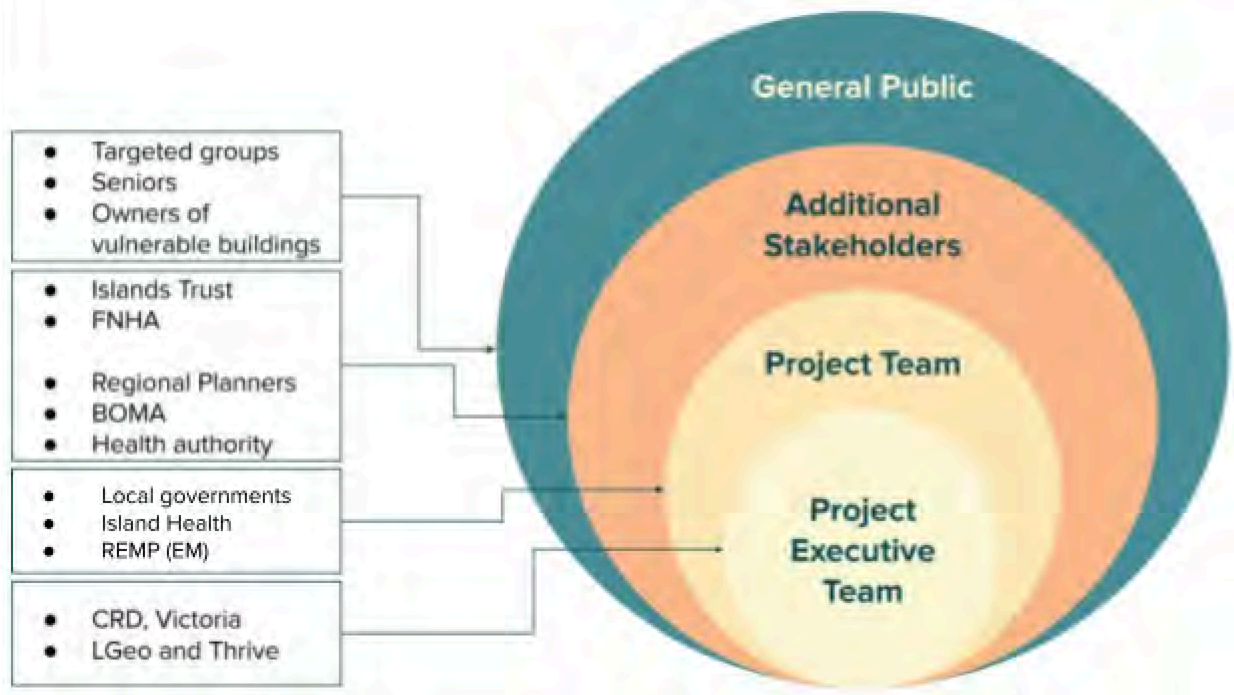

Figure 1.0 Structure for engagement during Project development.

A kick-off meeting was held to get to know the project team and hear their perspectives on how this mapping and modelling effort may support their ongoing and future work. At this meeting we heard a variety of ways in which these end-users were hoping to and could foresee using the data to inform:

- updates to their local hazard, risk and vulnerability assessments (HRVAs);
- climate adaptation planning/plans;
- planning for tree canopy/planting and urban forestry strategies; and
- assessment of where vulnerable populations are spatially located to inform response and preparedness planning.

The first workshop gathered a small group of those with specific, local subject matter expertise related to Socio-demographic Vulnerability (aka. the AHP workshop). The second workshop gathered a wider group of potential end-users to provide the background into the development of the three indices: socio-demographic vulnerability, heat exposure, and building vulnerability and gain critical feedback before proceeding to the analysis stage. The intent was to ensure project team members and additional stakeholders in the region were comfortable with the methods and approach before proceeding in earnest to the modelling and analysis stages. A third workshop was held with the consultant team and staff project team to review the final products and deliverables and review the draft public dashboard.

Several additional meetings were held to:

- Review the approach to the buildings index with internal stakeholders before completing the modelling effort for that particular index;
- Review various approaches to heat exposure modelling and ensure acceptability of this particular heat exposure approach; including meeting with the Pacific Climate Impacts Consortium (PCIC) and City of Victoria staff who conducted heat modelling for the City of Victoria; and
- Reach out to First Nations' representatives and organisations representing First Nations' interests in the region (e.g. First Nations' Health Authority, to discuss and explore the existing data and gaps in relation to First Nations' in the region and potential uses and improvements going forward.

A final workshop provided a final overview of all the end-products (i.e. including maps, modelling, GeoBC portal, story map) to support capacity building in the use of the mapping products for local government staff and other key end-users in the region.

2. Methods

For each index developed in this Project, considerable data collation and analysis has been undertaken. This Section provides a comprehensive presentation of methodology employed in calculating the three vulnerability indices: exposure, socio-demographic, and buildings. These indices form multiple perspectives on the Region's anticipated level of vulnerability to extreme heat.

Each index is calculated through a specific process of literature reviews, data acquisition and manipulation, analysis, and stakeholder engagement. The methodologies described in this Section present detailed processes in constructing each index and associated data validation, limitations, and quality assurance. The development of these indices aims to capture a comprehensive understanding of determinants of extreme heat vulnerability to both the community and building footprint levels.

This assessment references the 2021 extreme heat event as the design event for extreme heat in the capital region. Though this event is a so-called 'one-in-a-thousand-year' event, experts argue that as climate change progresses BC may experience heat events similar to the 2021 extreme heat event with greater frequency as high as every 5 - 10 years[17]. As such, it is beneficial to

[17] Union of BC Municipalities (2021). Preparing for more heat domes. Available from: https://www.ubcm.ca/about-ubcm/latest-news/preparing-more-heat-domes

consider the worst-case scenario that has been experienced when planning for the future[18, 19]. This assessment leverages available data in the development of each index to be temporarily aligned to the 2021 extreme heat event period[20]. This includes data sources, detailed further below, as census data, satellite observations, weather station data, building assessment data, and health data.

Below is a high-level summary of the methodology employed for each vulnerability index.

- Socio-demographic Vulnerability Index (Section 2.1).
  This index integrates a variety of demographic and health-related data utilising an Analytical Hierarchy Process (AHP) to weigh and prioritise multiple inputs based on their relevance to extreme heat vulnerability. This process involved collaboration with local subject matter experts to identify, weigh, and validate the index.

- Extreme Heat Exposure Layer (Section 2.2).
  This index describes the perceived outdoor air temperatures during the 2021 heat event. Using a non-linear modelling approach, this index considers multiple variables including land surface temperature, solar insolation, elevation, distance to coastline, and more. Climate station data that collected air temperature measurements during the 2021 heat event have also been used to train and validate this modelling process.

- Building Vulnerability Index (Section 2.3).
  This index addresses the physical characteristics of buildings and their local environment that affect the building's capacity to (remain) cool during an extreme heat event. The construction of this index is at the building footprint scale and includes leveraging inputs from multiple data sources, such as remotely sensed lidar (lidar - light detection and ranging) data and building assessment data. Factors that describe this index include building age, dwelling type, solar insolation, and building height.

Each index is underpinned by rigorous data validation and quality assurance processes, involving both technical analyses and stakeholder consultations. The methodologies employed are designed to ensure the indices provide an accurate, transparent, and reproducible representation of heat vulnerability in the Region. The project also includes a data dictionary, which presents a comprehensive view of all datasets used in this project, their currency, and their source. Please contact climateaction@crd.bc.ca if you would like a copy of the data dictionary.

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[18] IPCC. (2021). Summary for Policymakers. In V. Masson-Delmotte, P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, & B. Zhou (Eds.), Climate Change 2021: The Physical Science Basis. *Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. https://www.ipcc.ch/report/ar6/wg1

[19] Philip, S.Y., Kew, S.F., van Oldenborgh, G.J., et al. (2022). Rapid attribution analysis of the extraordinary heat wave on the Pacific coast of the US and Canada in June 2021. *Earth System Dynamics*, 13(4), 1689-1713. https://doi.org/10.5194/esd-13-1689-2022

[20] The 2021 extreme heat event in BC occurred during the 25th of June to the 7th of July. The design event we used for much of the modeling was June 28th, 2021.

2.1. *Socio-demographic Vulnerability Index*

The socio-demographic vulnerability index is designed to assess the *sensitivity* and *adaptive capacity* of communities to extreme heat events at a local level and includes determinants related to population health and socioeconomic status.

- Sensitivity in the context of extreme heat vulnerability refers to the extent to which a population is affected by an extreme heat extent. In the socio-demographic index, this includes factors such as age demographics, pre-existing health conditions, and income.
- Adaptive capacity in this context represents the ability of the community to adjust, absorb, and respond to the adverse impacts associated with extreme heat. In the socio-demographic index, this includes household size, education, and employment.

The socio-demographic vulnerability index has been developed through an Analytical Hierarchy Process (AHP), in which local experts such as epidemiologists, emergency managers, and social, community and climate planners were engaged in a workshop format. The selection of AHP over principal component analysis (PCA) was based on literature reviews and the consulting team's previous project experiences. Indeed, research suggests that PCA does not correlate well with actual heat-related health outcomes and is very sensitive to the input data used in the vulnerability index[21]. As a result, AHP was chosen for its ability to (1) include the engagement of groups that may have been traditionally excluded from such exercises, (2) more easily interpreted than PCA, and (3) provide a more relevant demographic weighting in relation to extreme heat related health outcomes.

The AHP workshop provided a platform for the group to evaluate over 50 identified socio-demographic determinants of vulnerability. The list of indicators was initially identified from an informal literature review and informed by previous studies on the subject[22]. For each indicator, a slide was presented that displayed the spatial distribution of the determinant across the region, as shown in Figure 2.0. Following the workshop, a survey was conducted to assign appropriate weights to each indicator, which were then used to calculate the socio-demographic vulnerability index for each Census dissemination area (DA) across the Region[23]. This approach ensures that the index is regionally relevant through the subject matter expert input in index design.

The full list of indicators used and their associated AHP weights are shown in Table 2.0 below.

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[21] Conlon, K. C., Mallen, E., Gronlund, C. J., Berrocal, V. J., Larsen, L., & O'Neill, M. S. (2020). Mapping human vulnerability to extreme heat: A critical assessment of heat vulnerability indices created using principal components analysis. Environmental Health Perspectives. https://doi.org/10.1289/EHP4030

[22] Bao, J., Li, X., & Yu, C. (2015). The Construction and Validation of the Heat Vulnerability Index, a Review. International Journal of Environmental Research and Public Health, 12(7), 7220–7234. https://doi.org/10.3390/ijerph120707220

[23] Due to time constraints that arose due to the rich discussion during the AHP workshop, remaining tasks were accomplished via survey. The consulting team was then able to run the index once the weightings were complete and the health data was acquired. Results were reviewed in a follow-up meeting with AHP workshop participants as well as a few additional stakeholders with socio-demographic expertise.

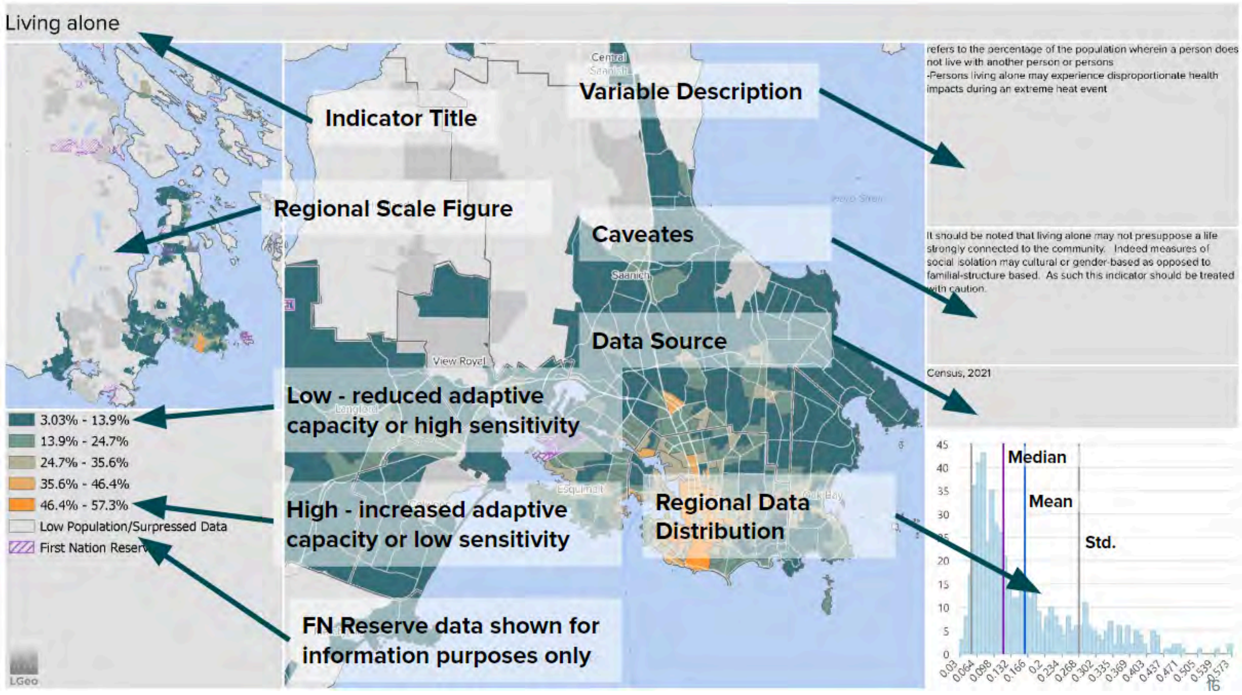

Figure 2.0. Sample slide of the demographic data review during the AHP workshop. Each variable was mapped, the distribution of data was assessed and data caveats and limitations were flagged and discussed.

Table 2.0 Socio-demographic variables and their associated weights. The table is ordered from largest weight to smallest.

Theme	Variable Name	Source	Date	AHP Weight
Age	Population age 65 or older (%)	Census	2021	5.79%
Health	Mental and Substance Use Disorders (crude rate)	BCCDC	2021	5.65%
Income	Low Income Adults	Census	2021	5.34%
Health	Chronic kidney disease (crude rate)	BCCDC	2021	5.26%
Identity	Living alone	Census	2021	5.15%
Health	Hospitalised stroke (crude rate)	BCCDC	2021	5.16%
Health	Chronic Obstructive Pulmonary Disease (Crude Rate)	BCCDC	2021	5.00%
Health	Acute Myocardial Infarction (Crude Rate)	BCCDC	2021	5.00%
Health	Hypertension (crude rate)	BCCDC	2021	4.76%
Health	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)	BCCDC	2021	4.66%
Income	Total - Adjusted after-tax economic family income decile group	Census	2021	4.59%
Health	Asthma (crude rate)	BCCDC	2021	4.21%
Identity	Population that are renters (%)	Census	2021	3.88%
Identity	Indigenous Identity	Census	2021	3.68%
Health	Diabetes (Crude Rate)	BCCDC	2021	3.72%

Employment	Outdoor Workers - Trades, transport and equipment operators etc.	Census	2021	3.30%
Identity	Speaking Neither English Nor French at Home	Census	2021	2.80%
Age	Primary household maintainers - 75 years and over	Census	2021	2.80%
Identity	Recent Immigrants 2016-2021	Census	2021	2.60%
Age	Primary household maintainers - 85 years and over	Census	2021	2.54%
Age	Primary household maintainers - 65 years and over	Census	2021	2.35%
Identity	Has high (secondary) school diploma or equivalency certificate or no diploma/degree	Census	2021	2.10%
Population	2021 Population Density (per Hectare)	Census	2021	2.03%
Housing	Housing Built Before 1960	Census	2021	2.03%
Housing	Major repairs needed at home	Census	2021	1.91%
Housing	Average number of rooms per dwelling	Census	2021	1.91%
Housing	Average spending on windows and doors	Environics	2022	1.78%

2.2. *Heat Exposure Layer*

The accurate measurement of the distribution and intensity of outdoor heat exposure is essential for a range of applications, including public health and urban planning[24, 25]. This assessment of heat exposure aims to provide a comprehensive picture of outdoor extreme heat throughout the capital region, with a focus on the 2021 extreme heat event. Our approach employs advanced remote sensing technology and environmental data analysis to develop a detailed Heat Exposure Layer. This layer visualises the intensity and distribution of extreme heat across the region and includes two key components:

- Land surface temperature (LST), measured in °C, provides a direct measure of heat emitted from the Earth's surface during the heat event. This layer captures the intensity of ground-level heat across the capital region.
- Air temperature, also measured in °C, provides a complementary perspective of how temperatures are experienced by individuals during the extreme heat event. This layer is indirectly measured from multiple inputs that are regressed against observed temperature from weather station data across the regional district.

The following subsections present detail on the components of the Heat Exposure Layer and their implications. This section includes the methodology included in calculating LST and air temperature, a comparison between both LST and air temperature assessments, limitations in the exposure methodologies, and potential future uses for these layers.

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[24]McGregor, G. R., & Vanos, J. K. (2018). Heat: A primer for public health researchers. Public Health, 161, 138-146. https://doi.org/10.1016/j.puhe.2017.11.005
[25]Havenith, G. and Fiala, D. (2015). Thermal Indices and Thermophysiological Modeling for Heat Stress. In Comprehensive Physiology, R. Terjung (Ed.). https://doi.org/10.1002/cphy.c140051

2.2.1. *Forecasting the Heat Exposure Layer*

This assessment initially explored forecasting heat exposure to an end-of-century scenario as aligned with Intergovernmental Panel on Climate Change (IPCC) high-emission relative concentration pathway (RCP 8.5°C), i.e. the "worst case scenario"[26]. However, this additional analysis was dropped given the following key concerns:

- The modelling used in understanding the future distributions of heat are developed from global-scale models that are attributed with resolutions order of magnitudes greater than the current heat exposure layer. While these aggregated global circulation models work well at understanding climate change at larger scales, their impacts are currently homogenous at the capital region level. Further, at an end-of-century, high-emission scenario there are relatively large margins of error introduced to the magnitude of extreme heat described[27].
- Land surface temperature, solar insolation, and other important variables in the exposure layer are closely aligned with land cover. As the region's land cover changes, it is expected that the distribution of the current heat exposure layer would also change. It would therefore be necessary to predict land cover changes to the end-of-century to accurately predict future extreme heat distribution at the localised level. Naturally, such an analysis would introduce many assumptions and uncertainties.
- A missing component of a hypothetical forecasted heat exposure would be an understanding of the forecasted population and infrastructure that will directly experience extreme heat at the end-of-century. Without an understanding of future demographics and density, the construction of a forecasted extreme heat layer would disingenuously present tomorrow's hazards and risks to today's community.

2.2.2. *Land Surface Temperature Analysis*

Land surface temperature (LST) directly measures the heat emitted from the ground. This analysis uses satellite data captured over the 2021 heat event. We use the Landsat-8 constellation to gather multispectral images with a 30 m^2 resolution. The LST analysis includes the following calculations:

- a normalised difference vegetation index (NDVI; i.e. a "greenness" index);
- fractional vegetation (i.e. the proportion of vegetation within the satellite image mosaic pixel);
- emissivity (i.e. the capacity for ground-based objects to retain and emit heat); and
- thermal radiation (i.e. the direct measurement of heat radiated from the Earth's surface).

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[26] IPCC. (2021). Summary for Policymakers. In V. Masson-Delmotte, P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, & B. Zhou (Eds.), Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg1

[27] ClimateData.ca (n.d.) Uncertainty in climate projects. Available from https://climatedata.ca/resource/uncertainty-in-climate-projections/

2.2.3. *Air Temperature Analysis*

While LST is representative of the distribution of heat across the region during the 2021 heat event, it is less accurate at describing human-observed discomfort to heat during that event. Air temperature, usually measured 2 m above the ground, is a more accurate representation of how extreme heat is experienced by an individual. Air temperature is not a measurement that is captured by spaceborne or airborne remote sensing platforms, such as Landsat.

To align the extreme heat to the human experience, our exposure layer assessment calculated air temperature through a regression-based model that is informed by LST and other local environmental factors, shown to be correlated with air temperature[28,29]. The air temperature regression-model predictor variables include:

- Digital elevation model (DEM), at 1 m^2 spatial resolution and derived from 2019 lidar and for beyond lidar survey extents at 30 m^2, as acquired from the Shuttle Radar Topography Mission (SRTM) data[30];
- Solar insolation (Wh/m^2) at 1 m^2 terrain models from the 2019 lidar data;
- Sky View Factor (SVF), at 1 m^2 spatial resolution that describes the degree of viewable sky for points on the ground and is a representation of multiple other environmental factors[31];
- Land surface temperature (LST; °C), at 30 m^2 and calculated from multiple spectral bands of the Landsat-8 satellite images captured during the 2021 heat event (described in the previous Section);
- Normalised water difference index (NDWI), which measures water content of the environment. NDWI is also roughly 30 m^2 and calculated from multiple spectral bands of the Landsat-8 satellite images captured during the 2021 heat event;
- Distance to coastline (km), which is a euclidean measurement at 30 m^2 pixel resolution; and
- Longitude and latitude.

In addition to the dependent variables listed above, we use an average daytime temperature observed on the 28th June, 2021 between 9:00 to 21:00 from a network of 66 stations located throughout the Region (Figure 2.2) as the independent variable in this regression model. Upon iterative regression analyses, it was found that variables differed significantly in terms of their predictability of air temperature. We found that the regression model performs well with highly significant variables including solar insolation ($p \risingdotseq 0$), land surface temperature ($p = 0.0013$),

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[28] Ho, H. C., Knudby, A., Sirovyak, P., Xu, Y., Hodul, M., & Henderson, S. B. (2014). Mapping maximum urban air temperature on hot summer days. Remote Sensing of Environment, 154, 38-45

[29] Xu, Y., Knudby, A., & Ho, H. C. (2014). Estimating daily maximum air temperature from MODIS in British Columbia, Canada. International Journal of Remote Sensing, 35(24), 8108-8121. https://doi.org/10.1080/01431161.2014.978957

[30] NASA Shuttle Radar Topography Mission (SRTM)(2013). Shuttle Radar Topography Mission (SRTM) Global. Distributed by OpenTopography. DOI:10.5069/G9445JDF. Accessed November 15, 2023

[31] Zakšek, K., Oštir, K., & Kokalj, Ž. (2011). Sky-View Factor as a Relief Visualization Technique. Remote Sensing, 3, 398-415. https://doi.org/10.3390/rs3020398

distance to coast (p = 0.0305), and elevation (p = 0.037). The other predictors identified were found to be cross-correlated or not significant and were dropped from the model.

The linear regression model is constructed without an intercept. The assumption here is that in the absence of the environmental factors considered, the perceived outdoor temperature by a typical individual would be 0°C. Our justification for the decision in not including an intercept for this linear regression are summarised below for each predictor variable.

- *Land surface temperature.*
  Given that land surface temperature is a direct measure of the heat emitted by the ground, a value of zero would imply no heat emission, theoretically corresponding to a scenario of absolute zero where no molecular motion—and hence no temperature—exists. However, such a condition is physically impossible on Earth's surface, rendering the inclusion of an intercept unnecessary for this variable.
- *Solar insolation.*
  The presence of solar insolation is a necessary condition for positive temperatures. While the insolation value does not reach zero in our dataset, we suggest that in the absence of insolation, such as during a total solar eclipse or polar night, the temperature would tend toward the lowest possible values observed.

Figure 2.2. Weather stations used in air temperature modelling.

The average daytime temperature is used at each station to account for potentially faulty sensors and/or temperature spikes that cause anomalous in the data, as shown in Figure 2.3.

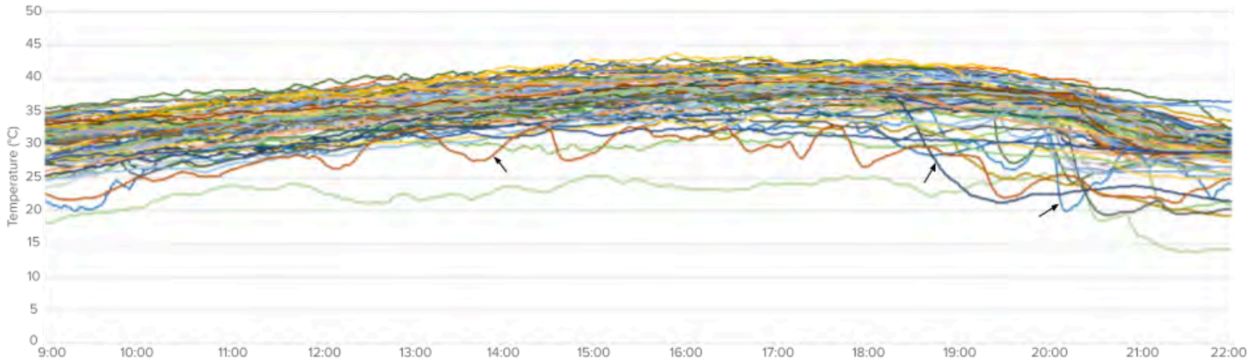

Figure 2.3. Hourly temperature observations at 66 weather stations throughout the Capital Region, as measured from 9:00 to 21:00 on the 28th of June, 2021. Black arrows indicate potentially anomalous and faulty sensor data.

In addition to the linear model, we also used a random forest model to produce predicted air temperature values throughout the Region. Our random forest model produces an R^2 of 0.73 and a root mean square error (RMSE) of 1.97 °C, a performance similar to that of similar studies[32]. While suggesting a strong model performance, the random forest model also produces an unexpected, inverted relationship between solar insolation and air temperature. For this reason, the regression model was selected for this study

2.3. Buildings Index

Building-level heat vulnerability mapping is multifaceted and has been a gap in many heat vulnerability indices that do not consider nuances at the building scale. Our approach aims to fill this gap by integrating multiple models that capture multidimensional factors of building-specific vulnerability to extreme heat events. This project assesses building-by-building vulnerability for all buildings throughout the region[33].

This Building Vulnerability Index Section presents key findings derived from a comprehensive review of relevant literature. Subsequently, each input of the building index is detailed with its respective model methodology, accompanied by discussions on index calculation and data verification.

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[32] Ho, H. C., et al. (2014)

[33] Not included are outhouses and other, non-primary buildings. The building footprint dataset is a combination of municipal and regional datasets, as well as lidar-based building footprint classifications as developed for this project in areas that are beyond the available building footprint data extents. Minor instances of misclassification and/or temporal misalignment are occasionally observed across building footprint datasets.

2.3.1. *Buildings Literature Review*

The importance of building characteristics in heat vulnerability assessments cannot be understated. Notably, many heat-related deaths—especially during extreme events—can be credited to indoor heat exposure[34, 35]. This is particularly relevant for certain vulnerable groups, such as the elderly or those with limited mobility, who spend much of their time indoors and therefore disproportionately face the heat impacts associated with buildings. Further, research indicates a significant discrepancy between indoor and outdoor temperatures[36], thereby demonstrating the need to complement our previously described efforts on extreme heat exposure modelling (see Section 2.2). Indeed, studies show that heat-related mortality and morbidity resulting from outdoor and indoor exposure may not always be correlated, highlighting that the composition of building characteristics may be more informative than outdoor surface temperature[37]. By considering building-level characteristics, heat vulnerability indices can provide a more comprehensive and nuanced understanding of heat vulnerability and help to facilitate targeted heat response and risk reduction.

In review of the literature around heat vulnerability analysis, some emerging building-level indicators were reviewed and selected based on available and reputable data sources. Through a literature review, we elucidated the following regarding building-specific heat vulnerability:

- While social-vulnerability heat indices can inform where to act in the event of an extreme heat event, analysing housing characteristics of those areas allows for a more nuanced understanding of how to facilitate risk reduction and adaptive strategies before the onset of a heat event[38].
- Indoor heat temperature may be significantly misaligned from outdoor measured temperatures, thereby underscoring the importance of building-specific indoor heat modelling as a required component to heat vulnerability assessments[39].

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[34] Samuelson, H., Baniassadi, A., Lin, A., Izaga González, P., Brawley, T., & Narula, T. (2020). Housing as a critical determinant of heat vulnerability and health. *Science of The Total Environment*, 720, 137296. https://doi.org/10.1016/j.scitotenv.2020.137296

[35] CDC, 2013. Heat illness and deaths—New York City, 2000–2011. MMWR Morb. Mortal. Wkly Rep. 62, 617.

[36] Alam, M., Sanjayan, J., Zou, P. X. W., Stewart, M. G., & Wilson, J. (2016). Modelling the correlation between building energy ratings and heat-related mortality and morbidity. *Sustainable Cities and Society*, *22*, 29–39. https://doi.org/10.1016/j.scs.2016.01.006

[37] Uejio, C. K., Wilhelmi, O. V., Golden, J. S., Mills, D. M., Gulino, S. P., & Samenow, J. P. (2011). Intra-urban societal vulnerability to extreme heat: The role of heat exposure and the built environment, socioeconomics, and neighborhood stability. *Health & Place*, *17*(2), 498–507. https://doi.org/10.1016/j.healthplace.2010.12.005

[38] Samuelson et al. (2020).

[39] Alam et al. (2016)

- Buildings can contribute to heat gains[40] during extreme heat events through solar heat gains (via roofs, walls, and windows) and internal heat gains (from appliances and lighting).
- Both forms of heat gains are important in identifying potential vulnerabilities[41], however internal heat gain data is limited and therefore is considered through peer-reviewed proxy indicators that focus on thermal performance, including construction year and dwelling type[42].
- The reflectance or albedo of a rooftop's material contributes to the amount of heat absorbed into the building.
- Floor level and building type are predictors of increased mortality and morbidity during extreme heat events, particularly for those who are aged, have chronic conditions, mobility constraints, or disability[43].

2.3.2. Buildings Index Inputs

To create a buildings level index, individual building footprints for the region were compiled from the various municipalities that make up the capital region. These compiled footprints were derived from various years ranging from 2018 to 2023. However, some areas in the capital region did not have readily available building footprints. Building footprint data gaps were present for Metchosin, parts of East Sooke and areas along the coast, west of Sooke out to Juan de fuca.

For Metchosin, where 2019 classified land cover data[44] was accessible, the project team opted for a cost-effective approach by deriving footprints from the available buildings class and regularising building polygons to simulate building form. Available lidar data was also used for the Metchosin area to derive building height information using a regional building height model (BHM), as detailed in section 2.3.2.4I.

For East Sooke and areas along the coast, west of Sooke out to the Juan de Fuca Electoral Areas, land cover classified data was not available. Instead, building footprints for these remaining areas were derived from Lidar BC's lidar portal containing 2019 lidar data[45]. After

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[40] Heat gains refer to the thermal energy that enters a building. It includes the heat absorbed from external sources, such as solar radiation penetrating through the building's roof, walls, and windows. As well as, from internal sources, including appliances, lighting, and human activities within the building. Heat gains play a crucial role in determining the indoor heat levels and overall thermal conditions within a building during heatwaves. Assessing and understanding heat gains is essential in evaluating the potential heat-related risks and vulnerabilities of buildings and their occupants

[41] BC Housing. (2022). *Extreme Heat and Buildings: An Analysis of the 2021 Heat Dome Related Deaths in Community Housing in British Columbia*. https://www.bchousing.org/sites/default/files/media/documents/Extreme-Heat-Report%2B2022.pdf

[42] Samuelson et al. (2020).

[43] Haigh, F., Chok, H., & Harris, P. (2011). Housing density and health: A review of the literature and Health Impact Assessments.

[44] Caslys (2021). Capital Regional District Land Cover Classification [Map/Dataset]. Shared under data agreement with the Capital Regional District.

[45] Lidar BC, Open Data Portal. Data collected in 2019. https://lidar.gov.bc.ca/pages/download-discovery.

removing outliers in the lidar point cloud data, building features were classified using ESRI's lidar classification tool[46]. Building features in the lidar data were extracted as raster data and then converted into polygon shapes, regularised, and attributed with building height information from lidar. After quality assurance checks were conducted on footprint delineation, a few gaps remained where manual delineation of footprints was undertaken for completeness[47].

With building footprints delineated and the use of high resolution data inputs, this index has been designed to assess the vulnerability of individual buildings to extreme heat and represents a significant advancement in this field, particularly given the limited body of existing literature on building-specific responses to extreme heat. Our literature review on this topic, as well as engagement with subject-matter experts, found six emergent determinants of building-specific vulnerability: building age, dwelling type, rooftop albedo, building height, solar insolation, and the presence of heat pumps. Each of these determinants is detailed below.

2.3.2.1. Building Age

While older buildings are not definitively hotter in all scenarios, age acts a proxy for multiple other variables such building construction type and thermal properties[48], which were unavailable inputs for this Project. Rather, age primarily acts as a marker for BC step-code adoption. Building age helps to flag buildings that are less likely to be up to code in terms of heat regulation and air tightness within the BC context.

Older buildings are ranked at a higher vulnerability, based off of BC's historic building code[49]. Buildings built before 1970 used building codes under local bylaw standards with no coherence in standards across the District, whereas buildings built after 2012 have higher standards for ventilation (see Table 2.1 below).

Table 2.1. Building age vulnerability based on an understanding of BC building code eras and their respective level of standards.

Building Age	Vulnerability
<1970	Very Vulnerable
1970-1985	Vulnerable

[46] *Classify LAS Building (3D Analyst)—ArcGIS Pro | Documentation*. (n.d.). Retrieved December 20, 2023, from https://pro.arcgis.com/en/pro-app/latest/tool-reference/3d-analyst/classify-las-building.htm
Parameters used in classification: The lidar building feature extraction algorithm was constrained by defining a minimum building height of 2m and a minimum area of 6 m^2.

[47] 446 building footprints were manually delineated.

[48] Samuelson et al. 2019

[49] Government of British Columbia. (2015). *History of British Columbia Building Regulations*. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/guides/history_of_the_codes_2015_update.pdf

1985-1998	Less Vulnerable
1998-2006	Moderately Vulnerable
2006-2012	Mildly Vulnerable
2012-2018	Minimally Vulnerable
> 2018	Not Vulnerable

2.3.2.2. Dwelling Type

Dwelling type is included in the buildings index as research has found that taller, multi-unit buildings may exhibit increased vulnerability to extreme heat[50]. Indeed, Haigh, Chok, and Harris (2011) assert that factors such as building floor level and type serve as predictors for elevated mortality and morbidity during extreme heat events[51]. Furthermore, a report from the BC Coroner in 2022 underscores the correlation between dwelling type and the incidence of heat-related deaths observed during the 2021 heat event.

To derive the vulnerability weight for each dwelling type, rankings were assigned based on the proportions of heat-related deaths by dwelling type during the 2021 extreme heat event, as reported by BC's Coroner. These proportions were then standardised relative to the capital region's housing stock proportions and normalised for the capital region's population per dwelling type (refer to Table 2.2). This standardisation process ensures that the dwelling type vulnerability weight is aligned with the composition of the capital region's housing stock.

Table 2.2. Dwelling type vulnerability ranking. Using the BC Coroner's report BC wide statistics, the proportion of deaths occuring in a dwelling type is normalised for the number of dwellings per dwelling type category within the capital region.

Heat-Related Deaths By Place of Injury	BC Wide Proportion of Deaths (%)	Proportion of capital region Dwelling Type (%)	CRD Proportion of Deaths (%)	CRD Vulnerability Weight
Private Residence - Multi-unit	39.1	30	45	0.36
Private Residence - Detached	33.9	64	39	0

[50] British Columbia Coroners Service (2022) Extreme Heat and Human Mortality: A review of heat-related Deaths in BC in Summer 2021.

[51] Haigh, F., Chok, H., & Harris, P. (2011). Housing density and health: A review of the literature and Health Impact Assessments.

Single Room Occupancy (SRO) or Supportive-/Social-housing	10.0	Data unavailable	Data unavailable	Data unavailable
Trailer Home/Mobile Home/RV/Camper	6.5	2	8	1
Senior/Long-Term Care Home	6.5	3	8	.86
Outside	2.1	N/A	N/A	N/A
Other Residential	1.9	N/A	N/A	N/A

Building age and dwelling type are both attributes taken from the BC Assessment's Building Information Report (BIR). In cases when flattening both the regional parcel fabric and the building information report onto the parcels, where multiple building information records exist for a single parcel, the building type assigned is determined by that of the largest square footage, and the age is designated based on the year corresponding to the largest square footage building type.

2.3.2.3. *Albedo*

Albedo was selected as a thermal performance proxy metric as it indicates how much solar thermal radiation is absorbed and emitted on building rooftops. Higher albedo surfaces (i.e white roofs) reflect light off the surface while darker surfaces have a low albedo and absorb more heat.

In our approach to calculate albedo, we utilise reflectance data from Sentinel-2 Multispectral Instrument (MSI)[52] imagery and weighting coefficients as developed by Vanino et al[53]. The weights represent the fraction of solar radiation within the spectral range for each Sentinel-2 band. These weights were established based on the spectral irradiance spectrum of the sun, essentially indicating the proportion of sunlight each band receives. Given these weights and the per-band reflectance values, we calculate the mean albedo for each pixel in the image using the following formula, as adaptive from Vinino et al (2018)[54]:

$$\alpha = \frac{\sum|\rho_{bi} \cdot \omega_{bi}|}{\sum \omega_{bi}} \tag{1}$$

where:

- α is mean albedo at a 10 m^2 pixel resolution;

[52] European Space Agency. (2015-present). Sentinel-2 Multispectral Instrument Level-1C data [Data set]. Copernicus Open Access Hub. https://scihub.copernicus.eu/dhus

[53] Vanino, S., Nino, P., De Michele, C., Bolognesi, S. F., D'Urso, G., Di Bene, C., Pennelli, B., Vuolo, F., Farina, R., Pulighe, G., & Napoli, R. (2018). Capability of Sentinel-2 data for estimating maximum evapotranspiration and irrigation requirements for tomato crop in Central Italy. Remote Sensing of Environment, 215, 452-470. https://doi.org/10.1016/j.rse.2018.06.035

[54] See Appendix A for corresponding band weights.

- ω_{bi} is the weight for band i; and
- ρ_{bi} is the reflectance in band i.

This equation computes a weighted average of the reflectances across the different bands (summarised in Appendix A), with weights given by the ω_{bi} values. Each band's reflectance is multiplied by the corresponding weight, and these products are then summed. The sum of these weighted reflectances is divided by the sum of the weights to normalise the result, providing an estimate for mean albedo (α) . Note that we diverge in methods from Vanino et al, in that we normalise our weights, thereby ensuring that the weights sum to 1. This way we maintain the reflectance values' relative importance and avoid artificially inflating or deflating the final albedo estimate.

2.3.2.4. Building Height

Taller buildings are more vulnerable irrespective of air conditioning[55], which is considered in the building index model using building height information derived from LiDAR. A digital surface model (DSM) and a digital terrain model (DTM also referred to as a ground elevation model) were derived from 2019 LiDAR[56] across the region. By subtracting the DTM from the DSM, building height is derived for each building footprint (See equation 2). Building height is averaged for each building footprint.

$$BHM = DSM - DTM \qquad (2)$$

where:

- BHM is Building Height Model, in metres;
- DSM is Digital Surface Model, in metres; and
- DTM is Ground Elevation, in metres.

2.3.2.5. Solar Insolation

Solar radiation refers to the amount of daily sun exposure a building receives; more sun exposure equates to hotter conditions. Solar heat gains are assessed using a solar loading model that considers various factors. Firstly, it uses the sun's position (azimuth and altitude), calculated via astronomical equations for different times of the day and year. A clear sky model is employed to estimate solar radiation, taking into account atmospheric conditions that can scatter and absorb radiation. The model also considers the impact of shade and shadows based on digital elevation models (DEMs), as well as the influence of surface characteristics like aspect and slope on radiation received. The tool calculates insolation, expressed in watt hours per square metre (Wh/m^2), for both direct and diffuse radiation, creating a raster output where each cell's value signifies the solar radiation received over a set period of time. The raster output has been averaged across each building footprint to better visualise relative variation in solar insolation.

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[55] Samuelson et al. (2020)
[56] Lidar BC, Open Data Portal. Data collected in 2019. https://lidar.gov.bc.ca/pages/download-discovery.

2.3.2.6. *Heat Pumps*

Lastly, building-specific data is available for residential buildings that have a newly installed heat pump (installed between 2011 and 2022)[57][58]. If a building has a heat pump, the model assumes a heat vulnerability score of 0 as it is likely to have appropriate protective effects against extreme heat[59].

The distribution of heat pumps is unequal in the capital region region with wide degrees of adoption by jurisdiction as well as building type. Based on our analysis of the heat pump data we note that overall 5.8% of residential buildings have confirmed or suspected heat pump installations based on the Technical Safety BC and City of Victoria permit data.

As summarised in table 2.3 below: The highest overall adoption rates in Colwood and View Royal at 9.8% and 9.6% respectively. Notable in Colwood, was the highest regional penetration of heat pumps in single detached homes (8.9%) compared to a regional average of 4.8%. In View Royal we noted a 31.8% penetration rate (by building count) of heat pumps in multi-unit buildings which was the highest in the region and triple the regional average of 11.4%.

Conversely, we note that of larger jurisdictions, Central Saanich, Victoria and Oak Bay all have lower adoption rates for heat pumps (3.3%, 4.5% and 4.0% respectively). Interestingly, Central Saanich has a very low adoption rate for single detached homes (2.5%) whereas the City of Victoria has lower adoption rates across the board but worryingly in multi-unit residential buildings (4.2%) which we note are more risky from a buildings heat perspective more generally). We should note, however, that multi-unit building heat pump adoption rates may be lower in Victoria due to the use of alternate cooling technologies (such as HVAC or traditional AC units) which were not captured for this study.

Table 2.3. Heat pump adoption rates by community for residential buildings

Community	Percentage of heat pumps in residential buildings
Central Saanich	3%
Colwood	10%
Esquimalt	6%
Highlands	6%
Juan de Fuca (Part 1)	4%
Juan de Fuca (Part 2)	0%
Langford	7%
Metchosin	7%
North Saanich	9%
Oak Bay	5%
Saanich	6%

[57] From Technical Safety BC Data for all jurisdictions outside of the City of Victoria and from City of Victoria permits in the locale

[58] We note that heat pumps are but one mechanical cooling technology that can be used during a heat event. More commonly air conditioning is considered as the mitigative factor. However, building level air conditioning data does not exist at a scale that would render it effective for a project such as this one.

[59] Canadian Climate Institute. (2023). *Heat Pumps Pay Off.* https://climateinstitute.ca/wp-content/uploads/2023/09/Heat-Pumps-Pay-Off-Unlocking-lower-cost-heating-and-cooling-in-Canada-Canadian-Climate-Institute.pdf

Saltspring Island	0%
Sidney	7%
Sooke	12%
Southern Gulf Islands	0%
Victoria	4%
View Royal	10%

2.3.3. Buildings Index Calculation

Given the scarcity of comprehensive studies in this area, we use a deterministic approach in modelling the buildings vulnerability index. The index is determined by calculating an equally weighted average of the aforementioned indicators. In cases where data for a specific indicator is unavailable for a particular building, that indicator is excluded from the vulnerability assessment for that building. This ensures that each building's vulnerability score is based only on available and relevant data. See Figure 2.5 below for a summary of the building index compilation.

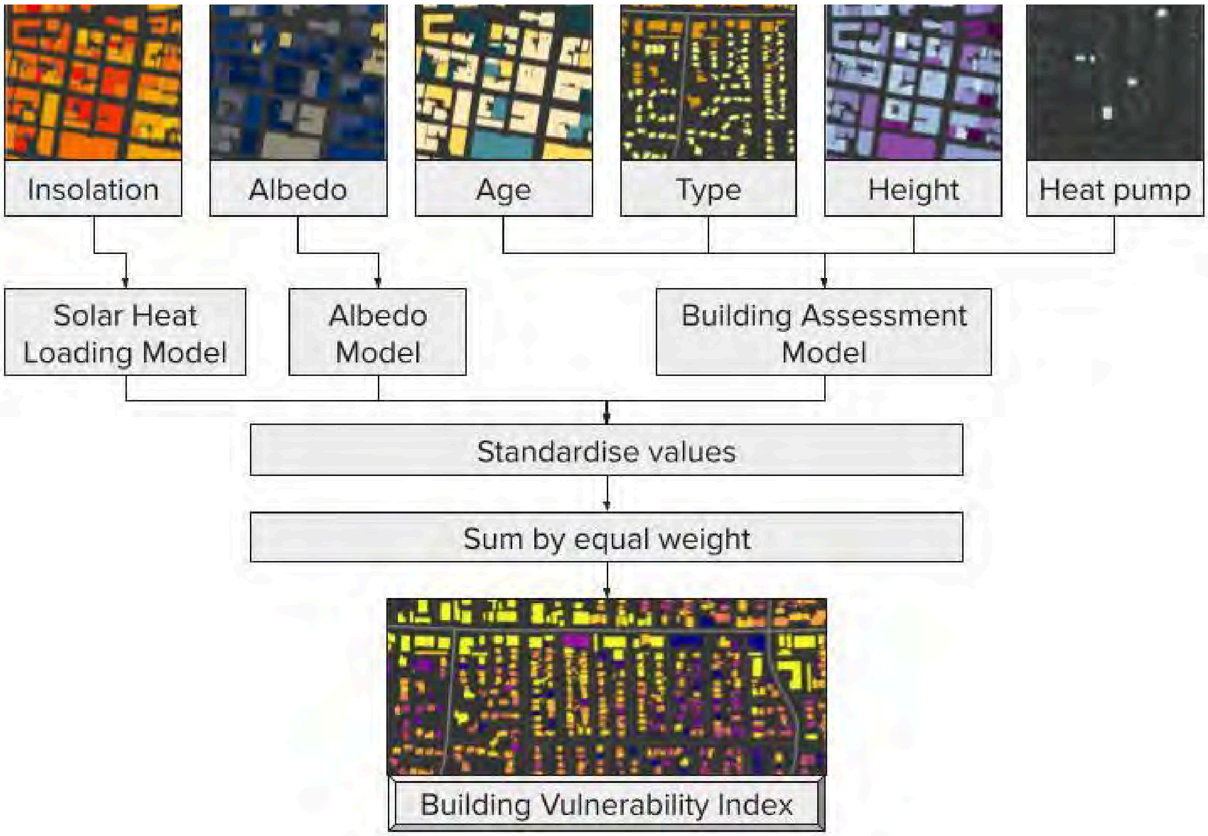

Figure 2.5. The Building Vulnerability Index consists of three models that capture multidimensional factors of building-specific vulnerability to extreme heat events. These factors include building age, dwelling type, building height and presence of heat pumps (Building Assessment Model), solar heat gain (Solar Heat Loading Model) and rooftop albedo (Albedo Model).

2.3.4. Anomalous and Missing Value Correction

The process of relating input values, such as BHM or albedo, to building footprints revealed some inaccuracies that required a specifically designed correction process. These inaccuracies are largely brought about by tree canopy coverage of building footprints and temporally misaligned lidar data.

This correction process applies a lidar-derived land cover classification layer, that distinguishes between treed and non-treed surfaces[60]. Albedo and BHM values are averaged from non-tree footprint segments, so that a more accurate height and reflectance values can be assumed. The correction process also tails height data to account for anomalous averages. Further, the correction process identifies buildings with missing values (either due to a high proportion of tree canopy coverage or due to temporal misalignment between the footprint and lidar dataset) and

[60] Caslys (2021). Capital Regional District Land Cover Classification [Map/Dataset]. Shared under data agreement with the Capital Regional District.

applies an archetypical height value that is representative of buildings of the same type within the local area.

2.3.5. *Building Attribute Verification Process*

The building footprint attribution QA process involves a multi-faceted approach that ensures the reliability of the Building Vulnerability Index inputs, namely height, albedo, solar insolation, dwelling type, and year built.

- *Sample selection for validation.*
  A representative sample of 80 building footprints was selected from both the upper and lower ends of the Buildings Index values. This sampling strategy was designed to cover a broad spectrum of buildings, facilitating a comprehensive evaluation of various attributes.
- *Findings from the attribution quality assurance process.*
  Our analysis revealed patterns consistent with expectations. Buildings identified as highly vulnerable in the index typically exhibited greater height and exposure to solar radiation. Conversely, buildings classified as less vulnerable were generally shorter and had more extensive tree coverage. However, it was observed that smaller buildings, predominantly single-family dwellings, demonstrated more variability in results. This variability included occasional misidentifications of building footprints and potential tree obstructions affecting building height measurements.
- *Albedo assessment.*
  The albedo values for smaller buildings were found to be closely clustered due to the spatial resolution of albedo measurements (10 m^2). This clustering makes it challenging to discern clear patterns for these small buildings. In contrast, larger buildings displayed more distinct albedo values, which more accurately reflected the colour and material of the roofs, ranging from white to dark grey.
- *QA methodology.*
  The quality assurance (QA) process serves as an essential validation measure to verify the rationality and validity of the regional model in its classification of buildings at the individual level. QA checks include the following procedures:
    - Street view analysis: Attributes such as building height, solar insolation, and dwelling type were cross-verified using Google Street View imagery. For example, a building identified as a seniors living building type, 11.1 m height, and high solar insolation (i.e. open environment, low tree cover) was validated through Google Street View, which confirmed the building as a four-storey senior care home with minimal shading and older construction material (Figure 2.6).
    - Satellite imagery analysis: Attributes, such as albedo, were also cross-checked using high resolution, RGB satellite imagery[61]. This cross-check confirmed the

[61] Maxar. (2022, July 24). Vivid RGB 30 cm high resolution imagery. Retrieved from ArcGIS Online: https://www.arcgis.com

accuracy of albedo values alignment with roof colours in the Region. The same building discussed above shows a typical grey roof colour in Figure 2.7

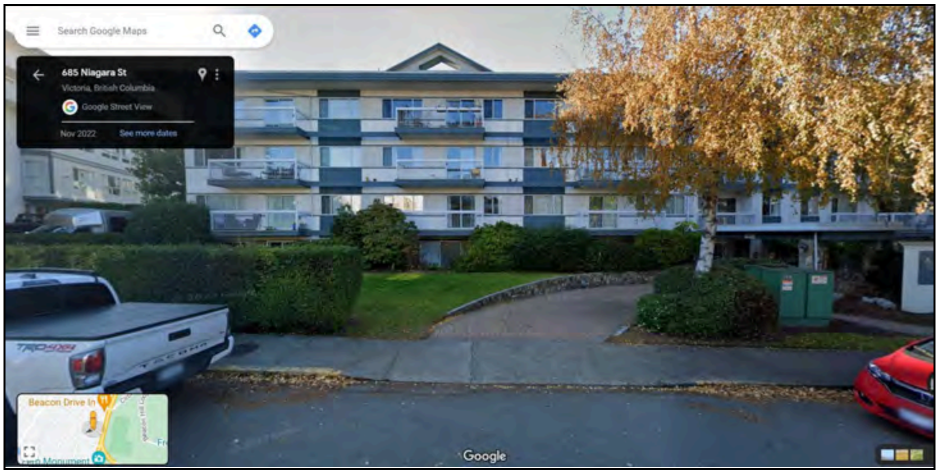

Figure 2.6. QA example of sense check methodology, Google Street View.

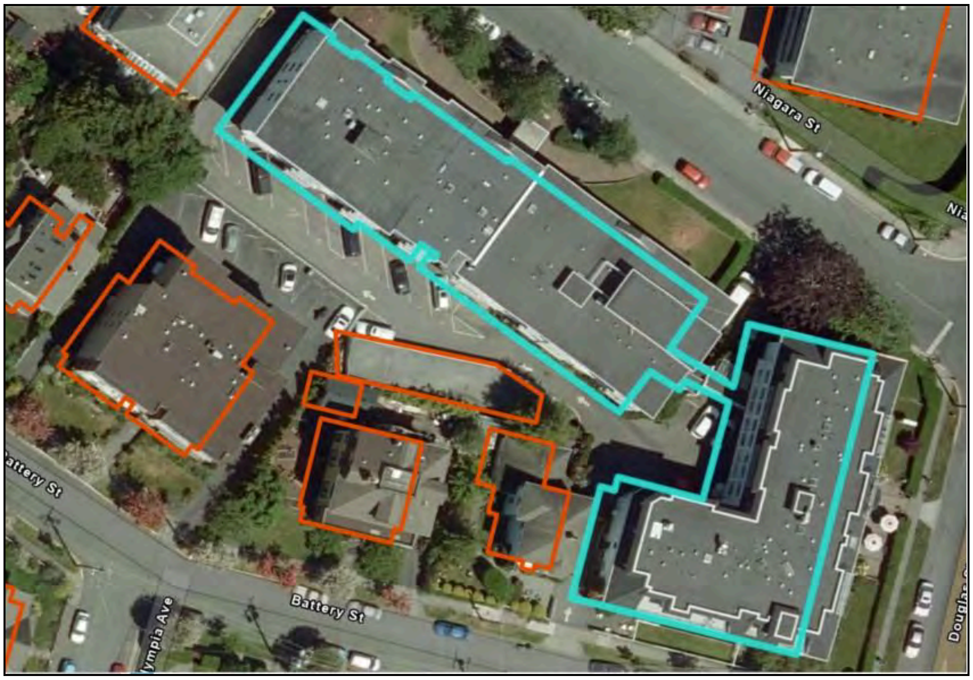

Figure 2.7. QA example of sense check methodology, aerial view.

The QA process concluded that 86% of the assessed buildings accurately represented all examined attributes. Discrepancies in the remaining 14% were attributed to various factors, as detailed in Table 2.4. These included construction-related changes (2.5%), misclassification of structures as buildings (3.7%), building height overestimations (2.5%), and tree interference in rural areas leading to inaccuracies in footprint delineation (4.9%). Imagery resolution challenges in rural areas further compounded these validation issues.

Table 2.4. Summary of error types found during the QA process

Type of error	Proportion of dataset (%)
Construction Related	2.5%
Misclassification of Buildings	3.7%
Building Height Errors	2.5%
Tree Interference	4.9%

In total, 100% of delineated building footprints were attributed a building height, albedo and solar insolation value while 97.12% of buildings were attributed with building construction year and dwelling type. Thus, 2.88% of buildings are left without BIR attributes. For buildings without BIR attributes, 1.43% of those buildings were on First Nations Lands and data is not available from the BIR for these buildings. There is also an estimated 2.28% of buildings missing from the buildings index model, which was gleaned from where a building information record was attached to a parcel, but no building footprint was present.

3. Results

This Section presents results pertaining to the socio-demographic vulnerability index, the heat exposure layer, and the building vulnerability index. For each, key patterns are described and emergent insights from the analysis are discussed. Additionally, the Section presents community-level and municipal analysis findings.

3.1. Socio-Demographic Vulnerability Index

As mentioned in the sections above, the Socio-demographic Vulnerability Index was informed by a rigorous process involving the assignment of weights to each variable during the Analytic Hierarchy Process (AHP) workshop, which was a collaborative effort with regional subject matter experts, including epidemiologists, emergency managers, and social planners. The Socio-demographic Vulnerability Index identifies key contributors to vulnerability, and based on the insights garnered from the AHP workshop, three variables emerged as the most significant risk indicators during extreme heat events. The demographic factors most strongly influencing the vulnerability index encompassed the percentage of the population aged 65 or older, the crude rate of individuals with mental and substance use disorders, and the percentage of low-income adults (see Table 2.0 for the full list of variables with their associated weights). These variables were collectively deemed as the most at-risk populations during extreme heat, as established through the informed perspectives of the workshop participants and antecedent literature review.

The demographic index was further broken down into two distinct sub-indices to gain a more nuanced comprehension of the spatial dynamics influenced by health-related demographic variables and socio-demographic factors. When decomposed, we note that the individual sub-indices performed poorly in comparison to the singular index which suggests that both health and demographic information contribute more or less equally to heat risk.[62] The demographic index, excluding health factors, displays a spatial pattern with a concentration of vulnerability observed in Victoria's downtown core (see fig 3.1). The pattern indicates relatively less vulnerable areas radiating outward from Victoria. In contrast, the demographic index considering only health-related factors illustrates increased vulnerability proportions in Saanich as well as an increased amount of Dissemination Areas (DAs) in Sydney (see figure 3.2). Overall, the combined socio-demographic index highlights a few areas in the region that have a greater proportion of the population that is vulnerable to extreme heat events (see figure 3.3). These highly vulnerable areas include James Bay and the surrounding areas near downtown Victoria, pockets of Saanich, and the town of Sydney (See figures 3.1, 3.2, and 3.3 for maps of the socio-demographic index and the two sub-indices). Additional detailed findings are indicated by municipality in the municipal summaries outlined in section 3.6 below.

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[62] While individually, each sub-index had weaker outcomes, on their own each can be used for alternative purposes or be combined with other variables and information to produce value-added outcomes. We suggest further evaluation regarding the combination of these sub-indices and other variables in future studies, as appropriate.

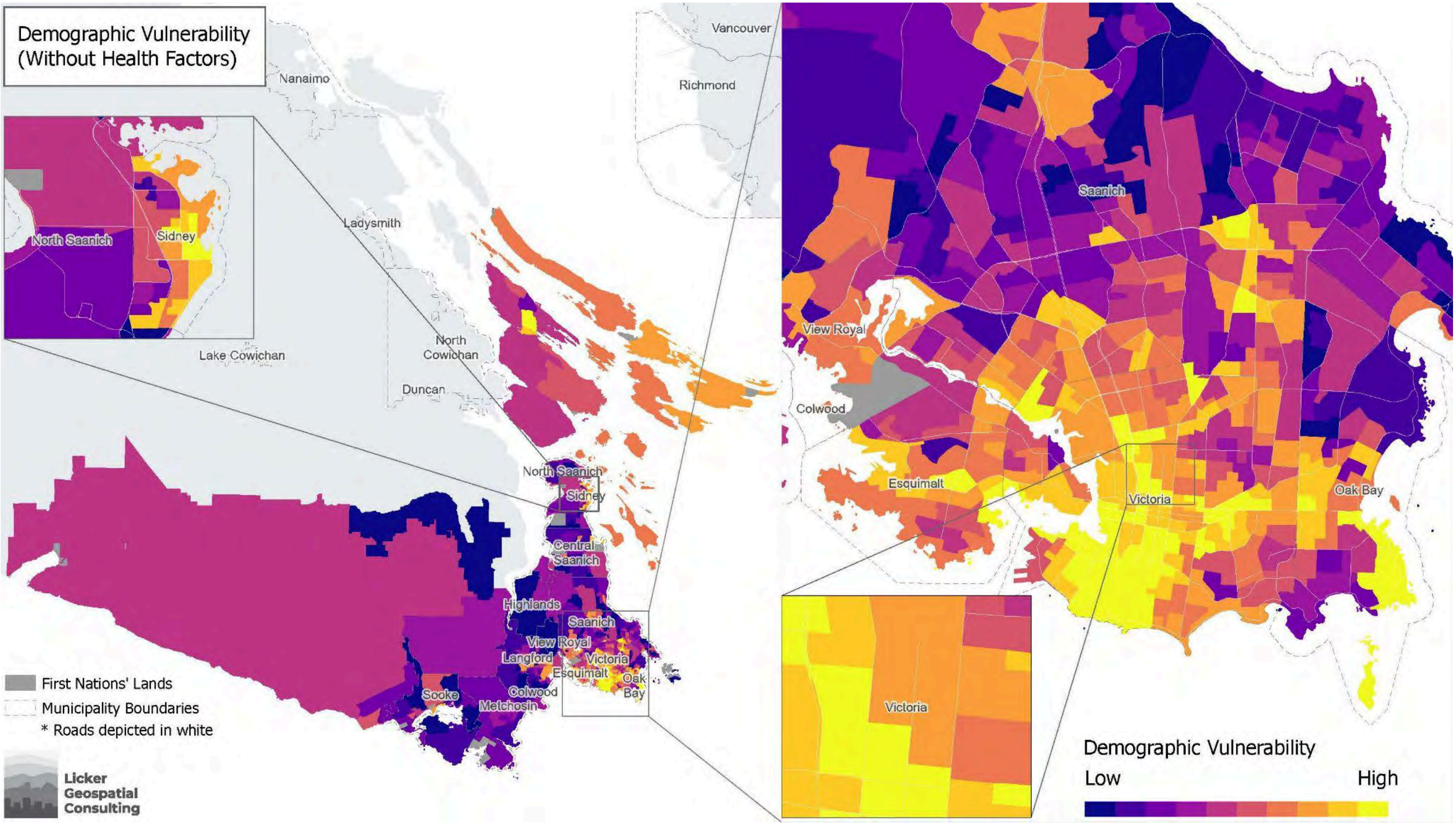

Figure 3.1. Extreme Heat – Demographic Vulnerability sub-index distribution (no health data included).

3.1.1. *Concentrations of health vulnerability*

When analysed by community, we note that significant health risk is present in Sidney (31% of its population reside in DAs with high health risk mainly due to an older population, however other determinants of health could still be a factor there), Esquimalt and the Southern Gulf Island and Salt Spring Island (Figures 3.1 and 3.3). When considered at a population level, the highest concentration of highly vulnerable populations reside in Victoria (28% share of the top two deciles), Saanich (20% share of the top two deciles) and Langford (11% share). However, when taken in proportion to the population as a whole, Sidney stands out with a 10% share of the highest two deciles compared to an overall 3% share of the capital region's population (resulting in a risk proportion ratio of 3.0). This is distantly followed by Esquimalt (1.43) and Victoria (1.36). (Tables 3.0 and 3.1 below).

Key determinants of health vulnerability in Sidney include:

- High rates of hypertension in the populace - 54th in the capital region
- High rates of episodic mood disorders - 54th in the capital region
- Higher rates of Acute Myocardial Infarction - 47th in the capital region; and
- Higher rates of Chronic kidney disease - 42nd percentile in the capital region

It bears noting that these are average percentile values and as such indicate a high degree of concentration of health risks in the municipality.

For reference, neighbouring North Saanich (which has a much lower index score) shows the following average rates (by capital region percentile):

- Hypertension - 39th Percentile
- Episodic mood disorders - 37th percentile
- Acute Myocardial Infarction - 29th percentile
- Chronic Kidney disease - 27th percentile

Colwood (the second lowest scoring municipality with regards to the health index) continues the trend:

- Hypertension - 17th Percentile
- Episodic mood disorders - 35th percentile
- Acute Myocardial Infarction - 15th percentile
- Chronic Kidney disease - 13th percentile

Indeed, areas such as Colwood, North Saanich and Saanich all have relatively lower proportions of at-risk populations in comparison to their proportionate share of capital region population (ratios of 0.56, 0.22 and 0.61 for Colwood, North Saanich and Saanich respectively). These ratios suggest that these areas have reduced concentrations of health risk overall.

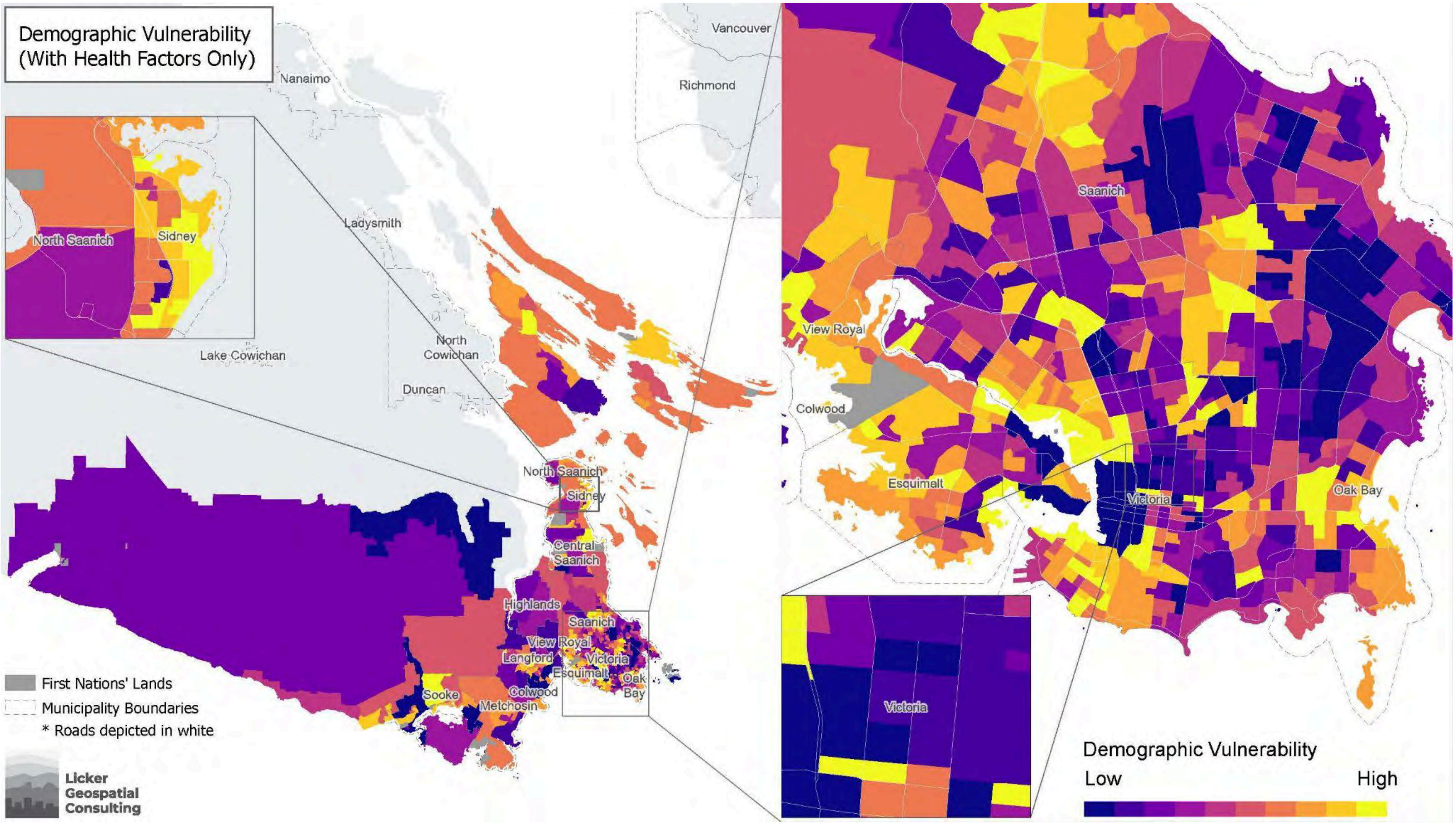

Figure 3.2. Extreme Heat – Health-Only Demographic Vulnerability sub-index distribution.

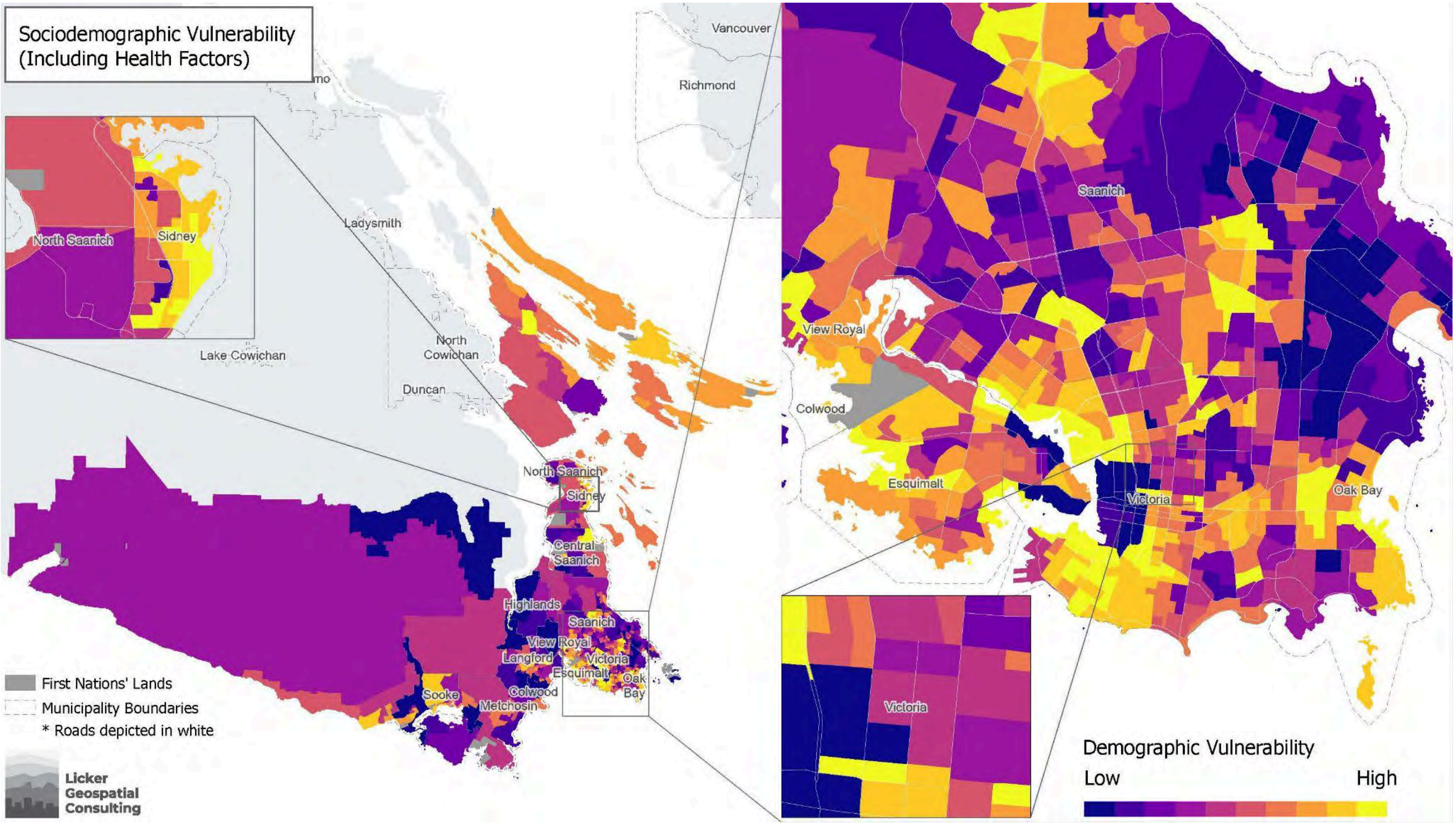

Figure 3.3. Extreme Heat – Socio-demographic Vulnerability Index with both demographic and health-related indicators

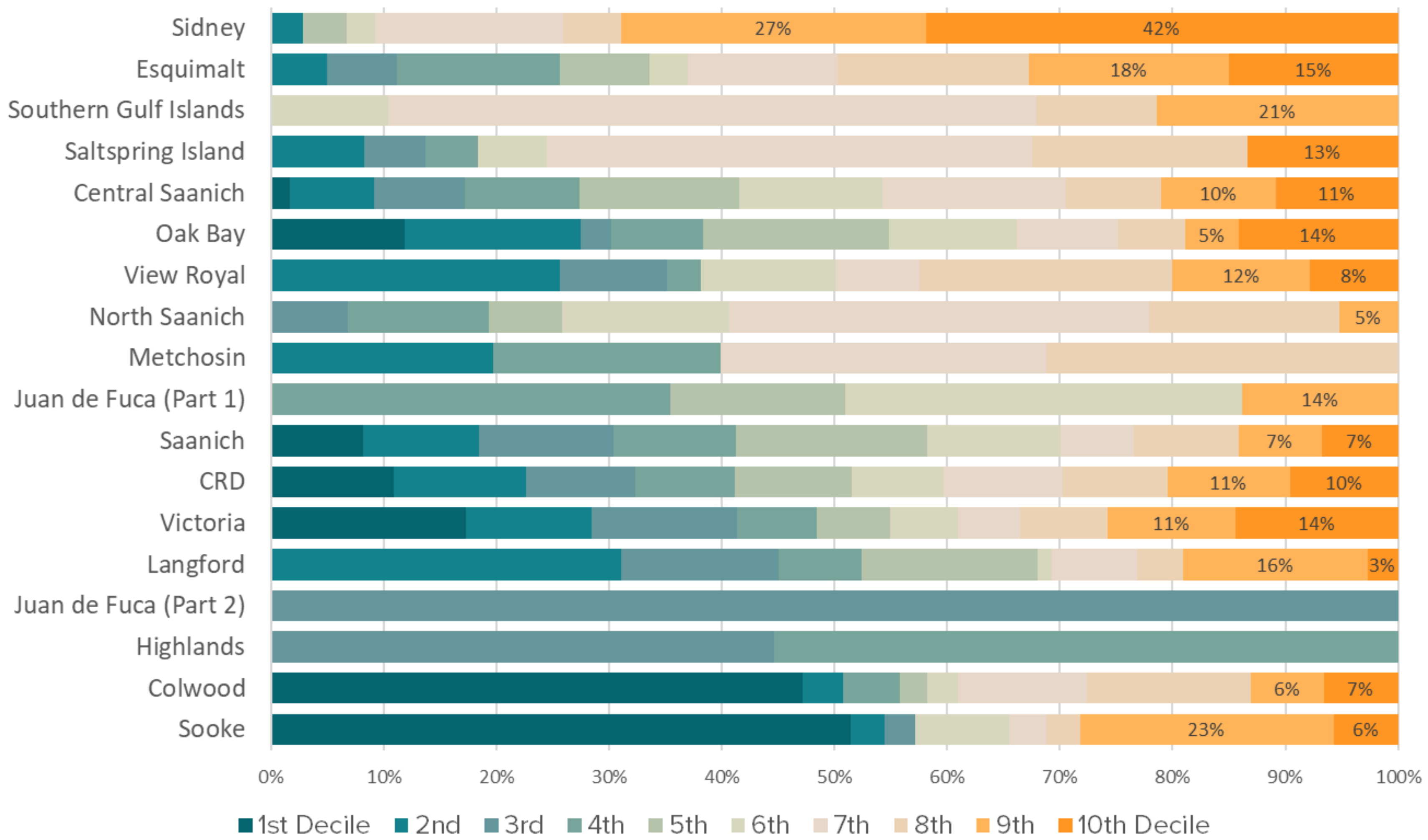

Figure 3.4. Demographic vulnerability (Health sub-index) by jurisdiction in the capital region, displayed by decile. Sidney BC, has the largest proportion of its population falling within the most vulnerable decile, while Juan de Fuca (part 2) and Highlands BC, have 0% of their populations within the most vulnerable decile.

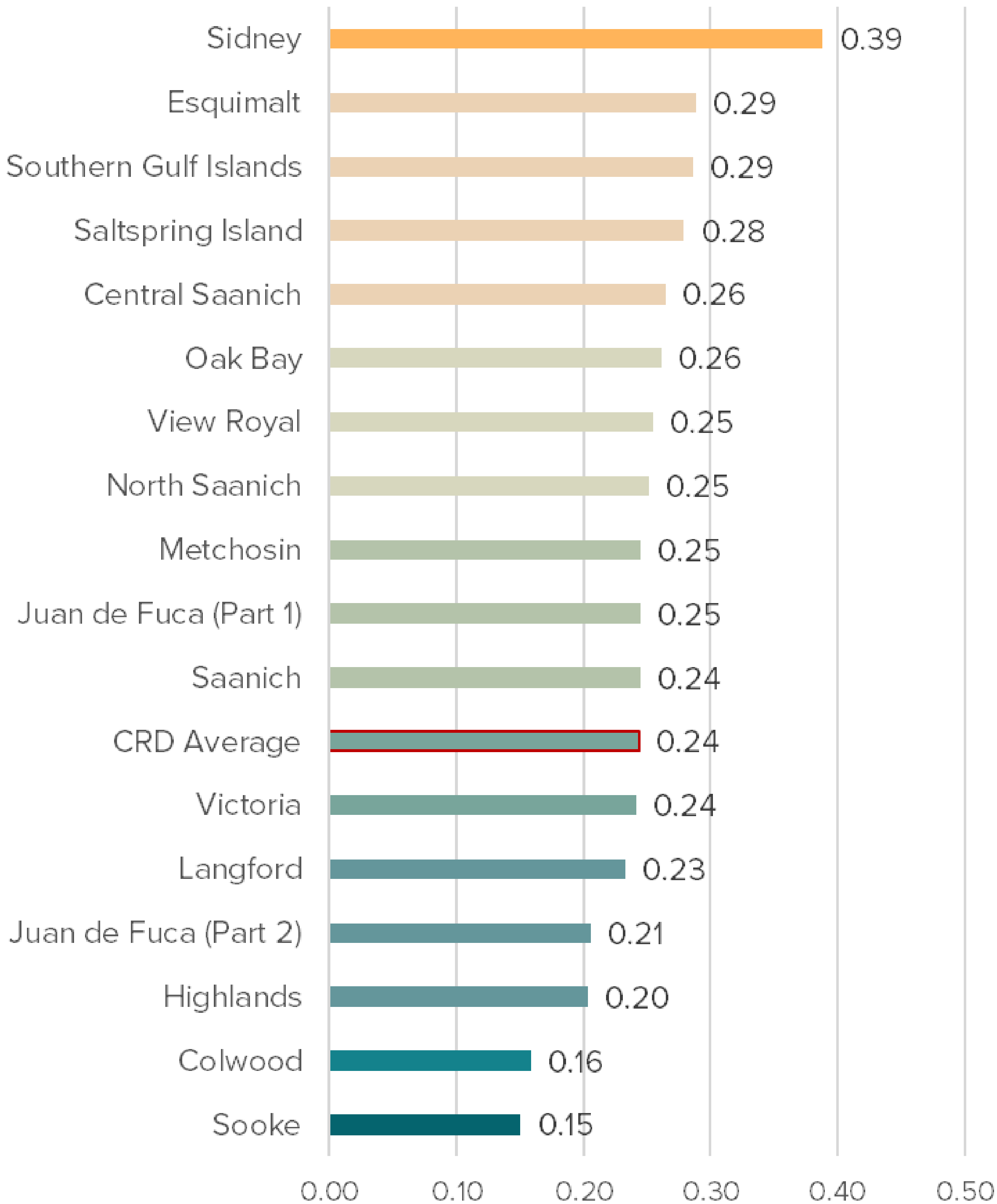

Figure 3.5. Demographic vulnerability by jurisdiction in the capital region (heath sub-index only).

Table 3.0. Population by demographic health sub-index decile by jurisdiction in the capital region (health data only).

Jurisdiction	1st Decile	2nd	3rd	4th	5th	6th	7th	8th	9th	10th Decile
Sooke	7,762	447	411			1,262	502	449	3,396	857
Colwood	8,939	689		947	472	501	2,175	2,762	1,231	1,245
Highlands			1,109	1,373						
Juan de Fuca (Part 2)			399							
Langford		14,476	6,528	3,398	7,288	573	3,532	1,912	7,624	1,253
Victoria		10,266	11,812	6,585	5,966	5,486	5,096	7,084	10,484	13,210
Saanich	9,593	12,181	14,057	12,697	20,076	13,885	7,677	10,936	8,639	7,994
Juan de Fuca (Part 1)				1,817	796	1,808			711	
Metchosin		998		1,025			1,462	1,582		
North Saanich			834	1,531	791	1,818	4,564	2,061	636	
View Royal		2,971	1,097	344		1,382	871	2,593	1,413	904
Oak Bay	2,143	2,799	486	1,475	2,955	2,041	1,639	1,048	856	2,548
Central Saanich	293	1,293	1,413	1,771	2,457	2,212	2,826	1,460	1,778	1,882
Saltspring Island		959	638	536		718	5,004	2,226		1,554
Southern Gulf Islands						637	3,509	651	1,304	
Esquimalt		882	1,077	2,532	1,393	601	2,337	2,976	3,104	2,631
Sidney		352			477	314	2,052	633	3,339	5,151
CRD Total		**48,313**	**39,861**	**36,031**	**42,671**	**33,238**	**43,246**	**38,373**	**44,515**	**39,229**

Table 3.1. Relationship between population in high risk DAs and proportion of regional population.

Jurisdiction	Proportion of Population in Top Two Deciles	Proportion of capital region's Population	Ratio of High Risk Proportion to Proportion of capital region Population
Sooke	5.1%	4.1%	1.2
Colwood	3.0%	5.2%	0.6
Highlands	0.0%	0.7%	0.0
Juan de Fuca (Part 2)	0.0%	0.1%	0.0
Langford	10.6%	12.7%	0.8
Victoria	28.3%	20.8%	1.4
Saanich	19.9%	32.2%	0.6
Juan de Fuca (Part 1)	0.8%	1.4%	0.6
Metchosin	0.0%	1.4%	0.0
North Saanich	0.8%	3.3%	0.2
View Royal	2.8%	3.2%	0.9
Oak Bay	4.1%	4.9%	0.8
Central Saanich	4.4%	4.8%	0.9
Saltspring Island	1.9%	3.2%	0.6
Southern Gulf Islands	1.6%	1.7%	0.9
Esquimalt	6.8%	4.8%	1.4
Sidney	10.1%	3.4%	3.0

3.1.2. Concentrations of demographic vulnerability

When analysed by community, we note that there is significant demographic risk in Victoria, Sidney and Esquimalt (Figures 3.6 and 3.7). This risk is driven by key factors such as family income, renting populations, and the overall age of the population. When considered at a population level, the highest concentration of highly vulnerable populations (per the demographic sub-index) reside in Victoria (67% share of the top two deciles), Saanich (12% of the top two deciles) and Sidney and Oak (Both 6.6%).

However, when using a proportionate share approach, Victoria stands out with a 66% share of the top two deciles compared with a 22.4% share of the capital region's population (resulting in a risk to proportion ratio of 3.0). Key factors that drive vulnerability in Victoria include:

- Percentage of renters in the community (59% community average, 18% model weighting)
- Spending on shelter improvements (windows and doors) (89th lowest percentile in the capital region, 12% model weighting)
- Percentage of the population living alone (28% community average, 12% model weighting)
- Percentage of the population that is 65 years and older (23% community average, 11% model weighting)
- Average number of rooms per dwelling (69th lowest percentile in the capital region, 10% model weighting).

Victoria's risk to proportion ratio is subsequently followed by Sidney (2.2) and Oak Bay (1.5) (Tables 3.2 and 3.3 below). Of note is the Oak Bay finding, which raises questions with regards to demographic risk in affluent areas which could suggest hidden poverty or a significant subset of the population who do not own their homes and potentially live in substandard housing. Accordingly, further investigation into this community is warranted.

Conversely, in West Shore communities such as Colwood, Sooke and Langford, we note no populations in highest deciles of the demographic sub-index which suggests very low risk in these communities overall (at least at the population level, noting the ecological fallacy discussed in the section above).

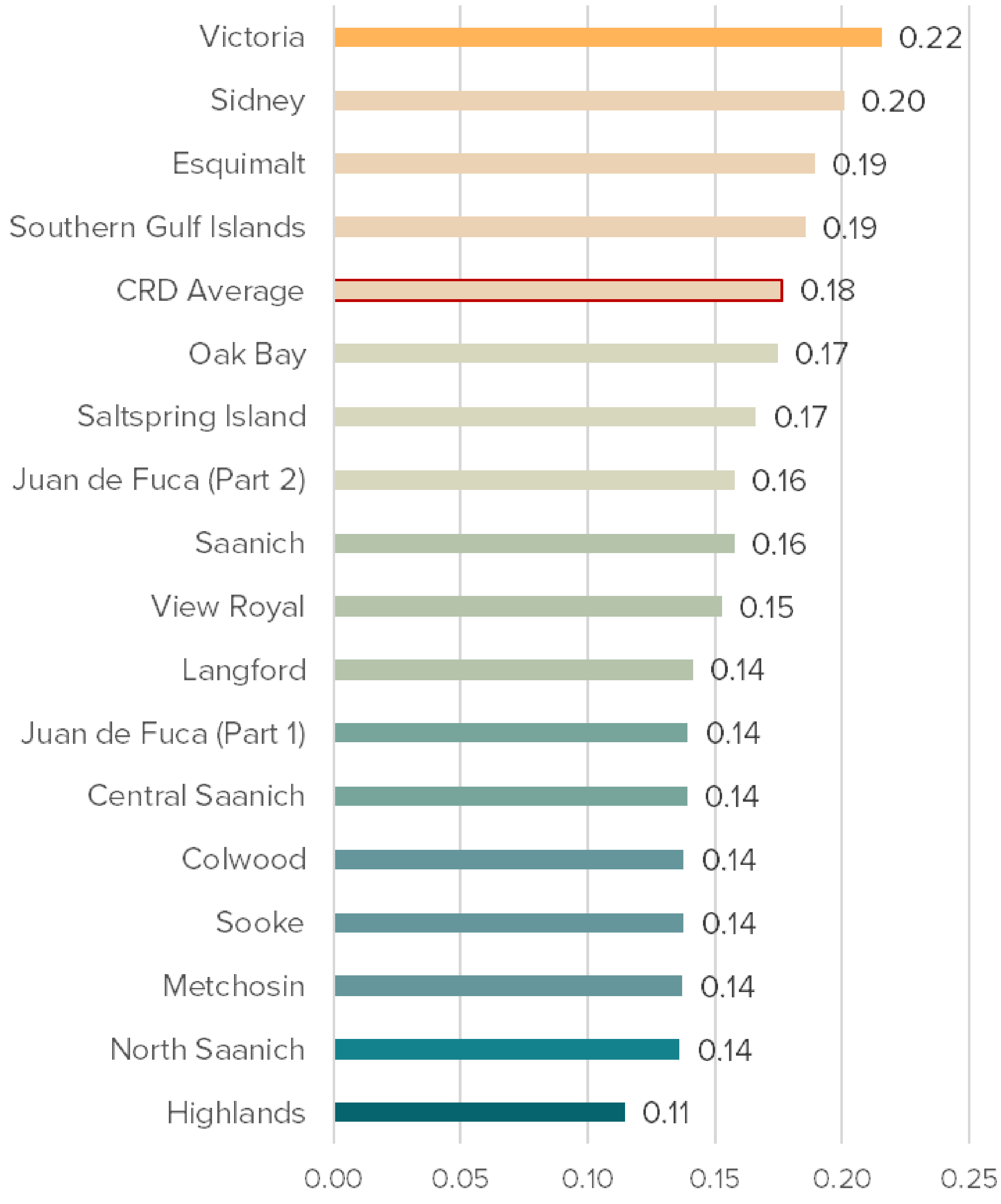

Figure 3.6. Demographic vulnerability by jurisdiction in the capital region (demographic sub-index only).

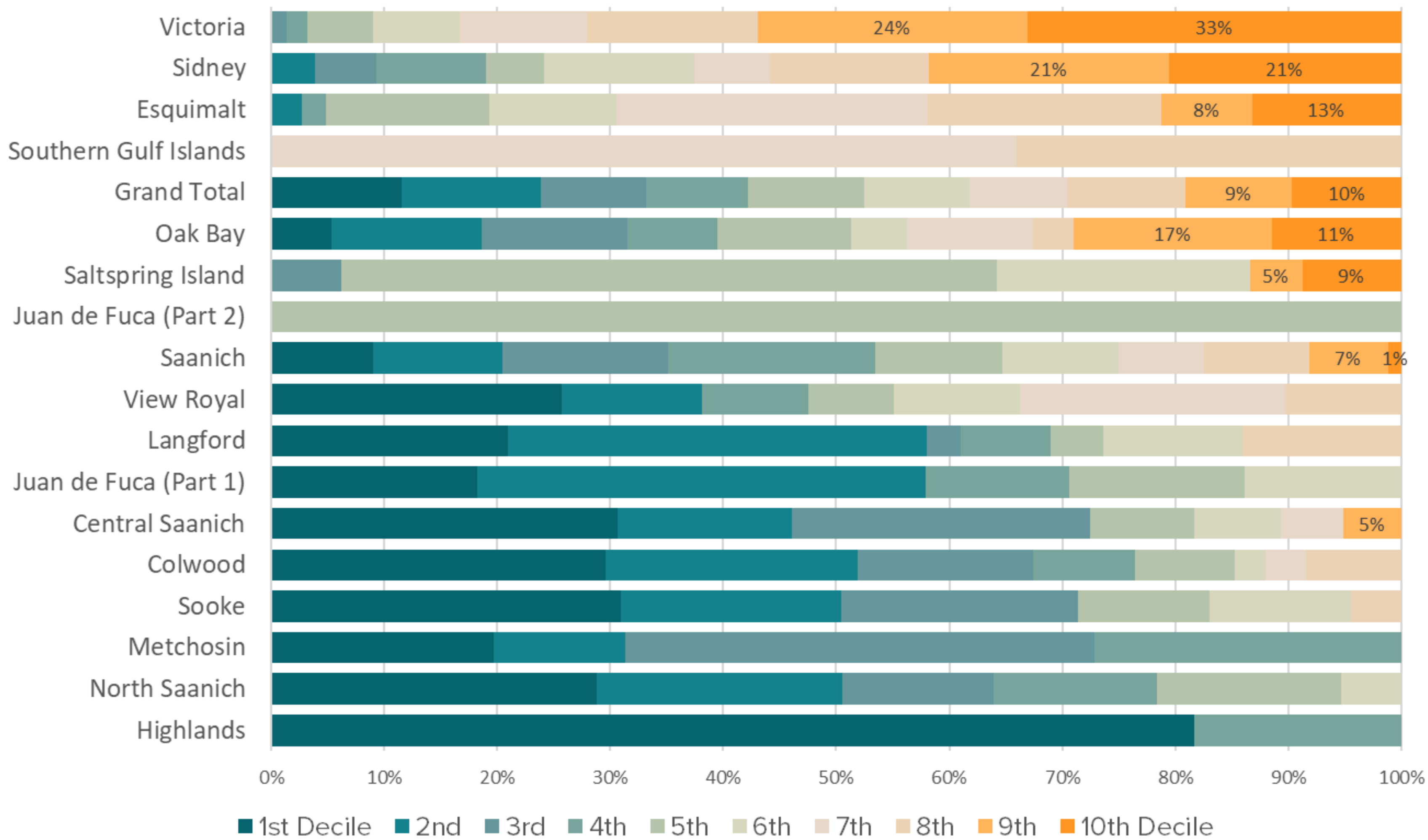

Figure 3.7. Demographic vulnerability (sub-index) by jurisdiction in the capital region, displayed by decile. Victoria, BC, has the largest proportion of its population falling within the most vulnerable decile, while North Saanich and Highlands BC, have 0% of their populations within the most vulnerable decile.

Table 3.2. Population by demographic sub index decile by jurisdiction in the capital region (no health data included).

Jurisdiction	1st Decile	2nd	3rd	4th	5th	6th	7th	8th	9th	10th Decile
Highlands	2,027			455						
North Saanich	3,519	2,668	1,628	1,778	1,990	652				
Metchosin	998	592	2,103	1,374						
Sooke	4,665	2,950	3,149		1,757	1,888		677		
Colwood	5,605	4,228	2,954	1,709	1,674	502	695	1,594		
Central Saanich	5,327	2,679	4,593		1,592	1,338	956		900	
Juan de Fuca (Part 1)		2,037		653	796	711				
Langford		17,239	1,388	3,738	2,127	5,737		6,575		
View Royal	2,971	1,441		1,093	871	1,297	2,709	1,193		
Saanich	10,581	13,472	17,316	21,570	13,282	11,995	9,016	10,891	8,265	1,347
Juan de Fuca (Part 2)					399					
Saltspring Island			718		6,748	2,615			536	1,018
Oak Bay	962	2,392	2,325	1,428	2,132	877	2,006	659	3,144	2,065
Southern Gulf Islands							4,026	2,075		
Esquimalt		477		368	2,537	1,975	4,838	3,621	1,398	2,319
Sidney		477	666	1,199	633	1,636	821	1,735	2,618	2,533
Victoria			1,229	1,707	5,374	6,999	10,342	13,872	21,917	30,427
CRD Total	**47,370**	**50,652**	**38,069**	**37,072**	**41,912**	**38,222**	**35,409**	**42,892**	**38,778**	**39,709**

Table 3.3. Relationship between population in high risk DAs and proportion of capital region population per the demographic sub-index.

Jurisdiction	Proportion of Population in Top Two Deciles	Proportion of capital region's Population	Ratio of High Risk Proportion to Proportion of capital region Population
Highlands	0.0%	0.6%	0.0
North Saanich	0.0%	3.0%	0.0
Metchosin	0.0%	1.2%	0.0
Sooke	0.0%	3.7%	0.0
Colwood	0.0%	4.6%	0.0
Central Saanich	1.1%	4.2%	0.3
Juan de Fuca (Part 1)	0.0%	1.0%	0.0
Langford	0.0%	9.0%	0.0
View Royal	0.0%	2.8%	0.0
Saanich	12.2%	28.7%	0.4
Juan de Fuca (Part 2)	0.0%	0.1%	0.0
Saltspring Island	2.0%	2.8%	0.7
Oak Bay	6.6%	4.4%	1.5
Southern Gulf Islands	0.0%	1.5%	0.0
Esquimalt	4.7%	4.3%	1.1
Sidney	6.6%	3.0%	2.2
Victoria	66.7%	22.4%	3.0

3.1.3. Concentrations of overall socio-demographic vulnerability

When analysed by community, we note a synthesis of patterns as detailed in the subindexes above. Of significance, we observe high index values for Sidney, Esquimalt, the Southern Gulf Island and Victoria. Notably, Victoria's health-related vulnerability is markedly lower compared to demographic factors. Conversely, Sidney is the true hot spot in the region with both high demographic and health sub-index values. (Figures 3.8 and 3.9). Given this prominence, we suggest outreach and proactive engagement in the community as a next step in regional risk reduction.

On a proportional basis, large concentrations of socio-demographic risk are present in both Victoria and Saanich (56% of the share of high risk areas). Notable is the comparatively lower risk profile of Saanich (0.6 ratio of high risk population to share of the capital regions population) in comparison to Victoria (1.7 ratio) (tables 3.4 and 3.5 below).

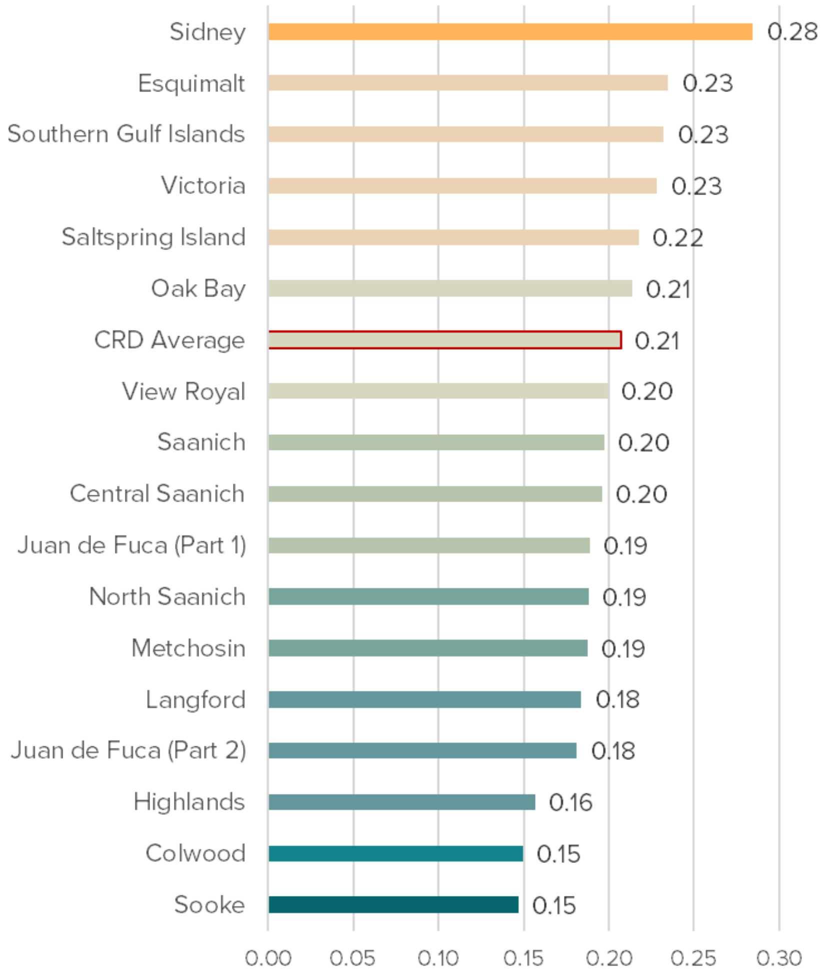

Figure 3.8. Average Socio-demographic vulnerability by jurisdiction in the capital region. Averages are weighted by population

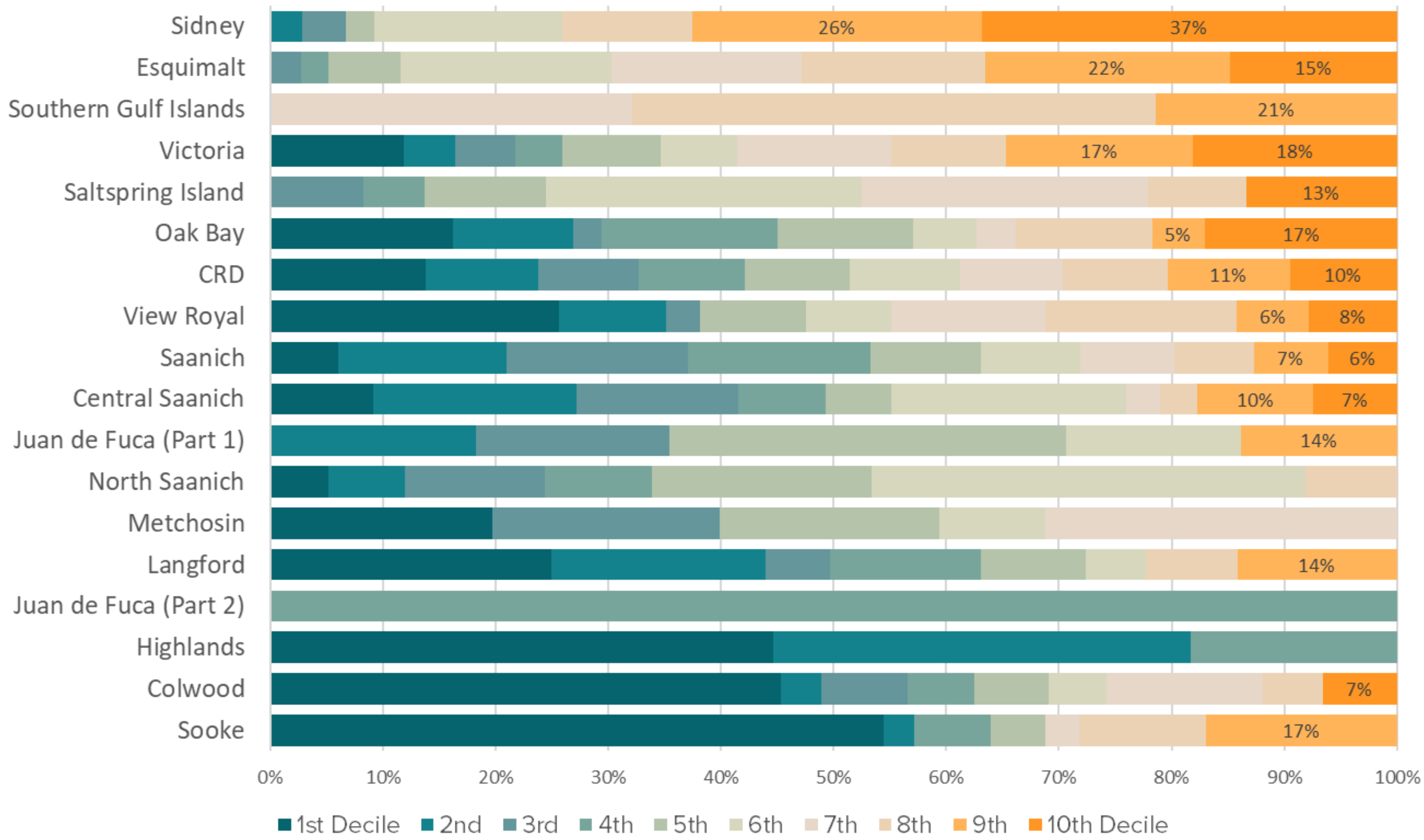

Figure 3.9. Socio-demographic vulnerability by jurisdiction in the capital region. Socio-demographic vulnerability is displayed by decile. Sidney BC, has the largest proportion of its population falling within the most vulnerable decile, while Juan de fuca (part 2) and Highlands BC, have 0% of their populations within the most vulnerable decile.

Table 3.4. Population by combined Socio-demographic Heat Vulnerability Index per jurisdiction in the capital region.

Jurisdiction	1st Decile	2nd	3rd	4th	5th	6th	7th	8th	9th	10th Decile
Sooke		411		1,025	739		449	1,688	2,565	
Colwood		689	1,448	1,112	1,254	985	2,630	1,008		1,245
Highlands	1,109	918		455						
Juan de Fuca (Part 2)				399						
Langford		8,855	2,655	6,270	4,335	2,480		3,802	6,575	
Metchosin	998		1,025		986	476	1,582			
North Saanich	627	834	1,517	1,168	2,383	4,714		992		
Juan de Fuca (Part 1)		935	882		1,808	796			711	
Central Saanich	1,586	3,135	2,506	1,335	1,018	3,629	516	584	1,778	1,298
Saanich	7,112	17,556	19,005	19,023	11,605	10,315	9,877	8,251	7,778	7,213
View Royal	2,971	1,097	344		1,093	871	1,586	1,964	745	904
Oak Bay	2,925	1,907	461	2,807	2,158	1,024	614	2,182	853	3,059
Saltspring Island			959	638	1,254	3,255	2,957	1,018		1,554
Victoria	10,863	4,192	4,942	3,807	7,989	6,312	12,560	9,334	15,204	16,664
Southern Gulf Islands							1,963	2,834	1,304	
Esquimalt			477	426	1,121	3,279	2,964	2,857	3,814	2,595
Sidney		352	477		314	2,052		1,416	3,168	4,539
CRD Total	**56,602**	**40,881**	**36,698**	**38,465**	**38,057**	**40,188**	**37,698**	**37,930**	**44,495**	**39,071**

Table 3.5. Relationship between population in high risk DAs and proportion of capital region population per the combined socio-demographic index.

Jurisdiction	Proportion of capital region Population in Top Two Deciles	Proportion of capital region's Population	Ratio of High Risk Proportion to Proportion of capital region Population
Sooke	3.1%	1.7%	1.8
Colwood	1.5%	2.5%	0.6
Highlands	0.0%	0.6%	0.0
Juan de Fuca (Part 2)	0.0%	0.1%	0.0
Langford	7.9%	8.5%	0.9
Metchosin	0.0%	1.2%	0.0
North Saanich	0.0%	3.0%	0.0
Juan de Fuca (Part 1)	0.9%	1.3%	0.7
Central Saanich	3.7%	4.2%	0.9
Saanich	17.9%	28.7%	0.6
View Royal	2.0%	2.8%	0.7
Oak Bay	4.7%	4.4%	1.1
Saltspring Island	1.9%	2.8%	0.7
Victoria	38.1%	22.4%	1.7
Southern Gulf Islands	1.6%	1.5%	1.0
Esquimalt	7.7%	4.3%	1.8
Sidney	9.2%	3.0%	3.1

3.1.4. *Validation of the socio-demographic vulnerability index*

Validation is a critical step in the process of the index creation and occurred in the development of this index in multiple forms:

- Validation with AHP workshop participants.
  The initial validation process of the socio-demographic vulnerability index was conducted in a workshop setting with participants of the aforementioned AHP workshop. This workshop served as a platform for AHP participants to provide feedback on their assessment of the index performance as based on their expertise.
- Correlation analysis with extreme heat related mortality and hospitalisation observations.
  The index was shared with Island Health Authority, who conducted a correlation assessment with confidential extreme heat related mortality and hospitalisation data that was observed from 2018 to 2023. This rigorous validation exercise allows the validation of the socio-demographic vulnerability index to be supported by statistical assessments of its effectiveness in predicting vulnerable populations across the Capital Region.
- To increase the sample size of mortality and morbidity data to validate against, we created a Vancouver Island-wide socio-demographic index for Island Health to analyse.

During the validation exercise, the socio-demographic index was disaggregated into two sub-indices: demographic sub-index (i.e. health data absent), and health-only sub-index. The validation results revealed different levels of correlations between the mortality and hospitalisation data and the socio-demographic index and sub-indices.

- The health-only demographic vulnerability sub-index showed a correlation coefficient (R^2) of 0.808 with Island Health data, indicating a strong relationship (Figure 2.1).
- The demographic-only vulnerability sub-index had a lower, but still significant, correlation coefficient of 0.66 (Figure 2.2).
- When considering the full Socio-demographic Vulnerability Index, which combines both health and demographic data, the correlation was very strong, with an R^2 value of 0.955 (Figure 2.3).

These findings suggest that the areas with fewer heat-related deaths in the Capital Regional align with lower vulnerability scores on the index, whereas areas with higher heat-related death incidences show higher vulnerability. This strong correlation confirms the performance of the AHP-derived socio-demographic vulnerability index. An important observation from this validation process is that the combined use of both health and demographic sub-indices leads to a very effective assessment tool. This approach is somewhat unique, as it considers both health determinants (demographics) and population-level health data in developing risk profiles for climate-related risks. This comprehensive approach reflects a more holistic understanding of the factors contributing to vulnerability in the context of climate change and extreme heat events.

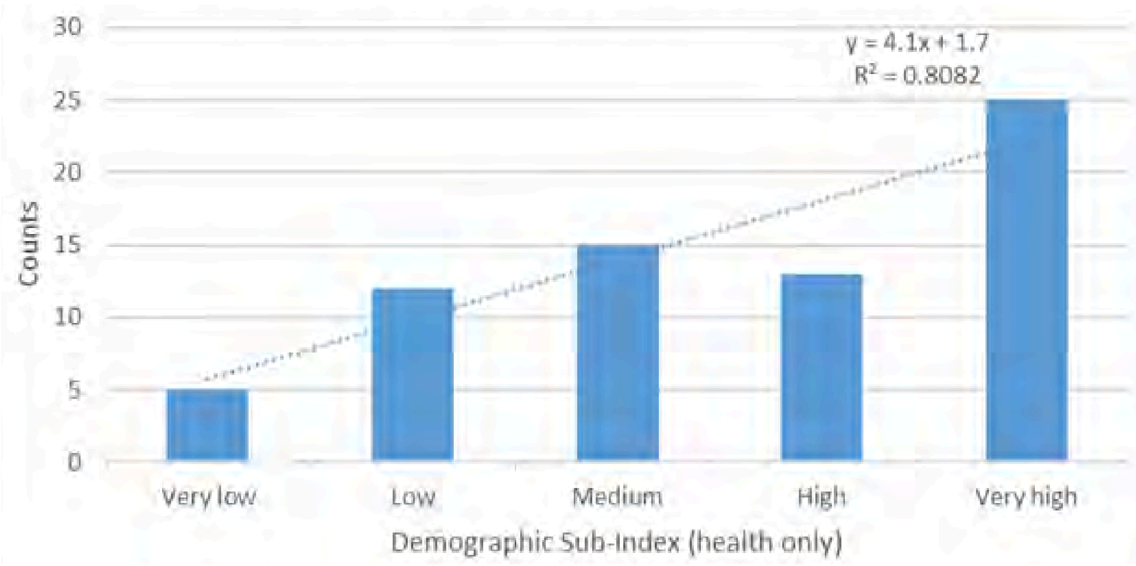

Figure 3.10. The demographic vulnerability sub-index (health data only) plotted on the x-axis against the counts of heat-related mortality and morbidity outcomes (2018 - 2023) on the y-axis. A strong correlation (R^2 value of 0.8) exists between heat related mortality and morbidity and where the demographic index predicts vulnerability.[63]

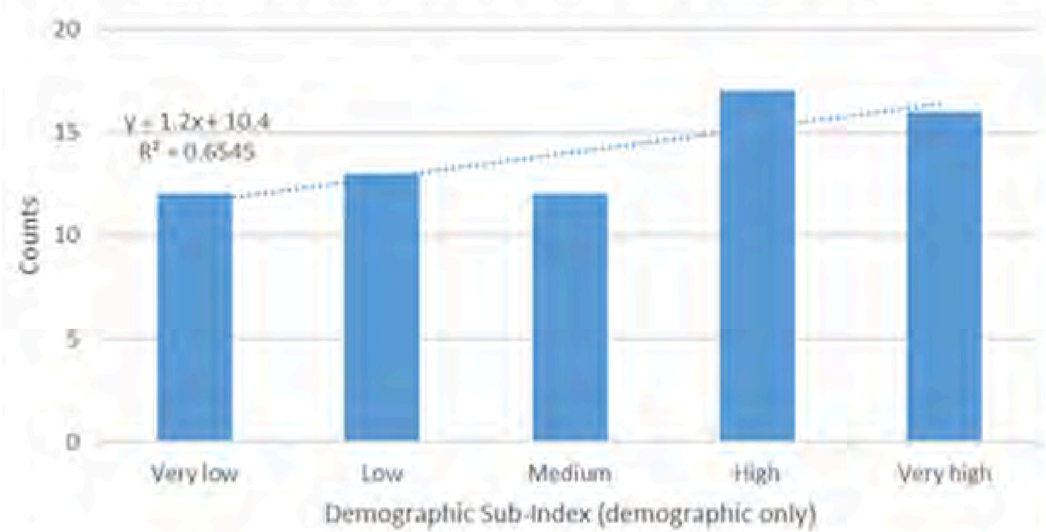

Figure 3.11. The demographic vulnerability sub-index (demographic data only) plotted on the x-axis against the counts of heat-related mortality and morbidity outcomes (2018 - 2023) on the y-axis. A positive linear relationship, evidenced by an R^2 value of 0.65, is observed between the demographic-only vulnerability sub-index and the counts of heat-related mortality and morbidity outcomes

[63]Note that the demographic-related graphs (figure 2.1 -2.4) are generated by Island Health which is why there is a discrepancy on titles and this will be changed for the final draft.

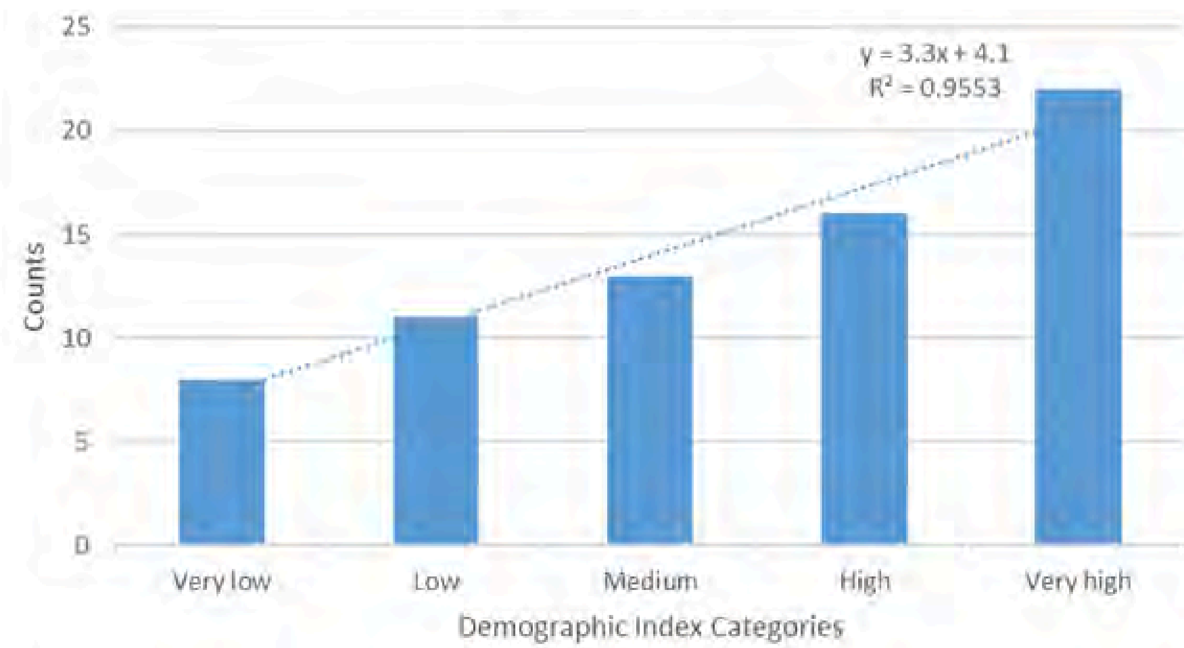

Figure 3.12. Socio-demographic vulnerability plotted on the x-axis against the counts of heat-related mortality and morbidity outcomes (2018 - 2023) on the y-axis. A strong correlation is present between where heat related health outcomes occurred and where the Socio-demographic Index predicts higher vulnerability.

To increase the sample size of heat related mortality and morbidity validation data points, we created the same Socio-demographic Index for all of Vancouver Island. Island Health validated this larger pool of data and found a 0.87 r2 value, which further confirms the Socio-demographic Vulnerability Index's validity within the CRD and for Vancouver Island as a whole (Figure 2.4). For further visualisation of this index, see the map figure B5 in appendix B.

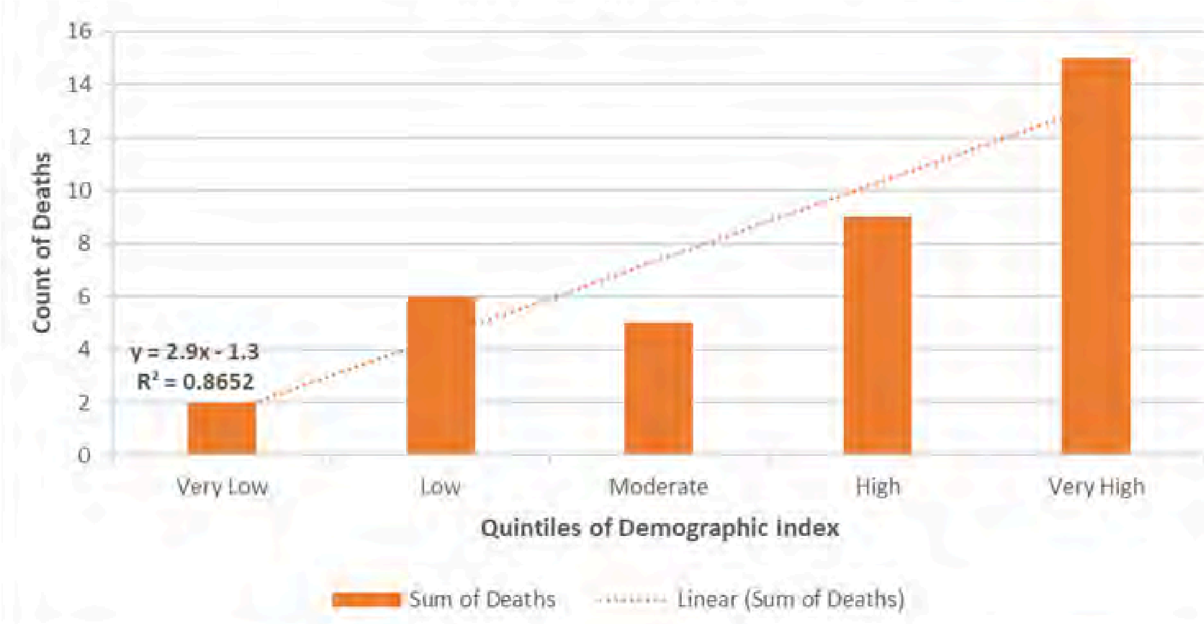

Figure 3.13. Vancouver Island Socio-demographic vulnerability plotted on the x-axis against the counts of heat-related mortality and morbidity outcomes (2021) on the y-axis.

3.2. *Heat Exposure Layer*

The distribution of predicted air temperature during the 2021 heat event is shown in Figure 3.0. The range in air temperatures that are observed in this model output are 23.8 to 39.8 °C. In this figure, the distribution of air temperature during the extreme heat event is evident. Warmer temperatures are mostly concentrated away from the coastline, which suggests that maritime cooling is a significant contributor to mitigating extreme levels of air temperature. Localised climatic variations of air temperature are also evident in urbanised areas (as shown in Figure 3.0 inset maps). Urban structures and surfaces in Victoria, Saanich, and Langford contribute to warmer temperatures. Coastal urban areas such as North Saanich and Sidney benefit from a high density of coastline that helps reduce temperature. Elevation and solar insolation are strong predictors of air temperature in this model, and as such higher, south facing areas appear as relatively warmer than lower elevation, north facing areas. Langford is identified as a higher risk area given its characteristics of being south facing, higher elevation, relative further from the coast, and having land cover characteristics that contribute significantly to higher land surface temperatures.

Note that the decision to represent heat exposure in Celsius rather than using an index distribution, as established in the two other mapping elements, serves to provide a more direct and tangible depiction of how temperatures are experienced during an extreme heat event. Unlike the socio-demographic and building indices that define the maximum value as "high vulnerability," using Celsius avoids imposing an artificial scale. Extreme heat vulnerability does not have a single universal or even Provincial threshold, as it can vary based on local climatic conditions and societal factors. Therefore, presenting the data in Celsius allows for a more flexible and context-specific assessment. Expressing heat exposure in Celsius also allows stakeholders and the general public to easily understand the magnitude of temperatures.

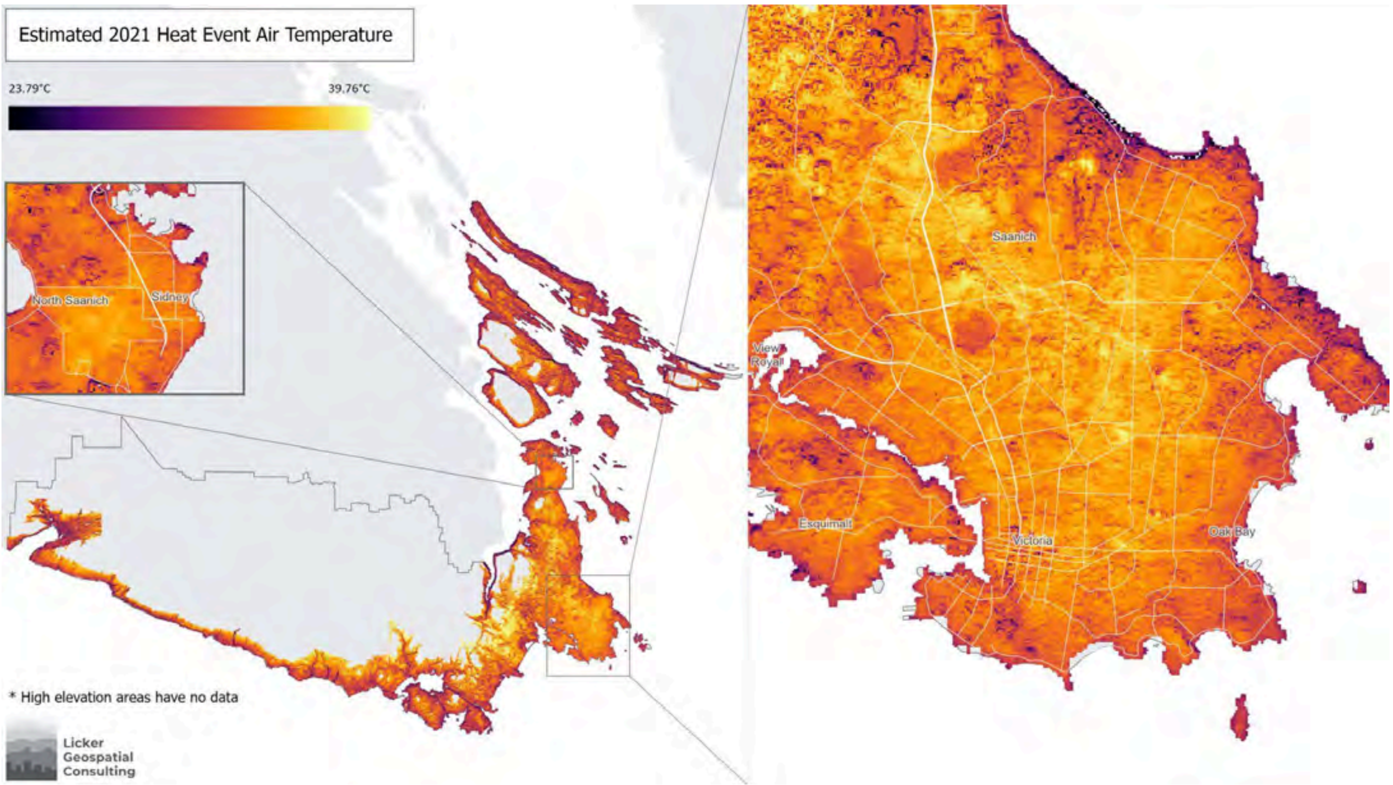

Figure 3.14. Predicted air temperature using a linear regression analysis of elevation, distance to coast, solar radiation, and land surface temperature.

3.2.1. *Land Surface Temperature and Comparative Analysis*

The distribution of land surface temperature (LST) during the 2021 heat event is shown in layer throughout the regional district. The LST layer considers environmental factors such as natural vegetation that support localised dissipation of heat and impervious material (such as concrete and asphalt) that support greater heat absorption and retention and has range of 18.7 to 36 °C (Figure 3.15).

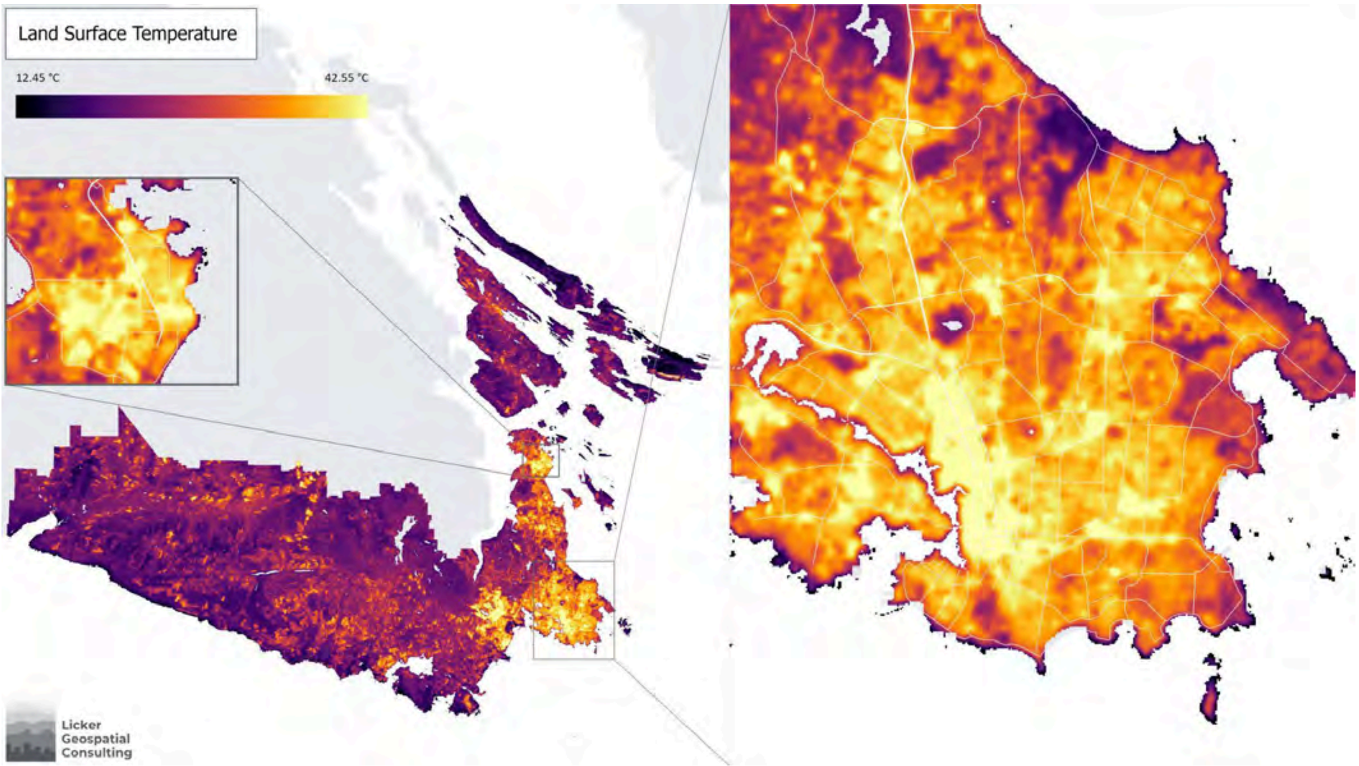

Figure 3.15. Land surface temperature (LST) in °C during the 2021 heat event, as calculated from the Landsat-8 satellite constellation and visualised at a 30 m^2 resolution.

While LST does show general distribution of heat throughout the region, it is not representative of the human experience and discomfort to extreme heat. Indeed, LST is closely associated with land cover, such as urban areas ("urban heat islands"), forestry cut-blocks, and vegetation. Air temperature and LST display different relationships of heat distribution across the capital regional district. While both are within a similar magnitude of temperature, the distribution of differences between these two layers provide a nuanced understanding of the region's effects on how temperature is absorbed, stored, and dissipated across the region (Figure 3.15).

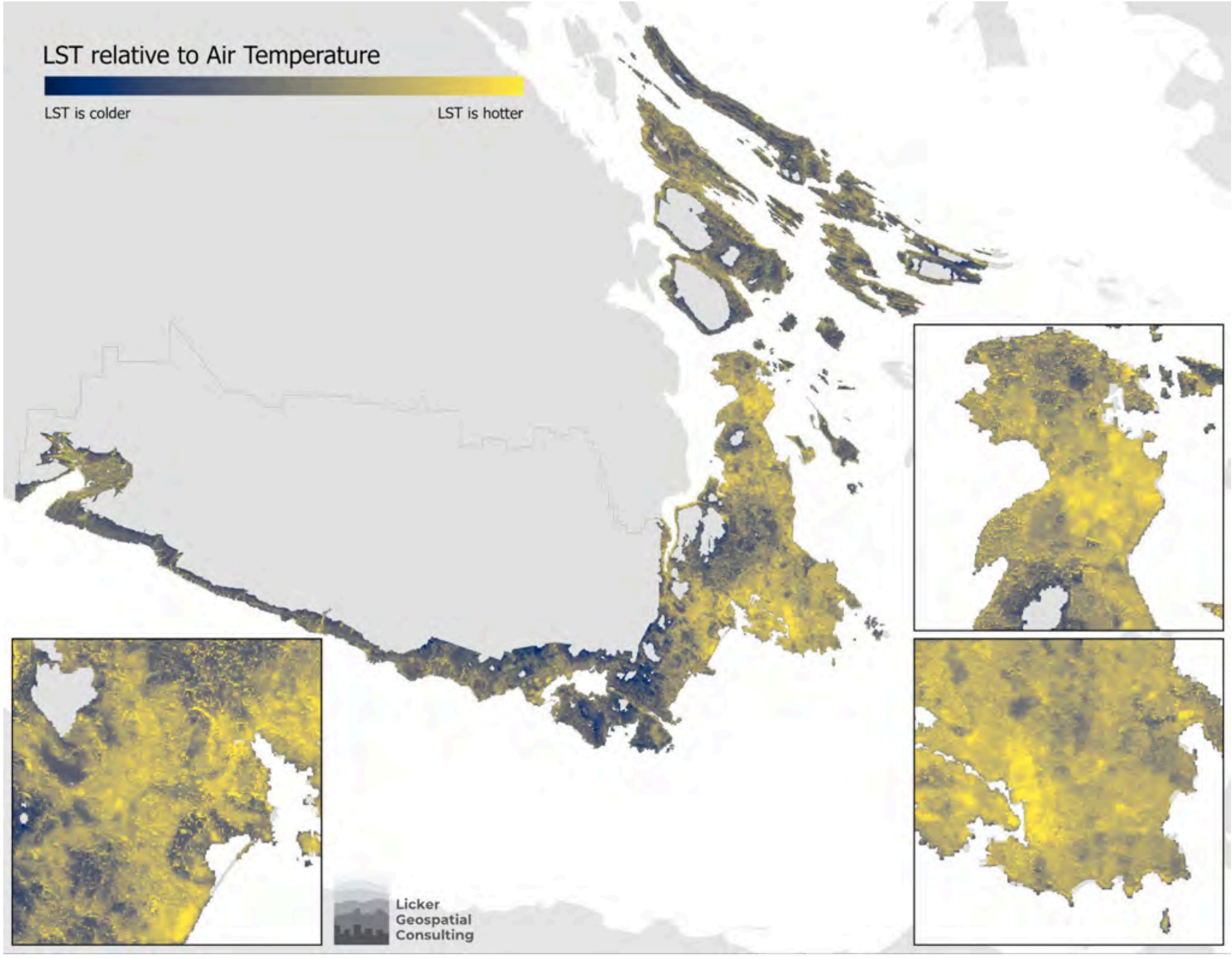

Figure 3.16. Relative difference between LST and air temperature. Blue areas indicate where air temperature is warmer than LST, yellow areas indicate where LST is warmer than air temperature. The range of temperature difference between these two models is -20.1 to 14.6 °C.

Figure 3.16 shows the temperature differences of LST relative to air temperature. Blue areas indicate where air temperature is warmer than LST, yellow areas indicate where LST is warmer than air temperature. The range of temperature difference of LST relative to air temperature is -20.1 to 14.6 °C. Areas in muted grey tones show where LST and air temperature are relatively similar. Not included in this assessment are areas beyond the lidar extent (namely most of the Electoral Area), and high elevations, given that predicted air temperature values are absent in these areas.

Evident in Figure 3.16 is the effect of coastal impacts on air temperature, wherein we see lower predicted air temperatures than observed land surface temperatures. Urban heat islands are also seen to be more clearly delineated in the LST layer. These urban heat islands appear so distinctly in the LST given the absorbing characteristics of roads and rooftops. While the air temperature also considers land cover and evapotranspiration, which correlate with urban heat islands, they are less impactful in the output prediction and thereby mute the effect of urban heat islands temperatures as measured on the surface.

3.3. Building Vulnerability Index findings

Using similar analytical lenses to those discussed in the socio-demographic section above, we can decompose risk factors by community or jurisdiction to understand overall heat risk in residential buildings (Figures 3.19, 3.20 and Tables 3.6, 3.7). Of note are the high concentrations of building risk in Victoria, Esquimalt and Oak Bay which consists of high volumes of older, taller buildings with some degree of prominence. As with the demographic sub-index above, West shore communities exhibit considerably lower risk than capital region core communities due to new construction, greater canopy retention and generally lower densities than the regional average. With the buildings index consisting of various vulnerability metrics, we can also see how the breakdown of each component contributes to the overall vulnerability of buildings at the jurisdictional level (refer to Figures 3.15 - 3.18). As noted in the validation section above, additional care should be taken when reviewing building index results as aggregate building information may misrepresent individual structural risk in some communities.

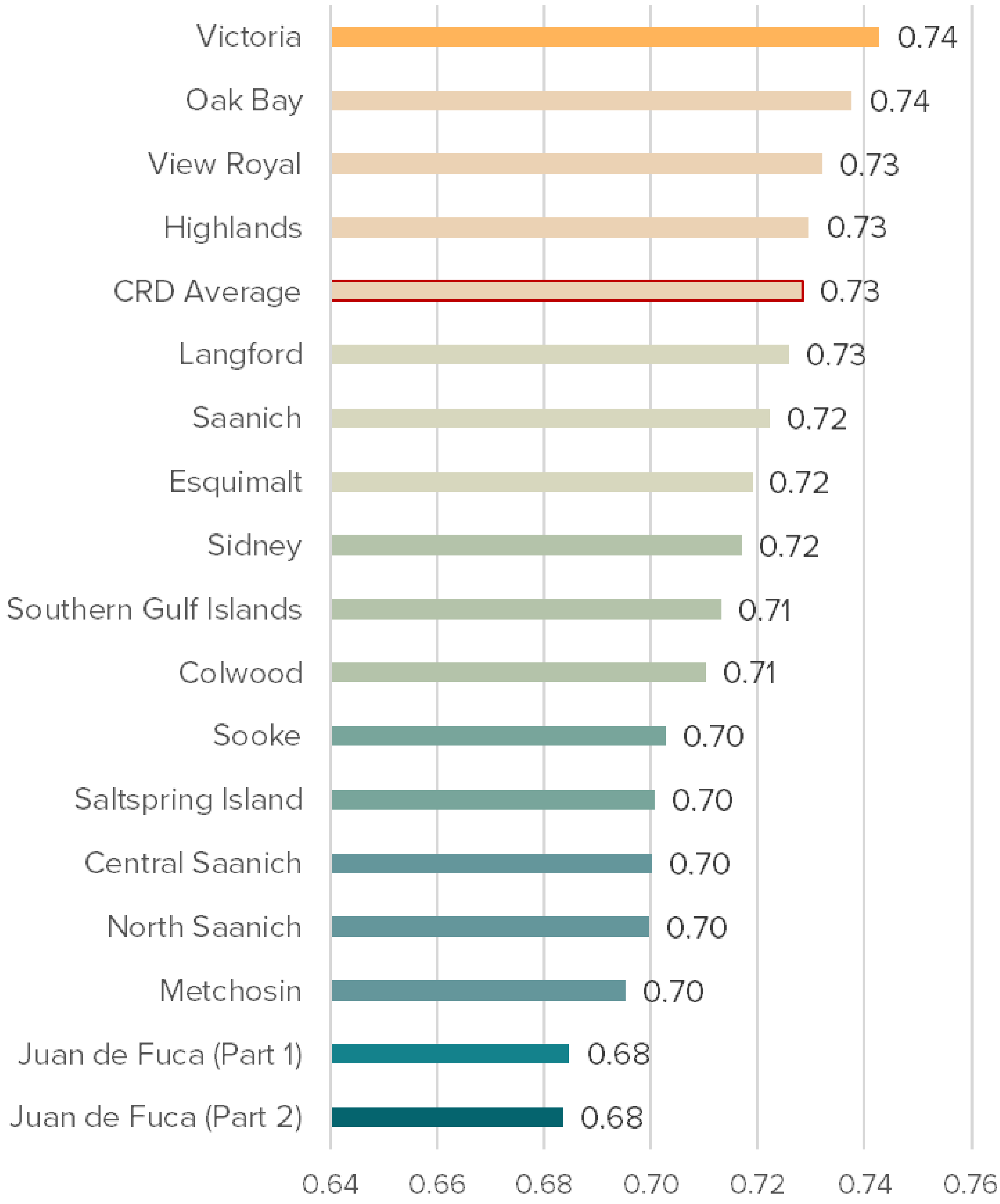

Figure 3.15. Average building albedo by jurisdiction in the capital region, for all buildings. Averages are weighted by the assumed interior floor area of buildings per DA.

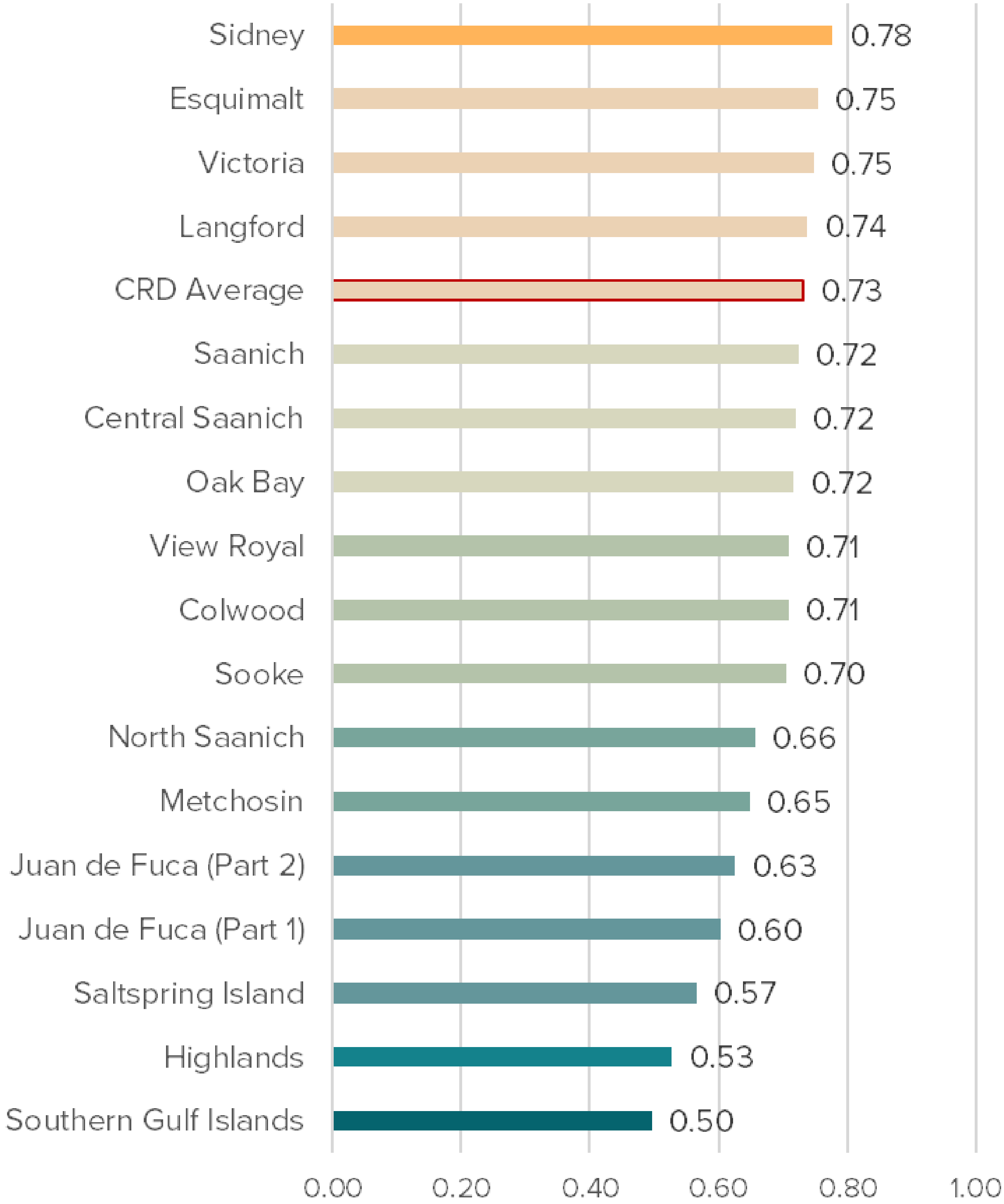

Figure 3.16. Average solar insolation index by jurisdiction in the capital region, for all buildings. Averages are weighted by the assumed interior floor area of buildings per DA.

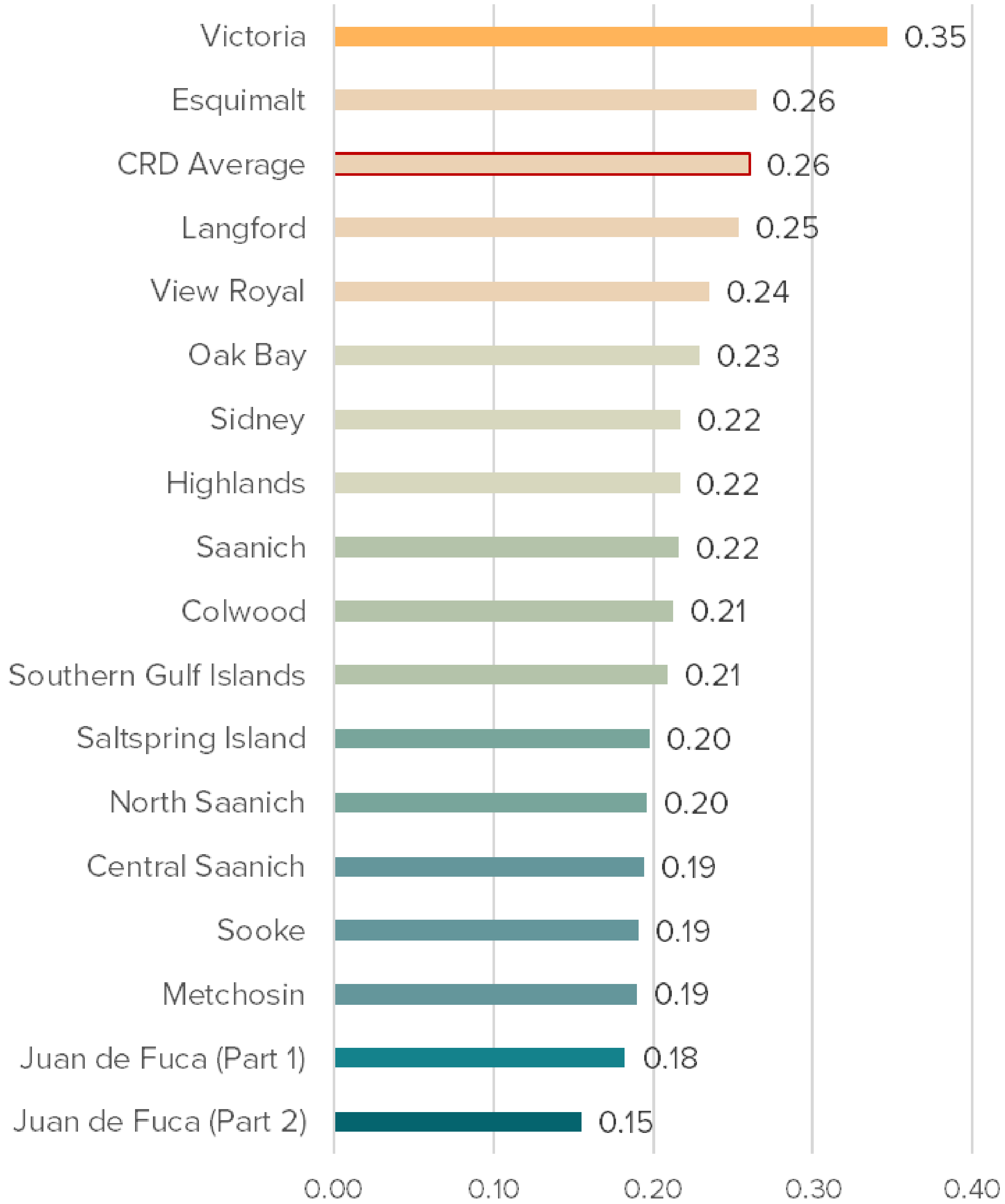

Figure 3.17. Average building height index by jurisdiction in the capital region, for all buildings. Averages are weighted by the assumed interior floor area of buildings per DA.

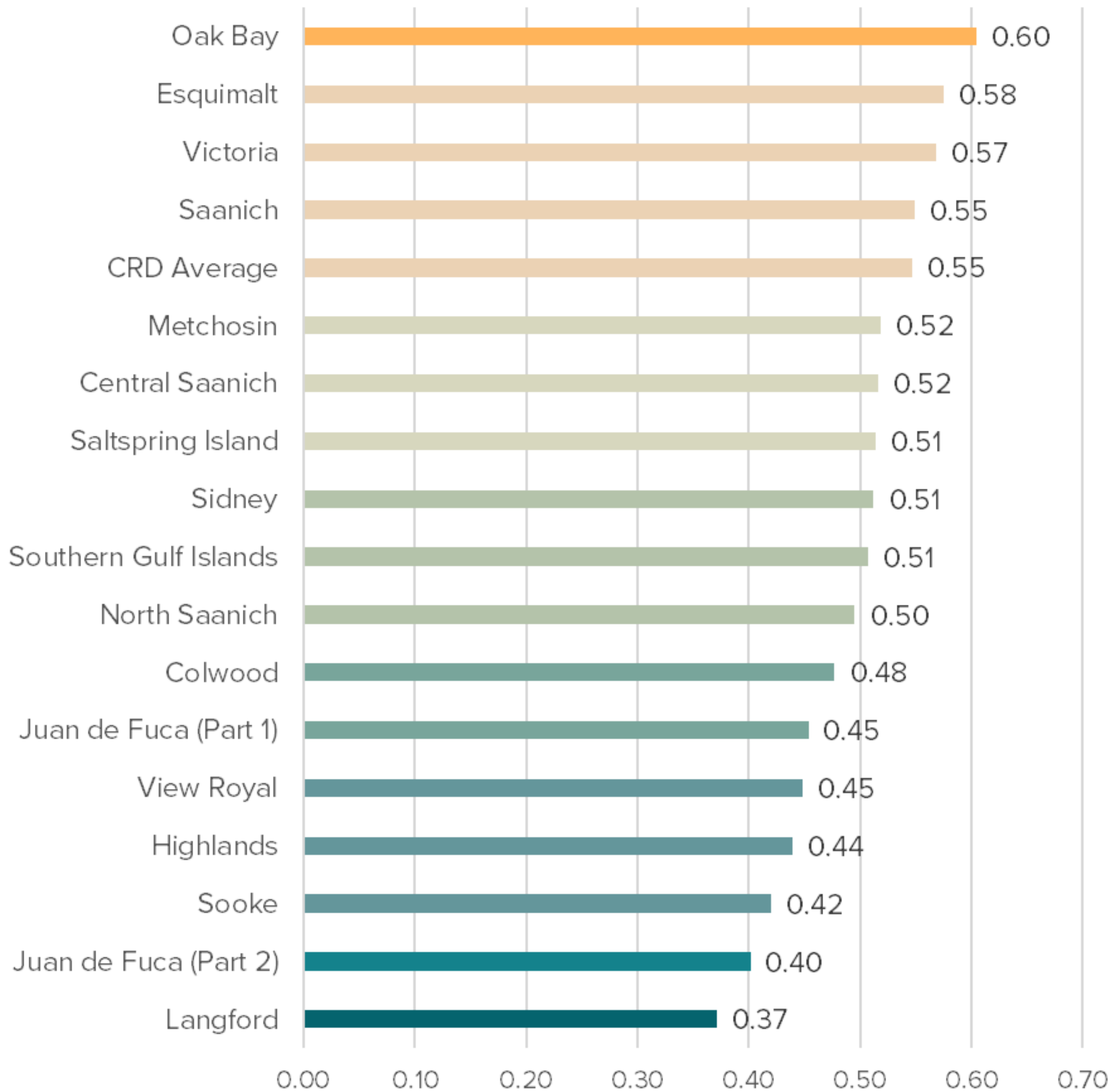

Figure 3.18. Average building age index by jurisdiction in the capital region, for all buildings. Averages are weighted by the assumed interior floor area of buildings per DA.

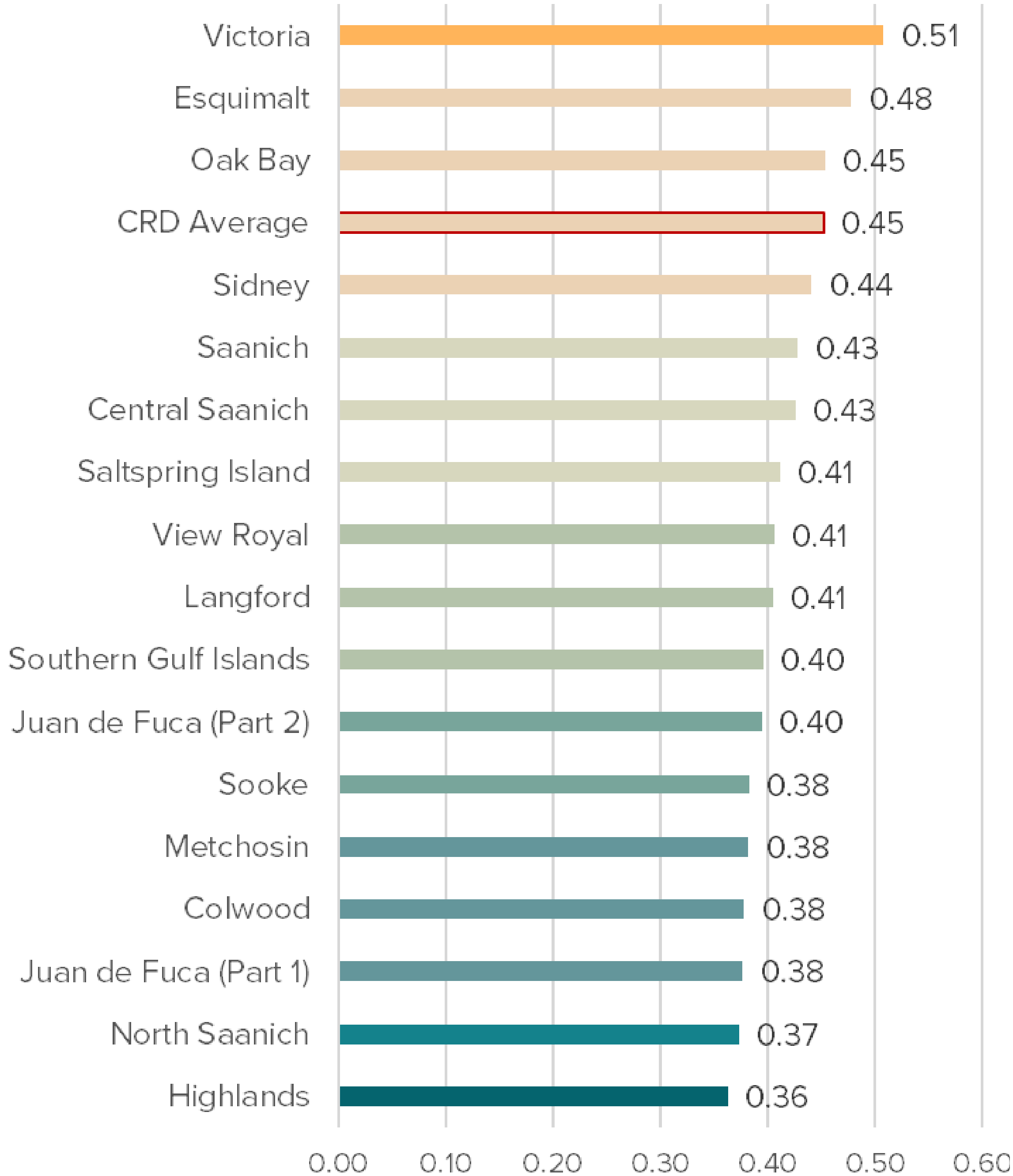

Figure 3.19. Average Building Vulnerability Index by jurisdiction in the capital region, for residential buildings only. Averages are weighted by the assumed interior floor area of buildings per DA.

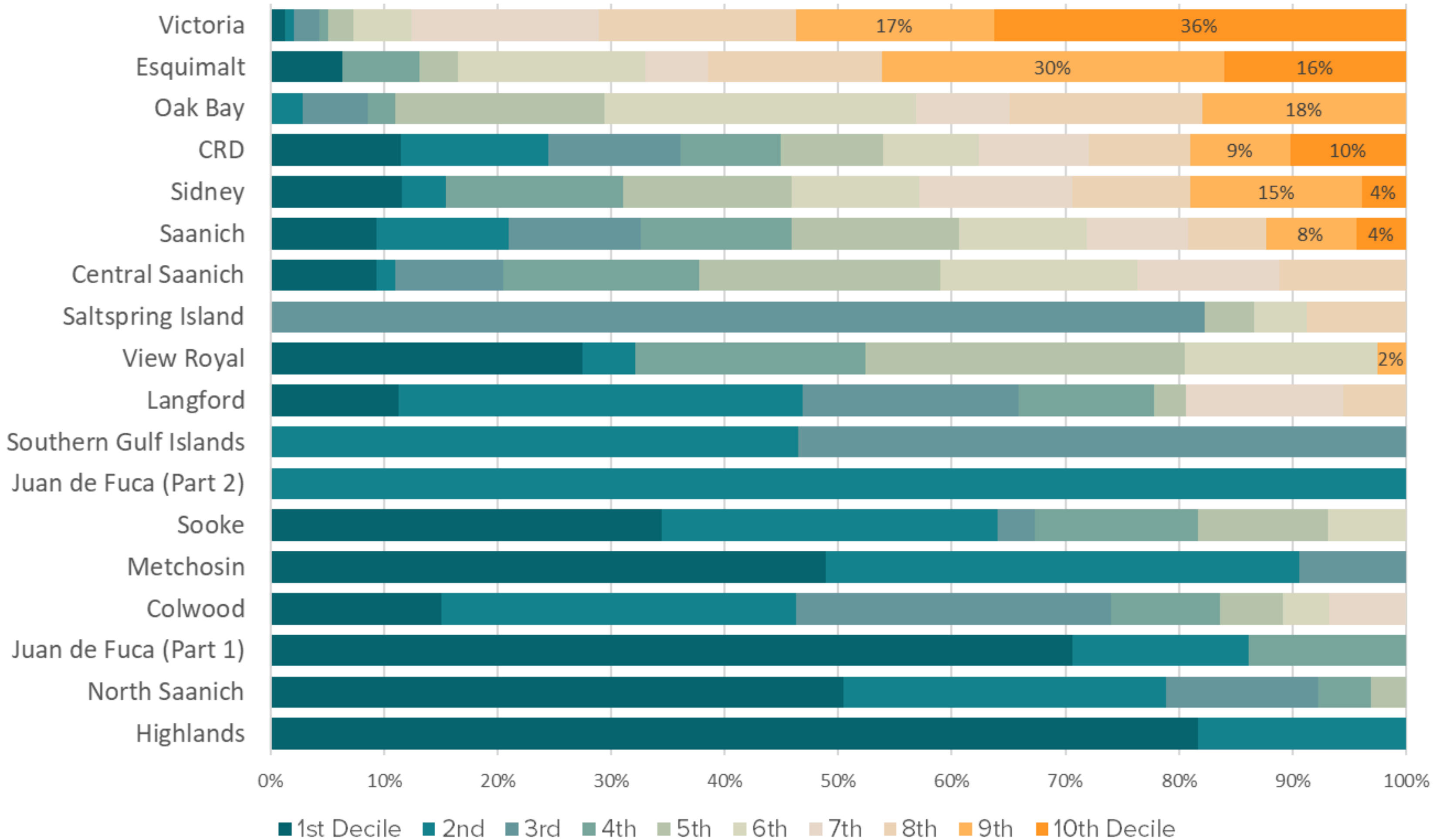

Figure 3.20. Residential building vulnerability by jurisdiction in the capital region, displayed by decile. Victoria, BC, has the largest proportion of its population falling within the most vulnerable decile, while North Saanich and Highlands BC, have 0% of their populations within the most vulnerable decile.

Table 3.6. Population by Residential Buildings Heat Vulnerability Index per jurisdiction in the capital region.

Jurisdiction	1st Decile	2nd	3rd	4th	5th	6th	7th	8th	9th	10th Decile
Highlands	2,027	455								
North Saanich	6,171	3,484	1,627	576	377					
Juan de Fuca (Part 1)	3,625	796		711						
Colwood	2,749	5,711	5,056	1,766	1,008	731	1,245			
Metchosin	2,476	2,115	476							
Sooke	5,203	4,457	502	2,155	1,738	1,031				
Juan de Fuca (Part 2)		399								
Southern Gulf Islands		2,834	3,267							
Langford	5,255	16,568	8,876	5,542	1,322		6,460	2,561		
View Royal	3,181	535		2,345	3,261	1,964			289	
Saltspring Island			9,570		511	536		1,018		
Central Saanich	1,623	293	1,652	2,987	3,708	3,005	2,179	1,938		
Saanich	11,033	13,662	13,723	15,646	17,294	13,282	10,487	8,116	9,344	5,148
Sidney	1,428	471		1,927	1,832	1,376	1,664	1,284	1,861	475
Oak Bay		508	1,030	432	3,324	4,933	1,480	3,053	3,230	
Esquimalt	1,114			1,190	592	2,890	976	2,678	5,297	2,796
Victoria	1,207	671	2,087	656	2,060	4,727	15,131	15,979	16,022	33,327
CRD Total	**47,092**	**52,959**	**47,866**	**35,933**	**37,027**	**34,475**	**39,622**	**36,627**	**36,043**	**41,746**

Table 3.7. Relationship between population in high risk DAs and proportion of capital region population per the residential buildings index

Jurisdiction	Proportion of capital region Population in Top Two Deciles	Proportion of capital region's Population	Ratio of High Risk Proportion to Proportion of capital region Population
Highlands	0.0%	0.6%	0.0
North Saanich	0.0%	3.0%	0.0
Juan de Fuca (Part 1)	0.0%	1.3%	0.0
Colwood	0.0%	4.5%	0.0
Metchosin	0.0%	1.2%	0.0
Sooke	0.0%	3.7%	0.0
Juan de Fuca (Part 2)	0.0%	0.1%	0.0
Southern Gulf Islands	0.0%	1.5%	0.0
Langford	0.0%	11.4%	0.0
View Royal	0.4%	2.8%	0.1
Saltspring Island	0.0%	2.8%	0.0
Central Saanich	0.0%	4.2%	0.0
Saanich	18.6%	28.8%	0.6
Sidney	3.0%	3.0%	1.0
Oak Bay	4.2%	4.4%	0.9
Esquimalt	10.4%	4.3%	2.4
Victoria	63.4%	22.4%	2.8

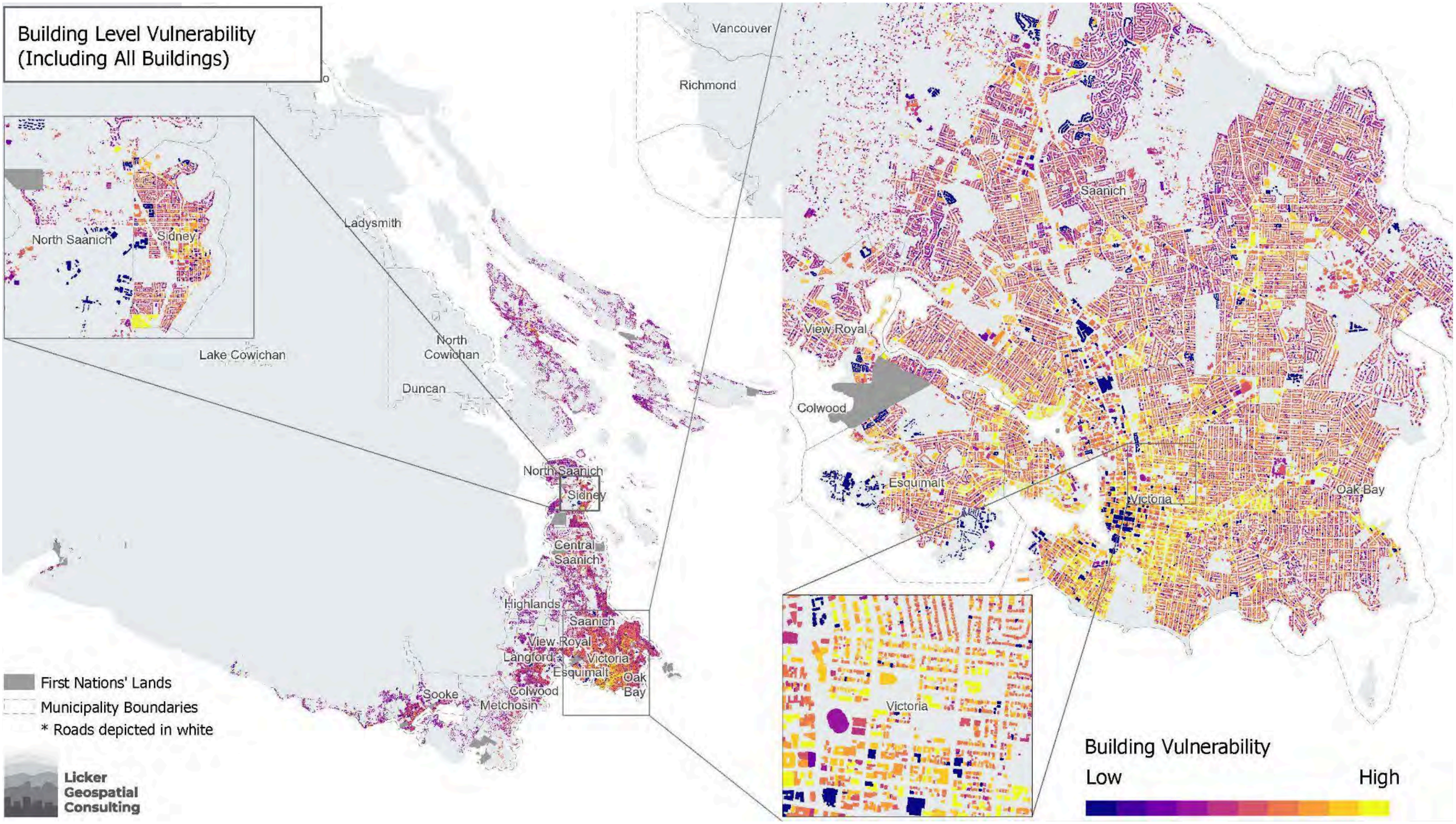

Figure 3.21. Extreme Heat - Building Vulnerability Index with all buildings included by building footprint.

3.3.1. *Validation of the building vulnerability index*

Much like the socio-demographic index validation, the buildings index went through a validation process to ensure empirical accuracy in estimating the risk associated with extreme heat for different buildings throughout the Capital Region. The buildings index validation process involved conducting a statistical analysis to inform the correlation between the index and historical health outcomes related to extreme heat. This analysis utilises morbidity and mortality data from 2018 to 2023[64], thereby providing a quantitative measurement of the index's predictive potential. The buildings index was disaggregated into two sub-indices that measure building vulnerability for residential and non-residential buildings.

- For non-residential buildings the index showed a moderate correlation, with an R^2 of 0.56, indicating some level of predictability (Figure 2.10).
- For residential buildings the index showed a stronger correlation, with an R^2 of 0.58 that suggests a higher degree of predictive accuracy (Figure 2.11).
- For all buildings (i.e. the complete Building Vulnerability Index), there is a weaker correlation with an R^2 value of 0.12 (Figure 2.12), suggesting a more complex relationship of factors that influence risk in broader buildings context.

The outcomes of this validation exercise support the index's application in regional planning and health strategy formulation. They reflect the nuanced application of the index, which exhibits varying levels of predictability across different building types. These findings underscore the necessity for a nuanced application of the index in planning and risk reduction strategies.

[64] Island Health used heat related morbidity and mortality data from 2018 - 2021 to ensure a large enough sample size in data points given that there were 9 deaths within the capital region during the 2021 heat-event.

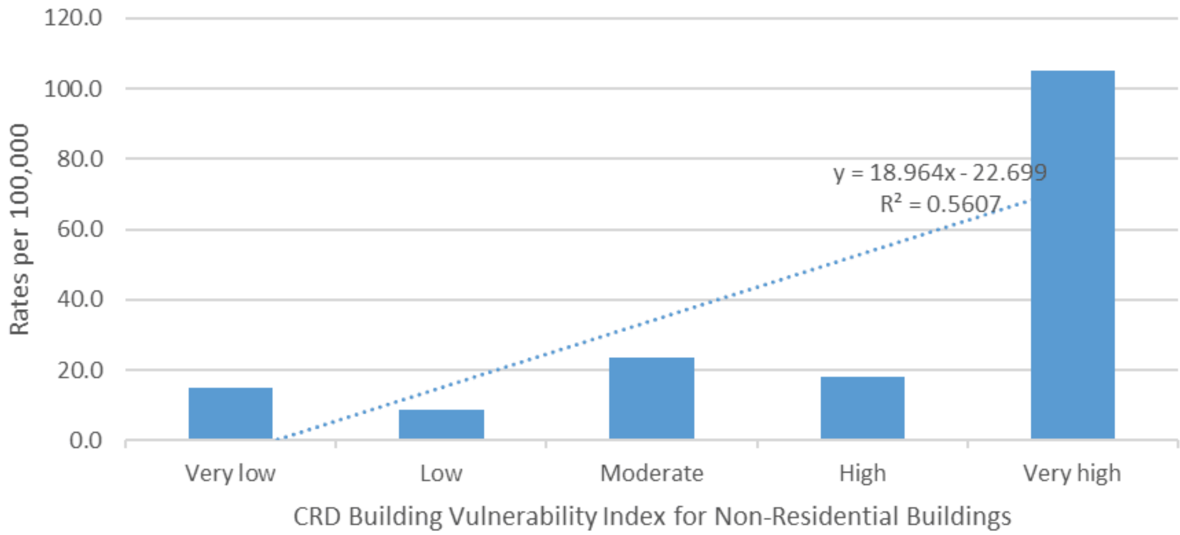

Figure 3.22. Correlation between capital region Building Vulnerability Index for Non-Residential Buildings and Heat-Related Health Outcomes (2018-2023). The bar chart depicts an ascending trend in health outcome rates per 100,000 as the vulnerability index increases from 'Very low' to 'Very high', with a trend line indicating a moderate correlation (R^2 = 0.5607).

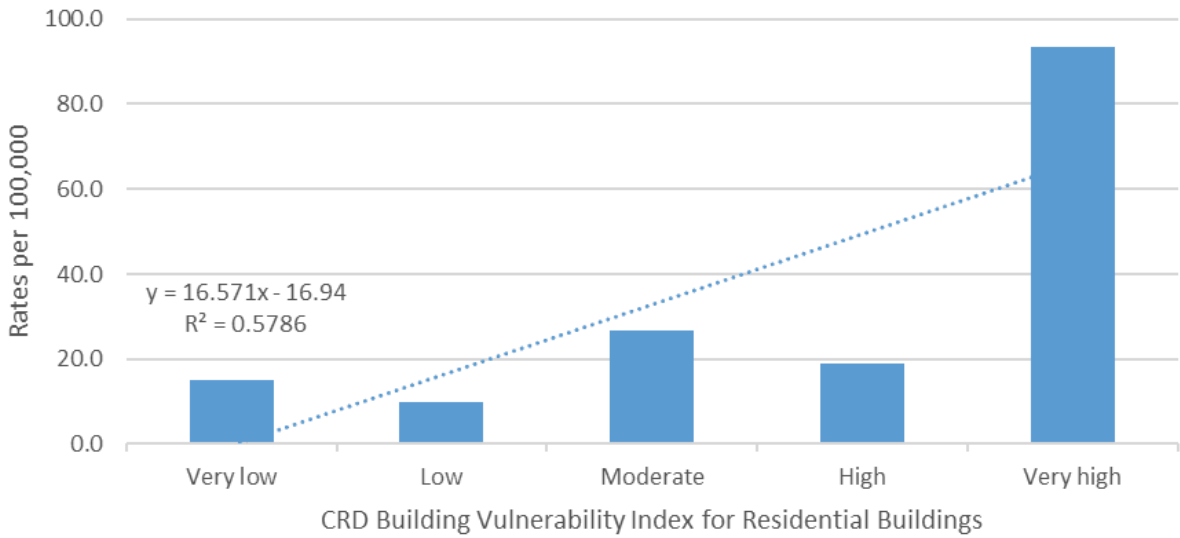

Figure 3.23. Relationship between capital region Building Vulnerability Index for Residential Buildings and Heat-Related Health Outcomes (2018-2023). This bar chart illustrates a clear upward trend in health outcome rates per 100,000 with increasing vulnerability index levels, with a stronger correlation evident for the 'Very high' vulnerability category (R^2 = 0.5786).

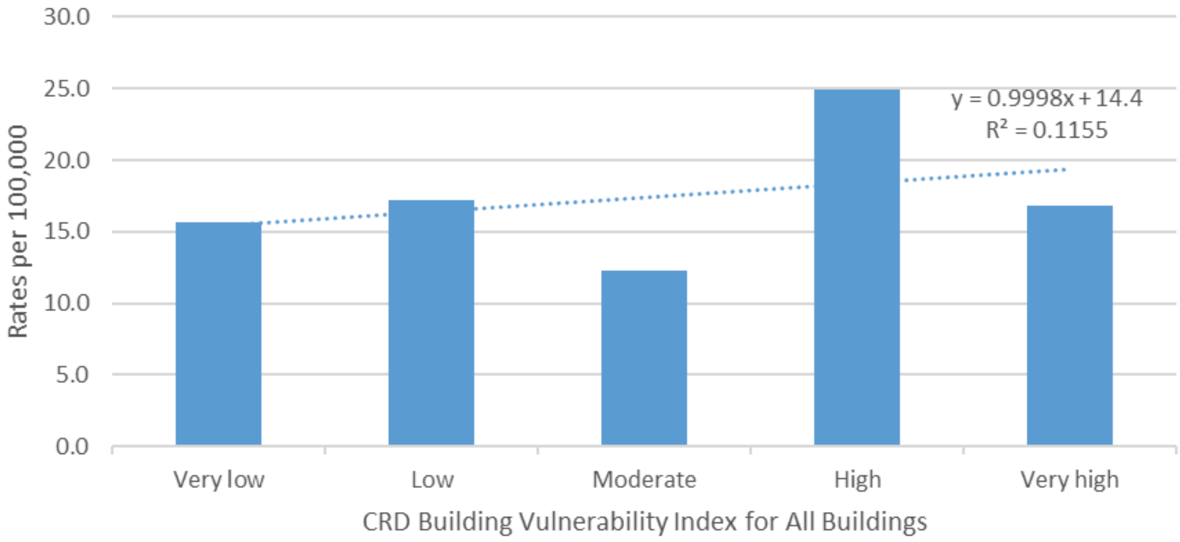

Figure 3.24. Analysis of capital region Building Vulnerability Index Across All Building Types and Corresponding Heat-Related Health Outcomes (2018-2023). The bar chart shows the rates of health outcomes per 100,000 in relation to building vulnerability, with a notable peak at 'High' vulnerability. The overall correlation is weaker (R^2 = 0.1155), suggesting additional factors may influence the rates for a combined analysis of buildings.

3.4. Key patterns and hotspots in the socio-demographic and building vulnerability indices

Given the construction of the two indices (buildings and socio-demographics), it is additionally possible to overlay risk and develop an initial understanding of multiple component risk by community. Pursuant to table 3.8 below we can note that communities such as Sooke, Colwood, Lagnord, Central Saanich and the Southern Gulf Islands all exhibit some degree of socio-demographic vulnerability at the highest risk level and no corresponding vulnerability for residential buildings. Conversely, communities such as Esquimalt and Victoria, exhibit comparatively lower risk with regards to socio-demographics in comparison to residential buildings. Interestingly, the risk profile for Saanich (at least in the top two deciles) is nearly identical between socio-demographics and buildings (though low in comparison to Saanich's share of capital region population 32.2%).

When examining socio-demographic vulnerability in conjunction with building vulnerability, certain areas reveal a confluence of vulnerabilities. Illustrated in Figure 3.25, areas such as Gorge-Tillicum, Burnside, James Bay, and Sidney BC stand out due to their combination of elevated socio-demographic vulnerability and a significant prevalence of buildings with high vulnerability. On the contrary, areas such as Sooke, Metchosin and Gordon head exhibit low socio-demographic vulnerability as well as a lower prevalence of building vulnerability.

Table 3.8 Summary of population in top vulnerability quintile for both socio-demographic and buildings vulnerability indices.

Jurisdiction	Population Residing in Top Sociodemographic Quintile DAs	Population Residing in Top Residential Buildings Quintile DAs	% of Population in Socio Demographic Index Top Quintile	% of Population in Residential Buildings Index Top Quintile
Sooke	2,565	-	3.1%	0.0%
Colwood	1,245	-	1.5%	0.0%
Highlands	-	-	0.0%	0.0%
Juan de Fuca (Part 2)	-	-	0.0%	0.0%
Langford	6,575	-	7.9%	0.0%
Metchosin	-	-	0.0%	0.0%
North Saanich	-	-	0.0%	0.0%
Juan de Fuca (Part 1)	711	-	0.9%	0.0%
Central Saanich	3,076	-	3.7%	0.0%
Saanich	14,991	14,492	17.9%	18.6%
View Royal	1,649	289	2.0%	0.4%
Oak Bay	3,912	3,230	4.7%	4.2%
Saltspring Island	1,554	-	1.9%	0.0%
Victoria	31,868	49,349	38.1%	63.4%
Southern Gulf Islands	1,304	-	1.6%	0.0%
Esquimalt	6,409	8,093	7.7%	10.4%
Sidney	7,707	2,336	9.2%	3.0%
CRD Total	**83,566**	**77,789**	**100.0%**	**100.0%**

Given the lack of granularity at the community scale, it can therefore be more effective to review overlapping risk at the DA level which is presented in figure 3.17 below. Notably the figure indicates where there are concentrations of the two indices coincident in space which suggests localised concentrations of risk that should be further investigated and explored. Of note are high concentrations in Victoria, Esquimalt and Oak Bay. Given the exploratory nature of this work, the next step would be to determine if combining these risk factors makes sense or introduces noise into the work. Additional validation against health outcomes would be highly beneficial in this regard.

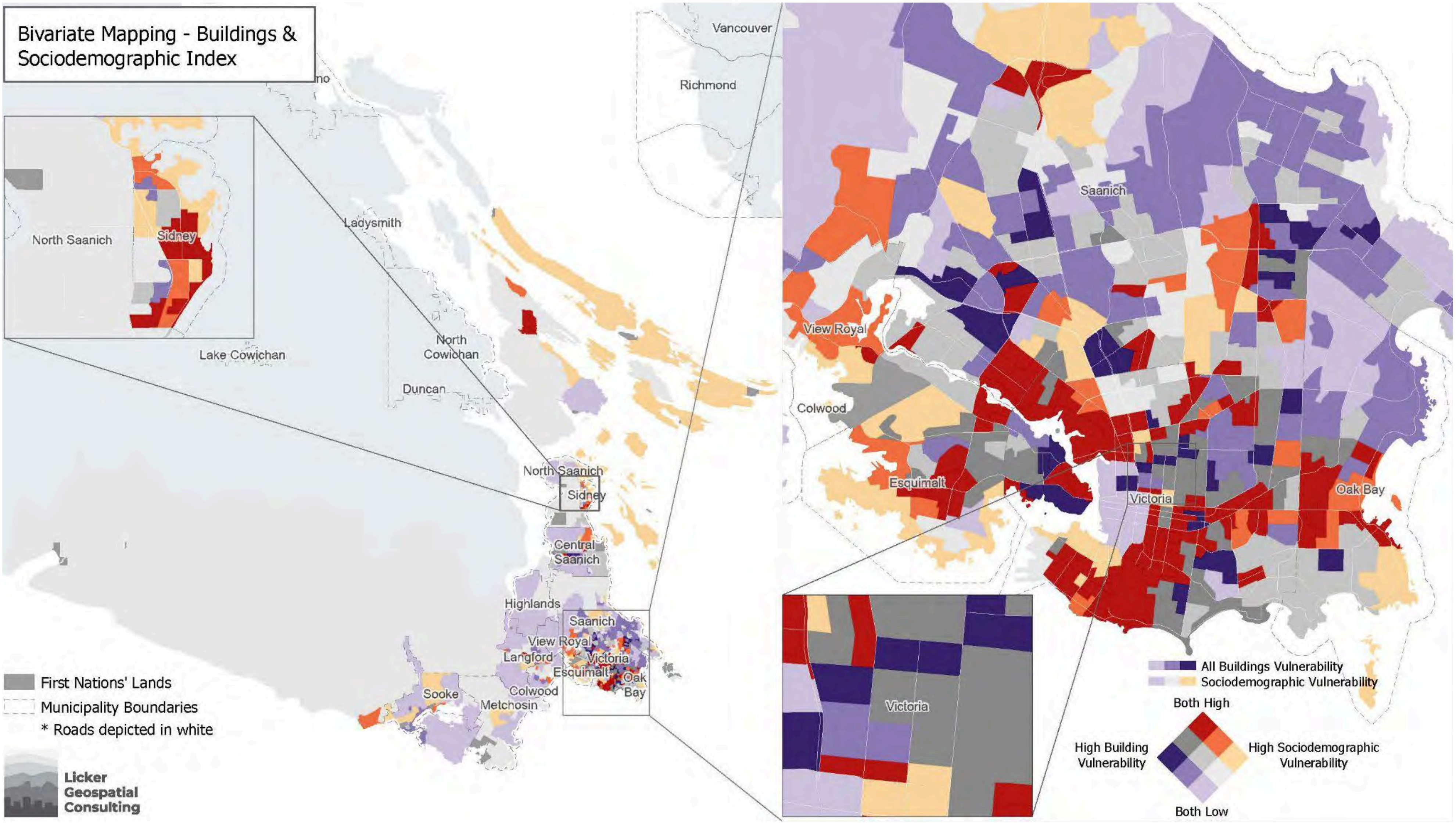

Figure 3.25. Extreme Heat Bivariate Mapping - Buildings and Combined Socio-demographic Vulnerability Index.

3.5. Community Level Summaries

For each of the 13 municipalities and three (3) electoral areas, key findings have been identified for further specificity for each community's specific heat vulnerability characteristics. These community level summaries help to show hot spots of heat vulnerability for each of the three mapping components. Community summaries can be found in appendix C. The community summaries also indicate the top contributing attributes from both the Socio-demographic Vulnerability Index and the residential Building Vulnerability Index, pertinent to each community. In addition, there are statistics relating to how the heat exposure layer overlaps with socio-demographic and building level vulnerability. For example, the District of Saanich's summary statistics table is depicted below in figure 3.26. In the table, very high vulnerability relates to the mapping categories labelled as very high. The District of Saanich is characterised by having 12.7% of its population residing in areas classified as very highly vulnerable according to the Socio-demographic Vulnerability Index. The top contributing demographic factor to the socio-demographic index is "population age 65 or older" (which makes up 23.1% of the population), while the top contributing health factor is "episodic mood anxiety disorders" (crude rate).

Housing type minimally contributed to the District of Saanich's overall building vulnerability (1.6%), as the community is mostly made up of single family dwellings, which was not considered as a vulnerable housing type (see table 2.2 for housing type vulnerability rankings). Rather, albedo and solar insolation are the largest contributing factors to this community's building vulnerability. This means that many building roofs are classified as very dark (absorbing heat), and buildings are exposed to very high amounts of solar insolation (30.4% of buildings). High solar insolation is predominantly due to low proportions of tree cover or shade, building aspect, elevation, and slope. By overlapping both socio-demographic and residential building vulnerability, the District of Saanich has 806 buildings that are classified as very highly vulnerable in both indices. As for modelled heat exposure results, 28% of the community's land area is modelled to have experienced some of the very highest temperatures in the capital region during the 2021 heat event (> 36.1 degrees celsius). Lasty, this community has the greatest amount of residential buildings classified as very highly vulnerable across all three mapping components (454 buildings).

Please note that the heat exposure layer is displayed in quintiles to help show variability in temperatures across each community. Quintiles divide the data into five equal parts, each representing 20% of the distribution of the data. The quintiles help identify areas with varying levels of susceptibility to heat-related impacts, however it should be noted that the range of values are all very warm temperatures during the extreme heat event, displaying that it can get quite hot everywhere. Regardless, quintiles are used to help to show the relative differences in temperature distribution across the region. Per the example below the "Very high" quintile is indicated as any area predicted to reach above 36.1 degrees celsius during the design heat dome event.

The Corporation of the District of Saanich

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

Population 2021	117,735
% population in very high Sociodemographic vulnerability	12.70%
% population in very high demographic-only vulnerability	8.20%
% population in very high Health vulnerability	14.10%
Top contributing demographic factor	Population age 65 or older (23.1%)
Second contributing demographic factor	Population that are renters (30.8%)
Third contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (18.2%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Hypertension (crude rate)
Third contributing health factor	Diabetes (Crude Rate)

Building Vulnerability

Total # of residential buildings in the community	35,638
Housing type contribution to building vulnerability	1.60%
Year Built contribution to building vulnerability	24.90%
Albedo contribution to building vulnerability	29.70%
Solar insolation contribution to building vulnerability	30.40%
Building Height contribution to building vulnerability	13.50%
# of buildings with very high demographic & building vuln.	806
# of buildings in very high	6,873
% of residential buildings in very high	11.80%
Average age of buildings in very high	1960

Heat Exposure

% of community area in very high heat exposure	28%
% of residential buildings with very high heat exposure	36%
# of buildings with very high socio-demographic & heat expo.	1,542
# of residential buildings highly vulnerable across all 3 indices	454

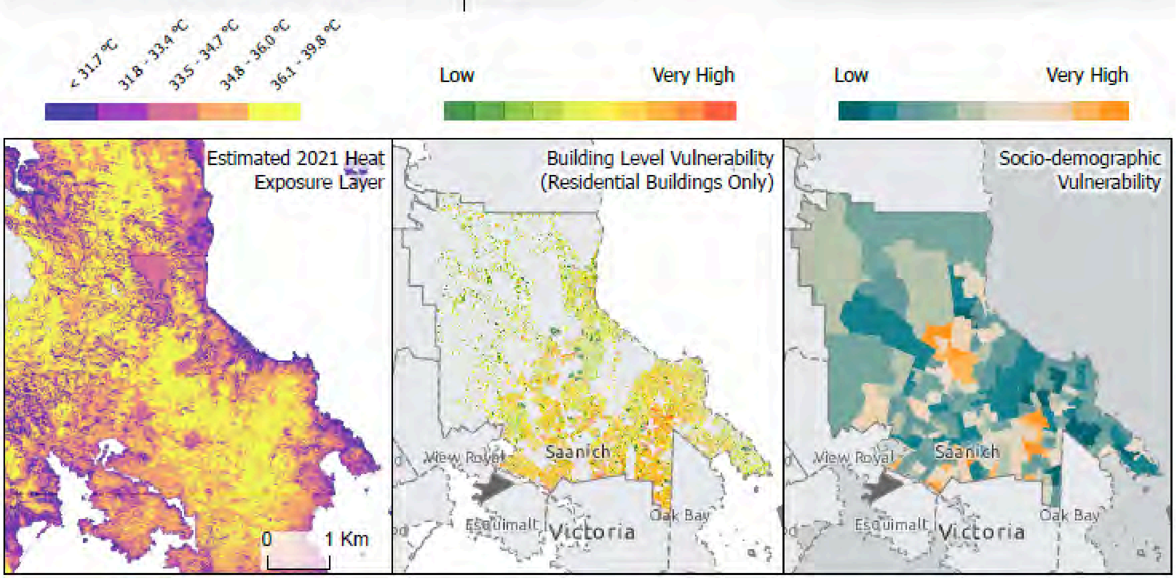

Figure 3.26. The Corporation of the District of Saanich Community Summary highlighting key determinants of heat vulnerability pertinent to Saanich.

3.6. *Community Level Key Findings*

While a detailed community-by-community analysis was out-of-scope for this assignment, we reviewed the summaries detailed above and can share the following key findings:

- Amongst all of the incorporated areas in the CRD, the top demographic consideration was consistently either: percentage of the population who are renters or percentage of the population who are seniors. The seniors finding is unsurprising as that was the highest weighted variable in the AHP model.
- The second highest demographic consideration encompassed considerably more variation including: % of population living alone (Victoria), Average number of rooms per dwelling (Langford), % of the population without post secondary education (Sooke), older housing (Oak Bay), and percentage of outdoor workers (Highlands).
- Low income residents did not factor in the top three for any community which suggests that no individual community in the CRD has elevated levels of poverty (recognizing, of course, that individual pockets of concentrated poverty are prevalent throughout the CRD).
- In most communities the primary health consideration is Episodic Mood Anxiety Disorders Prevalence followed by Hypertension (crude rate). This is noteworthy as neither mood anxiety disorders nor hypertension were weighted extremely highly in our model. This suggests that both of the health considerations are highly prevalent in the CRD and can be potentially addressed through municipal-level health measures which will reduce overall heat risk (for instance municipalities can consider food labelling bylaws or investments in active transportation which will reduce the incidence of hypertension).
- Noteworthy secondary health considerations include: high prevalence of diabetes in Colwood, high prevalence of Chronic Obstructive Pulmonary Disease (COPD)in Sooke, Victoria, Esquimalt and Salt Spring Island, high prevalence of Asthma in Langford and a high prevalence of Acute Myocardial Infarction in the Southern Gulf Islands and Metchosin.
- When unpacking the determinants of building risk, we note that Sidney, Victoria and Sooke all have the highest percentages of multi-family or congregant housing in their communities and therefore see higher values for the building type risk factor (all ~6%). Conversely communities that are nearly or mostly single detached in nature such as the JDF electoral areas, Highlands, North Saanich, Oak Bay and the Southern gulf islands all have the building risk factor contributing less than 1% to buildings risk.
- Owing to their comparatively new building stock, both Sooke and Langford (average age 1991 and 1984 respectively) indicate that era of construction (or building age) contributes less the 20% of building risk (18% and 19% respectively), conversely, Oak Bay, Esquimalt and Saanich all with comparatively older buildings indicate that era of construction contributes more than 25% to building heat risk.
- In general there is very little variance with regards to albedo and solar loading, though we note that Highlands has the lowest contribution for solar loading (24%) and the highest contribution for Albedo (35%) likely this is due to the fact that for the most part the

Highlands are very forested which can artificially increase albedo through shading and reduce solar loading commensurately. Also interesting to note is West facing communities such as Langford and Sidney have higher solar loading contribution percentages than other communities (though Oak Bay is an outlier here).

- When considered using region-wide averages, we note that 55% of Victoria's buildings are in the top quintile for building heat risk, followed by Oak Bay at 39%, Esquimalt at 33% and Sidney at 29%.
- When combined with demographic vulnerability we note that Victoria, Saanich and Sidney have the most buildings which are in very vulnerable areas for both buildings and socio-demographics at 1,174, 806 and 628 residential buildings respectively. When examined by percentage of total residential buildings, Sidney, Victoria and Esquimalt are the top three ranked communities with 19%, 13%, and 8% of all residential buildings being in both very high risk categories for buildings and sociodemographics. Conversely, Metchosin, Highlands and North Saanich have 0 buildings in these two categories.
- With regards to air temperature, we note that Langford, Highlands and Colwood all have significant areas of their community in highest heat quintile (>=36.6℃ daily average air temperature) at 61%, 49% and 32% respectively, which may increase risk in the communities. Conversely, communities more proximal to the ocean all have lower percentages of their communities in the highest heat quintile with Oak Bay, Sidney and Esquimalt at 5%, 2%, 1% of land area respectively.
- As urban heat is in many ways influenced by land use change and development, it is impactful to note that 84%, 56% and 48% of Langford, Colwood and Highlands' residential buildings are in the highest heat quintile. However, all three of these communities have relatively lower socio-demographic risk and only 6% (648), 1% (54) and 0% (0) of Langford, Colwood and Highlands' residential buildings are in both the highest quintiles for air temperature and socio-demographics
- Extending the above analysis to all three indices/layers we note that Saanich has 454 residential buildings in the three highest quintiles for heat risk, buildings risk and socio-demographic risk (1% of all residential buildings in the community), Victoria has 229 (2% of residential buildings) and Langford has 98 (1% of residential buildings in langford). Overall, there are 929 buildings in all three very high risk categories.

3.7. Sub-municipal analysis

Using the vulnerability indices in tandem can help to recognise priority areas for adaptation, risk reduction, and enhanced emergency response efforts. By examining where both building vulnerability is high and where socio-demographic vulnerability is also high, it becomes possible to strategically prioritise interventions and resources in areas most in need of attention. In figure 3.18 below, these overlapping vulnerabilities were identified at the building level and subsequently assessed for proximity to first responder data points. Buildings that are highly vulnerable and also fall within a DA that has a high Socio-demographic Vulnerability Index score are displayed in purple on the map below if they are also further than 2 kilometres away from a first responder dispatch facility. This analysis reveals key hotspots of vulnerability that could benefit from enhanced emergency preparedness and response. Some emergent hotpots of note occur near Gorge-Tillicum, Otter point, Oaklands (Vancouver) & Quadra (Saanich), south Oak Bay, Cordova Bay, and the north and south areas of Sydney, among others.

While an exhaustive analysis of key considerations for each of the abovementioned hotspots is beyond the scope of this study, we note for interest potential concerns in the Oaklands/Quadra areas of Victoria and Saanich which exhibits a high degree of buildings that are at risk, along with sizable concerns with regards to at risk populations and a seemingly longer potential response time for first responders[65]:

- 54% lower adoption rates of heat pumps per capita than the regional average;
- Rates at twice or more the regional average for acute myocardial infarction, chronic obstructive pulmonary disease, chronic kidney disease and hospitalised stroke;
- Population density at 1.8x of the regional average;
- Percentage of population living alone 1.4x of the regional average;
- Unemployment rates 1.3x the regional average;
- Concentrations of recent immigrants 3.5x the regional average;
- Concentrations of poverty with 16% of the households being in the bottom decile of family incomes in the region (compared to an expected 10%);
- Top risk quartile solar insolation (4,400 watt/hrs versus a regional average of 3,950) and building age values (average year built 1954 versus regional average of 1974); and
- A somewhat higher proportion of seniors living in multi-unit buildings than the regional average.

We note that while presented as a conceptual example only, the above risk profiling can be completed for any subset of buildings and/or dissemination areas considered for this study and as such can with some additional effort, be extended to multiple, additional hazards or disaster response scenarios.

[65] We note the very close proximity to Royal Jubilee Hospital, which, to the best of our understanding, does not dispatch ambulances.

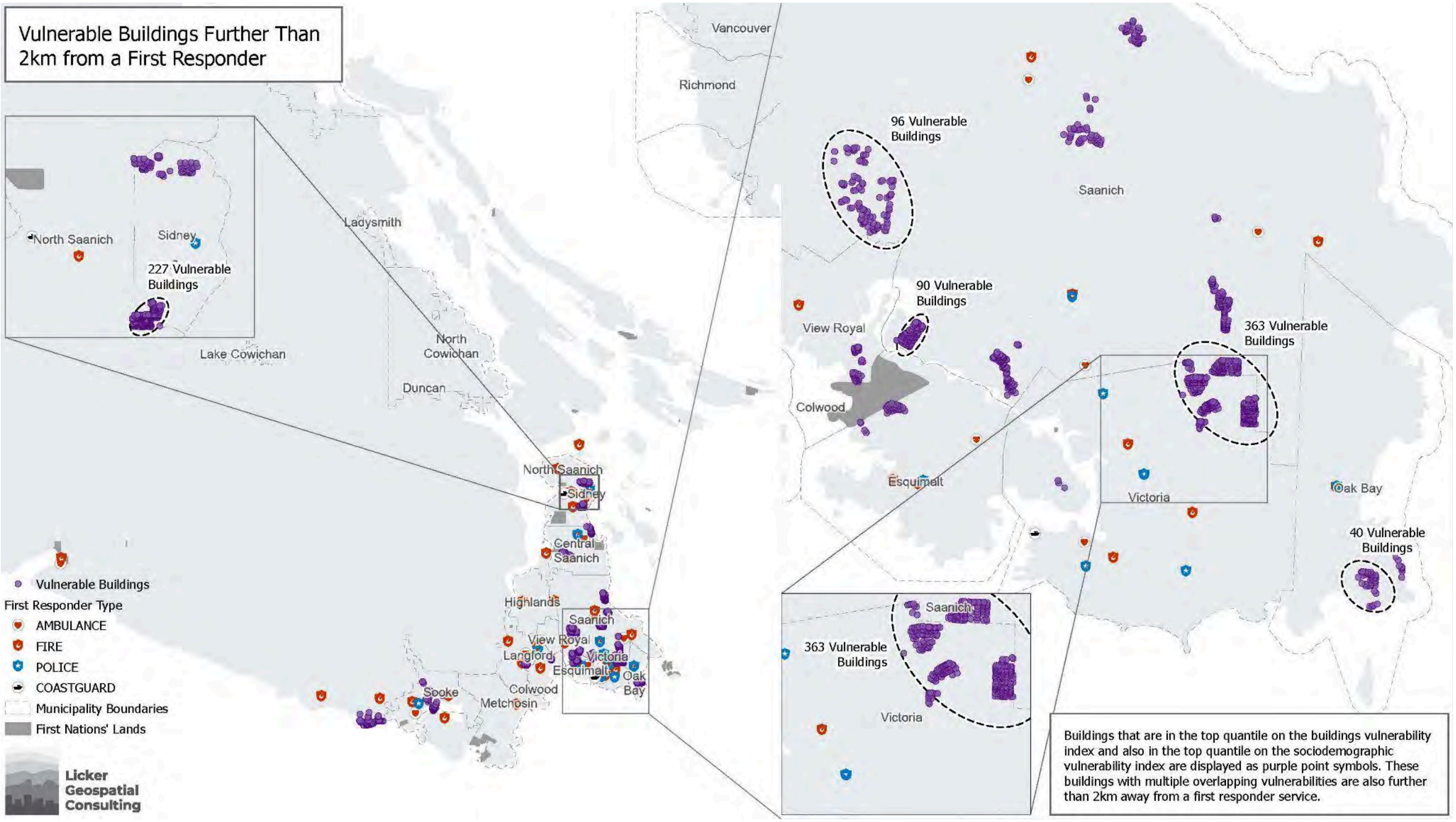

Figure 3.27. Buildings with multiple overlapping vulnerabilities that are also located further than 2 kilometres from a first responder dispatch facility.

4. Discussion

The findings of this study, while underscoring the multifaceted nature of extreme heat vulnerability and resilience in urban and rural environments, also bring to light the inherent complexities and constraints associated with such research. This Discussion section aims to detail these complexities, starting with a presentation of limitations of the socio-demographic vulnerability index, the heat exposure layer, and the building vulnerability index. The recognition of these constraints allows for transparency in our research, provides context of our findings, and also presents opportunities for future research in this area. Following a discussion on limitations, a carefully considered set of recommendations are provided, which have been drawn from our data-driven insights and are intended to guide practical interventions and policy formulations. Lastly, we present potential future uses of the analytical outputs of this study, in which we offer pathways to leverage this work towards the development of innovated solutions and strategies for enhancing resilience against extreme heat at the localised and regional level.

4.1. Methodology Limitations

4.1.1. Limitations of the Socio-Demographic Vulnerability Index

Despite the increase in accuracy in this index through the use of AHP, there are still some limitations to the dataset that should be considered when interpreting the information. These include:

- Census data limitations: Census data is collected through a quinquennial mandatory survey carried out by Statistics Canada. Despite the legal obligation to complete the Census, certain households or individuals may choose to not answer the Census, not be present on Census day or may not answer the questionnaire truthfully. While Statistics Canada makes every effort to guarantee the accuracy of the Census there is a certain degree of non-response rate for all dissemination areas in the Study Area. These non-response rates vary from 0 to 51% in the capital region with an average non-response rate of 4% and can possibly reduce the accuracy of collected information in some cases.

- Ecological fallacy: As both Census and health data are aggregated to the Census Dissemination area level, there is a modest concern that any index prepared using this data is subject to the ecological fallacy[66], which can lead to errors of interpretation. That is to say, rates and values results described at the Dissemination Area level may not describe singular cohesive groups who all share the same attributes. Rather these data describe singular descriptors of different groups of individuals.

- Atemporality of socio-demographic data: The most recent Census was completed in 2021, as such the data are nearly three years old at the time of this study, and the populations that they describe may not conform to the ones that currently reside in the capital region

[66] The ecological fallacy is a common issue in the interpretation of statistical data that occurs when inferences about the nature of individuals are deduced from inferences about the group to which those individuals belong.

or future populations. Accordingly, care should be taken when interpreting index data, to recognize that these data describe relative risk from 2021 with some degree of inaccuracy henceforth.

- During the socio-demographic index design phase we learned that the population with schizophrenia is at the highest risk for death during extreme heat due to a multitude of complex interacting factors[67]. While various health indicators pertaining to increased vulnerability during extreme heat were included in the index, we were unable to acquire data on schizophrenia at the DA level, leaving an important health indicator out of the equation.

- Future engagement could focus on outreach to key end-user groups. Many of these opportunities were discussed but not fully pursued given the timing and budget constraints of the project. Examples discussed were the Capital Region Housing Corporation (CRHC), other building managers/owners (BOMA, Devon properties, etc.), the Electoral Areas, and the health authority (i.e. Island Health).

- This effort did not include cross-tabulated Census data, which describes the intersection of data inputs. For example the spatial distribution of the population that are seniors *and* live alone (cross-tabulated), versus the spatial distribution of the population that are seniors *or* live alone (not cross-tabulated). Cross-tabulated Census data was not included in this project for several reasons, including project capacity limitations in regards to timing and cost, and privacy and confidentiality restrictions that are common for cross-tabulated data at the Census DA level. In regards to spatial resolution, Census data was accessed at the dissemination area level, meaning that any variations within dissemination areas are not fully captured.

- In the development of our AHP, we acknowledge potential limitations regarding representation and inclusion. Despite efforts to engage a diverse array of subject matter experts knowledgeable about the local context of the capital region, some perspectives will have been underrepresented or overlooked, thereby introducing gaps in the index creation. Further, the use of AHP introduces subjectivity due to its reliance on subjective judgments in weighting of inputs. The inherent biases and personal preferences of the analysts involved will influence weight attribution and thereby the demographic vulnerability index.

- The census data deployed in the analysis does not include the homeless population. Their adaptive capacity is perhaps higher for extreme heat as they are more connected to supporting resources during a heat event.

[67] Studies of Mortality in British Columbia During the 2021 Extreme Heat Event. Heat Preparedness Knowledge Exchange, May, 10th, 2023. With Sarah Henderson, Kathleen McLean, Michael Lee, Shirley Chen, Corinne Hohl.

In our analysis of extreme heat, we recognized the importance of considering First Nations' (FNs) communities in the region and sought to engage with them. First Nations representatives were included in the AHP workshop, for example, to ensure their perspectives were integrated in the way socio-demographic vulnerability/adaptive capacity was being defined in the region. Effort was also made to reach out to several other First Nations. The project timeline and budget constraints limited this consultation and inclusion process, as did data availability in certain circumstances. We acknowledge that more input and guidance from local FNs would have been valuable in enhancing our understanding of the specific vulnerabilities and needs of their communities in relation to extreme heat events.

Exploratory work to investigate available data for First Nations was conducted with available Census data. It was found that there were higher Census non-response rates on FN lands, which would decrease the confidence in the vulnerability assessment. Long-form[68] non-response rates [69] for FN reserve DAs has a mean of 35.5%, and for short-form[70] a mean of 20.2%, whereas for non-reserve DAs, the long-form non-response rate averages 4% and for short-form is ~3%. Multiplying non-response rates at the DA level by FN population equates to 27% of the population for long form Census and 13% of the population for the short-form. Whereas for non-reserve DAs, long-form and short-form non-response rates average 3.8% and 2.8% of the population respectively (see Table 2.1). However, Statistics Canada has reported that total non-responses to the long-form questionnaire are compensated for through imputation. Data for households that did not respond to any questions are imputed using data from a respondent household[71].

BC Assessment data (i.e. the buildings information report or BIR), as deployed in the buildings vulnerability index is not available for buildings on First Nations' reserve lands. Further, lived experiences on some First Nations reserves suggests a highly protective factor of living in these communities[72]. Accordingly, more work is required to develop a methodology that would help overcome data limitations and integrate these intercultural considerations.

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[68] The long-form questionnaire complements the short-form questionnaire and is designed to provide more detailed information on people in Canada according to their demographic, social and economic characteristics. It is disseminated to 25% of the population.

[69] Non-response rate is defined by Statistics Canada as the percentage of individuals or households that did not provide a completed response to the Census questionnaire. The non-response rate helps to understand the quality and coverage of Census results.

[70] Short-form refers to Canada's Census form that collects basic demographic and household information and is disseminated to 75% of the population.

[71] Statistics Canada (2022). *Guide to the Census of Population, 2021, Chapter 12 – Sampling and weighting for the long form*. Retrieved June 30, 2023, from https://www12.statcan.gc.ca/census-recensement/2021/ref/98-304/2021001/chap12-eng.cfm

[72] Canadian Climate Institute. (n.d.). Community is the solution. Available from https://climateinstitute.ca/publications/community-solution-2021-extreme-heat-emergency-experience-british-columbia-first-nations/

Table 4.1. Non response rate comparison within the capital region.

Non Response Category	FN Reserve DAs	Non-reserve DAs
Long form - Non-Response	35.5%	4%
Short form - Non-Response	20.2%	~3%
Long form - Proportion of Population - Non-Response	27%	3.8%
Short form - Proportion of Population - Non-Response	13%	2.8%

4.1.2. Limitations of the Heat Exposure Layer

Both the air temperature and LST model have limitations in their calculations and usage. Below are limitations associated with the LST and air temperature layers:

- LST is sensitive to immediate land cover change. Because LST is very closely aligned with what is directly on the ground, any changes to that surface will as a result impact the LST measurement. This LST layer is specific to the 2021 heat event. While land cover may generally be similar in the short-medium term, it is expected that by the long-term, the LST distribution will change significantly from land cover changes alone, notwithstanding changes to the magnitude of extreme heat events.
- As aforementioned, LST can provide a detailed perspective of how the region heats during a heat event. However, the distribution of the layer is less appropriate when relating to the human experience of extreme heat events, given that temperatures differ as they dissipate up to 2 m above the surface.
- Air temperature is based off a regression-model without an intercept. This approach introduces assumptions including that without any input (elevation, solar insolation, distance from coastline, etc.) the air temperature will be 0°C.
- Air temperature also heavily relies on the selected environmental variables for predictions, which may not account for all the factors that influence air temperature (such as windchill).
- The air temperature layer is inflexible and may produce erroneous values when applied in different regions.
- The air temperature layer is a linear model, which may not necessarily be true under all scenarios, especially in complex urban environments.
- The air temperature regression analysis is dependent on a relatively small sample size of weather stations (66), which may have sensor inaccuracies and has a limited distribution. As such the model becomes inflexible at high elevations where there is a gap in reliable station data during the 2021 heat event.

4.1.3. Limitations of the Building Vulnerability Index

While comprehensive, innovative and highly detailed, this index still presents a first attempt at regionally characterising potential heat in buildings and is subject to the following limitations:

- There are potential limitations of this model relating to data availability/accessibility (i.e air conditioning data for commercial buildings, indoor temperature, building wall material, single room occupancy (SROs)/residential hotels) and data nuance (i.e. have building components been updated since the building was built, averaging of building heights over their footprints). These are improvements the consulting team recommends be made in the future if and when possible.
- To help validate the model, ideally indoor air temperature gauges across the region would have been used to help validate the buildings index. Indoor air temperature data was sought after by ecobee. However, data was unavailable at the address level for the Project's use. If building level indoor air temperature data becomes available (for dates durings a heat wave), it would be recommended to incorporate this data into the modelling to help predict vulnerability as well as for model validation.
- Another limitation stems from the fact that, although each building is assigned specific values for height, albedo, and solar insolation, all buildings on a given parcel share a common set of building age and type information sourced from the Building Information Report. Thus, lower overall reliability exists in the ultimate ranking where there are multiple structures on the same parcel.
- Building albedo is based on the reflectance of a building's roof assembly only, that is to say, while the roof is a key element in heat loading, the walls of a building may absorb heat as well. Unfortunately, the albedo analysis, as conceived, can only be completed in planimetric (ie two dimensional) space and accordingly this nuance is lost in the buildings index model. During the meeting to discuss the buildings modelling approach, there were live experience comments that some new buildings, with lots of glass, that are south facing experienced extreme indoor temperatures during BC's 2021 heat event. With this in mind, we suggest that when possible, future model iterations consider building facade materials.
- Building age is a strong determinant of heat risk and it is fortunate that the BC assessment year of construction data captures this information. However, the year of construction of a building may not equate directly to the age of the interiors or exterior walls or windows of the building as these may have been renovated over time.
- A total of 2.9% of buildings lack information on building age or dwelling type. These data gaps can be attributed to four factors: temporal issues with BIR data, building footprint delineation and parcel boundary data, First Nations' Lands are not assessed by BC Assessment, occasional discrepancies when Joining Building Information on PID resulted in a small number of unmatched records, and the inherent potential for a minor degree of error in the BIR assessment process, which involves human evaluation.
- There is conflicting evidence around using building age as a predictor of vulnerability without also knowing construction material. Unfortunately, construction material was not a consistent attribute available for all buildings. Additionally, there is still no consensus among building experts and scientists on which construction materials are best in an extreme heat event, as specific building dynamics need to be considered which are very complex and not within the scope of this project to discern. However, in the context of the

District and BC as a whole, we are able to make approximate inferences about air tightness based on BC's building code history. Therefore using building age gives us a reasonable proxy around building air tightness, however adjustments could be made to this variable based on future potential findings from the building science community.

- As noted in Section 2.3.2, footprints for East Sooke, Metchosin and Juan de Fuca were delineated by LGeo, whereas footprints for the rest of the capital region were sourced from their respective municipalities. Note that footprint delineation errors within the provided source footprints from capital region were not scoped for QA or revisions.
- The buildings index, functions as a regional model, and has undergone thorough quality assurance through comprehensive sense checks across all attribute types. Nevertheless, given the extensive volume of buildings within the region, a meticulous examination of each individual building wasn't feasible, which has the potential for introducing errors or discrepancies. It's essential to acknowledge that, at a certain point, the effort invested in quality assurance encounters diminishing returns when building a regional model.
- While heat pumps are known to provide protective effects against extreme heat, our model assumes that the heat pump is providing cooling for all buildings on the associated parcel, as heat pump data was only available at a base address level. For single family homes this assumption is fairly sound. However, for multi-unit buildings, the heat pump data available does not distinguish if it's for a singular residence, or if the heat pump is able to provide cooling for the entire building.

4.2. Recommendations for usage and future research

- Analysing multiple overlapping vulnerability maps – Using all three mapping components together can help to recognise priority areas for risk reduction (i.e. risk reduction potential) and enhanced emergency response efforts. By examining vulnerability at the dissemination area level, considering both vulnerable populations and buildings along with the presence of urban heat islands, it becomes possible to strategically prioritise interventions and resources in areas most in need of attention.

- Identifying priority areas for tree canopy and green spaces – The data and maps derived from this project can help support urban forest strategies in the region. The vulnerability indices can be used to identify areas with a higher concentration of vulnerable populations that also have low proportions of canopy coverage. These areas can be prioritised for the development and enhancement of urban green spaces, parks, and tree canopies. Planting trees in areas with higher vulnerability can contribute to providing shade, reducing surface temperatures, and improving overall microclimates, thereby enhancing the well-being of vulnerable populations.

- Modelling and forecasting urban heat island effects - Our air temperature index results from a function of topography, urban form and to a lesser extent density and canopy coverage. Given that air temperature is to a some degree anthropogenically influenced, we can potentially model this out into a baseline and design case scenarios. This can be readily accomplished using an exploratory forecasting approach wherein we forecast the correlating factors driving air temperature using a simulation-based approach. This is similar to how climate mitigation modelling is forecasted using land use as a driving factor.

As discussed in the air temperature section above, our air temperature model describes the relative predictive value of insolation and land surface temperature both of which can be forecasted using a future case. Future case considerations could include:

- Generic temperature increases due to climate change (as discussed 2.5 degrees median for South Island)
- Canopy regrowth and degrowth rates by land use typology (we know that there is a generic increase on public lands, modest decrease on infill lands, a spectacular decrease on greenfield development followed by rapid regrowth, static growth in mature single detached areas etc - this can be generated from landsat data and plugged into the Canopy growth model we developed for Vancouver). Cutblock simulations could be included as well.
- Urban intensification (would change energy density, population and employment density - this can be generated from build out models similar to those which have been developed previously for Victoria and Saanich)
- Greenfield development (significantly increasing road network / traffic density and reducing LST)
- Changes to vehicular travel behaviours / shifting to non heat generating modes of travel.

A business as usual or "dark-sky" case could be developed wherein deltas to urban heat could be considered as a result of unchecked development absent any mitigating effects of canopy regrowth and design considerations to increase albedo. Alternative cool-city cases could be developed considering reduced buildings thermal density (or increased r-values), design considerations to increase albedo, reduced vehicular density, road reallocation to greenspace, aggressive tree planting scenarios and secession of aggressive foresting practices. The difference in modelled LST between scenarios could be considered as a positive effect of good urban planning and could mitigate against future heat vulnerability (at least on the exposure side of things).

- Response Resource Allocation – Based on the extreme heat event experienced in British Columbia in 2021, we know that emergency response personnel were at or over capacity in many areas throughout the capital region. Understanding at the dissemination level where there are vulnerable people and where there is a shortage of emergency responders or a long distance for a response team to travel, can help to better plan for where greater emergency response resources are needed. In local authorities where establishing cooling centres is common practice, the mapping produced by this project can provide an evidence base for where cooling centres should be prioritised.

- Updating local hazard, risk, and vulnerability analyses (i.e. HRVAs) - The new Emergency and Disaster Management Act (i.e. EDMA) is ramping up requirements for local authorities to undertake hazard and risk assessments. The effort and investment made via this project can support these obligations for local authorities in the CRD. A large component of the work for an HRVA had been completed, with the ability to add in multi-hazard considerations for the other 'major hazards of concern' in the region.

- Supporting climate action planning and reporting – As mentioned above, this may involve considering changes in land use planning and policies to help mitigate the impacts of extreme heat. Specifically, high heat areas should be tested against canopy coverage to determine the influence of urban canopy on heat. Should the relationship prove durable then tree planting should be prioritised for hotter areas to reduce urban heat island effects.

- Supporting response to and adaptation of high risk buildings – The Building Vulnerability Index can help to inform which buildings are likely in need of retrofitting for extreme heat adaptation. It can also help prioritise areas for redevelopment. In the nearer term, the building modelling can help prioritise outreach and response. For example, in Burnaby, the emergency managers posted flyers in high-risk multi-unit buildings to educate residents about extreme heat hazards and options to help manage it. It can also support in-person wellness checks as first responders can respond to the buildings being mapped as high-risk, as they often cannot get information about the specific socio-demographics at a given building.

- Prioritising subsidies of heat pumps. Based on our findings, there is significant disparity with regards to the distribution of heat pumps in the region. In light of these findings, there should be some consideration for localised subsidies for heat pump adoption perhaps based on socio-demographic factors as well as overall building risk.

- Synergies with buildings benchmarking. As buildings benchmarking for energy performance becomes more common both in the capital region and province-wide, it may prove beneficial to require reporting for indoor air temperatures (as well as indoor air quality!) along with the mandatory energy reporting. Secondly, benchmarking information can be furthermore used to support identification of low or high risk buildings based on interpretation of hourly energy profiles which can indicate the presence of electric cooling or weak r values for instance.

- Community Engagement, Outreach and Education: The demographic and health-related vulnerability information can be used to help facilitate targeted community engagement and education efforts, regarding extreme heat events. This can include outreach programs to educate vulnerable populations on heat-related risks and the importance of preparedness.

4.3. *Future Model Updates*

As noted in the limitations sections for each index, data availability and granularity of validation are the predominant cause for any shortcomings in the model. If pertinent data becomes available at a later date, new indicators can be added in a streamlined fashion. For example, schizophrenia data could be added to the demographic index, if it becomes available at the DA scale. Proportions of the population having schizophrenia would simply need to be multiplied by a decided weighting factor (likely by a high weight percentage in relation to the other demographic variables given its significance) and added to the index score.

As new demographic information becomes available from the next Census, the demographic index could be updated with these new data. Data can be extracted from Statistics Canada's API by dissemination area unique identifier (DAUID)[73]. If you are unfamiliar with Census data scraping, LGeo has automated processes in place that can assist. After acquiring the appropriate Census data variables, adaptive capacity variables will need to be inverted to ensure that high values always represent higher vulnerability. In addition, variables that are not percent values, such as average number of dwellings and population density per hectare, would need to be scaled to have values ranging between 0 and 1. Once variables are configured, each variable is multiplied by their associated AHP assigned weight and then summed together to create the demographic index. We have automated this process through scripting and can assist in updating when needed.

To update the Heat Exposure Layer, a digital elevation model (DEM), at 1 m^2 spatial resolution will need to be derived from the newly available lidar data. Solar insolation (WH/m^2) at a spatial resolution of 30m^2, derived from a digital terrain model (DTM; 30 m^2) will need to be rerun using the newly available lidar data. Then the Sky View Factor (SVF), will need to be re-assessed at 1 m^2 spatial resolution. In addition, land surface temperature (LST; °C), will need to be recalculated from Landsat-8 satellite images captured during the updated heat event time period. Similarly, Normalised water difference index (NDWI), will need to be recalculated with appropriate updated Landsat-8 satellite images. Lastly, if the distance to coastline (km) layer needs to be remade, it can be calculated using one of ESRI's distance tools using coastline polyline data and either a 30m2 raster or polygon-grid covering the Region.

To update the Building Vulnerability Index, effort would need to be made to update parcels with new BIR data including actual use codes, and year built. New LiDAR derived footprints would also need to be created and attributed with building height. New Sentinel-2 imagery can be downloaded from the European Space Agency[74] to process a new albedo layer for the region. And lastly, updated air conditioning or heat pump data would need to be geocoded and attributed to its associated parcel. Additionally, it should be noted that there is a lack of literature from building experts and scientists discussing how particular building characteristics affect

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[73]Statistics Canada. Application Program Interface (API). https://www.statcan.gc.ca/en/microdata/api

[74] European Space Agency. (2023). Sentinel-2 Multispectral Instrument Level-1C data [Data set]. Copernicus Open Access Hub. https://scihub.copernicus.eu/dhus

vulnerability to extreme heat events. As research emerges in this area of study, it would be beneficial to apply any new and relevant findings to future iterations of the buildings index.

With regards to validation we note that our validation efforts are based on aggregate levels of observed hospitalizations that can be attributed to heat. While this is a reasonably effective method for validating the sociodemographic and buildings indices at the dissemination area level, it does not account for risk at the individual or buildings level. Recognizing that individual demographic or health data is practically impossible to gather, disseminate and validate for a public study such as this one, it may prove more effective to produce custom Census cross-tabulations which can then be validated at the DA level with some reassurance that the ecological fallacy has been mitigated to a certain degree. For additional buildings validation, it may prove beneficial to promote the installation of indoor temperature monitors in suspected at-risk-buildings[75] such that real risk data can be captured and validated against modelled information produced for this study.

[75] Note that the project team made reasonable, though unsuccessful efforts, to acquire third party indoor air temperature data from a number of providers as well as to collect anecdotal information from buildings managers who had been present during the 2021 heat event. Our efforts were not successful due, in part to concerns with regards to data privacy which hampered appropriate sharing of sensitive information.

Closing remarks

This study conducted by the Capital Regional District (CRD) and in conjunction with Licker Geospatial Consulting Co (LGeo), Thrive Consulting (Thrive), and municipal partners, represents a significant advancement in both the understanding and identification of extreme heat vulnerability within the capital region, but also the way in which regional and local governments may measure and assess extreme heat vulnerability in their communities. By leveraging a multidisciplinary approach that combines socio-demographic vulnerability, heat exposure, and building vulnerability, this research offers a comprehensive and nuanced perspective on extreme heat vulnerability in the region that offers the identification of key areas and populations that exhibit elevated risk to extreme heat.

This study presents actionable insights and targeted recommendations aimed at enhancing climate change adaptation and mitigation strategies, prioritising emergency response mechanisms, and refining urban planning practices to foster resilience and equity in the face of extreme heat challenges. Key recommendations are identified below as:

- Integrate the use of these indices in planning for climate change adaptation, risk reduction, and emergency response with a focus on overlapping vulnerability;
- Nuance urban forestry and green infrastructure with vulnerability data. Tree planting and shade provisioning are elements of extreme heat adaptive capacity and should be prioritised in areas that are presented as highly vulnerable;
- Strategically allocate resources such as emergency response. Our analysis presents areas in which there are both high overlapping vulnerabilities and also a dearth of emergency response service coverage;
- Integrate the findings into local governments' hazard risk and vulnerability analysis (HRVAs) updates to allow for informed policy-making and climate action planning; and
- Prioritise building retrofit programs to highly vulnerable buildings, whereby a multi-hazard perspective is applied.

The collaboration among various project stakeholders, including local experts and community members, has enriched the study and ensures that the analysis and findings are grounded in local realities and experiences of extreme heat. Such a collaborative and data-informed approach not only maximises the relevancy and efficacy of the study's recommendations, but also underscores the importance of community engagement in addressing climate change-related hazards and vulnerabilities.

Moreover, the study's methodology and findings have a significant implication beyond the immediate scope of extreme heat vulnerability. Indeed, they contribute to a broader understanding of how regional and local governments may integrate scientific research with policy-making and community planning. This effort thereby offers a foundation for future initiatives aimed at addressing various aspects of climate change and public health preparedness. The emphasis on a holistic, evidence-based approach to addressing climate resilience challenges can serve as a guiding framework for other regions and municipalities that face similar challenges.

In summary, the initiative undertaken by the CRD marks a significant advancement in the discipline of local and regional government response and resilience to climate change, and offers a starting point for potential strategies to address heat vulnerability with actions that are informed, inclusive, and evidence-based. This research not only advocates our understanding of the complex dynamics of extreme heat exposure and its impacts, but also champions a proactive and collaborative model for building safer, more resilient communities in the face of escalating climate risks.

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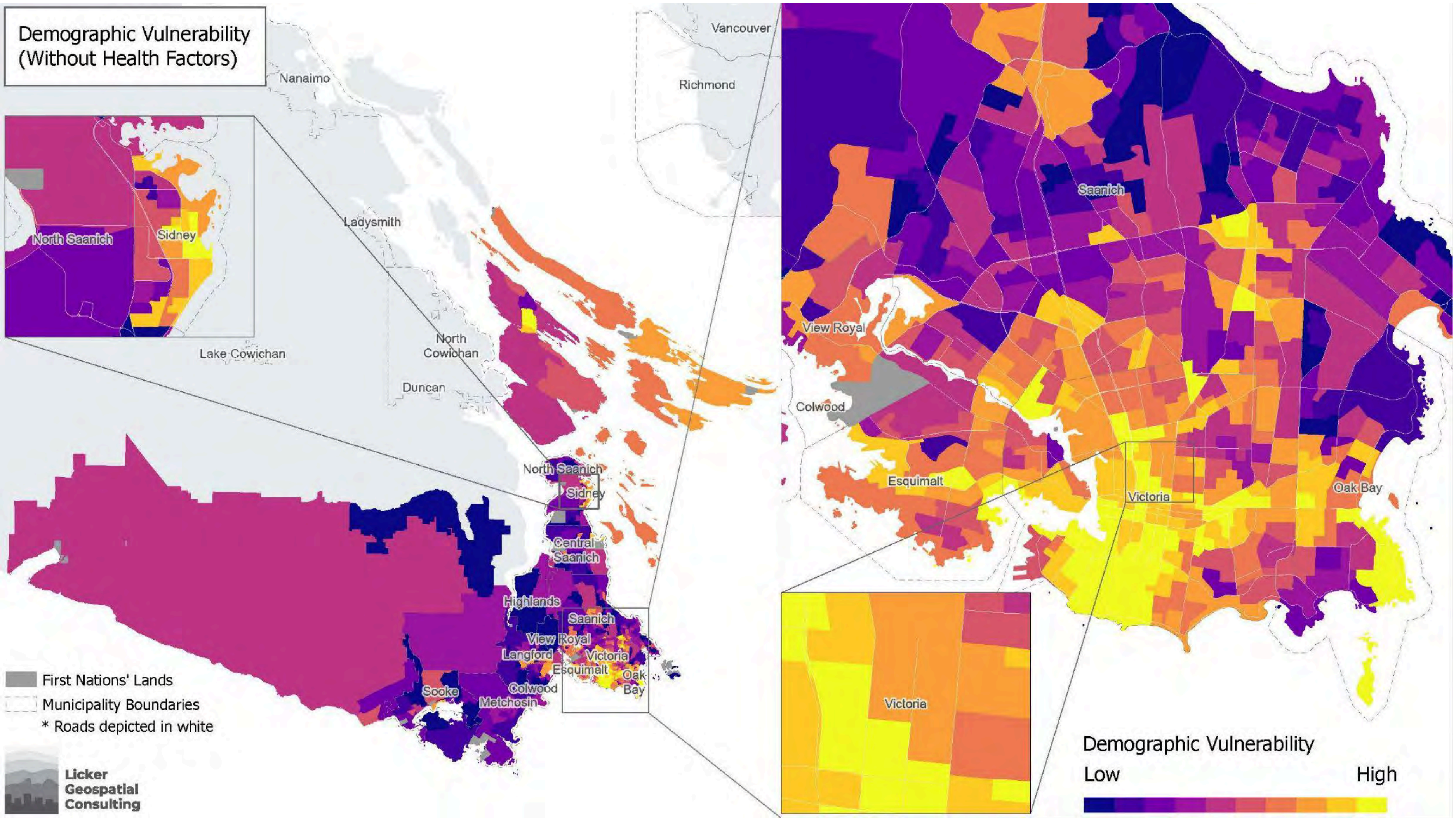
Appendix A. Weights (ωbi) by spectral band for rooftop albedo calculation, derived from Vanino et al (2018)[76].

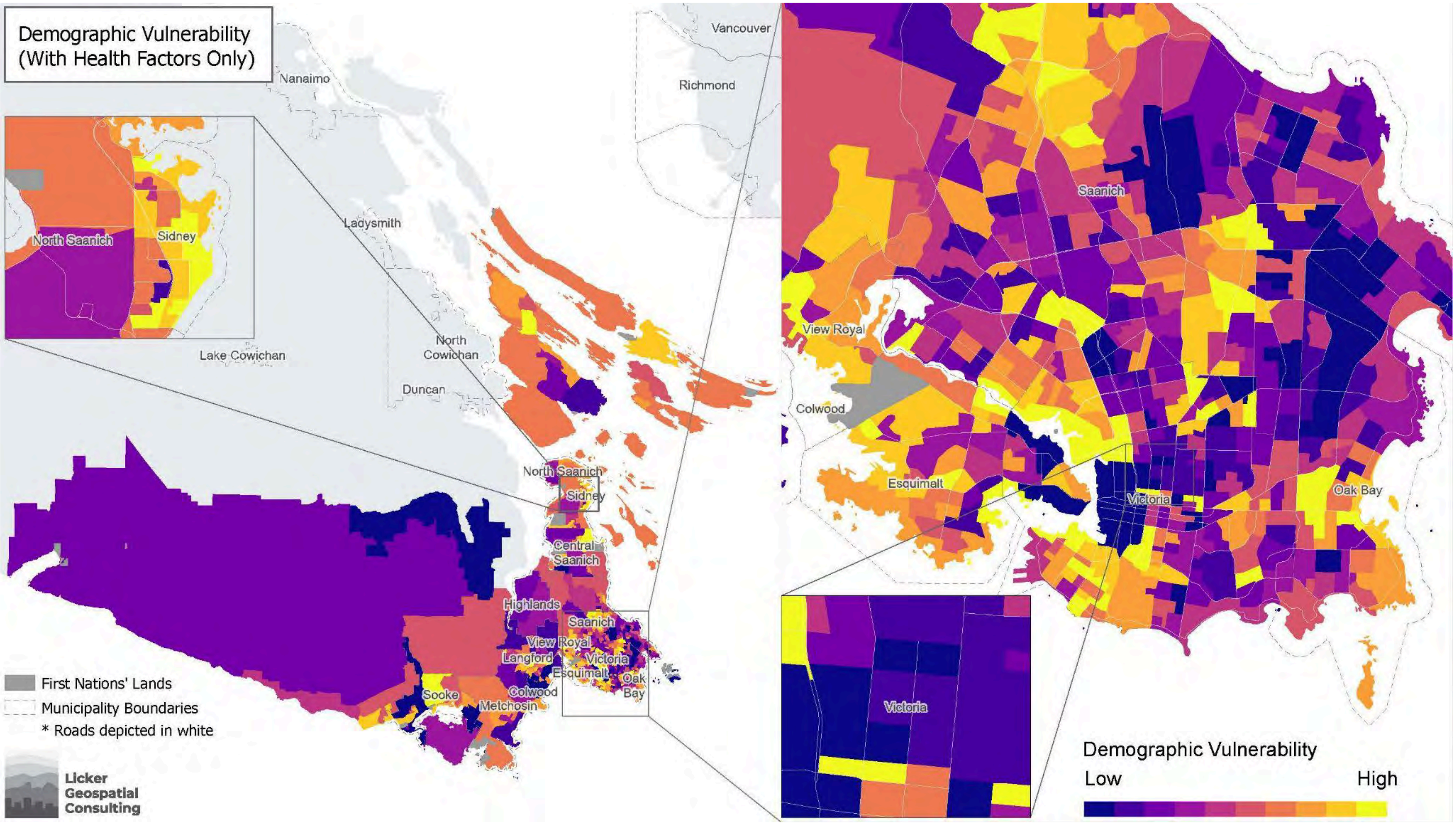
Band	Center λ (µm)	Spectral width Δλ (µm)	Esun (W m−2)	ω_{bi}
1	0.443	0.020	1,893	-
2	0.490	0.065	1,927	0.1324
3	0.560	0.035	1,846	0.1269
4	0.665	0.030	1,528	0.1051
5	0.705	0.015	1,413	0.0971
6	0.740	0.015	1,294	0.0890
7	0.783	0.020	1,190	0.0818
8	0.842	0.115	1,050	0.0722
8a	0.865	0.020	970	-
9	0.945	0.020	831	-
10	1.375	0.030	360	-
11	1.610	0.090	242	0.0167
12	2.190	0.180	3	0.0002

[76] Vanino, S., Nino, P., De Michele, C., Bolognesi, S. F., D'Urso, G., Di Bene, C., Pennelli, B., Vuolo, F., Farina, R., Pulighe, G., & Napoli, R. (2018). Capability of Sentinel-2 data for estimating maximum evapotranspiration and irrigation requirements for tomato crop in Central Italy. *Remote Sensing of Environment, 215*, 452-470. https://doi.org/10.1016/j.rse.2018.06.035

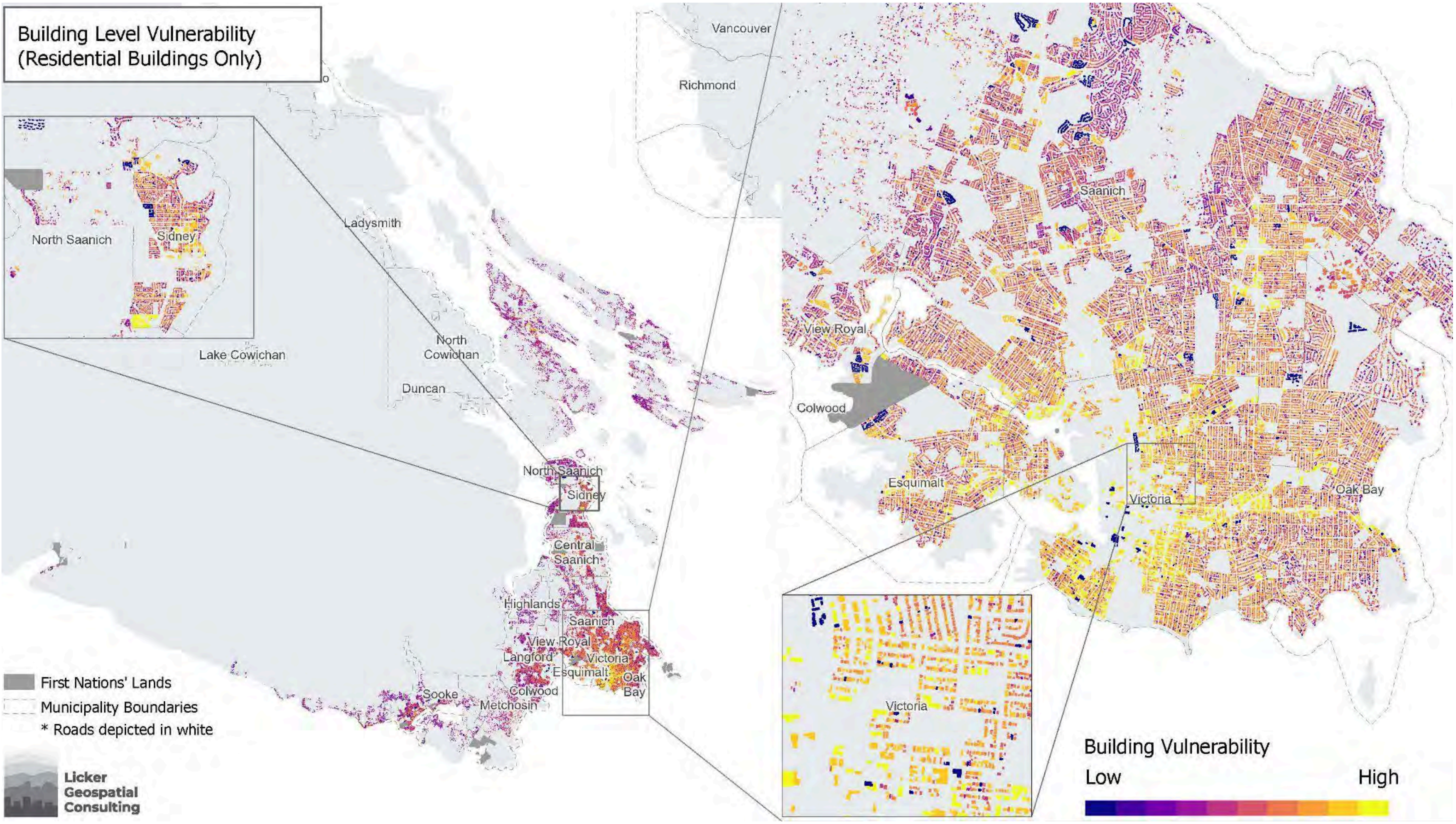
Appendix B - Additional Maps: Sub-Indices



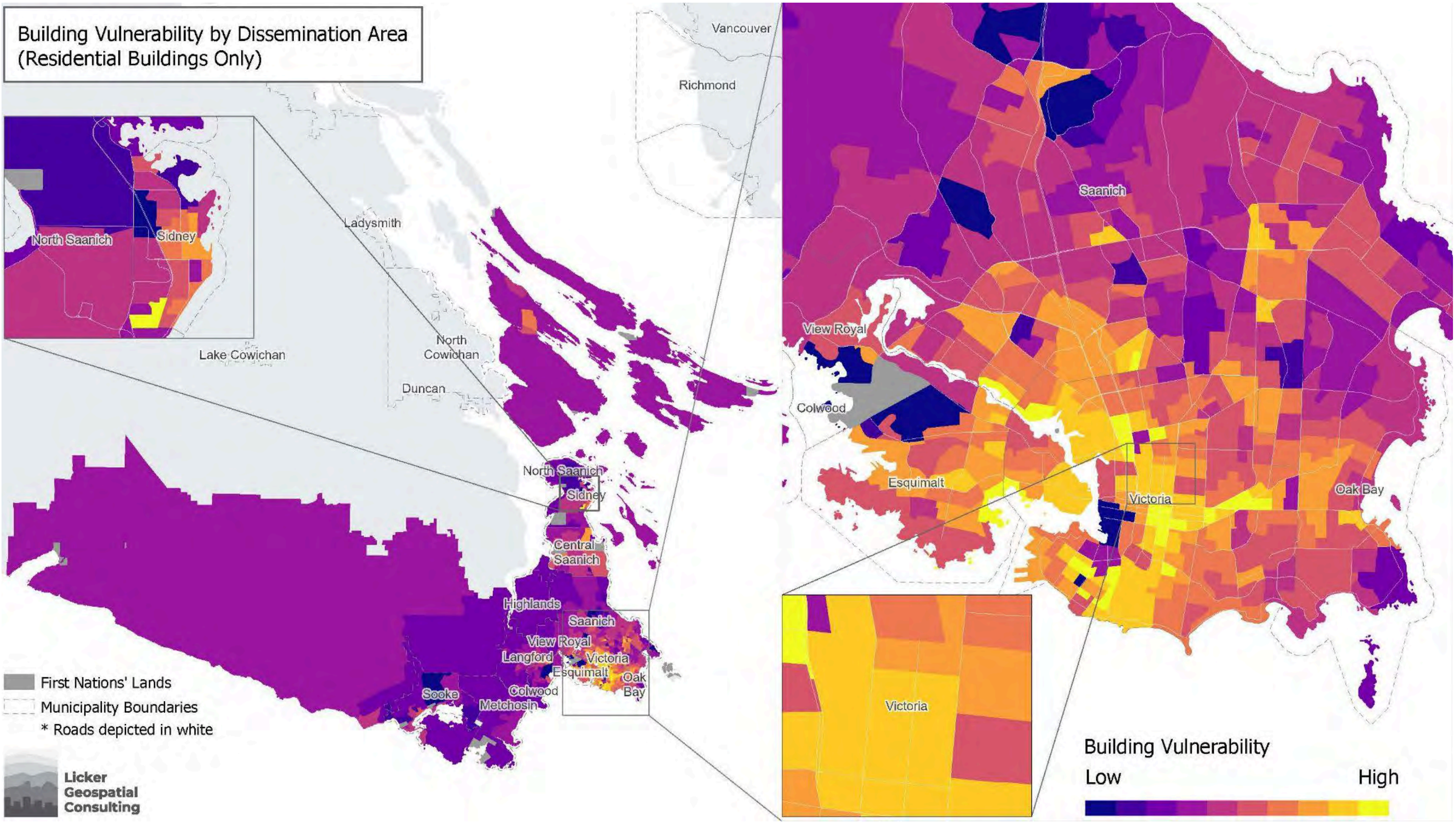
B1. Extreme Heat - Demographic Vulnerability Index without health-related factors.



B2. Extreme Heat - Demographic Vulnerability Index with health-related factors only.



B3. Extreme Heat - Building Vulnerability Index with residential buildings only, by building footprint.



B4. Extreme Heat - Building Vulnerability Index with residential buildings only, by DA.

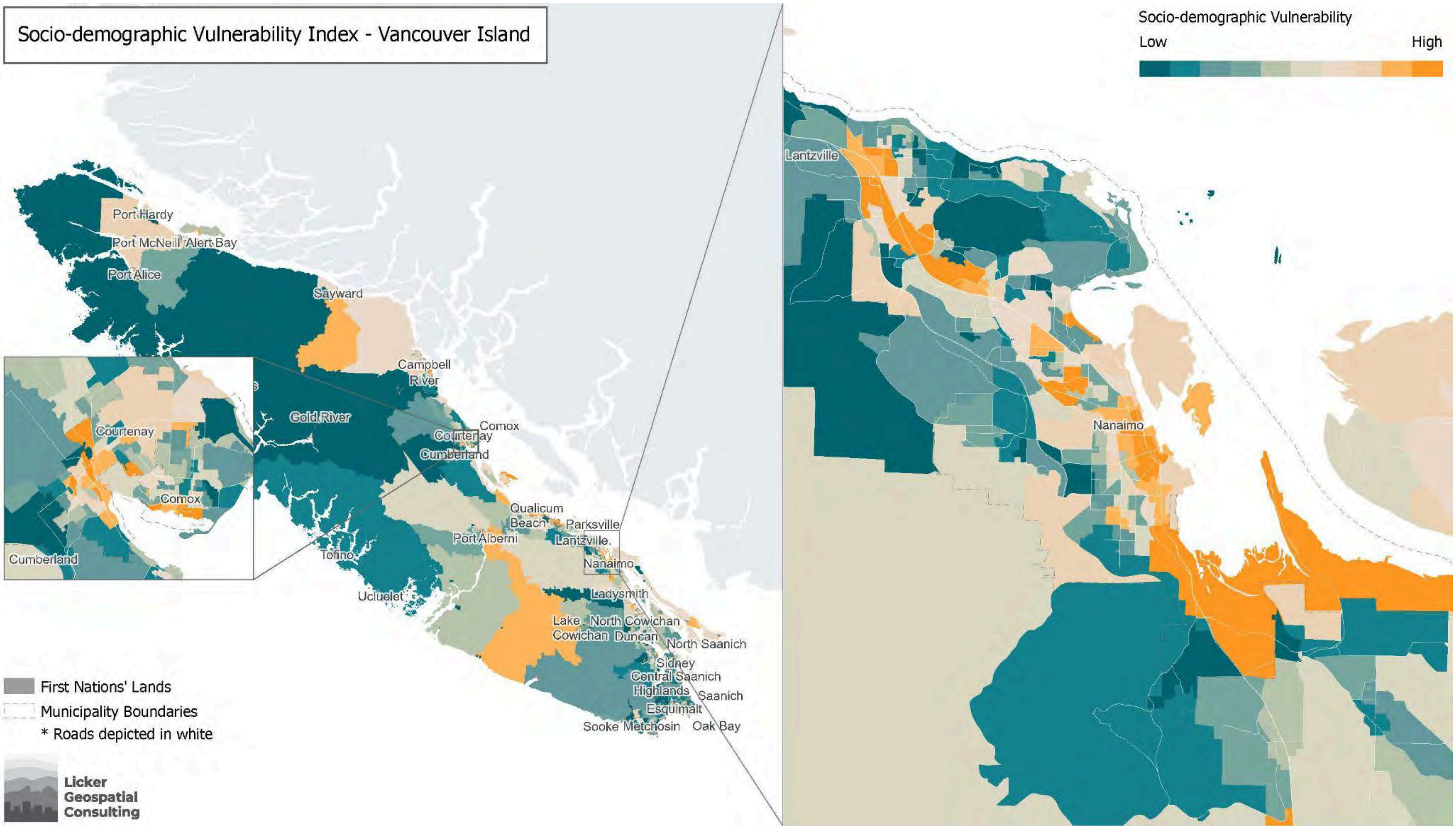


Figure B5. Vancouver Island wide Socio-demographic Vulnerability Index. Used for validation of the index at a greater scale.

Appendix C - Municipality Level Summaries

Extreme Heat Vulnerability Summarised by Community

Licker Geospatial Consulting Co.

2405 East Hastings St
Vancouver BC, V5K 1Y8

City of Colwood

Demographic Vulnerability

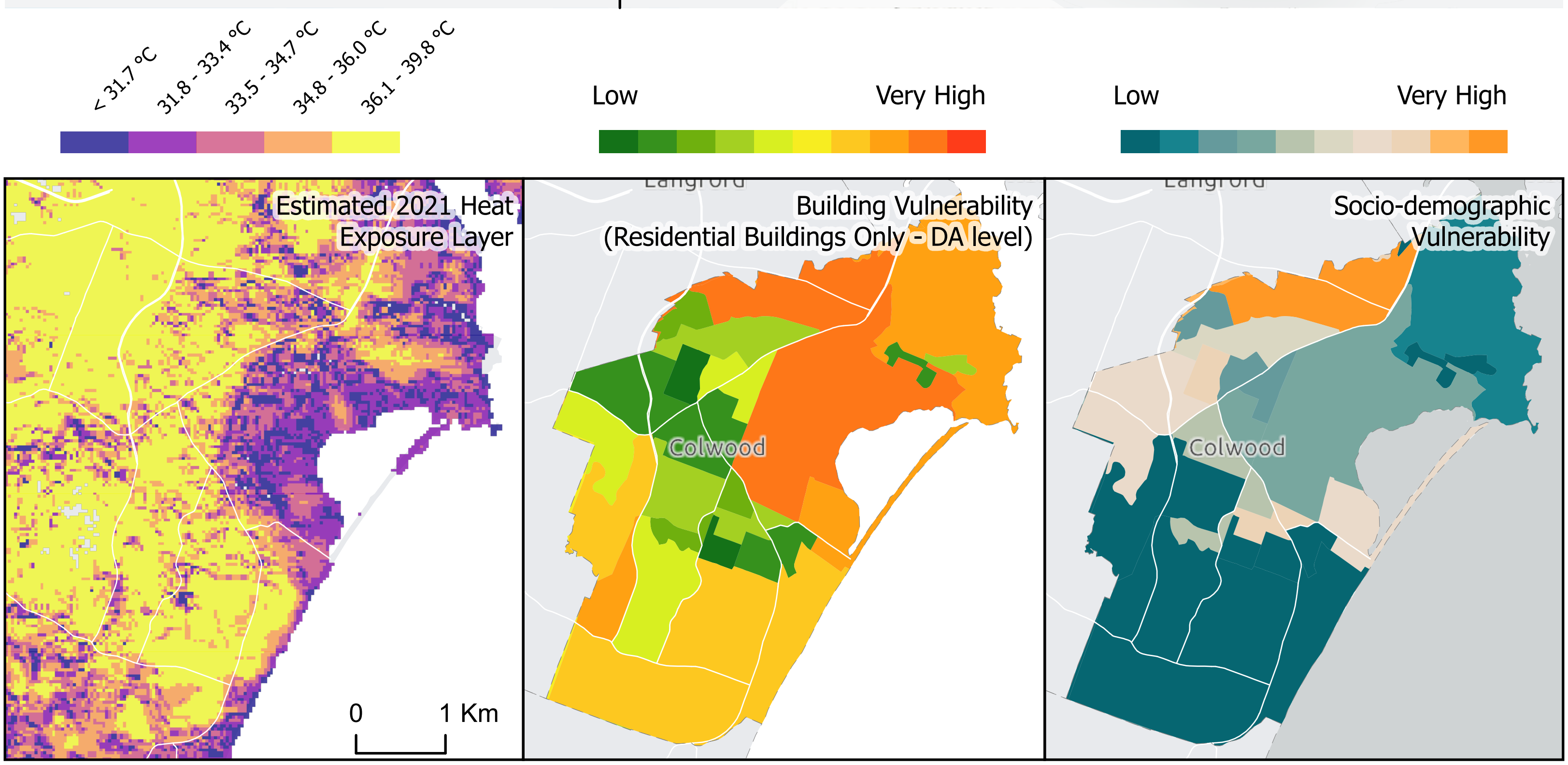
Population 2021	18,961
% population in very high Sociodemographic vulnerability	6.60%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	13.10%
Top contributing demographic factor	Population that are renters (26.7%)
Second contributing demographic factor	Population age 65 or older (19.3%)
Third contributing demographic factor	Has high (secondary) school diploma or equivalency certificate or no diploma or degree (45.3%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Diabetes (Crude Rate)
Third contributing health factor	Hypertension (crude rate)

Building Vulnerability

Total # of residential buildings in the community	5,549
Housing type contribution to building vulnerability	2.00%
Year Built contribution to building vulnerability	22.00%
Albedo contribution to building vulnerability	30.60%
Solar insolation contribution to building vulnerability	31.50%
Building Height contribution to building vulnerability	13.80%
# of buildings with very high demographic & building vuln.	59
# of buildings in very high	476
% of residential buildings in very high	11.80%
Average age of buildings in very high	1981

Heat Exposure

% of community area in very high heat exposure	32%
% of residential buildings with very high heat exposure	56%
# of buildings with very high socio-demographic & heat expo.	54
# of residential buildings highly vulnerable across all 3 indices	14



City of Langford

Demographic Vulnerability

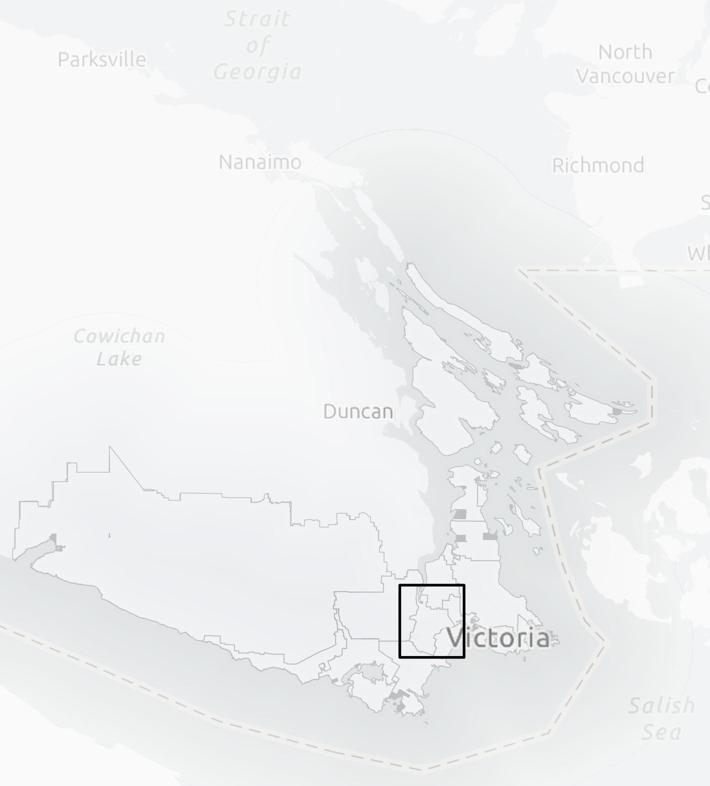
Population 2021	46,584
% population in very high Sociodemographic vulnerability	14.10%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	19.10%
Top contributing demographic factor	Population that are renters (35.2%)
Second contributing demographic factor	Average number of rooms per dwelling (5.6%)
Third contributing demographic factor	Population age 65 or older (13.7%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Asthma (crude rate)
Third contributing health factor	Diabetes (Crude Rate)

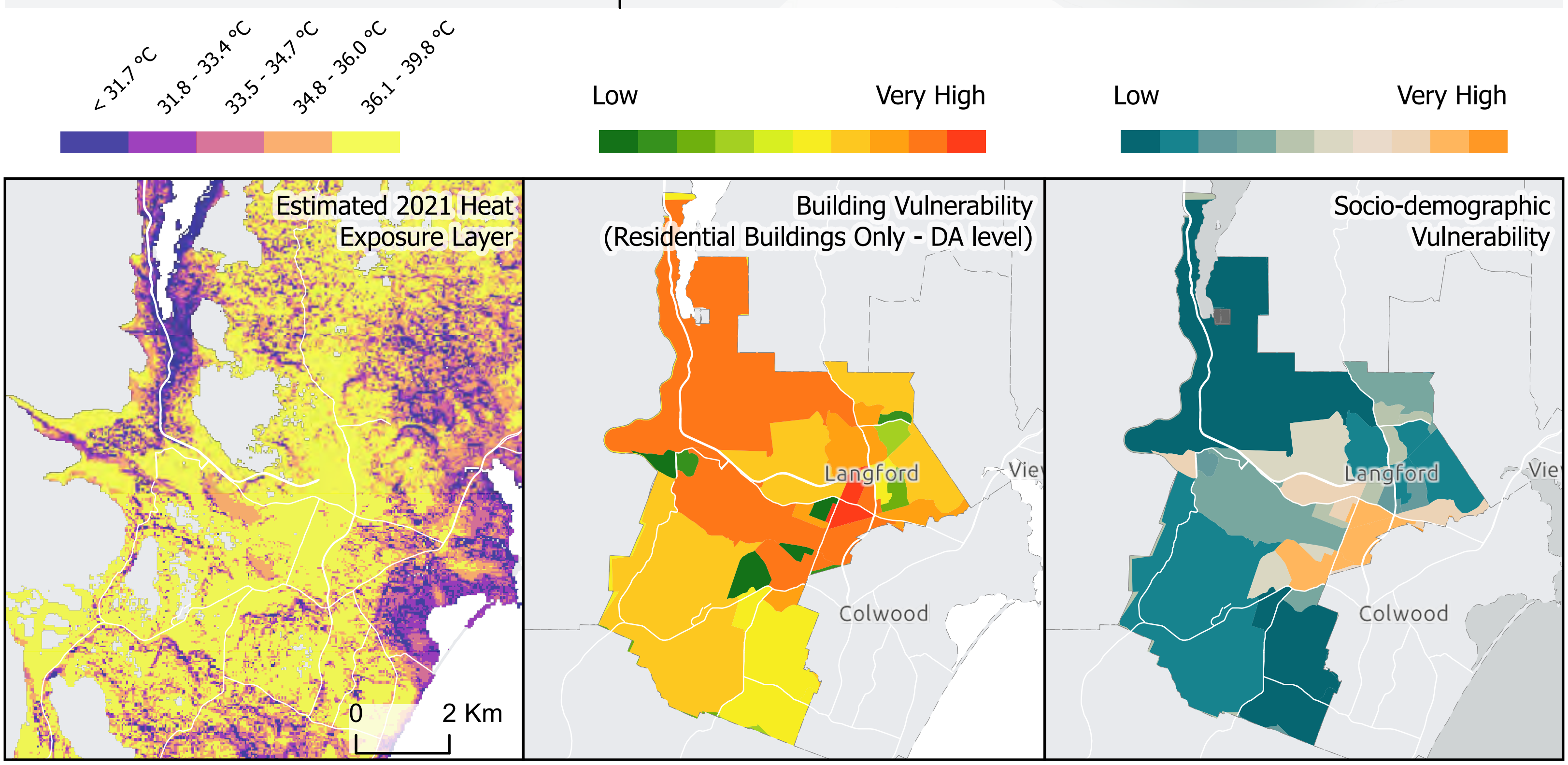
Building Vulnerability

Total # of residential buildings in the community	10,437
Housing type contribution to building vulnerability	2.40%
Year Built contribution to building vulnerability	18.20%
Albedo contribution to building vulnerability	31.60%
Solar insolation contribution to building vulnerability	33.20%
Building Height contribution to building vulnerability	14.60%
# of buildings with very high demographic & building vuln.	110
# of buildings in very high	945
% of residential buildings in very high	11.80%
Average age of buildings in very high	1984

Heat Exposure

% of community area in very high heat exposure	61%
% of residential buildings with very high heat exposure	84%
# of buildings with very high socio-demographic & heat expo.	648
# of residential buildings highly vulnerable across all 3 indices	98





District of Highlands

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

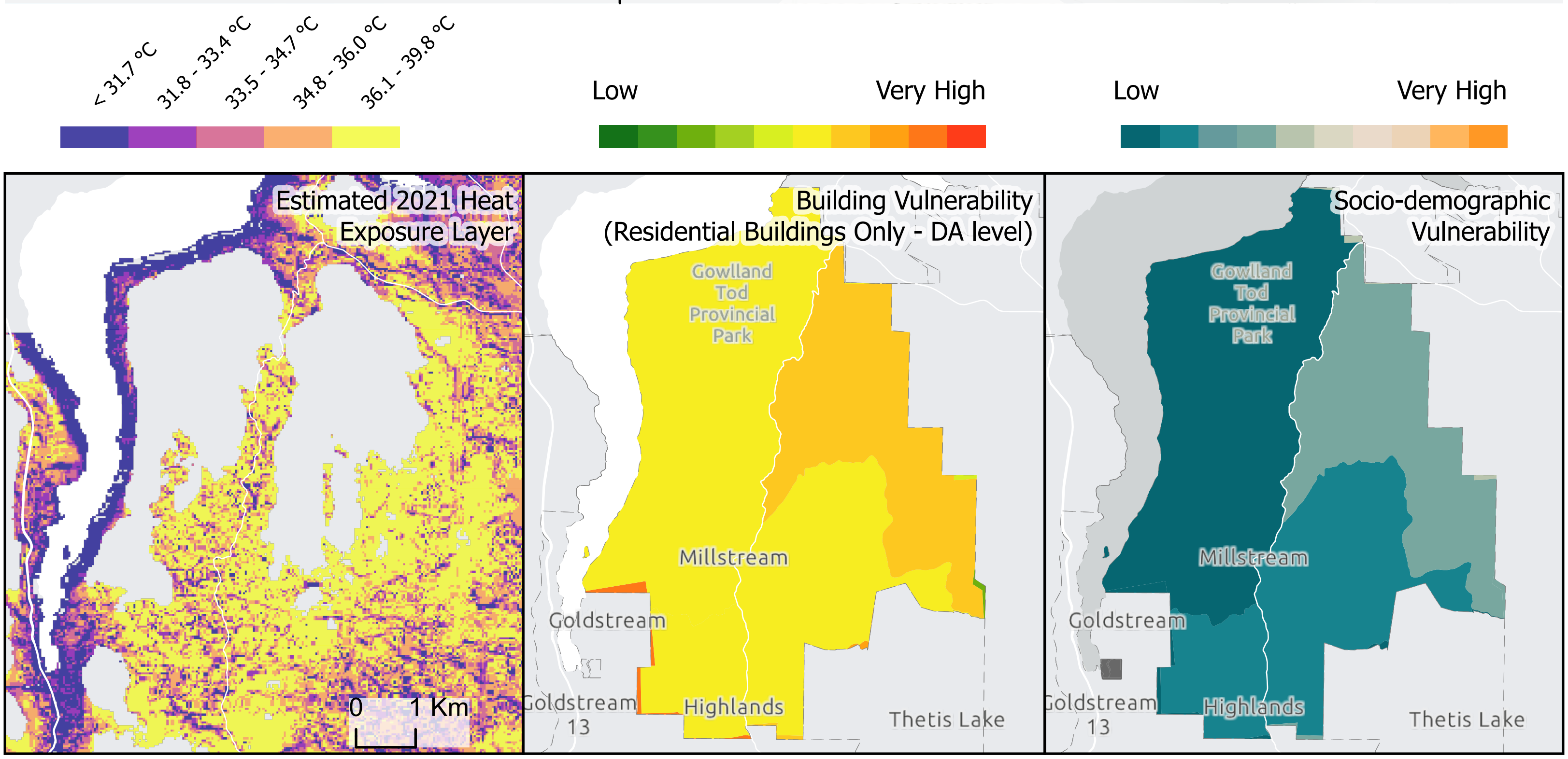
Population 2021	2,482
% population in very high Sociodemographic vulnerability	0%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	0%
Top contributing demographic factor	Population age 65 or older (18.1%)
Second contributing demographic factor	Outdoor Workers - Trades, transport and equipment operators and related occupations (27.1%)
Third contributing demographic factor	Has high (secondary) school diploma or equivalency certificate or no diploma or degree (42.9%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Hypertension (crude rate)
Third contributing health factor	Asthma (crude rate)

Building Vulnerability

Total # of residential buildings in the community	1,432
Housing type contribution to building vulnerability	0.60%
Year Built contribution to building vulnerability	22.00%
Albedo contribution to building vulnerability	34.90%
Solar insolation contribution to building vulnerability	23.90%
Building Height contribution to building vulnerability	18.50%
# of buildings with very high demographic & building vuln.	nan
# of buildings in very high	15
% of residential buildings in very high	11.80%
Average age of buildings in very high	1969

Heat Exposure

% of community area in very high heat exposure	49%
% of residential buildings with very high heat exposure	48%
# of buildings with very high socio-demographic & heat expo.	0
# of residential buildings highly vulnerable across all 3 indices	0



District of Metchosin

Demographic Vulnerability

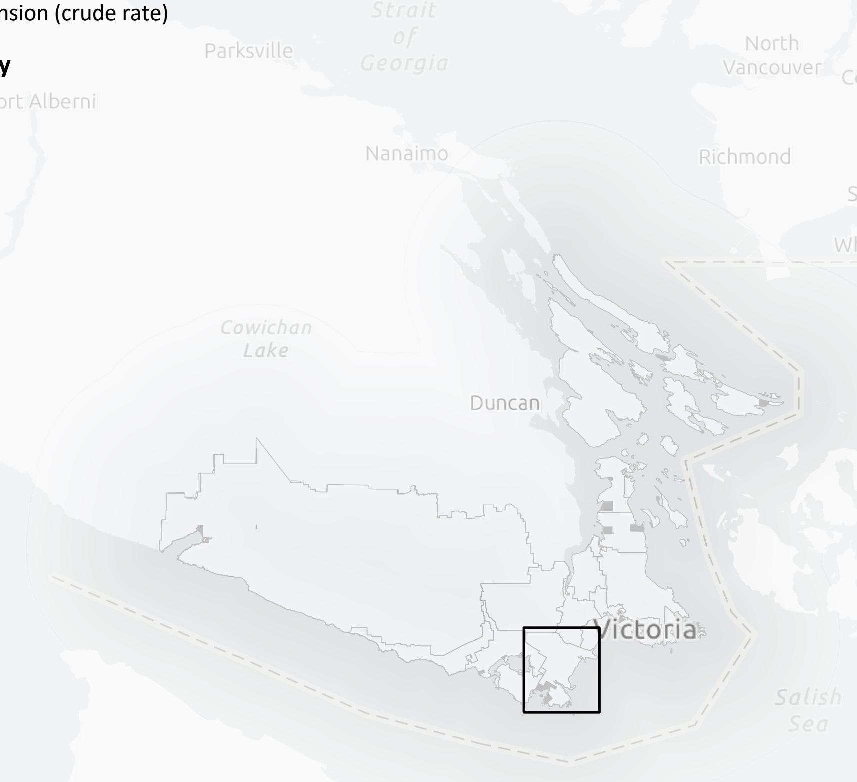
Population 2021	5,067
% population in very high Sociodemographic vulnerability	0%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	0%
Top contributing demographic factor	Population age 65 or older (26%)
Second contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (24.3%)
Third contributing demographic factor	Outdoor Workers - Trades, transport and equipment operators and related occupations (22.9%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Acute Myocardial Infarction (Crude Rate)
Third contributing health factor	Hypertension (crude rate)

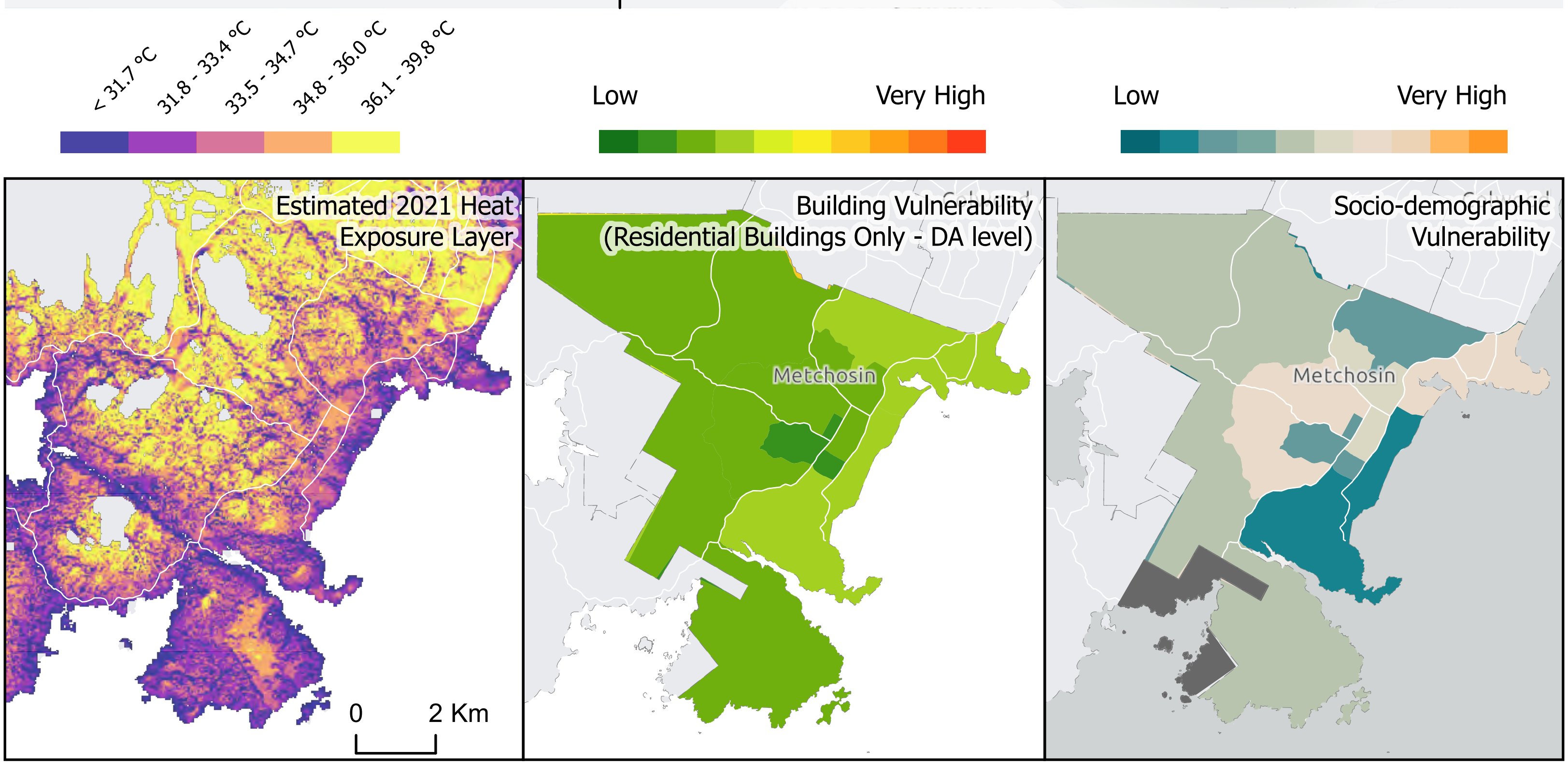
Building Vulnerability

Total # of residential buildings in the community	1,912
Housing type contribution to building vulnerability	2.60%
Year Built contribution to building vulnerability	24.00%
Albedo contribution to building vulnerability	29.10%
Solar insolation contribution to building vulnerability	30.50%
Building Height contribution to building vulnerability	13.90%
# of buildings with very high demographic & building vuln.	nan
# of buildings in very high	133
% of residential buildings in very high	11.80%
Average age of buildings in very high	1968

Heat Exposure

% of community area in very high heat exposure	18%
% of residential buildings with very high heat exposure	12%
# of buildings with very high socio-demographic & heat expo.	0
# of residential buildings highly vulnerable across all 3 indices	0





District of North Saanich

Demographic Vulnerability

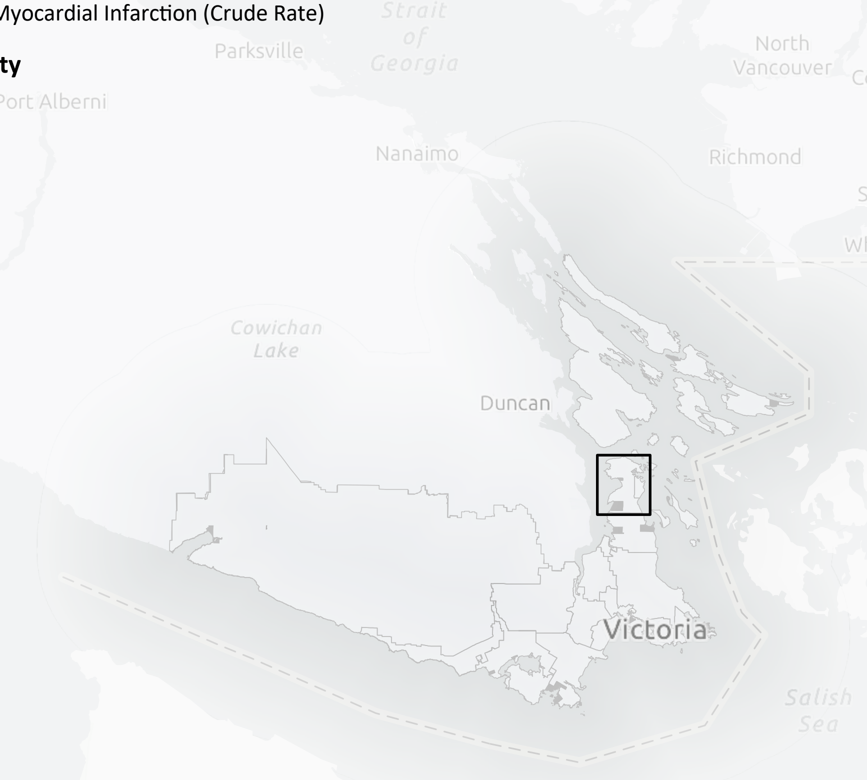
Population 2021	12,235
% population in very high Sociodemographic vulnerability	0%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	5.20%
Top contributing demographic factor	Population age 65 or older (34.7%)
Second contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (27.3%)
Third contributing demographic factor	Private households by age of primary household maintainers - 75 years and over (15.9%)
Top contributing health factor	Hypertension (crude rate)
Second contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Third contributing health factor	Acute Myocardial Infarction (Crude Rate)

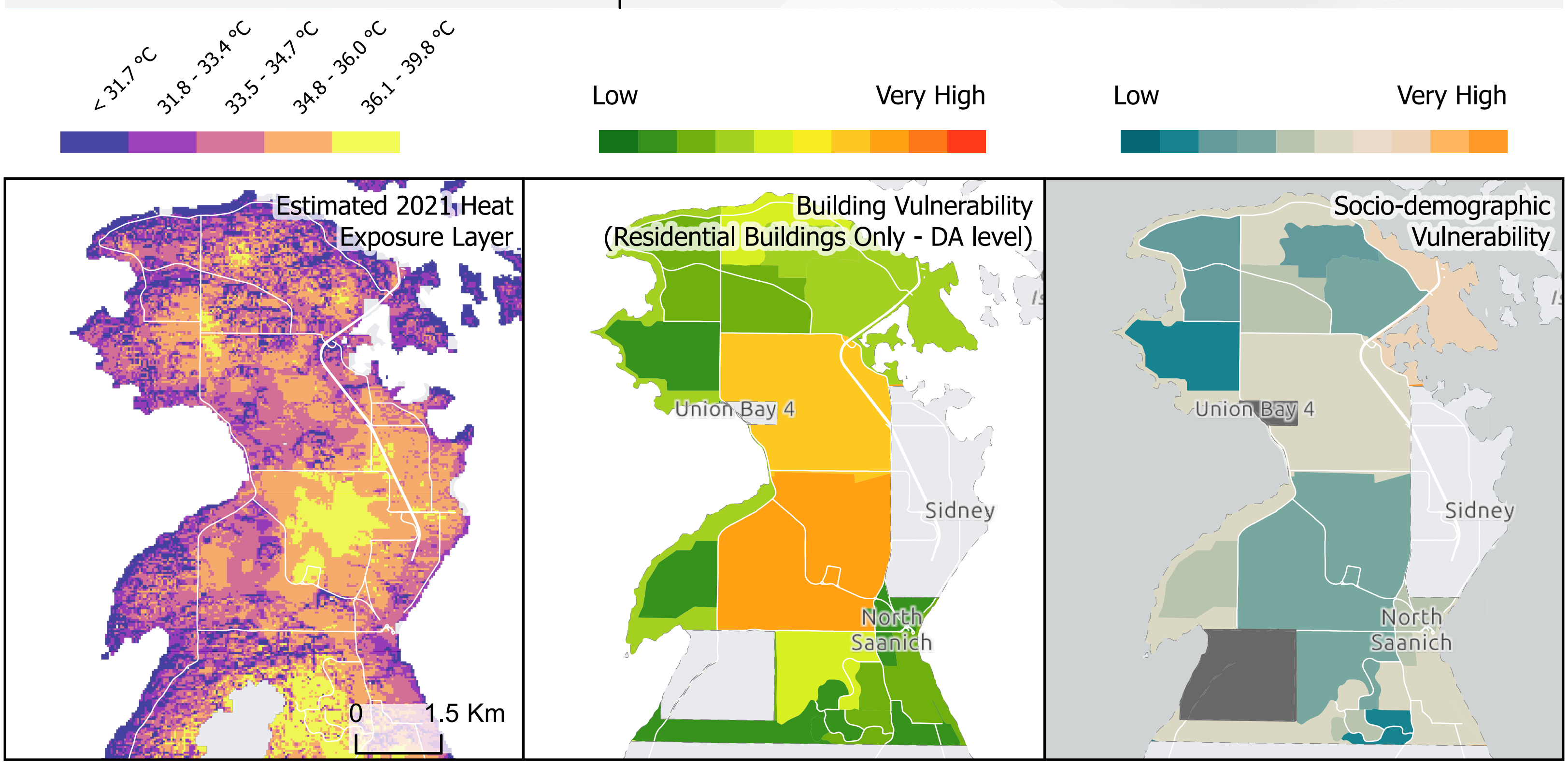
Building Vulnerability

Total # of residential buildings in the community	5,788
Housing type contribution to building vulnerability	0.90%
Year Built contribution to building vulnerability	23.80%
Albedo contribution to building vulnerability	31.00%
Solar insolation contribution to building vulnerability	29.40%
Building Height contribution to building vulnerability	14.80%
# of buildings with very high demographic & building vuln.	nan
# of buildings in very high	270
% of residential buildings in very high	11.80%
Average age of buildings in very high	1968

Heat Exposure

% of community area in very high heat exposure	6%
% of residential buildings with very high heat exposure	10%
# of buildings with very high socio-demographic & heat expo.	0
# of residential buildings highly vulnerable across all 3 indices	0





District of Sooke

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

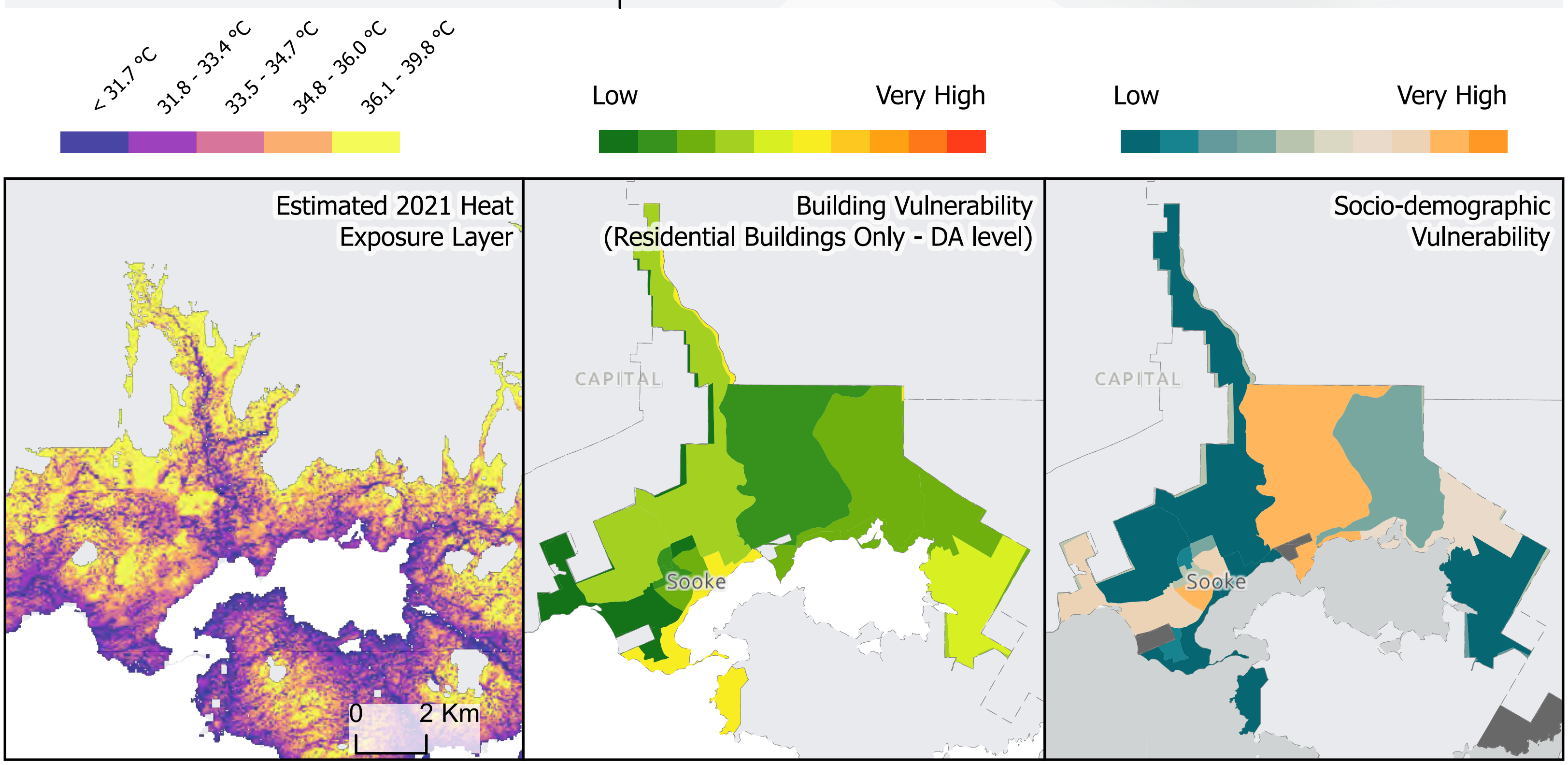
Population 2021	15,086
% population in very high Sociodemographic vulnerability	17.00%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	28.20%
Top contributing demographic factor	Population age 65 or older (20.3%)
Second contributing demographic factor	Has high (secondary) school diploma or equivalency certificate or no diploma or degree (45.9%)
Third contributing demographic factor	Outdoor Workers - Trades, transport and equipment operators and related occupations (23.2%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Chronic Obstructive Pulmonary Disease (Crude Rate)
Third contributing health factor	Hypertension (crude rate)

Building Vulnerability

Total # of residential buildings in the community	6,251
Housing type contribution to building vulnerability	5.60%
Year Built contribution to building vulnerability	19.40%
Albedo contribution to building vulnerability	29.70%
Solar insolation contribution to building vulnerability	31.60%
Building Height contribution to building vulnerability	13.70%
# of buildings with very high demographic & building vuln.	157
# of buildings in very high	753
% of residential buildings in very high	11.80%
Average age of buildings in very high	1991

Heat Exposure

% of community area in very high heat exposure	17%
% of residential buildings with very high heat exposure	15%
# of buildings with very high socio-demographic & heat expo.	9
# of residential buildings highly vulnerable across all 3 indices	0



Juan de Fuca Electoral Area (Part 1)

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

Population 2021	5,132
% population in very high Sociodemographic vulnerability	13.90%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	13.90%
Top contributing demographic factor	Population age 65 or older (20%)
Second contributing demographic factor	Has high (secondary) school diploma or equivalency certificate or no diploma or degree (25%)
Third contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (26.1%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Acute Myocardial Infarction (Crude Rate)
Third contributing health factor	Hypertension (crude rate)

Building Vulnerability

Total # of residential buildings in the community	3,040
Housing type contribution to building vulnerability	0.50%
Year Built contribution to building vulnerability	21.60%
Albedo contribution to building vulnerability	31.80%
Solar insolation contribution to building vulnerability	33.60%
Building Height contribution to building vulnerability	12.60%
# of buildings with very high demographic & building vuln.	114
# of buildings in very high	203
% of residential buildings in very high	11.80%
Average age of buildings in very high	1980

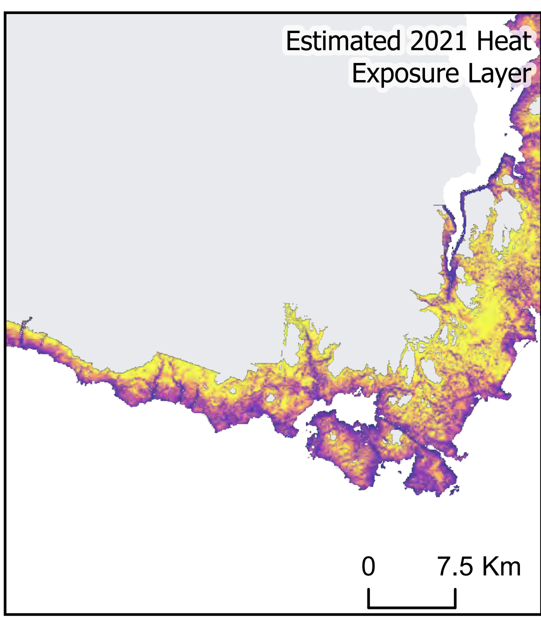
Heat Exposure

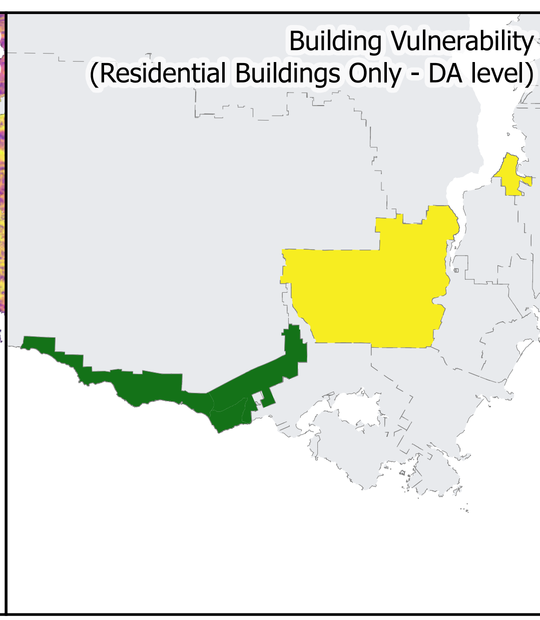
% of community area in very high heat exposure	19%
% of residential buildings with very high heat exposure	8%
# of buildings with very high socio-demographic & heat expo.	0
# of residential buildings highly vulnerable across all 3 indices	0

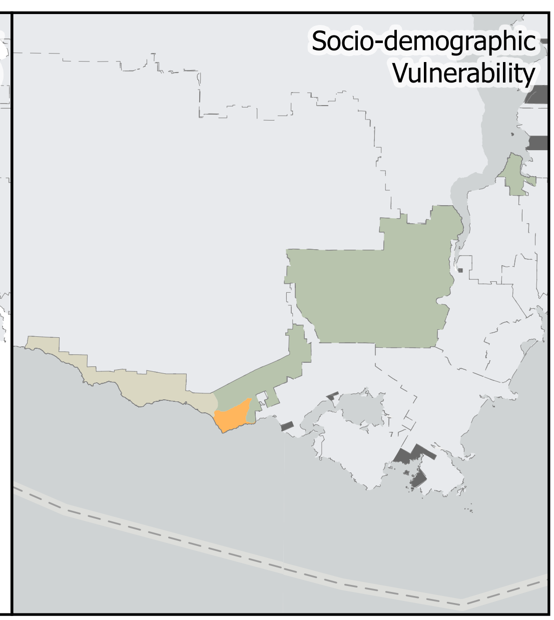
< 31.7 °C | 31.8 - 33.4 °C | 33.5 - 34.7 °C | 34.8 - 36.0 °C | 36.1 - 39.8 °C

Low — Very High

Low — Very High







Juan de Fuca Electoral Area (Part 2)

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

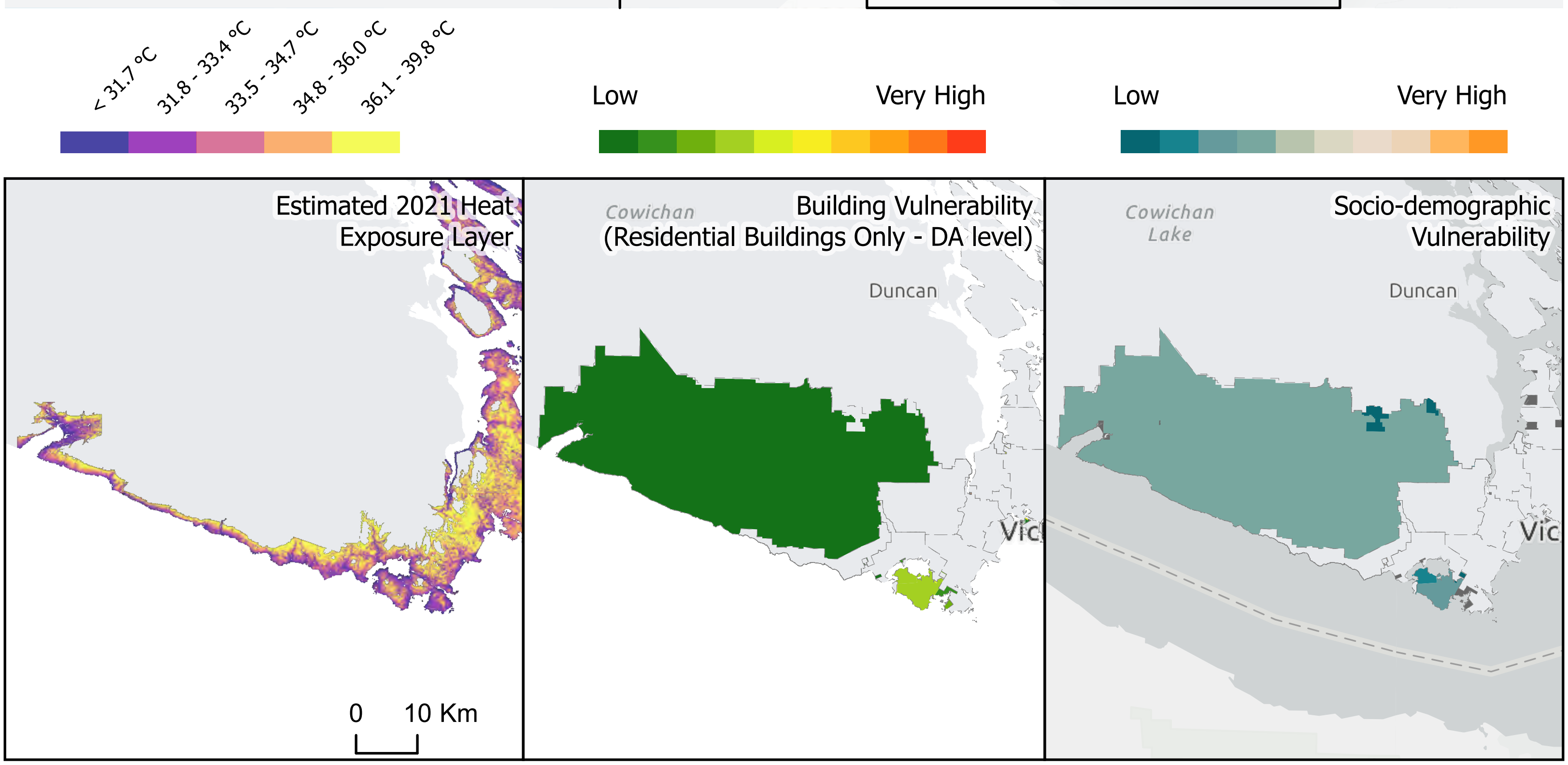
Population 2021	399
% population in very high Sociodemographic vulnerability	0.00%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	0%
Top contributing demographic factor	Average number of rooms per dwelling (6.6%)
Second contributing demographic factor	Population age 65 or older (24.1%)
Third contributing demographic factor	Living alone (10.5%)
Top contributing health factor	Chronic Obstructive Pulmonary Disease (Crude Rate)
Second contributing health factor	Acute Myocardial Infarction (Crude Rate)
Third contributing health factor	Asthma (crude rate)

Building Vulnerability

Total # of residential buildings in the community	438
Housing type contribution to building vulnerability	1.70%
Year Built contribution to building vulnerability	25.60%
Albedo contribution to building vulnerability	34.20%
Solar insolation contribution to building vulnerability	38.60%
Building Height contribution to building vulnerability	0.00%
# of buildings with very high demographic & building vuln.	nan
# of buildings in very high	21
% of residential buildings in very high	11.80%
Average age of buildings in very high	1980

Heat Exposure

% of community area in very high heat exposure	39%
% of residential buildings with very high heat exposure	5%
# of buildings with very high socio-demographic & heat expo.	0
# of residential buildings highly vulnerable across all 3 indices	0



Salt Spring Island Electoral Area

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

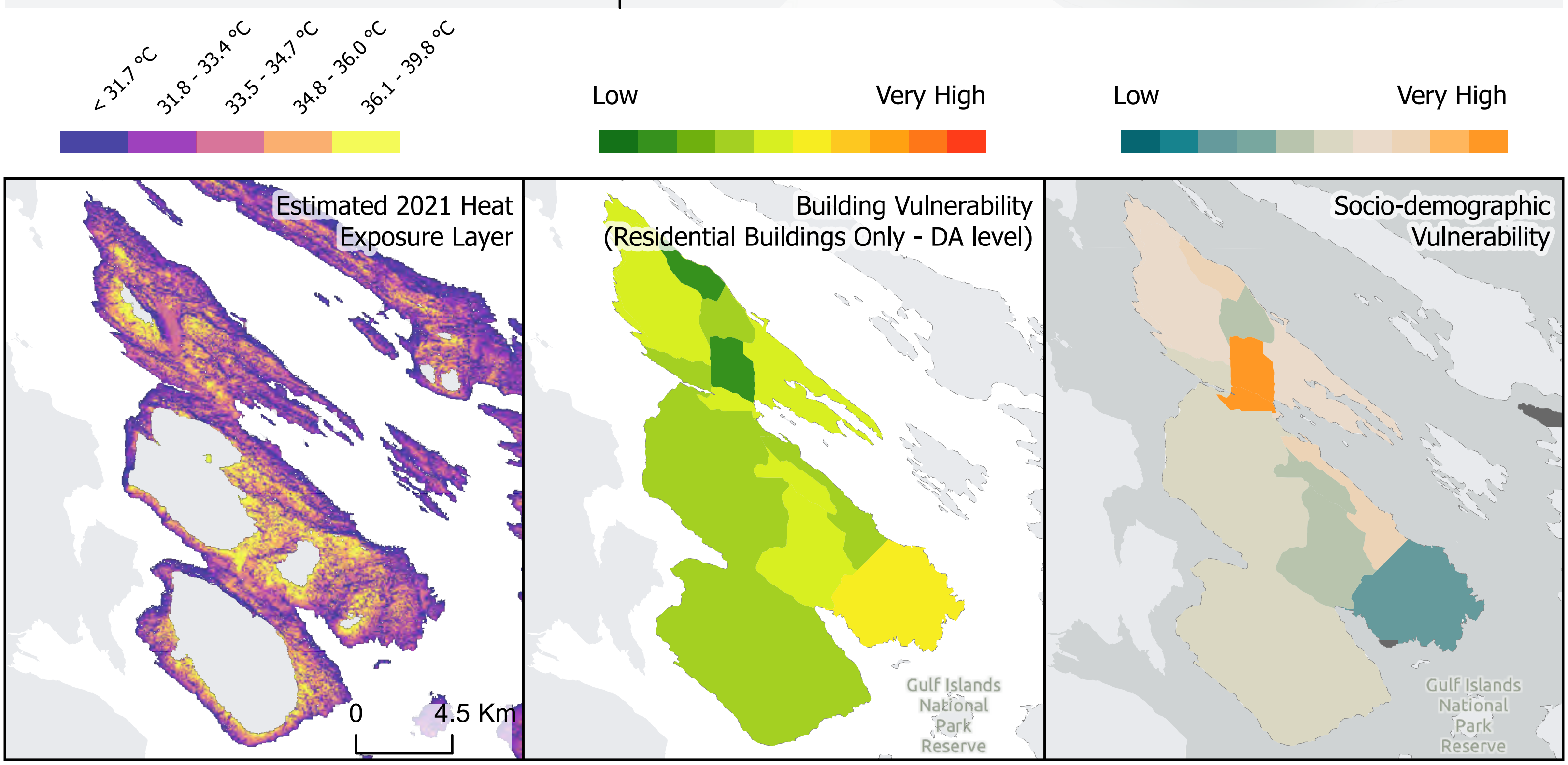
Population 2021	11,635
% population in very high Sociodemographic vulnerability	13.40%
% population in very high demographic-only vulnerability	13.40%
% population in very high Health vulnerability	13.40%
Top contributing demographic factor	Population age 65 or older (34.8%)
Second contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (28.4%)
Third contributing demographic factor	Average number of rooms per dwelling (6.1%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Chronic Obstructive Pulmonary Disease (Crude Rate)
Third contributing health factor	Hypertension (crude rate)

Building Vulnerability

Total # of residential buildings in the community	7,212
Housing type contribution to building vulnerability	2.80%
Year Built contribution to building vulnerability	22.30%
Albedo contribution to building vulnerability	28.60%
Solar insolation contribution to building vulnerability	31.80%
Building Height contribution to building vulnerability	14.50%
# of buildings with very high demographic & building vuln.	303
# of buildings in very high	651
% of residential buildings in very high	11.80%
Average age of buildings in very high	1976

Heat Exposure

% of community area in very high heat exposure	7%
% of residential buildings with very high heat exposure	6%
# of buildings with very high socio-demographic & heat expo.	78
# of residential buildings highly vulnerable across all 3 indices	74



Southern Gulf Islands Electoral Area

Demographic Vulnerability

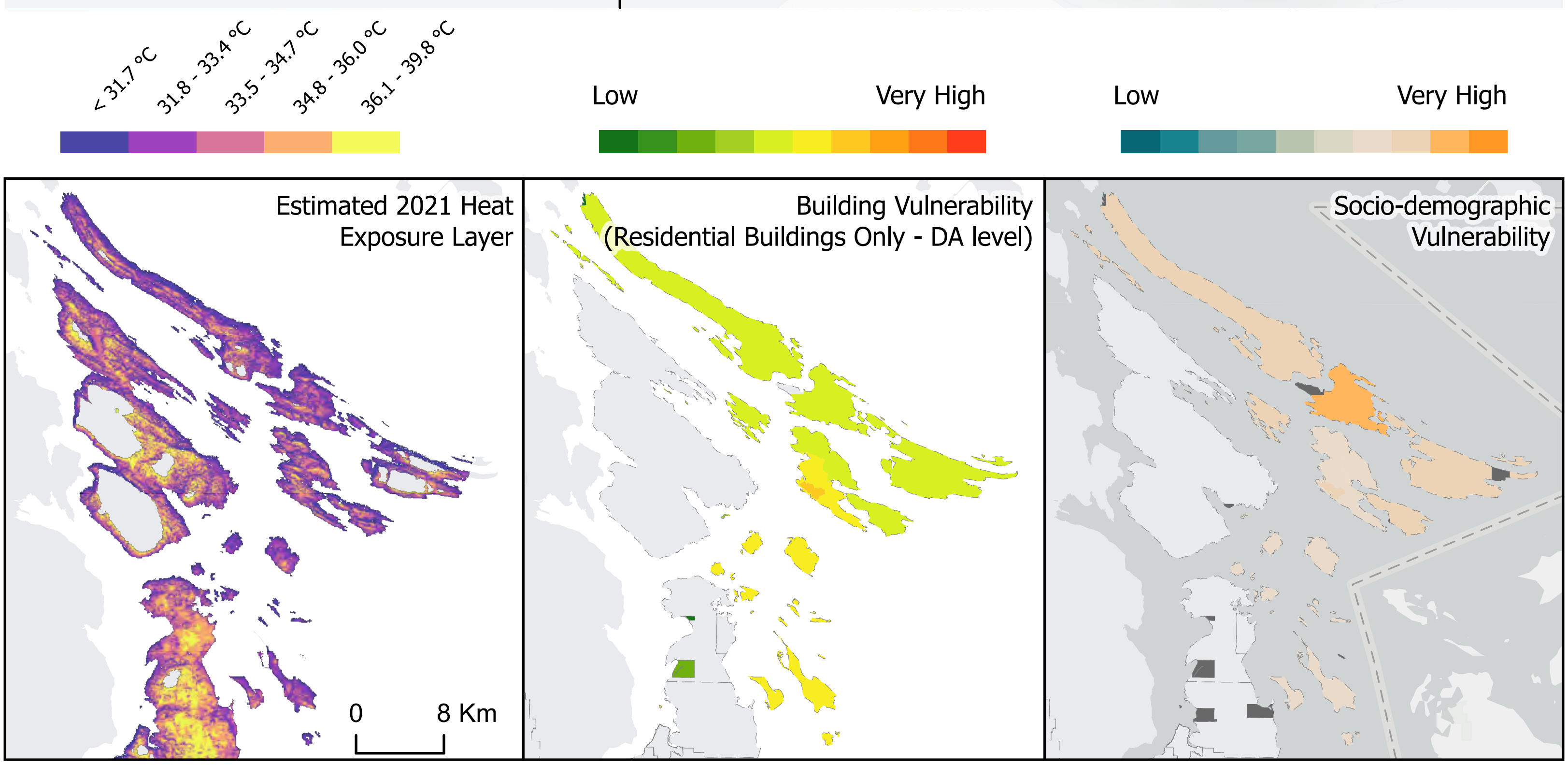
Population 2021	6,101
% population in very high Sociodemographic vulnerability	21.40%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	21.40%
Top contributing demographic factor	Population age 65 or older (42.4%)
Second contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (33.5%)
Third contributing demographic factor	Average number of rooms per dwelling (5.5%)
Top contributing health factor	Hypertension (crude rate)
Second contributing health factor	Acute Myocardial Infarction (Crude Rate)
Third contributing health factor	Chronic Obstructive Pulmonary Disease (Crude Rate)

Building Vulnerability

Total # of residential buildings in the community	6,329
Housing type contribution to building vulnerability	1.40%
Year Built contribution to building vulnerability	22.40%
Albedo contribution to building vulnerability	29.20%
Solar insolation contribution to building vulnerability	31.80%
Building Height contribution to building vulnerability	15.20%
# of buildings with very high demographic & building vuln.	59
# of buildings in very high	271
% of residential buildings in very high	11.80%
Average age of buildings in very high	1970

Heat Exposure

% of community area in very high heat exposure	1%
% of residential buildings with very high heat exposure	0%
# of buildings with very high socio-demographic & heat expo.	8
# of residential buildings highly vulnerable across all 3 indices	0



The Corporation of the City of Victoria

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

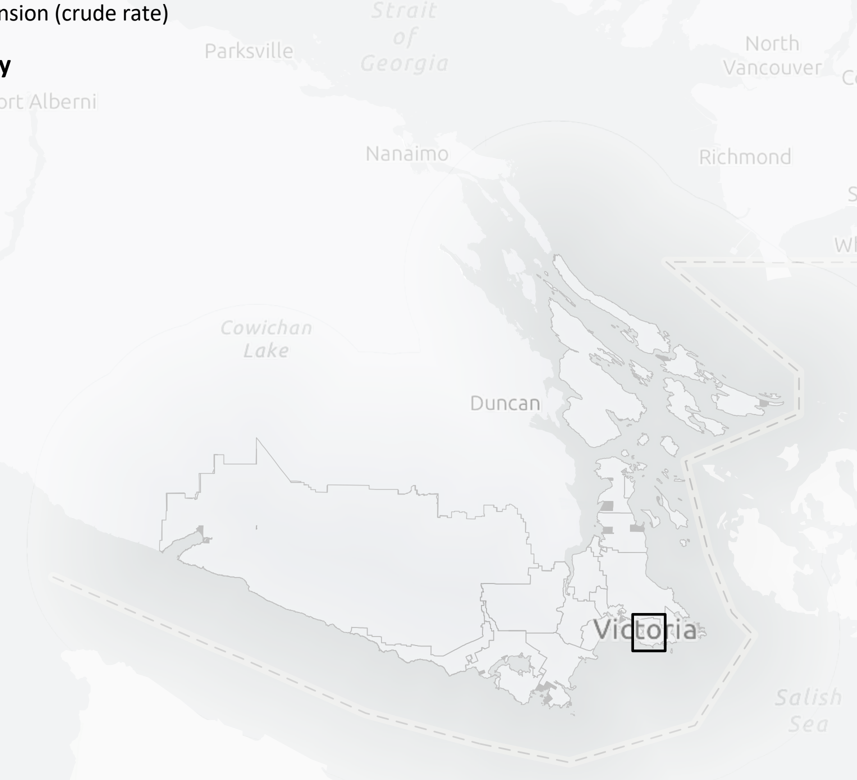
Population 2021	91,867
% population in very high Sociodemographic vulnerability	34.70%
% population in very high demographic-only vulnerability	57.00%
% population in very high Health vulnerability	25.80%
Top contributing demographic factor	Population that are renters (60.5%)
Second contributing demographic factor	Living alone (27.4%)
Third contributing demographic factor	Population age 65 or older (23.2%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Chronic Obstructive Pulmonary Disease (Crude Rate)
Third contributing health factor	Hypertension (crude rate)

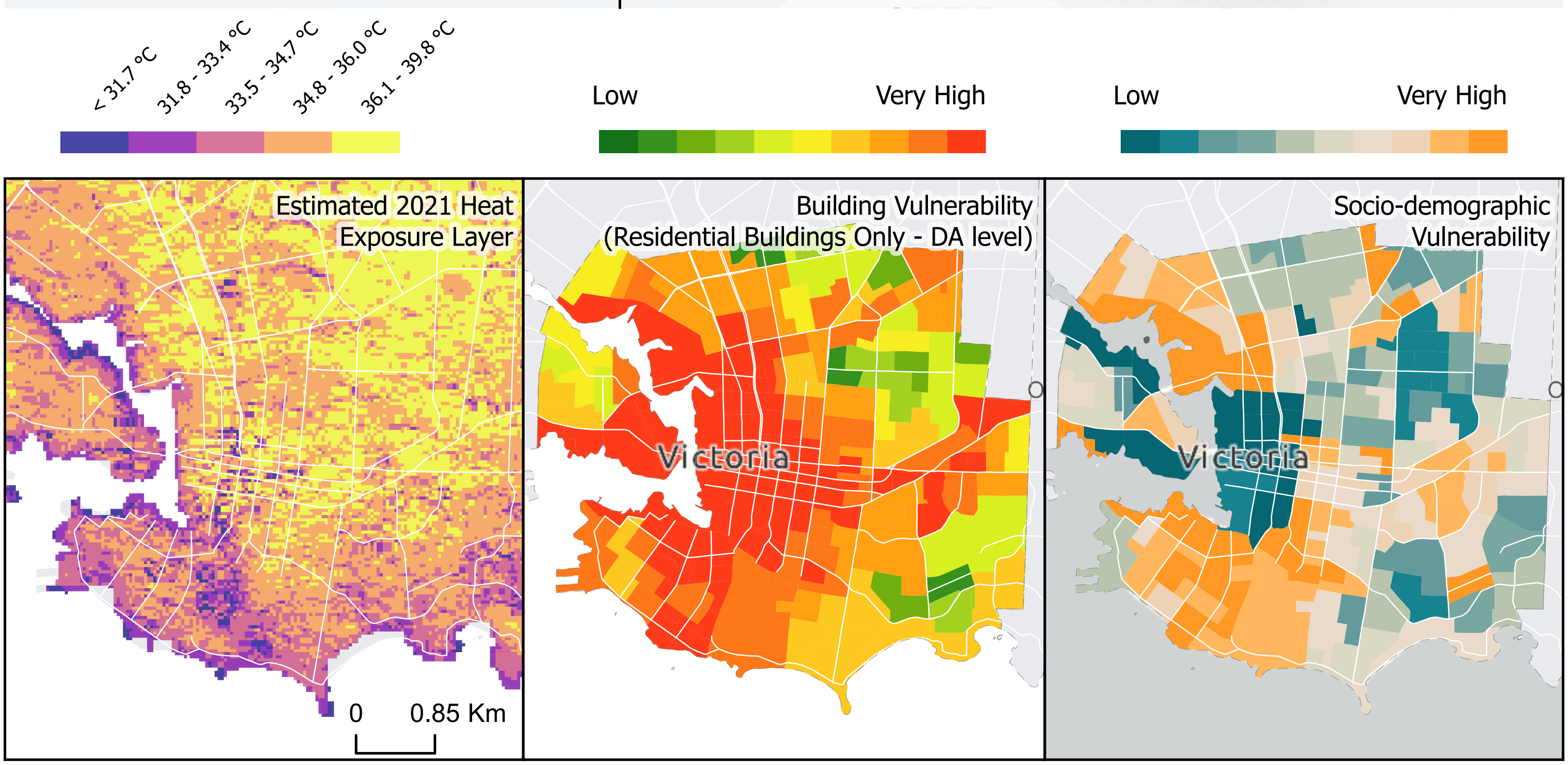
Building Vulnerability

Total # of residential buildings in the community	13,753
Housing type contribution to building vulnerability	5.80%
Year Built contribution to building vulnerability	23.40%
Albedo contribution to building vulnerability	28.00%
Solar insolation contribution to building vulnerability	28.80%
Building Height contribution to building vulnerability	14.10%
# of buildings with very high demographic & building vuln.	1,774
# of buildings in very high	7,583
% of residential buildings in very high	11.80%
Average age of buildings in very high	1941

Heat Exposure

% of community area in very high heat exposure	16%
% of residential buildings with very high heat exposure	19%
# of buildings with very high socio-demographic & heat expo.	485
# of residential buildings highly vulnerable across all 3 indices	229





The Corporation of the District of Central Saanich

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

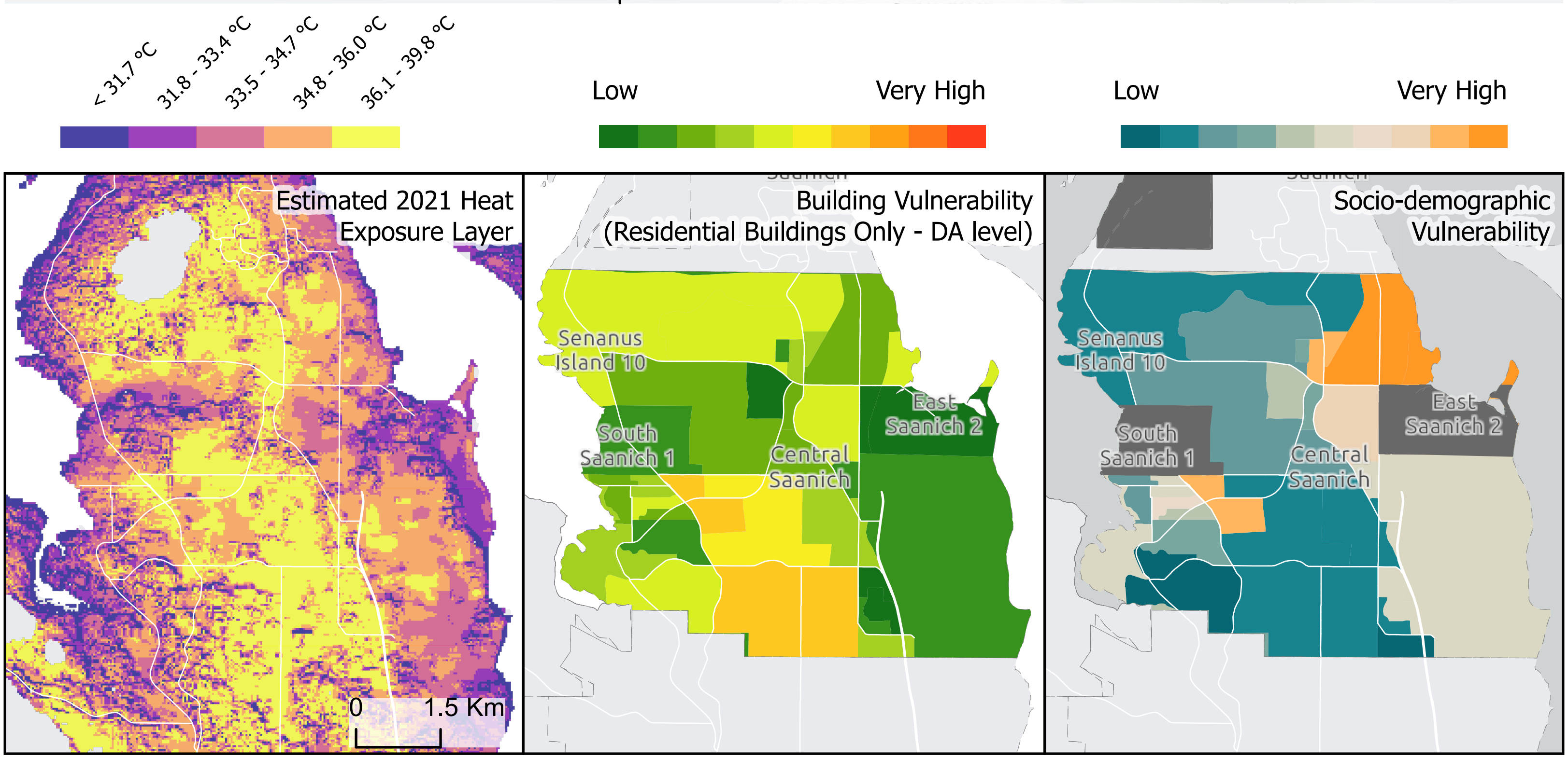
Population 2021	17,385
% population in very high Sociodemographic vulnerability	17.70%
% population in very high demographic-only vulnerability	5.20%
% population in very high Health vulnerability	21.10%
Top contributing demographic factor	Population age 65 or older (27.2%)
Second contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (23.3%)
Third contributing demographic factor	Population that are renters (20.1%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Hypertension (crude rate)
Third contributing health factor	Acute Myocardial Infarction (Crude Rate)

Building Vulnerability

Total # of residential buildings in the community	5,908
Housing type contribution to building vulnerability	2.30%
Year Built contribution to building vulnerability	23.40%
Albedo contribution to building vulnerability	29.80%
Solar insolation contribution to building vulnerability	30.90%
Building Height contribution to building vulnerability	13.70%
# of buildings with very high demographic & building vuln.	113
# of buildings in very high	742
% of residential buildings in very high	11.80%
Average age of buildings in very high	1972

Heat Exposure

% of community area in very high heat exposure	25%
% of residential buildings with very high heat exposure	43%
# of buildings with very high socio-demographic & heat expo.	324
# of residential buildings highly vulnerable across all 3 indices	60



The Corporation of the District of Oak Bay

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

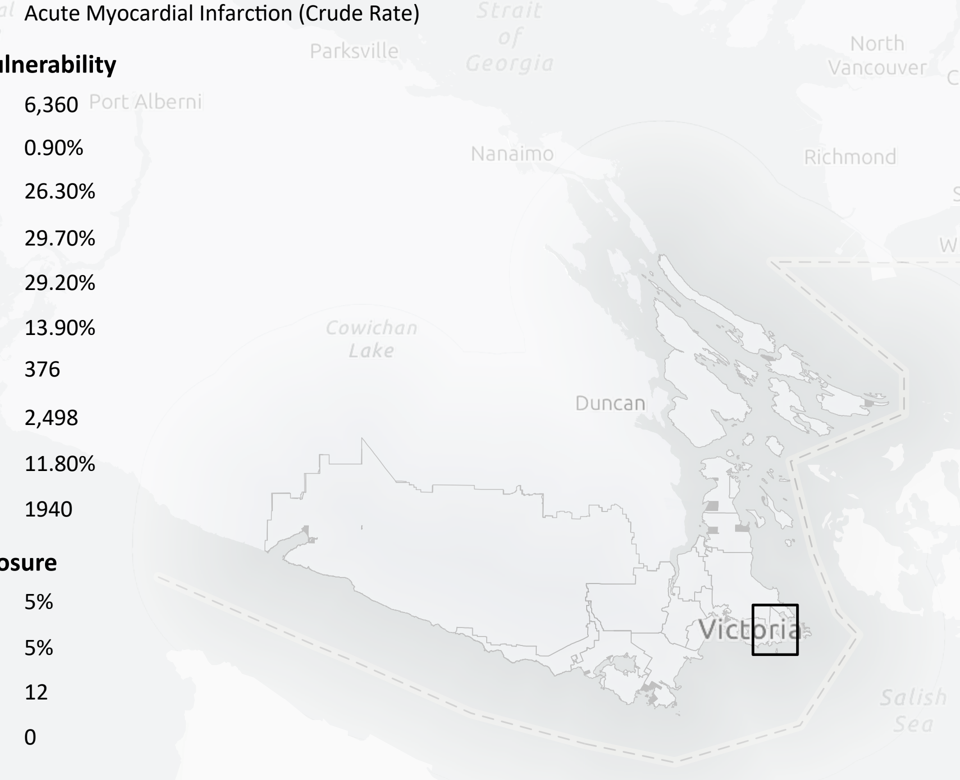
Population 2021	17,990
% population in very high Sociodemographic vulnerability	21.70%
% population in very high demographic-only vulnerability	29.00%
% population in very high Health vulnerability	18.90%
Top contributing demographic factor	Population age 65 or older (34.2%)
Second contributing demographic factor	Housing Built Before 1960 (59%)
Third contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (25.7%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Hypertension (crude rate)
Third contributing health factor	Acute Myocardial Infarction (Crude Rate)

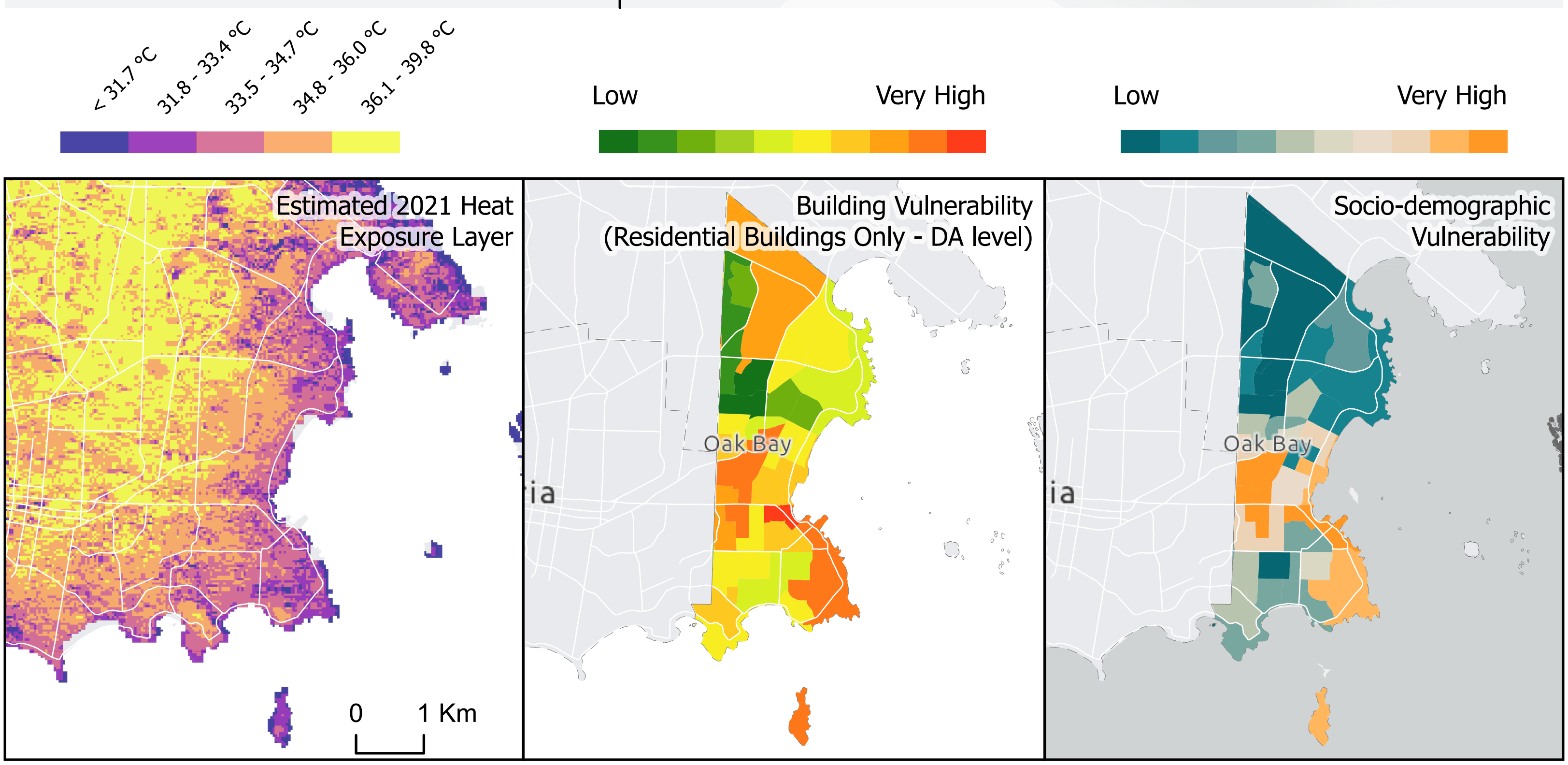
Building Vulnerability

Total # of residential buildings in the community	6,360
Housing type contribution to building vulnerability	0.90%
Year Built contribution to building vulnerability	26.30%
Albedo contribution to building vulnerability	29.70%
Solar insolation contribution to building vulnerability	29.20%
Building Height contribution to building vulnerability	13.90%
# of buildings with very high demographic & building vuln.	376
# of buildings in very high	2,498
% of residential buildings in very high	11.80%
Average age of buildings in very high	1940

Heat Exposure

% of community area in very high heat exposure	5%
% of residential buildings with very high heat exposure	5%
# of buildings with very high socio-demographic & heat expo.	12
# of residential buildings highly vulnerable across all 3 indices	0





The Corporation of the District of Saanich

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

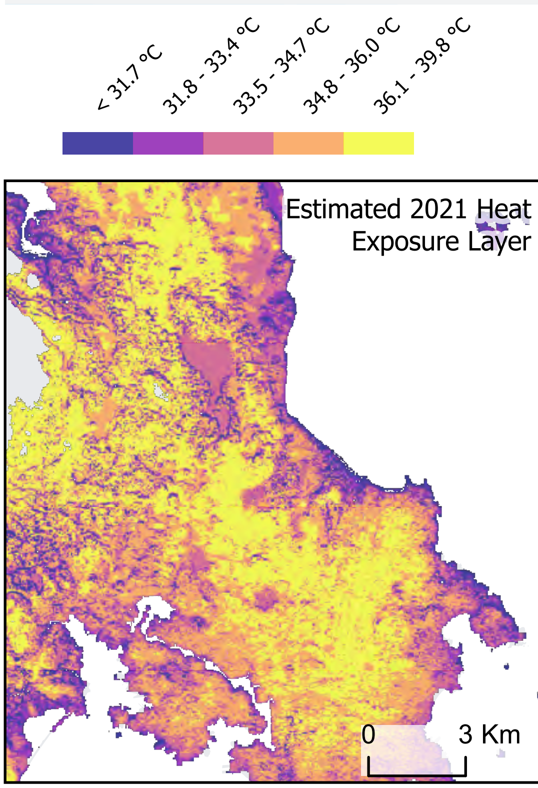
Population 2021	117,735
% population in very high Sociodemographic vulnerability	12.70%
% population in very high demographic-only vulnerability	8.20%
% population in very high Health vulnerability	14.10%
Top contributing demographic factor	Population age 65 or older (23.1%)
Second contributing demographic factor	Population that are renters (30.8%)
Third contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (18.2%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Hypertension (crude rate)
Third contributing health factor	Diabetes (Crude Rate)

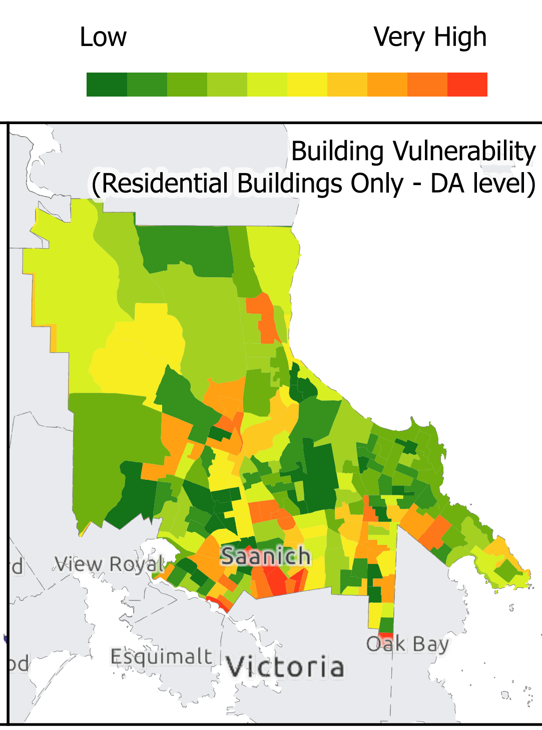
Building Vulnerability

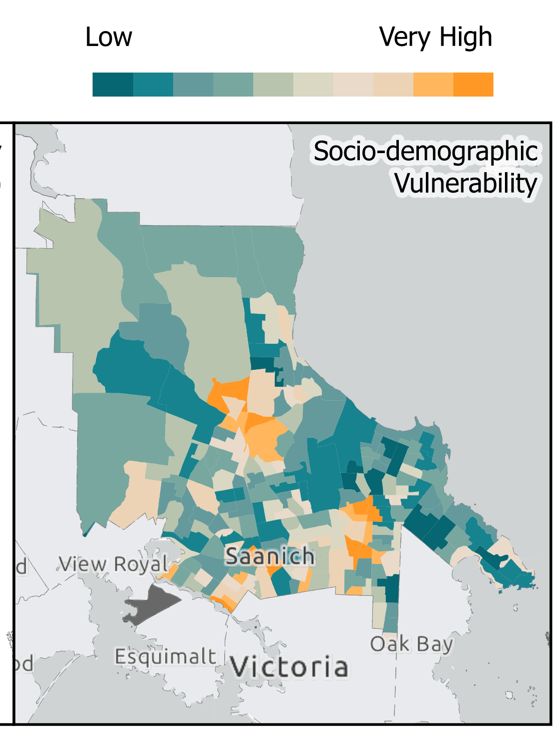
Total # of residential buildings in the community	35,638
Housing type contribution to building vulnerability	1.60%
Year Built contribution to building vulnerability	24.90%
Albedo contribution to building vulnerability	29.70%
Solar insolation contribution to building vulnerability	30.40%
Building Height contribution to building vulnerability	13.50%
# of buildings with very high demographic & building vuln.	806
# of buildings in very high	6,873
% of residential buildings in very high	11.80%
Average age of buildings in very high	1960

Heat Exposure

% of community area in very high heat exposure	28%
% of residential buildings with very high heat exposure	36%
# of buildings with very high socio-demographic & heat expo.	1,542
# of residential buildings highly vulnerable across all 3 indices	454







The Corporation of the Township of Esquimalt

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

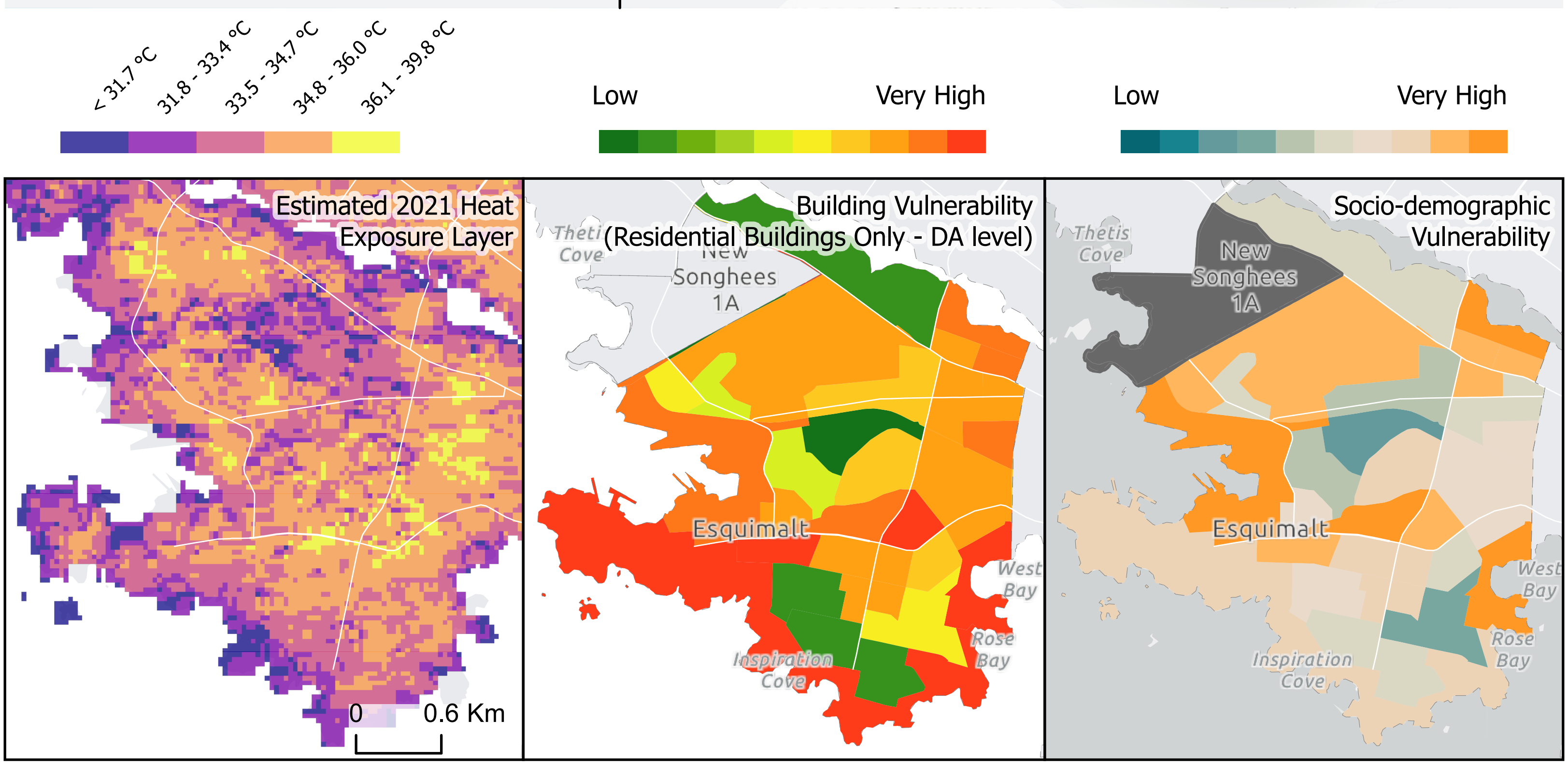
Population 2021	17,533
% population in very high Sociodemographic vulnerability	36.60%
% population in very high demographic-only vulnerability	21.20%
% population in very high Health vulnerability	32.70%
Top contributing demographic factor	Population that are renters (51.1%)
Second contributing demographic factor	Population age 65 or older (20.7%)
Third contributing demographic factor	Average number of rooms per dwelling (5.1%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Chronic Obstructive Pulmonary Disease (Crude Rate)
Third contributing health factor	Diabetes (Crude Rate)

Building Vulnerability

Total # of residential buildings in the community	3,410
Housing type contribution to building vulnerability	3.90%
Year Built contribution to building vulnerability	25.00%
Albedo contribution to building vulnerability	28.40%
Solar insolation contribution to building vulnerability	29.50%
Building Height contribution to building vulnerability	13.20%
# of buildings with very high demographic & building vuln.	289
# of buildings in very high	1,138
% of residential buildings in very high	11.80%
Average age of buildings in very high	1956

Heat Exposure

% of community area in very high heat exposure	1%
% of residential buildings with very high heat exposure	1%
# of buildings with very high socio-demographic & heat expo.	8
# of residential buildings highly vulnerable across all 3 indices	0



Town of Sidney

Heat Vulnerability Data & Analysis Project
Prepared for The Capital Regional District

Demographic Vulnerability

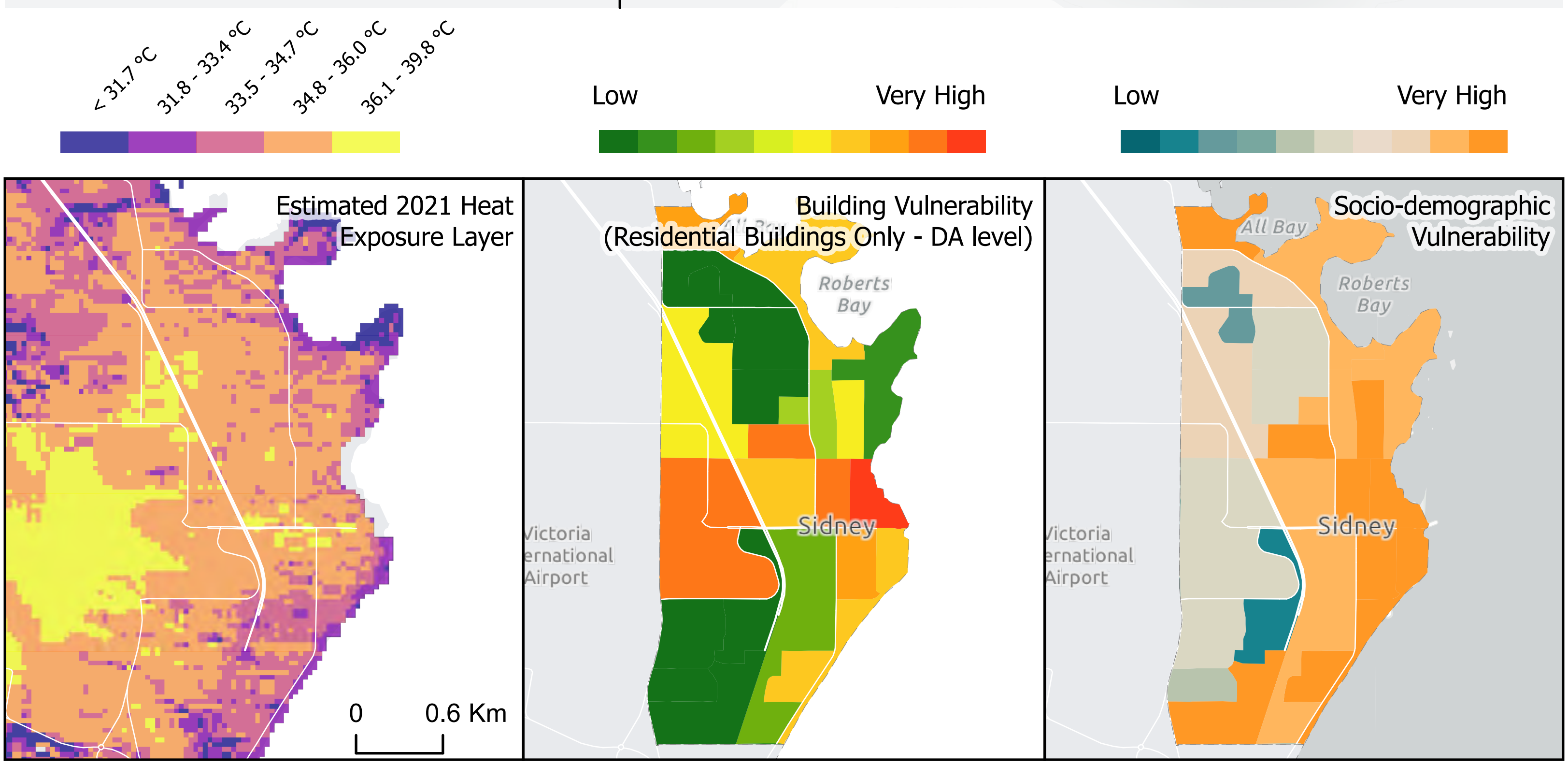
Population 2021	12,318
% population in very high Sociodemographic vulnerability	62.60%
% population in very high demographic-only vulnerability	41.80%
% population in very high Health vulnerability	68.90%
Top contributing demographic factor	Population age 65 or older (45%)
Second contributing demographic factor	Private households by age of primary household maintainers - 65 years and over (25%)
Third contributing demographic factor	Living alone (19.6%)
Top contributing health factor	Hypertension (crude rate)
Second contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Third contributing health factor	Acute Myocardial Infarction (Crude Rate)

Building Vulnerability

Total # of residential buildings in the community	3,274
Housing type contribution to building vulnerability	5.60%
Year Built contribution to building vulnerability	21.30%
Albedo contribution to building vulnerability	28.20%
Solar insolation contribution to building vulnerability	32.20%
Building Height contribution to building vulnerability	12.80%
# of buildings with very high demographic & building vuln.	628
# of buildings in very high	941
% of residential buildings in very high	11.80%
Average age of buildings in very high	1978

Heat Exposure

% of community area in very high heat exposure	2%
% of residential buildings with very high heat exposure	1%
# of buildings with very high socio-demographic & heat expo.	2
# of residential buildings highly vulnerable across all 3 indices	0



Town of View Royal

Demographic Vulnerability

Population 2021	11,575
% population in very high Sociodemographic vulnerability	14.20%
% population in very high demographic-only vulnerability	0%
% population in very high Health vulnerability	20.00%
Top contributing demographic factor	Population that are renters (32.6%)
Second contributing demographic factor	Population age 65 or older (20.9%)
Third contributing demographic factor	Average number of rooms per dwelling (5.9%)
Top contributing health factor	Episodic Mood Anxiety Disorders Prevalence (Crude Rate)
Second contributing health factor	Hypertension (crude rate)
Third contributing health factor	Diabetes (Crude Rate)

Building Vulnerability

Total # of residential buildings in the community	2,788
Housing type contribution to building vulnerability	3.00%
Year Built contribution to building vulnerability	21.50%
Albedo contribution to building vulnerability	30.60%
Solar insolation contribution to building vulnerability	30.60%
Building Height contribution to building vulnerability	14.20%
# of buildings with very high demographic & building vuln.	55
# of buildings in very high	360
% of residential buildings in very high	11.80%
Average age of buildings in very high	1978

Heat Exposure

% of community area in very high heat exposure	11%
% of residential buildings with very high heat exposure	4%
# of buildings with very high socio-demographic & heat expo.	4
# of residential buildings highly vulnerable across all 3 indices	0